DOCTOR OF PHILOSOPHY (CLINICAL ANATOMY & MEDICAL

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DEFINING CORE CLINICAL ANATOMY FOR UNDERGRADUATE
MEDICAL EDUCATION IN ZAMBIA USING A NEW NEEDS
ASSESSMENT STRATEGY

By

SEKELANI STANLEY BANDA

A THESIS

Submitted to University of Zambia in fulfilment of the requirements for
the degree of

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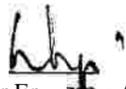
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The research problems, for this study, were that, a) there was no agreement on what constituted core clinical anatomical knowledge for undergraduate medical education, b) there were no studies, based on investigational findings, which had identified and/or described the anatomy required for clinical practice, c) there were no studies, based on investigational findings, which had defined and/or described how anatomy is

used in clinical practice. Core clinical anatomy is defined as the minimum knowledge of anatomy that students must study to prepare them for their future roles as doctors.

ABSTRACT

DEFINING CORE CLINICAL ANATOMY FOR UNDERGRADUATE
MEDICAL EDUCATION IN ZAMBIA USING A NEW NEEDS
ASSESSMENT STRATEGY

By

SEKELANI STANLEY BANDA

Commenced July 2000

Supervisor: Professor Krikor Erzingatsian Co-supervisors:

Professor Dickson Mwansa Professor Joseph Karashani Major:

Clinical Anatomy & Medical Education (Multidisciplinary)

Previous studies have relied mainly on expert opinion.

The methods used to identify the anatomy required for clinical practice were: content analysis for anatomical terms in Hutchinson's Clinical Methods (Swash, 1989); 2,216 hours of contact with clinical practitioners as a participant observer; collection of 221 critical incidents of clinical situations in which knowledge of anatomy had contributed to either success or failure of a clinical outcome. In addition, medical records of the national referral hospital, a regional hospital, a district hospital, and urban clinics were also reviewed to identify the clinical

The problem concerning identifying the core clinical anatomy was compounded by the different and specific requirements of the many clinical specialities, consequently the objective of the study was directed at defining core anatomy for undergraduate medical education only. Four research questions were investigated: a) what is the amount and nature of anatomical knowledge in clinical methods? b) Which anatomical knowledge determines success and/or failure in clinical situations? c) Is there a difference between anatomical knowledge that clinical students and clinicians possess compared to that which preclinical medical students possess? And, d) Can the detail of anatomical knowledge required for diagnosis, investigation, and treatment of a clinical condition be determined consistently?

An important hypothesis, that guided this study, was that the anatomy used in clinical practice was different from that taught in the traditional anatomy courses, and, as such, efforts to identify core clinical anatomy should not concentrate on traditional anatomy. This study investigated the anatomy required for general clinical practice as a needs assessment strategy for defining core anatomy for undergraduate medical education. This work could be the first to use investigational methods for defining core clinical anatomy for undergraduate medical education.

that should be learned. It was found that the nature of anatomy in history-taking and physical examination was a cognitive clinical reasoning process that involved analysing symptoms and signs in order to decide which tissue, organ, region, and system is involved (TORS analysis). In physical examination, it was found that knowledge of anatomy was used to assess normal structure and function and, as such, detect altered states. The study identified 15 themes of anatomical knowledge that determine success and/or failure in clinical situations, i.e., Anatomical knowledge that contributes to ability to 1) extract body fluids, 2) collect venous blood, 3) cannulate veins, 4) insert tubes or trocars into body cavities, 5) locate nerves, 6) locate blood vessels, 7) avoid accidental injury to important structures, 8) locate important structures, spaces, cavities, 9) access internal organs at operation, 10) describe and interpret plain x-rays, 11) describe and interpret special x-rays, 12) make clinical decisions, 13) repair body structures surgically, instructions

conditions that represented the main burden of a doctor's work. Furthermore, a Case Anatomical Knowledge Index was developed to identify which of the clinical conditions had a high demand for anatomical knowledge in order to make a diagnosis, interpret investigations, and implement treatment. The coding instrument for the content analysis was found to be reliable (Intraclass Correlation Coefficient alpha 0.8). The Case Anatomical Knowledge Index was also found to be reliable in consistency (Cronbach's alpha 0.9). Other workers investigating problems in other disciplines of medicine have successfully utilized the methods used in this study.

With regard to the research questions they were all answered. The study found that there was a difference between the knowledge that preclinical students possessed compared to that possessed by doctors. In clinical methods it was found that technical anatomical terms constituted 40 percent of the content of Hutchinson's Clinical Methods and that there were 67 discrete anatomical themes

14) recognise developmental basis of clinical conditions, and 15) comprehend histological reports.

In addition, the study identified several clinical conditions, procedures, and operations that required significant detail of anatomy for diagnosis and concepts, interpretation of investigations, and for treatment. The cases requiring significant detail of anatomy knowledge were identified and ranked consistently. All the above findings were used to generate content for the core clinical anatomy course for undergraduate medical education and a curriculum was developed. Some of these findings have been implemented on a pilot basis, as developmental testing, in the UNZA clinical anatomy course.

The implications of this study are that: a) the study may have contributed toward defining what clinical anatomy is (this is important because clinical anatomy had different meanings in the literature), b) the focus for identifying core anatomy for undergraduate medical education may shift from that based on identifying what is of clinical relevance in traditional anatomy to that based on considering the anatomy needs of clinical practice, c) the clinical anatomy courses, available worldwide, could benefit from the evidence from this study, and d) the UNZA clinical anatomy course can now be revised on the basis of more rational and scientific findings.

FOREWORD

Throughout this volume where the male or female pronouns "he", and "she" and the possessive pronouns - "his", and "hers" are used they generally refer to both male and female genders. It is hoped all men and women will construe them as intending to embrace both human genders equally.

Bowa, James Munthali, Jabin Mulwanda, Welani Chilengwe, Rosemary Kumwenda, Makungu Kabaso, and Peter Mwaba. Special mention is due to Drs Maximillian Bweupe, Shadreck Lungu, Wized Banda, Kennedy Lishimpi, and Jonathan Kalanda who served as the local co-ordinators. I am also grateful to Dr Ann Frye, Mr. Richard Tumeo and Ms. Elinas Malama. Special thanks are due to my supervisors. Professors Krikor Erzingatsian, Dickson Mwansa, and Joseph Karashani.

"If I have seen further than others, it is by standing upon the shoulders of giants."
ACKNOWLEDGEMENTS
Sir Isaac Newton

PRELIMINARIES

I

e-mail - Electronic Mail

Et al. - and others (from Latin et alii, et aliae)

CMC - General Medical Council, UK

GPEP - General Physicians Education of the Physician and College
Preparation

GPs - General Practitioners

HMIS - Health Monitoring Information System

HTML - Hyper Text Markup Language

HTTP - Hyper Text Transmission

JRMO - Junior Resident Medical Officer
3-D - Three Dimensional
KCM - Konkola Copper Mines
AACA - American Association of Clinical Anatomists

ANOVA - Analysis of Variance

AV Node - Atrioventricular Node

BACA - British Association of Clinical Anatomists

CAKI - Case Anatomical Knowledge Index

CBOH - Central Board of Health, Zambia

CIT - Critical Incident Technique

CNS - Central Nervous System

CSF - Cerebrospinal Fluid

CT - Computerised Axial Tomography

DHMT - District Health Management Team

ECG - Electrocardiography

e-mail - Electronic Mail

UNZA - University of Zambia

URL - Uniform Resource Locator

USA - United States of America

UTH - University Teaching Hospital, Zambia
MCQ - Multiple Choice Question
UTMB - University of Texas Medical Branch
MRI - Magnetic Resonance Imaging
www - World Wide Web
NBME - National Board of Medical Examiners,

USA

NIH - National Institutes of Health, USA

NLM - National Library of Medicine, USA

Preclinical 3 - Year-3 preclinical medical students

Preclinical 4 - Year-4 preclinical medical students

SA Node - Sinoatrial Node

SPSS - Statistical Package for Social Sciences

SRMO - Senior Resident Medical Officer

TAI - Total Anatomy Indicators

TAIR - Total Anatomy Indicators Ratio

TAT - Technical Anatomy Terms

TATR - Technical Anatomy Terms Ratio

TORS - Tissue Organ Region System

TOTE- Test Operate Test Exit

TRU - Total Recording Units

UK - United Kingdom

rational ways concerning a clinical situation.

Compendium: a brief summary of a larger work or of a field of knowledge.

Concepts: an abstract or generic idea generalised from particular instances.

Construct: a theoretical idea developed to explain and to organise some aspects of existing knowledge.

1   **Content analysis:** a research method that uses a set of procedures to make valid inferences from text, and other records (eg. video, film, picture). **Context:** the interrelated conditions in which something exists or occurs.

DEFINITION OF TERMS

Anatomical interpretation: explanation of the anatomical basis of a situation.

Anatomy: the science of the development and structure of the body. **Clinical:** apparent to or based on direct observation of the patient. **Clinical anatomy:** those aspects of anatomy important to the clinical practice of medicine.

Clinical context: existing or occurring in clinical conditions.

Clinical data: factual information elicited from history-taking, physical examination, investigations, knowledge of diseases and used as a basis for clinical reasoning. **Clinical management:** investigations and treatment of a patient.

Clinical methods: the approach to a patient and to his or her disease. Predominantly, history-taking, physical examination, investigations, and interpretation of these to formulate a diagnosis.

Clinical practice: the action of evaluating and treating patients.

Clinical problems: matters peculiar to patients that the doctor solves.

Clinical reasoning: the power of comprehending, inferring, or thinking m orderly rational ways concerning a clinical situation.

High order intellectual (cognitive) processes: cognitive activities that involve the application of knowledge, problem-solving and evaluation.

Horizontal integration: blending of medical information from disciplines that are taught at the same stage in a medical curriculum (i.e. a basic science with another basic science; a clinical discipline with another clinical discipline).

Core: the most important/essential components.

Core anatomy: the most important/essential components of anatomy required for clinical practice.

Index: a device that serves to indicate a value or quantity.

Instrument: a measuring device for determining the present value of quantity under observation. (For example, a questionnaire, a scale, an interview protocol).

Critical incident: An incident is an observable human activity that is sufficiently complete in itself and perm-its inferences about the outcome of the activity. Critical refers to the pivotal role of the action (by the observed) in the outcome of an activity

Domain (category): a general class that designates a property or relation or that to which properties or relations belong. (For example, the cognitive domain; the psychomotor skills domain)

Empirical (Investigational): depending on research findings. (Not experience)

Flexnerian: After Abraham Flexner, a medical education reformist.

General practice: the science and art dealing with the maintenance of health and the prevention, alleviation, or cure of disease, without focus on a specific field of medical Specialisation.

General practitioner: the doctor practising the science and art dealing with the maintenance of health and the prevention, alleviation, or cure of disease, without focus on a specific field of medical specialisation.

Systematic: pertaining to a methodical approach

Systemic: based on the body systems, for example, the respiratory system. **Scale:**

something graduated especially when used as a measure or rule.

Integration: to blend medical information from different disciplines into a
Topography: the graphic delineation in detail to show relative positions of
whole. **Interpret:** to explain or tell the meaning of
structures in the human body.
Literature: In this study, the word literature was used to refer to printed matter

found at PubMed, Medical Education Bibliography, African Journals on Line

(AJOL) and anatomy textbooks and other published works.

Low order (cognitive) process: cognitive activities that involve only memory

recall of facts and association of facts.

Medical education: The lifetime process by which knowledge, skills and attitudes

are imparted to medical students and practitioners to equip them for the

professional practice of medicine. In this study the focus was on the formal training

years of undergraduate study.

Medical practice: the science and art dealing with the maintenance of health and

the prevention, alleviation, or cure of disease.

Participant observer: a research method by which a researcher observes a group

or activity whilst participating in the group's activities.

Problem-based learning: the kind of learning where the basis of learning is

derived the problem presented.

Reliability: the consistency with which an instrument measures the value under

measurement.

Undifferentiated doctor: a doctor who has been trained in the main areas of medicine, i.e., general surgery, internal medicine, obstetrics and gynaecology, and paediatrics but has not undertaken specialist training.

Universe: the whole system of things (not in galactic sense).

Validity: the extent to which an instrument measures what it purports to measure.

Vertical integration: blending medical information from disciplines that are taught at

different stages in a medical curriculum (i.e. basic sciences with clinical subjects).

LIST OF TABLES

xx

I

LIST OF FIGURES

24

LIST OF APPENDICES

DEDICATION

Dedicated to my father Stanley Perekamoyo Banda

No one man has inspired the belief in myself greater than he, nor taught, greater than he, the wisdom that if I am committed, I do what it takes, I can be all I can be. To him I dedicate this work.

Sekelani Stanley Banda

CHAPTER I
INTRODUCTION

27

3. There were no studies, based on investigational findings, which had defined and/or described how anatomy was used in clinical practice.

To increase clinical relevance many strategies had been adopted, for example, case based teaching (Lachman, 1981; Peplow, 1990; Scott, 1994), and problem-based learning (Percac and Armstrong, 1998). These strategies had also been used to increase clinical context, and to teach higher order intellectual skills. These responses, attempting to increase relevance to clinical practice, have instigated a new brand of anatomy often referred to as 'clinical anatomy'.

Statement of the Problem

The impetus for change in the way anatomy is taught has been the persistent calls for reform (GPEP, 1984; Charlton, 1991a, b; Lowry, 1993; GMC, 1993) and the dwindling curriculum time available for anatomy (Fitzgerald, 1992; Fasel, 1996; Heyling, 2002). The time constraint together with calls for increase in clinical relevance (Lachman, 1981; Pabst et al., 1986; Peplow, 1990; Scott, 1994; Abu-Hijleh and Marwan, 1995; Cliff and Wright, 1996; Zehr et al., 1996; Heylings and Stefani, 1997; Percac and Goodenough, 1998), have instigated the need for a core of anatomical knowledge that prepares medical undergraduates for future clinical practice. The problems identified were:

1. There was no agreed core of anatomical knowledge for undergraduate medical students (Heylings, 2002);

2. There were no studies, based on investigational findings, which had identified and/or described the anatomy required for clinical practice.

because it could be the first to use investigational methods to define the anatomical knowledge that was required for clinical practice; h could also be the first to propose a tool for investigational selection of clinical conditions for inclusion in clinical anatomy courses. This was considered important because, the literature review indicated that the field of clinical anatomy was not well established. The lack of a clear paradigm for clinical anatomy classes that ill-defined content in clinical anatomy courses; and the anatomy was still out of focus in the clinical topics in service as a practice, thus the effort to the study to identify core anatomy should become focus would shed some light on the above issues that the anatomy that was actually used in clinical practice. In this regard, the study asserted that the beginning point was to identify what is core amongst the anatomy that is used in clinical practice.

Purpose of the Study

The purpose of this study was to define the anatomical knowledge that is required for the general practice doctor, and thus identify the core anatomy for undergraduate medical education, and additionally, to contribute to the new field of clinical anatomy. The study was concerned with illuminating the characteristics of clinical practice and the common demands of clinical practice and discussing how these interacted with anatomical knowledge i.e., how anatomical knowledge was used in clinical practice. This study was done with a view to contributing to improvement of the existing practice of clinical anatomy and medical education. This study was considered important to clinical anatomy and medical education[29]

methods?

    a) The amount and nature inherent in history-taking?

    b) The amount and nature inherent in physical examination?

    c) The amount and nature inherent in a textbook of clinical methods
that is widely used at University of Zambia?

end of the study. First, the core anatomical knowledge required for clinical practice

2. Which anatomical knowledge determines success and/or failure in clinical
for the general practice doctor would be defined, and second, a curriculum for
situations?

clinical anatomy (medical education) would be proposed.

3. Is there a difference between the anatomical knowledge that clinical
The study could be important to clinical anatomy and medical education because
students and clinicians possess compared to that which preclinical medical
it was a pioneering effort in addressing the above problems; no previous study has
students possess?

taken the evidence-based approach similar to this study.

Specific Objectives

This study was designed to explore the nature of anatomical knowledge that is used
in clinical practice for the general practice doctor working in Zambia, by studying
the relationships of anatomical knowledge and clinical practice. The study
attempted to answer the questions:

    a) "What anatomical knowledge is used in clinical practice?"

    b) "How is anatomical knowledge used in clinical practice?"

These questions were investigated by exploring the following
questions:

    1. What is the amount and nature of anatomical knowledge in clinical

      methods?

accepted diagnosis, the clinicians then institute the treatment, which is based on the medical knowledge they possess. The hypothetico-deductive theory, therefore, requires a fund of existing knowledge of disease and basic sciences, which can be retrieved to test hypotheses. It is for this reason that Norman (1997) and Eva et al. (2002) contend that cognitive knowledge is the most important factor in problem-solving irrespective of problem-solving strategies being applied. Cognitive knowledge in most academic

4. Can the detail of anatomical knowledge required for diagnosis, investigation, and treatment of a clinical condition be determined consistently? Answers to these questions could identify what and how anatomical knowledge is used in clinical practice.

Theoretical Perspective

This study was based on the hypothetico-deductive clinical reasoning theory developed by Elstein et al. (1978). Elstein et al. (1978) studied how doctors solve problems in clinical situations and proposed the hypothetico-deductive theory. Patel et al. (2001) has studied how basic sciences (anatomy inclusive) may be used in the clinical reasoning process. Mandin et al. (1997), Norman (1997), Bordage (1999) and Eva et al. (2002) have studied clinical reasoning. Whilst other clinical reasoning theories exist, the hypothetico-deductive theory is the most dominant in the philosophy of science (Homer and Westacott, 2000) and cognitive psychology (Cohen, 1977). The hypothetico-deductive theory asserts that when faced with a clinical problem clinicians solve it by formulating hypotheses of possible diagnosis and then they test these hypotheses using medical knowledge and investigations and thereafter accept or reject the hypotheses (Elstein et al. 1978). Based on the

31

anatomy and/with clinical practice. A paradigm for tos, currently, does not exist.

The study may also contribute to improvement in the practice of clinical anatomy and medical education by:

a) Proposing standard content for clinical anatomy courses
disciplines (as may be for clinical anatomy) is not intuitive it must be learned before
b) Enhancing integration of basic science and clinical sciences
it can be applied in problem-solving.

c) Enhancing higher order intellectual skills (problem-solving)

d) Increasing relevance of anatomy to clinical practice.

Significance of the Study

The study may add to the scholarly research and literature in the fields of clinical anatomy, and medical education by way of

a) Proposing a compendium of anatomical knowledge that is required for clinical practice for the general practice doctor in Zambia;

b) Proposing a curriculum of "core clinical anatomy" for undergraduate medical education;

c) Proposing a tool for content analysis of text to identify anatomical concepts;

d) Proposing a tool for identifying clinical situations. that have substantial requirement for anatomical knowledge, and thus warrant their inclusion on clinical anatomy learning objectives. No such tool was found in the literature.

e) Identifying diseases that require substantial detail of anatomical knowledge for diagnosis, concepts, investigations and treatment.

f) Proposing investigational methods[32] for studying the relation/interaction of

students and ultimately that of doctors.

5. The study will focus on the problems relevant to Zambia and also offers practical solutions to these problems.

Setting and Limitations

Setting: The study was confined to different levels of health care service provision in four different geographical areas of Zambia. These include, The University Teaching Hospital, a district hospital and medical education.

Justification for the Study

1. A review of the existing literature on the subject reveals that defining core anatomy for clinical practice and thus for medical education remains an unresolved issue, which requires further study; no investigational studies were found in the literature.

2. No known or published researcher has undertaken this study in Zambia.

3. The study is original and is based on research objectives and a design that attempts to meet a gap in the field after an extensive review of the literature; no evidence-based studies were found in the literature which were based on an approach similar to this study.

4. The study seeks to address a serious pedagogical gap in order to contribute to improving the quality of patient care by improving the quality of the

I

central referral hospital; Kitwe Central and Kabwe General hospitals - provincial hospitals; St. Francis Hospital (Katete), Malcom Watson and Ronald Ross hospitals (Mufulira), Nchanga KCM and Nchanga South hospitals (Chingola), and Konkola KCM hospital (Chililabombwe) - district hospitals; and clinics in Lusaka. This way the different levels of health care provision and geographical settings were captured.

Limitations; Purposive sampling procedures decrease how one may generalise fmdings of a study. Some aspects of this study may not be generalised to regions outside Zambia. The fmdings from the participant observer technique could be subject to other interpretations. Furthermore, information obtained via e-mail through the American Association of Clinical Anatomists listserv may not be completely valid. However, in specific exceptions e-mail communication \^ considered acceptable in scholarly work. The number of incidents collected, the number of doctors studied, and the number of units observed- were not selected necessarily on the basis of their proportional representation in the doctor population in the countiy.

CHAPTER II LITERATURE
REVIEW

internist, or a surgeon, or an obstetrician, or a pathologist. All these have varying degrees of specific demands for anatomy. The problem was that no consensus existed about a core anatomy that could serve all these disciplines (Heylings, 2002).

The second section addresses the efforts that have previously been undertaken to increase the relevance of anatomy to clinical practice. This section also explores how anatomy fits into clinical reasoning, an integral part of clinical practice, and

Introduction

finally explores the matter of what 'clinical anatomy' is.   The basis for this conceptual

The review of literature is organised in three sections:

a. Background; The Source of the Problem

b. Clinical Anatomy: Past Efforts of Increasing Clinical Relevance

c. Review of Methods

The first section describes where the necessity to identify core anatomy for medical education came from It discusses briefly the work of a previous study "Perceptions of Teachers of Medical Undergraduates Towards the Teaching of Anatomy" (Banda, 1999) and also summarises the main issues raised, about teaching of anatomy, by medical education scholars up to the last decade (1990 - 99). Some of the issues related to the concern that students forgot their anatomy by the tijne they required it in clinical practice, and that they failed to apply anatomy to clinical problems. Working to address these concerns, some scholars (Lachman, 1981; Scott, 1994; Percac and Goodenough, 1998) proposed teaching anatomy that is relevant to clinical practice. However, a new problem emerged; medicine had

4,600 biomedical journals published in the United States and 70 other

countries. The file contains over 11 million citations dating back to the

mid-1960s. Coverage is worldwide, but most records are from

English-language sources or have English abstracts.

consideration is that clinical anatomy would inherently possess the desired clinical

B. Medical Education Bibliography is an Internet-based list of medical education

relevance, application, and clinical context.

bibliography hosted by PennState Mihon S. Hershey Medical Center College

The third section of the literature review considers the methods that have

of

previously been used to the study clinical features of the medical profession. The

basis of this approach is that, in order to define what kind of anatomy would be

required for clinical practice and medical education, one must first identify,

describe, and define what a medical practitioner does. Content analysis, the critical

incidence technique, observational studies, and scaling are described in this

section. Critiques of each method and how it has been used previously are also

presented.

The literature review included many sources:

A. PubMed is an Internet resource available via the National Center for

Biotechnology Information (NCBI) Entrez retrieval system developed by the

NCBI at the National Library of Medicine (NLM), located at the United

States of America National Institutes of Health (NIH). PubMed provides

access to citations and full-text articles found on MEDLINE, which is the

premier bibliographic database covering fields of medicine, nursing,

dentistry, veterinary medicine, the health care system, and the preclinical

sciences. MEDLINE contains citations and author abstracts from more than

school faculties in three universities. Questionnaires were distributed to clinical and basic science departments at the University of Zambia (Lusaka), the University of Glasgow (Scotland, UK) and the University of Wales College of Medicine (Wales, UK). The purpose of that study was to gam a deeper understanding of the challenges that would face the future of anatomy teaching in the twenty-first century by surveying the perceptions of teachers of medical undergraduates towards the teaching of anatomy.

Medicine at The George T. Harrel Library. The bibliography has 323 entries developed by the Library staff.

African Journals online (AJOL) is an Internet-based resource hosted by the International Network *for* the Availability of Scientific Publications (INASP). The site hosts abstracts and tables of contents for over fifty African published journals from both Anglophone and Francophone countries. Services are also available for a search engine and librarian services.

D. Anatomy textbooks reviewed by the researcher (see appendix 1).

E. Internet Search Engines. Internet search engine Google was also used for searches. Google has 1.35 billion documents and on average 500 million documents are available to most searches.

F. Published works, i.e., journals and textbooks.

Section 1

Background: Source of the Problem

In another research project, for a masters degree dissertation (Banda, 1999), a postal questionnaire with 23 five-point agreement scales (Likert scales), four open questions, and one question with a one-answer choice was distributed to medical

38

most (77 percent) respondents in all the categories.

4. The statement, "learning anatomy through consideration of clinical cases

   can

   improve seeing the relevance of anatomy," was supported by nearly all (96

The study achieved 74 percent response rate, and the rehabihty coefficient for all

   percent) respondents in all the categories.

the constituent scales was at least 0.70. The study was considered valid and

The point of departure of this study from that noted above is that this study aims to

reliable. Findings from the literature review, for that study, were that;

provide the basis for further exploration of how to identify anatomy required for

1. The time allocated to anatomy teaching in the curriculum was contracting in

   most medical schools.

2. The teaching of anatomy had many educational criticisms.

3. There was some difficulty in defining the core curriculum for medical students,

   given the diversity of medical specialisation.

Findings from the study were that;

1. Making anatomy more clinically oriented was overwhelmingly supported.

   At all three universities, of the total 96 respondents, more than 90 percent

   were in favour, also more than 88 percent in all disciplines supported

   clinical relevance.

2. The statement, "learning anatomy through consideration of clinical cases

   can improve; students' motivation," received support from most (81 percent)

   respondents in all the categories.

3. The statement, "learning anatomy through consideration of clinical cases

   can improve; students' understanding of anatomy," received support from

substantial reduction by British and Canadian standards and only began to

approximate the trends in the United States as reported by Mainland (1935). Banda

(1999) predicted that more reduction of anatomy time would happen, given the

introduction of the reforms supported by the panel of General Physicians Education of the Physician and College Preparation (GPEP, 1984) report and the General Medical Council (GMC, 1993) report.   Such a trend had earlier been reported with the

clinical practice and thus define core clinical anatomy required for undergraduate medical education. The salient points of the literature review highlighting the source of the problem are presented below.

Reduced Time Available for Teaching Anatomy Throughout the

world, it was found that time for teaching anatomy has been reduced, in some cases

drastically (Fitzgerald, 1992; Fasel, 1996; Heylings, 2002). A survey of 62 medical

schools in Great Britain and Ireland reported a mean of 192 hours spent on gross

anatomy (Fitzgerald, 1992). The literature indicated that this was probably due to

the increasing competition for time in the curriculum from new courses (e.g.,

behavioural sciences, genetics) and established courses have had to expand on

account of the growing number of scientific discoveries. In 1989, the Management

Committee of the Anatomical Society of Great Britain and Ireland, commissioned a

review of undergraduate medical anatomy teaching in British medical schools. By

using questionnaires Fitzgerald (1992) reported that the average recommended

teaching hours for each component as found in their survey were: total anatomy

course 350 hours; gross anatomy 92 hours; dissecting room 155 hours; histology 82

hours; embryology 24 hours; neuroanatomy 41 hours. They fiirther recommended

that the ideal total time that should be devoted to anatomy is 300 hours. This was a

sciences were overloaded (Charlton, 1991b; Lowry, 1993; GMC, 1993; Weeks et al., 1993).

Topographical detail was regarded as the leading cause for the factual overload in anatomy (Sinclair, 1975). Sinclair (1975) reported that about a hundred years ago (1875) physiology branched off from anatomy and later (1900) biochemistry began to branch off from physiology resuhing in undergraduate anatomy narrowing itself down to an immensely detailed descriptive study of the human body, with gross overemphasis on topographical detail. This overemphasis on topographical detail was viewed, by many medical educators, as being pedagogically flawed; it concentrated on memorisation of facts by rote; it was excessive in volume; and it was deficient in conceptual challenge (Neame, 1984; Adeyemi-Doro and Ojeifo, 1988; Peplow, 1990; Charlton, 1991b).

Factual Overload

The frontiers of scientific knowledge were reported to be expanding exponentially and they continue to do so and as a result, the amount of biomedical facts to be learned by undergraduates has increased. Furthermore, gross anatomy, histology, embryology and neuroanatomy on their own accord are voluminous. The separation of the traditional curriculum into basic sciences and clinical sciences was considered to be responsible for the perpetuation of the factual overload. This was because it allowed for the basic sciences to deal with their material

exhaustively (GMC, 1993). There was considerable consensus that the basic

4) Analysis: analysis of elements, analysis of relationships; analysis of organised principles;

5) Synthesis: production of a unique communication; production of a plan or a proposed set of operations; derivation of a set of abstract relations;

6) Evaluation: judgement in terms of internal evidence; judgement in terms of external criteria.

persisted well into the 20 century and was a target of fervent criticism (Davies, 1948; Charhon, 1991b). This matter of topographical detail provoked an interesting question as to what level of detail of topography should be taught in the anatomy course.

The use of lectures, a major method of teaching anatomy and other basic sciences, coupled with factual overload was blamed for making students passive and uncritical

Lower Level Intellectual Skills

Educational objectives encompass mostly three categories (domains): cognitive, affective, and psychomotor domains (Rowntree, 1982). The cognitive objectives involve the learner in thinking processes like remembering, evaluating and problem-solving. The most famous taxonomy of educational objectives in the cognitive domain (category) is that by Bloom (1956). Bloom (1956) identified six levels in the cognitive domain, the lowest first and the highest last:

1) Knowledge: knowledge of specifics; knowledge of ways and means of dealing with specifics; knowledge of universals and abstraction in a field;

2) Comprehension: translation, interpretation; extrapolation;

3) Apphcation;   42

basic sciences to chnical situations was documented (Balla et al., 1990; Peplow, 1990; Scott, 1993; Sobral, 1995). Sobral (1995) investigated 180 students at the University of Brasilia in Brazil and amongst other questions, he wanted to test if there were significant differences in the diagnostic ability scores between groups coming from distinct preclinical backgrounds. Sobral (1995) administered the t Diagnostic Thinking Inventory (DTI). Significant differences were found in the diagnostic ability scores of students coming from integrated teaching in comparison with those coming from the conventional teaching background. Students from the

recipients of information presented to them; the resuUing learning environment did not develop skills of reasoning and mdependence (Neame, 1984; Lowry, 1993; Abrahamson, 1996; Scott and Chafe, 1997). Scott and Chafe (1997) studied

questions from examinations in the first three years of the medical curriculum at Memorial University of Newfoundland in Canada. They categorised the questions into level one (tested simple recall), level two (used basic information obtained from recall to make generalisations) and level three (demanded interpretation of data and other higher level activities such as synthesis and evaluation). This taxonomy was applied to anatomy, biochemistry and genetics from first year as well as to other courses. In all the years of study, questions demanding simple recall dominated examinations. This study found that in the anatomy examination, 50 percent of the questions were level one questions, eight percent level two and 42 percent level three. This study demonstrated that lower level intellectual skills dominated the assessment and was likely to be true for other medical schools because of the similarity of the medical schools. There is therefore merh in the call for introduction of courses that are designed to promote the higher intellectual skills.

Additionally, the premise that students, in traditional curricula, had trouble applying

anatomical knowledge in the clinic they had forgotten a significant part of it (Lachman, 1981; Charlton 1991a). Many asserted that the problem arose when the facts are dispensed as dry scientific facts (Charhon, 1991a; Lowry, 1993). Others stated that if the relevance of the material was not appreciated, **I** it resuhed in poor motivation on the part of the student to leam that material (Lowry, 1993). Krebs et al. (1997), working at the University of Geneva in Switzerland, had 37 students, who had sat the basic science exam in 1990, retake the examination in

integrated/problem-based background scored higher in the structure of memory, a feature that was reported as important in applying basic science information to clinical practice. The students from traditional curricula seemed to perceive two domains: basic sciences and clinical sciences and as resuh failed to establish the necessary link between the two different knowledge structures (Balla et al., 1990).

Psychology literature supported the view that successftil retrieval of information at some point in future was promoted when retrieval cues were encoded together with the information to be recalled (Tulving and Thompson, 1973; Cohen, 1977; Gruppen et al., 1997).

This kind of anatonry teaching that fostered mere recall of facts, recognition of facts and inability to apply knowledge was considered of low-level intellectual educational objectives (Bloom, 1956). Higher intellectual skills in the cognitive domain include skills like ability to apply knowledge, ability to evaluate, and ability to synthesise facts for problem-solving (Bloom, 1956).

Relevance to Medicine

The literature also indicated that preclinical students mastered anatomy but were not aware of its application to clinical medicine (Lachman, 1981; Pedington, 1986; Charlton, 1991a). Furthermore, it was reported that in the clinical years when the students were ready to use

studies were that they heightened and satisfied the interest for learning information related to clinical medicine (Lachman, 1981; Scott, 1994), and therefore resuhed in longer retention of knowledge and easier application to clinical practice (Scott, 1994), fostered better understanding and knowledge of important anatomical areas (Lachman, 1981; Scott, 1994), built self-directed learning and developed teamwork skills (Scott, 1994).

1992. They found that more than one third of the initial knowledge was lost after two years. Of interest was their finding that even though students forgot across the whole content spectrum more was retained in areas which students retrospectively considered to be relevant to subsequent clinical work.

Teaching in Clinical Context

The degree of clinical context varies. At one end, would be 'least' (mere mention of clinical relevance in the lecture) and at the opposite end would be 'most' (problem-based leammg - as defined by Barrows and Tamblyn, 1980). Many courses have been developed around the world in an attempt to put anatomy in clinical context and mcrease hs clinical relevance (Lachman, 1981; Pabst et al., 1986; Peplow, 1990; Scott, 1993; Scott, 1994; Abu-Hijleh and Marwan, 1995; Chff ai^d Wright, 1996; Zehr et al., 1996; Heylings and Stefani, 1997; Percac and Goodenough, 1998).

One method used to achieve clinical context and relevance was the use of case studies (a short account of an actual or hypothetical patient). At the Memorial University of Newfoundland the first year course was redesigned to reduce the amount of rote learning and to increase the understanding of fiinctional anatomy, by introducing clinical case studies (Scott, 1993). Further justifications for case

The amount of time available for the teaching of anatomy was noted to be drastically reduced (Fitzgerald, 1992; Fasel, 1996). The time constraint increased the demand to define the 'core' i.e., that anatomy that is essential to all undergraduates and also relevant to their specialisation whatever it was (Editorials, Lancet, 1991).

The medical profession has very diverse professional speciahies. Upon graduation, clinicians can practice as general practitioners, as surgeons, as paediatricians, as obstetricians or gynaecologists, or indeed as public health speciahsts. These options have a unique and yet divergent requirement for anatomy. How then, can one define

Other methods of achieving clinical context and relevance were also used. Percac and Goodenough (1998) described a clinical anatomy course designed to bridge basic anatomy with clinical clerkships. In that course, second year students who had already completed the traditional dissecting anatomy course revisited anatomy during small group discussions of clinical cases. At McMaster University a collection of self-directed anatomy learning modules were made available to medical students preparing for tutorial discussions (Zehr et al., 1996). Abu-Hijleh and Marwan (1995) described an innovative 'Clinical Anatomy and Anatomical Skills' course that aimed to refocus, vertically integrate, and revise the subject using problem-solving methods plus testing of various clinically relevant skills recorded in a logbook.

It was believed that anatomy taught by this approach (clinical context) would make students realise that anatomy was neither for anatomists nor a memorisation by rote exercise. They would understand that anatomy was important for interpreting physical examination findings and diagnostic imaging, as well as understanding clinical problems (Pabst et al., 1986; Scott, 1993; Charlton, 1991b).

46
Defining the Core

considerable differences among schools in their clinical courses. The critical

incidence method was what Fasel et al (1998) and Fasel (1998) used in their studies

for defining a core anatomy curriculum for their School in Switzerland. They asked

a sample of Swiss general practitioners to identify the different anatomical
the core anatomy to be taught to undergraduates whose future speciahies are
structures, that they judged necessary for general practice, from the international
undefined at the time?
anatomical nomenclature. They found that general practitioners agreed with a very
  The GMC (1993) recommendation of the 'core and option' strategy inspired
high concordance (92.1 percent) on the structures
many responses. Alberti and Baylis (1993) welcomed the lack of definition, by the

General Medical Council (GMC), of the core curriculum They argued that h gave

each medical school the opportunity to maintain hs own character within a broad

firamework, which would not be possible if the GMC provided detail and defined a

national core curriculum.

MacLeod (1993) argued that while a core of essential knowledge and skills

relevant to medical practice existed and could be defined, the cost and purpose

were not justifiable. He suggested that, instead, medical schools should have

confidence in students' ability to discern appropriate learning objectives and pursue

them in a self-directed fashion. He was concerned that endorsement of the 'core and

options' model would perpetuate a content-driven, professorially controlled system

of medical education. On the other hand, other scholars attempted to identify what

constituted the 'core' curriculum. McManus and Wakeford (1989) stated that the

definition of a core curriculum was feasible with methods such as the critical

incident technique in which thousands of real medical events were analysed to

determine the skills needed to do the job. This, they believed, would address the

core knowledge would diminish the inter-departmental pov/er struggles that negatively affect consensus in medical schools. Another method would be to examine what is common to all different speciahies (Editorials, Lancet, 1991).

Interestingly, the pre-registration house officer (intem), sometimes also known as the 'undifferentiated doctor', was considered the object of educational objectives of medical education by the General Medical Council of Britain (GMC, 1993). After completion of internship the pre-registration house officer, in Zambia, is eligible to necessary for general medical practice. Fasel et al. (1998) contended that an

mentioned in the international anatomical nomenclature that they judged necessary of medical education by the General Medical Council of Britain (GMC, 1993). for general medical practice. Only about a quarter (22.6 percent) of the structures mentioned in the international anatomical nomenclature were identified as eligible to

anatomy course defined in terms of the specific epidemiological needs of physicians providing primary care, would satisfy both the reduced time available for teaching anatomy and the need to master the basic anatomical knowledge needed for general practice in medicine. Many authors questioned this epidemiological approach if used as a sole determinant in defining core curricula. However, if medical schools or heaUh policy makers insist on training doctors for their needs there may be a role for the epidemiological approach; the critical incidence method may still be useflil for defining a core curriculum.

Another worker, Carmichael (1988) instead advocated for consensus on the objectives of undergraduate education in each specialty, under the auspices of the General Medical Council's Education Committee. He asserted that because the GMC recommended that medical education target the responsibilities of the pre-registration house officer, medical education should focus on the pre-registration house officer. Additionally, he argued that such a consensus on

intellectual (cognitive) processes.

It is agamst this background that this study further investigated how the anatomy for clinical practice could be identified and thus a core clinical anatomy curriculum for undergraduate medical education defined.

practice as a licensed clinician. Such a practitioner, without further specialist training, is considered a general practitioner.

Summary of the Educational Concerns about Traditional Anatomy

Thus in summary, a sense of gloom and worry about anatomy teaching permeated the world of educators (Charlton, 1991a). It was considered that anatomy teaching fostered rote learning, overburdened students with irrelevant scientific facts, and was lacking in conceptual challenges (Charlton, 1991a; Scott, 1993). On the other hand, how teaching was conducted was reported to be changing in many countries (Limpkin, 1989). The core objective of medical education was now viewed as the production of competent clinicians and as such purely scientific pursuits had decreased fimdamentally (Bok, 1989). Application and integration of the basic sciences to clinical medicine, problem-based learning and self-directed leaming were being advocated instead. Concerns and developments regarding the status of anatomy as an academic discipline in the future medical curriculum demanded serious and thoughtful appraisal. More especially that there was a decline in the number of hours available for anatomy teaching (Fitzgerald, 1992; Fasel, 1996)

and better understanding of educational principles that foster higher level

Clinical anatomy focuses on the structure and fimction of the body that are important in the clinical practice of medicine, dentistry and the allied health sciences (Moore and Agur, 1996). Most clinical anatomy approaches incorporate systemic and regional approaches but stress the clinical applications.

Books that affirmed the clinical anatomy approach were the ones reviewed in this section. The books reviewed are listed in appendix one.

The aims of the review were threefold:

1) to explore for how long such clinical anatomy works had been around;

2) to explore why the authors had chosen the clinical anatomy approach over the systemic and regional approaches;

Section 2

Clinical Anatomy: Past Efforts at Increasing Clinical Relevance

Anatomy, literally "dissection", according to Gray's Anatomy 38"" Edition (Williams et al., 1995), is the science of the structure of the body. The main approaches to studying anatomy include (1) systemic anatomy, (2) regional anatomy and (3) clinical anatomy (Moore and Agur, 1996). Surface anatomy, 'visualization' of structures that lie beneath the skin, is used in all three approaches.

Systemic anatomy studies the structure of the body as a series of organ systems, for example: integumentary, skeletal, muscular, nervous, circulatory, digestive, respiratory, urinary, reproductive and endocrine.

Regional anatomy (topographic anatomy) studies the structure of the body as regions (e.g. thorax, abdomen, pelvis, upper limb etc.) The structural relationships of the parts of the body in the region under consideration are studied. Most human

anatomy courses and textbooks are based on such a regional approach.

c) To enhance remembering of anatomical facts because it was realised

many students forgot the anatomy they learned m preclinical years

(Lachman, 1981; Elhs, 1997)

d) To enhance higher order educational objectives (Healy, 1969)

3) to illustrate the different styles adopted within the clinical relevance

e) To comply and respond to curricular reform recommendations which

approach.

were considered obligatory (Basmajian and Slonecker, 1989;

Sinnatamby, 1999)

The efforts to increase clinical relevance have been sustained since the 1930s.

The efforts were notable in the 1930s, 1960s, 1980s and the 1990s. The edhions of

the 1980's and 1990's are now enjoying more recent editions going into the 21" Century.

Why the Authors Chose the Clinically Oriented

Approach The issues that drove clinical-orientation of anatomy

included:

a) The need to distinguish what anatomy is relevant to clinical practice

from that which is irrelevant; this was so because the subject of

anatomy was considered wide and exhaustive (Healey, 1969;

McGregor, 1932; Baxter, 1950; Ellis, 1997; Backhouse and

Hutchings 1998;Sinnatamby, 1999)

b) The need to present anatomy in a more stimulating exciting manner

as opposed to dry facts which were considered to be boring (Healey,

1969; Lachman, 1981; Snell, 1986; Basmajian and Slonecker, 1989)

In the foreword of "A Synopsis of Clinical Anatomy"(Healy, 1969), Loyal Davis wrote: "Nothing stimulates the medical student, dedicated to becoming educated to treat patients, more than to correlate the material being taught with an application to the patient. Every doctor of medicine recognises this fact." By the quote above, Davis introduces a new concept, stimulating motivation to learn. He reported that the Department of Surgery at University of Texas attempted for several years to exemplify the clinical application of gross anatomy by demonstrating patients with obvious and visible signs and symptoms of distortion of normal anatomical

f) Identify core anatomical knowledge (Healy, 1969; Snell, 1986; Ellis, 1997)

Reduce Irrelevant Parts and Increase Relevant Parts

A standard reference book in anatomy. Gray's Anatomy 38"" Edition (Williams et al., 1995) had 1,934 pages of text and illustrations. Sentiments in the literature indicated that efforts should be directed to writing books that focussed on anatomical facts relevant to practical apphcations of the subject. As early as 1932 the need to sift the enormous amount of anatomical facts had been seen, so that those that were more applicable to the practice of medicine could be identified. However, no details were given about how select what was of practical value to clinical practice. Ellis (1997) highlighted those features of anatomy, which he regarded as of clinical importance, to radiology, pathology, medicine, midwifery and surgery. He contended that the anatomy presented was that which students could reasonably be expected to carry with them during their years on the wards and career.

Present Anatomy in a Manner that Stimulates Student Interest

Healy (1969) stated that learning anatomy in clinical context and with increased relevance to clinical practice would change the learning methods of students by discouraging mere memorisation of anatomical facts.

relationships e.g., patients with inguinal hernia, enlarged thyroid glands, hare lip, syndactyly and x-rays of fractures and displaced bone fragments. These demonstrations were made to freshman classes of human anatomy. He wrote: "this was an attempt to change the teaching of anatomy from memorisation of the origin, insertion, nerve and blood supply of muscles and facts about viscera to a method of pedagogy in which the student's interest could be vitalised." Lachman (1981) used case studies as a way of addressing the students' yearning for information relating to clinical medicine and strengthening their motivation to learn.

Enhance Remembering of Anatomical Facts

Lachman (1981) alluded to the fact that in teaching anatomy "anatomists are faced with the dilemma that when students are learning quite an enormous amount of anatomy they are not aware of its application in clinical medicine... On the other hand, when they are in the clinical field they would have forgotten a substantial part of it." He proposed that a solution to this would be to teach anatomical principles in order to explain clinical signs, events, and therapeutic procedures right from the beginning of the first exposure to anatomy.

Encourage Higher Level Educational Objectives

light on how the "commonly diseased" areas of the body were ascertained.

Sinnatamby (1999) admitted that time constraints and interdisciplinary integration

had restricted the study of anatomy. With this regard, he asserted that anatomical

knowledge was required for performing physical examination and diagnostic tests,
Comply with Medical Education Reform
interpreting their resuhs and instituting treatment, particularly surgical procedures.
For "Grant's Method of Anatomy" in the preface (pg. vii) the authors advised that

the edition was a response to the GPEP (1984) report of the American Association

of Medical Colleges. The edition intended to reflect problem-solving methods,

which were being called for in the new basic science curricula The preface adds:

"There is no question this is the 'wave of the future' in professional education."

Sinnatamby (1999) spelled it out that the curricular reforms of undergraduate

education and the restructurmg of surgical training had been borne in mind in the

preparation of the textbook.

Identify a Core of Anatomical Knowledge

Healy (1969) warned that the difficulty about enhancing clinical relevance was

how to identify what sections of anatomy would be emphasised for the different

speciahies. Defining the core anatomy emerges here as a significant problem. Snell

(1986), while acknowledging the diversity in eventual specialisation of the

students, contended that the book offered a core of anatomical knowledge that

would serve physicians throughout their professional life. Perhaps the attempt to

define what was core lay in the admission that the book tried to deal in detail with
those areas of the body that were commonly diseased. He, however, did not shed

The approach in these types of books, essentially, presented descriptive topographical data and then provided sections that emphasised clinical applications of that data. In Healey (1969) each chapter was arranged into two sections. The first, 'General Considerations', gave an outline of topographical anatonty (i.e., boundaries, relations to nearby structures, blood and nerve supply). This approach provided a combination of descriptive text and an atlas. The second section, 'Clinical Considerations', explained the relevant clinical concepts and surgical procedures. In Snell (1986) the practical application of anatomical facts to medicine was stressed throughout the book

Styles of Clinical Orientation Several styles were used by the scholars in pursuit of this endeavour:

1) Descriptive topographical anatomy supplemented with separate sections or inserts of clinical anatomy (Healy, 1969; Snell, 1986; Mathers et al., 1996; Moore and Agur, 1996).

2) Descriptive topographical anatomy blended with clinical commentaries (Baxter, 1950; Ellis 1997).

3) Selected clinical problems used to decide the anatomy region to be discussed (McGregor, 1932).

4) Case Studies employed as stimuli for discussion of relevant anatomy (Lachman, 1981).

5) Clinical procedures and disease processes specific to the anatomical structure (Stem, 1999).

Descriptive Topographical Anatomy Supplemented with Separate Sections or

Inserts of Clinical Anatomy

anatomy comprehensively but are likely to remember the salient anatomical points

in enough detail to aid clinical practice.

Descriptive Topographical Anatomy Blended with Clinical Commentaries The

approach in such textbook was mainly discussing the clinical relevance of the
in the form of sections headed 'Clinical Notes'. Case studies were also used at the
anatomical data immediately the anatomical data was alluded to. In Baxter (1950)
end of each chapter. This book made no assumptions about earlier exposure to
the approach was such that he brought to the fore, immediately, the clinical
gross anatomy and therefore explained the basics; the introduction describes the
relevance of the subject matter imder discussion.   In clear style he presented
anatomy of the basic tissue types (epithelium, muscle, nervous tissue and
anatomical facts,
connective tissue). It also defined and explained the terminology used in anatomy.

Mathers et al., (1996) was organised by region. However, the fimdamental

organisation was buih around correlating anatomy to clinical medicine. Clinical

cases were also presented in substantial amounts after each chapter. They, however,

did not form the focus of discussion, because the authors believed that while there

might have been a role for case studies in teaching anatomy, the subject of anatomy

was too complex to be learned by this method alone. Moore and Agur (1996) was a

concise text of regional anatomy with descriptive figures, tables and illustrations

including modem imaging techniques i.e., computerised tomography and magnetic

resonance imaging. The clinical aspects and surface anatomy commentaries were

interspersed in the text. The book also made no assumption about previous

exposure to gross anatomy and provided clear definitions and illustrations of most

of the material.

Students learning anatomy from such textbooks might not learn topographical

clinical practice. However, the anatomical facts were discussed without reference to the cases. The cases were, as such, stand-alone. Chnical aspects that pertained to the anatomical facts were, however, concomitantly discussed within the text. Illustrations included diagrams, photographs of patient materials like x-rays. The

clinically salient features of anatomy were thus discussed as the descriptive without exhaustive topographical detail, and correlated them to clinical anatomy of the region was being discussed.

applications. Baxter (1950) assumed prior knowledge of basic anatomy because the book neither layed a background of basic anatomy nor defined all the concepts it discussed in any detail at all.

In Bruce et al. (1964) the text presented classical anatomy topography separately followed by clinical events that apply to discussed anatomy. It is evident from the excerpt (see appendix 2) that the anatomical detail required for surgical operations was discussed.

Smout et al. (1969) was mostly an anatomical text, restricted to the areas relevant to the pelvis particularly gynaecological and obstetrical practice. Of note, the textbook discussed histology i.e. histology of the ovary, uterus, vagina. It was no wonder the authors warned that while some of the material (histology by Professor Jacoby) may have appeared to the clinician to have little immediate relevance to the routine practice of a busy hosphal it was the basis of a scientific understanding of many gynaecological problems.

In Basmajian and Slonecker (1989), after introductory and systemic descriptions, each of the sections was accompanied by a clinical case - giving a history, physical

examination and course of treatment to show relevance of the material discussed to

text of descriptive anatomy.

Selected Clinical Problems used to Decide the Anatomical Region to be Discussed

Books that had this style discussed clinical applications when they presented the

topography. In McGregor (1932) the text of topographical anatomy was in

   In Ellis (1997) the descriptive components of anatomy were blended together
summary form and the clinical application of the facts presented was pointed out
with clinical application and concepts. A section, 'clinical features' followed each
with the text, as immediate as possible. As such, the book read like a descriptive
descriptive component and fiirther highlighted the clinically important concepts.
text of anatomy
Surface anatomy and surface markings were given prominence at the beginning of

each section. The book, as clearly stated in the title, assumed prior exposure to

anatomy and gave neither a background on anatomy concepts and terminology nor

explicit definitions. The contents were arranged using the regional anatomy

approach. Each part had a summary of surface anatomy and markings and was

sub-divided into sections and each section had sub-headings. The sub-headings

were consistently tackled in the same format - descriptive topography followed by

the clinical features summary. These were augmented whh diagrams and

illustrations.

   Sinnatamby (1999)'s Last's anatomy assumed no prior knowledge of anatomy

and introduced the basic tissue structures and anatomical concepts and terminology.

Noteworthy was that Last's anatomy included a brief account on embryology and

anatomy of the child. The material was arranged such that detailed anatomical

discourse was given and then followed by application and finally a surgical

approach. Rarely were direct clinical applications referred to within the body of the

masterfijlly composed case studies available in literature, such as the works of Hertzler, Cabot, or Kanavel." Ahhough, Lachman (1981), informed us of the source of the case studies, he did not reveal what criteria was used to choose the particular cases he used under each regional grouping. However, case studies, were found to be used widely in problem-based learning courses.
immediately correlated to clinical application. There were no separate sections highlighting the clinical applications.

Case Studies Employed as Stimuli for Discussion of Relevant Anatomy In this style case studies were used as stimuli for learning anatomy. In Lachman (1981) for each case, a short history, physical findings, diagnosis, therapy and further course were given, The clinical setting was used to discuss the material from an anatomical perspective in the form of a series of questions that were then answered. Relevant sections of the anatomy being discussed were illustrated by drawings. This approach hoped to synthesise factual information obtained in basic science with application to clinical problems. This approach was good for self-study since all questions formulated were answered in detail and the student could follow up other areas of interest stimulated by the case whether they were anatomical or clinical. The content in this book was arranged into a regional format. Under each region several case studies were discussed to illustrate the anatomical concepts. Lachman (1981) reported that these case studies were based on case histories chosen from the literature and from his experiences. He frirther contended that: "in a few instances the histories were taken from one of the classical collections of

School of Medicine UNZA library and from peers. The inclusive census conducted, and the ordering of specific tides recommended by 'knowledgeable' faculty could, however, mitigate for the sample to be considered representative of clinically-oriented textbooks.

The key issues revealed were that some scholars believed that: A) there was a hiatus between the anatomy that was taught in the preclinical years and the anatomy which was used on the wards and operating theatres by clinical students

Clinical Procedures and Disease Processes Specific to the Anatomical Structure

and practitioners. B) That learning anatomy in the clinical context could motivate

Only one textbook had this style. Stem (1999) took this unique approach. Chapters

the students to learn anatomy, encourage learning application of the subject matter

were arranged according to regional anatomy. The unique feature was diat in this

and discourage rote learning. C) That the challenge to overcome was how identify

text the author highlighted the clinical aspects from start to finish. He picked on an

what

anatomical structure, for example "Vertebrae", and started to discuss the clinical

applications without reference to the standard anatomical approach of a topographical description of the stmcture (see appendix 2).

Summary of Past Efforts of hicreasing Clinical Relevance

This review of the textbooks on anatomy with clinical orientation was not exhaustive. There were textbooks that were not included in the review, for example, "Pocket Examiner: Problem-solving Tutorials hi Clinical Anatomy" by Peter Abrahams; "Case Studies in Clinical Anatomy" by W. McDonald; "McMiim's Functional and Clinical Anatomy" by Robert McMiim, listed in Medical Textbook Catalogue 2000 (Harcourt Publishers Limited, 2000). Some of

the reasons for non-inclusion were financial limitations, paucity of availability at

concept is understood and applied.

"For the precise way in which he taught anatomy to his class, always with a view of practice of medicine" were the words of John Goodsir (1814-1869),. successor of Monro tertius who was professor of anatomy in Edinburgh, commending Monro primus (1697 - 1767) (Newell, 2001). Many other scholars (McGregor, 1932; Baxter, 1950; Bruce et al., 1964; Healy, 1969; Lachman, 1981; Snell, 1986; Basmajian and Slonecker, 1989; Moore and Augur, 1996; Matters et. al, 1996; Ellis, 1997; Stem, 1999) came this route too. Yet Newell (2001) in his presentation to the British Association of Clinical Anatomists (BACA) asked these questions: What was clinical 1932; Healy, 1969; Lachman, 1981; Snell, 1986; Ellis, 1997). None of the authors, however, explichly indicated the methods used to arrive at their selection of clinically relevant anatomy.

was core given the diversity of clinical specialisations. Several authors indicated that they have used their experience, in addition to some other selection criteria, to arrive at what they consider as anatomy relevant to clinical practice (McGregor,

Core anatomy for clinical practice could be defined by, first, closely studying the anatomical concepts that apply to clinical methods (history-taking, physical examination, clinical reasoning and interpretation of investigations), the daily tools of the medical practice, and second, closely studying the diseases, clinical procedures and operations that the clinician encounters. None of the authors reviewed here used this approach.

The Meaning of Clinical Anatomy The attempt to increase the relevance of anatomical knowledge to clinical practice caused the emergence of
a new concept, clinical anatomy. This sub-section explores, critically, how this new

anatomy in treatment? Were clinical anatomist required to be teachers of clinical

anatomy? Were all clinicians with interest in anatomy clinical anatomists?

Clinical Anatomy: A New Discipline

Traditional components of anatomy are classically gross anatomy, histology,

embryology and neuroanatomy. The emergence (with significant impetus) of

clinical anatomy as a new branch of anatomy is fairly recent. The emergence of

clinical anatomy was largely due to the dissatisfaction of the content and relevance

to Ahhough the literature on clinical anatomy had mushroomed over the 90s

decade, clinical anatomy as a discipline was still ill defined, there were conflicting

views about what it was, what its practitioners did, and who should be called a

clinical anatomist. Newell (2001) asserted that the first chair of clinical anatomy

was held by H. A. Harris in 1931. The other known clinical anatomist was Harold

Ellis who was 'university clinical anatomist' at Cambridge beginning 1980 (Newell,

2001). Richard Newell also held a position of clinical anatomist at University of

Wales. Newell (2001) raised many questions that invariably stimulated thought

about the nature of chnical anatomy. The questions that Neweh (2001) raised were

many: Was all clinical anatorr^ topographical? Did clinical anatomy include

radiological? Why not just diagnostic anatomy? Should clinical imply

pathological? Could something be clinical and normal? Did clinical anatomy mean

anatomy applied to patients? How did it differ fi-om surgical anatonry? How did it

differ from applied anatomy? Was clirffcal anatomy, anatomy in diagnosis, and/or

anatomy in treatment? Were clinical anatomist required to be teachers of clinical

anatomy? Did everybody who used the phrase mean the same thing? Who should be
considered a clinical anatomist?

Association of Anatomists <**Error! Hyperlink reference not valid.**> and the Anatomical Society of Great Britain <http://www.anatsoc.org/>.

Clinical anatomy courses that previously didn't exist (or didn't go by that title) also emerged in universities. Examples were the courses at:

1. University of Florida <**Error! Hyperlink reference not valid.**>

2. Columbia University <http://cpmcnet.**Columbia.**edu/dept/clinicalanatomy>

3. Creighton University <http://owKvebl.creighton.edu/pages/Registrar/su2002CAN.htm>

medicine **as** it was classically taught, Newell (2001) quoted Malaigne (1806 -65) who wrote "... it is not at all paradoxical to affirm that professional anatomists have only **a** very imperfect grasp of anatomy'. There were many clinicians who thought that the anatomy that was taught by professional anatomists was inappropriate. Let alone not understanding the clinical applications that were required for the clinician.

Thus **a** new field emerged. Clinical anatomy associations appecired:

1. American Association of Clinical Anatomists was available on the website <**Error! Hyperlink reference not valid.**> and was founded in 1984.

2. British Association of Clinical Anatomists was available at webshe <**Error! Hyperlink reference not valid.**> and was founded in 1977.

3. European Association of Clinical Anatomists <http://www.eaca-aeca.org/> founded in 1988.

These associations emerged even if anatomy associations were already in existence. For example, two leading anatomical associations were the American

et al. (1999) proposed that a common body of anatomical knowledge appropriate for the field of general medical practice did in fact exist and should be considered for anatomical courses. Dangerfield et al. **(2000)** stated that developments in undergraduate medical education in the United Kingdom had produced changes in the content and delivery component of courses, including human anatomy. They (Dangerfield et al., **2000)** advised that anatomy could retain *its* place in the medical

curriculum by gaining recognition as an integral part of the curriculum, which
The Educational Affairs Committee of the American Association of Clinical
underpirmed much of the practice of clinical medicine. Trends towards reclaiming
Anatomists had come up with "clinical anatomy curriculum for the medical student
lost place of anatomy time in the curriculum were already happening; on 17* May
of the **2r'** century" in gross anatomy (AACA, 1996), and another for developmental
2002 the University of Texas Medical Branch at
anatomy (AACA, **2000).** Other courses that emerged were conducting their

curriculum differently from what had been done previously (Monkhouse and Parrel, 1999; Satyapal and Henneberg, 1997; Fasel et al., 1999; Dangerfield et al., **2000;** Boon et al., **2002;** Tavares and Silva, **2002;** Vidic and Weitlauf, **2002).** Monkhouse and Farrel (1999) decried the changes that were taking place to the anatomy curriculum given the unchanging nature of the structure and function of the human body. Monkhouse and Farrel (1999) also drew attention to the lack of evidence by the United Kingdom General Medical Council in its condemnation of departmental structures and "its uncritical espousal of integration." Satyapal *and* Hermeberg (1997) acknowledged that change in anatomy curriculum was happening, in their paper they raised concerns regarding anatomy as an academic disciplme and its fLiture. Satypal and Henneberg (1997) asserted that the traditional place of anatomy in the medical and other curricula was under serious threat. Fasel

What Clinical Anatomy Meant: The Many Views

Boon et al. (2002) stated that clinical anatomy was usually defined as anatomy applied to patient care. Tavares and Silva (2002) implied that the discipline of clinical anatomy was necessarily adopting a clinically based approach. This had been the case with many authors (McGregor, 1932; Baxter, 1950; Bruce, Walmsley, and Russ, 1964; Healy, 1969; Lachman, 1981; Snell, 1986; Basmajian and Slonecker, 1989; Moore and Augur, 1996; Matters et al., 1996; Ellis, 1997; Stem, 1999). The American Association of Clinical Anatomists (AACA, 1996)

Galveston Curriculum Committee voted to introduce basic sciences in the clinical years (year 4 and 5) by way of joint grand grounds, teaching rounds and electives. Boon et al. (2002) asserted that medical students recognised the importance of anatomy as the basis for clinical examination when exposed to an appropriate from the outset, may

integrated presentation. Tavares and Silva (2002) stated that the discipline of clinical anatomy, as introduced at Medical School of Porto in 1995/6, involved major changes in the way anatomy was taught by adopting a clinically oriented approach. Vidic and Weitlauf (2002) surmised that the future pedagogical system in medical schools would most likely be a combination of "classical" presentation of material combined with either hypothetical or real clinical cases. Vidic and Weitlauf (2002) also advised that for the new curriculum to succeed basic science departments would have to be reorganized to determine ownership; systems would have to be ^established to reward faculty for teaching; and new course objectives would have to be developed. The evidence that a new kind of anatomy course (clinical anatomy) had emerged was irrefutable. But as Newell (2001) asked did everybody who used the phrase 'clinical anatomy' mean the same thing?"

3-D Anatomy   Anatomical Variation

(Base) **Anatomical Terminology**

inadvertently, have caused confusion. The title of the document was "A Clinical Anatomy Curriculum for the Medical Student of the 21*' Century: Gross Anatomy." That was clinical anatomy and gross anatomy in the same breath. Furthermore, in the outlines section of the document the sections were titled: 1. Introduction; 2. Anatomical concepts. Anatomical Terminology, Three-Dimensional Anatomy, Anatomical Variation, Functional Anatomy, Living Anatomy, Imaging Anatomy, Clinical Anatomy; 3. Regional Anatomy; Thorax, Abdomen, Perineum and Pelvis, Back, Head and Neck, Upper Limb, Lower Limb. Clinical anatomy appears as the last part of each of the regional anatomy components.

Figure 2-1 The Anatomical Concepts That Bind the Subject Matter of a Gross Anatomy Curriculum into a Clinically Applicable Form (Adapted from AACA, 1996)

(Apex)   **Clinical Anatomy**

Living Anatonny   Imaging Anatomy

applications. On page 75 (AACA, 1996) they elaborated clinical anatomy as applying the structural aspects of human biology to better understand the fimction and dysfunction of the human body, with particular emphasis on patient care. The subsequent statement was;

"This includes both the clinical applications of gross, histologic, developmental, and neurologic anatomy as well as implications of clinical observations in expanding our understanding of anatomy." Was it clinical anatomy bases (as on page 2 and the lists of topics that fall under clinical anatomy sections (at the end of each regional section) of the general concept of clinical anatomy (on page 73) that made the apex in the hierarchy of concepts that bound the subject matter of

The confusion arose because their presentation was analogous to defining a word by using the same word in a definition. It was a tautology, that is, clinical anatomy was a component of clinical anatomy.

Despite this earlier confusing situation with the terms, the AACA stated that 'The document stresses the significance of anatomical terminology, normal variation, three-dimensional relationships, functional and living anatomy, and imaging technology as applied to patient care, -a discipline termed clinical anatomy." This definition was summarized in figure 2.1 as the anatomical concepts that bind the subject matter of a gross anatomy curriculum into a clinically applicable form.

It was not clear how clinical anatomy appearing at the apex of figure 2.1 was to be understood. On page 72 (AACA, 1996), AACA stated that it followed that training in clinical anatomy included instruction in the anatomical basis of diagnostic and therapeutic procedures and as such each regional anatomy section concluded with clinical anatomy topics relevant to current medical

67

into gross anatomy (back and upper extremity; thorax; neck and head; abdomen; pelvis and perineum; lower extremity) and developmeiital anatomy (bilaminar germ disc; trilaminar embryonic disc and its derivatives, vertebral column and spinal nerves, extremities; lungs and pleural cavities; heart; head and neck; eyes and ears; gastrointestinal tract; urogenital system). For Florida clinical anatomy was a combination of specific topics in gross anatomy, developmental anatomy and clinical cases, all used to highlight anatomical concepts in clinical cases.

gross anatomy into a clinically applicable form? Furthermore, other concepts were introduced in the statement on page 73, i.e., histologic, developmental, neurologic anatomy, and implications of clinical observations in expanding understanding of anatomy.

The clinical anatomy masters programme at Creighton University included human gross anatomy and neuroanatomy; pathology, surgery, radiology, and embryology as they were understood to relate to human clinical practice

The course offered by the University of Florida in the United States that was found at website <http: // wvm. medinfo. ufl. edu/year 1 /ha/co urse. html> was primarily laboratory oriented with discussion sessions used to highlight anatomical concepts and pruiciples. The discussions in the course were based on clinical presentations that emphasised anatomical concepts. The course was designed around clinical presentations i.e. how a patient presented to a physician. Some of the clinical presentations that were used for the course were: for gross anatomy (abnormal growth, diminished pulse, sore throat, trauma to perineum, for example); for developmental anatomy (hydatidiform mole, tracheosophageal fistula, bilateral cleft lip/palate, for example). The course included a core component for the discipline of anatomy. The core was divided

Association of Clinical Anatomy in 1988. In university departments that offered courses in anatomy per se, new courses titled chnical anatomy had emerged or the old courses had been given this new name. It was irrefutable that phenomenal change to the way anatomy had been taught was happening.

The striking feature was that the phrase clinical anatomy meant different things to different people. Confusion existed amongst the clinical anatomy associations, universities and individual faculty. It was not yet clear what clinical anatomy meant, who a chnical anatomists was, and what investigational research was to be in this new field. The lack of agreement, on many matters, m this field implied no paradigm in clinical anatomy existed yet.

(http://bifl 1 .creighton. .edu/~jerry/Public/clinatms.html). The course was primarily designed for those who wished to continue their professional careers as teachers of clinical anatomy or who would incorporate significant amount of chnical anatomy teaching into their academic careers. This course was designed bearing in mind the chronic shortage of human anatomists especially those trained to teach clinically relevant anatomy. The unique feature of this course was the clinical rotations. The course provided opportunities to experience day-to-day applications of gross anatomy in the clinical specialties of surgery, radiology, and pathology.

Summary of the Emergence of Clinical Anatomy

Over the years the increasing demand to make the teaching of clinical anatomy more relevant to medicine had resulted in the emergence of a new anatomical discipline called clinical anatomy. The emergency of this new discipline was evident by the formation of the British Association of Clinical Anatomists (1977),

American Association of Clinical Anatomists (1984), and the European

They considered semantic memory as referring to memory of facts (relationships between signs and symbols and what they represent) without regard to how they were acquired (Kurkland and Lupoff, 1999). Cohen (1977) asserted that semantic memory deah with the structure, storage, cross-referencing and indexing of knowledge in the human brain (Cohen, 1977). Kurkland and Lupoff (1999) and Bordage (1999) also supported this view. According to Cohen (1977) the basic building blocks in semantic memory were concepts. He asserted that properties of concepts and how they relate to each other defined them. This was why he considered that areas of knowledge are facts represented by concepts in particular

Anatomical Interpretation of Clinical Data: A Clinical Reasoning Perspective

relationships. The importance of how and what anatomical knowledge that the
This study was primarily concerned with identifymg the anatomy that the physician
clinician is taught, in training and how she finally uses it is highlighted in the
required for his/her daily clinical practice. All the data that is generated by a
following statement by Cohen (1977):
clinician by way of history-taking, physical examination, and investigations must

be interpreted. The process of interpretation is referred to as clinical reasonmg.

To understand how anatomy is employed in this clinical reasoning process requires understanding human thought and judgement: the psychology of cognition. The review of the literature in this regard was an attempt to be enlightened further on this process and see how it could impact on the teaching of anatomy for clinical practice.

Semantic Memory, and Models

Psychologists and scientists differentiated between episodic memory (memory of
regular and routine events) and semantic memory (Kurkland and Lupoff, 1999).

was concemed, Cohen (1977), Norman and Schmidt (1992), Kurkland and Lupoff (1999), agreed that familiarity and frequency played a critical role jn acquisition, storage and retrieval of knowledge. This may be important because anatomy taught in clinical context would be more frequently encountered in practice, thus providing the necessary familiarity. For the practice of medicine and medical education, however, the context was widely accepted as that of a clinical situation.

Cognitive psychologists admitted that different strategies were employed in processing new knowledge depending on existing background knowledge, motivation, intentions and other factors, which were difficuh to specify and control (Cohen, 1977; Norman and

> "Semantic memory is not just a static mental encyclopaedia, but a working system, in which new facts are constantly being incorporated, stored knowledge is being updated and reclassified, and particular items of information are being sought, located, assembled and retrieved. Semantic organization is especially important because it is one of the most powerfial and pervasive determinants of performance in mental tasks. How knowledge is arranged determines how we speak and how we understand, how we solve problems and how we remember."

In the context of the study, how was the clinician's knowledge of the anatomy stored? Did it foster recall of the anatomical facts? Was it stored in different formats, one preclinical and another clinical? Did it foster understanding and solving clinical problems?

There were many models of semantic knowledge quoted in the psychology of cogmtion: Space models, dictionary models, network models, set-theoretic models, and marker-search models (for details refer Cohen, 1977).

None of the models provided a fully comprehensive account of semantic structure and semantic processing (Cohen, 1977). Where retrieval of information

problems were considered the most economical strategies to tackle new problems in terms of previous experience rather than tackling each one afresh (Cohen, 1977; Elstein et al. 1978). Unfamiliar problems needed restructuring if a solution was to be attained.

Clinical Reasoning

In the medical education literature one of the most cited work on clinical reasoning was the Medical Inquiry Project (Elstein et al., 1978). That work at Michigan State University brought out interesting insights into the process of clinical reasoning.

Schmidt, 1992, Kurland and Lupoff, 1999). For medical practice and medical education, existing background knowledge, motivation, and uitention can be controlled for learning purposes. Understanding the semantic structure of knowledge could be useful to educators in how they organise anatomy teaching.

Clinical Reasoning and Problem-solving

Clinical reasoning is a form of problem-solving. Here, problem-solvmg as it applies to clinical reasoning is reviewed in detail because the hypothetico-deductive clinical reasoning process is the basis of the theoretical firamework of the study. The variables in problem-solving are discussed in detail in Cohen (1977). Of note was the consensus amongst several authors (Cohen, 1977; Norman and Schmidt, 1992; Bordage, 1999; Kurkland and LupofF, 1999) that familiarity with the problem had a significant role in problem-solving. Experience helped in solving problems similar to those encountered before. On the other hand, experience could limit the perspectives to be considered, in view of "fixedness" (Cohen, *X911),* created by previous experience or the lack of it, which determined how a problem was perceived or solved. Readily designed structures of solving

1. Cue acquisition,

2. Hypothesis generation,

3. Cue interpretation, and

4. Hypothesis evaluation or judgement.

Elstem et al. (1978) and Bordage (1999) agreed that thoroughness of cue
Several authors acknowledged that diagnostic problems were solved through a
acquisition and accuracy of cue interpretation were statistically independent.
process of hypothesis generation and verification (Elstein et al.,1978; Bordage,

1999; Round, 2000). In this hypothetico-deductive process hypotheses were

consistently generated early in a medical workup (history-taking, physical

examination, and investigation) when only a very limited database had been

obtained. In subsequent steps early hypotheses that are not later supported by

subsequent data are rejected (Elstein, et al., 1978; Bordage 1999). The purpose of

the hypotheses are to serve as organising rubrics in working memory (Elstein et al.,

1978). This supported Cohen (1978) who, as seen earlier, stated such an approach

was an economic strategy to problem-solving. Such rubrics, it was stated, helped to

overcome limitations of memory capacity and served to narrow the size of the

problem space that was searched for solution (Elstein et al., 1978). According to

Elstien et al.(1978) it was impossible to conduct an efficient inquiry without some

hypothetical goal that would tell the inquirer when to stop, hypotheses served to

transform an open medical problem (what is the patient's illness) into a set of closed

problems (Elstein et al. 1978) that were much easier to solve. In Elstein et

al.(1978)'s general model medical inquiry there were four major processes:

h) instructions

* Radiology is considered under 'laboratory' as an investigation

The clinical methods procedure (search for information), as taught in many Practice of Medicine (POM) courses, includes doctor-patient interviews which ask about a patient's habits and life styles and medical history; the physical examination includes procedures such as examining the eyes, measuring the blood pressure, and the investigations are requests for specified laboratory tests (Elstein et al., 1978; Swash, 1989). Cues are the data or findings obtained via the clinical methods i.e..

How physicians work. The cognitive psychology approach to clinical reasoning is based on the widely used outline of chnical methods for assessing patients (Swash, 1989). Information search units are used to index information in the history-taking and physical examination protocols (Elstein et al. 1978). Elstein et al. (1978) defined an information search unit as "any statement or act of the physician that either seeks mformation from the patient, instructs the physician concerning a procedure in the examination, or establishes rapport between the physician and the patient." Eight content categories were developed by Elstein et al. (1978) into which any information search unit could be assigned:

a) rapport

b) history of present illness

c) personal and social history

d) previous medical history

e) family history

f) physical examination

g) laboratory (*radiology)

h) instructions

* Radiology is considered under 'laboratory' as an investigation

recall of appropriate content from long-term memories. 'The finding of case specificity does indeed raise a significant problem for curriculum planning in medical education, for it suggests that the extent of transfer from problem to problem is less than a case-oriented curriculum appears to require for justification" (Elstein et al., 1978).

Regarding the implications of their findings on curriculum Elstein et al. (1978)

concluded that beyond the fundamentals of the generic process, transfer is indeed limited; but they did not conclude that case-oriented curricula were not inappropriate. On the contrary, they contended the limitations on the extent of transfer possibly

history-taking, physical examination and investigations (Elstem et al., 1978). The cues are either volunteered by the patient or elicited by the attending physician. The physician then develops hypotheses that explain the condition or solves the

problems (Elstein et al. 1978). According to Elstein et al. (1978) the hypotheses are concepts of medical significance used to cluster cues and are in turn verified or disproved by the evidence. These cues are considered for an outcome goal. There are three possibilities from this consideration: "a cue may be positive, non-contributory, or negative with respect to a particular hypothesis" (Elstein et al., 1978). The researchers (Elstein et al, 1978), Bordage (1999), Eva et al. (2000) contended that early generation of possible diagnostic hypotheses was a key stratagem used by, especially successfiil, clinicians to restrict the possibilities to a problem space most likely to be successful in the solution.

This hypothesis testing approach approximates "Test Operate Test Exit (TOTE) programme" described by Cohen (1977). Norman (1997) and Elstein et al (1978) admitted that this generic problem-solving strategy of solving any medical problem must be taken with caution because effective problem-solving depends also upon

information evaluation was not equivalent to storing and recalling facts from this store and was a skill that was acquired, like other skills, through practice.

Other Views on Clinical Reasoning

Another worker, Bordage (1999) commenting on how physicians think asserted

that faulty detection or triggering could be attributed to a number of causes: having
helped to understand why some medical students educated in a traditional
no prior instances to refer to, overestimating certain features, or having no mental
preclinical curriculum that were the heritage of the Flexner's 1910 report have
representation of the problem overall.   According to Bordage (1999) "physician
difficulty adapting to the clinical approach; students from such curricula, they

contended, found it hard to transfer scientific facts and principles to clinical

applications because the classical curriculum did not offer enough early

opportunities for practice. A case-oriented curriculum, they suggested, should ease

this transition, but chiefly for problems studied in the preclinical years. In

conclusion they advised that a medical school curriculum buih around clinical

problems and case discussions in the preclinical years should therefore choose

problems and cases carefully and deliberately. It cannot be assumed that any

problem will do because all exemplify the problem-solving process. They do

exemplify this process, but competence is also dependent upon knowledge of

content. Carefully selected problems are vehicles for building a store of memories

(knowledge) as well as a set of formal strategies. Elstein et al. (1978) also

contended that there was evidence from their studies for proposition that

problem-solving - the evaluation and integration of clinical data - was a skill that

could not proceed without a well developed memory store. At the same time,

of thoroughness as an initial data-gathering strategy is not ideal because if one doesn't know what to look for, there are likely not to see it no matter how thoroughly one looks."

Considered in detail, experts employ three main methods or a combination of these: a) Hypothetico-deductive approach, in which a hypothesis or hypotheses are

generated very early during the initial presentation of the problem, from existing
recognise patterns (prior instances), follow rules (analysing features), and activate
knowledge, associations, and experience. Further questions or examinations are
neural networks (exploring complex pathways and concepts)".
oriented towards supporting or refriting these first ideas.
In pattern recognhion the physicians have encountered the problem before and recognise the pattem of presentation and solution (Bordage, 1999, Round, 2001).

Success in Clinical Problem-solving

Bordage (1999) advised that errors in diagnosis were not due to inattention but failure to make connections and quickly recall similar prior instances stored in memory. In other words, according to Bordage (1999), you see what you are looking for. This is to say when physicians are presented a case they consider features of the case; if they happen to be considering the correct diagnosis. Round (2001) surmised that while students were taught to take a history and perform an examination before constructing a differential diagnosis experienced doctors utilised shortcuts (heuristics), based on knowledge and previous experience. This is what makes the experienced physician to work more quickly and more accurately than students (Round, 2001).

Based on such findings, Bordage (1999) advised that "thoroughness for the sake
of thoroughness as an initial data gathering strategy is not ideal because if one

depended on the mastery of domam content than on problem-solving strategy.

Mandin et al. (1996) contended that the hypothetico-deductive was used when there

wasn't mastery of content; whilst pattem recognition, a strategy that didn't use basic

science principles and was mostiy used by experts; forward reasoning, was widely

used by experts to solve sophisticated problems. Norman (1997) had this say about

problem-solving skills "study after study, in disciplines from chess to cardiology

b) Pattem recognition in which disease patterns are recognised from previous

and from wrestling to waitressing, have shown that the most important determinant

experience and knowledge and form the basis on which particular combinations

of expertise in a domain is how much knowledge you have of that domain.

of symptoms or cues suggest a diagnosis.

Problem-solving skills

c) Knowledge of pathognomonic signs and symptoms is the other method, by

which a particular finding almost guarantees a certain diagnosis.

Another worker Patel et al. (2001) contended that non-expert doctors used two

types of clinical reasoning depending on the type of training they underwent;

doctors trained in problem based leaming curriculum (teaching of basic science in

context of clinical medicine and explicit teaching of problem-solving strategies in

the form of hypothetico-deductive method of reasoning) used the

hypothetico-deductive method; doctors trained in conventional curriculum (in

which the hallmark is the teaching of basic sciences before clinical practice) used

the forward reasoning method (clinical data "triggers" the diagnostic hypothesis).

Mandin et al. (1996), Norman (1997), argued that a generalised problem-solving

process did not exist in medicine but instead the presence of "problem-specificity"

was the mle. According to Mandin et al. (1996) success of problem-solving

means of early exposure to clinical context. As new information is learned, it can be integrated meaningfully mto relevant prior knowledge and thus ensure maximum retrieval. Anatomical knowledge assembled in clinical context would enhance greatly the acquisition of relevant anatomical knowledge base, encoding knowledge in the context it mostiy likely to be required hence enhance recall (Tulving and Thompson, 1973). From the above discussion, in anatomical context, one can thus suggest that clinical practice involves an intricate, interrelated set of are not at all general. Performance on one problem tells you next to nothing about medical knowledge and skills. The process involves constantly developing and performance on the next problem."

drawing upon and interpreting three areas of knowledge and skills (Figure 2.2).

Summary of Clinical Problem-Solving as a Theoretical Perspective for Clinical Anatomy

The hypothetico-deductive theory of clinical reasoning was the major strategy of clinical reasoning, in the literature. The theory addresses the issues of integration between basic science and clinical sciences; leaming in clinical context; and increasing clinical relevance. Problem-solving models in cognitive psychology also concluded that problem-solving is greatly affected by familiarity or unfamiliarity of the problem. By deduction students, must leam anatomy, not simply in a mechanistic manner, but with diagnosis, discriminating anatomical features, and a sense of clinical application in mind all at once. With the help of case studies, clmical presentations that discuss anatomy, students can actively store and retrieve knowledge, all the while rehearsing and building traces in memory for future ease of access and understanding. Clinical information in the case studies could offer a means of early exposure to clinical context. As new information is leamed, it can be

Clinical   Basic Science   Past   Clinical
Knowledge and   Knowledge (i.e.,   Experience
Techniques   Anatomy)

Clinical Reasoning Process
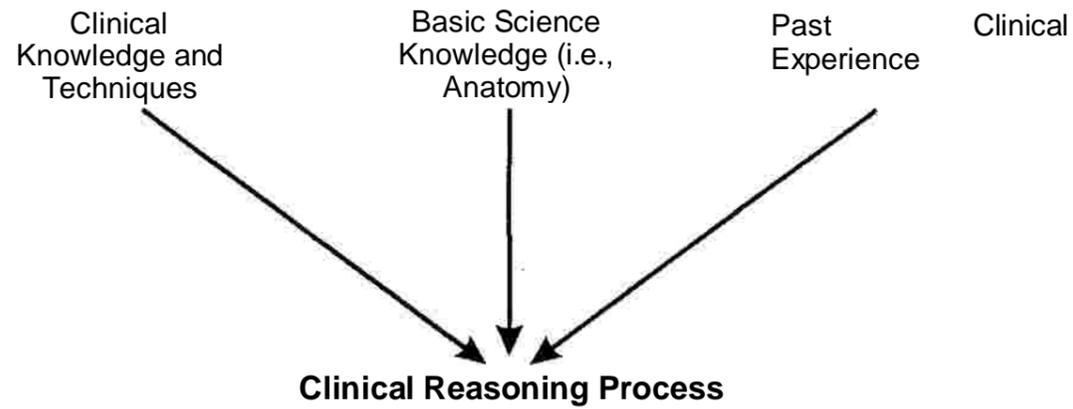
Figure 2.2. Clinical Reasonmg Process and the Knowledge/skills Areas [Adapted from VM8284(2001)]

The knowledge of anatomy must be coupled with clinical knowledge and skills generally organised around categories of clinical data: 1) Symptoms and signs (obtained by way of history taking and physical examination), 2) Irriaging and laboratory data, 3) Illness profiles and, 4) Demographics.

Practice is the major independent variable in the acquisition of skill (Chase and Simon, 1973, as quoted by Cohen, 1977). In the case of anatomy what do you practice? Repeated reading of anatomical text would consolidate anatomical knowledge but it has been shown that when leamed as anatomy per se it is difficulty to transfer to clinical scenarios. Thus the practice must be that of anatomy as applied to clinical situations and problems.

qualitative research refers to research procedures that lay emphasis on process and meanings (Mwansa, 1993; Verma and Mallick, 1999). Qualitative research thus emphasises the value-laden nature of inquiry, seeking answers to questions that stress how social experience is created and given meaning (Mwansa, 1993; Verma and Mallick, 1999). On the other hand, the quantitative paradigm is a research methodology that emphasises the measurement and analysis of causal relationships between variables, not processes (Verma and Mallick, 1999). In the quantitative paradigm the inquiry is purported to be within a value-free framework (Verma and Mallick, 1999; Homer and Westacott, 2000).

Table 2.1 shows the different characteristics of qualhative and quantitative research.

Section 3 Review of Research Methods

The Research Paradigms In research there are, conceptually, two paradigms: the qualitative, and quantitative paradigms (Verma and Mallick, 1999; Homer and Westacott, 2000). According to Mwansa (1993) a paradigm of research is not defined at the level of method but at the level of paradigm Mwansa (1993) quotes Bogdan and Biklen (1990) in defining a paradigm as " a loose collection of logically held together assumptions, concepts or propositions that orient thinking and research." A brief review of the two paradigms is included here.

Qualitative Research Paradigm Vs Quantitative Research Paradigm As a paradigm

qualitative research refers to research procedures that lay emphasis on process and

Table 2.1
Characteristics of Qualitative and Quantitative Research

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables
Techniques or Methods	
• Observation	• Experiments
• Reviewing documents/artefacts	• Survey research
• Participant observation	• Structured interviewing
• Open-ended interviews	• Structured observations
Relationship whh Subjects	
• Empathy	• Distant
• Emphasis on trust	• Circumscribed
• Equalitarian	• Short contact
• Intense contact	• Subject-researcher
• Subject as friend	
Data Analysis	
• Inductive	• Deductive
• Ongoing	• Occurs at conclusion of data collection
• Constant comparative method	• Statistical
Problems in Using the Approach	
• Time consuming	• Controlhng other variables
• Data collection difficult	• Validity
• Procedures not standardised	
• Difficulty in studying big populations	
• Reliability	
Natural setting	Artificial settmg
Degree of structure imposed by observer	

Table 2.1
Characteristics of Qualitative and

(adapted from seminar notes: University of Texas Medical Branch at Galveston,

2002).

lack; Stolberg et al (1998), developed core curriculum in the evaluative sciences for

diagnostic imaging. Hodes

(1998) discussed a core curriculum for child and adolescent psychiatry while Avery

(2000) examined core competencies for basic midwifery practice; Cattini and

Knowles (1999), discussed core competencies for clinical nurse specialists; Dove

(1999) , defined core competencies for psychiatry residents. Many other scholars

have

written about methods used for defining the core of a profession or task, for

example,

Achike and Ogle (2000), Hodes (1998), Aljabadi-Wahle et al.(2000)

The Necessity to Identify the Core

Several methods have been used to understand a profession, analyse a specific
This sub-section reviews the literature to examine how and what has been done to
attribute as it applies to a profession, and then use such information for compiling a
investigate issues in medicine with particular focus on the methods used for the
set of core knowledge, skills, attitudes and competencies. The methods identified in
kind

the literature are the critical incident technique; content analysis; participant
Muclow (2002) reported on the knowledge and skills that are essential for
observation; and the Delphi method.
specialists in clinical pharmacology and therapeutics. Baldwin et al. (2000)

described a process to identify the core skills required of basic surgical trainees.

Robbins and Beck (1982) discussed the process for identifying the core content for

geriatrics. Battles and Mandle (1986) discussed determining the core competencies

of the ideal health sciences communicator while Macdonald et al. (2000) examined

the common core competencies required for occupational physicians. Dolan and

Lauer (2001) examined identifying core competencies in geriatric dentistry;

Buchanan et al. (1997), identified the management competencies which doctors

development of training programmes or other aids to increase the effectiveness of individuals (Flanagan, 1954; NLM, 2001). The use of investigational data on actions/behaviours that actually make a difference to the outcome of an activity, provides a more comprehensive, specific, and vahd basis for performance evaluation, selection, for example, than does a set of requirements based solely upon the opinion of experts (NLM, 2001).

Several researchers reported work that used this technique: Blum and Fitzpatrick (1965); Hubbard et al. (1965); Jacobs et al. (1978). Derrington and Smith (1987);

Sim Critical Incident Technique The critical incident

technique (CIT) was developed by John C. Flanagan (Flanagan, 1954), The critical incident technique is a set of procedures for collecting detailed reports of incidents in which an individual did something that was particularly effective or ineffective (Flanagan, 1954). An incident is an observable human activity that is sufficiently complete in itself and permits inferences about the outcome of the activity (Flanagan, 1954). The incidents are collected, by interview or written record from observers who are qualified, by virtue of their training and experience, to decide whether the outcome was effective or ineffective (Flanagan, 1954). The term critical in this context should not be confiased with an emergency, or a matter or life and death, it refers to "the pivotal role of the action (by the observed) in the outcome of an activity" (NLM, 2001). The critical incident technique yields lists of critical requirements (generally termed performance taxonomies) that can then be used for a variety of practical purposes such as the evaluation of performance, the selection of individuals with the greatest likelihood of success in the activity, or the

incident forms. This procedure was repeated at an international meeting of the

American Orthopaedic Association. Subsequent to the meetings further requests

and critical incident forms were also mailed to attendants of the meetings reminding

them to complete the critical incident forms and sending new ones if required.

Critical incident forms were also mailed to directors of residency programmes in

America for distribution to third and fourth-year residents. Blum and Fitzpatrick

(1965) had attempted to mathematically determine the number of incidents required

et al. (1996); Holmes et al. (1990); Plutchik et al. (1994); Allery et al. (1997);

a priori but abandoned this method because various assumptions of variables were
Diamond et al. (1995); Gilbart et al. (2001); Bryne (2001); Robling et al. (1998).
untenable for sample size formulas. Blum and Fitzpatrick (1965) continued
  In the study by Blum and Fitzpatrick (1965) the purpose of the study was to
examining incidents until 1500 incidents when there was a decline in the
develop an explicit and comprehensive definition of competence for the

orthopaedic surgeon. The American Board of Orthopaedic Surgeons would then use

this definition to develop assessments that would measure orthopaedic competence.

For this study Blum and Fitzpatrick (1965) defined a critical uicident as an event

which lead to particular desirable or undesirable consequence. Blum and Fitzpatrick

(1965) also advised that a critical incident should be reported by individuals who

are able to observe the critical events as they occur and should have sufficient

knowledge to report what occurred, notably they assert that in a report of an incident

the emphasis is description and not evaluation of the incidence. Blum and

Fitzpatrick (1965) mailed to regional chairmen of the American Academy of

Orthopaedic Surgeons notifications, ahead of regional Academy meetings, the

introduction of their study. At the Academy meetings one of the researchers

introduced the study to the attendees[85] and after which they distributed critical

incident forms. This procedure was repeated at an international meeting of the

a) Approaching diagnosis objectively

b) Recognising a condition

4. Judgement in deciding an appropriate care

a) Adapting treatment to the individual care

b) Obtaining consultation on proposed treatment

5. Judgement and skill in implementing treatment

a) Planning the operation

b) Making necessary preparations for operating

c) Performing the operation

d) Modifying operative plans according to situation

new number of categories being generated. Flanagan (1958) recommended about 2000 incidents for professions. In sorting the incidents Blum and Fitzpatrick (1965) used simple judgement of 'same or different' to classify the incidents into systematic categories. Following developing an outline of categories subsequent incidents were sorted into already established categories. In view of the complexity of the specialty in terms of technical language and interpretation of clinical situations, experienced orthopaedic surgeons were asked to review the categories at various stages. Nine main categories were drawn up:

1. Skill m gathering clinical information

a) Eliciting historical information

b) Obtaining information by physical examination

2. Effectiveness in using special diagnostic methods

a) Obtaining and interpreting x-rays

b) Obtaining additional information by other means

3. Competence in developing a diagnosis

e) Manifesting teaching, intellectual and scholarly attitudes

f) Accepting general responsibilities to the profession and community

In another study, by means of the critical incident techmque, a realistic defmition of clinical competence at the level of internship was extensively documented by the American National Board Medical Examination (Hubbard, et al., 1965). New methods were then developed to test clmical competence as defmed by the critical incident technique (Hubbard et al., 1965). Hubbard et al. (1965) described one of the most extensive uses of the critical incident technique m medicine. The National Board of Medical Examiners (NBME) had recognised that clinical skills evaluations were influenced by three variables: the examiner; the patient; and the candidate

e) Handling operative complications

f) Instituting a non-operative therapy programme

7. Competence in providing continuing care

a) Paying attention post-operatively

b) Monitoring patients' progress

c) Providing long-term care

8. Effectiveness of physician-patient relationship

a) Showing concern and consideration

b) Relieving anxiety of patient and family

9. Accepting responsibilities of a physician

a) Accepting responsibilities for welfare of patient

b) Recognising professional capabilities and limitations

c) Relating effectively to other medical persons

87

d) Displaying general medical competence

condition from observation of clinical signs; withholding decision about the diagnosis until additional needed information was available; correctly suspecting an obscure diagnosis despite the obvious symptoms and signs of another diagnosis; and taking appropriate emergency action when indicated. Hubbard et al. (1965) reported as examples of poor or inappropriate chnical practice the following; failing to consider other than the most obvious causes of symptoms and signs; making a

diagnosis with inadequate information; and prescribing medication with inadequate (Hubbard et al., 1965). The problem for them was to control two variables (the indications. The large body of information collected from 3300 incidents was examiner and the patient) in order to obtain reliable measurement of the third summarised into nine major areas of clinical performance with subheadings variable (the candidate) (Hubbard et al., 1965). Their first step was to define clinical (Hubbard et al., 1965);

competence and skill at the intem level, the level they were interested in measuring

(Hubbard, et al., 1965). Under the guidance of John Flanagan (the one credited for

describing the technique) they developed a realistic definition of clinical

competence using the critical incident technique (Hubbard, et al., 1965). They

interviewed and sent mail questiormaires to senior physicians and residents (doctors

in specialist training), all of whom supervised interns. They asked them to record

clinical situations (incidents) in which they had personally observed interns doing

something that impressed them (examples of good chnical practice) and also to

record examples of conspicuously poor clinical practice (Hubbard et al., 1965). A

total of 3300 incidents were collected from approximately 600 physicians (Hubbard,

et al., 1965). Hubbard et al. (1965) reported the most frequently reported examples

of good chnical practice as; taking a history thoroughly and performing a physical

examination in an orderly, sequential manner; accurately recognising the patient's

A. Recognising causes.

B. Exploring condition thoroughly.

C. Arriving at a reasonable differential

diagnosis.

5. Treatment:

A. Instituting the appropriate type of treatment.

1. History

B. Deciding on immediacy of the need for

therapy.

A. Obtaining information irom patient.

C. Judging the appropriate extent of treatment.

B. Obtaining information from other sources.

6. Judgement and Skill in Implementing Care

C. Using judgement.

2. Physical Examination

A. Making necessary preparations.

B. Using correct methods and procedures.

A. Performing thorough physical examination.

C. Performing manual techniques properly.

B. Noting manifest signs.

C. Usmg appropriate technique.

3. Tests and Procedures:

A. Utilizing appropriate tests and procedures.

B. Applying test methods correctly.

C. Modifying tests to meet the patient's needs.

D. Interpreting test results.

4. Diagnostic Acumen:

89

American Nurses' Association used the critical incident technique to provide investigational performance data to be used for developing measurements of performance, as part of the validation of the State Board Test Pool Examination. They (Jacobs et al., 1978) collected data to develop a basis for a comprehensive behavioural definition of the work of the nurse in providing safe-effective patient care. After understanding what constituted a safe and effective nursing practice they would then develop measures for testing for this practice. In their study (Jacobs et al., 1978) used self-report and/or observed-report questionnaires to collect 14,000 critical incidents of nursing behaviour from 2,795 nurses at all levels of experience and responsibility. They collected their data from five clinical specialties and by geographical region. Jacobs

6. Adapting method to special procedures

7. Continuing Care

    A. Following the patient's progress.

    B. Modifying treatment.

    C. Planmng effective follow-up care.

8. Physician-Patient Relation:

    A. Establishing rapport with the patient.

    B. Relieving tensions.

    C. Improving patient co-operation.

9. Responsibilities as Physician:

    A. For the welfare of the patient.

    B. For the hospital.

    C. For the heahh of the community.

    D. For the medical profession.

Jacobs et al. (1978) reported how the Council of State Boards of Nursing

actions) in anaesthesia (Derrington and Smith, 1987). Derrington and Smith (1987) reported that the critical incident technique increased the size and extent of the anaesthetic risk database. It also helped reveal that the maintenance period of anaesthesia was the most dangerous phase of anaesthesia administration and not the induction or recovery phase as earlier believed (Derrington and Smith, 1987).

An analysis of commonly occurring positive and negative critical incidents, at the beginning and at the end of a general practice course, helped Royal Australian College of General Practhioners (RACGP) obtain information about the changes in et al. (1978) classified critical requirements for safe-effective nursing practice. The main categories included:

1. Exercises professional prerogatives based on clinical judgement

2. Promotes patient's ability to cope with immediate, long-range, or potential heahh-related change

3. Helps maintain patient comfort and normal body functions

4. Takes precautionary and preventive measures in giving patient care

5. Checks, compares, verifies, monitors, and follows up medication and treatment processes

6. Interprets symptom complex and intervenes appropriately

7. Responds to emergencies

8. Obtains, records, and exchanges information on behalf of the patient

9. Utilises patient care plarming

10. Teaches and supervises other staff

Test measures were developed to test these critical requirements and as such improve the validity of the tests in assessing safe/effective nursing practice.

The crhical incident technique was also used to assess "near-misses" (ineffective

major skills associated with both positive and negative critical incidents were: interpersonal skills (rapport and listening), diagnostic skills (thorough clinical assessment and appropriate investigations), and management skills (knowing when and how to obtain help). Diamond et al. (1995) concluded that an analysis of commonly recurring positive and negative critical incidents can be used by the

Royal Australian College of General Practitioners GP programme to accelerate the performance of candidates after the course (Sim et aJ., 1996). Sim et al. (1996) leaming process of doctors in vocational training and that their findings have concluded that the critical incident technique was a usefiil tool for leamuig and implications for the planning of the undergraduate curricula.   Plutchik et al. (1994) assessment in a vocational training programme. The critical incident technique was reported that knowledge of critical

used to define non-cognitive behaviours that doctors should demonstrate in their practice (Holmes et al., 1990). In this study (Holmes et al., 1990) 484 behaviours were categorized under four categories namely a) atthude and personal attributes, b) communication, c) practice organization, and d) professional competence. The largest represented category was communication (46 percent) of all the behaviours (Holmes et al., 1990). These non-cognitive behaviours were written as curriculum objectives so that they could be incorporated into the medical school curriculum and evaluated with less subjectivity (Holmes et al., 1990). Allery et al. (1997) used the critical incident technique to study why general practitioners and consuhants change their clinical practice. Organisational factors, education, and contact with professionals were the three most frequently mentioned (Allery et al., 1997). Diamond et al. (1995) used the critical incident technique; they undertook qualitative analysis of open-ended interviews about the incidents which described

competent or poor professional practice. Diamond et al. (1995) reported that the

would satisfy both the reduced time available for teaching anatomy and the

exigency of mastering the basic anatomical knowledge needed for general practice

in medicine. Bradley (1992) in the article 'Tuming anecdotes into data: The critical

incident technique" extolled the particular virtue of this research method to exploit

the natural tendency of doctors to tell anecdotes. Bradley (1992) also discussed the
incidents in psychotherapy may provide a source of material for training in
principles of the technique as *it* related to significant event analysis, a form of
communication skiUs. Gilbart et al. (2001) used the critical incident technique to
medical audit.

determine the criteria most important in selection of surgical residents. The critical

incident technique has also been used in studying specific attributes of medical

practice. Robling et al. (1998) aimed to describe the use of magnetic resonance

imaging (MRI) by GPs in South Glamorgan (Wales) so that they could summarize

the GPs reasons for requesting MRI; and to produce crheria to assess the

appropriateness of MRI scan requests. The study (Robling et al., 1998) identified

those reasons which are important to GPs when requestmg MRI scans and have

circulated criteria which will be used to determine appropriateness. McManus and

Wakeford (1989) stated that the definition of a core curriculum for medical

education was feasible with methods such as the critical incident technique in

which thousands of real medical events are analysed to determine the skills needed

to do the job. Fasel et al. (1998) and Fasel (1998) used the critical incident method;

in their study they asked a sample of Swiss general practitioners to identify the

different anatomical structures listed in the international anatomical nomenclature

they judged as necessary for general practice. They contended that an anatomy

course defined in terms of specific needs of physicians providing primary care,

accordmg to competent observers make significant contribution to the activity. This method avoids the collection of interpretations, ratings, and opinions based on general impressions. The collection and tabulations of these observations make it possible to formulate the critical requirements of a job or an activity.

Content Analysis

The cntical incident technique was a widely used job-analysis tool. The Society of Industrial and Organisational Psychology and the Index of Citations recognised Flanagan's (1954) critical incident technique article as the most frequently cited article (AIR, 2001). The application of the critical incident technique generally fell in the following categories:

Krippendorf (1980) defined content analysis as a research technique for making replicable and valid inferences from data to their context. Content analysis is

a) Measures of typical performance (criteria);

b) Measures of proficiency (standard samples);

c) Training;

d) Selection and classification;

e) Job design and purification;

f) Operating procedures;

g) Equipment design;

h) Motivation and leadership (attitudes);

i) Counselling and psychotherapy.

The literature revealed that the critical incident technique was very versatile and flexible. It focuses on reporting of facts regarding actions/behaviour which

Millidonis et al. (1999); Sleath et al. (1997); Buchanan et al. (1997); Benson and Britten (1996); Hogan (1999); Hayes et al. (1999) are examples.

One of the large-scale content analysis projects was by Hogan (1999). The work (Hogan, 1999) involved analysing the textbook Principles and Practice of Medicine by Sir William Osier, and the ll"* edition of Harrison's Principles of Internal Medicine. The analysis focused on comparing the treatment recommendations for 4 conditions (diabetes mellitus, ischaemic heart disease, pneumonia and typhoid fever) that were covered in both books (Hogan, 1999). The analyses concluded that Osier's textbook dealt with typhoid fever and pneumonia at greater length, whereas Harrison's covered ischaemic heart disease and diabetes mellitus more (Hogan, 1999).

conducted to analyse documentary information in order to systematically describe the contents of documents (Verma and Mallick, 1999). As a research technique it provides knowledge, new insights, a representation of facts, and a practical guide to action (Krippendorf, 1980). The content analysis technique is applied to any form of communication; usually in written form, but radio and television programmes, pictures, tape-recording of interviews, lessons or conservations, or music are used (Verma and Mallick, 1999). Content analysis can provide valid resuhs at various levels of sophistication and is reported to be widely used by many post-graduate students (Verma and Mallick, 1999). Krippendorf (1980) suggested that any content analysis must be performed relative to and justified in terms of the context of the data

The literature is replete with scholars who have used content analysis: McKinley and Middleton (1999); Wilson and Thomson (1999); 0'§ullivan et al. (2000); Bernhardt et al. (2000); Coenen et al. (2000); Berth (2001); Prystowsky and Bordage (2001); Dejong et al. (2001); Dalley and Sim (2001);Lye et al. (2001); Maggs and Rapport (1995); Marcdante and Simpson (1999); Gottschalk (1999);

therapy. The study (Millidonis et al., 1999) content-analysed the 1993 Practice

Analysis for Orthopaedic Physical Therapy Certified Specialists, and then

compared the attributes that were identified to those identified in 3 selected

theoretical models of clinical decision making and practice. Their study

(Millidonis'et al., 1999) demonstrated that attributes that characterize an expert

physical therapy practitioner involved clinical reasoning, and the ability to teach

patients. Sleath et al. (1997) analysed 508 audiotapes of physician-patient

interactions and interviews with each patient and physician from 11 different

ambulatory care settings. Sleath et al. (1997) studied the physician Vs patient

inhiation of psychotropic prescribing in primary care settings. Buchanan et al.

(1997) used content analysis to identify the management competences which

doctors lack

The study found that the two books devoted equivalent space to treatment (in terms of proportion of total sentences for the conditions). The comparative content analysis study was conducted in order to investigate the criticism that The Prmciples and Practice of Medicine was deficient in the area of therapeutics (Hogan, 1999).

The study by Hayes et al. (1999) compared pre-test and post-test content analysis

to evaluate the effects on a 1-year ethics course on medical student's

decision-making skills. Marcdante and Simpson (1999) did content analysis of

teachmg scripts to identify how paediatric teachers knew what to teach.

The study (Marcdante and Simpson, 1999) helped support the hypothesis that

developing teaching expertise was associated with use of teaching scripts.

Gottschalk (1999) demonstrated that content analysis avoids biases and

measurement errors which other methods i.e. standardized self-report measures

and observer rating scales are susceptible in studies of effects of psychoactive

pharmacological agents. Millidonis et al. (1999) used content analysis to gain

insight of the nature of clinical practice for specialists in orthopaedic physical

(Prsytowsky and Bordage, 2001). The study demonstrated how categorization of concepts and matrices could be used effectively in content analysis.

The literature indicated that content analysis utilises three types of research designs. The typology depends largely on how the resuhs of content analysis are embedded in larger research efforts (Krippendorf, 1980). The first design type, the

most basic, estimates some phenomenon in the context of data; Krippendorf (1980)
when the doctors move into a formal management role. Based on their findings
provided the example of inferences regarding the level of anxiety of a psychiatric
Buchanan et al. (1997) designed ways to remedy the deficit. Content analysis of
patient during an interview. A second type, are designs to test whether one method
written patient agendas for the consuhation (McKinley and Middleton, 1999);
can be replaced by content analysis (Krippendorf, 1980). In this type of study, two
Content analysis and publication outcomes of projects by public health medicine
or more methods are

registrars (Wilson and Thomson, 1999); Students' perceptions of the relative advantages and disadvantages of community-based and hospital-based teaching (O'Sullivan et al., 2000) are fiirther examples of content analysis being used to gain insight into questions about professions.

One study specific to medical education is the Prystowsky and Bordage (2001). This study did content analysis of leading medical education journals (Academic Medicine, Medical Education, and Teachmg and Learning in Medicine) to determine the primary foci of medical education research (Prystowsky and Bordage, 2001). The researchers used a three-dimensional outcomes research framework based on the paradigm of health services outcomes research (Prystowsky and Bordage, 2001). Each article was categorized according to primary participant (i.e. trainee, faculty, provider and patient), outcome

(performance, satisfaction, professionalism and cost), and level of analysis

Figure 2.3 Procedures in Content Analysis (Adapted from Krippendorff, 1980 pg. 54)

Content analysis is a versatile method that can adapted to a variety of problems. It is a

well-documented and scientifically rigorous method (Verma and Mallick, 1999;

Krippendorf, 1980).

applied to the same data or to different data obtained from the same situation to test

whether the two methods yield comparable resuhs (Krippendorf 1980). The third type of

Participant Observation Observational research can be

designs are meant to test hypotheses; This research design provides insights into relations
divided into a number of different types according to three main criteria;
that might exist between social stratifications and the characteristic in question
1. Whether the observer participates or not in the activities of the observed
(Krippendorf, 1980).
individuals.

Looking at content analysis research design in detail, one can distinguish several

different components or steps in the process. These are illustrated in figure 2.3;

_____ ! Theories and knowledge about the
l stable data-context relations

Unitizati
on
Scheme
Samplin
g Plan

Recordi
ng
Instructi
ons

t

Unitization--- Sampling   Recordi   Data   Inference—**1**—Analys
•   ng   98 Collection   is -
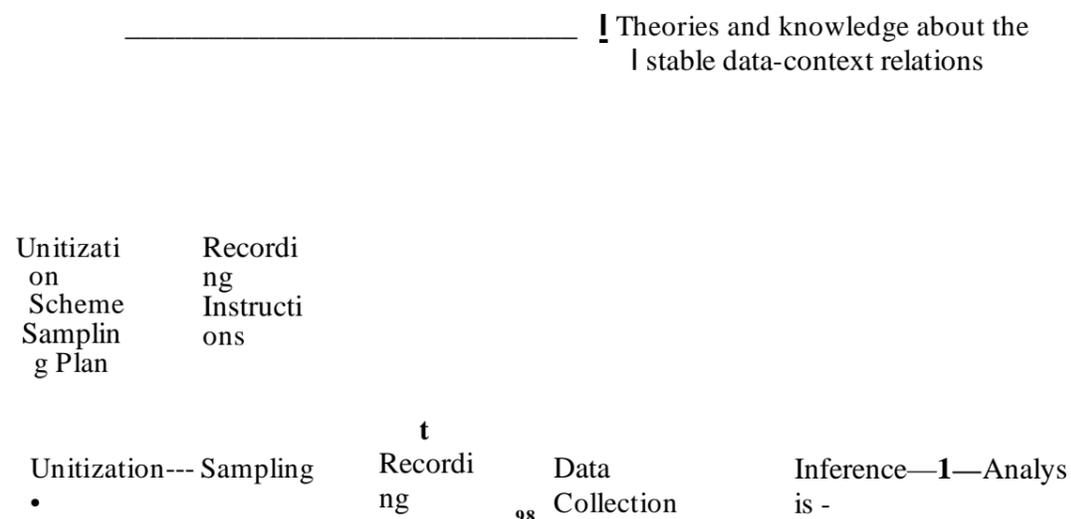
2. Observations are structured or unstructured; and

3. Whether the observed behaviour occurs in a natural setting or artificial

   setting (Observation Research, 2001)

Table 2.2 shows a matrix of the relations of the setting and the structuring of the

Table 2.2
Schematic of Structure of Observational Setting Degree

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal,

Source: Bailey, 1994, p. 247 as quoted by Observation Research (2001).

observations.

In procedural terms observational research can be differentiated into participant or non-participant. The participant observer is a regular participant m the activities observed. A non-participant observer does not participate in the activities being observed.

In a structured observational study, the observers classify and quantify behaviours according to the pre-defined scheme. Effectively, they conduct a content analysis of the activities occurring in front of them recording the different types of behaviours that occurred, the types and number of individuals involved and possibly also details about the environment in which they occurred in those cases where observed individuals may move from one location or setting to another. In other words it monitors and classifies the way people behave in their natural environments.

2. Informant interviewing to establish social rules and statuses. There may be systematic sampling of informants to be interviewed, content analysis of documents encountered, and even recording of observation in structured question-and-answer format.

3. Participation to observe and detail illustrative incidents.

One method that can study what the doctor does and not what the doctor says he does is observational research. Of the two types, non-participant observation and participant observation, the latter would be appropriate for a researcher who is qualified in medicine and is a registered practitioner. These properties for a researcher would facihtate entry into the study group and closer first-hand access to the activities of the doctor. The researcher may then gam understanding, perhaps more deeply than could be obtained, for example, by questionnaire items.

The method has been successfully used by many researchers: Pathak et al. (2000), Fox (1996), Bourgois (1999), Rudge (1996), Schwartzberg (1994), Donaldson (1992),

In this sub-section the key concepts, and terms in participant observation are introduced. This is followed by a critique of the participant observer method. The investigational approach to participant observation emphasises participation as an opportunity for in-depth systematic study of a particular group or activity. Zelditch (1962) defined three components of this approach:

1. Enumeration of frequencies of various categories of observed behaviour, as in interaction analysis. Often there is an explicit schedule of observation geared to hypotheses framed in advance of participation. 'As Garson (2001) observes, participation may lead to aheration of hypotheses and observation schedules, the attempt to observe systematically is ongoing.

hypotheses and b) triangulation of the data using a muhi-method approach.

McElroy and Jezewski (1986) observed and described interactions between clinicians and patients in a paediatric clinic serving famihes of diverse ethnicity.

They (McElroy and Jezewski, 1986) used the concept of ethnography as an interpretive, problem-resolving method. In that study the participant observer moved cognitively and analytically focusing on awareness of a problem, applying knowledge structures and coherence (McElroy and Jezewski, 1986). McElroy and Jezewski (1986) reported that the framework apphed not only to describing what the ethnographer did, but also stages in the clinician's

Power (1989), Smith (1987), McElroy and Jezewski (1986), Brenner (1987), Wilner (1987), Edgerton (1984), Oldham et al. (1983), Lo and Schroeder (1981), Houge (1981), Christenfeld and Haveliwala (1978).

In the study by Pathak et al. (2000) twelve senior consuhants with more than 10 years' experience in neurosurgical practice at three different university hospitals were observed during rounds by a participant observer. The researcher observed group climate of the teams lead by the senior consultant, the leadership pattem, the language expressed by the senior consuhant, and the consultant's effectiveness in his performance as a leader during clinical discussions (Pathak et al., 2000). Schwartzberg (1994) studied a peer-developed support group of 13 persons with head injury who attended sessions for 16 months to identify helping factors. As a participant observer Donaldson (1992) studied the implementation and evaluation of learning contracts in the clinical area of a small group of nurses. Smith (1987) described the development of a methodology to study the relationship between quality of care received by patients and the quality of the ward as a leaming environment for nurses in training. The key research perspectives of the study

(Smith, 1987) included a) the role of participant observer in generating working

Positivists such as Buroway (1994) surmise that the standard criticisms of participant observation are the 4 R's: reactivity, reliability, replicability and representativeness. Participant observers contaminate the data they collect by their participation (Buroway, 1994; Tyrell, 1998) they have no systematic way of selecting from their mass of observations (Buroway, 1994); they produce idiosyncratic results that cannot be replicated (Buroway, 1994; Tyrell, 1998), they have no way of knowing how representative their findings are (Buroway, 1994).

efforts to communicate. They McEhoy and Jezewski (1986) contended that awareness of repeated breakdowns allowed the ethnographer to document fundamental differences in expectations and premises that affect communication between clinician and patient.

The review of hterature demonstrated that participant observation, which requires immersion in the real world of persons being studied and at the same time requirmg disciplined detachment from that world, has been used in a variety of settings in the medical context. Edgerton (1984) contended that participant observation had the advantage of allowing investigators to leam how people actually behave in a variety of contexts and to grasp the meaning these activities had to them.

The chief criticisms levelled against observation research lay in the areas of reliability and validity (Tyrell, 1998). The controversy concerning rehability centred on whether other researchers could replicate the study, and that about validity was concemed about the accuracy of the method and whether it actually measured the issue under study (Tyrell, 1998). The debate revolved around the approaches of Positivism and Naturalism (Tyrell, 1998), and, for others, Hermeneutic (Buroway, 1994).

by poshivists, into three: defensive, extended case method, hermeneutic. In the defensive, the participant observer can accept the 'positivist' principles and use them as guidelines:

• Be 'objective' and as far as possible, non-involved relation to their field she.

• Find standardised methods of data collection.

• Make clear exactly how they have gathered the data so that someone can follow Naturalism argues that: no human being can ever be completely objective and no in their footsteps and replicate the study.

method of data collection is free of presuppostions (Tyrell, 1998). Naturalism

• Maximise the variance in the field by comparing situations so that their claims argues that researchers must aim to achieve objective knowledge by transcending have greater generalisability.

biases not by ignoring *it* and pretending that *it* does not exist as poshivist do, rather, by evaluating it and making it explicit (Buroway, 1994, Tyrell, 1998). Conceming reliability, supporters of naturalism argue that whilst in quantitative research, a study is reliable if it is repeated whh a different sample it yields the same resuhs and is representative if the resuhs can be generalised to a larger population (Tyrell, 1998), in qualitative research a study is reliable if when repeated it yields the similar range and diversity of findings (Tyrell, 1998). Tyrell (1998) stated that representativeness is achieved when explanatory associations (not statistical associations) are matched whh the general population. Thus one is not aiming for statistical representativeness, but explanatory and conceptual representativeness (Tyrell, 1998). Lastly, supporters of naturalism contend that participant observation when used together with other methods, combination, enhances consistency and validity (Tyrell, 1998).

Buroway (1994) classified responses to the criticisms of participant observation,

individuals to a population. But if meaning emerges a the level of the situation rather than the individual then we should be studying a sample of shuations not a sample of individuals.

In the hermeneutic science Buroway (1994) contended that if social research cannot live up the 4 R's then an ahemative conception of social science was called for.

• First, the critique of reactivity is replaced by the embrace of inter-subjectivity as an inherent feature of all social science. Inter-subjectivhy may not be real but virtual, as it is for demographers, and historians, but *it* nonetheless involves a relationship between observer and participant.

In the extended case method Buroway (1994) suggested, "Proponents of participant observation could reject the pursuit of any "objective" science and celebrate the interactive relation between participant observer, the subjective and idiosyncratic character of research and the uniqueness of its resuhs".

This option argued that no social science research technique, mcluding its prototype, survey research, fulfil the 4 R's.

• First, surveys cannot avoid reactivhy in the form of interview effects (race, gender of interviewer, order and form of questions, etc.)

• Second, they may standardise questions but there is no control over the way respondents mterpret them. This effectively undermines reliability.

• Third, to claim replicability assumes that the context of the survey is identical at two points in time. This may be true of the chemistry laboratory but unlikely to be true for the social world.

104

• Fourth, representativeness is based on extrapolation from a sample of

theories.

Delphi Technique

The Delphi technique was developed by the Rand Corporation (Strauss and Zeigler,

2002; Cline, 2002). The purpose of the Delphi technique is to elicit information

from experts to facilitate problem-solving, planning, and decision-making
- Second, if we cannot standardise responses we are better off deciphering the
(Dunham, 1996). All Delphis use panels of experts for obtaining information or
    meaning of what respondents say and do. We replace reliability whh validrty
data, are conducted in writing, systematically attempt to produce a consensus of
- Third, if replicability is unattainable - except for the most trivial of
opinion (demonstrate divergence of opinion), and guarantee the anonymity of the
    phenomenon - because we cannot keep conditions of social research fixed,
experts and the expert's
    we should make a virtue out of a necessity and insist on locating all social

    situations in the field of relations which determine them

- Fourth, if we cannot obtain a representative sample because we don't know

    the population perhaps we are better off abandoning the idea of induction,

    that is, inferring theory fi-om data. Instead we might use our case materials

    to challenge and then reconstruct pre-existing theory. This means choosing

    or constituting our cases on the basis of theoretical relevance.

Participant observation has a role as a method, especially as an observation

method for identifying behaviours that define a construct. Three leading theories:

positivism, naturalism, and hermeneutic science provide guidelines and critiques

on how and what to consider when formulating tests or measures for the identified

constructs, depending on the persuasion of the researcher with regard to these

Bettcher et al. (1998), McKenzie (1994), Battles and Mandle (1986), Robbins and Beck (1982), Milman et al. (2001), Fraser (1999), Klessig et al. (2000), Black et al. (1999), Baldwin et al. (2000), Crisp et al. (1999), Stewart et al. (1999), Gallagher et al. (1996), Triezenberg (1996), McKenna (1994), Williams and Webb (1994) for example.

Mucklow (2002) used the Delphi method to identify the knowledge and skills that should be considered essential for specialists in clinical pharmacology and therapeutics. Mucklow (2002) used a sample of 20 specialists who identified 78 statement (Strauss and Zeigler, 2002; Dunham, 1996; Cline, 2002). The stages of the Delphi are:

1. Development of questionnaire which serves as the focus of the problem

2. Selection of a group of experts

3. Each expert answers the questionnaire independently and returns it

4. The inhiators of the questionnaire summarize the responses and develop a second questionnaire and send to the experts

5. The experts independently rate priority ideas included in the second questionnaire and mail back responses

6. The process is repeated until investigators feel the positions are firm and agreement on a topic is reached

(Strauss and Zeigler, 2002; Dunham, 1996; Cline, 2002).

-ss

The technique has been used in medical education and other medical settings by many researchers: Mucklow (2002), Soulie et al.(20(>2), Dolan and Lauer (2001), Macdonald et al. (2000), Duffield (1993), Jones et al. (1992b), Elder and Andrew (1992), Knight and Knight (1992), Forrest et al. (2002), Catlin and Carter (2002),

because not all stakeholders were involved in earlier phases were only experts were

consulted. Black et al (1999) advised that the output from consensus development

methods hke the Delphi may be affected by; the way the task is set (choice of cues,

recognition of contextual cues, the focus of the task, the comprehensiveness of the

scenarios); the selection of participants (choice of individuals, degree of

homogeneity of the group, their background, their number); the selection and
statements for consideration, in four domains (core knowledge, therapeutic skills,
presentation of scientific information (format, extent to which its quality and
educative skills, and investigative skills) of which 58 (74.4 percent) were accepted
content is assessed); the participation (physical environment for meetings); and the
by more than two-thirds of the specialists. Soulie et al. (2002) defmed the training
method of synthesizing individual judgements (definition of agreement, mles
objectives for urology; a list of 10 operations that should be mastered at the end of
governing outhers, method of
urology training. Dolan and Lauer (2001) used the Delphi technique to identify the

geriatric dentistry core competencies; Macdonald et al. (2000) identified core

competencies required for occupational physicians in Europe; Jones et al. (1992a)

used the Delphi to explore the extent to which consuhants agreed on the key

attributes of a high quahty senior house officers or registrar; Elder and Andrew

(1992) used the Delphi to assist deans of schools of allied heahh professions to

come to consensus on knowledge and skills that graduates should have for

professional accreditation and credentialing; Forrest et al. (2002) used the Delphi to

gain a consensus from 26 consultant anaesthetists about technical tasks during

anaesthesia.

   Strikingly the hterature was replete with criticisms of the Delphi technique:

Klessing et al. (2000) contended that their resuhs demonstrated the diversity of

opinion of what defines quality in residency education for intemal medicine

7. Delphi is primarily concerned with transient collections of snap judgement opinions of polled individuals from unknown samples, which should not be confused or equated with coherent predictions, analyses, or forecasts of operationally defined and systematically studied behaviours or events.

8. Delphi anonymity reinforces unaccountability in method and findings.

mathematical aggregation). Klessing et al. (2000) advised that since these features

9. Delphi systematically discourages adversary process and inhibhs

had not been studied sufficiently the method should considered whh caution. Crisp

exploratory thinking.

et al. (1999)'s views on the Delphi echoed Klessing et al. (2000)'s views as follows:

"Whhout in-depth understanding, we may find ourselves violating fundamental underpinning assumptions or conventions through ignorance, and the resuhing studies are unlikely to stand up to tests of congruence and rigour." McKenna (1994) concluded that even if the Delphi was beuig used increasuigly questions remain about its scientific respectability. The ten general failings of the Delphi technique were summarized by Strauss and Zeigler (2002) as:

1. The Delphi's concept of the expert, and its claim to represent valid expert opinion, is scientifically untenable and overstated.

2. Delphi claims superiority of group over individual opinion, and of the superiority of remote and private opinion over face-to-face encounter, as well as their counter statements, are unproven generalizations.

3. Delphis consensus is specious consensus.

4. Delphi questions are likely to be vague.

5. Delphi responses are likely to be ambiguous.

6. Delphi results probably represent compounded ambiguity.

measurement of psychological constmcts was explored to enlighten such a task.

Composite measures hi psychometric studies include indexes and scales (Judge, 2002). Indexes and scales are composite measures of variables in which several indicators of a variable are combined into a single measure (Judge, 2002). Such composhe measures, indexes and scales, have been widely used in the medical field and this aspect of measurement has been called 'Clinimetrics' (Zyzanksi and Perloff; 1999). The Health and Psychosocial Instruments (HaPI) database (Behavioural Measurement Database Services, Pittsburgh, Pennsylvania) had over 70, 000 records

10. Delphi has been characterized by isolation from the mainstream of scientific questionnaire development and behavioural experimentation, and has set an undesirable precedent for interdisciplinary science in the professional plarming of policy studies community.

The Delphi method requires further scientific understanding to be used widely and as such was not found suitable for this study.

Measurement of Psychological Constructs: Scales and hadexes Review of clinical reasoning and concepts of knowledge, and methods clearly indicated that psychological constructs were central to the practice of medicine. A study that examines the practice of medicine in order to differentiate the challenges that require the application of a particular field of knowledge and the detail of such knowledge requires to measure such constructs. For instance, it is envisaged that the study would require to measure the detail of anatomical knowledge in order to differentiate between those clinical situations that require anatomical knowledge

and those that don't, or to rank such anatomical demands. The literature on

- Best verbal response (oriented - 5, confused - 4, inappropriate - 3, incomprehensible - 2, none - 1);

- Best motor response (obeymg - 5, locahsmg - 4, flexing - 3, extending - 2, none -1).

Krahn et al. (2000) reported the constmction of the patient-oriented prostate utihty scale (PORPUS). Krahn et al (2000) constructed a classification system for prostate cancer outcomes, because they believed generic prostatic cancer indexes did not represent the prostate cancer outcomes such as sexual, urinary, and bowel dysfunction. Krahn et al. (2000) reported that PORPUS could be used in conjuction with a set of utility weights; to develop a health status index; to improve utility rigour.

for instruments in the health and behavioural seiences (Zyzanksi and Perloff, 1999). Feinstein (1999) confirmed that many clinimetric indexes in the clinical literature did not meet rigorous statistical testing and that others did meet such rigour.

Examples of composite measures used in medicine included: the Glasgow Coma Scale; APGAR Score; Bishops Score; Alcohol Critical Index; Adolescent Drinking Index; Arthrhis Helplessness Index; Asthma Symptom Utility Index; Benign Prostatic Hyperplasia Impact Index; Crohn's Disease Activity Index, Diabetes Atthude Scale; Drinking Problems Index; End Stage Renal Disease Severity Index; Functional Bowel Disorder Severity Index; Faecal Incontinence Quality of Life Scale; Gastrointestinal Quahty of Life Index; Inflammatory Bowel Disease Stress Index; Index of Sexual Function; Meniere's Disease Patient-Oriented Severity Index; NIH Chronic Prostatitis Symptom Index (Instmments, 2002).

The Glasgow Coma Scale measures the state of consciousness and scores *it* out of 14 (or 15). The Glasgow Coma Scale uses three categories of information:

- Eye-opening (spontaneous-4, to speech-3, to pain-2, none - 1);

assess the effectiveness of treatment of constipation.

Crocker and Algina (1986) advised that because psychological constructs were abstractions which could only be assessed indirectly, the design of instruments to measure such variables present several challenging problems:

1. No single approach to the measurement of any construct is universally accepted. There is always the possibility that two theorists who talk about the same

measurements in patients; and to serve as a short psychometric (nonutilhy) instrument. Ruta et al. (2000) used the composhe measure psychometric method to

develop the postoperative symptom severity (poSSe) scale. Ruta et al. (2000) developed the postoperative symptom severity scale (PoSSe) scale from questions commonly used in the clinical assessment of patients who had third molars extracted, and divided *it* into subscales corresponding to seven main adverse effects identified from a previous study. Ruta et al. (2000) reported that they found the PoSSe Scale to be a reliable, valid and responsive measure of the severity of symptoms after extraction of third molars, and of the impact of those symptoms on patient's perceived heahh. Kleinman et al. (1999) responded to a lack of a gold standard for evaluation of symptoms after clinical management of constipation. In that report (Kleinman et al.,1999) a constipation symptom assessment instrument, the PAC-SYM, was developed to address the patient perspective on the disorder. The PAC-SYM content was based on literature review and resuhs of focus groups. The PAC-SYM contained 12 hems assigned to 3 subscales: stool symptoms, rectal symptoms, and abdominal symptoms (Kleinman et al., 1999). Kleiman et al. (1999) concluded that the PAC-SYM was internally consistent, reproducible under stable condhions, valid, and responsive to change and provided a comprehensive means to

definhions but must also have demonstrated relationships to other constructs or observable phenomena. A psychological measurement, even though it is based on observable responses, would have little meaning or usefialness unless h could be interpreted based on the underlying theoretical construct.

First, the construct must be defined in terms of observable behaviour. Second,

the construct must be defined in terms of its logical or mathematical
construct may select very different types of behaviour to defme that construct
relationship to other constructs whhin the theoretical system This second type
operationally.
of definhion provides a basis for interpreting the measurements obtained.
2. Psychological measurements are usually based on limhed samples of
If such relationships cannot be
behaviour. It **IS** impossible to explore all the possible attributes of a concept.

Thus any attempt to measure that concept must involve only a sample of that

domain.

3. The measurement obtained is always subject to error. Most psychological

measurements are based on a limited number of sample of observations and

usually taken at only one pomt in time. Thus a persistent problem in

psychological measurement is how to estimate the degree of error present in a

given set of observations.

4. The lack of well-defmed unhs on the measurement scales poses still another

problem. Defining the properties of the measurement scale, labelling the

unrts, and interpreting the values derived are complex issues, which also must

be considered whenever a psychological instrument is developed and a

scoring system, devised.

5. Psychological constructs cannot be defined only in terms of operational

the level of measurement helps a researcher to decide how to interpret the data from that variable. Second, knowing the level of measurement helps to decide what statistical analysis is appropriate on the values that were assigned. For example, if a measure is nominal, then you know that you would never average the data values or do a t-test on the data.

Levels of Measurement

demonstrated by investigational methods, the measurements obtained are of

There are typically four levels of measurement that are defined:
no value.

• Consideration of the tenets of test theory (the discipline devoted to the study of measurement problems and methods for solving them) can help researchers overcome these problems.

Vhanza (1999) contended that an effective measurement should have the following important features:

• Transferability: Measurements developed and used in one setting for a specific purpose can be used in a similar setting for the same purpose.

• Unidimensionality: Measurements measure only one contmuum at a time.

• Reliability: Measurement, using the same hastrument, will provide the same resuhs repeatedly when used to measure precisely the same thing.

• Validity: Measurement is tapping into what it claims to measure.

The level of measurement describes the relationship among the values (Trochim, 1999). The numbers are simply shorter terms for the lengthier text terms. Knowmg

any sense (Vhanza, 1999; Trochim, 1999). Eighty degrees on the Fahrenheit measure is not twice as hot as 40 degrees (although the attribute value is twice as large). In ratio measurement there is always an absolute zero that is meaningful. This means that you can construct a meanmgful fraction (or ratio) with a ratio variable. Weight is a ratio variable. In applied social research most 'count' variables are ratios, for example, the number of clients in past six months. This is so because

- Ordinal

you can have zero clients in the past six months.

- Interval

- Ratio

In nominal measurements the numerical values just 'name' the attribute uniquely. No ordering of the cases is implied. In ordinal measurement the attributes can be rank-ordered. Here, distances between attributes do not have any meaning. Trochim's (1999) example on a survey of educational attainment coded the attributes as 0=less than high school; l=some high school; 2=high school degree; 3=some college; 4=college degree; 5=post college. In this measure, higher numbers mean more education. The distance from 0 to 1 is not the same as 3 to 4. The interval between values is not interpretable in an ordinal measure. In interval measurement the distance between attributes does have meaning. For example, the temperature measure (in Fahrenheit), the distance from 30 - 40 is same as distance from 70 - 80. The interval between values is interpretable. Because of this it makes sense to compute an average of an interval variable, where rt doesn't make sense to do so for ordinal scales. But note that in interval measurements ratios don't make any sense (Vhanza, 1999; Trochim, 1999). Eighty degrees on the Fahrenheit

not repeated here but some salient points in hs application are presented.

The universe of attributes according to Guttman (1944) is the concept whose scalabihty is being investigated, like marhal adjustment, opinion of Brhish fighting ability, knowledge of arithmetic, for example. The universe consists of all the attributes that define the concept. Another way of describing the universe is to say *it*

consists of all the attributes of interest to the investigation which have a common
In developing an instrument for educational or psychological assessment, the test content, so that they are classified under a single heading which hidicates that developer is actually engaged in testing a series of hypotheses about the content (Guttman, 1944). Guttman (1944) advised that there were an indefmhely "scalabiUty" of the data obtained from measurements of the proposed construct large
(Crocker and Algina, 1986), Crocker and Algina (1986) advised that first, a hypothesis was implicitly formulated that the construct was a property occurring in varying amounts so that *h* could be quantified using the proposed scaling rule on a theoretical unidimensional continuum. Usually this is called the psychological continuum. Second was the question of what real-number properties (order, distance, and origin) the scale values on this continuum possess.

Guttman Scale

Louis Guttman in 1944 in his article "A basis for scaling qualitative data" presented what he termed a new approach to the problem which seemed to afford an adequate basis for quantifying qualhative data. This work has gone to be widely quoted and is the basis of what is now commonly known as the' Guttman scale (Vitanza, 1999; Trochim, 1999; Crocker and Algina, 1986). Elaborate and mteresting mathematical basis for the scale were presented in that original paper (Guttman, 1944). These are

categories are in general unique (except for direction). Both orderings emerge

from analysis of the data, rather than from a *priori* considerations.

5. The predictability of any outside variable from the scale scores is the same as

   the predictability from the multivariate distribution with the attributes. The zero

   order correlation with the scale is equivalent to the muhiple correlation whh the

   universe. Hence, scale scores provide an invariant quantification of the
number of attributes which belong in the universe; and in a particular investigation,
   attributes for predicting any outside variable whatsoever.
ordinarily only a sample of the universe was used. Guttman (1944) contended that
6. Scales are relative to time and to populations.
an attribute belonged to the universe by virtue of its content. The evaluation of the

content thus far remained a matter that could be decided by consensus of judges or

by some other means.

   The key concepts of the Guttman (1944) paper were the following:

1. The muhivariate frequency distribution of a universe of attributes for a

   population of objects is a scale if *it* is possible to derive from the distribution a

   quanthative variable with which to characterise the objects such that each

   attribute is a simple function of that quanthative variable.

2. There is an unambiguous meaning to the order of scale scores. An object with a

   higher score than another object is characterised by higher, or at least

   equivalent, values on each attribute.

3. There is an unambiguous meanmg to the order of attribute values. One category

   of an attribute is higher than another if it characterises objects higher on the

   scale.

4. It can be shown that if the data are scalable, the orderings of objects and of

    c. The ordering of categories in a sample scale is essentially that m the complete scale.

8. Perfect scales are not found in practice.

    a. The degree of approximation to perfection is measured by a coefficient of reproducibility, which is the investigational relative fi-equency whh which values of the attributes do correspond to intervals of a scale variable.

    b. For a given population of objects, a universe may be scalable at one time but not at another, or it may be scalable at two periods of time but whh different orderings of objects and categories.

    b. In practice, 85 percent perfect scales or better have been used as efficient approximations to perfect scales.

9. In imperfect scales, scale analysis picks out deviants or non-scale types for case studies.

    b. A universe may be scalable for one population but not for another, or *it* may be scalable for two populations but with different orderings of objects and categories.

    c. Comparisons whh respect to degree can be made only if the same scaling obtains in both cases being compared.

7. From the muhivariate distribution of a sample of attributes for a sample of objects, mferences can be drawn concerning the complete distribution of the universe for the population.

    a. The hypothesis that the complete distribution is scalable can be adequately tested with a sample distribution.

    b. The rank order among objects according to a sample scale is essentially that in the complete scale.

117

practice. A new discipline 'clinical anatomy' emerged as an innovation that could fulfil the concerns raised. However, the phrase clinical anatomy meant different things to different people. In reviewing both journal publications and textbooks h was found that most researchers and scholars had adopted strategies to increase clinical relevance by teaching anatomy through clinical cases and emphasizing the anatomy, by highlighting the clinical relevance of the anatomy presented, or by teaching anatomy and cluiically related materials side by side. However, no study, in the hterature studied clinical practice before recommendmg

In contemporary times (Crocker and Algina, 1986; Vitanza, 1999; Trochim, 1999) a Guttman scale is considered a cumulative scale measuring concepts which are supposedly unidimensional (Crocker and Algina, 1986); The general idea of the Guttman scale is to have several indicators for the same concept that expresses different strengths of opinion. You assume that those who agree with the strongest will agree with the weaker hems as well (Trochim, 1999). In other ways in making a Guttman scale you need to have hems that are all measuring the same concept, but whh different intensity. The procedure for constructing a Guttman scale are explained in detail m the Trochim (1999) discourse.

Summary of Lherature Review The hterature indicated that medical education was changing and the teaching of anatomy had borne the brunt on many fronts, i.e., the time available for teaching anatomy had been reduced; there were calls to increase its relevance to clinical practice and to teach anatomy in a manner in which h fostered higher order intellectual abilities. In addressing these demands many scholars and researchers used different strategies but no consensus existed about what was core anatomical knowledge for clinical

practice. A new discipline 'clinical anatomy' emerged as an innovation that could

what anatomical knowledge was best suhed for clinical practice. In addition, the cases that had been selected for use for teaching anatomy had been selected arbitrarily or based on experiences of a few people. Furthermore, the use of case studies alone had been criticized, because some authorities argued that anatomy was too complicated to be taught as case studies alone.

Cognhive psychology, problem-solving, and clinical reasoning literature was reviewed because it was extant knowledge that in clinical practice, already existing knowledge was used to derive a diagnosis, choose investigation, and formulate a treatment plan, in a process of chnical reasoning. The hypothetico-deductive clinical reasoning theory was the dominant theory. Cognitive psychology accounted for it in the Test Operate Test Exh (TOTE) model of problem-solving (Cohen, 1977). The philosophy of science accounted for its popularity as the 'scientific method' (Homer and Westacott, 2000). This was also the basis of the clmical reasoning theory developed by Elstein et al. (1978).

The review of literature also explored the methods that have been used to answer similar kinds of research questions. The research design selected the apphcable methods, that is, participant observation, critical incident technique, content analysis, and scaling of psychological constmcts, and left out the Delphi technique.

CHAPTER HI RESEARCH DESIGN & METHODS

Personal Experience

Personal experience also contributed to the conceptual context. The University of Zambia School of Medicine offers a semester course in clinical anatomy. The researcher had been the course co-ordinator for this course. The objectives of the course were that the student should be able to:

1. Identify the anatomical basis for diagnosis and hitervention in a given clinical scenario

2. Demonstrate the application of anatomical facts in carrying out clinical procedures

Introduction

The pauchy of investigational data on how to define core anatomy for clinical practice was seen as an indicator for the need for mvestigational research m this aspect. The review of methods revealed that methods/techniques from both quaUtative and quanthative research paradigms had been successfully used before.

   Based on the valuable lessons from the literature review, the research design was developed. This section addresses the framework of the whole study, that is, why the study was done (purposes), the conceptual context, the research questions, what was planned for the methods, and the general validity of the study.

Purpose

For the purpose of the study see Chapter I (Introduction).

thoroughness of an academic course and was not mere repethion of earlier anatomy

courses.

Specific Objectives (Research Questions)

The specific objectives are presented in chapter one.
3. Describe the relevant anatomy of disordered stmcture and function in
Methods
common clinical condhions
Table 3.1 summarizes the methods and the research questions that each method
4. Compile an apphed anatomy report on a given clinical scenario or
addresses.
patient

5. Show ability to integrate knowledge of gross, microscopic and

developmental anatomy as a basis for future clinical studies.

Desphe these objectives many students were not clear about what to study. In

seminars they mostly reproduced anatomical facts with little integration to the

clinical case. To the faculty, it was also not clear what to teach, how to differentiate

it from the earlier anatomy courses (gross anatomy, histology, embryology,

neuroanatomy). Since the course was based mostly on seminar topics the choice of

topics was a problem because topics varied each year, the content (and thus the

clinical anatomy) learned would be different for each stream of students. These

unsettling questions motivated the search for a 'core' of clinical anatomy knowledge

that would be consistent for each stream of students. The need for the course was

endorsed by both the Department of Anatomy and the School's Board of Studies.

The challenge was to develop a categorical content and structure that had the

Table 3.1

Research Questions, Methods, and Materials Used

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables
Techniques or Methods	
• Observation	• Experiments
• Reviewing documents/artefacts	• Survey research
• Participant observation	• Structured interviewing
• Open-ended interviews	• Structured observations
Relationship whh Subjects	
• Empathy	• Distant
• Emphasis on trust	• Circumscribed
• Equalitarian	• Short contact
• Intense contact	• Subject-researcher
• Subject as friend	
Data Analysis	
• Inductive	• Deductive
• Ongoing	• Occurs at conclusion of data collection
• Constant comparative method	• Statistical
Problems in Using the Approach	

Validity

Questionnaires are self-report tools and as such the respondents may provide answers of the right thing to do rather than what actually is done. Observations results depend on the inference of the observer, these may hitroduce observer biases.

The concept map for the research design (figure 3.1) shows the relationship of the purpose, the conceptual context, the research questions, the methods, and validity. The data analyses are discussed in full for each method and are not depicted here.

The valididy of the scaling mstrument depends on how accurately h represents the constructs h measures. In addhion the study had small samples. Validity and reliabihty enhancing measures were incorporated in developing of the instmments to address these threats to validity.

The techniques are discussed separately, in the methods, because they were adapted as standalone techniques addressing specific objectives. An integrated approach to the methods could conceal the detail of the processes.

for diagnosis, investigations, treatment be estimated consistently?

Methods
1.Content analysis
2.Critical Incident Technique
3.Participant observer

4.Scaling

Validity
1.Questionnaire self-reports
2.Observer biases
3.Small sample

Purpose
¦ Define core anatomy for clinical practice
¦ Develop clinical anatomy curriculum

•improve practice of clinical anatomy and medical education

Conceptual context
• hyptothetico-deductive theory .own experience as clinical anatomy lecturer ¦ review of literature

Figure 3.1. Concept Map for the Research Design

Figure 3.1 summarises the bhiding stmcture for the various techniques of the study.

Research questions

1.What is the amount and nature of anatomical concepts inherent in history-taking?

2.What is the amount and nature of anatomical concepts inherent in physical examination?

3.What is the amount and nature of anatomical concepts inherent in a text book of clinical methods that is widely used at University of Zambia?

4.Which anatomical knowledge determines success,and/or failure in clinical situations?

5.Is there a difference in the anatomical knowledge that clinical students and clinicians possess compared to that which preclinical medical students possess?

6.Can the detail of anatomical knowledge required

Methods (A): Participant Observation of Clinicians

<u>Purpose</u>

The purposes of the participant observation were twofold:

a) To observe how clinicians used anatomy in clinical practice.

b) To observe what anatomy clinicians used in clinical practice.

c) To observe any situations in which the possession of knowledge of anatomy influenced a clinical outcome.

d) To observe any situations in which lack of knowledge of anatomy influenced a clinical outcome.

e) To reflect on the knowledge of anatomy that could be taught to students to enhance their clinical practice.

<u>The Setting</u>

126

The University Teaching Hospital (UTH) of Lusaka, Zambia is the national referral

and paediatric surgery), intemal medicme (one general unh), paediatrics and child health (a general unit with neonatology attachments), and obstetrics and gynaecology. Tables 3.2 and 3.3 summarise the attachments and average hours spent in each setting.

The researcher, in all the unhs, had no special privileges and worked accordmg to the responsibilities appropriate for his skills and as assigned by the responsibihties of the firm. The settings of observations included ward rounds, outpatient clinics,

The Participant Observer
theatre operations, and admissions (on call duty).

As a medical doctor and licensed to practice medicine by the Medical Council of Zambia the researcher, in 1995 (before the study), was appointed by the UTH as an honorary registrar and was deployed m the casualty section of the Department of Surgery. In addhion the participant observer is qualified in anatomy and medical education.

Entry into the Setting

Upon approval of the study, by the Research and Ethics Committee (appendix III), the researcher wrote to the University Teaching Hosphal Managing Director for permission to collect data in the hosphal. Permission was granted (appendix III) and the appointment as honorary registrar was also re-confirmed. In each department the researcher was introduced as a new member of staff to all departmental staff at several occasions. The introductions often stated that research was an area of interest for the new member of staff The participant observations were conducted in the departments of surgery (general surgery, orthopaedics, urology, neurosurgery,

Table 3.2
Summary of Participant Observer Attachments

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical

Table 3.3
Average Participant-Observer Hours Spent in Each Department

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables

* Contact hours = time spent in the service

The duration in intemal medicine, paediatrics, and obstetrics and gynaecology was shorter because after 6 months of exploratory work and piloting the data format the study became more focussed, refined, and better informed enabling the experience to

Unit: YeUow Firm
Setting: Operating theatre, assistmg the surgeon dohig above-knee amputation.
Anatomical Note: Noted that the surgeon did not know the anatomical names of most of the muscles, the blood vessels and nerves. He ernphasised more the levels of incisions for the skin, muscle, and bone. He also was able to ligate (tie) any 'bleeders' but was not able to clearly describe the blood vessel arrangement in the thigh, nor name them mdividually. I realised that for some operations surgeons only know where to make incisions in the skin, muscles, and bones; how to arrest bleeding; and what to suture. Anatomical knowledge of the names and relations does not seem critical in such incidents.

be more efficient and quicker. Secondly, the departments of intemal medicine, obstetrics and gynaecology, and paediatrics did not have as many sub-specialised units as in surgery; the firms in these other departments were, by and large, identical.

Example 2

Field Note Entry
Department: Medicine

Unit: Three

Research Paradigm and Data CoUechon

The research paradigm was principally quahtative. Data collection techniques included observation, introspective reflection, and survey of literature. The data collected was recorded as participant observer's field notes. All field notes were recorded within 48 hours of the field experience. Most were recorded at the earhest opportunity soon after the session (either at a subsequent break or during lunch break) and were therefore recorded within 24 hours. Each set of field notes mdicated the department of attachment and the unit/firm. The daily field note entries included the setting and anatomical note, an example is included below:

Example 1

Field Note Entry:
Department: Surgery

formulating order on the data so that comparisons, contrasts, and insights could be made. This was achieved by categorising the data. The purpose of categorisation was to reflect on the range and diversity of perspectives studied and not mere count of number of instances falling in each category. Once the categories were developed and pieces of data were being allocated to categories the researcher remained open to changing and developing the categorisation system. Realisation of inadequacies of the categorisation system led to categories being renamed or merged. Parts of the data appeared for the data Analysis involved consideration of words, context, frequency, extensiveness, specificity and of the data. Interpretation on the other hand involved attaching meaning and

Setting: Ward round as (like physician's consultant and registrar away on other duties). Had SRMO's, JRMO's and new set of clinical students.
Anatomical Notes: Opposed for the chest... considered... posterior and anterior ribs, all 5* year students were not able; Noted that the students were unable to divide the chest x-ray into upper, mid and lower zones; were unable to discuss the parts of the heart represented m the cardiac silhouette. One... on the other hand observed... students barely conversant with the arrangement of great veins in the thorax and neck to explain the engorged neck veins and suffusion of the face.

The setting described who was in attendance, the physical setting of the event under observation and the clinical context at hand. The anatomical note described the discussion of the relevant anatomy that ensued or that the observer noted as lacking or being used. The anatomical notes also included the observer's reflections about what had been observed.

Data Analysis and Interpretation

The field notes were separated into observation field notes (observation of others) and participatory field notes (reflections on the experiences of the participant observer). The data was then classified into emerging themes. An analysis and interpretation are conceptually separate processes, the analysis involved

so that the results may have greater generalisability.

significance to the analysis, explaining descriptive patterns, and looking for relationships and linkages in the themes and categories developed. The researcher finally developed his interpretations and conclusions.

Because fieldwork is a highly personal experience, dependent on individual capabilities and shuational variations, and being cognisant of the fact that the validity and meaningfulness of the resuhs depend directly on the observer's skill, disciplme, and perspective the researcher used data from other methods (content analysis, crhical incident technique, and measurements of anatomical knowledge) in developing the quahtative description.

Measures Taken to Reduce Validity Threats

1. Reactivity - Conscious effort made not draw attention to the background of the researcher as an anatomist, and did not interfere in shuations under observation with this regard.

2. Reliability - Developed a standardised method of data collection and recording.

3. Replicability - Described in excess detail how the data was gathered and the context so that someone can follow the steps and replicate the study.

4. Representativeness - Observed different shuations, unhs, and departments

131

methods, at the University of Zambia School of Medicine for the last 15 years. For this reason the textbook was adopted as the universe of content for content analysis of a clinical methods textbook for anatomical concepts. The nineteenth edhion (Swash, 1989) was used for this exercise. The nineteenth edhion (Swash, 1989) has 17 chapters. These chapters (pages 1 - 575) were content-analysed for anatomical content.

Pilot Studies

In the first heration the researcher reviewed the history and physical examination

Methods (B): Content Analysis to Measure the Amount and Nature of

template (13 pages) from Fundamentals of Medicme (Kay and Rose, 1983). Each

Anatomy in a Standard Clinical Methods Textbook

Purpose

The purpose of the content analyses was to hivestigate the amount and nature of anatomy intrinsic to clirucal methods (history takmg, physical examination, and understanding of clhiical fmdmgs) in a standard clinical methods textbook (Hutchinson's Clinical Methods 19* edhion used). The research design was intended for estimation of the phenomenon of anatomical concepts in the context of clinical methods.

The Universe of Content (sample)

Hutchison's Clinical Methods has been the prescribed textbook, for leam29 clinical

Coding Unhs

Using the above categorisation for anatomical indicators the textbook was coded by the researcher alone. The primary unh of analysis in the study was words/phrases/sentences that needed anatomical knowledge to make sense of Sentences and the sub-headings were used as the recordmg unhs in this study. word, phrase or sentence that triggered a requirement for anatomical knowledge to Preliminary category umts developed from the pilot studies were used as category comprehend the statement was noted and designated as an 'anatomy indicator'. The Kay and Rose (1983) template was circulated to nkie volunteers from the American Association of Clinical Anatorr^ Listserv and to two other anatomists with medical degrees as well. They were requested to identify anatortty indicators from the Kay and Rose (1983) template as well as suggest anatomy concepts that they thought were required to comprehend the template. Preliminary analyses yielded the classification of categories of anatomy indicators:

1. Named anatomical structures e.g., femoral nerve, duodenum, ischium.

2. Inflections of anatomical terms, which imply that an anatomical structure is involved e.g., peritonitis, uvehis, arthroscopy.

3. Histological/microscopic terms e.g. endothelium, leucocytes, macula densa.

4. Body poshion and actions e.g., anterior, lateral, dorsal, flexion, abduction.

5. Reference to body parts using lay terms e.g., mouth, finger, eye.

An example of the text that was analysed is included m Appendix IV together whh the coding instructions.

(appendix IX). The text of these two pages were typed out into a content analysis sample forms (appendix IV). Where a figure existed the words of the legend were used. No training of the raters was undertaken but the coding instructions and categories were explamed to each rater. Raters then independently rated the test sets according to the coding instructions. Eight raters, inclusive of the researcher,

coded the test set. The raters included four anatomists who are also qualified and
units in the final content analysis. Categories 1, 2, and 3 were adopted as
registered medical doctors, and four clinicians (one each from surgery, medicine,
representing "Technical Anatomical Terms" and 4, 5 as representing "General
paediatrics, obstetrics and gynaecology) matched whh the four anatomists. The
Anatomical Terms".
anatomists are the only four available at the insthution who were eligible for the

study. The clinicians

Reliability and Validity Issues

All the coding for the study was done by only one rater (the researcher). This option was designed to avoid issues of inter-rater rehabihty although measures can be taken to increase inter-rater reliability. Nevertheless the coding instructions were tested for mter-rater rehabilhy. Inter-rater reliability is used to assess the degree to which different raters give consistent estimates of the same phenomenon. In this case the inter-rater reliability estimated how consistent the coding instructions were when used by different raters.

The inter-rater coding mstructions test set (403 recording unhs) consisted of two pages from Hutchinson's Clinical Methods 20* edhion (1995). First, two chapters were randomly selected (chapter 6 pages 141 - 164; chapter 12 pages 339 - 364). From these two strata, two pages (pages 138 and 332) were fiarther selected. Both the chapters and the pages were selected randomly using a random number table

were selected randomly (the first available in the respective departments) from the rank of registrar upwards. Two registrars and two senior registrars completed the test sets.

All the raters responses were collected and compiled into one list of anatomical indicators. Each rater's categorisation of each indicator into ehher general anatomical term (coded 1) or technical anatomical term (coded 2) was recorded. Where the rater had not identified the term as an anatomy indicator h was designated non-anatomical indicator (coded 9). These categorisation for each indicator by each rater were loaded into Microsoft excel (Windows 2000) and imported into SPSS (statistical package for social sciences) version 9. The intraclass correlation coefficient (measure for inter-rater reliabilhy) was then computed. The average measure intraclass correlation was 0.76 (see table 3.4). Table 3.5 compares the percentage of anatomy indicators identified from the test

Table 3.4
Coding Instructions Measure for Consistency

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical descriptio
• Develop understanding	• Show relationship b(
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predete
• Evolving, flexible, general	specific
	• Detailed plan of ope
Data	
• Descriptive	• Quantifiable coding

set for each rater. The researchers percentage approximated the raters' mean (15.8%).

Table 3.5

Percentage of Anatomy Indicators Identified by Each Rater From the Test Set of 403 Recording Umts

	Qualitative		Quantitative
		Goals	
•	Develop sensitising concepts	•	Theory testing
•	Describe multiple realities	•	Statistical description
•	Develop understanding	•	Show relationship between var
•	Empowerment of marginalized groups	•	Prediction
		Design	
•	Hunch as to how you might proceed	•	Structured, predetermined, fo specific
•	Evolving, flexible, general		
			• Detailed plan of operation
		Data	
•	Descriptive	•	Quantifiable coding

The material for the whole study (Swash, 1989) was coded over a period of one month and only one chapter was coded at each occasion to avoid fatigue-and loss of concentration. Reliability was increased by consistent reference to the definition of categories. Furthermore, validity was enhanced by consuhations with qualified professionals in the pilot study in developing categories. The reliability of the coding instructions was demonstrated whh the acceptable intraclass correlation coefficient for mter-rater reliability of 0.76.

Data Analyses

For each chapter the total recording unhs and the total anatomical indicators were counted and used to compute the Total Anatomical Indicators Ratio. This provided an estimate of how much of the content was anatomical. General anatomical terms and technical anatomical terms were used to compute the technical anatomical terms ratio, which provided an estimate of how much of the content were technical anatomical terms. Frequencies of anatomical terms were also computed. The context of the anatomical data was also analysed for dommant themes.

form was developed after consuhations with several colleagues whh qualifications in both anatomy and medicine. Most of these were members of the American Association of Clinical Anatomists e-mail discussion list, to which the researcher belonged. Several preliminary forms were also piloted on four small groups of doctors in Lusaka (University Teaching Hosphal) at departmental meetings. Finally, two sets of crhical incident questionnaires (appendix V) were formulated. The first asked qualified clinicians to describe clinical events in which a doctor successfiilly completed a task because of applying specific knowledge of anatomy.

The second asked about clinical events in which a doctor did not successfully

complete a clinical task because of lack of specific knowledge of anatomy. The incidents collected in

Purpose

The purpose of the data coUection *in* the critical incident method was to collect data that evaluated the impact of knowledge of anatomy on the practice of medicine. Respondents were asked to provide written accounts of clinical incidents in which the possession of specific anatomical knowledge or the lack of such knowledge influenced the outcome of a clinical shuation. Aggregates of clinical incidents are considered a functional description of the crhical aspects of the job (Jacobs et al., 1978).

The Data Collection Instruments

The incident report forms were developed over a period of time. The preliminary

such calculated 1/6 (15%) of 2000 incidents, that is, 300 incidents (considered sufficient for the size of the study). The sample size of doctors was worked out pro rata based on number of doctors in each department, hosphal, province (see sampling plan below). Time, money and the number of doctors in the country were constraints in the sample size considerations. Other considerations in the design of the sampling plan were:

a) Geographical diversity. Incidents were collected from urban settings and rural settings. The University Teaching Hosphal, Lusaka Urban District clinics, Ndola Central Hosphal, Kitwe Central Hosphal, Konkola Copper Mines Group Incidents were collected from doctors representing a broad spectrum of clinical experience. They were collected from doctors working in each of the four major clinical disciphnes: surgery, intemal medicme, obstetrics and gynaecology, and paediatrics.

Incidents were also collected from doctors working in clinics where they see patients from all the four discipline categories. The selection of this grouping into specialty areas is based on the clinical disciplines that constitute the core of clinical training for doctors. Previous efforts to calculate sample size for crhical incidents have been reported as futile (Blum and Fhzpatrick, '1965) because various assumptions of variables are untenable for sample size formulas. For job-analysis of a profession Flanagan (1954) recommended 2,000 incidents. The study focussed only on anatomy, one of the six major basic sciences (physiology, anatomy, biochemistry, pathology, and pharmacology). The sample size of incidents was as

this study were either self-reports or a report of an event that the respondent actually observed.

Selection of the Sample

Hospitals (Chingola and Chilabombwe) were considered urban settings. Institutions outside these settings were considered rural settings. University Teaching Hosphal was included because h is the site of the only medical school in Zambia. The Copperbeh was selected because it hosts two thirds of intems (Copperbelt) and the second largest number of practicing clinicians. The remainder of provinces of Zambia were considered collectively as 'other'.

b) Diversity of insthutions. For practical reasons most of the sample was from University Teachmg Hosphal where there is a large concentration of doctors and is the national referral hospital. Ndola Central and Kitwe Central hosphals have the second largest number of doctors and serve the Copperbeh, an urban area Lusaka District has the largest collection of generalists clinics, both private

Table 3.6

Sampling Plan of Incidents for Regions and Level of Health Service

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between vari
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, for specific
• Evolving, flexible, general	

and government, in the country. Table 3.6 the sampling plan for number of incidents.

Taking into consideration the number and distribution of doctors in Zambia, the different levels of health care provisions, and accessibilhy to the doctors the pro rata sampling plan of crhical incidents was drawn based on the proportions (provided by Central Board of Health HMIS) shown below:

Regional distribution

A. Lusaka 60 percent

insthution was ready for the researcher before arrival.

2. On arrival, interviews were held with the directors to personally arrange and finalise the data collection schedules.

3. Procedures for training the crhical incident local representatives hicluded familiarization whh the crhical incident technique, by means of an overview presentation by the researcher. This exercise was intended to enhance quality of records collected, consistency in reporting and the validity of the reports.

B. Copperbelt 30 percent

C. Other 10 percent

Health care level

A. Large hosphal (Lusaka 75 percent, Copperbeh 25 percent)

B. District hosphal (Copperbeh 50 percent. Other 50 percent)

C. Clinics (Lusaka 65 percent, Copperbeh 35 percent).

Data Collection

Wrhten approval to conduct this study at all the institutions was obtained. Copies of letters of approval from University Teachmg Hosphal and Lusaka Urban District Health Management Team are appended (see appendix III). Preliminary vishs to these institutions were also undertaken to establish rapport" and mtroduce the study. Cost effective data collection circuhs were undertaken that ensured high response rates. Each data collection circuh lasted no more than five working days.

Data collection involved:

1. A notification of the data collection vish was sent in advance so that the

the other recorded the anatomy that was required or lacking. This meant that for each incident report three considerations were made; a) the clinical activity that was cited, b) the reason why the outcome was successful or unsuccessful, and c) the specific anatomical knowledge, or lack of h, that caused the outcome to be successfril or unsuccessful.

In developing taxonomies those statements that were similar or identical were placed together, but the aim was the maintain as many as possible distinctions between the statements, and to organise these into themes of anatomical knowledge that impact clinical practice in Zambia. The themes were broader categories in a logical manner. Finally themes were not developed for each incident, but the process of grouping

Incidents were collected by the local representatives, in each institution and department from the doctors working in the hospitals and clinics. Further incidents were collected at the research seminar of this nature. Data collection continued beyond the not call to accommodate any doctors who were not available at the time. Incidents were also collected from doctors from other regions visiting Lusaka.

5. Data collection was voluntary, and participants were assured anonymity. Incident forms were not signed and lists of participation were not maintained.

The total number of incidents collected and the distribution of these incidents among the clinical speciahies and geographical locations are reported in resuhs.

Data Analysis (Incident classification)
The inhial analysis of the crhical incident data was designed to develop the frames of reference that would be used m developing taxonomies. This involved creathig a two-column table. For each incident, one column recorded the clinical incident, and

similar incidents, and developing distinct themes for dissimilar incidents continued until ail incidents had been considered. Both the successful and the unsuccessful incidents were used in construction of the themes. Data conceming respondent characteristics were examined separately.

2. High anatomy knowledge-demanding clhiical cases.

<u>Inventory of Disease of Burden</u> Govemment health services in Zambia are provided by the Ministry of Heahh (MOH) and the Central Board of Health (CBOH). The Mirustry is the policy organ whilst the CBOH implements the policy. The CBOH monhors Zambia's disease burden by way of the Health Monhoring Information System (HMIS). The HMIS became operative m 1998/9 but the first reliable data are those of 1999. Each of the 72 districts in Zambia has an HMIS officer who compiles data fi-om the hosphals and heahh care services in the districts and then forwards to the national HMIS centre at CBOH offices in Lusaka.

Methods (b): Developing the Case Anatomical Knowledge Index (CAKI) and Evidence-Based Selection of Clinical Cases for Anatomy Teaching

This section is divided into two categories. The first describes the inventory of medical records to examine the disease burden at different levels of heahh care services; the second describes the development of a tool to estimate the detail of anatomical knowledge demanded of by clinical cases.

This study, in part, sought to improve selection of clinical cases for anatomy teaching and leaming, through systematic review and use of explich crheria. Two criteria were natural considerations:

1. High-volume medical condhions, which the clinician encounters frequently, and

researcher recruited four doctors (one from each major clinical discipline) and one local HMIS officer to assist in piloting these data sheets when collecting clinical audh for Ndola Central Hosphal. The five assistants were trained by the researcher on how to categorise and enter information from hosphal records onto data sheets. Data from the departments of surgery, obstetrics and gynaecology, and paediatrics were compiled. Each research assistant was paid a research assistant fee. This procedure was repeated for the UTH department of obstetrics and gynaecology.

The researcher obtained permission from the Director-General of CBOH to access this information for the study. Data from 1999, 2000, and 2001 were made available for assessing the national disease burden.

The incidence data for Katete's St. Francis Hospal, Lusaka Urban District Health Management

Hosphal records: At the University Teaching Hosphal (UTH) the data were collected from departmental records. The Department of Surgery has maintained morbidity and mortalhy audh records since the late 1980's. Each clinical firm m the Department completes a monthly audh of the number of patients, types, numbers, and outcomes of clinical care/operations. The audhs are presented to other members of staff" at weekly departmental morbidhy/mortality meetings. The researcher took an inventory of the morbidity and mortality records of a) two general-surgery firms; one in which the researcher worked and the other chosen randomly; b) orthopaedics, c) urology, d) neuro-surgery, e) paediatric surgery, f) cardiac surgery, g) opthalmology, h) maxillo-facial surgery, i) plastic surgery, for at least five years for each firm Based on the experience of doing this exercise the researcher developed data collecting sheets (categories and how to enter them), which could be used for transferring information from hospital records onto a standard form.

Whh the permission of the Executive Director at Ndola Central Hosphal, the

Indexes are sets of items, which are considered to measure a latent variable and

aaggregated measures (Garson, 2001; IISDnet, 2002). In considering the Case

Anatomical Knowledge Index, a hypothesis has been implichly formulated that the

construct is a property occurring m varying amounts so that h can be quantified
Board, and UTH departments of internal medicine, and paediatrics was collected

using the proposed index on a theoretical unidimensional continuum. Thus an index
from the respective statistics departments. In order to standardise the frequency

measures the presence of the same concept in different intensity. It appears
reports from the different sources the data were consolidated: the higher figures

reasonable to suppose that the detail of anatomy required for medical practice
were adopted based on the priority crheria. Frequency figures were selected based
and/or
on the following priority ranking: HMIS national figures, UTH researcher data,

UTH HMIS data, Ndola researcher data, HMIS DHMT data It is noteworthy that

data from HMIS is collated into more general categories in which specificity is lost

whilst those collected by the researcher and research assistants maintained

specificity of disease category. Where appropriate the figures whh more specific

disease categories were selected.

Student log sheets for year-4 medical students in the clinical and applied

anatomy class were used to assess the frequency of observed clinical procedures.

This was used as a proxy to estimate the frequency of ward clinical procedures

done at the University Teaching Hosphal. Log sheets for the 2002/3 academic year

were reviewed.

Developing an Index: Case Anatomical Knowledge Index

- Possession of knowledge of general topographical relationships of specific structures of the body

- Possession of knowledge of specific and accurate topographical relationships of body structures

- Possession of knowledge of specific mechanism of function of structures in the body

in considering a clinical case varies. For the CAKI the universe of attributes whose scalability is being investigated was identified and a scale of development. The following sample of attributes were developed by the researcher in consultation whh anatomists and medical practhioners:

- Possession of knowledge of parts of the body using lay terms

- Possession of knowledge of general functions of stmctures m the body

- Possession of knowledge of basic tissue types of the body

- Possession of knowledge of parts of the body using anatomical terms

- Ability to identify tissue types of the body

- Possession of knowledge of blood supply and drainage of structures in the body

- Possession of knowledge of nerve supply to structures in the body

- Possession of knowledge of the root values of the nerves in the body

- Possession of knowledge of origins and drainage of blood vessels in the body

- Ability to identify specific blood vessels in the body

- Ability to identify specific nerves in the body

knowledge inherent in a clinical case.

Scalogram Analysis

The items that were developed (supra vide) were circulated to the listserv (an e-mail

discussion group) of the American Association of Clinical Anatomists (AACA), by

questionnaire. E-mail discussion lists can be used in research (Gibaldi, 1999). The

    • Ability to identify specific structures accurately in a topographical

questionnaire hems were rearranged randomly so that no particular pattem was

     relationship

discemable. The group of volunteers were asked to rate the statements in terms of

The Case Anatomical Knowledge Index, should be able to estimate the detail of

anatomical knowledge that is required to understand the ahered function/structure

for formulating a basis for:

1) Diagnosis and concepts

2) Interpreting diagnostic images/ performing clinical procedures

3) Treatment of a clinical condhion

Aim

The aim was to develop a set of hems or statements so that a respondent who agrees

with any specific level of the index would also agree with all previous levels of the

index. In this way h would be possible to predict the detail of anatomical knowledge

at a level knowing only the total score for a particular clinical case.

Defining the Focus

The focus was to develop a cumulative index that measured the detail of anatomical

agreed to an hem ranked second they always agreed whh the hem ranked first, and so on (Guttman, 1944; Trochim, 1999).

The coefficient of reproducibility (C. of R.) measures how well the tool can predict any given respondent's responses from his poshion within the table (Guttman, 1944; Trochim, 1999; Garson, 2001). The C. of R. that is considered adequate for a Guttman scale is .90 (Linacre, 1995; Garson, 2001). Guttman scales are evaluated by the coefficient of reproducibility or the coefficient of scalability (Trochim, 1999; Crocker and Algina, 1986). The C. of R. is a ratio or proportion obtained by dividing the number of 'appropriate' responses by the total number of responses (e.g., if 10

how favourable they were to the concept of measuring detail of anatomical knowledge. Fifteen members of the American Association of Clinical Anatomists responded; Nine had a medical/health qualification, six had no medical/health qualification; 11 had a qualification m anatomy; with half possessing both a

medical/heahh qualification and an anatomical qualification. Of those whh health-related qualifications five were medical doctors, one was a veterinary surgeon, one a dental surgeon. Others were a physical therapist and one medical artist. Of those with anatomical qualifications nine had a doctor of philosophy (Ph.D.), one had a masters of science, another a bachelors of science and one had a diploma. Seven of the respondents were from the Unhed States, two were from New Zealand, two from South Africa, two from Unhed Kingdom, and one each from Japan and Austraha.

Table 3.7 shows the matrix after the respondents who agree with more statements are listed at the top and those agreehig with fewer at the bottom The respondents whh the same number of agreements have been sorted by statements from left to right from those that most agreed to those that fewest agreed to (Guttman, 1944;Trochim, 1999). This way the scale is nearly cumulative that is if someone

people completed a 10-item scale, and 80 of the total 100 responses were 'correct', then the coefficient of reproducibility = 80/100, or .80). More statistical definhions are available fi-om Linacre (1995) and Garson (2001). The C. of R. for this study

Table 3.7
Scalogram of Statements Judged by Volunteers From the American Association of Clinical Anatomists

	Qualitative	Quantitative
Goals		
	• Develop sensitising concepts	• Theory testing
	• Describe multiple realities	• Statistical description
	• Develop understanding	• Show relationship between variables
	• Empowerment of marginalized groups	• Prediction
Design		
	• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
	• Evolving, flexible, general	
		• Detailed plan of operation
Data		
	• Descriptive	• Quantifiable coding
	• Personal documents	• Counts, measures
	• Field notes	• Operationalised variables
	• Photographs	• Statistical
	• Official documents/artefacts	
Sample		
	• Small	• Large
	• Non-representative	• Stratified

R = respondent; Y = yes; N = no; hem (- 10) refer to questionnaire (appendix VI)

was 0.91 (considered adequate for a Guttman scale).

The literature did not identify any previous work on the relationship of anatomical knowledge to clinical cases. This work might be the first.

Using the established Guttman scale, the Case Anatomical Knowledge Index (CAKI) was constructed. The next phase was designed to establish evidence that the proposed index truly functioned as an ordered (low - high) scale when applied by raters.

The following steps were undertaken:

1. Clinicians were given a set of clinical situations (diseases, investigations, and treatment options) composed from the inventory studies (see appendix VI). This group was asked to order the clinical cases in order of low to high in terms of the detail of anatomical knowledge required, without reference to the CAKJ. Agreement between the raters was investigated.

2. A second set of clinicians replicated the steps in 1 except they rank ordered the clinical shuations using the CAKI (appendix VI). Agreement between raters was also investigated.

3. The rankings obtained in step 1 were compared to the rankings obtained in step 2. The degree of correlation between the two steps was considered evidence indicating how well the CAKI works in hs intended use.

4. The CAKI was applied to the lists generated from clinical condhion incidence.

5. Ten hems from the scored CAKI inventory were randomly selected and distributed to a panel of 10 raters. Each rater was blinded to the CAKI scores on the list. Each rater scored the selected hems independently using the CAKI. Inter-rater reliability was calculated using SPSS inter-rater correlation coefficient for reliability scores.

context, b) the answers to the questions were readily available from the same text, c) the preface of the textbook reported that the guidelines on composhion of objective questions included use of a panel of examiners to scrutinise questions, pre-testing, item analysis and bi-serial correlation coefficients in selection of questions. Two questions were randomly selected, using a random number table (appendix IX), from each of the ten chapters (1- The structure of the body, 2- Embryology, 3 - The vertebral column, 4 - Thorax, 5 - Abdomen, 6 - Pelvis and perineum, 7 - Upper limb, 8 - Lower limb, 9 - Head and neck, 10 - Central nervous system). Section A of appendix VII represents these traditional questions.

Methods (E): Comparison of Anatomical Knowledge Between

Preclinical, Clinical Students and Clinicians

The Test Questions

Two sets of questions, one tradhional and the second cHnical were prepared and compiled into one research test paper (appendix VII). The tradhional questions were selected randomly, using a random number table (appendix IX), from 'MCQs IN ANATOMY' (Lumley et. al, 1979). Lumley et al. (1979) had 394 muhiple choice questions based on the textbook 'Essential Anatomy' published in 1976 (Lumley et al., 1979). The authors (Lumley et al., 1979) asserted that the questions cover the majority of important anatomical points. This MCQ text (Lumley et al., 1979) was selected to represent the tradhional anatomy for three reasons: a) the questions were based on a textbook published in 1976, way before the medical education reforms (1990 - 2000) espousing problem-based-leaming and clinical context; b) the answers to the questions were readily available from the same text;

Preclinical (third and fourth year) students - Third year medical students at the University of Zambia are technically in the first year of medical studies. The basic science courses (inclusive of anatomy) are taken over 32 weeks divided into two semesters. The third year anatomy course includes dissection of the human body, gross anatomy lectures, histology, and embryology. The course, overall, is tradhional (dissection m small groups, histology laboratories, and lectures) m

The chnical anatomy questions, using a random number table (appendix IX), approach. The fourth year class studies basic sciences, that is, anatomy, pathology, were selected from the clinical and applied anatomy course (AN 432) MCQ microbiology, physiology, and pharmacology, together with other courses over two question bank. The question bank was compiled from previous AN 432 16-week semesters.   In the first semester they study neuroanatomy (tradhional) end-of-semester tests and examinations run at the University of Zambia School of and in the

Medicine from 1997 to 2002. The question bank was selected to represent the clinical anatomy questions because the objectives of the course espouse clinical context and the questions are constructed with these objectives in mhid. Twenty questions were randomly selected, using a random number table (appendix IX), from the 110 questions m the question bank. Section B of Appendix VII represents these clinical anatomy questions.

Additionally, four anatomists, who also have a medical degree, were, m the draft phase of constructing the research test, requested to evaluate section A and section B. They also evaluated the categorisation of the two sections. On a 5-point Likert scale, that ranged from disagree very strongly (1) to agree very strongly (5), all the four respondents agreed very strongly with the categorisation.

The Subjects and Settmg

after administration of the test. Clinicians - The clinicians were from the University

Teaching Hosphal.

The sample sizes required for each group were calculated using a statistical

package nQuery Advisor version 4. nQuery offers sample size and power

determination for a variety of needs based upon means, proportions, and measures

of agreement. In order to achieve a level of statistical significance of $p < 0.05$, and
second semester they study chnical anatomy. The clinical anatomy course is
have a power greater than 90%, it was calculated that 50 subjects/respondents from
conducted in a more problem-based approach. The components of the clinical
each group would be required. The *a priori* assumptions were that the minimum
anatomy course are lectures (8 hours), seminars based on clhiical condhions (24
difference

hours), surface anatomy practical classes (15 hours), anatomy of clhiical

examination practical classes (15 hours) and ward vishs (10 hours). The third and

fourth year semester schedules are identical; both classes took the anatomy research

test at the end of the second semester.

Clinical (fifth, sixth, seventh year) medical students - The School of Medicine has

three clinical year classes (fifth, sixth and seventh). The fifth years take 9-week

each introductory clinical clerkships in medicme, surgery, paediatrics, and

obstetrics and gynaecology. The sixth year class takes 9-week clerkships in

psychiatry, community medicine, surgical sub-speciahies, and medical

sub-speciahies. The seventh year class takes 9-week long senior clerkships in

medicine, surgery, paediatrics, and obstetrics and gynaecology. The term schedules

for the three classes were identical, the fifth and seventh year classes took the

anatomy research test at the end of the academic year (all clerkships done).

Precautions were taken to prevent 'leakage' of the test by collecting all test copies

not informed that they would be sitting a test. During the test session the purpose of

the test was explained and the students informed that the resuhs would not

contribute to their academic records but requested to apply themselves to their best

ability. The students were also instructed to enter their computer numbers on the

answer sheets, to encourage an inspired performance because the students could

then make a follow up on their performance. The time allowed for the test was one
m means in each group would be different by 30 points and the standard deviation
hour. All the students sat the test and entered their computer numbers. The fourth
in each group is about 10.
year students were invhed to an aftemoon session for the class; the nature of the
   Determination of the sample size is important because too small a sample may
session was not specified. When assembled they were hivhed to participate in the
produce inconclusive resuhs and too big a sample is wasteful of resources. Power of
test for research reasons. They were
a test is the probability that a false statistical null hypothesis will be rejected in

favour of an ahernative true hypothesis (Jaeger, 1990). Standard deviation is the

indicator of spread of scores; h is higher where variability is higher in a distribution

(Glass and Hopkms, 1984; Jaeger, 1990). A mean is the sample statistic used as an

indicator of the middle of a score distribution (Glass and Hopkins, 1984; Jaeger,

1990).

Test Administration, Coding and Marking

Sixty-six of the seventy third-year medical students at the School of Medicine

(University of Zambia) took the Anatomy Research Test. For the thhd year medical

students, arrangements were made to 'borrow' one hour from the regular timetable.

The class representative was informed that they would be an important session for

that one hour and that all the students in the class should attend. The students were

The average time spent on the test was forty minutes (30 minutes for the quickest and one hour for the slowest).

Each of the question papers was marked for identification (CI - C70) to allow for easy detecfion should any miss and thus alert the researcher to a possible 'leak' of the question paper. The answer sheets were coded (P = third years, M = fourth years, C = 5* and 7"* years, D = qualified doctors) for identification during data entry and latter verifications. The answer sheets were corrected and a score of one awarded for each correct answer and zero for a wrong or unanswered option. Percentage scores were

advised the test would not contribute to their academic record but requested to do their best on the test. All the 48 students who attended the session completed the test. Fifth and seventh year students have clinical seminars on Thursdays (among other days). After one such seminar the students were asked to stay on for the purpose of the anatomy research test that would be administered as a surprise test. The purpose of the test was explained and the students informed that it was entirely voluntary for them to take the test and that only those that wished to receive a feedback should enter their computer number. Forty-five of the 47 students present at the seminar took the test. Two of the students had to leave to attend a prior engagement. The doctors took the test at a research seminar organised in UTH. The list of all the doctors working in UTH (219) was used to select, at random, 50 doctors to participate in the research semmar. Doctors on leave were excluded from the list. The letters of invhation (appendix VII) were sent to all those selected. No prior warning of the actual activhies of the research semmar was given. The participants were informed the exercise was voluntary and anonymous: Only those that arrived on time took the test; twenty-two doctors participated in the test. The attendance for the seminar was thirty-three.

calculated for each section. On the data matrix the digh 1 was entered for a correct response, the digh 2 for a wrong response, and the digh 9 for a missing answer for each question for all respondents. The spreadsheet data matrix was then imported to SPSS version 9 for analysis. The respondents were grouped into four sets: preclinical 3"* year students, preclinical 4* years, clinical 5* & 7* years, and clinicians. Each set was compared with others to determine significant differences of performance on each section of the test.

Data Analyses

Analysis of variance (ANOVA) was used to determine the difference among the groups using SPSS version 9. The test scores were disaggregated into two sets (tradhional, and clinical) and analysis of variance between the two sets of questions

Table 3.8
Analysis of Variance of Scores from the Research Anatomy Test

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large

by the different respondent groups (table 3.8) done.

CHAPTER IV
RESULTS

157

methods used in the study^

Introduction

The resuhs chapter is divided into five sections. Section 1, "The Nature and Amount of Anatomical Concepts in Clinical Methods", offers resuhs to the first three research questions. Section 2, 'The Impact of Knowledge of Anatomical Knowledge on Clinical Practice", explores the answers to the research question about which anatomical knowledge determines success and/or failure in clinical shuations. This section also offers results concerning the role of anatomy in clinical practice. Section 3, "Can the Detail of Anatomical Knowledge Required for Diagnosis, Investigations, and Treatment of a Clinical Condition be Estimated Consistently? The Case Anatomical Knowledge Index", explores the research question of the same title. Section 4, "Is there a Difference in Anatomical Knowledge. Possessed by Clinical Students and Clinicians Compared to that of Preclinical Students? The Two Anatomies" investigates the last specific objective (research question). Section 5, "Core Anatomy for Undergraduate Medical Education" provides a defmhion of what core anatomy is based on the answers of the specific objectives (research questions). This definhion is a resuh of the triangulation (convergence) of answers from the different research questions and

textbook are presented. The chapters have been arranged in decreasing order of total anatomy indicators ratio, and not as the sequence of chapters in the textbook.

In the textbook, the history-taking and physical examination chapter was introductory; it provided a general background and introduced the medical student to the interaction between doctors and patients. While this might be considered the clinical methods chapter, h was superficial and introductory only. The subsequent chapters tackled in detail the clinical methods as they apply to clinical condhions seen per system or specialty (psychiatry bemg a case in point). It must then be understood that to cover clinical me**Section 1**frill, the history-taking and physical examination

The Nature and Amount of Anatomical Concepts in Clinical Methods

Amount of Anatomical Concepts in Clinical Methods Hutchison's Clinical Methods (nineteenth edhion) by Swash (1989) was content analysed for anatomical terms and concepts. From a total of 17, 223 recording unhs 10, 162 (59 percent) were found to be general anatomy indicators (Table 4.1). Of the many (10,162) general anatomy indicators 6,980 (69 percent) were designated as technical anatomy terms (Table 4.1). This content analysis implies that pne cannot benefit maximally from the instruction on clmical methods by Swash (1989) whhout possessing substantial knowledge of anatomy.

Table 4.1 summarises the findmgs in chapters. The total recording unhs, anatomy indicators, and anatomy indicators ratio, together with the general anatomy terms, technical anatomy terms, and the technical anatomy ratio, for each chapter in the

chapter must be considered together with the detailed chapters in total. This

Table 4.1
Resuhs of Content Analysis of Hutchinson's Clinical Methods for Anatomical Terms/Concepts

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables
Techniques or Methods	
• Observation	• Experiments
• Reviewing documents/artefacts	• Survey research
• Participant observation	• Structured interviewing

TRU = Total Recording Units
TAI = Total Anatomy Indicators
TAIR = Total Anatomy Indicators Ratio

approach conveys a more accurate content analysis of clinical methods.
GAT = General Anatomy Terms TAT
= Technical Anatomy Terms TATR =
Technical Anatomy Terms Ratio

Doctor and Patient: History-taking and Physical Examination

Routine questions in history-taking relate to specific knowledge of clinical features

to specific anatomical regions or systems. The anatomical regions or systems are

enquired after under the following headings:

glands); Abdomen (ingumal, extemal iliac, and femoral glands). The chapter on history-taking and physical examination had a Total Anatomy Indicators Ratio (TAIR) of 0.48 and Technical Anatomy Terms Ratio (TATR) of 0.39, thus 39 percent of the general anatomy indicators were technical anatomy terms.

The object of history-taking, physical examination and ancillary investigations is to make a diagnosis (Swash, 1989). Forty-eight percent of that requires knowledge of anatomy whilst 39 percent of that process requires knowledge of technical anatomy.

1. Gastrointestinal system, abdomen, and pelvis - upper alimentary tract; lower alimentary tract; liver and gallbladder.

2. Genital system

3. The cardiovascular system

4. The blood

5. The respiratory system

6. The urinary system

7. Skm

8. The nervous system

9. The locomotor system

From the above *it* seems that *a priori* anatomical knowledge of what consthutes these systems, and their functions is implied.

The physical examination section referred to both general anatomy terms and technical anatomy terms under each of the subheading: Eyes (optic fundi); Face (trigeminal nerve); Mouth and Pharynx (buccal mucous membrane); Neck (carotid pulses); Upper hmb (radial artery and brachial artery); Thorax (mediastinal

terms. In the chnical context, and that of this study, in making a diagnosis one should ask "How far can this person's disability be explained in anatomical terms, i.e. where is the lesion? What is the system involved? What systems are not involved? To what extent is function and structure of anatomical tissues, organs, regions, systems ahered?"

The Major Anatomical Themes The major anatomical themes found in Hutchison's Clinical Methods are shown in table 4.2 below.   The clhiical methods themes are arranged in order of the Total Anatonty Indicators

Table 4.2
Major Anatomical Themes Found in Hutchinson's Clinical Methods Concepts

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables
Techniques or Methods	
• Observation	• Experiments

Ratio (TAIR).

Ear, Nose & Throat

1. Hearing apparatus axis: extemal audhory meatus, tympanic membrane, ossicles, oval fenestra, and cochlea.
2. Tympanic membrane and auriscope
3. Middle and inner ears (bony and membranous labyrinthes).
4. Structure of the nasal vestibule, nasal septum and nasal turbinates.
5. Olfactory and respiratory mucosa and Little's area.
6. X-rays showing the paranasal sinuses (frontal, maxillary, ethmoidal, sphenoidal)
7. Larynx as seen at laryngoscopy
8. Divisions pharynx: naso-, oro-, laryngo.

Nervous System

Respiratory System

1. The chest wall
2. Bronchopulmonary tree

1. The motor system: lower motor neurones, corticospinal system, upper motor neurones, extrapyramidal system, and cerebellum.
2. Segmental innervation of muscles of the upper and lower limb.
3. The Sensory system - spinothalamic tracts
4. Anterior and posterior dermatomes of the body
5. Blood supply to the brain and spinal cord.
6. The lobes of the brain and the functional centres.
7. Cranial nerves: function, clinical disorders, how to examine them.

The Unconscious Patient

1. Brainstem
2. Pupillary size and reflexes
3. The tentorium - supra-, trans-, infra- organs and lesions
4. Intracranial haemorrhage - subarachnoid, subdural, extradural.
5. Coning: brainstem & cerebellar herniation

Ocular movements: brainstem, vestibular nuclei, medial longhudinal fasciculi, oculomotor, trochlear, abducent nerves.

Cardiovascular System

1. Anatomical landmarks of the chestwall
2. Locating peripheral pulses: radial, brachial, carotid, femoral, poplheal, posterior tibial, dorsalis paedis.
3. The cardiac cycle and chambers of the heart.
4. Auscuhation of heart sounds and valvular surface poshions.
5. Congenhal abnormalhies of the heart: atrial septal defects, ventricular septal defects, patent ductus arteriosus, Fallot's tetralogy, coarctation of the aorta.
6. The relationship between myocardial regions, coronary vessels, and ECG.
7. Radiographic examination of the heart.

perhoneal fluid, cerebrospinal fluid.

Psychiatric Assessment	1. Lobes of the brain
	2. Visual pathways
	3. Autonomic nervous system
	4. The limbic system

In essence, this table provides a table of contents for the anatomical knowledge required for the medical student to leam clinical methods effectively.

	3. Pleura and pleural spaces
	4. Identifying anatomical structures on chest x-rays.
Genitalia and Sexually Transmitted Diseases	1. Examination of The male genitalia: penis, urethral orifice, prepuce, glans, coronal sulcus, scrotum, testis, epididymis.
	2. Examination of the female genitalia: vulva, labia majora, labia minora, clitoris, urethral orifice, vagina
	3. Anorectal examination: ischial spines, anus, anal canal, rectum, perineal body, ischiorectal fossa.
The Blood	1. Lymph node groups: head & neck, axillary, ephrochlear, para-aortic, inguinal, femoral, popliteal.
	2. Shes for venepuncture
	3. Components of blood: cehs and fluid
Examination of Women	1. The cervix
	2. Vagina and vagmal vauh
	3. Gravid uterus and abdominal landmarks and foetal parts.
	4. Radiology in women: hysterosalpingography, x-ray pelvimetry, CT scan of pelvis
Examination of Children	1. Examination of the head: fontanelles, sutures, and head circumference.
	2. Screening for congenital abnormalities.
	3. Developmental milestones
Kidneys & Urine	1. The structure of the kidney - glomeruli, calyces, renal pelvis.
	2. The general arrangement of the urinary system - glomerulus, renal tubules, c^yces, pelvis, ureters, bladder.
	3. Identification of anatomical structures in intravenous pyelograms.
	4. CT scan of abdomen at kidney level
Using the Laboratory	1. Obtaining specimens for laboratory investigations: venous blood, arterial blood, pleural fluid, gastric fluid,

normal structure of the eye.

The Locomotor System

This chapter ranked second (of the 17 chapters) on anatomy indicators (TAIR = 0.81) and had a Technical Anatomy Terms Ratio of 0.76 (Table 4.1). The theme on anatomical description of motion at joints and the poshion of body parts relative to each other was most prominent in this chapter (17 percent of the anatomy content). The terms used in this theme included: flexion, extension, abduction, adduction, intemal rotation, extemal rotation, dorsiflexion and plantar flexion. The anatomic context themes in each chapter are now discussed in full. The context of data in content analysis is considered an important aspect of the resuhs (Krippendorf, 1980) The

Eve

The chapter on the eye ranked first m terms of content for anatomy indicators (Total Anatomy Indicators Ratio = 0.87) and also had a high Technical Anatomy Terms Ratio (TATR = 0.76), see Table 4.1. These data indicate that a substantial knowledge of anatomical terms and the references thereof is required for this chapter. The chapter on the examination of the eye made specific references to the anatomy of the eyelids, the lacrimal gland, the conjunctiva, the comea, and the iris. References to the optic fundus (eight pages) contributed 11 percent of the anatomy indicators making it the most dominant theme in the examination of the eye. This theme explored the anatomical identification of the stmctures seen at ophthalmoscopy and several clinical features of altered structure due to different diseases. Assessment of the eye after trauma requires one to have a full grasp of the

dermis. The growth stages of hair follicles were a dominant theme in this chapter. The anagen, catagen, and telogen phases were presented in both description and illustration.

The Gastromtestinal Tract and Abdomen

This chapter had a high Total Anatomy Indicators Ratio (TAIR = 0.73) and an equally high Technical Anatomy Terms Ratio (TATR = 0.61, see Table 4). These ratios indicate that 73 percent of the recording units had a general anatomy indicator and the examination of the individual joints included the: cervical sphie, thoracic and lumbar spine, sacroiliac joint, shoulder, elbow, wrist, fingers, thumb, hip, knee, ankle and foot. At all these joints the range of motion, articulating parts, the stabilizing factors and the pathology were presented. Radiological examination of the joints and the bones was a prominent theme.

The Skin. Nails and Hair

The chapter of skin, nails and hair ranked third (out of the seventeen chapters) in terms of Total Anatomy Indicators Ratio (TAIR = 0.80). However, the Technical Anatomy Terms Ratio was low (TATR = 0.27. The dominant themes in technical anatomy terms were epidermis (4 percent); and anagen/catagen/telogen (4 percent). The context of the chapter on the skin is mostly distribution of skin lesions in terms of whether they are symmetrical or asymmetrical; on extensor or flexor surfaces; affecting mucosal surfaces or keratinized surfaces. The morphology of the lesions also explores the exact layer of the skin that might be affected, i.e. epidermis or

The Nervous System

Of the 17 chapters *in* Hutchinson's clinical methods (Swash, 1989), the chapter on the nervous system was the fifth ranked chapter in terms of Total Anatomy Indicators Ratio (TAIR = 0.71), and also had a very high Technical Anatomy Terms Ratio (TATR = 0.79), see Table 4.1. Rating high (71 percent) in anatomical

terms, 64 percent were technical anatomical-technical. This chapter ranked fourth in the considerable amount of anatomical knowledge in a body interested in clinical terms, the aim of neurological

a) anterior and posterior external relations of the abdominal thoracic organs,

b) the division of the abdomen into regions (right and left hypochondrium; epigastrium; right and left lateral (lumbar); right and left inguinal (iliac); pubic (hypogastrium/suprapubic) whh the view of identifying organs that lie deep to these areas,

c) the surface of the abdominal skin in terms of commonly employed abdominal incisions and the distribution of superficial veins which may become engorged in disease of the portal circulation

d) the palpation of organs or masses m these regions.

In the gastrointestinal tract examination included the mouth and throat (lips, teeth, gums, tongue, buccal mucosa, palate, fauces, tonsils, pharynx); the abdomen; the urinary bladder; the groins, the male genhalia; the anus and rectum One other dominant feature was the radiological kiterpretation of plain and contrast x-rays of
the gastrointestinal tract.

examination was to delineate the patient's disability in physiological and anatomical terms (Swash, 1989). Eleven pages were dedicated to the anatomy and physiology of the nervous system.

The important anatomical themes were:

a. The motor system: lower motor neurones; the corticospinal system; the upper motor neurones; the extrapyramidal system; the cerebellum. This section explored afferent tracts, efferent tracts, central nuclei and how lesions affect the function. On three pages the illustrations were dedicated to segmental innervation of the muscles of the upper limb (36 named muscles), muscles of the lower limb (32 named muscles).

b. The sensory system: cutaneous sensation and spinothalamic tracts; the spinal cord and the segmental supply of the parts of the body. An illustration was used to show the anterior (27 dermatomes) and posterior (28 dermatomes) cutaneous areas supplied by sensory roots.

c. Vascular supply of the brain and spinal cord: the blood supply to the brain and the circle of Wilhs were presented in detail. The named arteries, inclusive of their origins, were internal carotid arteries, middle cerebral arteries, anterior communicatmg artery, anterior cerebral arteries, posterior cerebral arteries, basilar artery, and vertebral arteries.

tomography of the brain required identifying anatomical structures from cross-sectional views and magnetic resonance imaging identified stmctures in axial view (sagittal).

        d. The lobes of the bram and the functional (Broadmann) areas responsible for fianctions, such as, emotional state, hallucinations, orientation, consciousness, memory, speech and language.

The cranial nerves were another important theme in the chapter on nervous system (29 pages). The chapter described the essential points in the anatomy of each cranial nerve, indicating hs function and the clinical disorder resuhing fi-om lesions affecting the nerves. The method for clinical examination of each cranial nerve was also described.

In addition, specific clinical features were associated with different shes of lesions on the nerves (upper motor neuron lesions and lower motor neuron lesions). The assessment of muscles (e.g., flexors, extensors, abductors, adductors) for strength of the upper limb, lower limb and trunk was an important component of the clinical methods. Knowledge of the segmental supply and the specific nerve supply was a prominent theme. Assessment of reflexes and knowledge of the spinal cord segmental supply was an important theme.

Special investigations mentioned which required applications of anatomical knowledge to perform or interpret are the lumbar puncture, Queckenstedt's test,

oculomotor nerve and its anatomical path, the structural relationship to the brainstem, and the foramen magnum, and the relations of the cerebellum to the tentorial hiatus were important anatomical concepts in the interpretation of findings of the pupil size. Ocular movements and their relation to the brainstem, vestibular nuclei, medial longitudinal fasciculi, the oculomotor nerve, trochlear nerve and abducent nerves and their nuclei were important anatomical considerations.

The "Unconscious" (Comatose) Patient

The Total Anatomy Indicators Ratio was 0.70 and the Technical Anatomy Terms Ratio was 0.74 (Table 4.1) for die chapter on the unconscious patient. Seventy-four percent of the anatomical terms were technical anatomy terms. This chapter ranked fourth for the TAIR. The dominant themes were brainstem (9 percent); pupil/pupillary (7 percent); ocular (3 percent) and references to the supra-, trans-, sub-tentorial (3 percent) together composmg 22 percent of the content of anatomical terms. Clinical assessment of consciousness was mostly done by use of the Glasgow coma scale (Swash, 1989). The three categories of information required for the Glasgow coma scale required no special skills (Swash, 1989) but the interpretations of the scale required specific anatomical knowledge. Swash (1989) stated that coma may be due to either metabolic or stmctural disease of the brain. Many clinical terms required anatomical concepts to conceptualise them, for example, subarachnoid haemorrhage, subdural haematoma, intracranial, extradural. Examination of the head and neck discussed phenomena referring to leakage of cerebrospinal fluid through fractures of specific anatomical regions, e.g. basal skull fractures. The pupils were one of the three features observed. The oculomotor nerve and its anatomical path, the stmctural relationship to the

Perhaps the most important theme in cardiovascular system for clinical methods was the cardiac cycle, i.e., systole and diastole and the knowledge of the anatomical relations and components of the heart (atria, ventricles, tricuspid valves, bicuspid valves, the aorta and the pulmonary trunk): Valvular lesions at the tricuspid valve, bicuspid valve, aortic valve and pulmonary valve were a prominent theme in interpretation of clinical features. Anatomically, the examiner was expected to locate the sites of these valves on the anterior chest wall, locate the site where they were best auscuhated. The cardiac silhouette on the anterior chest wall and on x-rays was also another prominent theme requiring anatomical knowledge.

The Cardiovascular System

The cardiovascular system chapter had a high Total Anatomy Indicators Ratio (TAIR = 0.66) and the highest Technical Anatortty Terms Ratio (TATR = 0.85), see Table 4.1. These data indicate that 85 percent of the anatomy knowledge indicators were technical anatomy terms. In comparison this is the chapter that required the most of specific technical anatomy terms. References to locating, palpating and interpreting findings from arterial pulses and veins were prominent. Anatomical landmarks, e.g. ribs and stemal angle, were key features in the examination of the chest wall.

The presence or absence of the main peripheral arterial pulses - the radial, brachial, carotid, femoral, pophteal, posterior tibial, and dorsahs pedis- were important fmdings and are required to be noted. Anatomical landmarks on how to locate these pulses thus present important anatomical knowledge tasks. The venous pulses in the neck were discussed as important for estimation of an important clinical theme - pressure in the heart. This required specific identification of intemal jugular veins, extemal jugular veins and the anatomical structures with relations to these vessels.

Abnormal developments of the heart present a special demand on developmental knowledge of the heart or at least 'visualisation' of the she of the problem. The congenital abnormalhies ched in Hutchison's clinical methods (Swash, 1989) were atrial septal defect; ventricular septal defect, patent ductus arteriosus, Fallot's tetralogy, and coarctation of the aorta The high incidence of ischaemic heart disease in America and Europe (Swash, 1989) made knowledge of the arteries of the coronary circulation a very important requhement. Routine cardiovascular examination, as presented in this sample, included electrocardiography. References to anatomical landmarks, for placing of chest leads, and also references to the she of mfarction demanded knowledge of the structures of the heart, and their blood supply. In addhion the conducting system of the heart, the heart cycle and the interpretations thereof were a prominent theme, with 16 pages dedicated to it. Understanding of myocardial infarction was closely presented with anatomical concepts, for example: The relationship between myocardial regions, coronary

Table 4.3
The Relationship Between Myocardial Regions, Coronary Vessels and the Electrocardiograph

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal,

Adapted from Swash (1989), page 268.

vessels and the electrocardiograph (ECG) seen in table 4.3.

membranous labryinthes). The section on radiological examination focused on the temporal bone, the mastoid processes, and structures that could be identified m the middle ear and bony parts of the area.

The nose and the paranasal sinuses was a prominent theme. The anatomical concepts explored in this theme included the stmcture of the nasal vestibule, nasal septum, nasal turbinates, olfactory and respiratory mucosae, and Little's area. The nasal pharynx and oropharynx structures were listed, including the walls, the fauces, the uvula, the palate, and the tongue. The paranasal sinuses (frontal, maxillary.

Radiographic examination was also an important theme, and identification of anatomical structures and the parts of the ear on the x-ray shadow on postero-anterior x-rays had five pages dedicated to this theme.

The Ear. Nose, and Throat

For this chapter the Total Anatomy Indicators Ratio was 0.59 and the Technical Anatomy Terms Ratio was 0.79 (Table 4.1). The eardmm (tympanic membrane) and extemal audhory meatus contributed 11 percent of the prominent anatomy themes. The apparatus for hearing from an anatomical standpohit was the axis of the extemal audhory meatus, tympanic membrane, ossicles, oval fenestrae, and the cochlear. The relations of these anatomically were discussed. The section on examination of the ear focused on the extemal auditory meatus and the appearance of the tympanic membrane at examination with an auriscope. The topographical appearance of the tympanic membrane listed the different parts visible at examination, i.e., short process of malleus; anterior malleolar fold; pars flaccida; posterior malleolar fold; long process of incus; handle of malleus; pars tensa and the cone of light. The vestibular apparatus and the semi-circular canals were discussed. The major themes were the middle ear, the inner ear (bony and

system, 58 percent referred to anatomical terms. Of these anatomical terms 62 percent were technical anatomy terms. The dominant anatomical themes were references to the chest wall (8 percent), the bronchial tree (7 percent) the pleura and pleural spaces (9 percent), and the bronchio-pulmonary segments and bronchi (14 percent) and chest x-rays (3 percent). The anatomy of the bronchial tree was an important theme in this chapter. Anterior and posterior surface markings of the pleura, lung parenchyma and the bronchopulmonary segments of the bronchial tree were presented. Chest x-rays were

The examination of throat included inspection of the mouth, oropharynx, nasopharynx and laryngopharynx. A section was dedicated to examination by laryngoscopy where particular attention was paid to the anatomy of the larynx as seen in the laryngeal mirror showing the anatomically labelled illustration. Two illustrations showed this area (one with the vocal cords in abduction, and another with the vocal cords in adduction).

This chapter concluded whh the exammation of the neck. It discussed the poshion of the thyroid cartilage and gland, and the relations of the trachea, the larynx, the vertebral column, the strap muscles, the sternocleidomastoid muscles, the cervical lymph nodes. The course and role of the recurrent laryngeal nerve in common abnormalhies were also presented.

The Respiratory System

The respiratory system was ranked ninth of the 17 chapters m terms of Total Anatomy Indicators Ratio (TAIR = 0.58) and had high Technical Anatomy Terms Ratio (TATR = 0.62), see Table 4.1. Of the recording unhs on the respiratory

terms of content of anatomy indicators. However, 73 percent (TATR = 0.73) of

those anatomy indicators were technical anatomy terms (Table 4.1). The prominent

themes were lymph nodes (9 percent); erythrocytes (6 percent); bone marrow (5

percent); platelets (5 percent) and leucocytes (5 percent) together accounting for 30

percent of the anatomy indicators. The physical examination section of this chapter
considered an important extension of the chnical examination. Anatomical
clearly emphasised the distribution of lymph node groups and illustrated them in a
identification of the chest wall, the bronchial tree, the lobes of the lungs, and the
figure of the body and their location. The groups listed included the occiphal,
fissures of the lungs on posteroanterior and lateral views was important in
submandibular.
pinpointing lesions fairly accurately in particular lobes or even segments. The x-ray

examination of the chest was an prominent theme with 11 pages dedicated to the

theme.

The Genitalia and Sexually Transmitted Diseases

The total anatomy indicators ratio for this chapter was 0.53 and the technical

anatomy terms ratio was 0.69 (Table 4.1). The context was examination of the male

genitalia: penis (extemal urethral orifice, penile prepuce, glans penis, coronal

sulcus); scrotum and contents (testis, epididymis, spermatic cord). The anorectal

examination was also a prominent theme.

   The examination of the female genhalia (as discussed hi examination of women

chapter) was also discussed here.

The Blood   175

The Total Anatomy Indicators Ratio of 0.48 ranked this chapter 13* out of 17 in

anatomical structures of the external and internal genitalia. Examination of the rectum and anal area were also presented.

Radiological investigations included hysterosalpingography, lateral x-ray pelvimetry and the other investigations were computerized tomography, magnetic resonance imaging and ultrasound. cervical supraclavicular maxillary epitrochlear, para-aortic, inguinal, femoral, and pophteal. The liver and spleen were also discussed as associated organs in blood disorders.

Accessing blood for laboratory examination was an important theme; venepuncture

(phlebotomy) and preferred shes were presented.

The Examination of Women

The recording units in this chapter were mostly non-anatomy indicators (Total Anatomy Indicators Ratio = 0.44) and only 52 percent were of the anatomy indicators were technical anatomy terms (TATR = 0.52) see Table 4.1. The dommant themes were cervix/cervical (10 percent), Vagma/vaginal vauh (9 percent), pelvis/pelvic viscera 8 percent, and foetal parts (8 percent). A section m this chapter was dedicated to abdominal examination in pregnancy. The anatomical abdominal landmarks were an important theme, and as was the relation of the foetal parts to the mother's pelvis, and the axis of the uterus. The section on pelvic exammation brought to fore the requhement to identify and examine anatomical stmctures m the extemal genhalia of the female. This was a prominent theme and had three pages exclusively describing this theme. Several illustrations labelled

176

dominant themes. In terms of context a general arrangement of the urinary system

glomerulus, renal tubules, calyces, pelvis, ureters and bladder was required. An

important anatomical theme was interpretation of cross-sectional views of

computerised tomographic scan of the abdomen, at the level of the kidney. From an

anatomical perspective radiological interpretation of plain and contrast radiographs

was a significant section in investigations. In the radiograph anatomical

The Examination of Children

identification of calyces of both kidneys, the ureters and the bladder were required.
Only 42 percent of the recording unhs had anatomy indicators (TAIR = 0.42) but 73
Other anatomical structures visible in these views also requhed identification.
percent of these were technical anatomy terms (TATR = 0.73) see Table 4.1. The

prominent anatomical themes were: examination of the child's head in examining

the fontanelles, sutures, and head circumference, examination for features

suggesting congenital abnormalities; and the other anatomical features as in

physical examination described in the physical examination of an aduh (head to

toe).

The Kidneys and the Urine

The chapter on kidneys and urine had a low Total Anatomy Indicators Ratio (TAIR

= 0.33), however, the Technical Anatomy Terms Ratio (TATR = 0.55) was

significantly high (Table 4.1). This entails that of the total recording unhs, only 33

percent had general anatomy terms 55 percent of which were technical terms. Of

the 17 chapters the kidneys and urine was ranked fifteenth. The blood

(erythrocj^es, leucocytes) contributed (8 percent), glomerular/glomerulus (6

percent), bladder (4 percent); renal tubules and calyces (3 percent) each to the

dominant themes. In terms of context a general arrangement of the urinary system

functional rather than structural status), although organic causes for mental disorders were also explored. Rather than locating anatomically the she of the problem the exercise was focused on establishing triggers for disordered mental (functional) state. In this chapter the technical terms encountered were frontal lobe of the brain; autonomic nervous system; temporal lobe; hmbic system and visual pathways.

The amount and nature of anatomic concepts in clinical methods, i.e., in history-taking, physical examination, and in a clinical methods textbook, have been defined (Table 4.1).

Using the Laboratory.

This chapter had minimal anatomy indicators (TAIR = 0.18) and of these 54 percent (TATR = 0.54) were technical anatomy terms (Table 4.1). The main anatomical theme was on the collection of specimens, whh venepuncture (site and vessel selection) being the prominent one. Other specimens whh anatomical knowledge implications were perhoneal fluid, pleural fluid, gastric fluid and pancreatic juice, arterial blood, and cerebrospinal fluid.

Psychiatric Assessment

This chapter had the lowest demand of anatomical knowledge (TAIR 0.07 and TATR 0.22). The bram, and head (36 percent each) were the dominant themes. The physical examination process was not repeated in this psychiatric assessment chapter and possibly contributed to the low demand for anatomical knowledge in this chapter. Addhionally, the focus of the psychiatric assessment was on how an individual interacts with his environment and how h impacts his mental status (a

(UTH, DHMT, GPs), Copperbelt (Ndola Central, Arthur Davison, Kitwe Central, Mufulira Malcom Watson, Mufulira Ronald Ross, Chingola KCM, Chililabombwe KCM hospitals), and other provinces of Zambia contributed incidents (see appendix X).

Ahhough the data collection plans were to collect 300 incidents, from doctors representing each of the clinical speciahies, the response rate achieved was 74 percent. The response rate for the medical students was 93 percent (n = 28). Factors that may have contributed to no retums were difficulty of the questionnaire, time required to complete h (20 mmutes average), demand to recall events from the past, status of the local co-ordinator in the setting, and lack of personal contact between the respondent and the researcher. Factors that might have contributed to the fairly good

Section 2

The Impact of Knowledge of Anatomy on Clinical Practice

The Anatomical Knowledge that Determines Success and/or Failure in Clinical Situations

This concept was investigated usmg the crhical incident technique and the participant observer method. The first part presents the findings fiom the critical incident technique and the second part that of the participant observer technique.

Number of Incidents Collected

Two hundred and twenty-one crhical mcidents were collected'from 140 doctors at all levels of experience and responsibility. Addhional crhical incidents were collected from senior medical students (6* and 7* years). Participants from Lusaka

(UTH, DHMT, GPs), Copperbelt (Ndola Central, Arthur Davison, Kitwe Central,

return rate included personal contact between the researcher and the local co-ordinators, the allowance paid to some local co-ordinators, status of the local co-ordinator, and seeking permission and co-operation of the insthutional heads.

Analysis of the hicidents from the different clinical specialties indicated that no bias from this source existed. The numbers were generally comparable, as shown in

Table 4.4
Number of Crhical Incidents Collected from Respondents by Clinical Specialty and Geographic Region

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding

the table below.

There were more successful incidents reported than unsuccessful ones. This trend was observed across the disciplines. The reporting of more successful incidents may be a resuh of self-report bias rather than that doctors have good knowledge and skills in clinical anatomy. There was little difference in the kind of incidents reported from the different speciahies.

Table 4,5
Types of Critical Incidents Reported by Clinical Specialty

	Qualitative		Quantitative
		Goals	
•	Develop sensitising concepts	•	Theory testing
•	Describe multiple realities	•	Statistical description
•	Develop understanding	•	Show relationship between variables
•	Empowerment of marginalized groups	•	Prediction
		Design	
•	Hunch as to how you might proceed	•	Structured, predetermined, formal, specific
•	Evolving, flexible, general		

Caution is advised in summing up the numbers to counter-check totals because the tables do not reflect the missing values from the questionnahes. Excluding missmg values, at least 76 respondents were male, whilst 31 were female. This is probably a reflection of the male-to-female ratios in the institutions studied. Table 4.6 indicates the ranks of the respondents by region.

Table 4.6
Respondents' Ranks by Region

	Qualitative		Quantitative
		Goals	
•	Develop sensitising concepts	•	Theory testing
•	Describe multiple realities	•	Statistical description
•	Develop understanding	•	Show relationship between variables
•	Empowerment of marginalized groups	•	Prediction
		Design	
•	Hunch as to how you might proceed	•	Structured, predetermined, formal, specific
•	Evolving, flexible, general	•	Detailed plan of operation
		Data	
•	Descriptive	•	Quantifiable coding
•	Personal documents	•	Counts, measures

The distribution of the ranks shows that more seniors participated in Lusaka than the other regions. This could be explained by the fact that relatively junior staff, compared to Lusaka, marmed the more peripheral institutions.

      b. Lumbar puncture

      c. Pericardiocentesis

      d. Paracentesis

      e. Culdocentesis

      f Suprapubic puncture

2. Ability to collect venous blood from

      a. Veins of the dorsum of the hand

      b. Veins of the forearm and cubital fossa

Classification Structure

The final classification structure is presented below. It must be noted that in the crhical incident technique, no special significance is attached to the frequencies of the incidents (Jacobs et al., 1978). The frequency of the incident may be a good indicator of how often the behaviour occurs and may suggest areas for intervention but does not indicate importance (Jacobs, et al., 1978). A single report of a highly dangerous behaviour may indicate serious need for mtervention as opposed to a very frequent and less dangerous behaviour.

Taxonomies

Themes of anatomical knowledge that determine success and/or failure in clmical practice:

Anatomical knowledge that contributes to:

1. Ability to extract body fluids. '

      a. Pleural tap (Thoracentesis)

a. Avoid accidental injury to them during clinical

procedures

b. Effect local anaesthesia (nerve blocks)

c. Assess function of the structures they supply

d. Locate their course
c. Femoral vein
e. Identify nearby structures
d. Jugular vein

6. Contributes to locating blood vessels hi order to:
    e. Scalp vein

    a. Avoid accidental injury to them in clinical procedures
3. Ability to cannulate the following:

    b. Control bleeding

    a. Scalp veins

    b. Subclavian vein

    c. External jugular vein

    d. Great saphenous vein

    e. Intraosseous cavhies

4. Ability to msert tubes or trochars into body cavhies for:

    a. Peritoneal dialysis

    b. Gastric lavage

    c. Nasogastric tube feeding

    d. Tracheal hitubation

    e. Maxillary shius drainage
5. Contributes to locating nerves m order to:

9. Contributes to accessing internal organs at operation:

    a. Layers of the abdominal wall

    b. Layers of the thoracic wall

    c. Characteristic features of internal organs

    d. Relations to nearby structures

    e. Normal poshion of internal organs

    c. Palpate their pulses

10. Contributes to describing and interpreting plain X-rays of

    d. Collect blood

    e. Insert cannulae

    a. Bones

    b. Soft tissues

7. Contnbutes to avoiding complications and/or accidental injury to important

    structures:

    a. Tendons and muscles

    b. Ducts (e.g. ureters, vas deferens)

    c. Parts of special sense organs (e.g. comea)

    d. Glands

8. Contributes to locating important stmctures, spaces, cavities, these include:

    a. Surface landmarks

    b. Pulses

    c. Mnemonics of sequence of structures in specific region

    d. Resistance or 'giving' to instruments

    e. Emergence of liquid contents

9. Contributes to accessmg hitemal organs at operation:

a. Normal alignment of mucosal surfaces

b. Attachment of muscles

c. Course of nerves, blood vessels, tendons, and other stmctures

d. Normal position, size, colour, relation whh spaces and neighbouring

structures
c. Organs
e. Connection to other spaces, surfaces, tubular structures
d. Joints

14. Contributes to ability to recognise developmental basis of clinical
e. Vertebral column

condhions:

11. Contributes to describing and interpreting special X-rays of:
d. Recognise congenital abnormalities

a. Blood vessels (arteriograms, venograms, lymphograms)

b. Cross-sections of the body

c. Tubular structures of the urinary tract

d. Tubular structures of the female reproductive tract

e. Tubular stmctures of the gastrointestinal tract

12. Contributes to making clinical decisions based on:

a. Recognising ahered shape, size and form of body structures

b. Understanding the function of the structures that are affected

c. Understanding the blood supply to structures that are being assessed

d. Understanding the nerve supply to structures that are being assessed

e. Considering normal variation of form and arrangement of structures

13. Contributes to surgical repair of anatomical structures:

setting, the clinical context, tasks and procedures whilst the second focuses on the role of anatomy in clinical practice.

b. Describe the developmental failure in many congenhal abnormalhies

c. Understand the cause of congenhal abnormalhies

d. Plan management of congenhal abnormalhies

e. Determine prognosis of congenital abnormalhies

15. Anatomical knowledge that contributes to the ability to cope whh histological basis of clinical condhions:

a. Identify basic tissue types (nerve, muscle, epithelium, cormective tissue)

b. Understand tissue types involved in malignancies

c. Understand a histopathologist's description of microscopic slides

d. Understand description of cells at molecular level

e. Know the different cellular components of blood

Use of Anatomy in Clinical Practice The fmdings in this part were generated mostly from the participant observer technique. The researcher's field notes were analysed. The field notes analysed were detailed and in some instances discursive. Their structure was oriented towards understanding the context of the observations and reflection on how anatomy was used in this

clinical context. The resuhs are offered in two parts; the first reports on the physical

clinics. In admission wards, clinical officers, and nurses complemented the doctors' team

In these working environments the doctor was generally considered the team leader where decisions of patient care were concemed.

The roles of the doctor in each of the clinical contexts were the following: In

<u>Physical Setting. Clinical Context. Tasks and Procedures</u>

theatre - surgeon, assistant, observer; on the wards - team leader, presenter, clerk, clinical technician (performing procedures); m the outpatient clinic - team leader,

This is concerned with describing where the observations were made, who was in attendance, what are the objectives in those settings. This builds up on

understanding of what consthutes the work situations of the doctors observed.

Tasks and procedures focus on how the organisation of a unit/firm (the clinical care unh of doctors) and considers job descriptions, level of specialisation, and presumed competencies for each cadre in the hierarchy.

The physical settings for a doctor in clmical practice mcluded the in-patient wards, the admission ward, out-patient theatre, out-patient clinic and academic/professional meetings. In all these settings the doctor was present singly or as part of a team of doctors. In each team, the hierarchy, in decreasing order, was consuhant, senior registrar, registrar, senior resident medical officer (SRMO), junior resident medical officer (JRMO), and medical students. Allied health professionals found in the inpatient ward included nurses, nursing students, physiotherapists, physiotherapy students, clinical officers, clinical officer students, arid nursing assistants. In the operating theatres, allied health professionals included clinical officer anaesthetists, theatre nurses, theatre nurse students, and

porters. Nurses were usually the only allied health profession present in outpatient

supported with evidence or according to agreed protocols.

Clerking involved interviewing patients, conducting a physical examination, ordering and interpreting investigations, making a diagnosis and implementing an initial treatment plan.

Clinical procedures included drawing venous blood, setting up intravenous clerk, clinical technician; in admission ward - team leader, presenter, clerk, clinical infusions, dressing wounds, removing medical prostheses (e.g., Steinman's pin and technician, in clinical/professional meetings - moderator, presenter. In all of the intercostal drains).
contexts being an observer was a possibility.

In theatre, as surgeon, the doctor was responsible for planning the course of the operation, making incisions and surgical dissections, identifying structures, deciding what structures were viable or not, what to preserve and what operative precautions to take, and in addhion to teach the others. The assistant's role involved securing the operation field (using retractors), ensuring visibility of the operative field (controlling bleeding and using retractors), and following the surgeon's instructions.

The team leader reviewed and oversaw the work of the subordinates. He reviewed the medical history, the findings of the physical examination, decisions and interpretations conceming investigations, diagnoses, and treatment plans and other interventions.

The most junior in the team was usually a presenter in the team. This involved presenting to the superiors, the patient's history, the findhigs of the physical examination, the investigations ordered and how they were interpreted, the

diagnosis made, and the interventions undertaken. These were required be

structure and function – diagnosis; explanation of signs and symptoms; or cause of clinical condhions - pathogenesis; understanding as in possession of semantic knowledge (facts and concepts) and being able to deduce meaning -conceptualisation; problem-solving, which refers to the use of anatomical knowledge to plan and execute an intervention.

The practical processes influenced clmical performance, whilst the cognhive
At academic/professional meetings the presenter prepared and expounded processes influenced clinical reasorung. Figure 4.1 is a concept map of the hiter medical information, case studies, or mortality and morbidity reviews.

Medicine is widely considered an apprenticeship and as such observation and gradual participation was widely accepted.

Application of Knowledge of Anatomy

This part focuses on the role of anatomy in clinical practice. It develops a conceptual framework based on the categories developed from field notes and attempts to show how the categories inter-relate in chnical practice.

The role of anatomy in clinical practice was classified into two broad themes: practical processes and cognhive processes.

Practical processes included the rationale for clinical/operative procedures; competence in performing clinical/operative procedures due to knowledge of anatomy being a determinant of outcome m these procedures; anatomy as a tool for orientation/locating structures in the body; 'seeing', understood as a basis of readmg clinical images.

Cognhive processes included problems identification as in recognising ahered structure and function - diagnosis; explanation of signs and symptoms, or cause of

in deciding where the needle should be inserted. One student volunteered the landmarks as midaxillary line in the 7* or 8* intercostal space-because of the risk to the intercostal nerve and vascular bundles."

Anatomical knowledge was a common basis for protocols of procedures in clinical practice. It was the basis for choice of site for mvasive procedures; the approach of stmctures lying deep to the skin; and manoeuvres for physical relations of the categories, within the two themes, and uhimately the role of manipulation to correct altered stmcture. The latter is illustrated by the field note anatomy in clinical practice.
below:
The main fmdings are presented below, together with ihustrative field notes to give a basis for the views and inferences expressed.

Practical Processes

Doctors frequently performed clmical procedures that required practical use of hands and tools (instruments). How anatomy contributed to that domain is now considered.

Rationale (basis) for clinical/operative procedures. "...assisting in performing a sigmoidoscopy for volvulus. Anatomical note: The procedure takes into account the length and flexures of the, anal canal and rectum. Recognhion of mucosal transhions also guides the procedures."

"...saw a patient with a massive pleural effusion and asked a senior student to do a diagnostic pleural tap. Another student asked about the anatomical considerations

" ...Patient with dislocated shoulder...performed Kocher's manoeuvre and successfully reduced the shoulder. Wondered how the manoeuvres take into consideration the muscle pull, position of bones, joint space, for example. Made *it* a learning issue to analyse the manoeuvres in this context."

During the fieldwork h was sometimes apparent that doctors did not know the anatomical basis for the clinical procedures they performed. Many had learned how to do the procedures and the desired outcome with little consideration for the anatomical basis. Several (especially the senior ones) doctors did, however, pay attention to the anatomical basis for the procedures and explained them to colleagues.

Anatomy as an outcome determinant, "...reviewing a postoperative patient who had had an open reduction and fixation (ORIF) of the humerus and now had a wrist drop. Anatomical note; Complication of injury to radial nerve. I assessed the other peripheral nerves too.

SSES

Poor Clinical Performance

+

Good Clinical Performance

COGNI
TIVE

Informed Clinical Practice -f-

Uninformed Clinical Practice —

Clinical conditions Requiring Sound Knowledge of Anatomy

Explanation   Understanding

CLINICAL PERFORMANCE
PROCE
SSES

Proble
m
Identific
ation

Problem
Solving

Reading
Clinical
Images

Outco
me
Deter
minant
Clinica
l/Oper
ative
Proced
ures

Orientatio
n Diagnosis

Processes

Conceptualising

Interve
ntion

Seeing

Locati
ng

Compe
tence

Ration
ale

Figure 4.1. Concept Map of Role of Anatomy in Clinical Practice

CLINICAL REASONING

Clinical Procedure
Requiring Sound
Knowledge of
Anatomy

PRACT192
ICAL
PROCE
SSES

was well-oriented whh the anatomy of the area. He identified and preserved the lingual nerve and hypoglossal nerve. He pointed out the relations of these nerves and also how to ensure they are not damaged."

"Assisting a consultant operating on the lower part of the oesophagus. The siirgeon mcised the diaphragm in order to approach the oesophagus caudally. Anatomical Noted and re-affirmed the need to pay attention to anatomy at operation to prevent note; Surgeons with good anatomical knowledge are more daring and adventurous such comphcations."

"Operating theatre, assistmg in insertmg a ventriculo-peritoneal shunt. Anatomical note; SRMO asked to insert the distal part of the shunt tubing into the perhoneum SRMO not certam about the layers of the abdomen after incishig the skin and could not be certain he had inserted the tube into the peritoneum Consuhant had to intervene and inserted the tube into the perhoneum himself"

The knowledge of anatomy was found to be an important factor in whether the outcome of a clinical procedure was successful or not. It was also an important determinant in whether the procedure resuhed in a complication or not. Generally the doctors that were aware of structures to avoid, who could identify the structures and how to do the procedure manifested more confidence and were also more competent. They also undertook comphcated procedures.

" ...Assisting a consultant doing a mandibulectomy. Anatomical note; Consuhant

The registrar discussed the surface landmarks, the position, and the target stmctures hi the procedure (in this case the subarachnoid space to access CSF). I noted he had applied the use of surface landmarks to assess deep structure."

In several instances doctors needed to locate structures that were deep to the skin and as such could not be viewed directly. In such shuations doctors used other with their operations because they do not worry about getting 'lost' and also visible or palpable landmarks to indirectly reach their desired structures. inadvertently causing damage. In contrast, lack of anatomical knowledge does Knowledge of the
contribute to the surgeon bemg heshant and tentative."

Lack of knowledge of anatomy in terms of stmctures that will be encountered in a procedure, what to avoid damaging, what can be sacrificed frequently prevented doctors from doing clinical procedures. It was also a common reason for consuhing senior colleagues for advice on further management of patients.

Orientation.

"Assisting at a laparatomy for suspected perforated intestine and had to inspect the intestines. Anatomical note: The operating registrar advised that the beginning point is to find the ligament of Trehz (suspensory hgament of the duodenum). This way, one is orientated in the abdomen and can systematically inspect the duodenum, jejunum, ileum, and colon."

"... registrar called to assist two JRMOs who had failed to do a lumbar puncture.

"Ward round, consultant reviewing lateral x-ray of the skull...he identified the sella turcica and stated its relation to the nasal cavity, cranial sutures, sinuses, and the middle meningeal artery."

A beginning point for reading clmical images was to know what you were seeing, i.e., which section of the body, what specific region, identifying the structures that general topography of the body served as a map for orientation of where you are and where you desired to be. Knowledge of specific surface landmarks, palpable structures or pulses, and the topographical relations of structures m the vicinity was used to locate or orient oneself in clinical procedures.

Reading clinical images. Clinical images are representation of body stmctures in a pictorial form. The most common being x-rays. X-rays are taken from different angles, the commoner ones were postero-anterior, antero-posterior, and lateral. Sometimes special positions, and contrast media were used to demonstrate specific stmctures. Cross-sectional anatomy assumed more importance with the advent of computerised axial tomography (CT Scan) at UTH. The field notes below illustrate the demand for anatomy to read chnical images.

"...reviewing chest x-rays with students. One 7* year student able to identify posterior and anterior ribs, all the others (5* and 7*) were not able. Further, noted that the students were not familiar with division of the chest x-ray into upper, mid and lower zones. Discussed with the students how to use specific chest x-ray marks for broncho-pulmonary segments, lobes, and fissures."

195

notice the gross abnormal size of the head..."

"... loss of contour of the shoulder hi a patient with a dislocated shoulder. X-rays confirmed the dislocation - subcoracoid anterior dislocation of the right shoulder.

were visible. Determining the pathology was in many instances secondary to identifying the anatomical structures.

There were many practical procedures that doctors performed on the wards and in the operating theatres. In the concept map (figure 4.1), these consthuted clinical performance. It can thus be stated that anatomy played a significant role m good clinical performance.

Cognhive Processes

Cognitive processes cannot be observed directly. This part presents the reflections of the researcher upon observing particular clinical behaviours of doctors and the researcher's own. These results are therefore an interpretation of the directly observed behaviour of doctors in the clinical setting.

Problem identification. Knowledge of normal stmcture and function enabled the doctor to identify altered structure and function.

"Ward round...consuhant reviewing patient with hydrocephalus and increased intracranial pressure. Anatomical note: Noted that necessarily the first step is to

There were many instances hi clinical practice in which the doctor could only explain the clmical condhion encountered, anatomically. In some shuations the pathogenesis of the clinical condition was anatomical (in many cases developmental). In some instances the observed clinical phenomenon was explained by knowing the anatomical stmcture involved and hs function.

Anatomical note: Familiarity with normal form is important for one to identify Knowledge of anatomical relations explained why pathology on a particular she ahered form."

manifested elsewhere. The example below, from the field notes, was a case m point:

When doctors assessed a patient the form was inspected for deviation from the norm. Recognition of such deviation served as a beginning point in problem identification.

Explanation.

"Anatomical note: saw a patient with complete heart block (pulse 45 - 50 per minute), relied on the knowledge of the conducting system (in this case the role of S A and AV nodes) to explain the slow rate and even consider heart block as a differential diagnosis."

"...reviewing patient with hydrocephalus and spina bifida. Anatomical note: consuhant reviewed the embryological basis of spina bifida. Noted that she dwelled on the vertebral arch defect but not on the primary lesion, i.e., failure of neurulation."

To understand, in this context, refers to the ability to evaluate the appropriate knowledge one possesses and to make meaningful interpretation and offer explanations, and mterventions based on this knowledge. As a result of this understanding, one can then conceptualise - have a mental grasp of what is 'going on' m a disease process.

"... patient had muhiple septic spots on the head. Consuhant asked students why h would be important to examine the neck thoroughly. It was not immediately apparent to the final-year students that the issue under consideration was the lymphatic drainage of those septic spots into the lymph node groups of the neck."

Head injury observations were cormnon. The protocol for caring for a patient with head injuries included observation of the size of the pupils and the level of consciousness. It was interesting to note that these clinical phenomena were explained anatomically.

"Post-admission round, reviewing patient with head injury. Anatomical note: consuhant discussed the anatomical basis of loss of consciousness, and the dilatation of the pupils, i.e., mvolvement of the bramstem reticular formation, and the third cranial nerve. Also considered complications of brain hemiation through the foramen magnum and tentorial notch."

Understanding.

was used to solve the problem."

"Patient with cardiac tamponade. Physician performed pericardial tap and the patients symptoms were reheved shortly after."

"...Noted the need for sound anatomical knowledge of ascending and descending tracts to assess the CNS comprehensively."

"On a ward round reviewing patient with hydrocephalus. Anatomical note: Discussed the cerebrospmal fluid (CSF) circulation, and the ventricular system of the brain. Noted that the SRMO was not conversant with the CSF circulation and the ventricular system"

Anatomical knowledge was essential, in some clinical conditions, for the doctor to conceptualise what was going on in the patient. It helped understand the signs and symptoms, complications, and interventions. Lack of this anatomical knowledge, in such cases, prevented understanding of the clirucal phenomenon.

Problem-solvmg.

"In operating theatre... difficulty to visualise the structures in the operative field (hand) due to excess blood. Anatomical note: surgeon achieved a dry field by requesting the assistant to occlude the ulnar and radial arteries, at the wrist, with
finger pressure. Noted how anatomical knowledge of the blood supply to the hand

Problem-solving is a wide and encompassing concept. It can literally include all the shuations ched above. In this case h is being applied to those circumstances in which the relief of the problem was immediate. The context of the problem was in this case a barrier to successful implementation of a clinical manoeuvre or the apphcation of a manoeuvre to relieve distress. Knowledge of anatomy had dramatic impact in solvmg such problems.

The work of a doctor invariably involves some cognhive processes. Anatomy did have a role in these cognitive processes in many clinical conditions. Possession of knowledge of anatomy, in cases requiring sound knowledge of anatomy, made the difference between informed clinical practice and uninformed clhiical practice.

to in specialists clinics are also presented.

Most Common Clinical Condhions With High CAKI Scores

Surgical Cases

One of the most common surgical conditions, with high CAKI scores, seen in this research, are peri-anal pathology (anal fistulae, anal fissures, haemorrhoids, and abscesses), fractures of the ulna and radius, head injury, fractures of the tibia and fibula, mtestinal obstruction, inguinal hernias and shoulder dislocations. Intestinal

Section 3

Measurement of Detail of Anatomical Knowledge Required for Diagnosis, Investigation, and Treatment of a Clinical Condition: The Case Anatomical Knowledge Index

Having reviewed the chnical condhions that preoccupy the doctors, the clinical conditions were each graded for the detail of anatomical knowledge required for diagnosis and clinical concepts, hiterpretation of mvestigation materials, and for management, using the Case Anatomical Knowledge Index (CAKI). Lastly, the clinical procedures that were identified as requirmg significant detail of anatomy are listed.

While the general practhioner refers cases to the specialists, he is the first one to assess the patients and must come up with an informed decision before selecting the appropriate specialty to which to refer. As such the clinical cases that were attended

Fracture Ulna/Radius (91) (300 +31 + 3M)

Perianal Pathology (94) (4DC +21 + 3M)

Shoulder Dislocation (13) (300 +41 +2M)

Inguinal Hernia (40) (3DC +21 +5M)

Intestinal Obstruction (40) (3DC +41+5M)

Fracture Tibia/Fibula (50) (3DC +31 + 3M)

Head Injury (52) (5DC +31 +4M)

100   80   60 40   20   5 10 CAKI   15

Cases seen per year (Consolidated)   Scores

High Frequency and High CAKI Score Surgical Cases

* Component scores for CAKI; DC = Diagnosis & Concepts, I = Investigations, M = Management

obstruction had the highest CAKI score (13), scoring 3/5 for diagnosis and concepts, 4/5 for interpreting investigations (plain abdominal erect and supine Figure 4.2 x-ray) and 5/5 for management (usually laparotomy, that may involve resection of intestines, anastomosis and or a colostomy). The least of the CAKI scores was perianal pathology whh a CAKI score of nme; 4/5 for diagnosis and concepts (understanding the anorectal anatomy of the perhieum), 2/5 for investigations (usually none, relying mostly on physical examination), and 3/5 for management which usually requires surgery (fistulectomy, haemorrhoidectomy). Figure 4.2 shows the consohdated number of common surgical cases with high CAKI scores.

202

The higher CAKI scoring common clinical condhions included dental caries, hydrocephalus, congenital talipes equinovarus, fracture mandible, congenhal hernia, prostate disease (benign prostate hypertrophy and cancer of the prostate), burns/contratures, urethral strictures, cleft lip and/or palate, and cataracts. Dental caries were by the far the commonest, whilst hydrocephalus, congenhal talipes equino varus, and cleft lip/palate had the highest CAKI scores at 13 each.

Hydrocephalus scored 4/5 for diagnosis and concepts (ventricular system of the brain and cerebrospinal fluid circulation), 4/5 for interpretation of hivestigations (reading cranial uhrasound images), and 5/5 for management (ventriculoperhoneal shunts).

Figure 4.3
High Frequency and High CAKI Score Surgical Specialists Cases

Condition	Score	
Fracture Mandible	(3DC + 4M)	+
Congenital Talipes Equino V^rus (206)	(4DC +41 5M)	+
Hydrocephalus (216)	(4DC +41 5M)	+
Dental Caries (649)	(3DC +21 4M)	+
Cataracts (51)	(3DC +21 5M)	+
Cleft Lip/ Palate (89:	(4DC +31 + SM)	
Urethral Stricture (71)	(3DC +31 3M)	+
Bums / Contractures (73)	(2DC +21 3M)	+
Prostate Disease (76)	(4DC +21 5M)	+
Congenita Hernia (90)	(3DC +4M)	+
	(112)	

Cases per year (Consolidated): 200 160 120 80 40 0

CAKI Scores: 5 10 15

203

disease. It scored 4/5 for diagnosis and concepts (chambers of the heart, valves, atrial and ventricular septum, conducting system), 2/5 for investigations (chest x-rays, ECG, and echocardiograms), and 2/5 for management, which is usually with oral medications. Pulmonary tuberculosis, upper respiratory tract mfections and pneumonia each had a score of 2/5 for diagnosis and concepts (bronchopulmonary tree), 3/5 for investigations usually

Congenital talipes equino varus scored 4/5 for diagnosis and concepts (specific anatomical defects of the club foot), 4 for interpreting investigations (x-rays of the deformed foot), and 5/5 for management (usually a surgical correction of the deformity taking into consideration the various tendons and neurovascular bundles). For cleft lip/palate the score was 4/5 for diagnosis and concepts (developmental basis for the deformities and the structures involved), 3/5 for investigations (cranial x-rays) and 5/5 for management (usually involving surgical correction of the deformity). The lowest scoring in CAKI were dental caries 3/5 for diagnosis and concepts (anatomy of the alveoli, teeth and gums), and 2/5 for investigations (x-rays of the mandible and maxilla), and 4/5 for management (involving dental blocks of nerves to the teeth). Figure 4.3 shows the relation of frequency and CAKI scores for the surgical specialist clinical condhions.

Medical Cases

The medical conditions had much higher frequencies but tended to have lower CAKI scores. Amongst the higher CAKI scoring conditions, pulmonary tuberculosis was the commonest, followed by upper respiratory tract infections,

meninghis, pneumoiua and heart disease. The highest scoring for CAKI was heart

Paediatric Cases

The type of diseases seen in paediatrics were similar to the cases in medicine except for the premature cases and congenhal abnormalhies. Pneumonia, pulmonary tuberculosis, meninghis, acute respiratory tract infections were the commonest higher scoring CAKI cases. Congenhal abnormalities (mostly neuratube defects) as a group had the highest CAKI score. They scored 4/5 for diagnosis and concepts (developmental basis and recognhion of tissues involved), 2/5 for investigations (x-rays, and uhrasound), and 4/5 for management as this sometimes involves surgical intervention. Prematurity requires a knowledge of intrauterine developmental milestones, and also that of postnatal grov^h developmental milestones and as such

chest x-rays, and 2/5 for management because most offices the management is with oral drugs. Figure 4.4 shows the relation of frequency of cases and the CAKI scores.
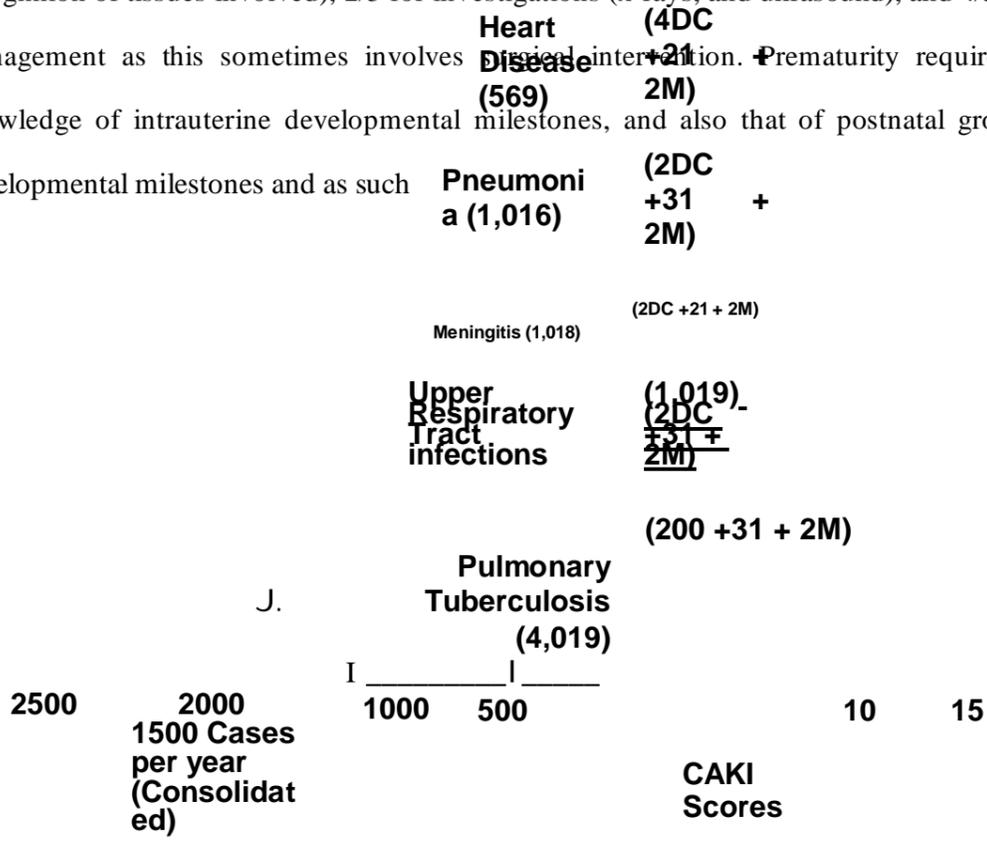
Figure 4.4
High Frequency and High CAKI Score Medical Cases

scored 4/5 for diagnosis and concepts. Figure 4.5 shows the relations of frequency of cases and CAKI scores.

OA (102) — **(4DC +21 + 4M)**

Premature (128) — **(400 +21 + 2M)**

Acute Respiratory Infections (323) — **(2DC +31 + 2M)**

IMeningitis (559) — **(2DC +21 + 2M)**

Pulmonary Tuberculosis (700) — **(2DC +31 + 2M)**

Pneumonia (3,264) — **(2DC +31 + 2M)**

1000 800 600   400   200   5   10   15

Cases per year (Consolidated)
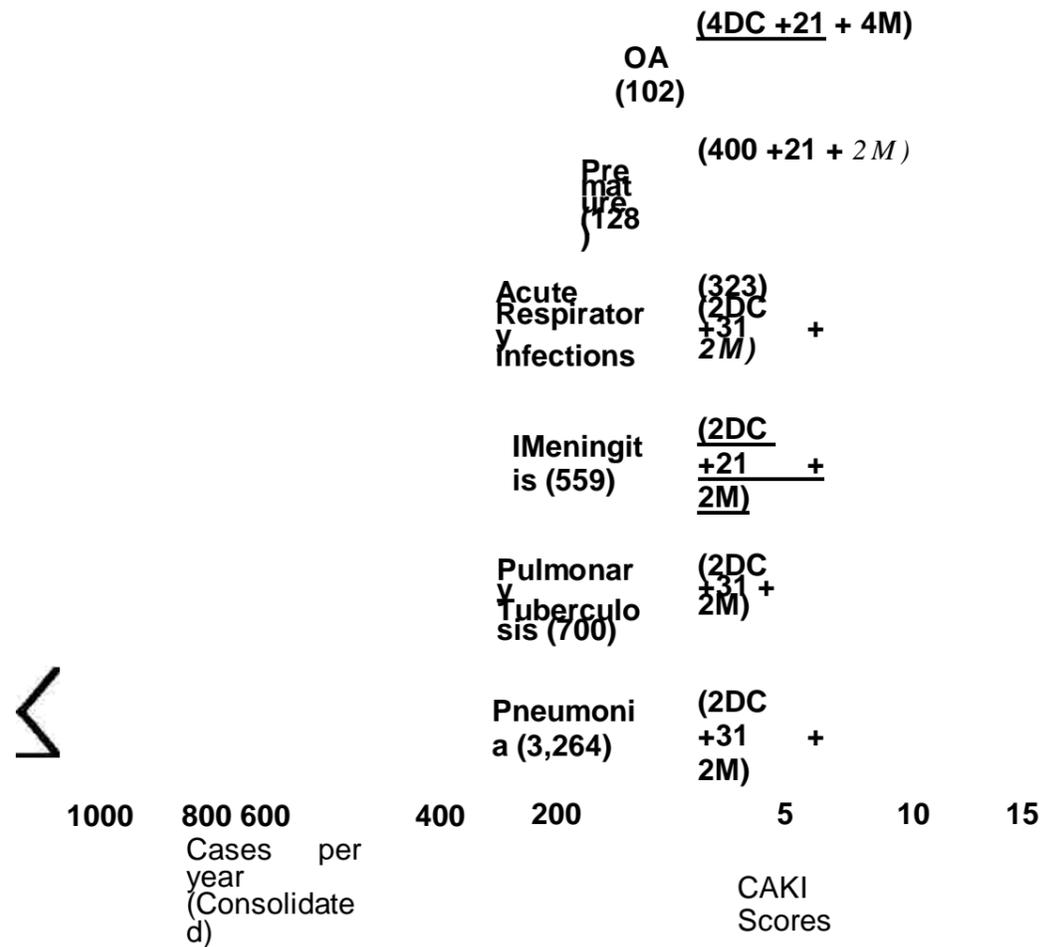
CAKI Scores

Figure 4.5
High Frequency and High CAKI Score Paediatric
Cases (Note: CA = Congenhal Abnormalhies)

Obstetric/Gynaecology Cases

In obstetrics normal delivery was by far the commonest and had CAKI score of nine. For diagnosis and concepts (conception, presentation, lie, growth and monhormg) the CAKI score was 4/5, and for management (spontaneous vaginal delivery) the score was 3/5. The cancer of the cervix and ectopic pregnancies were the two cases with CAKI scores higher than 10. In both cases management (surgical operation) was the determinant for higher scores contributing 4 or 5 to the score. Figure 4.6 shows the frequency of cases per year and the CAKI scores for the obstetric condhions.

Ectopic Pregnanc y (139)

(300 +21 + 4M)

(4DC +21 + 5M)

Cancer of the Cervix (207)

Fibroid s (211)

(3DC +21 + 4M)

(4DC +21 + 3M)

Normal Delivery (8,010)

J _____ I_____ I __

250   200 150   100 50   10   15

Cases per year (Consolidate d)
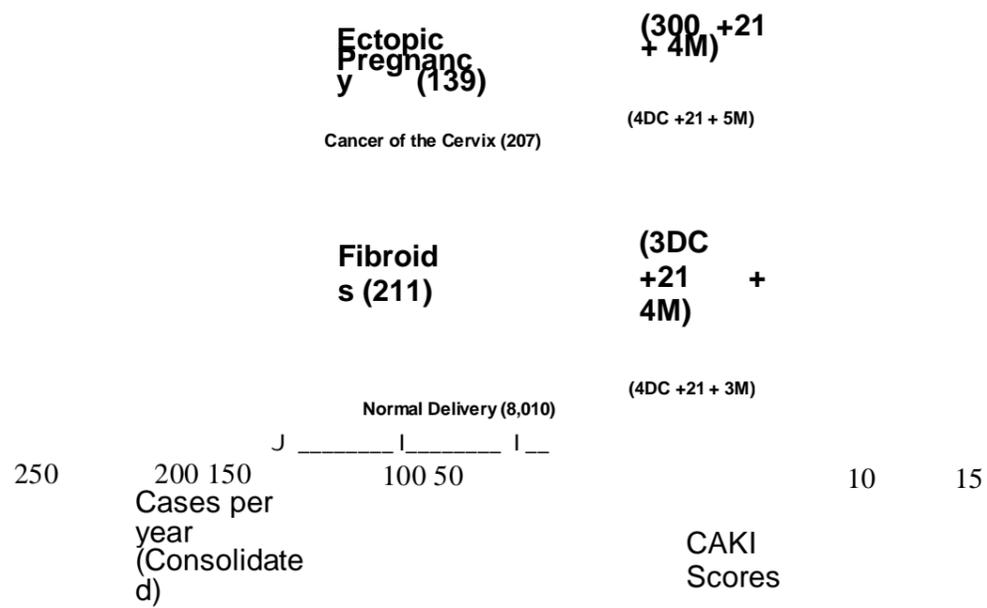
CAKI Scores

Figure 4.6

Higli Frequency and High CAKI Score Obstetric/Gynaecology Cases

Table 4.7

High Frequency High CAKI Score Cases

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables
Techniques or Methods	

The summary of high-frequency high-CAKI cases are shown below in table 4.7

Table 4.10
Frequency of Observed Operations
1. Hemiorrhaphy - 32
2. Circumcision - 28
3. Bowel resection/anastomosis/colostomy - 28
4. Salpingectomy - 26
5. Skm grafts- 1 1
6. Arthrotomy - 11
7. Amputations - 11

Ward. Clinic, and Operating Theatre Cases

The lists compiled under this part were comphed from the log sheets from all (55)

fourth year medical students and the inventory of operations. The fourth year log

sheets requires students to observe clinical condhions that have anatomical

applications. The lists below are from the cases most observed.

Table 4.8
Frequency of Observed Ward Procedures
1. Intravenous cannulation/venepunture - 159
2. Urethral catherisation - 53
3. Exammation of placenta - 51
4. Nasogastric intubation/ lavage - 50
5. Abdominal/Aschic tap - 49
6. Lumbar puncture - 47
7. Fundoscopy - 24
8. Vaginal examination - 19
9. Ear nose throat examination - 15
10. Per rectal examination - 14
11. Venous cutdown - 12

Table 4.9
Frequency of Observed Clinic and Minor Theatre Procedures
1. Dental blocks-105
2. Lymph node biopsy - 49
3. Manual vacuum aspiration of products of conception - 37
4. Intercostal dramage - 23
5. Episiotomy- 19

Table 4.10

Summary of CAKI Scores in Clinical Specialties

Surgical and obstetrics cases tended to have higher CAKI scores than the medical and paediatric cases. Some medical and paediatric cases, however, did have high CAKI scores for diagnosis and concepts (e.g. heart disease, congenital abnormalities), the cases with investigations that required images (x-rays, CT scans, ultrasound) for example pneimionia, tuberculosis (TB) also had higher CAKI scores for mterpreting investigations. The surgical and obstetric cases mostly had high (4/5 or 5/5) scores for management because they required surgical interventions.

were from a normal distribution. The Levene test for equal variance and a spread-versus-level plot are used to test the assumption of equal variance within groups. Important assumptions in analysis of variance and other classical statistical procedures are that the whhhi-group data are samples from normal populations with same variance.

The third sub-section is an analysis of variance to investigate the performance of the groups on test 1 (pure anatomy) and on test 2 (clinical anatomy). Within-group and between group comparisons of performance on the two tests are also investigated.

Section 4

Comparison of Anatomical Knowledge Between Preclinical, Climcal Students and Clinicians: The Two Anatomies

This section is divided into three sub-sections. The first sub-section explores the reliability of the anatomical knowledge test, which was administered to the four groups, i.e., preclinical third-year class (preclinical 3), preclinical fourth-year class (preclinical 4), fifth and seventh year clinical students (clinical students) and the qualified doctors (doctors). The reliability Cronbach alpha was measured for the two scales, i.e., pure anatomy (test 1) and clhiical anatomy (test-2).

The second sub-section explores and describes the subpopulations of respondents' scores on the tests and m fact characterises each subpopulation on their performance. The statistical exploration takes into consideration the matter of normality of the distribution of the population in preparation for hypothesis testing. More specifically the exploration queries whether the within-group data samples

It is envisaged that this approach establishes, first, that test 1 and test 2 were rehable (the resuhs can be trusted), second, that the data qualified (in terms of statistical assumption) for further analyses, and third, whether significant differences existed between the four groups.

Reliability Analysis

Table 4.11
Reliability Analysis Output for the Four Groups on Test 1 and 2

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures

The answers m a reliable test differ because respondents have different knowledge content and not because the questions are confusing or have muhiple interpretations (SPSS, 1999). Reliability is always a function of the examinees as well as the questions; for this reason reliability tests were done for each group on both test 1 and test 2. Many scholars accept rehability coefficient of 0.6 - 0.7 (Henerson and Fhz-Gibbon, 1987; De Vaus, 1990). The Cronbach's alpha reliability coefficient for all the groups on the two tests was greater than .80 (table 4.11). Test 1 (pure anatomy) and test 2 (clinical anatomy) were reliable for all the groups of respondents tested.

Statistical Characteristics of the Data

Test for Normalhv

The test for normality was done using Q-Q test for normal probability (figure 4.7) and the detrended normal probability plots (not shown because *it* tests the same phenomenon).

Normal Q-Q Plot ofTESTI

Observed Value

Figure 4.7
Normal Q-Q Plot of
Test 1

The observed data values are plotted on the horizontal axis and the 'expected' values under normality on the vertical axis. Each observation in a normal probabilhy plot is plotted against the corresponding quartile of a standard normal distribution. If the data are from a normal distribution the plotted values should fall roughly around

the hne. The points hi test 1 cluster along the line indicating the data/sample are from a normal distribution.

Normal Q-Q Plot **ofTEST2**
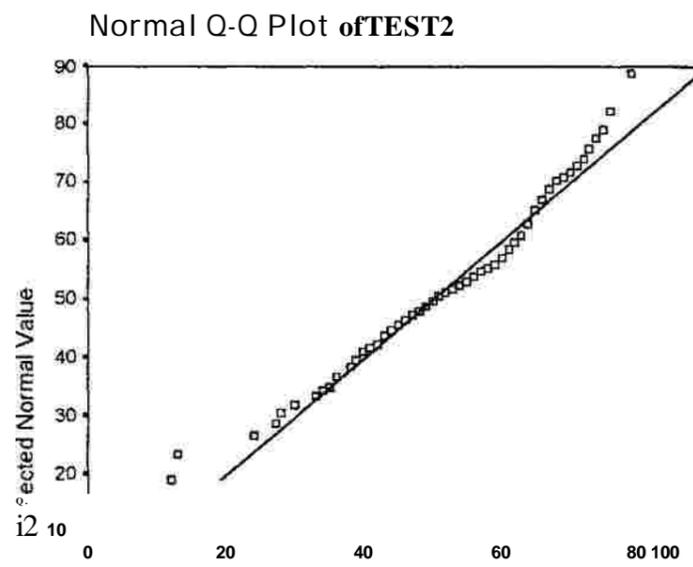
Observed

Value

Figure 4.8
Normal Q-Q
Plot of Test 2

The plotted points in figure 4.8 also cluster around the line mdicathig the data/sarr^le are from a normal distrubution.

The detrended normal probability plot is helpful for detecting patterns of how the points depart from normalhy. The detrended plots in this case were not necessary since normality of distribution had been established by the Q-Q plots. For the sake of completeness they were done and for both test 1 and test 2 the plotted points scattered randomly along the line (detrended plots not shown).

Test of Homogeneity of Variance

Another important assumption of classical analysis of variance is that the data in each cell come from populations with the same variance. This assumption was

Table 4.12
Test of Homogeneity of Variance for the Four Groups on Test 1 and 2

Qualitative	Qua
Goals	
• Develop sensitising concepts	• Theory test
• Describe multiple realities	• Statistical (
• Develop understanding	• Show relati
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured,
• Evolving, flexible, general	specific
	• Detailed pl;
Data	
• Descriptive	• Quantifiabl

Df = degrees of freedom; Sig. = Significance

Table 4.13
Test of Homogeneity of Variance for the Four Groups on Test 2

Qualitative	Qua
Goals	
• Develop sensitising concepts	• Theory test
• Describe multiple realities	• Statistical (
• Develop understanding	• Show relati
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured,
• Evolving, flexible, general	specific
	• Detailed pl;
Data	
• Descriptive	• Quantifiabl
• Personal documents	• Counts, me

tested by the Levene test.

When variances are unequal, the withhi-cell distribution are also skewed. In such shuations transformation of data is used by many scholars to remedy the problem (SPSS 1999). For both test 1 and test 2 the Levene test based on means, which tests

for equality of group variances, is highly significant (F= 15.150, p value < 0.0005; F=9.947, p value< 0.0005, respectively). This shows that the nuU hypothesis that variances with the groups are equal has been upheld.

Having established that the data/samples are from normal populations and that the variances between the groups were homogenous, analyses that utilise these assumptions could now be undertaken.

Comparison of Respondents' Performance on the Anatomy Research Test

Figure 4.9 and 4.11 illustrate the performance of the groups on test 1 and 2. Note
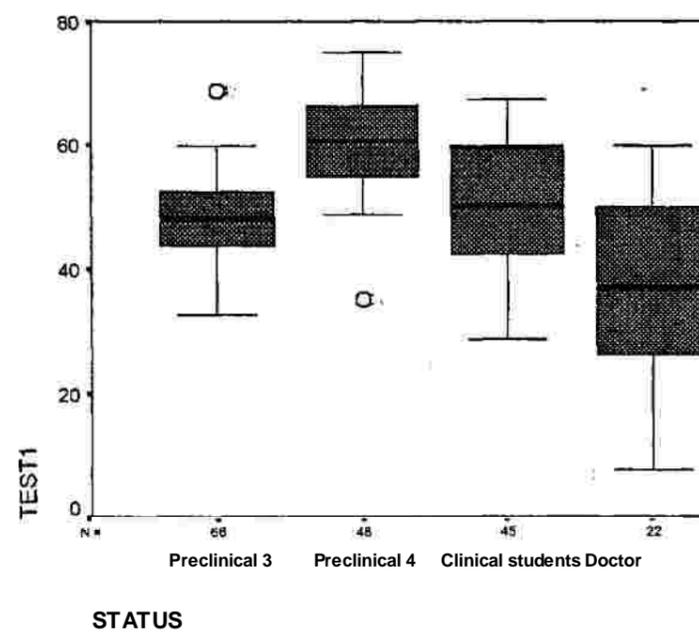
Figure 4.9
Marks on Test 1 by Groups

that test 1 is scored out of 80 whilst test 2 is out of 100.

Pure Anatomy Test (Test 1)

The striking feature about the resuhs of test 1 was the poor performance of the doctors (mean 38 with **standcU**"d deviation 3.2021). The median score for the doctors was 38 marks. The best performing group on test 1 was the preclinical 4 achievhig a mean of 61 (standard deviation 1.1875) and a median of 61 marks. Preclinical 4 also had the highest score. The range was widest in the doctors group with 32, i.e., highest score - Q_2 lowest score = 7.5. The order (best to worst) performance on test 1 was preclinical 4 (mean 61), clinical students (mean 51), preclmical3 (mean 48), and last doctors (mean 37). If 50 percent is considered the pass mark, as is the policy

✳ Values more than 3 box-lengths from 75th percentile (extremes)

Values more than 1.5 box-lengths from 75th percentile (outliers)

Largest observed value that is not an outlier 75th PERCENTILE

50% of cases have Values (

MEDIAN

25th PERCENTILE

Smallest observed value that is not an outlier

Values more than 1.5 box-length from 25th percentile (outliers)

Values more than 3 box-lengths from 25th percentile (extremes)

Figure 4.10

in UNZA School of Medicine, for test 1 the doctors, as a group, failed their pure anatomy test.

It is worth noting that the clinical students (year 5 and 7) performed better than the preclinical 3. This was because the clinical students completed their formal
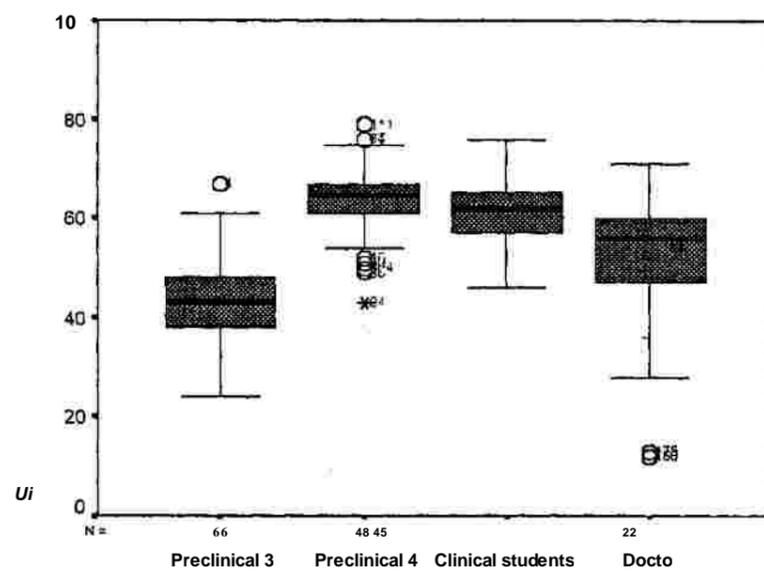
anatomy courses at least a year earlier.

STATUS

Figure 4.11
Marks on Test 2 by Group

<u>Clinical Anatomy Test (Test 2)</u>

The striking feature about the resuhs of test 2 was the poor performance of the preclinical3 with a mean of 43 (standard deviation 1.0099) and a median score of 43. The best performing group was preclhiical 4 with a mean of 64 (standard deviation 1.0963), and a median of 64.5. Preclinical 4 also had the highest score of 79 per cent. The range of scores was widest for the doctors with 59 (maximum = 71, mmimum =

both test 1 and test 2.

Pure anatomy test (test 1). At 0.05 level on test 1; there was a sigiuficant difference between the mean scores of preclinical 3 and those of preclinical 4 and doctors. There was no significant difference with those of clinical students. The mean scores of preclinical 4 were significantly different from all the groups. The

12). The order (best to worst) of performance on test 2 was preclinical 4 (mean 64), preclinical 4 scored on average 23 marks higher than the doctors, 12 higher than the chnical students (mean 62), doctors (mean 50) and preclmical 3 (mean 43). If 50 preclmical 3, and 9.5 higher than the

percent is considered the pass mark, as is the policy in UNZA School of Medicine, for test 2 the prechnical 3, as a group, failed the clmical anatomy test.

It is worthy noting that the preclinicaW takes a clinical anatomy course. In this mstance even if they are not yet a clinical class their knowledge of anatomy as applied to clinical condhions was comparable to clinical students and better than that of doctors.

Do the Groups Know Different Kinds of Anatomy?

Muhiple comparisons of the groups' scores (analysis of variance) were done ushig the Bonferroni pairwise method. It is widely accepted that when the number of comparisons is small the Bonferroni method is more senshive in detecting differences whilst the Tukey method is more senshive in larger number of comparisons (SPSS, 1999). The analysis of variance was undertaken to test if any statistical differences existed among the means (average scores) for the four groups in test 1 and 2. Table 4.14 shows the results of the Bonferroni pairwise method for

218

clmical students. The clinical students' mean scores were significantly different from the doctors. The former scored, on average, 13 marks higher than the doctors. It is notable that the doctors' mean scores were significantly different from all the groups. The doctors, on average, scored 23 marks less than preclinical 4, 13 less than clinical students, and 10.5 less than the preclinical 3. The doctors' knowledge of pure anatomy was significantly less than that of preclinical 4, clmical students,

Table 4.14
Bonferroni Tests for Statistical Differences of Scores on Tests 1 and 2 by Groups

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large

* = The mean difference is significant at the 0.05 level

and preclinical 3, in that order.

Clinical anatomy test (test 2). At 0.05 level on test 2 there was a significant difference between the mean scores of preclinical 3 and those of all the other groups. All groups, on average, scored higher than the preclinical 3; preclinical4 by 20.5 marks, clinical students by 19 marks and

doctors by 6 marks. The prechnical 4 group was different from the doctors and preclinical 3. On test 2 the doctors scored 14 marks less than the preclinical 4. Notably, there was no difference between preclinical 4 and clinical students. However, a significant difference between the mean scores of clinical students and doctors existed, doctors scored, on average, 12 marks less than clinical students. The prechnical 3's knowledge of clinical anatomy was significantly less than that of all the groups that had clinical experience.

Core Anatomy = Type 1 Anatomy (prerequisites) + Type 2 Anatomy (clinical anatomy)

Type 1 anatomy (prerequisites): Anatomical terminology (body poshions, movements and anatomical intemafional nomenclature), basic tissue types (muscle, nerve, ephhelia, connective tissue), the skeleton (axial and appendicular) and muscle

Section 5

Core Clinical Anatomy for Undergraduate Medical Education

<u>Definition of Core Clinical Anatomy</u> The study found that there were two types of anatomical knowledge. One that was the knowledge possessed by preclmical students and the other possessed by the clinicians. Sinclair (1975) labeUed these two types. Type 1 anatomy and Type 2 anatomy. The first refers to the classical anatomy of the Flexnerian curriculum, that is, the components of gross anatonty, histology, embryology, and neuro-anatomy. The second is that which refers specifically to the application of anatomy to clinical shuations. The study identified this similar categorisation, .however, the content of each categorisation is specific to the study fmdings. By this study, core clinical anatomy for undergraduate medical education mcludes basic anatomy concepts from type 1 anatomy, here labelled prerequishes and type 2 anatomy (clinical anatomy) which are concepts that are mostly applied to clinical practice.

groups, regions of the body, the structure and function of body systems, general embryology (gametogenesis, gastrulation, embryonic period, foetal period).

Type 2 anatomy (clinical anatomy): Anatomy themes found in clmical methods (see the 67 themes); anatomical hiterpretation of clinical data (tissue, organ, region, system - TORS- analysis); anatomical knowledge that determines success and/or failure in clinical practice; conceptual understandmg of the role of anatomy in clinical practice; high-CAKI clinical cases; anatomical basis of common clinical procedures and operations; interpreting common clinical images.

Type 1 anatomy identified here is considered a prerequishe with regard to laymg a foundation (prior knowledge) on which to build knowledge of Type 2 anatomy.

CHAPTER   V
DISCUSSION

Section two, "Developmental Testing", discusses the UNZA clinical anatomy course in view of the available hterature, and evaluation of the course.

Section three, presents a clinical anatomy curriculum based on the findmgs of this study, and theoretical considerations from the Iherature.

Introduction

This study defined the core clinical anatomy for undergraduate medical education. The content was defmed by an investigational research strategy, m contrast to the numerous textbooks and reported courses that used arbhrary methods of selection of material. This chapter discusses these fmdings. The chapter is divided into three sections:

Section one, "Core Clinical Anatomy for Undergraduate Medical Education", discusses the content as defmed by the study. The strategy of using needs assessment as evidence-based practice for curriculum development is discussed first. Each of the components of the core clinical anatomy content are then discussed: comparing and contrasting whh the literature and highlighting any original contributions of this study. The assertion that the anatomy taught in tradhional (Flexnerian) curricula was different from that used in clmical practice is discussed in the sub-section 'The Different Kinds of Knowledge of Anatomy: The Two Anatomies". Section one concludes with a crhique of the research design and
methods of the study.

nature of essential duties for general practice; the relevance of clinical competencies to clinical practice by the general practitioner.

2. The anatomy needs in clinical practice. Findings related to the range of knowledge of anatomy as they related to the essential competencies of clinical practice.

To understand the essential competencies of clinical practice the study investigated the components of clinical practice and the disease burden of Zambia. As such, there was investigational support for linking training goals in anatomy to clinical practice. Understanding clinical practice and the disease burden contributed to ensuring that the proposed curriculum had proper scope and emphasis for undergraduate medical

Needs Assessment as Strategy for Evidence-based Curriculum Development:

Assessment of the Anatomy Needs for Clinical Practice The views and findings of various scholars on needs assessment and evidence-based practice are presented before the components of clinical anatomy (the other part of the core) found in this study. This is an effort to set the context and justification in order to allow continuity of presentation of the core clinical anatomy components.

Needs Assessment

Primary findings from the study fell into two categories as outlined below:

1. The nature of a doctor's clinical practice. Findings relating to the generic

overall perspective should always be home in mind: what do doctors do? what affects what they do? how do they do h? Allen and Roberts (2002) reported an innovative programme that correlated anatomy, clinical medicine and radiology. The reason for the innovative programme was: "Clinical applications make thmgs easy to remember and help to relate to the big picture... you forget to think clinically when memorising anatomy, so this brought back the focus." Latman and

Lamer (2001) recommended that the gross anatomy course content and teaching education in Zambia. After defining what consthuted chnical practice and the methodologies should be responsive to the needs of each clinical specialty and that disease burden, the study investigated the mteraction of knowledge of anatomy the educational philosophy in medicme should be to prepare students for theh whh clmical practice: what kind of knowledge of anatortty was required, m what specific clinical practice. All the above views were also expressed amount and how h was used.

Other scholars have advocated this approach: Monekosso (1998) asserted that the doctor-patient encounter should serve as the catalyst for medical education reform In order to do this, he recommended that educationalists should profile the medical doctor with regard to history-takmg, clinical examination, selection and interpretation of resuhs of investigations, treatment and rehabilitation. He concluded that whh this approach the curriculum would focus on clmical problems, clinical methods, and clinical management. Included on the list, by Monekosso (1998), of a doctor's profile were professional thmking, that is, critical scientific thinking, clinical decisionmaking, and problem-solving. In planning education in medicine Odimba (1999) advised that determination of population's and individual needs were a necessary prerequishe step. Squires (2002) maintained that while students focus on different aspects of medicme at different times hi the trairung the

Bradley (2001) contended, enhanced learning curves of clinical skills in latter years of medical education. This link of the integration of basic sciences and clinical skills to the learning curves may be; important for learning the anatomical basis of clinical procedures. Jolly (2001) reported a lack of preparedness for practical clinical skills, such as suturing and nasogastric tube insertions, amongst pre-registration house officers in the UK. Considering Miller's triangle of clinical

competence, i.e., base to apex - knows, knows how, shows how, does- *it* can be argued that knowledge of anatomy and hs basis for clinical procedures and other clinical skills contributes to clinical competence and performance (Rethans et al., 2002). The findings by Jolly (2001) were in agreement with those of Board and

by Bligh et al. (2001) in the treatise "PRISMS: New Educational Strategies for Medical Education". Bligh et al. (2001), hi part, argued that future curricula would emphasise clinical practice and would be more relevant to communhies. The relevance to communities was also emphasised by Bimdred and Gibbs (2002) who

stated that planners of medical curricula must mcorporate the burden of disease and heahh needs of their locales; importing curricula from other locales may be mistaken because of the variability of burden of disease and health needs. In this regard. Gate (2002) argued that setting global (intemational) standards was not equivalent to identical educational content and that the means by which educational objectives were derived should, necessarily, reflect local health needs. Thus education planning and research should address the relationship between teaching and subsequent clinical practice (Bligh, 2003). With regard to practical chnical processes many views have been reported. Bradley (2001) argued that when trairung was stmctured to core clinical skills, such as communication, history-taking, and physical exammation, and mtegrated with basic sciences it represented the synergy of basic sciences and clinical training. This approach,

teachmg anatomy is supported by this approach.

These considerations of what the clmician does and how anatomy affects these roles should rightly be considered the "Needs Assessment" for a proposed curriculum of clinical anatomy. This study's findings are based on a "Needs Assessment".

Evidence-based Practice

Mercer (1998) who surveyed basic practical skills of final-year medical schools in The question of evidence to support practices m clmical anatomy was raised in the a United Kingdom university medical school. Board and Mercer (1998) found that hterature (Jones et al., 2002). Questions conceming evidence to support the basis of lack of knowledge of basic practical skills as well as inability to perform them was many medical education reforms were also raised (Monkhouse & Farrel, 1999; distressing to doctors and dangerous to patients. Wdh regard to cognhive processes,

clmical reasoning and relevance was core. Schuwirth (2002) asserted that there was insufficient evidence that teaching reasonmg processes separately from content was effective. This view was consistent with the findings of Eva et al. (2002) who stated that the expert in medicme becomes so by virtue of ability to arrive at a correct diagnosis and exploit the information that confirms the diagnosis; and sensitivity to data that discriminates differential diagnoses. These are consistent with efforts to teach specific anatomical content with regard to the use of anatomy hi clinical reasoning. The clinical reasorung strategy for how anatortiy contributes to clinical reasoning is constructed from the hypothetico-deductive theory. Although differences in problem-solving may not be dependent on the method of problem-solving (hypothetico-deductive theory in this case) content and

organisation of knowledge in memory is important (Una, 1997); clinical context for

2. Inflections of anatomical terms, which imply that an anatomical stmcture is

mvolved, e.g., peritonitis, uveitis, and arthroscopy.

3. Histological/microscopic terms, e.g., endothehum; leucocytes, macula

densa.

This study found that 40 percent of the content in clinical methods leaming is

anatomical knowledge. A student that does not posses this anatomical knowledge,

or does not leam *it* at the time, cannot comprehend 40 percent of the content she is
Colliver et al., 2003). Others (Norman, 1988; Norman & Schmidt, 2001; Kwan,
attempting to leam in clmical methods. This indicates that the clmical methods
2001; Leung, 2002; Colliver, 2002; Smits, Verbeek, de Buisonje, 2002) questioned
textbook either presupposes already existmg anatomical knowledge or expects the
the evidence on which the problem-based leammg recommendations were based. If
leamer to acquire anatomical knowledge concurrentiy. Several workers
clmical anatomy is to become an essential component of medical education, it will
(McGregor,
have to be evidence-based. This study has endeavoured to base hs

recommendations on evidence.

Discussion of Components of Core Anatomy

<u>Pre-requisite Anatomy (Type I Anatomy)</u> hi Hutchmson's

textbook (Swash, 1989), from a total 17,223 recordmg units 10,162 (59%) were

found to be general anatomy indicators. Of the'10,162 general anatomy mdicators

6,980 (69%) were designated as technical anatomy terms (Table 4.1 m the results

chapter). Technical anatomical terms included the following:

1. Named anatomical stmctures, e.g., femoral nerve, duodenum, ischium.

229

Anatomical Terminology

The study found that anatomical nomenclature was a requhement based on the findings that clinical methods included named anatomical stmctures, for example, femoral nerve, brachial artery; inflections of anatomical terms, for example, peritonitis, arthroscopy. Anatomical planes, such as, coronal, and cross-section were also used. Addhionally, descriptions of movements like flexion, extension, 1932; Baxter, 1950; Bruce et al., 1964; Smout et al., 1969; Lachman, 1981; abduction, and adduction were dominant in the chapter on the locomotor system. Lumley, 1996; Elhs, 1997, Backhouse & Hutchings, 1998; Stem, 1999), m theh The learning of anatomical terminology and concepts, m the hterature was textbooks, assumed prior knowledge of anatomy, whereas, others (Healy, 1969; supported by

Snell, 1986; Basmajian & Slonecker, 1989; Mathers et al., 1996; Moore & Agur, 1996; Sinnatamby, 1999) provided detailed anatomical knowledge alongside clinical application. The latter approach implies that the authors expect the student to leara the anatomy at the same time as hs application to clinical situations. The consideration of these approaches is important: the first, could perpetrate the tendency to consider anatomy as a discipline in its own right and for its own sake. The second, may approach anatomy in a superficial and simplistic manner. The difficuhy arises when attempts are made to defme the pre-requishe core anatorry: how much of *it,* when, and how should *it* be taught. For this study, the identification of prerequishe anatomy was based on the findings from content analysis of a clmical methods textbook, participant observation of clinicians, and the taxonomies of anatomical knowledge that determine success and/or failure in clinical practice derived from the crhical incidence survey of clinicians.

anatomical terminology and basic anatomy concepts, is required before learning the

details of application of anatomy to clinical practice.

<u>Clinical Anatomy (Type 2 Anatomy) Prominent Anatomy</u>

<u>Themes in Hutchinson's Clinical Methods</u> The prominent anatomy themes could be

categorised into three: anatomy concepts, anatomy of clinical examination, and
the recommendations of AACA (1996) and Fasel et al. (1998). Snell (1986),
anatomical knowledge specific to clinical cases. These three themes are applicable
Basmajian & Slonecker (1989), Mathers et al. (1996), Moore & Agur (1996) and
to:
Sinnatamby (1999), in their textbooks, also provided these basic principles.

<u>Anatomy Basic Concepts</u>

The basic principles include the structure and function of basic tissues (muscle,

nerve, ephhelia, and connective tissue), the regions of the body, and the structure

and function of body systems. The protocols for history-taking, and physical

examination in Hutchinson's Clinical Methods (Swash, 1989) were both based on

the regions of the body, and body systems. The structure and function of regions

and systems formed the basis of assessment of normality. Clinical reasoning, as

deduced from cognhive processes of the doctors, also included an assessment of the

integrity of the body systems. Knowledge of developmental anatomy was required

for comprehending congenital abnormalhies ched by Hutchison's Clmical Methods

(Swash, 1989), deduced from the observation of clinicians and the review of

clhiical data.   231

   These resuhs indicate that a background of anatomical knowledge, i.e.,

reviewed for this study. This concept was, however, prominent in the clinical methods textbook (Swash, 1989) and should be recognised by this merit.

Example 2. Topic: The Sensory System - Spinothalamic tract. Under the sensory system in table 4.2 only the spinothalamic tracts were identified as a prominent theme. One could consider this approach superficial. Nevertheless, the central nervous system was covered in three different chapters in clinical methods: the nervous system, the unconscious patient, and psychiatric assessment. This provides

1. Systems: Locomotor system; Gastrointestinal tract and abdomen; Nervous system; Cardiovascular system; Respiratory system

2. Regions Organs, and Tissues: The eye; Skin, nails, and hair; Ear, nose, and throat; the blood; Kidneys and urme.

3. Selected clinical phenomena: The unconscious patient; Genitalia and sexually transmitted diseases; Examination of women; Examination of children; Usmg the laboratory; Psychiatric assessment.

The content to be included under each of these headings are listed m the results (table 4.2). While from an anatomical point of view the content, in some topics, could be considered incomplete, superficial, and obscure h must be recognised that the aim was to define the core anatomy concepts from the clinical methods and not to be comprehensive. Below are a few examples to which this statement may apply.

Example 1. Topic: Growth of hair; anagen, catagen, and telogen. It is possible to consider this topic obscure because h is not usually mcluded in anatomy course and books. This topic was not listed in any of the clmically oriented textbooks that were

Anatomical Basis of Common Clinical Procedures

Tables 4.8, 4.9, and 4.10 (Results) list the common clmical ward and theatre procedures, and operations. Figure 4.1 (Results) depicts the role of anatomy in practical processes. This is a concept that was commonly missing in anatomy teaching. While references were made to apphcation of anatomy in clinical procedures, for example, lumbar puncture in learning about the vertebral column and cerebrospinal fluid circulation, the references were isolated and did not portray the importance of anatomy to this component of clinical practice.

three opportunities to leam specific concepts about the nervous system; in particular, for the sensory system opportunities were available in at least three sections, i.e., segmental innervation, dermatomes of the body, the lobes of the bram and the functional centres. Therefore, while h is true that, considered in isolation, a topic may appear superficial or seem to have omitted important concepts, considered hohstically, several opportunhies were available at different but appropriate times.

These examples illustrate the pohit that h is possible to omit or include 'perceived' important concepts depending on the viewpoint of the study or author. Some of the concepts listed in this study but not used in almost all of the anatomy books reviewed, for the study included: growth stages of hair (anagen, catagen, telogen); the anatomy concepts important for assessment and management of the unconscious patient; the relationship between myocardial regions, coronary vessels, and the electrocardiograph; developmental milestones (central nervous system development); the limbic system The point being that this study focussed on the anatomy requhement of clinical practice while other authors focussed on anatomy and their opinions whh regard to what was important to clinical practice.

practice (e.g., proctoscopy, urethral swab). The list by Moercke and Eika (2002), was different from that found in the study probably because the Moercke and Eika list was based on the competencies required for clinical practice for the newly graduated physicians but the list from this study was generated from clinical procedures commonly encountered in Zambia.

The practical processes included, ability to read clinical images like x-rays (which are based on recognising anatomical structures); anatomy for orientation (in terms of a body map); and anatomy as an outcome determinant (knowledge of anatomy was observed as being important hi determining success or failure in practical procedures such as lumbar puncture, pleural tap, and cut dovm) and potential complications (doctors who lacked anatomical knowledge were more likely to cause complications, such as, injury to nerves or excessive bleeding). Thus, competence in practical procedures is important in clhiical practice (Board and Mercer, 1998). Board & Mercer (1998) identified nine practical skills, which they considered commonly required for the daily activhies of the pre-registration doctor in the United Kingdom. They observed that lack of knowledge of basic practical skills, together with hiability to effectively and efficiently perform them, was dangerous to the patient. Moercke and Eika (2002), in their survey, grouped the procedures under the headmgs: emergency procedures (e.g., securhig patient airways, endotracheal hitubation, performing an ECG, setting up an IV drip), casualty procedures (e.g., simple wound suturing, ophthalmoscopy, local nerve analgesia), gynaecology-obstetrics procedures (e.g., Apgar scoring, examinmg the newbom, cervical swab, estimating pelvis, normal vaginal delivery), and general

234

(Tissue, Organ, Region, System) method. That is to say, as the clinician considers information cues he tests hypotheses about the possible involvement of the type of tissue, organ, region or system. For example, in making a differential diagnosis of a lump in the femoral triangle Ellis (1997) asserted that for each anatomical structure shuated in that region, possible pathological conditions were considered, thus:

Anatomy in Clinical Reasoning (TORS analysis): Cognitive Processes Anatomy is important for clinical reasoning. Other workers supported this assertion (VM 8224, 2001).   Consideration of the clinical methods (history-taking and physical examination) in light of what role anatomy plays in the process of clinical problem-solving follows.

    The hypothetico-deductive theory was thought to be more scientifically sound (Homer and Westacott, 2000), was widely acknowledged in cognitive psychology (Cohen, 1977; Kurkland & Lupoff, 1999) and was more widely apphed to clmical reasonmg (Elstein et al., 1978; Jones, 1997; Bordage, 1999; Round, 2000; Eva et al., 2002). Accordingly, the hypothetico-deducfive theory was the theoretical perspective supported by the findmgs of this study (see resuhs: cogmtive processes in concept map) but it raised many issues when applied to anatomy.

    The hypothetico-deductive clinical reasoning theory sigrufied that the clmician begins by interpreting cues (search unhs), which suggest the tissue (e.g. muscle, nerves, bones, blood), organ (e.g. heart, liver, kidney, spleen, brain.), region of the body (e.g. head and neck, axilla, hip) and system (cardiovascular, respiratory, reproductive) that is the 'seat' of the clinical problem This process is the TORS

(Tissue, Organ, Region, System) method. That is to say, as the clinician considers

consider each hypothesis.

Anatomical structure in the (Femoral) region	Possible pathological change
• Skin and soft tissue	• Lipoma, sebaceous cyst, sarcoma
• Artery	• Aneurysm of femoral artery
• Vein	• Varix of the great saphenous vein
• Nerve	• Neuroma of the femoral nerve
• Psoas sheath	• Psoas abscess
• Lymph nodes	• Any cause of lymphadenopathy

This approach was supported by the study data, 1) that indicated that anatomy was used to identify structures that are involved m orienting oneself in the body 'terrain', understand concepts of disease whh an anatomical basis, and locate structures, and 2) the common themes in clinical methods, i.e.. Systems, Regions, Organs, and Tissues. According to the hypothetico-deductive theory the unhs of clinical reasonmg are: 1) information search unhs (cues), and, 2) hypotheses. Information search unhs tested whether the data generated was congruent to the hypothesis and exit was attained to verify a hypothesis. If the test on the search unhs was mcongruent, further test and operate pathways were engaged to verify or disqualify hypothesis about which tissue, organ, system was affected. In a clinical work-out these cues are generated from a medical history and the physical examination. Applied to anatomy, the information cues are the symptoms and the signs; the object of the clmical methods is to conduct the TORS analysis. A matrix

of cues (mformation search unhs) by TORS may thus be constructed (Table 5.1) to

Table 5.1 Cue-hypothesis Matrix.

	Qualitative	Quantitative
Goals		
	• Develop sensitising concepts	• Theory testing
	• Describe multiple realities	• Statistical description
	• Develop understanding	• Show relationship between variables
	• Empowerment of marginalized groups	• Prediction
Design		
	• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
	• Evolving, flexible, general	• Detailed plan of operation
Data		
	• Descriptive	• Quantifiable coding
	• Personal documents	• Counts, measures
	• Field notes	• Operationalised variables
	• Photographs	• Statistical
	• Official documents/artefacts	
Sample		
	• Small	• Large
	• Non-representative	• Stratified
	• Theoretical sampling	• Control group

NT = Nerve Tissue; MT = Muscle Tissue; ET = Epithelial Tissue; CT = Connective Tissue; RSP = Respiratory System; CVS=Cardiovascular System; CNS = Central Nervous System; GIT = Gastro-Intestinal System; GUT = Genital Urinary System; INT=Integumentary System; SKL = Skeletal System; BLD = Blood System.

Involved Which region

Which organ

Based on the standardised set of routine questions that are pre-assigned the clinician indicates at the intersection in the matrix a + for those that are positive and a - for those that are negative for that particular tissue, or system Named organs and regions are entered in the last column and then a + indicated under the appropriate system. Each physician's call for further investigations and finally the interpretation of the combination of positives and negatives for each system then leads him/her to a diagnosis. Thus in clinical reasoning (clinical practice) anatomy does play a role in the evaluation of the hypotheses (which tissue, organ, region, system is involved) - in deciding whether a feature adds, dispels or does not contribute to the hypothesis.

Which tissue

Figure 5.1
Anatomical Consideration of a Clinical Problem

<u>Is anatomy a consideration in this case?</u>

Positive Negative

Which System is

238

and diagnosis how do we integrate h into clinical practice?   Furthermore, is there mitigation for considering the learning of anatomy in clinical context, as opposed to the traditional building block approach (pure anatomy followed by learning clinical sciences)? Cohen (1977) observed thus:

Applied to the hypothetico-deductive clinical reasoning model, anatomical search for the type of tissue, organ, system model is consistent with the findings of Elstein et al. (1978) who speculated that the so-called routine questions in a workup (history-taking, physical examination, and investigations) were really aimed at testing particular hypothesis (which tissue, organ, system) or at least determining whether further inquiry into a particular hypothesis was warranted. They also observed that a cue may be positive, non-contributory, or negative to a particular hypothesis. Consideration of other clinical problems, as in free-recall, the process would take the pattern depicted in Figure 5.1

Cohen (1977) and Elstein et al (1978) argued that a purely inductive method of gathering data until a solution emerged was never employed because the size of the search space would be so enormous that a problem could never be finished in a reasonable time. For this reason detailed anatomical knowledge only follows after an initial TORS analysis.

The same reasoning applies when interpreting imaging films (e.g. x-rays), and in understanding complex clinical conditions (e.g. homonymous hemianopia, coning of the brainstem).

Integration and clinical context. If anatomy is the basis of clinical reasoning

More specifically Elstein et al. (1978), and Barrows and Tamblyn (1980) advocated for the hypothetico-deductive method as a problem-solving strategy.

The Gestah approach theory, on problem-solving, wamed of a tendency to perceive objects as serving only theh most common or most recent fimction ("functional fixedness"), which could impede problem-solving (Cohen, 1977). This "How knowledge is arranged determines how we speak and how we understand, could imply that students may perceive a section of anatonty as taught m a specific how we solve problems and how we remember." problem to be

Several authors (McGregor, 1932; Baxter, 1950; Healy, 1969; Lachman, 1981; Snell, 1986; Ellis, 1997) noted that anatomy taught m the conventional (classical) curriculum was forgotten by the time students were in the clinical years, and that they failed to apply anatomy to clinical shuations (Balla et al., 1990; Scott, 1993). Some reasons for these observations were offered: a) failure to integrate the anatomy whh clinical shuations as seen by the physicians, b) lack of clinical relevance of the anatomy taught, and c) the strict separation of preclinical (basic science) years from clinical years.

Scholars proposed some recommendations to address the observations alluded to above. One was that clmical context must be hicreased (McGregor, 1932; Baxter, 1950; Healy, 1969; Lachman, 1981; Snell, 1986; EUis, 1997), another was that clinical context must be increased through the use of case studies (Elstein et al., 1978; Lachman, 1981; Scott, 1993). Another recommendation was that students should learn basic sciences in clinical context, use case studies and be taught

240

problem-solving strategies (Elstein et al., 1978; Barrows and Tamblyn, 1980).

principles to clinical applications. This, Elstein et al. (1978) claimed, was because the classical curriculum did not offer enough early opportunities for practice. Elstein et al. (1978) and Kurkand & Lupoff (1999) believed that carefully selected problems were vehicles for building a store of memories (knowledge) as well as a

set of formal strategies and that if used in a case-oriented curriculum would ease the only applied to that clinical scenario and fail to apply h to other situations. The transhion from scientific facts to clinical application for the students.

Gestalt approach proposed that failure to solve a problem was often due to the persistence of a rigid, inappropriate "set", which may have been established by earlier experience, or by the way in which the instructions were phrased (Cohen, 1977). Patel et al (2001) expressed concern whh the teaching of problem-solving skills, especially, the hypothetico-deductive. The concem was that knowledge organisation and schema acquishion that were more important for the development of expertise, should be enhanced rather than teaching particular methods of problem-solvmg. Patel et al., further stated, that teaching basic science within clinical context could have the disadvantage that once basic knowledge was contextualised, *it* was difficuh to separate h from the particular clinical problems into which it was integrated. Elstein et al. (1978) referred to this phenomenon as limitation of transfer of the problem-solving process. They asserted that such a finding and the findhig of case specificity should not lead to the conclusion that a case-oriented curriculum was inappropriate. They indicated that on the contrary, the limitations on the extent of transfer could help understand why some medical students educated in a tradhional preclinical curriculum had difficulty adapting to

the clinical approach; they had difficulty in transferring scientific facts and

for which the learned material was learned is important in its recall (Eva et al.

2002). By analogy, a student who learns that anatomy is important in clinical

reasoning and clinical practice wiU learn anatomy with the purpose of applying h in

clinical practice. This way, recall of anatomical information, when required, in

clinical practice would be enhanced. Of the three forms of memory probe; free
   Network models in cognitive psychology (Cohen, 1977) alluded to the
recall; cued recall; and recognhion (Eva et al., 2002), the context of learning
importance of frequency of use of concepts and links in memory. Bordage (1999)
anatomical knowledge would affect most the latter two forms.
also advised that the semantic qualifier could represent links to basic sciences; thus

two bodies of knowledge could come together, the anatomical and clmical, where

one was used to construct explanations for the other. The goal would be to get away

from rote memorisation of countless facts of anatomy and move toward building

meaningful repertoires of exemplars (patterns), recognising and seeking key

discriminating anatomical facts, and build conceptual understanding and indexing

of problem representation. Eva et al. (2002) asserted that the expert in medicme

becomes so by virtue of a) ability to quickly make a diagnosis and explore

mformation that confirms that diagnosis ("confirmatory data"), and b) senshivity to

data presented by the patient that may discriminate between the primary diagnosis

and the differential diagnoses ('discriminatory data"). The TORS analysis considers

information from the patent (information cues or search units) to help quickly

arrive at which tissue, organ, region, system is affected and explores, at the same

time, information that confirms the diagnosis (hypotheses). This way of defining

the role of anatorrry in the clinical reasonhig process could enhance senshivhy to

information cues, a necessary virtue for expert clinicians. Moreover, the purpose

for which the learned material was learned is important in its recall (Eva et al

and cognhive processes (the two applications of anatomy in clinical practice). The study also contributed to identifying the amount and nature of anatomical concepts inherent in clinical methods (see resuhs: table 4.2) and has discussed how it is probably used in the clinical reasoning (TORS).

In considering the TORS analysis, h is necessary to answer the question posed by Schuwirth (2002): "Can clinical reasoning be taught or can h only be leamed?" The idea of TORS analysis is dependent on interpreting the fmdings from the established and standard clinical methods (history-taking and physical exammation). The history-taking protocol, according to Elstein et al. (1978) and Barrows & Bermet (as quoted by Jones, 1997) is a model of the hypothetico-deductive problem-solving. By inference the TORS analysis is a form of hypothetico-deductive problem-solving; can h be taught? Schuwirth (2002) asserted that there was lack of evidence that teaching reasoning process separate from content was effective. Mandin et al. (1996), Norman et al. (1997), Kurkland & Lupoff (1999), argued that a generalised problem-solving process did not exist in medicine but instead 'problem specificity' was the mle. In the case of TORS analysis, if many experts considered an identical case history usmg the TORS analysis method, very high concordance (agreement) would result (this was not investigated but is being noted, here, as a possible future investigation). In addition, TORS analysis is specific to anatomical interpretation of a case history, and as such is specific to a specific task. Based on this, TORS analysis should be part of the learning process for students.

This discussion section has explored the use of anatomy in practical processes

undergraduate medical education is the crucial period durmg which the student becomes familiar with the clinical shuations in which knowledge of anatomy plays an important role. The critical incident reports are discussed, below, by themes; Anatomical knowledge that contributes to ability to: <u>Extract body fluids.</u>

Meningitis is a common disease in Zambia. The basic investigation recommended, when this diagnosis is made, is the collection of cerebrospinal fluid (CSF) for

<u>Themes of Anatomical Knowledge that Determines Success and/or Failure in Clinical Practice</u>

Crhical incidents, in which anatomy determined the outcome in a clinical shuation, be h success or failure, were collected from doctors using self-report questionnaires. The incidents were grouped into fifteen themes. There were no previous studies, m the hterature, vwth which to compare.

Doctors reported 221 crhical hicidents hi which knowledge of anatoniy resuhed in a successful or unsuccessful outcome m a clinical situation. The major themes of knowledge of anatomy associated with both successful and unsuccessful clinical outcomes are presented in the resuhs chapter.

The anatomical basis for all the shuations resulting in success or failure in clinical shuations are important in the training of the future general practhioner. An analysis of commonly recurring successful and unsuccessful critical incidents, due to anatomical knowledge, can be used by medical educators to accelerate the leam/ing of medical students during their clinical clerkships, and has implications for the planning of the anatomy teaching m undergraduate curricula Therefore,

<u>Carmulate veins.</u>

Life-saving procedures like re-hydration, blood transfusion, intravenous therapy, or intravenous injection of antibiotics are dependent on having a cannula placed in a

microscopy, culture and sensitivity tests. The doctor has to collect the CSF from the subarachnoid space of the spinal cord. The procedure involves inserting a needle through several anatomical structures to reach the vertebral canal and fmally the subarachnoid space which contains the CSF. In addhion, precautions have to be taken not to cause injury to the spinal cord, and avoid the serious complication cahed coning (hemiation of the brainstem through the foramen magnum; hemiation of parts of the cerebellum through the tentorial hiatus). This example, of the anatomical considerations of a lumbar puncture, illustrates the role of knowledge of anatomy in extracting body fluids.

<u>Collect venous blood.</u> Many doctors reported incidents in which the routine procedure of drawing venous blood (phlebotomy) became problematic due to veins not being easily visible or palpable. Important clinical decisions were usually based on laboratory fmdings from venous blood (e.g. levels of urea and electrolytes in the blood) and as such gettmg a sample of venous blood, sometimes, attakied priority status in clinical practice. Many doctors reported incidents in which they had to resort to knowledge of anatomy, that is, known pattems of the distribution of veins or the surface markings of deep veins, to 'blindly' obtain venous blood.

Furthermore, bleeding is a common complication of surgical and accidental trauma, and h can be life-threatening. Many doctors reported incidents of how knowledge of anatomy was used to ligate a

vein. Strategies reported in the section above (phlebotomy) were used to access veins in life-threatening shuations.

Insert tubes or trocars into body cavhies. In many medical emergencies securmg an airway was of fundamental importance. A conmaon way of ensuring a stable airway was endotracheal intubation, a very common procedure in the hospitals. Endotracheal intubation made the difference between life and death in shuations where the patient required assisted ventilation, such as during an operation or when placed on a ventilator. Knowledge of anatomical landmarks and the appearance of stmctures at laryngoscopy was key to the success of endotracheal mtubation. This is but one example, tracheostomy and laryngostomy are others.

Locating nerves.

Peripheral nerve blocks (local anaesthesia) are common and in many mstances may be the most convenient way of doing an operation. The begirming point in such instances is locating the nerves. In addhion, to prevent hiadvertent injury to nerves the doctor must be aware of which nerves are at risk and how to avoid injuring them

Locating blood vessels. Doctors fi-equently palpate for arterial pulses.

doctors, reported instances of failure, in this life-saving procedure, because of lack of knowledge of anatomy associated with the procedure.

troublesome bleeder or how lack of anatomical knowledge resulted m the loss of lives because of uncontrohed bleeding.

Avoiding accidental injury to important structures. Several doctors, workmg in obstetrics and gynaecology, reported incidents of inadvertent injury to the ureters during a hysterectomy resulting in a potential life-threatening and serious medical calamity. This example demonstrates well the assertion that knowledge of anatomy is an outcome determmant of clinical procedures. Sometimes serious injury is caused by what are considered common and safe clinical procedures. A case in pohit was reported hi one incident where the doctor caused a foot drop due to injury to the common peroneal nerve when inserting a Steinmann's pin in a patient with a fracture of the femur.

Locatuig important stmctures. spaces, cavities. Several doctors reported how knowledge of anatomy, or the lack oi' h, influenced decisions and the eventual failure or success of doing a pericardiocentesis. Perhaps, due to the high incidence of tuberculosis in Zambia, more doctors found themselves in situations which required them to drain fluid from the pericardial cavity. When fluid accumulates in

this space it impedes the contraction of the heart (cardiac tamponade). Many

one to comprehend the anatomical arrangement of the corticospinal tracts (cortex, corona radiata, internal capsule, descending fibres, decussation, upper motor neurones, lower motor neurones). To explain hydrocephalus requires the knowledge of the cerebrospinal fluid circulation

Accessing internal organs at operation. Exploratory laparotomies are common in hospitals. Most are performed by surgeons, but in many instances, where there are no surgeons, general practice doctors may be called upon to perform this operation. An example of this theme, is the incident reported where locating the ligament of Trehz (suspensory duodenal ligament) helped the operator to locate, identify, and inspect the duodenum, jejunum, ileum, and colon.

Describing and interpreting plain and special x-rays. In interpreting plain x-rays, which are very common, the beginning point is to identify all visible anatomical stmctures and assess them for normality. In special x-rays e.g., arteriograms (x-rays of arteries whh special contrast), hysterosalpingograms (x-rays of the utems and Fallopian tubes whh a special contrast) all the anatomical stmctures have to be first identified. In recent times, cross-sectional anatomy has attained more prominence due to the introduction of CT scans which rely, mainly, on cross-sections of the body.

Making clmical decisions. Knowledge of anatomy also formed the basis of comprehending clinical concepts, understandmg the pathogenesis, and explammg clinical phenomenon. For example, to understand the sequelae of a stroke requires

and the anatomy of the cerebral ventricular system. Clinical decisions are based on such understanding of disease phenomena.

Surgical repair of structures. This is an important anatomical consideration because to restore function, and shape and form, careful attention has to be paid to the topography of the injured structure. This anatomical knowledge may determine what is cosmetically acceptable or not for facial repairs, such as repairs of the eyelids or lips.

Recognise developmental basis of clhiical condhions. Neural tube defects (spina bifida, hydrocephalus) and ventricular septal defects consthute the larger percentage of congenital abnormalhies seen at UTH paediatrics (Neonatology Unh Records, UTH). The doctor requires anatomical knowledge to recognise, describe and manage these, and many other congenhal abnormalhies.

Comprehend histological reports. This is an important theme because the three common themes of pathology in Zambia are infection, trauma and malignancy. For malignancies, specimens are sent to the pathology laboratory for a histopathological report. Knowledge of tissue types enables comprehension of such reports.

Detail of Anatomical Knowledge

The differences in amount of technical anatomical terms made known by the content analysis of Hutchmson's Clmical Methods (Swash, 1989) suggested that different topics demand varying amounts of anatomy detail. Table 4.1 shows the hierarchy of chapters in terms of total anatomy indicators ratio. In this hierarchy Summary of Impact of Anatomical Knowledge on Clinical Practice The reports of more anatomy mdicators were found on the chapter on the eye, then by the the incidents mdicate that anatomy was used with remarkable diversity in clinical locomotor system and progressing to the chapter with the least anatomy hidicators. practice.   Information obtained from the critical mcidents has important The highest Technical implications for patients, medical students, and medical educators.

   The anatomical knowledge used in clhiical situations was noted to be specific to the clinical shuation and the task at hand, and in many cases had to be detailed.

   This study has generated detailed accounts of clinical hicidents in which knowledge of anatomy determines success and/or failure.

The data produced in this study found that anatomy did impact and was required for clmical practice and the lack of it in many instances explamed poor performance reported in medical education, for example, m surgery also alluded to by Ellis (2002). The awareness of the importance of anatomy m clinical practice perhaps explains the resurgence of anatomy in medical schools that drastically reduced time for anatomy in the curriculum, for example, the University of Texas Medical Branch at Galveston.

<u>Scoring the CAKI.</u>

The CAKI is scored in three domains (diagnosis and concepts, investigations, and

treatment) and the composhe score arrived at by adding these scores in the final

Anatomy Terms Ratio (TATR) was for the cardiovascular system (0.85) whilst the

CAKI, that is, n(DC) + n (I) + n (T) = CAKI

lowest TATR was for the psychiatric assessment. This fmdmg entails that a leamer

is likely to encounter many more technical anatomical terms in leaming about the

cardiovascular system than they would in leaming psychiatric assessment.

Having reviewed the clinical condhions that preoccupy the doctors, the clinical

cases were each graded for the detail of anatomical knowledge required for

diagnosis and concepts, interpretation of investigation materials, and for

management, using the Case Anatomical Knowledge Index. The CAKI

differentiated low anatomical cases from high anatomical cases. For surgery the

high-CAKI cases were intesthial obstmction (CAKI = 12), head mjury (CAKI =

12), inguinal hemia (CAKI = 10). For Obstetrics the high-CAKI cases were cancer

of the cervix (11), ectopic pregnancy (9). Medicine and paediatrics had lower

scores for their high-CAKI scores, heart disease (8), pneumonia (7), pulmonary

tuberculosis (7). The CAKI was validated by over 40 respondents from all four

major clmical disciplines. The statistical tests (tables 5.5 and 5.6) showed that the

CAKI was reliable and consistent. The data from this study has shown that the

amount of detail of anatomical knowledge required to deal whh a clinical case

varies from case to case and that it can be consistently measured. The theoretical

considerations for the CAKI, based on the studies results, are discussed below.

invasion of the body.

Theoretical interpretation of CAKI. The operational definition adopted
defines CAKI as the detail of anatomical knowledge that is required to understand
the altered structure/function or basis for diagnosis, investigation and
Where n(DC) is the score for diagnosis & concepts domain, n(I) is the score for the
treatment of a clinical condition. Detail is
Investigations/clinical procedures domain, and n(T) is the score for the treatment
domain. The maximum possible score for the CAKI is 15. The final score can be
used to rank several clinical conditions in order to prioritise the clinical cases to be
taught and also to identify anatomical learning issues for a given clinical condition.

Theoretical base of the domains. The three domains (diagnosis &. concepts,
investigations and treatment) are based on simple theoretical reconstruction of the
elements of clinical practice. Diagnosis, has specific pre-requishes, among which
the more important are history-taking, physical examination and the interpretation
of the information gathered in a clinical reasoning process. Investigations serve to
confirm or reject hypotheses that are present as the probable diagnosis and
differential diagnoses. This may include interpreting imaging films such as x-rays,
computerised axial tomography scans, and magnetic resonance imaging. After the
diagnosis and investigations the clinician constructs a treatment plan. The
treatment may be administration of drugs by mouth, or by intravenous infusion or
manipulation of altered structure (anatomy) back to hs normal state. It may be by
invasive procedures that will require [252] anatomical knowledge to facilhate the
invasion of the body.

h is more valid to base decisions of what is taught in clinical anatomy on empirical means than to use personal experience and intuhion alone. Second, that the mdividual using the tool has medical qualifications to enable them judge the scores for each domain.

The CAKI provides an approximation about the detail of anatomical knowledge required for clmical cases. The scoring of a scaled sequence of mdex hems is a scale. This defmition is warranted by the character of the phenomenon itself as well as by the muhiplicity of clinical practice that includes the distinct phases of

unidimensional phenomenon, and is theoretically measurable on a cumulative scale. This defmition is warranted by the character of the phenomenon itself as well method of weighting that is based on their assumed intensity stmcture:

diagnosis, investigations, and treatment. Given the range of scores, 1 - 5, for each domain, the maximum possible score is 15 if all domams are rated very high (5). From a scaling point of view the scores are ordinal m nature (Guttman, 1944; Crocker and Alghia, 1986; Vhanza, 1999; Trochim, 1999). Scores of 12 and above are high and represent substantial detail of anatomy for a clinical case. A score of 9 - 11 is average detail, and scores of 8 and below are low for the purposes of directing leammg issues and priorhisation of which clinical condhions should be studied. The CAKI is scored as a three domain operation, i.e. $n(DC)+n(I)+n(T)$ to address direct learning issues so that low scores may be scmtinized for possible leaming issues where a single domain may warrant study of anatomy for that domain in a clinical condhion. The CAKI score must always be interpreted having in mind the specific objectives; identification of clinical cases that require substantial detail of anatomy in order to priorhise and identify anatomical learning issues.

253

The basic theoretical assumptions for the constmction of the CAKI are, first, that

Table 5.2
Sex Distribution of the CAKI Respondents

	Frequency	Percent	Valid Percent	Cumulative Percent

a. The most potent measure (in this case the most detailed) of the variable is scored the highest, followed by the rest in descending order. This has been achieved by arranging the index items in a logical order such that the least intense or powerful indicators gradually build to the most powerful ones.

b. The total score thus reflects a pattern of answers, not just the sum of individual responses.

The CAKI has been scored according to the domains so that divergent patterns (the three domains) of the clinical aspects of a case are reflected m divergent total scores.

CAKI validation scores. Forty-four doctors participated in the validation of the CAKI. Thirty-one participated in investigating if the Index was ordered (ranking without the CAKI) and sixteen participated in investigating whether the CAKI correlated with the results of the ranking done whhout the CAKI. Table 5.2, and figures 5.2 and 5.3 show the profile of the doctors who participated by sex, by

rank and by department, respectively. Seventy-two per cent of the respondents were male and twenty-one per cent were female. This trend is probably a reflection of the male-to-female ratio of the doctor

population. Only six percent of the participants did not hidicate their sex on the
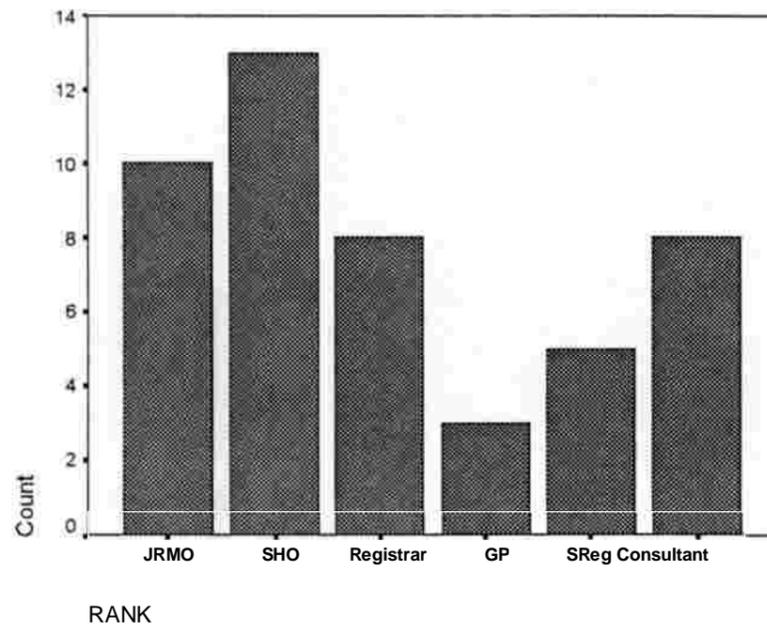
forms (indicated as 'missing' in the table).
Figure 5.2
Frequency of CAKI Evaluators by Rank

In the medical hierarchy junior resident medical officers and senior house officers are considered junior doctors, registrars as intermediate, senior registrars and consuhants are regarded senior. There was equal representation of doctors from the two categories. This indicates that there was probably no bias in the evaluation by virtue of rank in the medical hierarchy. Representation from the four major clinical departments was also comparable and thus no bias existed by virtue of practice from a particular discipline (see figure 5.3 below)
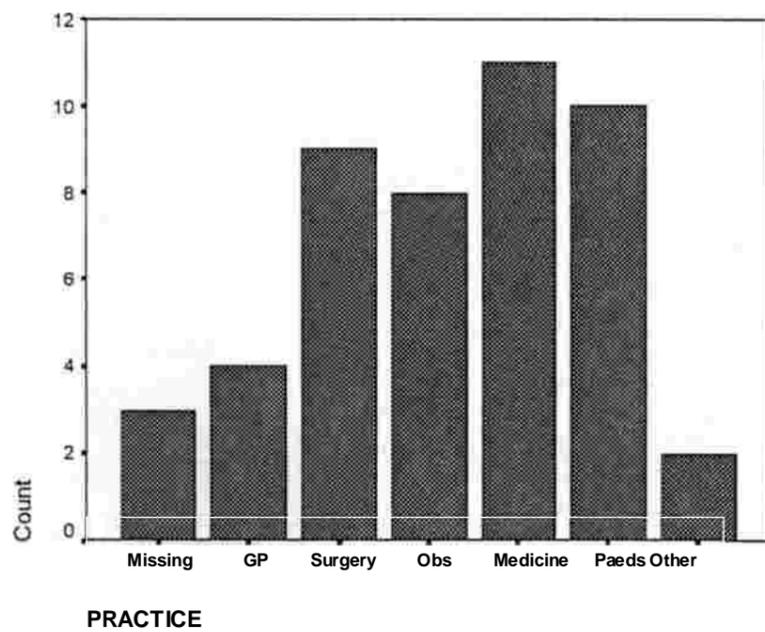
Figure 5.3
Frequency of CAKI Evaluators by Department • (Missing =
did not indicate specialty)

Respondents were requested to rank four items in terms of anatomical detail required for diagnosis, interpreting of investigations, and implementing the course of treatment. For each domain, respondents had to rank the four items from the least to the most in terms of anatomical demand for the exercise at hand. Taking hito consideration missing values in data collection, there were 31 valid responses for items qla, qlb, qlc, qld and 29 valid responses for items q2a to q3d (appendix 7 -ranking without the CAKI). For the ranking done with CAKI (appendix 7) there were 16 valid responses for items qla through to q3d. The rehability scores, i.e., the proportion of all the respondents agreeing on the classification of each of the items for was computed for all the 12 items. The reliability scores are presented m table 5.3 showing the comparisons between rankhigs with and without the CAKI.

Table 5.3
Reliability Scores for Rankings With and Without the CAKI

	Qualitative	Quantitative
Goals	• Develop sensitising concepts • Describe multiple realities • Develop understanding • Empowerment of marginalized groups	• Theory testing • Statistical description • Show relationship between variables • Prediction
Design	• Hunch as to how you might proceed • Evolving, flexible, general	• Structured, predetermined, formal, specific • Detailed plan of operation
Data	• Descriptive • Personal documents • Field notes • Photographs • Official documents/artefacts	• Quantifiable coding • Counts, measures • Operationalised variables • Statistical
Sample	• Small • Non-representative • Theoretical sampling	• Large • Stratified • Control groqp • Random selection • Control for extraneous variables
Techniques or Methods	• Observation • Reviewing documents/artefacts • Participant observation • Open-ended interviews	• Experiments • Survey research • Structured interviewing • Structured observations
Relationship whh Subjects	• Empathy • Emphasis on trust • Equalitarian • Intense contact • Subject as friend	• Distant • Circumscribed • Short contact • Subject-researcher
Data Analysis	• Inductive • Ongoing • Constant comparative method	• Deductive • Occurs at conclusion of data collection • Statistical
Problems in Using the Approach		

* Bold numbers = Reliabilhy Score for Ranking with the CAKI
* Plain numbers = Reliability Score for Ranking whhout the CAKI

On all the hems that were ranked the hem ranked highest in the area of choice concerning whether h had the least or the most demand for knowledge of anatomy was identical in all the cases (with or without the CAKI). The reliability scores were similar.

Table 5.4
The Item whh the Highest Reliability Scores Whh and Whhout the CAKI

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables
Techniques or Methods	
• Observation	• Experiments
• Reviewing documents/artefacts	• Survey research
• Participant observation	• Structured interviewing
• Open-ended interviews	• Structured observations
Relationship whh Subjects	
• Empathy	• Distant
• Emphasis on trust	• Circumscribed
• Equalitarian	• Short contact
• Intense contact	• Subject-researcher
• Subject as friend	
Data Analysis	

Qla = Question hem on CAKI questionnaire; R= Rank order (1 - least, 4 - most)

diabetes mellhus, pneumonia, and aneurysm) both sets of respondents (those ushig the CAKI and those not using the CAKI) ranked diabetes mellhus as demandhig the least knowledge of anatomy. Both sets of respondents also ranked diagnosing an aneurysm in a brain artery as demanding the most anatomy. The reliability scores on all the rankings (least anatomy - rank 1, second least - rank 2, second most -rank

<u>Evidence that the CAKI truly functioned as an ordered (low - high) scale</u>

3, most anatomy - rank 4) were comparable between the two sets of the

<u>when applied by raters.</u> Ranking whhout the CAKI: The respondents were
respondents.

asked to rank the clhiical scenarios in order of low to high in terms of the detail of anatomical knowledge required, whhout referring to the CAKI. The resuhs indicate that there was good agreement between the respondents. The reliability score for the most selected hem, on all the twelve hems, ranged from 0.552 to 0.897. The mean reliability score was 0.785.

Ranking with the CAKI: The respondents were asked to rank the same clmical scenarios in order of low to high m terms of detail of anatomical knowledge requhed, using the CAKI. The resuhs indicate that there was good agreement between the respondents. The reliability scores for the most selected hem, on all the twelve hems, ranged from 0.500 to 0.938. The mean reliability score was 0.767.

<u>Comparison between rankings without the CAKI,and rankings with the CAKI.</u> Table 5.5 illustrates the salient comparisons between the rankings whhout the CAKI and those with the CAKI.

Concerning making a diagnosis, of the four hems (hidirect mguinal hemia,

Correlation between the resuhs obtained from the two sets can be considered evidence in indicating how well the CAKI works in sorting out clinical scenarios in terms of the detail of anatomical knowledge required for diagnosis, interpreting investigations and accomplishmg the treatment. The Pearson correlation coefficient was 0.60 indicating a positive correlation. This value suggests that as the ranking without the CAKI increases so does the rankhig whh the CAKI and thus does reject the hypothesis that there is no relation ($r = 0$) between the sets of ranking.

For interpreting investigations, interpreting blood sugar results was considered demanding the least knowledge of anatomy. Interpreting cross sections of computerised tomography of the abdomen and interpreting angiograms of arteries of the brain were both considered as either the most or the second most in demands of anatomical knowledge, by both sets of respondents. There was no clear discrimmation between the two m terms of rank.

Whh regard to requhement of knowledge of anatomy for executing a course of treatment, both sets of respondents ranked operating on aneurysm as the most and controlling hypertension whh oral drugs as the least demanding of anatomical knowledge. Operating on an inguinal hemia was ranked second and inserting an intercostal drainage as thhd from the most ranked in anatomical knowledge demands.

The resuhs show that respondents ranking the hems whhout the CAKI had wider distribution of choices whh at least one respondent rankhig each item as ehher first, second, third or fourth. On the other hand for the respondents usmg the CAKI, the options for first, second, thhd, and fourth were more imanimous for the selected options. This could indicate that the rankings with the CAKI made the exercise more precise.

to score qune differently. If the CAKI is a good instrument, although users can give different scores for the same clinical scenario, theh pattem of scorhig should be similar. That is, cases with high anatomical content should receive scores higher than average content cases, and average anatomy content cases receive higher scores than low anatomy content cases notwithstanding that two users can differ on the precise score on a particular clinical scenario. This feature was tested using the SPSS Intraclass Correlation Coefficient (ICC). This test investigated consistency rather than absolute agreement. The resuhs are shown in table 5.6 below.

Table 5.5

Correlation of Reliability Scores With and Without CAKI Rankings

Correlations

		NO CAKI	CAKI
NO CAKI	Pearson Correlation	1.000	.596
	Sig. (2-tailed)		.041
	N	12	12
CAKI	Pearson Correlation	.596	1.000
	Sig. (2-tailed)	.041	
	N	12	12

* Correlation is significant at the 0.05 level (2-tailed).

Furthermore, the probability associated with 0.60 is 0.04 (significant at 0.05) indicating that the correlation does differ significantly from 0.

Table 5.6

Intraclass Correlation Coefficient Test for Consistency of the CAKI

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical descriptio
• Develop understanding	• Show relationship b
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predete
• Evolving, flexible, general	specific
	• Detailed plan of ope
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised vari
• Photographs	• Statistical
• Official documents/artefacts	

*: Notice that the same estimator is used whether the interaction effect is present or not.

These resuhs show the average of the scores of the four anatomists-physicians are highly reliable (mterval of .7760 to .9830 with 95 % confidence), suggesting that despite their apparent differences in scoring particular clinical scenarios, the CAKI was successful in guiding the respondents to separate different levels of detail of anatomy required for the many (8) clmical scenarios.

The Different Kinds of Knowledge of Anatomy: The Two Anatomies Previous scholars (McGregor, 1932; Baxter, 1950; Healy, 1969; Snell, 1986; Mathers et al., 1996; Moore & Agur, 1996; Ellis, 1997) extrapolated the identity of the stmcture and nature of anatomy used in clinical practice from ehher experience or expert opinion. This was reflected in the approaches they took in defining the content of theh texts. The approaches are presented in the Iherature review.

first to be considered followed by aspects of relevant anatomy of the area concemed. This way the anatomy that the clinician requires is better defined.

Sinclah (1975) coined the phrase the 'two anatomies', the first referred to anatomy concemed with structural morphology and scientific enquiry (most of which has no direct clinical relevance), and the second referred to clinically relevant anatomy. The findings of this study support Sinclair's concept of the two anatomies. First, the outline of content, as an example, of a tradhional anatomy of, courses in clinical anatomy, in which anatomy knowledge was dictated by the course (derived from the

None of the approaches stated were investigational studies of clinical practice. The result was courses in anatomy, that also discussed clinical applications, instead

needs of clinical practice.

This study used content analyses, crhical incident techruque, inventory of records and participant observer techniques to emphically define the clinical methods concepts, the burden of clinical work, and clinical procedures that clinicians deal whh commonly. The anatomical themes eminent in these are then used to define the content of the anatomy that clinicians require. This approach is unique to this study; no similar approach, specific to anatomy, was found in the literature.

Table 4.2, themes of anatomical knowledge that impact clinical practice in Zambia, the concept map of the role of anatomy in clmical practice, clinical cases whh high case anatomical knowledge index and fi-equently performed clmical procedures in wards, clinics, operating theatre form the basis of content. This approach is substantially different from previous approaches. In them, anatomy is paramount (first) upon which aspects that may be clinically relevant are

supplementary. The approach in this study is different in that clinical practice is the

joints). Even more: the upper limb (fasciae, cutaneous nerves, superficial veins,

lymphatic drainage, pectoral muscles, axilla, back and shoulder regions, arm, wrist,

hand, joints), the head (skull, face, scalp, cranial meninges and cerebrospinal fluid,

brain, orbh, temporal region, temporomandibular joint, oral cavity, pterygopalatine

fossa, nose, ear), neck (fasciae of the neck, triangles of the neck, deep structures hi
literature and the UNZA anatomy courses) is compared to and contrasted whh the
neck, root of the neck, lymphatics of the neck, cervical viscera), and craihal
content derived from this study, and second, the fmdings of the component of the
nerves.
research design that tested the existence of these two anatomies in medical

education are discussed.

Comparison of Content m a Tradhional Anatomy Course to that Defmed by this

Study

Outline of content from a tradhional course. In traditional courses content

was organised around four main components: gross anatomy, histology,

embryology and neuroanatomy. The gross anatomy corr^onent included content

under the headings: anatomical and medical terminology, skin and fascia, skeletal

system, muscular system, cardiovascular system, lymphatic system, nervous

system The other gross anatomy content was organised by body regions: thorax

(thoracic wall and cavity), abdomen (Abdominal wall, perhoneum, perhoneal

cavity, abdominal viscera). Others were: the pelvis (pelvis osteology and pelvic

viscera), the perineum, the back (vertebral column, muscles of the back, spinal

cord, and meninges), lower limb (bones, nerves, vessels, poplheal fossa, leg, foot,

joints). Even more: the upper limb (fasciae, cutaneous nerves, superficial veins,

hours dedicated to learning tradhional anatomy have varied, on average: 760 hours in Brhish schools; 220 - 440 hours in American schools, 480 - 920 hours in Canadian schools (Mainland, 1935). More recent Heylings (2002) reported on hours allocated for anatomical components in Unhed Kingdom medical schools:

1. Traditional curricula: gross anatomy 160 hours, histology 66.3 hours, embryology 20 hours, neuroanatomy 48.3 hours.

Topics in histology included: epithelium, connective tissue, muscular tissue, nervous tissue, circulatory tissue, lymphoniyeloid complex, endocrine glands. Others were integument, alimentary system, respiratory system, urinary system, male reproductive system, female reproductive system, audhory apparatus, visual apparatus, olfactory apparatus, bone development and tooth development.

The embryology course hicluded: gametogenesis, fertilization, bilaminzu- germ disc, gastrulation, embryonic folding, development of systems (e.g., resphatory, gastrointestinal, circulatory, nervous), development of head and neck, development of eyes and ears, development of the bram and cranial nerves, foetal development and the foetus as a patient.

Neuroanatomy included: cells of the central nervous system, peripheral nervous system, spinal cord, brain stem (extemal anatomy, nuclei and tracts), cranial nerves. Others were the cerebellum, reticular formation, topography of the cerebral hemispheres, functional localisation in the cerebral cortex, medullary centre, intemal capsule, lateral ventricles, olfactory system, limbic system Further topics included: general sensory systems, visual systems, audhory system, vestibular system, motor systems, visceral innervation, blood suppy and the meninges.

The outline given above is only an example, courses varied. Over the years the

requirements for clinical practice. It is therefore more contrived, specific, focussed, relevant to clmical practice and senshive to the disease burden and prevalence. The matter of specific diseases may engender scepticism about geographical relevance; this may be so but the study developed the CAKI method to be used as a tool for generating local lists. The codmg frame for content

2. Problem-based leaming: gross anatomy 20 hours, histology 20 hours, embryology 10 hours, neuroanatomy 30 hours.

3. Systems-based leammg: gross anatomy 116.3 hours, histology 31.8 hours, embryology 10.1 hours, neuroanatomy 20.3 hours.

4. Survey overview: gross anatomy 124.5 hours, histology 36.4 hours, embryology 12.9 hours, neuroanatomy 27.5 hours.

5. Fitzgerald recommendations: gross anatomy 155-192 hours, histology 24 hours, embryology 24 hours, neuroanatomy 41 hours.

6. UNZA Anatomy courses: gross anatomy 224 hours, histology 128 hours, embryology 64 hours, neuroanatomy 48 hours. *(The figures in no. 6 are not from Heylings, 2002. They are UNZA figures.).*

This demonstrates that there is considerable variation in level, content and depth of teaching of anatomical curricula.

Outline of content from the study. The structure of events and content in the proposed course (Table 5.7 in section 3) presents the content of the course. The

content derived from the study is based on a needs assessment of anatomy

analysis for anatomical concepts can also be used for defining the prominent anatomy played an important part of the anatomic training of physicians in Russia. themes in clinical methods textbook used in specific univershies.
The components of

The survey of clinically relevant textbook did not find any book with content organised similar to this study. The study also reviewed Iherature about clinical anatomy curricula and programme models existing. What this enquiry found could best be described as a mixed bag of programmes, programme goals and instructional formats. All courses cited one common goal: "Improvmg the relevance of anatomy teaching to clinical practice". Addhional goals were to teach in clinical context, reduce learning of irrelevant material, teach higher-order intellectual skills such as problem-solving, teach in a problem-based leaming format. The clinical anatomy courses reflected a variety of programme models and strategies, both short courses and semester long courses.

The Zagreb clinical anatomy course (Percac and Armstrong, 1998) was a second year course taken after a prior 180 hours of anatomy. It was structured as an eight week course with 30 hours of tutorials, 14 hours of lectures, and 16 radiology sessions. Its five modules were clinical anatomy of extremities; thorax; abdomen; urogenhal system; and head and neck. Each module had lectures; a "progressively

disclosing" case, and one to two radiology sessions. The evaluation of the Zagreb

many, pre-requishes of basic anatomical knowledge were required or implied. The study has spelled out the topics for the pre-requishes.

Of note is that the course content found in tradhional anatomy courses was different fi-om that found in most clinically oriented courses, which in tum were different from the content generated in this study.

the Russian chnical anatomy, as reported by Kagan (2002) included topography of body regions, that is, anatomical landmarks, anatomical layers, and the projection of organs, blood vessels and nerves on the skin surface. The topography of an organ would include: " Holotopy - the special orientation in the region; Skelotopy - the poshion of the organ in relation to the skeleton; Synotopy - the relationship of the organ with surrounding organs, blood vessels, and nerves"(Kagan, 2002). The Russian clinical anatomy course followed a prior anatomy course and was offered in years three and four.

The clinical anatomy course reported by Tavares et al. (2002) was introduced in 1995/96 at their medical school. The course was approached regionally: head and neck; thorax; abdomen; pelvis and perineum. For each region the consthuents were: concepts and anatomical organisation; surface anatomy; sectional and imaging anatomy; variations and anatomical malformations; and case studies (Tavares et al., 2002).

Creighton University (Creighton University website, 2002) described a postgraduate course for clinical anatorny course for faculty who plan to teach clinical anatorrty. The Iherature review can be consuhed for flill details. What was common about the courses and many clinically oriented textbooks was that, for

passed both the tests. This supports the hypothesis that there are two anatomies in medical education. The 3"" year preclinical students possessed knowledge of anatomy that was different from the knowledge of anatomy that doctors possessed.

Of hiterest to medical education reformists, and to this study, is the clinical anatomy.

Testing for the two anatomies in the continuum of the medical education.

This study investigated which cadre on the medical professional conthiuum possessed which anatomy. Four groups of respondents took two tests each, one m pure anatomy and the other in clinical anatomy. The groups were:

a) preclinical students (year 3), who had completed a year of leaming anatomy taught mostly by the tradhional methods, i.e. dissection, lectures, histology practical classes.

b) Preclinical students (year 4), who had completed the year-3's course, a year earlier, and in addition had completed the UNZA clmical anatomy course (seminars on clinical cases, anatomy of clinical examination, and clinical surface anatomy).

c) Clinical students (year 5 and 7) - Year-5 students had taken the year 3 and 4 courses. The year-7 students had completed year-3 courses, but the year-4 clinical anatomy course had since changed somewhat.

d) Doctors - Most of the doctors may not have taken a standalone clinical anatomy course.

The doctors failed the tradhional (pure anatomy test) whilst the preclmical (year 3) failed the clinical anatomy test. The preclmical (year 4) and the clinical students

knowledge that the doctors possessed. The preclinical 4 group passed the test 2 (mean score 64) demonstrating that the intervention was poshive and the preclinical 4 group had acquired the anatomical knowledge that doctors possessed.

The statistical difference between preclinical 4 and doctors ($p < 0.0005$) was
The working hypothesis for the tradhional (pure) anatomy test was that 'the
because the average mean score for preclinical 4 was much higher than the doctors.
doctors studied traditional (pure) anatomy, at least four years ago, and had smce forgotten the traditional anatomy because they are not applying h hi their day-to-day work, otherwise they would remember it. The control group m this case were the preclmical year 3 group who had studied tradhional (pure) anatomy in the same year of the test. The resuhs on test 1 showed a significant statistical difference ($p < 0.0005$) between the preclinical year 3 group and the doctors. The doctors as a group failed test 1.

The working hypothesis for the clinical anatomy test was that doctors possess clinically relevant anatomy and that this anatorrry can be taught to preclinical students. A lower stratum hypothesis is that this clinical anatomy being investigated has been correctly identified and is the one taught m the clinical anatomy course. The preclinical year-4 in this case were the subjects and the clinical anatomy course was the intervention (treatment). The preclinical year-3 group were the control in the research design. The resuhs on test 2 showed a statistical significant difference ($p < 0.0005$) between preclinical 4 group and preclhiical group 3. The doctors passed test 2 (mean score 50) and were also sigiuficantly different ($p < 0.027$) from the preclinical 3 group. The preclinical 3 group failed test 2 (mean score 43) so they did not possess the anatomical

or not in support of its hypothesis and answers could come either way. The critique of individual methods is now presented.

Critique of the Research Design and Methods If the research is properly designed the answers to the research questions can come either in support or not in support of a hypothesis. Researchers must be ready to accept the fmdings. Given the research design h was possible for this study to support or not support the hypothesis that the anatomy taught m traditional (Flexnerian) anatomy courses was different from the anatomy used hi clmical practice. Similarly the research design could ascertain the amount, whatever the proportions, of anatomy inherent in clinical methods; h could describe the nature of the anatorrty concepts whatever the amount that was inherent m clinical methods. Considering the anatomical knowledge that determines success and/or failure the number of themes or categories generated were dependent on actual reports of incidents and could not be predetermined. For the tools (CAKI, Coding instructions for content analysis), that were developed to measure selected phenomena, the possibility that validity and reliability tests could be sigruficant or insignificant was present. The research design allowed for one to conclude that the detail of anatomical knowledge requhed for diagnosis, investigation, and treatment of a clinical condhion could or could not be estimated consistently. This research design could yield results either in support

The Anatomy Research Test

All the tests were voluntary and anonymous. The purpose of the test was explained fully to all the respondents, and they had the option not to take the test. On one occasion two students declined to take the test. Therefore, informed consent was obtained firom study participants before the test and, as such, the resuhs could be considered ethically valid. In the study process the information that was withheld

Critical Incident Technique

One hundred and forty doctors and 28 medical students reported the critical incidents. The doctors were represented m surgery, medicme, obstetrics, and paediatrics and at different levels of seniorhy (consuhants, senior registrar, registrar, general medical officer, senior and junior residents). Whilst there was no bias in the sample based on respondent profiles it is important to note that these proportions, and all other quantitative descriptions of respondents and hicidents contained in the full resuhs, should not be considered unbiased estimates of the experiences and characteristics of the total population of doctors in Zambia The respondents were not selected necessarily on the basis of theh proportional representation in the doctor population. Moreover, in obtaining the accounts of specific incidents, respondents were asked to report on those that were a success or a failure, rather than the typical daily use of anatomy. From a methodological standpomt, the effort has been successful because doctors of all grades and from all the regions provided the information. The mcidents reported had enough detail of the anatomy that was used or was lacking, to support the development of the 15 themes of anatomical knowledge, which can help determine success or failure hi clinical shuations.

Participant Observer Technique

Persons more acquahited to quanthative research methods could fmd this technique less convincing, as they perceive the method as rather subjective. The discussion concerning views about qualitative research methods have been earlier discussed in the Iherature review. Comprehensive discussions can be reviewed in Buroway (1994) and Tyrell (1998).

from the participants was about the nature of the sessions they were being mvhed to. At invitation the respondents were not informed they would be shting a test.

This was for two reasons: a) to prevent those that had sat the test earlier discussing it with prospective study respondents for the purpose of improvmg the latter group's performance, b) to avoid discouraging prospective respondents and biasing the sample by having only those that were confident of passing attending the test. From a methodological point of view this was successful. It was noteworthy that doctors, even a professor, agreed to sit the test when they were under no obligation to do so. It was also noteworthy that only two students out of about 170 declined to take the test.

CAKI Scores

In comparmg the investigations (e.g. blood sugar and bram angiogram) and diagnosis (diabetes mellhus and aneurysm) one could argue that h is a comparison between unlike hems. In fact this is not a comparison of unlike hems but a test to mvestigate the existence of a rank order in terms of demand for anatomy. The comparison is in fact at the level of rankings obtained without and those whh the

273

CAKI.

research approaches and research methods particularly the use of methods from clinical and basic sciences m educational research. Complexity, randomisation and control, sample size, and choice of outcome measures have been of special interest in the crhiques (Prideaux, 2002). In particular, Prideaux (2002) stated that the critiques have been concemed with the merhs of quanthative designs over those of qualitative designs in what he calls "biomedical elhism of quanthative design".

Content Analysis

Kneebone (2002) offered thoughtfijl advice: "medical education emphasises a
After validating the coding instructions for the exercise of identifying the positivist (scientific) approach to knowledge
anatomical concepts only one textbook Hutchmgson's Clinical Methods (Swash, 1989) was analysed. Two factors contributed to analysing only one text: a) h has been the prescribed textbook for clinical methods at UNZA for over 15 years, b) the constraints of time and resources. Ideally another, equally reputable, textbook would be content analysed and the anatomical themes generated compared. This could help explore whether the anatomical themes generated are textbook dependent. From a methodological standpoint the exercise was successful and the coding instructions were found reliable in consistency.

The methods employed m this study were used successfully. None of them presented a peculiar problem worthy of detailed discussion. The views concerning the merhs and demerits of qualhative and quanthative methods are not unique to this study. The interpretation of resuhs in many instances may depend on the experiences of the mterpreter. It is noteworthy to point out that this study used both the qualhative and quantitative methods. Prideaux (2002) discussed the crhiques of

places outside Zambia

3. The scope of coverage in Zambia and the sample size of the doctors studied were limited by financial and logistic constraints but were within statistical and methodologically acceptable levels.

4. The total of clinically oriented textbooks is not known. The sample of the books reviewed may be representative of only the commonest books available to the researcher.

but educators need to develop insight of differing world views (naturalism) to develop skills to interpret educational Iherature." Kneebone (2002) emphasised that the effectiveness of the scientific approach, for the questions best suited for a scientific approach, should be recognised. Additionally, he stated that not aU questions could be approached by the scientific method and other paradigms needed to be explored and educators needed to be aware of these alternative paradigms. His caution and advice are encapsulated m his statement;

"When your field of study is people, not molecules, there are many different versions of reality and many different ways of knowing".

Limitations of the Study

1. Alternative mterpretations are possible for the participant observer interpretations. However considering vahdity measures they are unlikely to be significantly different.

2. The fmdings concemmg disease prevalence may not be generalised to

5. The presence of the researcher, well known to many as an anatomist, may have made the observed doctors pay more attention to anatomy related matters.

6. The number of doctors that participated m the research anatorrty test was half of that calculated for the desired sample size to achieve a statistical power of 90. In that respect the power of the statistical significance was less than that planned for.

Notwithstanding the limhations of this study, the fmdings and conclusions are acceptable; guidelines and tenets of quanthative and qualhative study paradigms were observed.

which had been envisaged in the late 1980s. This new course at inception consisted primarily of applied anatomy seminar topics and self-study. From mception, in 1997, this researcher had the opportuiuty to serve as course co-ordinator. The Department of Anatomy has been evaluating, continually, the clinical and applied anatomy course. Exposure to this course also histigated, in part, the study reported herem.

In view of the on-going research of this study, m the last two years (2001/2, 2002/3) the course has evolved. The course now hopes to achieve hs aim using introductory lectures, seminar presentations, anatomy of clhiical examination

The UNZA Clmical Anatomy Course

Context

The University of Zambia has a discipline-based curricula whh two years of mainly basic science and three years of mainly clinical education. The basic sciences include anatomy, physiology, biochemistry, psychology, pathology, microbiology, parashilogy, and pharmacology. The anatomy course was previously a one-year course consisting of embryology, histology, neuroanatomy, and gross anatomy. Prior to 1996, applied anatomy semmars (hicluding ward visits and presentations) were integrated in the single anatomy course (AN 310). In 1997, when the semester system was introduced in the School the Department of Anatomy seized the

opportunity to create a separate course "Clinical and Applied Anatomy (AN 432)",

added something new to the medical education curriculum in that h achieved an outcome different from the standard prior anatomy courses. The preclinical 4 group (subjects who were taught clinical anatomy) scored significantly, on average 14 marks, higher than the doctors on test 2. This could mean that the anatomy used by sessions, ward visitations and student centred problem-solving case studies. The introductory lectures are aimed at teachmg the principles of history-taking and physical education so as to provide the students the clinical context that is universal in chnical practice. The seminar presentations are done in groups. Students are allocated a topic and then they identify a patient or case consistent with .the topic. During the seminar they present the history and physical fmdings of the patient and then discuss the relevant anatomy. The aim is not to duplicate clhiical presentations done in clinical years m which medical knowledge (and not anatomy) is the purpose. Ward vishations are aimed at observing clinical procedures to whness how anatomy is applied in clinical practice. The anatomy of clinical examination practical sessions are not aimed at teaching physical examination per se but to impart practical anatomical knowledge needed for physical examination. This aim is far removed from the aims of gross anatomy were topography is part of a general assemblage of understanding body stmcture. The course hopes to build on anatomy leamed from previous anatomy courses by integratmg the knowledge with clinical knowledge and concepts. The course provides a course manual to guide students and espouses student-centred self-directed leaming methods.

One important hicidental finding, in the study, was the result of the tradhional anatomy/clinical anatomy tests. The resuhs showed that the clinical anatomy course

doctors had been correctly identified, i.e., the doctors also passed the clinically relevant anatomy test. •

The UNZA anatomy course benefited from the study and also served as a 'laboratory' *for* trying the concepts as the evidence emerged. Developmental testing is considered acceptable in medical education.

Evaluation

The full evaluation results of the students of the 2000/2001 students and 2002/3 are appended (appendix 8). Summaries of the findmgs are presented below.

Neccessity

40 T --- 1
Neccessity
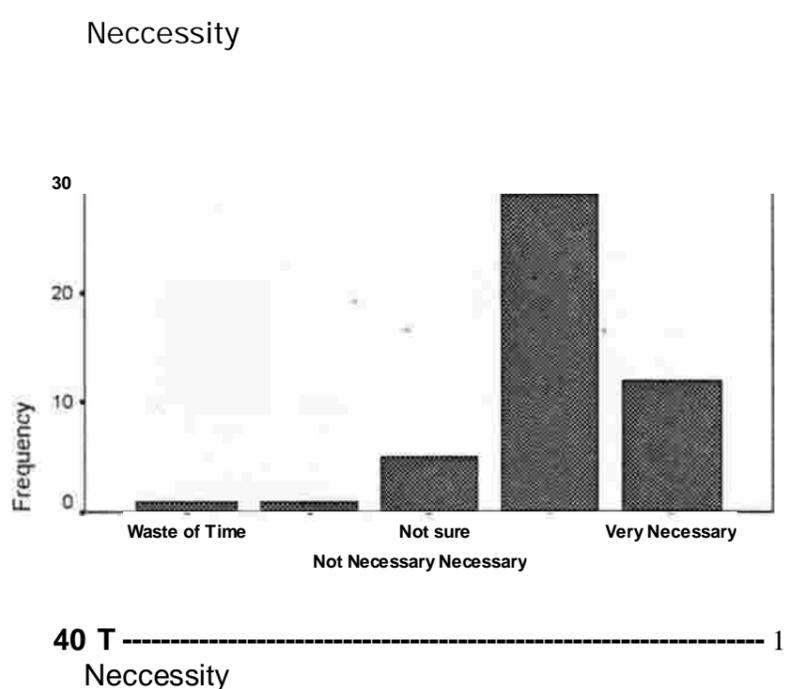
Figure 5.4
Frequency of Responses Concerning Necessity of the Clinical Anatomy Course

The Cronbach's alpha for reliability for the 2002/3 evaluation was 0.7 for the scale that measured necesshy of the course, relevance to medicine, motivation to learn anatomy. The correlation coefficient for course components was 0.6. The evaluation

exercise for that year was considered reUable. No rehabihty statistics are available for 2000/1 because the required statistical software was not available, to the Department, then.

The respondents' answers to the question "considering that you have already completed the general anatomy course, what are your ratmgs about the necesshy of the clinical anatomy course" are shown in figure 5.4.

Understand Relevance
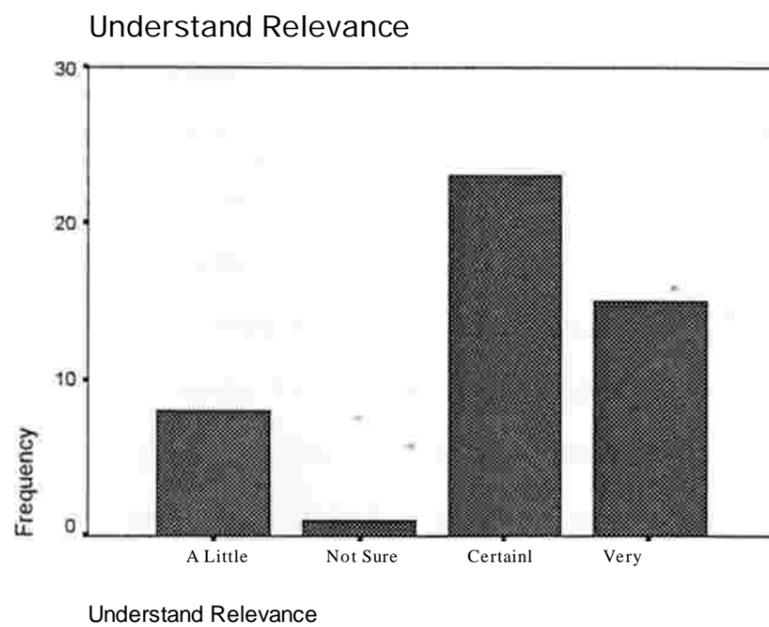
Figure 5.5
Frequency of Responses Conceming Understanding of Relevance of Anatomy to Clinical Practice

Eighty-five per cent of the students who had undertaken the course in the 2002/3 academic year believed that the course was necessary even if they had completed the general anatomy course. An enlightening comment related to the course was the frequent observation that the course was a good bridging course between

after further study.

Developmental testing is important because educational programmes are a series of successive approximations, constantly approaching closer and closer the best programme (Odimba, 1999). The effort to evaluate educational programmes, as developmental testing, should also conform to the five main stages proposed by theory/preclinical classes and application of the theory m clinical practice. This Odimba (1999): view was supported by the responses to the question "Does the course improve 1. Determination of the needs of the population and hidividuals in order to meet your understanding of the relevance of anatomy to clinical practice" shown in their expectations. figure 5.5.

Seventy-nine per cent of the respondents believed the course helped them understand the relevance of anatomy to clinical practice. A further interesting finding in the evaluation was that 73 percent believed the course motivated them to leam anatomy.

All the components of the course were found useful by the students: 87 percent for the course manual (study guide), 85 percent for the clmical surface anatomy practical sessions, 83 percent for the anatonty of clinical examination practical sessions, 77 percent for the introductory lectures, and 71 percent for the seminars. The students feh that the course was too demanding m terms of time. In view of this comment the semester written assignment and the clinical surface anatomy practical sessions have been removed from the final proposal. This is so because no mitigating reason against removal could be perceived.- Another salient observation was the regular comment that the course could be better taught alongside gross anatomy teaching. In view of the Senate regulations this will have to be considered

2. Selection of teaching components m accordance with expected professional performance.

3. Implementation of the education programme involving both the formative environment and apprenticeship.

4. Evaluation of the education programme involving students, graduates, the acadenuc structure, teaching components, and teaching methods.

5. The evaluation should lead to a general feedback at each level of educational process: implementation of the education programme; development of programme and hs components; defmhion of national aims, demands, and needs.

should be adaptable to a wide variety of circumstances.

<u>Rationale</u>

The important constraints to consider are the few numbers of staff with both anatomical and clinical backgrounds who are available in the University of Zambia, and the University Regulations which may not allow for hinovation whhout first amending the relevant policies. In addhion, the limhed time available for the course is 16 weeks (one semester). In this available time, the staff must plan the course, prepare teaching materials, conduct the course and assessments. Students will also

Core Clinical Anatomy Cm-ricnlmn for Undergraduate Medical Education in Zambia

Introduction

The course wiU be predommantly knowledge-oriented with some discipline orientation. The aim is to get the student to leam and apply the subject matter mcluded in the course. Such subject matter will make up the basic core of the discipline. The student must acquire a grounding of knowledge m this subject matter in order to be considered as having completed the cour5.e. The methodological component will be discipline oriented and as such used to develop process objectives i.e. life-skills, scientific writing, and clmical reasoning. The discipline-oriented component is envisaged to be leaming a methodology that

283

have 16 weeks to devote to the course in addhion to the other courses that will make demands on them also. Other constraints will include shared lecture rooms (for lectures, seminars, and tests), and clinics for practical lessons. The ability of the students on entry is an important constraint in this shuation.

The student is considered to be responsible for his leaming and is expected to be self-motivated and self-directed. The role of the teacher is considered to be that of facilhating learning and providing feedback and guidance. This leaming structure is cognisant of the fact that a course is structured not only by hs teachhig-leammg methods, hs critical events, and flow of ideas, but also by the perceptions of the students and lecturers conceming their roles.

The course has not been stmctured around a sequence of ideas. The cburse entails the study of a number of separate anatomical topics or themes, important to clinical practice; each is more or less independent. In a field as diverse as clinical practice h is not easy to agree on any logical sequence of ideas, and the regions of the body can be tackled independently.

Training will be the educational milieu in which the student will be expected to learn the central role of anatomy in clmical practice.

1. To hitroduce students through the medium of clmical anatomy to reason clinically, to leam to be critical, to express themselves lucidly.

2. To introduce students, in a general way, as to how most clmicians collect a medical history, examine a patient, and interpret the clinical data to formulate a diagnosis and treatment plan.

3. To instruct students through the medium of clinical anatomy in formulating leaming goals.   Aims and Objectives

Pre-requisites (Type 1 anatomy):

Basic principles of anatorny: a) anatomical nomenclature - position and movement, b) structure and function of basic tissue types - muscle, nerve, epithelia, connective tissue, c) structure and function of body systems, d) regions of the body, e) musculoskeletal - the skeleton and muscle groups, f) general embryology -gametogenesis, gastrulation, embryonic period, foetal period.

Aim

To introduce the student to the application of anatomical knowledge required in clinical practice. The student should know the role of anatomy, the prominent anatomical themes, the anatomical bases of common clinical procedures and operations, be aware of anatomical knowledge that determines success or failure,

and common clhiical cases that have a high mdex for anatomical knowledge.

4. To familiarise students with tenets of scientific writing.

The student should be able to:

1. analyse medical history and physical examination cases in order to establish which tissue, organ, region, and system (TORS Analysis) is involved.

2. discuss clinical examination as an anatomical process of assessing normal structure and function in order to detect altered structure and function.

3. identify anatomical structures in common x-rays, and computerised axial tomography (CT scans).

4. discuss anatomical knowledge that determines success and/or failure in common clinical situations.

5. define clinical anatomy and give examples of application of anatomical knowledge in clinical practice.

6. explain the anatomical basis of common clinical procedures and operations.

7. discuss the anatomical knowledge required for clinical cases with a high index for anatomical knowledge.

8. judge clinical cases for the detail of anatomical knowledge required for diagnosis, investigations and treatment (index for anatomical knowledge).

obtaining information and developing his own responses to *it*. In addhion, the student domg the seminar presentation should acquire considerable anatomical, applied anatomy, and clinical knowledge.

Structure of Events and Content

The structure of events will be contained whhin the 16-week semester and a mid-semester break. In each week the course is allocated two three-hour sessions. It should be noted that the structure of the course (table 5.7) is not the curriculum but a guide of activhies. The whole of section 3 represents the curriculum

Structure of the Course

Pedagogical Structure

The course is designed to be an on-campus course structured around self-teachmg materials and regular face-to-face contact with facilhators and with other students. The pedagogical structure of the course (the teaching-leammg system) will comprise mtroductory lectures, applied anatomy seminars, anatonty of clinical examination practical sessions, observations (ward vishs), problem-solving exercises. These activhies wiU be supported by reading of primary source materials related to the themes of the course. The student will also undertake a seminar paper for the topic the student participated in. The idea behind the seminar presentation is that the student should be able to formulate anatomy leamng goals from a case presentation, present the relevant anatomy subject matter, and discuss how h impacts diagnosis, investigations, and treatment for that particular case. By submittmg a seminar paper the student may acquire the necessary skills in

Table **5.7 '**
Structure of Events & Content in the Core Clinical Anatomy Course for Undergraduate Medical Education

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large
• Non-representative	• Stratified
• Theoretical sampling	• Control groqp
	• Random selection
	• Control for extraneous variables
Techniques or Methods	
• Observation	• Experiments

Table 5.7

and nasal turbinates, olfactory and respiratory mucosa, Little's area
Throat - Larynx as seen as laryngoscopy, divisions of pharynx
Eye - optic fundus & ophthalmoscopic examination, parts of the eye, eyelids, lacrimal gland, conjunctiva, comea, iris, <u>normal relations of the eye</u>

ry size and reflexes, the tentorium (supra-, trans-, infra- organs & lesions), mtracranial haemorrhage (subarachnoid, subdural, extradural), coning (brahis tem and cerebellar hemiation).

muscles of limbs, dermatomes
Autonomic nervous system
Blood supply of the brain & spinal cord; functional mapping of bram; limbic system)

			Activity (Teaching Method)	

Lecture	Anatomy of Clinical Examination		Ward Clinic Visit	Clinical Anatomy Seminar
3-4	Hearing apparatus axis (external audhory meatus, tympanum, oval fenestra, ossicles, and cochlea) 1. Cranial nerves (fimction, clinical disorders, and how to examine them) 2. Ear, Nose, Throat, & Eyes Ear - Tympanum and auriscope. Nose - Stmcture of nasal vestibule, nasal septum,	N/A	1. Head injury/t he comatose patient 2. Hyp ertensi ve stroke 289 Brainst em, pupilla	Clinical Cases and Self Shidy dinal fasciculi. Nervous system/ localising CNS lesions: Motor - lower motor neurones, corticospinal system, upper motor neurones, extrapyramidal system and cerebellum Sensory - spinothalartuc tracts Segmental irmervation of

Ocular movements, vestibular nuclei, medial longitu

O

1

Table 5.7 continued

Activity (Teaching Method)

	Lecture	Anatomy of Clinical Examination	Ward/Clinic	Clinical Anatomy	Clinical Cases and
P			Vish	Seminar	Self Study
5-6	N/A	Cardiovascular & respiratory systems	Inter-costal drainage	I. Ischaemic heart disease (blood supply of the heart, conducting system,	I. Congenital heart disease (septal defects, patent ductus arteriosus, Fallot's
		1. Anatomical landmarks of the chest wall.	Venous cutdown	relationship between myocardial regions.	tetralogy, coarctation of the aorta)
		2. Locathig peripheral pulses (radial, brachial, carotid, femoral. popliteal, posterior tibial, dorsalis		coronary vessels and ECG	2. The cardiac cycle
				2. Pulmonary TB	and heart chambers.
		pedis).		(bronchopulmonary tree and	
		3. Auscultation of heart sounds and valvular surface positions		segments)	
		4. Surface anatomy of the pleura and lungs			
		5. Radiographic examination of the heart and lungs (lateral and posterior-anterior chest x-ray)			

Table 5.7 continued

			Activity (Teaching Method)			
i *Xi* H g e o <:	7-8	Lecture N/A	Anatomy of Clinical Examination Abdomen 1. The 9 Regions of the abdomen & organs underlying 2. Anterior and posterior surface anatomy of abdominal organs 3. Position of common skin incisions 4. Plain and contrast x-rays of the gastrointestinal tract	Ward/Clinic Visit 1. Examination of women (cervix, gravid uterus & foetal parts). 2. Episiotomy 3. Examination of the placenta 4. Nasogastric intubation	Clinical Anatomy Seminar 1. Normal delivery & pelvic assessment 2. Intestinal obstruction/Inguinal hemia (bowel resection & anastomosis)	Clinical Cases and Self Study 1. Radiology in women (hysterosalpingography, x-ray pelvimetry, CT scan of pelvis) 2. Ectopic pregnancy 3. Hemiorrhaphy 4. Portal circulation of the abdomen & superficial veins seen in portal circulation obstmction

Test 1 (End of Week 8)

Table 5.7 continued

		Lecture	Anatomy of Clinical Examination	Activity (Teaching Method)		
				Ward/Clinic Vish	Clinical Anatomy Seminar	Clinical Cases and Self Study
(U ·c ɔ 1	9-10	Anorectal anatomy -ischioanal fossa & the perineum	N/A	1. Exammation of the male extemal genitalia - penis, urethral orifice, prepuce, glans, coronal sulcus, scrotum, testis, epididymis 2. Examination of th^ female extemal genitalia - vulva, labia majora, labia minora, clhoris, urethral orifice, vagina 3. Urethral catheterisation 4. Per vaginal & rectal examination	1. Peri-anal pathology (haemorrhoids, anal fistulae, fissures, abscesses) - anorectal examination: ischial spines, anus, anal canal, rectum, perineal body, ischioanal fossa). 2. The enlarged prostate	1. The stmcture of the kidney and urinary system. 2. The glomemlus, renal tubules, calyces, renal pelvis and ureters, bladder. 3. Identification of anatomical stmctures on mtravenous urograms. 4. CT scans of urinary system.

Table 5.7 continued

		Activity (Teaching Method)				
		Lecture	Anatomy of Clinical Examination	Ward Clinic Visit	Clinical Anatomy Seminar	Clinical Cases and Self Study
1 8 o J	11-12	1. Layers of the skin (epidermis «& dermis) -bums and skin grafts *.	1. Upper limb 2. Lower limb A. Bones of the upper/lower limb and the carpus/foot, radiographic examination B. Examination of the elbow/knee joints C. Nerves - upper limb (long thoracic, axillary, median, uhiar, radial), lower - assessment of function and surface anatomy D. Superficial veins E. Tendon reflexes F. Dermatomes	N/A	1. Fracture ulna/radius 2. Fracture hbia/fibula	1. Joints: cervical spine, thoracolumbar, sacroiliac, shoulder, elbow, wrist, fingers, thumb, hip, knee, ankle, and toes. 2. Shoulder dislocation 3. Motion at joints - flexion, extension, abduction, adduction, intemal rotation, dorsiflexion, plantar flexion

Table 5.7 continued

		Activity (Teaching Method)				
		Lecture	Anatomy of Clinical Examination	Ward/Clinic Vish	Clinical Anatomy Seminar	Clinical Cases and Self Study
o **1 1**	13-14	1. Congenital malfoiniations & teratogenesis 2. Screening for congenital abnormalities in the newbom	N/A	1. Prematurity Neonatal assessment of maturity (gestational age staging) 2. Examination of the head: fontanelles, sutures, and head circumference	1. Neural tube defects (hydrocephalus & spina bifida) 2. Down's syndrome (example of chromosomal abnormalities)	1. Developmental milestones - Central nervous system assessment 2. Grovv1:h monitoring of the child

Table 5.7 continued

			Activity (Teaching Method)			
i	**1**	Lecture	Anatomy of Clinical Examination	Ward/Clinic Vish	Clinical Anatomy Seminar	Clinical Cases and Self Shidy
	15	Lymph node groups (head & neck, axillary, ephrochlear, para-aortic, inguinal, external iliac, femoral)	N/A	Lumbar puncture (Anatomy of the structures traversed)	N/A	1. Shes for venepuncture, arterial puncture 2. Components of blood

Test 2 (Week 16)

Note: N/A = no session in that period.

lecture will introduce the students to clinical methods by providing an overview of history-taking, physical examination and case presentation. Upon this clmical context, anatomical interpretation of clinical data, i.e., TORS analysis will be presented. The lecture on the role of anatomy m clinical practice will present to the students the concept map of the role of anatomy highlighting both the pra<:tical and cognitive themes. The Case Anatomical Knowledge Index will be introduced and hs use explained to the students. The lecture on anatomical knowledge that determmes success or failure in clinical practice, and will offer the 15 themes of anatomical

Teaching Methods The following teaching methods are proposed:

- Lectures

- Applied Anatomy Seminars

- Anatory of Clinical Examination Practical Sessions

- Observations of Clinical Procedures (Ward Visits)

- Seminar Report (Scientific Writing)

- Independent Study, Questions and Exercises (Study Guide).

Lectures

The course provides for 11 hours of lectures (19 percent of the course hours). The introduction to clinical anatomy course will offer a defmhion of clinical anatomy, convey the rationale for the course, and present the evidence for the basis of the course. In addition, the different components of the course will be mtroduced and

the student will have to operate whh them. The seminars also provide leaming

opportunities to achieve most of the process objectives.

Anatomy of Clinical Examination Practicum

The course provides 21 hours for practical sessions (36 percent of the course hours).
knowledge that impact clinical practice ching examples from each theme. The
The essential concepts and structures of clinical examination of patients are buih
other lectures are specific to the anatomical theme under study. These lectures are
into

designed to provide opportimity for students to explore in detail the anatomical

knowledge, as well as provide examples of anatomical basis hi clinical practice.

Applied Anatomy Seminars

The course provides 14 hours for applied anatomy seminars (24 percent of the

course hours). The underlying themes for these seminars are to get students to apply

the TORS analysis to clinical cases, formulate anatomical leaming goals and

evaluate how they impact on diagnosis, investigation, and treatment of their case. In

addition, the seminar topics will be selected from the commonest high-CAKI cases

and will also provide considerable amount of factual anatomical information

because h will have been used in memorable context. Clinical seminars are

particularly noted for the high-level of motivation they have generated in students,

in the past. This could be explamed by the relevance of the anatomical knowledge to

clinical shuations, and the students are involved as the key players rather than

passive recipients. The essential concepts of these real-life shuations like clmical

reasonmg, and application of anatomical knowledge could also be leamed because

may also record additional observations. Real patients, real procedures observed whh educational intent will provide the stimulus to leam the relevant anatomy from these procedures. The clmical procedures were carefully selected from the research study and will be the ones most commonly encountered. While opportunities for observmg and performing these clinical procedures exist m latter years of the the anatomy of chnical examination. The student follows sets of examination curriculum the instructions from the study guide and performs them; in the process he is reminded of essential anatomy. The stimulus for leaming the anatomy associated with clinical examination, will be a student volunteer and, as such, will provide an opportunity for the student to learn accurately hands-on the morphology of the human body and the application of anatomy in examining h. Highly relevant human interaction will also be involved, which is not the case on a cadaver. Working whh a fellow student the students will be freed from modesty and will be better trained for fiiture patient contact.

" I hear, and I forget; I see and I remember, I do and I understand"

Chinese proverb

Observafion of Clmical Procedures fWard Visits)

The course provides 12 hours (20 percent of the course hours) of protected daytime hours for ward vishs, however, the students are expected to arrange ward vishs outside the official timetable. The student will be provided with a logbook in which the list of required observations must be entered and countersigned. The student

intent then will be primarily patient care and with more emphasis on therapy rather than leaming of applied anatomy.

Studv Guide

There will be four components to the study guide. The first will provide introduction to the course, the course components, and course objecfives. The second will provide supplementary reading material and guidance to areas of study. The private study readmg and exercises have been carefully selected from the content of the anatomical themes identified in the research study. The third will provide examples of clinical cases, questions, and exercises. The student can then use these for practice and self-assessment. Finally, an annotated bibliography will provide directions to fiirther readings and important references.

All these cognhive levels are to be applied to the course subject matter hi context of anatomical knowledge and clinical practice. The underlying philosophy of the assessment is that pure knowledge, without higher order skills (analysis, interpretation, synthesis, and evaluation) is not much use. Oliver Wendell Holmes (1882), as quoted by Rowntree (1981) rebuked the medical educators of his day:

Assessment for the Proposed Course The assessment strategy is designed to enable the student to demonstrate knowledge, skills, attitudes she has acquired or improved upon during the course. The cogiutive levels targeted mclude:

a) Knowledge - ability to remember facts, terms, definitions, methods, mles, principles.

b) Comprehension - ability to translate ideas from one form into another, to interpret, and to extrapolate trends, consequences, i.e., to understand.

c) Application - ability to use general mles and principles in particular shuations.

d) Analysis - ability to break down an artefact and make clear the nature of hs component parts and the relationship between them.

e) Synthesis - abilhy to arrange and assemble various elements so as to make a new statement, plan or conclusion - a 'unique' communication.

f) Evaluation - ability to judge the value of materials or methods in terms of

intemal accuracy and consistency or by comparison with extemal crheria.

formative and summative assessment types.

All the assessment in the course will be crherion referenced, i.e., in which the student's work is measured agamst some crherion, as opposed to norm referenced in which the students are compared agahist each other or a predicted performance based on the bell-shaped distribution (normal curve).

"What is this stuff whh which you are cramming the brains of the young men who are to hold the lives of the communhy m their hands? Here is a man fallen into a fit; you can tell me all about the eight surfaces of the two processes of the palatebone, but you have not had the sense to loosen the man's neck-cloth, and the old women are still calling you a fool."

Assessment Methods

The assessment activhies in the course will include two written tests, grading of the seminar presentation, a seminar paper (report), and the final wrhten examination. The written tests are controlled tests in which students must answer questions whhout access to reference sources and whhin a rigid time limit. The seminar report will be an open activity in which the student will be given the task long before h is due to be completed and can consuh whatever sources and people he deems necessary, the only constraint being that he must complete within certain time. The assessment methods are presented in table 5.8 below.

The different assessment types (muhiple choice questions, essay, short answers, clinical cases) and how they relate to the cognhive level being tested are presented

in table 5.9. These assessment types are to be used in the vwitten tests both for

Table 5.8

Assessment Methods Related to Contmuous and Summative Assessments Against the Controlled - Open Continuum

	Qualitative	Quantitative
Goals	• Develop sensitising concepts • Describe multiple realities • Develop understanding • Empowerment of marginalized groups	• Theory testing • Statistical description • Show relationship between variables • Prediction
Design	• Hunch as to how you might proceed • Evolving, flexible, general	• Structured, predetermined, formal, specific • Detailed plan of operation
Data	• Descriptive • Personal documents • Field notes • Photographs • Official documents/artefacts	• Quantifiable coding • Counts, measures • Operationalised variables • Statistical
Sample	• Small • Non-representative • Theoretical sampling	• Large • Stratified • Control groqp • Random selection

[Adapted fi-om Rowntree (1981), pg. 199]

Table 5.9

Matrix of Assessment Types Agamst Most Appropriate Level of Cognitive Skill

	Qualitative	Quantitative
Goals	• Develop sensitising concepts • Describe multiple realities • Develop understanding • Empowerment of marginalized groups	• Theory testing • Statistical description • Show relationship between variables • Prediction
Design	• Hunch as to how you might proceed • Evolving, flexible, general	• Structured, predetermined, formal, specific • Detailed plan of operation
Data	• Descriptive • Personal documents • Field notes	• Quantifiable coding • Counts, measures • Operationalised variables

presentation (physical examination) Step 4 - Tissue

Organ Region System (TORS) analysis Step 5 -

Anatomical Concepts Relevant to the Topic Step 6 -

Anatomical Learning Goals Step 7 - Question and

Answer Sessions
<u>Conflation</u>

Since all the assessments are crherion-referenced the scores for contmuous

assessment will be conflated to score out of 40 percent (University regulations),

and the final examination will score of 60 percent (University regulations). Each

continuous assessment will be marked out of 100 and the four scores scaled out of

40. The guidelines of scoring the assessments are given below.

<u>Assessment Guidelines</u>

Written tests are common in the University of Zambia and most lecturers are

familiar whh the marking concerning muhiple choice questions, essays, short

answer questions and clinical cases. These are dependent on factual information

which is in most cases universal. Guidelmes are provided, below, for applied

seminar presentation and the seminar report to enhance validity and reliability of

the assessment. The format for both the presentation and the report have been

standardised.

<div align="center"><u>Standardised format for seminar presentation</u>.</div>

Step 1 - Case presentation (history) Step 2 - Tissue

Organ Region System (TORS) analysis ³⁰³ Step 3 - Case

6. References

Marking key for seminar report. Examiners will be advised to be aware of the word limit and should penalise reports well above the limh.

Case Summary: the student presents a concise case summary highlighting the important positive and negative findings. All important information to be presented.

Marking key for seminar presentation. Each student will be graded for clarity of presentation, accuracy of information presented, quality of visual aids, and abilhy to answer questions. The group will be assessed for history presentation, TORS analysis of the history, physical exammation presentation, TORS analysis of the physical examination, identification of appropriate anatomical concepts, and selection of specific and appropriate anatomical leaming goals. The scores of the group and the individual will be combined to come up whh a senunar-presentation score for each individual.

Standardised format for seminar report. 1. Case Summary (history, physical examination, investigations, diagnosis, and

treatment) - 300 words.

2. TORS Analysis (of history and physical examination) - 600 words.

3. Discussion of Impact of Anatomical Knowledge on Clinical Condhion (Topic) -800 words.

4. Anatomical Leaming Goals - 150 words.

5. Conclusion - 150 words.

TORS Analysis: the student should demonstrate a correct TORS analysis and to support the analysis with correct and appropriate anatomical facts and concepts.

Impact of Anatomical Knowledge on Clmical Condhion (Topic): the student is to identify the appropriate anatomical concepts that are required for diagnosis, investigation, treatment, and other related aspects such as understandmg or explaining the clinical phenomenon.

References: the student to use at least three references and to record them correctly with regard to established convention accepted by the department.

Bonus Marks: attention to presentation, accuracy, grammar, and punctuation is to be rewarded.

The examiner instructions are to mclude the method of marking: fail, pass, meritorious pass, or distinction m accordance with University marking guidelines.

reported in the Iherature.

The proposed aims and objectives are explich. These proposed aims, objectives, and the content of the course were developed after a needs assessment and are as such based on evidence. The needs assessment mvolved participant observation of clmical practice, content analysis of a clhiical methods textbook, critical incident studies of which anatomical knowledge determines failure and/or success of clinical practice, review of records of the common clinical cases seen in Zambia, and identification of clinical cases that have a high Case Anatomical Knowledge Index. The aims are relevant for medical students because upon completion they will become clinical

Evaluation of the Proposed Course

It is important to observe and study the context, the effects, and the effectiveness of the teaching and learning in every course. The purpose will be to understand the course so that informed decisions can be made. The evaluation appraises the plarming process by which the course was produced, the proposed aims, objectives, and the content of the course, the proposed teaching strategy, the material and facilhies that were available for use in the course, and the institutional setting in which the course will be run.

Independent evaluation will be necessary. The evaluation presented below highlights that done by the researcher.

Preliminary Evaluation

The planning process for this course was inspired by personal experience in the

Univershy of Zambia Clinical and Applied Anatomy Course and the experiences

this course and many are interested to see how it can be adapted for their postgraduate programmes.

practitioners and could utilise the course materials more efficiently and effectively. The timing of the course will have to be appropriate as a bridgmg course between preclinical and clinical years. Durmg clinical years students are hiundated with learning clinical information and may not have sufficient time to study anatomy to the desired level.

The proposed teachmg strategy has been developed after consideration of the aims and objectives, and review of the most current educational Iherature with regard to the teaching of anatomy, and a previous study, undertaken by the author, that examined the perceptions of teachers of undergraduate medical students concerning the teaching of anatomy. These references unanimously supported increasing clinical context in teaching, integratmg anatomical knowledge whh clinical knowledge, and increasing clmical relevance of anatomy teachmg.

There are several books on the market that can augment leammg this subject matter. A teaching guide to supplement the recommended textbooks will be required for the course. Lecture space, seminar space, and space for practical sessions are readily available.

The institutional setting is conducive. The University of Zambia senate and the Anatomy Department have already endorsed the necesshy of such a course. Many clinical departments in the School of Medicine have already expressed support for

| Anatomical interpretation of clinical data | Standardised report format | Guidance on relevant anatomy | reading materials |
| | Standardised Marking Keys | | Independent study questions and exercises |

<u>Developmental Testing</u>

Developmental testing has been an ongoing exercise. This has involved trying out learning materials (or teaching strategies) with students in the hope of developing or improving those materials (or strategies) for the benefit of future students. This is evidenced by the changes that have taken place over the years. Table 5.10 Summary of Changes of the Clinical Anatomy Course

Evaluation is an important component of all academic courses and will continue for this course.

Year	Role of anatomy in clinical practice / Determining failure and success in clinical practice / Anatomical basis of clinical tests	Seminar topics chosen based on evidence of high incidence setting / CAKI	Anatomy of Clinical Examination	Ward Visits	Study Guide
1998	Introductory lectures only (outline of the course)	No Standardised formats. Topics selected without basis	None	Non-specific logsheet (1-paged)	None
New (2003)	Introductory lectures (summary of evidence)	Standardised presentation format	7 practical sessions	Log book with specific procedures	Clear aims and objectives Supplementary

308

CHAPTER VI CONCLUSIONS AND RECOMMENDATIONS

students in a manner that enhances relevance to the future roles of medical students as clhiicians. The CAKI allows for exammation of clinical cases/situations to determme the appropriateness of usmg the case/situation as stimuli for teachmg and leamning important clinical concepts.

The study analysed data from a) 2,216 contact hours of participant observation of clinicians, b) content analysis of the 19* edition of Hutchison's Clinical Methods, c) 221 critical incidents from 140 doctors and 28 medical students, d) the CAKI analysis of the commonest disease conditions m Zambia, and e) comparison of knowledge of

Summary of the Study

This study mvestigated how to define a core clinical anatomy for undergraduate medical education hi Zambia by analyshig the anatomy requishes for general clmical practice, because there was no consensus, in the literature, about what core clmical anatomy was. The study established a proposed defmition of core cliiucal anatomy for undergraduate medical education and developed a curriculum for core clmical anatomy. The anatomy needs of general clhucal practice, that is, history-taking, physical examination, interpreting mvestigations, clmical procedures, operations, and managing common clmical cases, were analysed.

The study is significant in that h is probably the first to defme core clmical anatomy ushig evidence-based methods, and it developed the Case Anatomical Knowledge Index (CAKI), which is an original tool for measuring detail of anatomy knowledge required for making a diagnosis, interpreting mvestigation and

310

managing clinical condition. The core clmical anatomy can be used to train medical

shuations?

    3. Is there a difference between the anatomical knowledge that climcal students and clinicians possess compared to that which preclinical medical students possess?

an4toGay bhewdeta ilprě abmaicah irmddio o lwstuddgentoq wittdffrat difgdinsicsiaınv fsoiga t lSn , nexk arehtımehntofers clinical condhion be determined consistently?

The data analyses utilised a) formulation of order on the data for comparison, contrast, and msight, for participant observation, b) frequency counts for anatomical concepts to compute Total Anatomy Indicators Ratio, and context formulation, for content analysis, c) development of frames of reference and taxonomies, for the crhical incident technique, d) frequency counts of disease prevalence and CAKI scores for scaling disease condhions, and e) Analysis of Variance (ANOVA) procedures of SPSS-9 to determine significant differences among the preclinical students, chnical students, and clinicians (p < 0.05).

The following research questions (specific objectives) were investigated:

    1.   What is the amount and nature of anatomical knowledge in clinical

methods?

    a) The amount and nature inherent m history-takhig?

    b) The amount and nature inherent in physical examination?

    c) The amount and nature mherent in a textbook of clinical methods that is widely used at University of Zambia?

    2. Which anatomical knowledge determines success and/or failure in clinical

311

Clinical surface anatomy; Anatomical basis for common clinical procedures and operations; Anatomical considerations of common clmical condhions. Anatomical knowledge that contributes to success and/or failure in clinical shuation. The role of anatomy in clinical practice.

<u>Findings</u>

The fohowing findings resuhed from the study:

<u>Part 1: Core Chnical Anatomy</u>

1. Core anatomy has been defined as:

Core Anatomy = Type 1 Anatomy (classical) + Type 2 Anatomy (clinical anatomy)

Type 1 anatomy (classical/prerequisite): Anatomical termmology (body poshions, anatomical intemational nomenclature); Basic tissue types (muscle, nerve, epithelia, connective tissue); Body systems (structure and frmction); Regional anatomy topography (holotopy, syntopy, skelotopy); The cell (organelles and fimction); developmental anatomy (meiosis, ferthisation, teratology); Neuro-anatomy (sensory and motor pathways); **Anatomy themes found in clinical methods (see the 67 themes).**

Type 2 anatomy (clinical anatomy): Anatomical interpretation of clhiical data (tissue, organ, region, system - TORS- analysis); Anatomy of clmical examination;

body.

Anatomy Concepts in Clhiical Methods Textbook

- Sixty percent (60%) of content is general anatomy terms, 40% is technical anatomy terms.

- There are 67 discrete anatomy themes.

Part 2: Answers to Research Questions

1. The amount and nature of anatomical knowledge hi clinical methods comprises of the following: Fifty-nine percent of the content in Hutchinson's Chnical Methods (Swash, 1989) was anatomical hi nature. Technical anatomical terms constituted 40 percent and there were 67 discrete anatomical themes. History-taking:

- Eighteen percent (18%) of history-taking protocols consist of technical anatomy terms.

- The nature of anatomical knowledge m history-taking is of problem solving nature (clinical reasoning) in the sense that it helps m identifymg the tissue, organ, region, system that is affected (TORS analysis).

Physical Examhiation:

- Eighteen percent (18%) of the physical examination is technical anatomy terms. But all the concepts (100%) are based on assessing normal stmcture and function.

- The nature of anatomical knowledge in physical exammation is that of a reference template for detecting altered stmcture and function of the human

4. The detail of anatomical knowledge requhed for diagnosis, mvestigation, and treatment of a clinical condhion can be determined consistently. The Case Anatomical Knowledge Index (CAKI) developed in this study was able to

The nature of anatomical knowledge includes: discrete anatomy themes, and conceptual consideration of the role of anatomy in clinical practice (Concept Map of the Role of Anatomy in Clinical Practice - from the study).

2. The anatomical knowledge that determines success and/or failure hi clmical methods is that anatomical knowledge that contributes to ability to 1) extract body fluids, 2) cohect venous blood, 3) cannulate veins, 4) insert tubes or trocars in body cavhies, 5) locating nerves, 6) locating blood vessels, 7) avoiding accidental injury to important structures, 8) locatmg important structures, spaces, cavities, 9) accessing intemal organs at operation, 10) describing and mterpreting plain x-rays, 11) describing and interpretmg special x-rays, 12) making clinical decisions, 13) surgical repah of structures, 14) recognise developmental basis for clinical condhions, 15) comprehend histological reports.

3. Preclinical students possess knowledge of anatomy of the Type 1 kmd (taught in the Flexnerian tradhional curriculum) while clinicians posses knowledge of the Type 2 kind (based mostly on application of anatomical knowledge to clinical practice). Preclmical students failed a cognhive test based on Type 2 anatomy, and clinicians failed a cognhive test based on Type 1 anatonty.

taught to students. Educationally, this implies that the learning curve for clinically relevant anatomy, which will be applied in the future careers of the students, can be accelerated. These firidings can be used to develop strategies that would help resolve the issue of relevance to clinical practice and that of efficiency of the educational system.

consistently discriminate between clinical conditions that had a high demand for detail of anatomical knowledge from those that had a low demand.

Discussion - Commentary

A review of the data reveals the foUowmg additional outcomes:

1. The performance on the clmical anatomy (type 2) test by students who had imdertaken a clinical anatomy course (preclmical 4) was better than that of clhiicians and preclinical 3 students.

2. The clinicians had forgotten the traditional (type 1) anatomy that they leamed as preclinical students.

This additional finding may indicate that the content of the clmical anatomy course taught at UNZA has been correctly identified the anatomy that clinicians use. This findmg also demonstrates that clmicians over the years have forgotten the anatomy that they were taught m the preclinical years and have gone on to acquire a new and different type of anatomy. This is an important additional finding because h demonstrates that anatomy required for clinical practice can be identified and

taught to students. Educationally, this implies that the learning curve for clmically

students for clinical practice.

5. The demand of detail for anatomical knowledge is greater in some clinical situations than for others.

6. The extent of demand of detail for anatomical knowledge hi clhiical situations can be measured consistently.

7. The taxonomies of knowledge of anatomical knowledge that determhie success and/or failure are now available to serve as a basis for ensuring better preparedness for clmical practice.

Conclusions

The study met hs purpose and specific objectives (research questions). The following major conclusions resuh from analysis of the findings of this study. These conclusions, it is feh, on one part, can be generalised to medical undergraduate education worldwide, and are limited to Zambia on the other where the findings are focused on disease prevalence and clmical practice in Zambia.

1. A definhion of core chnical anatomy is now available to serve as a guide for developing courses for undergraduate medical education.

2. The Case Anatomical Knowledge hidex (CAKI) is now available to serve as a tool for selecting clinical cases, as stimuh, for use in leaming anatomical concepts.

3. There are significant differences in the type of anatomical knowledge possessed by preclmical students and clinicians.

4. The anatomical knowledge taught hi traditional (Flexnerian) curriculum may be different from the anatomy that should be tau^t for preparing students for clmical practice.

anatomical themes in clinical methods) should be taught as a prerequishe to prior students with prior knowledge upon which to build clinical anatomy. Anatomical themes in clmical methods can be taught as part of Type 2 teachmg e.g., as part of anatomy of clmical examination or as part of case studies.

2. The traditional anatomy curriculum should be revised to reflect the content
8. Qualitative methods, for example, participant observation can be used in of Type 1 anatomy derived from this study. This would reduce the amount, studying medical education.
and the irrelevant components of the traditional course.
9. Teaching clinical anatomy can accelerate the leaming curve for acquiring knowledge required for clinical practice.

10. A new paradigm clinical anatomy exists and this study has contributed to defining it.

Implications

Specific implications exist for individual professionals and professional organisations who advise or develop anatomy curricula for undergraduate medical education, contribute to curriculum committees, or who evaluate undergraduate medical education. There are also specific implications which exist for teachers who mstmct m anatomy, or are aspiring to be clmical anatomists.

1. Anatomy teachers need to be aware that they are two kinds of anatomical knowledge, that is. Type 1 anatomy (classical anatomy/prerequisite) and Type 2 anatomy (clinical anatomy). And that anatomy teachmg should hicorporate both types. It is recommended that Type 1 anatomy (except for

317

1. Correlative studies of the Anatomy Concepts Codmg Instmctions with different clinical methods textbooks.

2. Correlative content analysis of Hutchison's Clinical Methods by different coding raters.

3. Validation of the Case Anatomical Knowledge Index in a larger sample size and multicentre study.

3. The teaching Type 2 (clinical anatomy), neglected in many traditional medical schools, should be scaled up to enhance meeting the anatomy

4. Replication of CAKI scoring for common clmical conditions in different requirements of clinical practice, clinical relevance and context, and geographical settings.

teaching high order intellectual skills like apphcation, problem solving, synthesis and evaluation.

4. History-taking and physical examhiation process should be introduced in clinical anatomy teaching as a basis of anatomical interpretation of clinical data (TORS analysis) as well as the anatomical basis of clinical examination.

5. Clinical conditions used as case studies or clinical context stimulus, for teaching anatomy, should be carefully selected using high prevalence and high demand of anatomical knowledge (high CAKI scores) as criteria.

6. Clinical methods cannot be leamed, effectively and efficiently, from Hutchison's Clinical Methods without knowledge of anatomy.

Recommendations

Recommendations for future studies are as follow:

5. Replication of critical incident studies, for anatomical knowledge that detennines success and/or failure, in clinical practice in a different clinical care system.

6. Determination of core clinical anatomy for medical specialties, that is, surgery, intemal medichie, obstetrics and gynaecology, and paediatrics.

7. Determination of core clinical knowledge for other basic sciences, that is, physiology, biochemistry, microbiology, pharmacology, and pathology, usmg the research design and methods from this study.

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APPENDICES

APPENDIX I

LIST OF REVIEWED CLINICALLY ORIENTED ANATOMY

BOOKS

	Author	Title	Year of Publication
1	McGregor, A.L.	Synopsis of Surgical Anatomy	1932
2	Baxter, J, S.	Aids to Surgical Anatomy	1950
3	Bruce, J., Walmsley, R., Russ, J.	Manual of Surgical Anatomy	1964
4	Healey, J.E,	A Synopsis of Clinical Anatomy	1969
5	Smout, C, Jacoby, F., Lillie, E.W.	Gynaecological and Obstetric Anatomy	1969
6	Lachman, E.	Case Studies in Anatomy	1981
7	Snell, R.S.	Clinical Anatomy for Medical Students	1986
8	Pedington, J.	Clinical Anatomy in Action: Head and Neck	1986
9	Basmajian, J. and Slonecker, C.	Grant's Method of Anatomy. A Clinical Problem-solving Approach	1989
10	Mathers L.H., et al.	Clinical Anatomy Principles	1996
11	Moore, K. and Agur, A.	Essential Clinical Anatomy	1996
12	Lumley, J.S.	Surface Anatomy. The Anatomical Basis of Clinical Examination	1996
13	Ellis, H.	Clinical Anatomy	1997
14	Backhouse, K.M. and Hutchings, R.T.	Clinical Surface Anatomy	1998
15	Stern, J.	Clinical Sidelights to Core Concepts in Anatomy	1999
16	Sinnatamby, C.S.	Last's Anatomy Regional and Applied	1999
17	Evans, J., Moxham, B., Newell, R. and Santer, R.	Self-Assessment Colour Review of Clinical Anatomy	2003

APPENDIX II

SELECTED EXCERPTS FROM CLINICAL ANATOMY BOOKS REVIEWED:

ILLUSTRATION OF DIFFERENT STYLES

318

The female urethra is short. It opens just in front of the hymen or membrane which marks the lower limit of the vagina. At hs extemal opening are the minute openings of the five canals of Skene, homologous stmctures to the prostate of the male. These canals provide hiding-places for gonococci, and they sometimes form painful cysts if their openings are occluded by inflammatory changes.

(This approach to presenting anatomy as an aid to clinical practice is consistently used in the book)

1(A): **Baxter (1980)**

An excerpt is included here to illustrate Baxter's style: Surface

Anatomy of the Head and Neck (page 1. paragraph 1)

The fronto-nasal suture lies deep to the depression at the root of the nose and is termed the nasion. The external occipital protuberance (inion) is easily feh about 2 inches above the spine of the axis in the aduh; in the child h is poorly developed. The junction of the anterior and middle thirds of a line between the nasion and inion is where the two parietal bones meet the frontal and is known as the bregma. The anterior fontanelle is found here in the newborn. It is a diamond-shaped membranous area and is normally ossified before the end of the second year. The fontanelle overlies the superior sagittal sinus, and so in the babe this stmcture is readily accessible for blood transfusion or the removal of blood for examination.

319

The Abdomen (page 155-6)

intervertebral foramen. Thus, herniation of the C5/6 disc may compress the 6th cervical spinal nerve roots, or herniation of the C7/T1 disc may compress the 8th cervical spinal nerve roots.

(An anatomical stmcture is first identified then all the relevant clinical aspects are presented).

1(B). Stern (1999)

An Excerpt from Stern (1999) is included here to illustrate the unique approach.

Chapter 2: Vertebrae

Herniated (Slipped) Intervertebral Disc

Extrusion of the nucleus pulposus (sometimes covered by a thin layer of stretched anulus fibrosus) is called slipped disc. It occurs most commonly in the low lumbar region. No doubt this is due to the very much greater stresses on the discs of this region. The second most frequent she is in the neck, usually as a consequence of some trauma. A herniated nucleus pulposus will generally present to either the right or left* of the posterior longitudinal ligament. Compression of the spinal nerve roots heading toward an intervertebral foramen is a common consequence. If herniation occurs in the neck, the spinal cord may also be subjected to pressure. However, in the more common case of a low lumbar slipped disc, the site of nuclear protmsio^n is inferior to the spinal cord and only spinal nerve roots are in danger of compression.

Herniations of cervical discs affect the [320] spinal nerve that exhs at the corresponding

1(C). Basmajian and Slonecker (1989)

From Grant's, an example is of anatomy text - clinical application is given below: Pg63

"While the dermatomes C3 and 4 are present over the clavicular and scapular regions of the upper thorax, the dermatomes of C5, 6, 7, 8 and Tl are found primarily on the upper extremity. The Tl dermatome is therefore adjacent to the C5 dermatome. This point must be remembered in examining the chest wall in patients suspected of having neck injuries."

Pg 69

"The sternal angle is also used to locate the 2"" intercostal space. When a physician listens for heart sounds in this location, the aortic valves are heard over the right 2""^ intercostal space, and the pulmonary valves are heard over the 2"** intercostal space on the left side of the sternum.

(While giving topographical detail of anatomical stmcture the opportunity is seized to present the relevant clinical application)

321

pulled apart to expose the muscles covering the capsule. The joint is opened at the lower

edge of the infraspinatus tendon."

(The detailed topography akin to classical anatomy textbooks is abundant and is followed by

clinical applications of the region reviewed).

1 (D). Bruce et al. (1964)

Excerpt from Bruce et al.:

Pg. 1. Scalp

"Numerous arteries supply the scalp, ramifying for the most part in the superficial fascia.

They are derived from both the external and internal carotid arteries, and ascend towards the

vertex from the orbit, face and neck. A free anastomosis occurs between the two groups of

vessels and across the median line. In consequence, ligature of one external carotid fails to

cure a cirsoid aneurysm of the superficial temporal artery." Pg.3.

"The supraorbital and supratrochlear arteries accompany the nerves of the same name and

both are branches of the ophthalmic which arises from the internal carotid. The posterior

auricular artery mns backwards and upwards from the external carotid, and lies superficial to

the mastoid temporal bone." Pg. 172.

Surgical approach to the shoulder joint

"In pumlent arthrhis the joint may be opened from the front or the back. The posterior route

has the advantage of affording dependent drainage. The incision extends downwards from

the angle of the acromion in the line of the posterior fibres of the deltoid, which are spHt and

pulled apart to expose the muscles covering the capsule. The joint is opened at the lower

APPENDIX III

APPROVAL LETTERS FROM APPROPRIATE AUTHORITIES

Title: **"Anatomical Interpretation of Clinical Data and Critical Incidence Technique."**

Investigator(s):   Dr S S Bauda

Please keep the Committee informed about tlie progress of your research.

Signed:.

Prof K S Baboo MBBS M MED FRSH DABTM
CHAIRMAN, RESEARCH ETHIC COMMITTEE

THE UNIVERSITY OF ZAMBIA

RESEARCH ETHICS COMMITTEE

Telephone: 252641 Telegram: UNZA, Lusaka Telex: UNZALU ZA 44370

Fax: + 260-1-250753

Dean's Office   P.O. Box   50110 Lusaka, ZamtDia

17'" March 2000

Dr S S Banda Department
of Anatomy UNZA
LUSAKIA

Dear Dr Banda

The following Research Proposal was presented to the Research Ethics Committee of the University of Zambia on the lO'" of February 2000 and was approved. Congratulations.

Uiiiyersity Teaching Hospit

(Iloaid or **Management)**

P/Bag Lusaka - Z;
Tel: 253947
(Switcii E 250357
(,C Fax: 2: Telex:
ZA'

OFFICr, OF 11Il- MANACiING DIKHCTOR

Our

Ref:

YourR **20th September 2000**
ef:

> **Dr Sekelani S**
> **Banda UNZA**
> **P 0 Box, 50110**
> **LUSAKA,**

Dear Sir,
                                                                    »

RE: APPOINTMENT TO THE POST OF REGISTRAR
    HONOURARY AND PAYMENT OF PART TIME

please refer to your letter dated 31st January 1996 in
which UTH' Management appointed you to the post of
registrar (honcurary) oii part time basis and the letter
dated 21st August 2000 an which you sought permission
to attend UTH Departments for Ph D Studies.

UTH Board of Management has granted you permission to
attend UTH Departments for Ph D studies.

^.Since you will under take full time duties in the
department you will be entitled to part time allowance
upon completion of part time:claim forms. By copy of this
letter, the Director of Finance is requested l process
payment on a monthly basis. ;

We wish you the best in your programme. '

YoUrs faithfully
UTH BjOitRD OF MANAGEMENT

DR E M CHOMBA
MANAGING
DIRECTOR

cc.   A/Director of
Finance cc.   Human
Resources Manager

¦ V*   325
EL/nmn

p. O Box
50827 Lusaka
Tel; 235554
Fax. 236429

In reply please quote
No.......................

MINISTRY OF HEALTH
LUSAKA DISTRICT HEALTH MANAGEMENT BOARD

11* August 2000

Dr. Sekelani'S. Banda
UNZA
School of Medicine
P.O. Box 50110
LUSAKA.

Dear Dr. Banda,

RE: REQUEST FOR PERMISSION TO ATTEND DISTRICT CLINICS FOR PH.
    D STUDIES

Reference is made to your request dated 9"' August 2000.

The District office hereby grants you permission to collect data from the Lusaka .Distr-ict
Health Clinics.

As for the part-time employment, the DHMT requires details of your time-table, intended
working hours and the duration period per Clinic. The DHMT will not be able to provide you
with fuel. As for the calls you have to see Dr. Chirwa, Central ;' Board of Health for clearance
of calls taken in Lusaka District.

Wishing you success.

Dr. R. kumwenda-Phiri
DISTRICT DIRECTOR OF HEALTH

I

12" Decern ber,2001

Dr. Sekelani Banda
University Teaching Hospital
Department of Medicine Education Development
<u>LUSAKA</u>

Dear Dr. Banda

RE: <u>RESEARCH ATTACHMENT AT NDOLA CENTRAL HOSPITAL</u>

Reference is made to your faxed minute dated 12* December,2001 regarding the above captioned subject.

We wish to advise that we have no objection to your request of undertaking research activities at our Institution on the proposed dates respectively.

Yours faithfully
NDOLA CENTRAL HOSPITAL
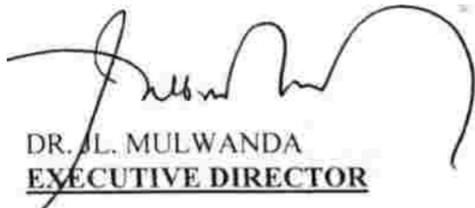
DR. L. MULWANDA
<u>EXECUTIVE DIRECTOR</u>

cc: Director Clinical Services

NDOLA CENTRAL HOSPITAL MANAGEMENT BOARD
POSTAL AGENCY
NDOLA
TEL: 611585-9
FAX: 612204/612362
e-mail: <u>nch@zainnet.7,m</u>

REPUBLIC OF ZAMBIA

MINISTRY OF EDUCATION

n
**ISAK
A**

27 January 2003

The Permanent Secretary
Ministry of Health
<u>LUSAKA</u>

<u>CONSENT FOR MINISTRY OF HEALTH TO SUPPORl -PHD FIELD WORK.</u>

Reference is made to the letter dated 22 January, 2003 on the above stated subject concerning Dr Sekelan; S. Banda, a PhD candidate at the University of Zambia - School of Medicine.

The Ministry has no objection to the Ministry of Healtli supporting the appjicant's PhD fieldwork. The nation needs qualified doctors and consultants such that any assistance towards the sanie is greatly appreciated.

B.Y. Chilangwa (Mrs) Permanent
Secretary <u>MINISTRY OF</u>
<u>**EDUCATION**</u>

I look forv/ard to your supporting Dr Sekelani S. Banda.

REPUBLIC OF ZAMBIA

MINISTRY OF HEALTH

28'^ January, 2004

NDEKE
HOUSE
P.O.Box
30205
LUSAKA

The Dean School of
Medicme University
of Zambia LUSAKA

Dear Prof. Munkonge

Re.   PhD RESEARCH FIELD ACTIVITIES IN HOSPITALS IN
        ZAMBIA AND ACCESS TO HMIS DATA

This letter certifies that Dr. Sekelani S. Banda was granted permission for the following PhD research activities.

1. Review records of Morbidity and Mortality from Hospitals in Zambia;
2. Review Health Management of Information Systems records cf the Central Board of Health;
3. Recruit research assistants from Hospital staff;
4. Interview and survey the views of clinicians;
5. Observe some operations and ward rounds.

The Ministr/ assisted Dr. Sekelani S. Banda with K5 million for the Phase 2 of his field activities.

Dr. S.K. Miti
Permanent Secretary
MINISTRY OF HEALTH
Yours faithfully

APPENDIX IV CONTENT ANALYSIS

MATERIALS

Content Analysis - Coding Instructions

<u>Example of analysed text</u>:

Lung disease

Patients who have severe chronic **lung** disease may develop **heart** failure, called cor pulmonale. Patients with condhion may develop **peripheral** oedema, and occasionally this is the presenting symptom rather than breathlessness.

<u>Content analysis coding instructions</u>:

The purpose of this exercise is to identify "anatomy indicators" from the sample of the text being analysed. Anatomy indicators are words or phrases that represent anatomical stmctures or concepts. Types of anatomy indicators and examples are provided below:

a. Technical anatomical terms e.g., femoral nerve, duodenum, ischium.

b. Body poshion and actions e.g., anterior, lateral, dorsal, flexion, abduction.

c. Reference to body parts using lay terms e.g., mouth, finger, eye.

d. Inflections of anatomical terms which imply that the anatomical stmcture is
331
inflamed e.g., peritonitis, uvehis, arthritis.

left kidney, frusemide.

Sample form 2

Fig. 12.59 (a) Lateral view of myelogram, or radiculogram, since only the cauda equina nerve roots are displayed in this limited view. There is disc protrusion opposhe the L4/L5 disc interspace which is indenting the column of water-soluble contrast wbhin the theca. The nerve roots can be seen above this level, (b) CT scan of the contrasted theca

bladder emptying and the retrograde passage of urine from the bladder towards the kidney (vesico-ureteric reflux).

Fig 6. 17 - L. kidney, R. kidney, background. Radioisotope excretion (ordinate) during the 30 min after intravenous injection in a patient whh right renal artery stenosis and hypertension. The left kidney achieves more rapid excretion of isotope. The malftinctioning right kidney was the cause of the pateint's hypertensions.

CYSTOSCOPY AND URETHROSCOPY

The interior of the bladder and urethra may be inspected through ai cystoscope and urethroscope respectively. The main value of these procedures is in the diagnosis and treatment of tumours of the bladder and in assessing the effects of disease of the prostate.

Fig 6.18 (a) The right kidney is large and the calyces are dilated and clubbed. The left kidney is small, (b) isotope excretion study showing poor excretion by the left kidney. Right kidney, left kidney, frusemide.

shown above. The disc protrusion can be seen a little to the left of the midline, displacing the dense, contrast filled thecal sac posteriorly. There is also a lateral disc protrusion extending toward the invertebral foramen and thus compromising the nerve root. The scan shows the paraspinal muscles and anteriorly, the upper parts of the two psoas muscles.

Diagnosis of primary diseases of muscle (myopathies and dystrophies) and of lower motor neurone lesions (denervations). The speed of conduction of afferent impulses (sensory conduction velocitiy) and efferent impulses (motor nerve conduction velocity) in peripheral nerves.

Fig. 12.60 (a) MRI scan with gadolinium enhancement. There is a neurofibroma at the C6 spinal level which is compressing the spinal cord, causing progressive paraparesis, (b) The tumour enhances slightly and can be seen as a sausage-shaped mass arising in the intervertebral foramen and compressing the spinal cord in the axial view.

APPENDIX V CRITICAL INCIDENT TECHNIQUE

MATERIALS

Successful Outcome

The University of Zambia

This section seeks to collect a written report of an event, in the clinical setting, in which you/or another individual did something that was <u>particularly effective</u> because of your/or another person's lack of specific knowledge of anatomy. Please do not use abbreviations in your answers.

School of Medicine

The Impact of Knowledge of Anatomy on the Practice of Medicine
Research Project (2003)

A. State the clinical activity below.
(Example: I was required to withdraw venous blood from a patient).

Principal Investigator:
Dr. Sekelani S. Banda, Clinic 2 University Teaching Hospital, Department of Medical Education Development PO Box 50110, Lusaka, Telefax: 01 - 254684, E-mail - ssbanda@zamnet.zm

Complete this section first

Tick the appropriate selection: Sex

Male

Female

Rank:
1. Junior House Officer:
2. Senior House Officer:
3. Registrar/Government Medical Officer:
4. General Practitioner:
5. Senior Registrar
   Consultant

Current Area of Practice:
1. General Practice/Clinic
2. Surgery
3. Obstetrics/Gynaecology
4. Internal Medicine
5. Paediatiics
6. Otiier:
   Specify:_____

362-^''^

If you wish to report more incidents please complete another form. Kindly note that there are two types of forms, one for a successfLil outcome and one for unsuccessful outcome. Ensure to complete the appropriate form.

Thank you very much for your co-operation. Please return the forms to your local co-ordinator or the principal investigator (see address on page 1).

B. Describe the clinical activity as accurately and as detailed as possible.
(Example: The patient was obese and as result I could not find any veins easily. My colleagues and I tried for about five times without success).

C. Explain why you think the outcome of the incident was successful.
(Example: We finally managed to draw the blood).

D. State clearly the specific knowledge of anatomy that caused the outcome to be successful.
(Example: Using the knowledge of how to locate the pulse of the femoral artery at the midinguinalpoint and then approximating that the femoral vein lies about I cm medially, I was able to draw venous blood from the femoral vein).

This section seeks to collect a written report of an incident, in the chnical setting, in which you/or another individual did something that was particularly ineffective because of your/or another person's lack of specific knowledge of anatomy. Please do not use abbreviations in your answers.

E. State the clinical activity below.

(Example: I was required to withdraw venous blood from a patient).

Principal Investigator:
Dr. Sekelani S. Banda, Clinic 2 University Teaching Hospital, Department of Medical Education Development PO Box 50110, Lusaka, Telefax: 01 - 254684, E-mail - ssbanda@zamnet.zm

Complete this section first

Tick the appropriate selection: Sex

Male

Female

Rank

1. **Junior House Officer:**
2. **Senior House Officer:**
3. **Registrar/Government Medical Officer:**
4. **General Practitioner:**
5. **Senior Registrar**

Consultant

Current Area of Practice:

1. **General Practice/Clinic**
2. **Surgery**
3. **Obstetrics/Gynaecology**
4. **Intemal Medicme**
5. **Paediatrics**
6. **Otiier:**
   Specify:_____

Unsuccessful Outcome

If you wish to report more incidents please complete another form. Kindly note that there are two types of forms, one for a successful outcome and one for unsuccessful outcome. Ensure to complete the appropriate form.

Thank you very much for your co-operation. Please return the forms to your local co-ordinator or the principal investigator (see address on page 1).

F, Describe the clinical activity as accurately and as detailed as possible.
(Example: The patient was obese and as result I could not find any veins easily. My colleagues and I tried for about five times without success).

G. Explain why you think the outcome of the incident was unsuccessfiil.
(Example: We were unable to the blood).

H. State clearly the lack of the specific knowledge of anatomy that caused the outcome to be unsuccessfiil.
(Example: We decided to do a femoral puncture but could not remember how to locate the femoral vein).

APPENDIX VI

CASE ANATOMICAL KNOWLEDGE INDEX MATERIALS

Detail of knowledge of anatomy. The following statements were developed by the researcher as concepts that represent measures of "detail of anatomical knowledge" one may possess. There are not ranked in any order.

Instructions;

1. Place an X in the column under YES if you think the statement implies a measure of detail of anatomical knowledge, or in the column NO if you think that the statement does not imply a measure of detail of anatomical knowledge.
2. In the empty cells on the left column (statements) add any statements that you think represent measures of detail of anatomical knowledge, that are not represented here.
3. Rank the items that have you chosen as representing a measiu-e of detail of anatomical knowledge (X in YES column) in increasing order (least anatomical knowledge to most anatomical knowledge). Ensure to include the items you have

Table

Study tide; Anatomical Interpretation of Clinical Data Tool: Detail of Anatomical Knowledge Table

Researcher: Sekelani S. Banda Office of Educational Development University of Texas Medical Branch at Galveston E-mah ssbanda@utmb.edu

Qualitative Goals	Quantitative
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
	Data

Code:_____ (For official use only)

Please complete the following section first; Section I (if you have added any) in the ranking.

1. Do you have a professional qualification m health/medicine?
   Yes _____ No:- _____ (put an X where appropriate).

2. If yes, please enter your professional qualification in the space below.
   _____ (e.g.. Medical doctor, nurse, etc).

3. Do you have a qualification in anatomy?
   Yes _____ No;-_____ (put an X where appropriate).

4. If yes, please enter your anatomy qualification in the space below.
   _____(e.g. MSc, Ph.D.)

5. Please state your location at the time of completing this correspondence i.e. Coimtry.
   _____ (e.g. USA, Britam)

367

Knowledge of basic tissue types
of the body
Knowledge of specific and
accurate developmental anatomy
of structures of the body
Knowledge of parts of the body
using anatomical terms
Knowledge of specific
mechanism of function of
structures in the body
Knowledge of specific and
accurate topographical
relationships of body structures
Knowledge of general fimctions
of structures of the body
Knowledge of blood
supply/drainage and nerve
supply of structures in body
Ability to identify tissue types,
named blood vessels and nerves

4. Kindly distribute this draft instrument to any colleague who has a quahfication in anatomy or is a medical doctor/health professional. Please ask tiiem to return the completed document to e-mail address; ssbanda@utmb.edu

Thank you for your cooperation

Very High = 5, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general functions of structures of the body
- Knowledge of parts of the body using anatomical terms
- Knowledge of specific mechaiusm of function of structures in the body
- Knowledge of general topographical relationships of body structures
- Knowledge of basic tissue types of the body
- Knowledge of general developmental anatomy of structures of the body
- Knowledge of blood supply/drainage and nerve supply of structures in the body

AND

- **Knowledge of specific and accurate topographical relationships of body structures**
- **Knowledge of specific and accurate developmental anatomy of structures of the body**

- **Knowledge of *basic* and specific *tissue types of the* body**

Very low = 1, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of structures of the body

Low = 2, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of structiu-es of the body

AND

- **Knowledge of parts of the body using anatomical terms**

Average = 3, requires
- Knowledge of parts of die body using lay terms
- Knowledge of general fimcUons of structures of the body
- Knowledge of parts of the body using anatomical terms

AND

- **Knowledge of specific mechanism of function of structures in the body**
- **Knowledge of general topographical relationships of body structures**

High = 4, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of structures of the body
- Knowledge of parts of the body using anatomical terms
- Knowledge of specific mechanism of fimction of structures in the body
- Knowledge of general topographical relationships of body structures

AND

- **Knowledge of basic tissue types of the body**
- **Knowledge of general developmental anatomy of structures of the body**
- **Knowledge of blood supply/drainage and nerve supply of structures in the body**

3. Junior House Officer:
4. Senior House Officer:
5. Registrar/Govenunent
6. Officer:

4. Internal Medicine
5. Paediatrics
6. Other:
Specify: _____

The University of Zambia
School of Medicine

The Impact of Knowledge of Anatomy on the Practice of Medicine
Anatomical Knowledge Demands
Research Project (2003)

The following condidons are commonly encountered in clinical practice. From the hsts provided below rank them, from low to high (were 1 is the least and 4 is the most) in terms of knowledge of anatomy required.

a) Knowledge of Anatomy required to make the diagnosis

Indicate the rank by entering A, B, C, or D on the corresponding line on the right.

Make diagnosis of: Disease	Rank	
A. Indirect inguinal hemia	I.	(least anatomical demand)
B. Diabetes mellitus	2.	
C. Pneumonia	3.	
D. Aneurysm in an artery in the brain	4.	(most anatomical demand)

Principal Investigator:
Dr. Sekelani S. Banda, Clinic 2 University Teaching Hospital, Department of Medical Education Development PO Box 50110, Lusaka, Telefax: 01 - 254684, E-mail -
ssbanda@zamnet.zm

Complete this section first

Tick
the appropriate selection:

Se

Male

Rank: Female   370
1.
2.
3.

General Practitioner:
Senior Registrar
Consultant
Current Area of Practice:
1. General Practice/Clinic
2. Surgery
3. Obstetrics/Gynaecology
4. Internal Medicine

b) **Anatomy required to interpret the investigations,**

Indicate the rank by entering A, B, C, or D on the corresponding line on the right.

Interpret investigation:	Rank	
A. Plain Chest x-ray	1.	(least anatomical demand)
B. Blood sugar	2.	
C. Cross section CT scan of abdomen	3.	
D. Angiogram of arteries in the brain	4.	(most anatomical demand)

c) **Anatomy required to implement the course of treatment**

Indicate the rank by entering A, B, C, or D on the corresponding line on the right

Treatment	Rank	
A. Insert an intercostal drain	1.	(least anatomical demand)
B. Control hypertension with oral drugs	2.	
C. Operate on an inguinal hemia	3.	
(hemioraphy)	4.	(most anatomical demand)
D. Operate on aneurysm in an artery in the		
brain		

Thank you for your cooperation

The Case Anatomical Knowledge Index (CAKI) is an instrument that measures the detail of knowledge required in a clinical case, for diagnosis, interpretation of investigations, or the treatment implementation. Using the OAK described (on page 2) rank the hems listed below. The items must be ranked from 1 to 4 were 1 is the least and 4 is the most for demand for minimal knowledge.

The Impact of Knowledge of Anatomy on the Practice of Medicine

Research Project (2003)

d) Knowledge of Anatomy required to make the diagnosis

Indicate die rank by entering A, B, C, or D on die corresponding line on the right.

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction

Principal Investigator:
Dr. Sekelani S. Banda, Clinic 2 University Teaching Hospital, Department of Medical Education Development PO Box 50110, Lusaka, Telefax: 01 - 254684, E-mail - ssbanda@zamnet.zm

Complete this section first

Tick the appropriate selection; Sex

Male

Female

Senior Registrar
Consultant

Current Area of Practice;
1. **General Practice/Clinic**
2. **Surgery**
3. **Obstetrics/Gynaecology**
4. **Intemal Medicine**
5. **Paediatrics**
6. **Other;**
   Specify;_____

Rank;
1. **Junior House Officer;**
2. **Senior House Officer;**
3. **Registrar/Government Medical Officer;**
4. **General Practitioner;**
5.

372

e) **Anatomy required to interpret the investigations,**

Indicate die rank by entering A, B, C, or D on the corresponding line on the right.

<div style="text-align:center">Qualitative   Quantitative</div>

<div style="text-align:center">Goals</div>

Qualitative	Quantitative
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction

<div style="text-align:center">Design</div>

Qualitative	Quantitative
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation

<div style="text-align:center">Data</div>

Qualitative	Quantitative
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	

<div style="text-align:center">Sample</div>

Qualitative	Quantitative
• Small	• Large
• Non-representative	• Stratified

The Case Anatomical Knowledge Index (CAKI).

Very low = 1, reqmres
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of structures of the body

Low = 2, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of stmctures of the body
<div style="text-align:center">AND</div>
- **Knowledge of specific mechanism of function of structures in the body**
- **Knowledge of parts of the body using anatomical terms**

Average = 3, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of stmctures of the body
- Knowledge of specific mechanism of fimction of structures in the body
- Knowledge of parts of the body using anatomical tenns
<div style="text-align:center">AND</div>
- **Knowledge of specific and accurate developmental anatomy of structures of the body**
- **Ability to identify tissue types, named blood vessels and nerves**

High   = 4, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of stmctures of the body
- Knowledge of specific mechanism of fimction of structures in the body
- Knowledge of parts of the body using anatomical terms
- Knowledge of specific and accurate developmental anatomy of stmctures of the body
- Ability to identify tissue types, named blood vessels and nerves

AND
- **Knowledge of blood supply/drainage and nerve supply of structures in the body**
- **Knowledge of specific and accurate topographical relationships of body structures**

Very High = 5, requires
- Knowledge of parts of the body using lay terms
- Knowledge of general fimctions of structures of the body
- Knowledge of specific mechanism of fimction of structures in the body
- Knowledge of parts of the body using anatomical terms
- Knowledge of specific and accurate developmental anatomy of structures of the body
- Ability to identify tissue types, named blood vessels and nerves
                                AND
- **Knowledge of basic tissue types of the body**

- **Ability to identify structures accurately in topographical context**

Thank you for your cooperation

APPENDIX VII ANATOMY RESEARCH TEST

MATERIALS

1. Exocrine glands:

    a) Typically discharge their content into the blood stream.
    b) Usually secretes in a holocrine manner.
    c) Are of mesenchymal origin.
    d) Are absent in stratified squamous epithelium.

2. The sympathetic nervous system:

    a) Has myelinated postganglionic fibres passing from the sympathetic tmnk to the spinal nerves.
    b) Has usually only 5 ganglia in the sympathetic tmnk.
    c) Fibres passing to the head and neck leave the spinal cord in the 5* - 8* cervical spinal nerves.
    d) Sends preganglionic fibres to the cortex of the suprarenal gland.

3. During the development of the external genhalia the:

    a) Primitive streak mesoderm migrates around the cloacal membrane.
    b) Laterally placed cloacal eminences develop into the body of the penis.
    c) Cloacal swellings form the glans penis.
    d) Gemtal folds form the labia majora.

Anatomy Research Test (2003)

Introduction: This test is being administered for the purposes of research only. The respondents will remain anonymous and the results cannot be traced to individuals. However, to enhance the validity and reliability of the test resuhs you are implored to apply yourself as you would an examination and not to use any reference materials when completing the test. The approximate completion time is one hour.

Test instructions: This test has forty (40) questions. The test is divided into two sections, section A and section B. You are required to complete both sections. Kindly enter all your answers on the answer sheet provided. You **must** surrender the question paper back to the test administrator **without fail.**

Both sections consist of tme or false multiple choice questions (MCQs). Please note that section A has four options (a - d), and section B has five options (a - e). For each question you must enter T for Tme or F for False in the spaces provided for in the answer sheet. If you do not want to provide an answer kindly leave the corresponding answer space blank.

376

Section A:

a)   Arches posteriorly over the root of the right lung.
b)   Is related, on its left side to mediastinal pleura.
c)   Is connected to the right pulmonary artery.
d)   Is related to the left brachiocephalic vein superiorly.

8.   The thoracic duct:

a)   Arises in the thorax.
b)   Ascends anterior to the vertebral column.
c)   Drains into the left brachiocephalic vein.
d)   Drains mainly thoracic stmctures.

9.   The coeliac trunk:

a)   Arises at the level of the inferior border of the pancreas.
b)   Has three main branches.
c)   Is surrounded by a plexus of nerves.
d)   Supplies the foregut and stmctures derived from *it*.

4.   The diaphragm:

a)   Is formed mainly from a dorsal mass of mesenchyme known as septum transversum.
b)   Receives contributions from the pleuropericardial membranes.
c)   Receives contributions from the ventral mesentery.
d)   Receives contributions from the body wall.

10.   The spleen:

a)   Lies deep to the 9*, 10* and 11* ribs.
b)   Is separated by the diaphragm from the chest wall.
c)   Is closely related to the stomach.
d)   Is separated by the stomach from the tail of the pancreas.

5.   In the vertebral canal the:

a)   Dural covering of the spinal cord fiises with the periosteum of adjacent vertebrae.
b)   Spinal cord of an aduh ends about the level of the 2"*^ lumbar vertebra.
c)   Internal vertebral veins have large branches draining the bodies of the vertebrae.
d)   Spinal nerve roots can be followed into their intervertebral foramina where the roots fiise.

6.   The intervertebral discs:

a)   Are largely composed of hyaline cartilage.
b)   Contribute about one quarter of the length of the vertebral column.
c)   Are found in all regions of the vertebral column.
d)   May compress the spinal cord when injured.

377

7.   The arch of the aorta:

d)   Supplies the skin of the medial and anterior aspect of the forearm.

15.   In movements of the foot:

    a)   Eversion is increased in plantar flexion.
    b)   Inversion is increased in plantar flexion.
    c)   Inversion is produced by the tibialis anterior and posterior compartment muscles.
    d)   Eversion is limhed by tension in the dehoid ligament,

16.   The soleus muscle:

    a)   Is the most superficial muscle in the calf
    b)   Has the tibial vessels and nerve lying between h and the gastrocnemius muscle.

11.   The cisterna chyli:
    c)   Is attached superiorly by hs medial head to the superior aspect of the medial femoral condyle.
    a)   Drains directly into the jugular vein.
    d)   Is attached by the tendo calcaneus to the middle of the posterior surface of the calcaneus
    b)   Lies between the right crus of the diaphragm and the aorta.
    c)   Receives the right and left lumbar lymph tmnks.

17.   The arytenoid cartilage:
    d)   Receives lymph (chyle) from the abdominal alimentary tract.

12.   The levator ani muscle:
    a)   Is jumted to the cricoid by a plane, synovial joint.
    b)   Gives attachment to the vestibular ligament.

    a)   Gains attachment from the fascia covering obturator intemus.
    b)   Gains attachment to both the perineal body and the anococcygeal body.
    c)   Reinforces both the rectal and urethral sphincters.
    d)   Is supplied largely by sympathetic and parasympathetic nerves.

13.   The palmar muscle space(s):

    a)   Are two in number.
    b)   Are each deep to the palmar aponeurosis.
    c)   Contain the thenar muscles.
    d)   Contain the lumbrical muscles.

14.   The radial nerve:

    a)   Is a terminal branch of the posterior cord of the brachial plexus.
    b)   Lies posterior to the humems between the medial and lateral heads of triceps.
    c)   Passes anterior to the elbow joint.

21. A patient complains of loss of taste at the anterior two-thirds of the tongue. He may have:

   a) Inflammation of the middle ear.
   b) A tumour in the external auditory meatus.
   c) Injured the angle of his mandible.
   d) A tumour of the his vocal cord.
   e) Divided the hypoglossal nerve as a resuh of an accident.

22. Concerning the anatomical bases of clinical features of spina bifida:
   c) Has a muscular process which gives attachment to the oblique arytenoid muscles.
   d) Is covered posteriorly by mucous membrane.
   a) The lesions can occur in both the cranial/cervical and the lumbar/sacral areas.
   b) The primary defect is failure of closure of part of the neural tube.
   c) The bony defect is the failure of formation of the vertebral bodies.

18. d) In spina bifida occuUa disturbance in bladder and bowel control may be present.
   e) Spina bifida occuUa may be indicated by a tuft of hair.

18. The lingual nerve:
   a) Innervates the lower molar teeth.
   b) Innervates the anterior belly of the digastric muscle.
   c) Passes anterior to the lingula.
   d) Carries taste fibres from the circumvalate papillae.

19. The cavernous sinus is related:

   a) Superiorly to the pituitary gland.
   b) Laterally to the thalamus.
   c) Posterioriy to the facial nerve.
   d) Anteriorly to the superior orbhal fissure.

20. In the cerebral venous drainage the;

   a) Superior cerebral veins pass to the inferior sagittal sinus.
   b) Anterior cerebral vein joins the deep middle cerebral vein.
   c) Choroidal veins from the lateral and 3'"^ ventricles pass into the cavernous sinus.

   d) Great cerebral vein is formed from the internal cerebral vein of each side.

379
Section **B**

a) It is usually dislocated inferiorly where *it* is completely unprotected by muscles.
b) The accessory nerve, lying in relation to the surgical neck of the humerus may be torn in this injury,
c) The greater tubercle of the humems is the most lateral bony projection.
d) The strength of the rotator cuff muscles prevents posterior dislocations.
e) Usually occur in violent abductions.

27. A common peroneal nerve palsy:

a) Can occur following a fracture of the neck of the fibula.
b) Causes loss of extension of the big toe.
c) Causes characteristic foot drop.
d) Causes loss of inversion.
e) Produces anaesthesia of the sole of the foot.

23. A cervical rib is pressing on the lower trunk of the brachial plexus. Examination of the patient is likely to show impairment of:

28. Clinical anatomy of the female pelvic viscera;

a) Pronation of the forearm
b) Flexion of the shoulder joint.
c) Raising of the upper limb above the head.
d) Adduction of the fingers.
e) Sensation over the nail-bed of the little finger.

a) The pudendal block is sometimes used to anaesthetise the utems in childbirth.
b) If a woman has borne no children the extemal os is a flattened horizontal aperture with thickened anterior and posterior lips.
c) In a pap smear (after Dr. Papanicolau) small samples of epithelium are collected from the uterine lining.
d) Samples of fluid in the peritoneal cavity (present in infections) may be removed by accessing the vesico-uterine pouch.

24. About the abdominal wall:

a) The Langer lines are vertical.
b) The abdominal musculature is important in defaecation.
c) The abdominal musculature is important in respiration.
d) The area of the umbilicus is supplied by the spinal nerve T8.
e) Gentle stroking of the skin near the umbilicus will elicit a contraction of the abdominal wall muscles on that side.

25. Which are the common sites where a ureteric stone may become lodged at:

a) The pelviureteric junction.
b) The vesico-ureteric junction.
c) The iliac vessels.
d) The sacro-iliac joint.
e) The junction of the ureter and uterine artery.

26. Concerning anatomical considerations of a dislocated shoulder:

32. About the applied anatomy of the stomach and duodenum:

   a) The cardiac orifice is located at the level of TIO.
   b) The stomach is a mobile organ.
   c) A large portion of the anterior surface of the stomach is directly related to the parietal perhoneum of the anterior abdominal wall whhout any intervening viscera.
   d) A perforation of a posterior duodenal ulcer is dangerous because it may erode into the right gastric artery.
   e) Vagotomy may used to treat gastric ulcers.

33. The appendix:

   a) Can be located at operation by the convergence of the three taenia coli of the caecal wall.
   e) Sexually transmitted diseases may spread to the peritoneal cavity.
   b) Is usually located in the retrocaecal poshion.
29. Concerning clinical anatomy of the TB of the spine:
   c) Mesentery contains the appendicular branch of the ileocolic artery.
   d) Lumen is wide in infants and accounts for the low incidence of acute appendicitis in
   a) infants. x-rays the intervertebral disks appear white.
   b) Fundus is located at McBurney's point. be lost due to muscle spasms.
   c) In the cervical region, the spinal cord level corresponds to the vertebral body level.
   d) A myelogram may demonstrate spinal cord compression.
   e) In TB of the lumbar spine the pus may point and drain into the groins.

30. Clinical anatomy of the vertebral column:

   a) During lumbar puncture the cerebrospinal fluid is tapped fi"om the epidural space.
   b) Spinal anaesthesia may be done by deposhing anaesthetic dmgs in the epidural space.
   c) Lumbar puncture is usually done between L4 - L5 or L5 - S1.
   d) "Whiplash" injury of the cervical spine denotes injury to the spinal cord.
   e) Prolapse of the intervertebral disc is caused by mal-alignment of adjacent vertebral bodies.

31. About conjoined twins:

   a) By defmition are monochorionic and monoamniotic.
   b) The pathogenesis is failure of complete separation.
   c) The pathogenesis is fusion of twins.
   d) The famous 'Siamese' twins were of the craniopagus type.
   e) The method of choice of delivery is caesarean section to maximise survival and prevent maternal and twins trauma.

a) Splh skin grafts include the epidermis only.
b) Full thickness grafts include all of the reticular layer of the dermis.
c) Pedunculated grafts transfer exclusively the epidermis from the donor site to the recipient site.
d) Skin grafts from thick (palms & soles) skin are common.
e) Full thickness bums are very painfiil because the nerve endings are exposed.

38. Concerning examination of the spleen:

a) Its long axis lies in the line of the 12* rib.
b) The spleen is separated from the ribs by the diaphragm, the lower part of the lung
and the costodiaphragmatic recess.
c) A normal spleen lies behind the mid-axillary line.
d) The spleen may enlarge as far as the right inguinal region.
e) An enlarged spleen grows in a vertical direction downwards.

34. Clinical anatomy landmarks:

a) The tranhea bifurcates at about T2/T3
b) The angle of Louis passes through a plane going through T4/T5.
c) The transpyloric plane roughly corresponds to the level of L I.
d) The transtubercular line of the pelvis corresponds to the end of the spinal cord at L1/L2.
e) The inferior vena cava passes through the diaphragm at about T8.

35. Vessels of the lower Umb:

a) The femoral artery can be felt pulsating at the mid-inguinal point, halfway between the anterior superior iliac spine and the pubic symphisis,
b) A finger on the femoral pulse lies directly over the head of the femur,
c) The pulse of the popUteal artery is oflen not easy to detect.
d) The pulse of dorsalis pedis is felt between the tendons of extensor hallucis longus and extensor digitomm on the dorsum of the foot.
e) The dorsalis pedis is absent in about 40% of normal subjects.

36. Concerning clinical features of the anatomy of inguinal hernias:

a) An indirect inguinal hernia passes through the internal ring.
b) A direct hernia, if reducible, can be completely controlled by pressure with the fingertip over the intemal ring.
c) If a hernia protmdes through the extemal ring, it can be feh to lie above and medial to the pubic tubercle.
d) A scrotal hernia is likely to be an indirect hernia rather than a direct hernia.
e) An indirect hernial sac will pass medial to the inferior epigastric vessels.

37. Conceming the anatomical bases of clinical features of the bums and grafts:

39. A number of bony prominences in the lower limb are associated with overlying bursae which may become distended and inflamed:

   a) The one over the ischial tuberosity may enlarge with too much sitting (weaver's bottom).
   b) That in front of the patella (prepatella bursitis) is affected by years of repeated kneeling in the more erect poshion as in praying (clergyman's knee).
   c) The bursa over the ligamentum patella is affected by prolonged kneeling forwards as in scmbbing floors (housemaid's knee).
   d) Young women who wear fashionable but tight shoes are prone to burshis over the insertion of the tendoachillis into the calcaneus.
   e) A bunion is a thickened bursa on the inner aspect of the first metatarsal head, usually associated with hallux valgus deformity.

40. Concerning clinical features of the anatomy of the spinal cord

   a) Complete transection of the cord is followed by total loss of sensation in the regions supplied by the cord segments below the level of injury.
   b) In hemisection of the cord (Brown-Sequard syndrome) pain and temperature senses are lost on the opposhe side below the lesion.
   c) Intractable pain can be treated in selected cases by cutting the appropriate posterior nerve roots (posterior rhizotomy).
   d) Intractable pain can be treated by division of the spinothalamic tract on the side opposite the pain (cordotomy).
   e) Tabes dorsalis (syphilhic degenerative lesion of the posterior columns and posterior nerve roots) is characterised by spastic paralysis.

End of the Test Thank you very much for your cooperation

Anatomy Research Test (2003)

Sex: Female/Male (circle)

Year of study: _____ (undergraduate medical students only)

Department: (qualified doctors only)

Specialist   _____ (if any)

qualification: **Section**

A:

				10	Qualitative
A,	B.	C.	D.		• Develop sensitising concepts
					• Describe multiple realities
					• Develop understanding
A,	B,	C.	D.		• Empowerment of marginalized
					• Hunch as to how you might pro
					• Evolving, flexible, general
A.	B.	C.	D.		
					• Descriptive
					• Personal documents
					• Field notes
A.	B.	C.	D.	14	A. B. C. D.
A.	B.	C.	D.	15	Qualitative

Qualitative

7

				16	Qualitative
A.	B.	C.	D.		
A.	B.	C.	D.	17	Qualitative
	B.	C.	D.	18	Qualitative

9.

19. _____

X   *[b . \~c.*

32. _____

20

Qualitative

Go

- Develop sensitising concepts
- Describe multiple realities
- Develop understanding
- Empowerment of marginalized groups

Des

- Hunch as to how you might proceed
- Evolving, flexible, general

Da

- Descriptive
- Personal documents
- Field notes
- Photographs
- Official documents/artefacts

Sam

- Small

25

Qualitative

Go

- Develop sensitising concepts

26

Qualitative

Go

- Develop sensitising concepts

27

Qualitative

Go

- Develop sensitising concepts

28

Qualitative

Go

- Develop sensitising concepts

29

Qualitative

Go

- Develop sensitising concepts

30

Qualitative

Go

- Develop sensitising concepts

31

Qualitative

Go

- Develop sensitising concepts

X   *[~B.*   Tc   *[d . [e*

33

Qualitative

Go

- Develop sensitising concepts
- Describe multiple realities
- Develop understanding
- Empowerment of marginalized groups

Des

- Hunch as to how you might proceed
- Evolving, flexible, general

De

36

Qualitative

Go

- Develop sensitising concepts

37

Qualitative

Go

- Develop sensitising concepts

38

Qualitative

Go

- Develop sensitising concepts

39

Qualitative

Go

- Develop sensitising concepts

40

Qualitative

Go

- Develop sensitising concepts

APPENDIX VIII CLINICAL AND APPLIED ANATOMY (AN 432) EVALUATION

QUESTIONNAIRE AND RESULTS, & LOG SHEET

The University of Zambia
School of Medicine

Department of Anatomy Clinical and Applied
Anatomy (AN 432) Evaluation Form Academic year:
2000/1

Your responses are anonymous. Kindly complete this evaluation form as tmthfiilly as possible. The mformation is very valuable m assistmg the Department to deliver quality courses.

Instructions: Please indicate your choices by circling the number correspondmg to the option that represents your views.
1. Considering that you have already completed the general anatomy course, what are your ratings about the necessity of the clinical anatomy course

Waste of time	Not necessary	Not sure	Necessary	Very Necessary
2/56 (3.6%)	3/56(5.3%)	6/56 (10.7%)	29/56 (51.8%)	16/56 (28.6%)

2. Does the course improve your understanding of the relevance of anatomy to clinical practice?

Not at all	A little	Not sure	Certamly	Very much
1/56(1.8%)	1/56(1.8%)	2/56 (3.6%)	34/56 (60.7%)	18/56(32.1%)

3. Does the clmical anatomy course hicrease your motivation to leam anatomy?

Not at all	A little	Not sure	Certainly	Very much
2/56 (3.6%)	5/56 (8.9%)	1/56(1.8%)	23/56(41.1%)	25/56 (44.6%)

5. Kindly write any comments you have about the course:
   1. There should better co-ordmation with departments in hospital.

4. Kindly grade each of the course components usefuhiess in the course:

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	

   2. Interestmg course
   3. Bridges the gap between theory and practical /clhiical work
   4. Good course
   5. Teachmg strategy perfect and very enlightening course.

*A of CE = Anatomy of Clmical Examination

	Useless	Slightly useful	Not sure	useful	Very useful
Seminars	1/48 (2.1%)	10/48 (20.8%)	2/48 (4.2%)	21/48 (43.8%)	13/48 (27.1%)
AofCE	1/48 (2.1%)	4/48 (8.3%)	2/48 (4.2%)	21/48 (43.8%,)	19/48 (39.6%)
CSA	1/48 (2..1%)	3/48 (6.3%)	2/48(4.2%)	24/48 (50%)	17/48 (35.4%)
Course Manual	1/48 (2.1%)	4/48 (8.3%)	1/48 (2.1%)	19/48 (39.6%)	23/48 (47.9%)

5. Kmdly write any comments you have about the course:
   - b. Good preparatory course/bridgmg course for clmical work
   - c. Relocate to teach alongside gross anatomy
   - d. Too demanding in terms of time
   - e. Needs more co-operation of clinicians

   f Needs more guidance on how to run semmars/reports/ward visits *

CSA = Clinical Surface Anatomy

The University of Zambia
School of Medicine
Department of Anatomy Clinical and Applied
Anatomy (AN 432) Evaluation Form Academic year;
2002/3

Your responses are anonymous. Kindly complete this evaluation form as tmthfully as possible. The mformation is very valuable m assisting the Department to deliver quality courses.

Instructions; Please indicate your choices by circling the number corresponding to the option that represents your views.
   1. Considering that you have already completed the general anatomy course, what are your ratings about the necessity of the clinical anatomy course

Waste of time	Not necessary	Not sure	Necessary	Very Necessary
1/48 (2.1%)	1/48 (2.1%)	5/48 (5%)	29/48 (60%)	12/48 (25%)

2. Does the course improve your understanding of the relevance of anatomy to clmical practice?

Not at all	A little	Not sure	Certainly	Very much
0/48 (0%)	8/47 (16.7%)	1/48 (2.1%)	23/47 (47.9%)	15/47 (31.3%)

3. Does the clmical anatomy course increase your motivation to leam anatomy?

Not at all	A little	Not sure	Certainly	Very much
2/48 (4.2%)	9/48 (18.8%,)	1/48 (2.1%)	19/48 (39.6%)	16/48 (33.3%,)

4. Kindly grac e each of the course components usefuhiess in the course;

	Useless	Slightly useful	Not sure	useful	Very useful
Introductory lectures	1/48 (2.1%)	4/48 (8.3%)	6/48 (12.5%)	28/48 (58.3%)	9/48(18.8%)

The University of Zambia
School of Medicine

AN 432- Clinical Anatomy <u>Clinical</u>

<u>*Anatomy Log Sheet*</u>

Instructions to all ward supervisors: This is a record form for the fourth year MB ChB students in the School of Medicine. They have been instructed to observe clinical procedures, and also discuss anatomically relevant cases on the wards. You are kindly requested to discuss the relevant anatomy of your procedure or case with the students before counter-signing for procedure/case observed. Please note that **only medical officers of senior house officer grade and above** are permitted to counter-sign. Thank you for your co-operation.

Student's Name: Computer Number:

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	

Students must rotate through all departments: Surgery, Medicine, Paediatrics, Obstetrics & Gynaecology.
Sample of procedures to be observed and discussed:
Lumbar puncture. Intercostal Drainage, Venepuncture, Cutdown, Scalp drip. Urethral catheterisation. Incisions & drainage, Sthching, Ear & Nose instmment examination. Intubation, Naso-gastric intubation, Fundoscopy, Paracentesis, Dental extractions. Dental blocks. Placenta examination. Laparotomy, and any other procedure or case of clinical anatomy relevance.

APPENDIX IX RANDOM

NUMBERS TABLE

Appendix 7.1 **Random numbers**

eproduced from Table XXXIII of Fisher and Yates 1963, by permission of authors and publishers)

```
03 47 43 73 86   36 96 47 36 61   46 98 63 71   62 33   26 16 80 45   60   11 14 10 95
97 74 24 67 62   42 81 14 57 20   42 43 32 37   32 27   07 36 07 51   24   51 79 89 73
16 76 62 27 66   56 50 26 71 07   32 90 79 78   53 13   55 38 58 59   88   97 54 14 10
12 56 85 99 26   96 96 68 27 31   05 03 72 93   15 57   12 10 14 21   88   26 49 81 76
55 59 56 35 64   38 54 82 46 22   31 62 43 09   90 06   18 44 32 53   23   83 01 30 30
16 22 77 94 39   49 54 43 54 82   17 37 93 23   78 87   35 20 96 43   84   26 34 91 64
84 42 17 53 31   57 24 55 06 88   77 04 74 47   67 21   76 33 50 25   83   92 12 06 76
63 01 63 78 59   16 95 55 67 19   98 10 50 71   75 12   86 73 58 07   44   39 52 38 79
33 21 12 34 29   78 64 56 07 82   52 42 07 44   38 15   51 00 13 42   99   66 02 79 54
57 60 86 32 44   09 47 27 96 54   49 17 46 09   62 90-  52 84 77 27   08   02 73 43 28
18 18 07 92 46   44 17 16 58 09   79 83 86 19   62 06   76 50 03 10   55   23 64 05 05
26 62 38 97 75   84 16 07 44 99   83 11 46 32   24 20   14 85 88 45   10   93 72 88 71
23 42 40 64 74   82 97 77 77 81   07 45 32 14   08 32   98 94 07 72   93   85 79 10 75
52 36 28 19 95   50 92 26 11 97   00 56 76 31   38 80   22 02 53 53   86   60 42 04 53
37 85 94 35 12   83 39 50 08 30   42 34 07 96   88 54   42 06 87 98   35   85 29 48 39
70 29 17 12 13   40 33 20 38 26   13 89 51 03   •7 17   76 37 13 04   07   74 21 19 30
                                              4

56 62 18 37 35   96 83 50 87 75   97 12 25 93   47 70   33 24 03 54   97   77 46 44 80
99 49 57    77   88 42 95 45 72   16 64 36 16   00 04   43 18 66 79   94   77 24 21 90
16 08 15 04 72   33 27 14 34 09   45 59 34 68   '49 12   72 07 34 45   99   27 72 95 14
31 16 93 32 43   50 27 89 87 19   20 15 37 00   49 52   85 66 60 44   38   68 88 11 80
68 34 30 13 70   55 74 30 77 40   44 22 78 84   26 04   33 46 09 52   68   07 97 06 57
74 57 25 65 76   59 29 97 68 60   71 91 38 67   54 13   58 18 24 76   15   54 55 95 52
27 42 37 86 53   48 55 90 65 72   96 57 69 36   10 96   46 92 42 45   97   60 49 04 91
00 39 68 29 61   66 37 32 20 30   77 84 57 03   29 10   45 65 04 26   11   04 96 67 24
29 94 98 94 24   68 49 69 10 82   53 75 91 93   30 34   25 20 57 27   40   48 73 51 92
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APPENDIX X

SUMMARY OF DATA COLLECTED FROM DIFFERENT HEALTH
CARE CENTRES

To ensure that the data collected represented Zambia as a whole data were collected from the following regional and health care level settings:

1. National morbidity and mortality records from the Health Monitoring and Information Systems (HMIS) of the Central Board of Health (CBOH).

2. Morbidity and mortality records and the participation of doctors from the national referral hospital. University Teaching Hospital (UTH).

3. Morbidity and mortality records and the participation of doctors from a regional referral hospital, Ndola Central Hospital.

4. Morbidity and mortality records and the participation of doctors from a provincial referral hospital, Katete St. Francis Hospital.

5. Morbidity and mortality records and the participation of doctors from outpatient clinics of a district health management team, Lusaka District Health Management

Regional and Health Care Setting, and Data Collection Method Matrix

Qualitative	Quantitative
Goals	
• Develop sensitising concepts	• Theory testing
• Describe multiple realities	• Statistical description
• Develop understanding	• Show relationship between variables
• Empowerment of marginalized groups	• Prediction
Design	
• Hunch as to how you might proceed	• Structured, predetermined, formal, specific
• Evolving, flexible, general	• Detailed plan of operation
Data	
• Descriptive	• Quantifiable coding
• Personal documents	• Counts, measures
• Field notes	• Operationalised variables
• Photographs	• Statistical
• Official documents/artefacts	
Sample	
• Small	• Large

Team.

2. Ectopic kidney   1
3. Epididymo-orchitis   7
4. Prostate pathology   16
5. Urethral stricture   21
6. Hydrocele   2
7. Paraphimosis   10
                                    Sub-total   58 6.30%

Head & Neck
1. Head injury   52
2. Fracture mandible   4

Example of Inventory of Records: Ndola Central Hospital   Sub-total   56 6.10%
Thoracic
1. Fracture ribs/sternum   4
2. Intercostal drainage   18
Ndola Central Hospital   Sub-total   22 2.40%
Annual averages of Disease Burden

Hernia   64 6.90%
Surgery

                            Annual average % of total
Gastrointestinal
1. Biliary   1
2. Peptic ulcer disease   15
3. Gastrointestinal tract cancer   9
4. Appendix   11
S Abdominal mass   5

6. Haemoperitoneum   18
7. Intestinal obstruction   40
8. Peritonitis   9
9. Pyloric stenosis   0
                            Sub-total   109   11.%8
Perianal region
1. Rectal prolapse   3
2. Fissure/fistula   30
3. Haemorrhoids   13
                                    Sub-total   46 5%
Skin

1. Burns   41 4.40%

Genital Urinary System   394
1. Renal stone   1

Vaginal-cervical-uterine axis (Cont'd)

1. Abortion — 158 88
2. Fibroids — 76 156
3. Carcinoma of Cen/ix — 152 291
4. iVlolar pregnancy — 2, 337

| | | Sub-total | | 30.3% |

5. Menorrhagia/dysmenorrhoea
6. Intrauterine fetal death
7. Antepartum haemorrhage — 738
276
106
106

Systemic diseases

1. Malaria — 310   1,
2. Anaemia — 536   20%
3. Pueperal sepsis
4. Diabetes

| | Sub-total | 129 | |

5. Hypertension — 123
34 286

External genitalia — 3.7%

1. Bartholin's abscess — 358 165
2. Vaginal warts — 191 139

| | Sub-total | 853 | |

3. Vulval cancer

Others — 146

1. Abcesses — 43 13   11.1%
Fallopian-ovarian-pelvic axis
2. Cellulitis — 70 69
3. Gangrene — 12
Pelvic Inflammatory Disease
4. Trauma — 6
5. Soft tissue injury — 4
1. Pelvic abscess
6. Wounds — 2
2. Ovarian cyst
7. Traumatic amputations — 7
3. Ectopic pregnancy
8. Lipoma/tumours — 1
4. Pyomyositis — 3
9. — 1

RARY

10. Osteomyelitis — 1
11. Foreign bodies — 1
5   57.10%

| | Sub-total | 527 | |
| | Grand total | 923 | |

Obstetrics and Gynaecology Ndola Central Hospital

Annual average % of total

Vaginal-cervical-uterine axis

1. Abortion — 1,416

Bony-pelvis-birth passage
1. Deliveries   1,559
2. Cephalo-pelvic disproportion.   181
3. Placenta pathology   335

            Sub-total   2,075 26.9%

Respiratory
1. Pulmonary Tuberculosis   133
2. Asthma   39
3. Pneumonia   169

            Sub-total   341 4.4%

Others
1. Gastrointestinal   118
2. Central Nervous System (psychosis/meningitis)   164

            Sub-total   282 3.6%

         Grand total   7,710

Operations
I. IVlinor   817
2. Major   538