SAGE Research Methods Cases Part 1

Pre-experimental Design in Project Evaluation: The Case of the Scaling-Up Nutrition (SUNI) Project

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Abstract

This research methods case is based on the end-line evaluation of the Scaling-Up Nutrition Intervention (SUNI) project implemented by CARE International in Zambia, Program Against Malnutrition and other partners. Apart from fulfilling funding requirements, the evaluation was meant to establish end-line values for outcome level indicators for the project and, to assess change and impact of the project by comparing baseline and end-line values. The end-line evaluation was commissioned by CARE International in Zambia. To conduct the end-line evaluation of the SUNI project, a one-group pre-test -post-test design was adopted. This is a pre-experimental design that measures changes as a result of an intervention/project by comparing the before and after intervention values and/or conditions, without comparison groups. Therefore, this research methods case illustrates how the design was applied in the evaluation of the SUNI project. Furthermore, the strengths and limitations of the design are highlighted and discussed. The research method case further proposes alternative research designs to overcome some of the weaknesses of the one-group pre-test -post-test design. Lastly, the research methods case also highlights some of the considerations to take into account when using the one-group pre-test -post-test pre-experimental design and the circumstances under which the design might be considered appropriate.

Pre-experimental design; one-group pre-test post-test design; project evaluation

Learning Outcomes

By the end of this case study, students should be able to:

- Apply the one-group pretest-posttest pre-experimental design to their research projects
- Apply mixed methods data collection techniques to their research projects
- Explain the strengths and weaknesses of the one-group pretest-posttest pre-experimental design in project evaluations and research

Project Overview and Context

CARE International in Zambia, an international nongovernmental organization (NGO), has been working in Zambia for over 25 years, focusing on humanitarian response and development in rural and periurban areas. Therefore, CARE International in Zambia has been implementing different projects in the areas of health and HIV/AIDS, maternal and child health, water, and sanitation, among others.

In response to the government effort in reducing malnutrition in Zambia, the European Union (EU), through CARE Deutschland, supported CARE International in Zambia and Program Against Malnutrition (PAM) to implement the Scaling-Up Nutrition Interventions (SUNI) project in Choma and Kalomo districts of Southern Province, Zambia. The project was implemented from November 2016 to October 2020. The SUNI project was aimed at building the capacity of targeted staff of the Government of the Republic of Zambia and community volunteers on nutrition, while promoting the production, preparation, and consumption of diverse foods in 20 wards of Choma and Kalomo districts. The project targeted 7000 children below 2 years, 4000 pregnant and Lactating women, 400 community volunteers, and 25 Government of the Republic of Zambia staff.

As per project funding requirements, CARE International in Zambia commissioned an end-line evaluation of the project, after project completion. The purpose of the end-line evaluation was to establish end-line values for outcome-level indicators for the project; examine the knowledge, attitudes, behaviors, and practices related to agriculture, health and nutrition, hygiene and sanitation, gender, and women empowerment; and, to assess the change and impact of the project by comparing baseline and end-line values. We were therefore engaged to conduct the end-line evaluation in accordance with the terms of reference prepared by CARE International in Zambia.

To conduct the end-line evaluation of the SUNI project, we used a one-group pretest-posttest design. This is a pre-experimental design (Creswell, 2014) that measures changes as a result of an intervention/project (SUNI project in this instance) by comparing the before (baseline) and after intervention (end-line evaluation) values. Pre-experimental designs do not have a control group to compare with the treatment group (Creswell, 2014). In this regard, the researcher does not examine differences between groups, rather, they examine differences across time in one group (Salkind , 2010). The differences observed (taking into account that other factors, besides that project, may have influenced the observed outcomes), between the baseline and end-line values, are attributed to the project. In other words, a case is made that the project has contributed to the observed outcomes.

The choice of the method was influenced by the need to obtain comparable results between the baseline and end-line evaluations. That is, before the commencement of the project, baseline data was collected from one group (potential project beneficiaries), hence, for purposes of making comparisons, we needed to do the same when conducting the end-line evaluation of the SUNI project. It should be noted that the one-group pretest-posttest design is one of the commonest research designs in project evaluation. However, where resources allow and, to improve internal validity, evaluators prefer conducting none-equivalent (pretest and posttest) control-group design, a quasi-experimental design. This design has both treatment and control groups selected without random assignment. Further, both groups are subjected to pretest and posttest. However, only the experimental group receives the treatment.

Section Summary

- The one-group pretes-posttest design is a pre-experimental research design that measures changes within a single group over a period of time.
- Pre-experimental designs do not have a control group to compare with the treatment group.
- To measure the changes, researchers compare the results of pretest and posttest.

Research Design

As indicated in the preceding section, we adopted a one-group pretest-posttest pre-experimental design in conducting the end-line evaluation of the SUNI project. The design was considered appropriate for measuring changes associated with the interventions of the SUNI project. This design is typically represented as follows: O1 X O2 where O1 represents the pretest, X represents some treatment (SUNI project), and O2 represents the posttest (Salkind , 2010).

To apply this research design to the SUNI project evaluation, two periods with pre- and post-indicator values for the study population were required. In this regard, data were collected before the project (baseline assessment) in 2016 and after the project (end-line evaluation) in 2020. To measure changes associated with the SUNI project, we needed to collect data on the same indicators, from the same areas, at both baseline assessment and end-line evaluation, using the same tools.

Sampling

For budgetary and managerial reasons, evaluators and researchers choose to select a subset of the project sites and/or population. This is especially the case when the project, as was the case with the SUNI project, affects a large number of beneficiaries. Therefore, evaluators and researchers need to determine the appropriate sampling techniques as part of developing the evaluation design. However, the appropriate sampling techniques are influenced by the type of data collection method that has been selected (Westat et al., 2002). In the case of the end-line evaluation of the SUNI project, we used mixed-methods data collection approaches. For this reason, both probability and nonprobability sampling techniques were adopted.

Probability Sampling

Probability sampling techniques allow evaluators and researchers to make generalizations from the sample to the population, that is, all project beneficiaries or all sites (Westat et al., 2002). In other words, probability sampling techniques would allow us to assume that the results of the end-line evaluation of the SUNI project are a representation of all the project beneficiaries and wards where the project was implemented, even when not all beneficiaries and wards took part in the evaluation. To be able to generalize the findings with a great level of confidence, evaluators and researchers first need to determine the acceptable level of margin of error that can be tolerated. In the case of the end-line evaluation for the SUNI project, the margin of error was fixed at 7%. This gave a required sample size at a 95% confidence interval of about 300 observational units in each district. In other words, we would be 95% confident that the results (from the sample) are a representation of all the 4000 pregnant and lactating women from all 20 wards.

To select participants for the household survey, we adopted a two-stage stratified cluster sampling design. In the first stage, we planned to select 24 enumeration areas from 10 wards in the project area using a probability proportional to the estimated size. An enumeration area is a functional geographic unit for collecting and dissemination of census data (Qader et al., 2021). In the second stage, we planned to randomly select 30 households from each of the 24 enumeration areas in the 10 wards in the two districts using a sampling interval of 4. That is, we planned to select every fourth household after the first household was randomly selected.

Nonprobability Sampling

Nonprobability sampling techniques do not allow evaluators and researchers to generalize the findings of their studies. In this regard, purposeful sampling, a nonprobability sampling technique, was to be used to select participants for the key informant interviews and focus group discussions. Using this sampling technique, evaluators and researchers use their judgment to select participants for the interviews.

Data Collection

To collect data for the end-line evaluation of the SUNI project, we planned to use mixed-method data collection approaches, involving both qualitative and quantitative techniques. Mixed-method approaches use both quantitative and qualitative techniques in data collection. It is believed that, by using both qualitative and quantitative data collection techniques, evaluators are able to develop a full picture of why a project may or may not have produced the expected results (Westat et al., 2002).

In the context of the end-line evaluation of the SUNI project, we planned to use a survey, key informant interventions, and focus group discussion. A household survey was meant to collect quantitative data from pregnant women and mothers with children below the age of two. Conversely, key informant interviews and focus group discussions were meant to collect qualitative data. We planned to conduct key informant interviews with selected staff from organizations involved in the project. Further, focus group discussions were designed to collect qualitative data regarding experiences, attitudes, knowledge, and behaviors in relation to nutrition, health, agriculture, etc., among project beneficiaries.

Section Summary

- As part of developing research designs, researchers and evaluators need to determine the appropriate sampling techniques.
- Probability sampling techniques, in contrast to nonprobability sampling techniques, allow

evaluators and researchers to make generalizations from the sample to the population.
- Mixed-method data collection approaches allow evaluators to form a complete picture of why the project may or may not have produced the expected outcomes.

Research Practicalities

Dealing With COVID-19

The end-line evaluation of the SUNI project was initially designed to replicate the methodology used in the baseline (before the project commenced)—for purposes of comparing results between the baseline and end-line evaluation. The baseline assessment collected both qualitative and quantitative data, including taking anthropometric measurements (weight and height) of children below the age of 2 using (SECA) scale to measure weight and a stadiometer for measuring height. However, before the commencement of data collection, Zambia recorded the first cases of COVID-19. This led to the indefinite suspension of the data collection for the end-line evaluation, until such a time when the situation would permit.

When COVID-19 cases reduced in the country, CARE International in Zambia, the organization that commissioned the end-line evaluation, permitted us to proceed with the data collection exercise. However, this was to be done within the COVID-19 restrictions and guidelines imposed by the authorities. Some of the restrictions imposed included the abolishing of gatherings—which meant that we were not allowed to conduct focus group discussions. Focus groups are a gathering of 8–12 people who share some characteristics relevant to the evaluation or research topic (Westat et al., 2002). Instead, we therefore decided to replace focus group discussions with in-depth interviews. An in-depth interview is a qualitative data collection technique designed to elicit the interviewee's perspective or opinion on a given research topic. It is mainly conducted face-to-face and involves one interviewer on one hand and one interviewee on the other.

In addition, it was decided that we would not take anthropometric measurements of children below the age of 2 due to the requirement to maintain the recommended "social distancing" space of about 6 feet. Furthermore,

since both the client (CARE International in Zambia) and the evaluation team had an ethical commitment to cause no harm to participants in the evaluation or to communities where the evaluation was to be conducted, we decided to recruit research assistants locally. This was designed to minimize the risk of transmitting and/or contracting the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), the virus responsible for COVID-19.

Moreover, we also decided to recruit and train research assistants locally (i.e., in the districts where data collection was to be undertaken). The training was to be conducted in a venue that ensured good air circulation as well as social distancing, as per COVID-19 guidelines. To ensure social distancing during data collection, a decision was made to have four vehicles as opposed to two initially planned. To further minimize the risk of spreading and/or contracting COVID-19, we also procured face masks and instant hand sanitizers for use by both researchers and participants. However, since the initial budget, approved by the client, did not include such expenses, CARE International in Zambia provided additional funding.

Practical and Ethical Considerations

As indicated previously, researchers and everyone involved have an obligation to protect research participants and the communities where their research is to be conducted. We therefore undertook to ensure that the end-line evaluation of the SUNI project was conducted in a manner that ensured the safety and protection of participants and everyone involved, especially given the outbreak of COVID-19. Some of the practical and ethical considerations undertaken included:

a. Procurement of face masks and instant hand sanitizers for use by both researchers and participants.
b. Obtaining ethical clearance for the research protocol.
c. Working with local health authorities for purposes of reporting and treatment of suspected cases of COVID-19.
d. Ensuring that the end-line evaluation was conducted in a manner that respected all the basic research ethics, that is, privacy, safety, confidentiality, informed consent, and respect for the rights of the participants, including their culture, religion, etc.
e. Obtaining verbal as opposed to written consent from all participants.

Research Team

The research team for the end-line evaluation included; a nutrition specialist (who was the lead investigator), two co-investigators, one data analyst, two supervisors, and 11 research assistants. The core team (lead and co-investigators) possessed relevant knowledge, skills, and experience, which enabled us to successfully conduct the evaluation. In addition, the two supervisors and 11 research assistants recruited locally also possessed the right mix of education and skills that were compatible with the research topic. In addition to their level and type of educational qualifications, the supervisors and the research assistants were required to be fluent in Tonga, the language predominately spoken in the two districts where the evaluation was conducted.

Training of Supervisors and Research Assistants

In order to ensure data quality, timely and effective collection of data for the SUNI end-line evaluation, the consultants and CARE International in Zambia conducted a 3-day training workshop for all the research staff. The training was designed to be highly participatory with a mix of group discussions and role plays. The purpose of the training workshop was to prepare research staff for fieldwork. The specific objectives of the training were to:

a. Explain the context and objectives of the SUNI end-line evaluation.
b. Explain the sources of data for the SUNI end-line evaluation.
c. Explain the sampling methodology for the SUNI end-line evaluation.
d. Explain the data collection tools for the SUNI end-line evaluation.
e. Explain the ethics and rules of conduct for research staff.
f. Explain COVID-19 guidelines, prevention measures, and any other related topics.

Section Summary

- Research design is supposed to be adaptable in order to reflect the prevailing circumstances at the time the research is being undertaken.
- Researchers and evaluators have an ethical obligation to cause no harm to research

participants and communities where their research is being conducted.
- Researchers must undertake practical measures to prevent unethical practices during data collection

Method in Action

When all the logistics and materials for both the training and fieldwork were in place, we traveled to Choma, the venue for the training. On the first day of training, two research assistants recruited earlier had to excuse themselves due to personal reasons. Therefore, we needed to find replacements as soon as possible. Working with CARE International in Zambia and some of the research assistants, we managed to find replacements in good time.

During the training, to ensure that we adhered to COVID-19 guidelines and regulations, all the training participants and facilitators wore face masks, had their body temperatures checked regularly, and maintained the recommended “social distancing” space of about 6 feet. Fortunately, none of the participants and facilitators exhibited COVID-19 symptoms. After the training, we conducted a pilot study. The purpose of the pilot study was to test both the tools and methodology, as well as other aspects of data collection. In addition, the pilot study was conducted to ensure familiarity with the study tools following the training. The other reason for the pilot study was to assess the ability of research assistants to undertake the data collection tasks. Based on the observations made during the pilot study, adjustments to the tools, where necessary, were made. However, since we were required to collect comparable data (with the exception of anthropometric measurements), we took care to avoid significant changes to the tools.

After the pilot study, our team split into two, one in Choma district and the other in the Kalomo district. During the data collection exercise, data were collected on a number of variables (access to basic water and sanitation, hygiene, maternal health, nutrition, etc.). The data were collected from the same areas (five wards in each district) as was the case with the baseline assessment. Remember that the one-group pretest-posttest design examines differences across time in one group.

However, in Choma, we could not meet the targeted household sample size (420) from the predetermined five wards. Since the project was implemented in 20 wards (10 in each district), to meet the shortfall, we decided to include two more wards. It must be mentioned that the two additional wards included were conveniently selected. Moreover, since the two wards were part of the intervention areas for the SUNI project, they had sufficiently similar characteristics with the initial five wards already included in the evaluation at baseline. This meant that we included two more wards that were not part of the study areas at baseline. However, for purposes of making comparisons between baseline and end-line values, there was a need to ensure equal sample sizes between the baseline assessment and the end-line evaluation. Data were collected on the following variables: access to basic water and sanitation, hygiene, maternal health and nutrition, child health and nutrition, and food production and preparations, among others.

The data collected during the end-line evaluation were analyzed and compared with the one obtained at baseline (before the start of the project). This comparison was necessary in order to determine the success of the SUNI project. For example, results indicated that, overall, the minimum dietary diversity score for children aged 6–23 months had doubled from 7% at baseline to 14% at end-line. In this instance, as indicated in the project context and overview section, the difference observed, between the baseline and end-line values could be attributed to the project—taking into account that other factors, besides the project, may have contributed to the observed outcomes. In other words, it is assumed that the project has contributed to the 7% increase in the dietary diversity score.

The main advantage of the one-group pretest-posttest design is that it allows for testing of the dependent and independent variables before and after the intervention (project). For example, using this design, we were able to assess the proportion of children (0-5 months) who were exclusively breastfed before and after the SUNI project. However, since projects are implemented in a natural environment where so many other factors, besides the project, can have an influence on the observed outcomes, evaluators are usually careful when making associations between the interventions and the observed outcomes. For example, project beneficiaries, (mothers of children, 0-5 months) who did not know the importance of exclusive breastfeeding for 6 months—before the project started—might have obtained the knowledge on the importance of exclusive breastfeeding from other sources, government programs, television, radio, neighbor, etc. However, due to recall bias, participants tend to have difficulties relating specific knowledge or information to a specific source.

Therefore, since the one-group pretest-posttest design does not include a control group (Creswell, 2014), evaluators are usually cautious when interpreting results. For example, although the results suggested an in-

crease in the dietary diversity score for children aged 6–23 months, from 7% at baseline to 14% at end-line, it was not possible to exclusively attribute the observed increase to the project since the design does not eliminate other factors (extraneous variable). It is for this reason that, Salkind (2010) asserts that the one-group pretest-posttest design is one of the weakest when trying to establish cause-and-effect relationships between independent variables (project interventions) and dependent variables (project outcomes).

In general terms, with the exception of the failure to meet the predetermined household sample size in one of the two districts, everything went well and according to plan. In terms of challenges, there were two major challenges encountered in the course of undertaking the end-line: insufficient project documents (data) to measure the efficiency of the SUNI project and failure to meet the required sample size for the household survey in the five preselected wards, in Choma. To address these challenges, the following actions were taken; to meet the required sample size, as indicated previously, two additional wards were sampled. Furthermore, we made a decision to exclude efficiency (as an evaluation criterion) from the report, due to insufficient data.

Section Summary

- An advantage of the one-group pretest-posttest design is that it allows for testing of the dependent and independent variables before (baseline) and after the intervention (project interventions).
- The one-group pretest-posttest pre-experimental design is one of the weakest designs when trying to establish cause and effect relationship between the independent variables (project interventions) and dependent variables (project outcomes).
- When insufficient data has been collected on a given variable, it is best to exclude such a variable from analysis and reporting.

Practical Lessons Learned

The main lesson learned in conducting the end-line evaluation of the SUNI project is that pre-experimental designs are relatively cheaper options when trying to establish cause and effect relationship between independent variables (project interventions) and dependent variables (expected project outcomes), compared with quasi-experimental designs. This is because the one-group pretest-posttest pre-experimental design does

not include a control, hence, reducing the cost of conducting the research and/or evaluation.

However, evaluators have difficulties establishing a cause-and-effect relationship, with a great degree of confidence, between project interventions and outcomes due to the absence of a control. It is difficult to associate observed outcomes solely with the intervention/project because there might be other factors contributing to the observed outcomes. For example, in the case of the SUNI project, we established that the government and other organizations have been implementing similar interventions in the districts where the SUNI project was undertaken. However, due to the lack of control in our design, we could not account for the contribution of these interventions to the observed outcomes. Therefore, the results from a one-group pretest-posttest pre-experimental design must be interpreted with caution.

To establish a strong association between the project interventions and the observed outcomes, quasi-experimental designs (that allow for the use of both treatment and control groups) are usually preferred when resources and conditions allow.

We also learned that the one-group pretest-posttest design is considered appropriate when researchers or evaluators have difficulties finding a control group similar in characteristics to the treatment group. Even when resources are available, it is often difficult to identify a valid control group that is willing to participate in the evaluation (Westat et al., 2002). In most cases, those who are not expected to participate in the project or have not received any benefits from the project are unwilling to participate in the evaluation just for the sake of it. The solution, if resources allow, is to provide different treatments (project interventions or benefits) to the treatment and control groups.

The other lesson learned is that, when using the one-group pretest-posttest pre-experimental design, there is usually a need to make adjustments to the tools. This adjustment, though necessary, due to changes that might have occurred between the pretest (baseline) and the posttest (end-line evaluation), has the potential to affect the validity and reliability of the original tool. For example, in the case of the end-line evaluation of the SUNI project, there were a number of variables added to the tool after the pr-test. Consequently, this affected our ability to make valid comparisons between pretest and posttest results in relation to the concerned variables since there were no similar values collected at baseline. For this reason, care must be taken to ensure that only minor and necessary changes are made to the tool. However, such changes to the tools must be noted and acknowledged when reporting and comparing the findings.

Section Summary

- The one-group pre-test-posttest pre-experimental design is a relatively cheaper option for establishing cause and effect relationship between independent and dependent variables.
- It is difficult to establish a strong association between the independent and dependent variables in a one-group pretest-post-test pre-experimental design due to the lack of a control group.
- The one-group pretest-posttest pre-experimental design is most appropriate when it is not possible to find a control group similar in characteristics to the treatment group.

Conclusion

This research method case is based on a commissioned end-line evaluation of the SUNI project. To conduct the end-line evaluation, a one-group pretest-posttest pre-experimental design was used. The design measures changes as a result of an intervention/project by comparing the before and after conditions and/or values, without a control group to compare with the treatment group. The differences observed, if any, can be attributed to the project, taking into account that other factors, besides the project, may have contributed to the observed outcomes. The design was chosen because it allowed us to obtain comparable results between the baseline and end-line evaluations at a relatively lower cost. However, this research methods case has also indicated that, where resources allow and, to improve internal validity, a none-equivalent (pretest and posttest) control-group design is preferred. This is a quasi-experimental design with both treatment and control groups selected without random assignment. However, only the experimental group receives the treatment.

It has further been illustrated in this research method case that the one-group pretest-posttest design has both advantages and disadvantages. One of its main advantages is that it allows for testing of the dependent and independent variables before and after the intervention. However, since the one-group pretest-posttest design does not include a control group and, projects are implemented in a natural environment, where so many other factors, other than the project, can influence observed outcomes, the results cannot be entirely attributed to the intervention. Therefore, to be able to attribute results with a great degree of confidence,

evaluators prefer using a none-equivalent (pretest and posttest) control-group design. The design has both treatment and control groups; hence, it allows evaluators to take into account the potential effects of extraneous variables, at least to some extent.

Furthermore, it has been indicated in this research methods case that mixed-method data collection approaches were used to collect both qualitative and quantitative data. The methods used included a survey, key informant interventions, and in-depth interviews. Mixed-method data collection approaches are desirable since they enable evaluators to develop a full picture of why a project may or may not have achieved its results.

In addition, this research method case has demonstrated that research design can be modified to comply with government regulations at any given time. In this regard, we modified the design of the end-line evaluation of the SUNI project in order to comply with the COVID-19 guidelines imposed by the authorities.

Section Summary

- To attribute outcomes of an intervention with a great degree of confidence, evaluators prefer using a none-equivalent (pretest and posttest) control-group design.
- A none-equivalent (pretest and posttest) control-group design has both treatment and control groups; hence, it allows evaluators to take into account the potential effects of extraneous variables.
- Mixed-method data collection approaches are desirable in project evaluations since they enable evaluators to develop a full picture of why a project may or may not have achieved its results.

Classroom Discussion Questions

1. Describe how you would apply the one-group pretest-posttest pre-experimental design to your research project.
2. Discuss the relevance of research ethics to ensuring credible findings in research and/or evaluations.
3. What ethical issues would you consider relevant to your research topic and how would

apply them?

4. Under what circumstances would you consider using the one-group pretest-posttest pre-experimental design?

Multiple-Choice Quiz Questions

1. The one-group pretest-posttest pre-experimental design measures changes as a result of the intervention/project by:

- **a.** Comparing the before and after intervention results

Incorrect Answer

Feedback: This is not the correct answer. The correct answer is B.

- **b.** Comparing the before and after intervention results within the same group.

Correct Answer

Feedback: Well done, correct answer

◯ **c.** Comparing the before and after intervention/project results between two groups

Incorrect Answer

Feedback: This is not the correct answer. The correct answer is B.

2. Which of the following sampling techniques allows researchers and evaluators to generalize the findings from the sample to the population?

◯ **a.** Probability sampling techniques.

Correct Answer

Feedback: Well done, correct answer

◯ **b.** Nonprobability sampling techniques

Incorrect Answer

Feedback: This is not the correct answer. The correct answer is A.

◯ **c.** Both probability and nonprobability sampling techniques

Incorrect Answer

Feedback: This is not the correct answer. The correct answer is A.

3. Which of the following is a quantitative data technique?:

◯ **a.** fFocus group discussion

Incorrect Answer

Feedback: This is not the correct answer. The correct answer is B.

b. Survey.

Correct Answer

Feedback: Well done, correct answer

c. In-depth interview

Incorrect Answer

Feedback: This is not the correct answer. The correct answer is B.

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