

Measuring Process Improvements Supported by mHealth Initiatives

The South African mHealth Strategy 2015–2019 defines mobile health—or mHealth—as the use of mobile computing, medical sensors, or other communication technology in the delivery of health-related services [1]. mHealth has the potential to empower patients with information to inform their healthcare decisions and link them to health services.

As with a traditional healthcare initiative, measuring the efficacy of an mHealth intervention is critical to understanding the impact on outcomes and processes that such interventions bring. While there has been criticism over the lack of evidence to support investment in mHealth [2], the focus on providing rigorous evidence via randomized controlled trials or other intensive evaluation methods may lead to simpler and less cost-intensive methods being ignored [3].

An alternative to randomized controlled trials and other, similar resource-intensive methods is the performance measurement approach. This approach uses the regular collection and analysis of data to assess improvements in performance and quality of care [4]. This brief provides an overview of the different types of performance measurements, along with tools and resources for implementing improvement studies.

Types of performance measurement

Measurement of the performance of an intervention can be divided into three categories: **accountability**, **research**, or **improvement** [5]. Understanding the performance measurement approach has an impact on the type of data collected and the information that data provides.

Accountability

The data collected for an accountability study focuses on outcomes, but provides little to no information about the process that results in those outcomes. Examples of accountability data could be a skilled birth attendant rate at delivery or the percentage of newborns receiving a postnatal care visit within 48 hours. The purpose of an accountability study may be to compare outcomes among health systems.

Research

Research studies are conducted to generate new knowledge. These studies seek to isolate the impact of the mHealth intervention itself. This often makes the data collection process long and complex and requires a large sample size in order to show significance. Technical assistance from statisticians and other experts is usually needed to conduct a research study.

Improvement

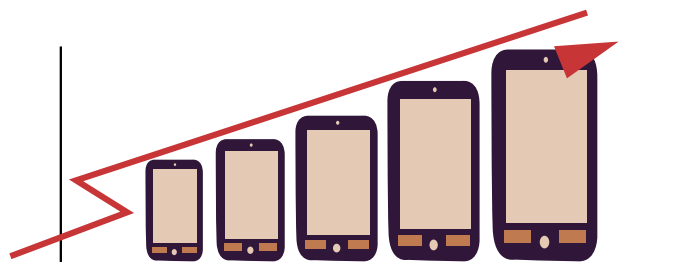
Improvement studies evaluate both the process and the impact of changes on outputs. They are generally conducted with small sample sizes in a short period and are useful for measuring incremental changes. Because there is less concern about the *fidelity* of the intervention in an improvement study, as compared to a research study, iterative improvements can be made as data collected indicate the need for adjustment.

To ensure that HIV test results are returned faster or that health professionals follow clinical practice guidelines, or to answer some other inquiry, many mHealth interventions focus on improving work processes. Improvement studies are therefore a natural choice for evaluating the impact of these interventions. The remainder of this brief outlines improvement science as applied to mHealth.

“Every system is perfectly designed to get the results it gets.”

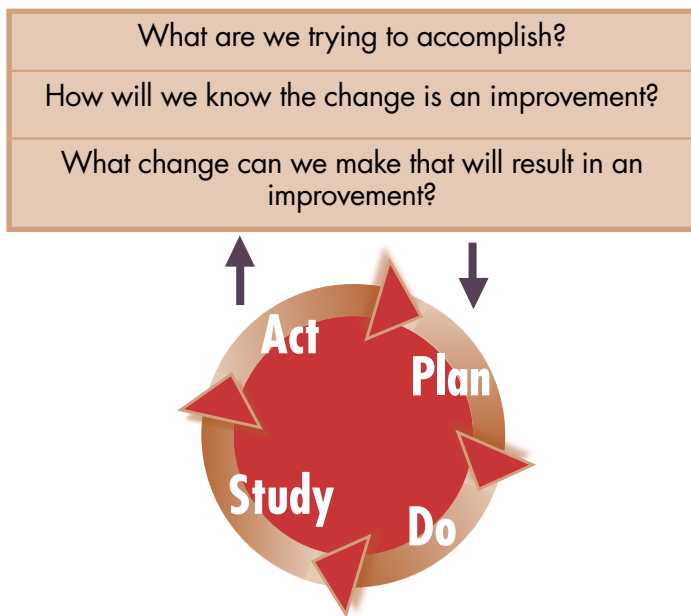
– Paul Bataldin

mHealth tools are not implemented in a vacuum. Most often, they are implemented in a healthcare system that is already performing suboptimally, owing to lack of resources, human capacity, or other constraints. The first time an mHealth intervention is implemented, there will likely be a need to make adjustments for the system to work optimally. In an improvement study, we analyze the current process and establish baseline performance, identify bottlenecks or waste in that process, and select and test a change to that process.



Model for improvement

Many visual models are available to help guide us through the steps of improvement studies. A common one is the Plan-Do-Study-Act (PDSA) Model for Improvement [5], depicted in Figure 1.

Figure 1. Model for improvement

To illustrate the use of the model, we'll look at an example of measuring improvement for two types of mHealth interventions:

1. A **client-side** example, in which pregnant women receive stage-based text messages throughout pregnancy and into the postpartum period
2. A **provider-side** example, as a referral tool that lets community health workers (CHWs) know when a newborn has been discharged from a facility and when a follow-up is due

What are we trying to accomplish?

The first question in the model for improvement guides us to clearly define the current problem or issue that we are trying to address with our mHealth intervention and what the aims of the improvement study should be. Problem statements explain the current issue and its significance. Having a clearly defined problem statement can help keep the study team on task and can be used to help garner support for the intervention [6]. Problem statements should include the following components: a description of the problem, a time frame for the issues, data that specify the gap in performance, and the impact of the issue.

Examples of mHealth problem statements

Client tool: From January 2016 through March 2016, only 8% of pregnant women newly enrolled in the text-messaging mHealth program could identify three or more danger signs in pregnancy. Not being aware of danger signs could result in delays in seeking care in an emergency, leading to maternal and/or neonatal death.

Provider tool: From January 2016 through March 2016, only 10% of neonates discharged from facility X received an at-home visit within six days of delivery. The first few days after birth are the most vulnerable to a neonate. Failure to receive appropriate and timely postnatal care can lead to neonatal disability or death.

The aim of the study should address how the mHealth tool will impact the problem. The aim statement should answer the questions:

- **What?**
- **For whom?**
- **By when?**
- **How much?**

Our aims should follow the guidelines commonly known as **S.M.A.R.T. objectives**: Specific, Measurable, Achievable, Realistic, and Time-bound. Answering the “what, for whom, by when, and how much” questions can help to make the problem specific. A goal is measurable when it explicitly states the expected change rather than a general statement, such as “improve the number of x” or “decrease the percentage.” An achievable and realistic goal will require understanding the capabilities of your tool, your project staff, and other local issues that may have an impact on the intervention. A goal that specifies a time frame when the goal is expected to be achieved is time-bound. The aim statement should directly address the issue that was outlined in the problem statement.

Examples of mHealth aim statements

Client tool: By January 2017, 50% of surveyed pregnant women enrolled in a stage-based text messaging program for at least three months can identify three or more danger signs in pregnancy.

Breakdown of aim:

- **What**—identify danger signs in pregnancy
- **Whom**—pregnant women enrolled in text messaging program
- **By when**—January 2017
- **How much**—50% of women enrolled for at least three months

Provider tool: By January 2017, 60% of neonates discharged from facility X are assessed in their home by a community health worker within six days of birth.

Breakdown of aim:

- **What**—in-home assessments within six days of discharge from facility X
- **Whom**—neonates discharged from facility X
- **By when**—January 2017
- **How much**—60% of neonates discharged from facility X.

In an ideal world, the goal would be for 100 percent of women to be able to identify danger signs and 100 percent of neonates to receive postnatal care, but this would be a significant improvement from our baseline numbers defined in our problem statement. Setting unachievable targets is discouraging to the project team. Confer with your teams to ensure that goals are achievable and realistic in the time frame specified.

How will we know that a change is an improvement?

Three types of measures are used to demonstrate improvements: **outcome**, **process**, and **balancing** [7].

The outcome measure is the impact of the intervention on the patient, client, or other relevant stakeholders. The **outcome measures** should be included in your aim statement. For our mHealth examples, the outcomes are:

1. The percentage of pregnant women who can identify three or more danger signs of pregnancy
2. The percentage of neonates receiving a postnatal care visit within six days

Process measures help us understand if the intervention is working as intended. Going back to our client example, we could survey women to see if the messages are coming in their language of choice and how often they are receiving the messages. We may find that women are not receiving all the messages we send or they may think there are too many messages and are thus ignoring some.

For our provider tool, we could assess the time lag between birth and the CHW receiving the referral notification. A significant lag could result in a failure to follow up with the neonate within the six-day time frame.

Balancing measures help us to look at unintended consequences of our intervention. For example, does our client tool increase demand for services that we don't have the capacity to meet? For our provider tool, does sending a referral result in earlier discharges for neonates who needed additional observation?

What change can we make that will result in improvement?

This question can be addressed by answering “What’s wrong with the system now?” and “What works?”

The initial mHealth implementation may be the change you want to measure or it may be adjustments to the tool. For example, if after initial testing of the client tool, women were still not able to identify danger signs in pregnancy, the issue could be the timing of the messages, the frequency of the messages, or the content. Get feedback from the users that helps answer the questions above; then adjust the tool and retest.

The Plan-Do-Study-Act cycle

With project aims set and measures in place, it's time to test changes using the PDSA cycle, shown in Figure 1. The PDSA cycle will help determine if a change leads to an improvement.

Plan

In this step, you have planned the test and method for measuring the impact. This includes the aim, S.M.A.R.T goal, and data collection plan.

Do

In the “Do” step, the test is done on a small scale. For our client-side example, this may be changing the timing of the messages for a subset of patients. For our provider example, if we found referrals were not being entered in the system in a timely manner, we could test adding a step to enter the referral into a birth checklist for the provider, or having someone other than the provider enter the referral in the mHealth tool.

Study

This is the step in which data are analyzed and compared to predictions. Use of run charts and other tools described in the data section will help to explain the results.

Act

In this step, adjustments are made based on data and in preparation for the next testing cycle or expansion of the intervention.

Necessary data

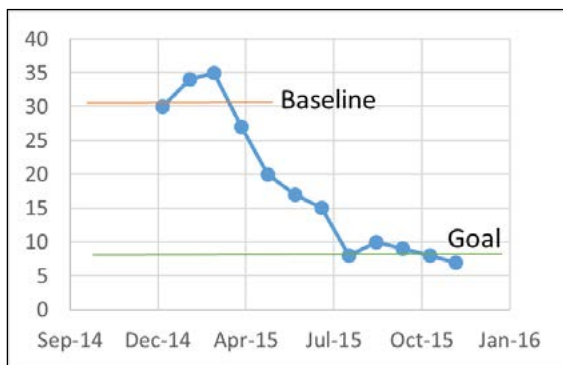
Conducting an improvement study requires data about the current process and also changes that are made during the PDSA cycle. Various methods and tools can be used to collect data, such as surveys, interviews, system logs, and observations. A well-thought-out data collection plan will help ensure that data collected are both useful and reliable. A data collection plan should be guided by the following questions [8]:

What information is needed to assess data quality?

1. **What is the source of the data?** Sources can include healthcare providers, clients, observations, or clinical records.
2. **How will you collect the data?** This could be from surveys, system logs, databases, etc. Our client tool was evaluated using a survey; the provider tool could be evaluated by reviewing log data.
3. **How much data need to be collected?** 10–30 observations may be sufficient to inform how a process is working, while more data may be necessary to compare performance among healthcare workers.
4. **What is the timeline for collecting data?** It is important to assess what resources are available in order to know how often data can be collected.

Reviewing data

Many methods exist for plotting and reviewing data. **A simple method that is often used in performance measurements is a run chart.** A run chart is a graphic display of data, usually plotted over time. Run charts are easy to make and to interpret. They allow the viewer to understand variations in data and the impact of changes without complicated statistical analysis. Figure 2 shows an example of a run chart from the provider mHealth project.

Figure 2. Sample run chart: Average hours till referral received

Three tips for data collection

Many resources are available to help guide the development of a data collection plan. Here are some tips for the data collection process:

1. **Do not collect unnecessary data**, because this wastes time and resources.
2. **Review data often**, especially in the beginning, because this can identify problems with the data collection process.
3. **Give feedback!** In our two examples, clients will want to know if receiving text messages helps pregnant women learn, while providers and CHWs would be encouraged to hear that the tool is helping improve follow-up care.

Conclusion

The improvement study approach to monitoring and evaluating mHealth allows an intervention to be systematically tested and enhanced. This can be useful in identifying process issues that may be having a negative impact on the overall performance of the tool. It also provides data for making tweaks to the mHealth tool or the implementation process that could have a significant impact on outcomes. The data from these studies can be used by program managers and other key stakeholders to make decisions about expanding the program or the need to make changes. Improvement studies also provide useful feedback both to clients and healthcare providers on the benefits of using such tools.

The resources in the next section provide additional guidance and detail on measuring performance improvements.

www.measureevaluation.org/sifsa

Improvement study resources

- MEASURE Evaluation: <http://www.measureevaluation.org/resources/training/online-courses-and-resources>
The USAID-funded MEASURE Evaluation project offers numerous courses, trainings, and tools.
- Institute for Healthcare Improvement (IHI): <http://www.ihi.org/>
IHI provides education and training on improvement science related to health.
- The MAPS Toolkit: <http://www.who.int/reproductivehealth/topics/mhealth/maps-toolkit/en/>

This World Health Organization toolkit aids in the assessment of an mHealth project and serves as a planning tool for scale-up.

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