Using mHealth tools to promote oral health among women living in poverty in Peru: a Program Plan

By

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Abstract

This paper presents the design of a program plan proposing the use of mHealth tools to promote behavioral change in oral health hygiene and dental health-seeking behavior for women living in poverty in Peru. mHealth is an area of electronic health that provides health services and information via mobile technologies such as mobile phones and personal data assistants (WHO, 2012).

The program plan was developed using an approach proposed by Issel (2009), which recommends describing the understanding of the context in which program will be implemented, stating the problem, and developing a program theory as a foundation for program plan. This is used to develop a logic model for program delivery and implementation, as well as developing program objectives and goals.

The program theory was based on the health belief model. It describes the factors that are crucial for implementation, and how the program will approach behavioral change. This program focuses on four domains of the theory: perceived susceptibility, perceived severity, perceived barriers, and cue to action.

The intervention itself will consist of sending out SMS messages three times a day during seven days, monthly, for three months. They will contain information on best oral health practices developed in accordance with the evidence base on that topic. The messages will be delivered in three blocks. The first block will have messages on best practices of tooth brushing techniques. The second block will incorporate messages on how nutritional habits, tobacco and alcohol use affect dental health status. The third block will incorporate messages on best oral health practices for children. Each block will consist of twenty-one short messages, and will be sent out every month.

The program will be implemented in three phases: preparation phase, pilot project phase, and full implementation phase. Basics of the implementation plan and the proposed framework and methods for
evaluation are also described in the paper.

The proposed program plan, designed to address the multiple issues aligned with poor oral health promotion in women living in poverty in Peru, can be viewed as a pilot that will help understand usability and effectiveness of mHealth tools in helping to achieve better oral health in Peru.
Introduction

Oral diseases are most common disease of humankind. Nearly 100% of adults worldwide have dental caries (WHO, 2012). Oral health diseases have a great burden in low and middle income countries, even though they are preventable (FDI World Dental Federation, 2014). Poor oral health is connected to other aspects of physical and psychological health (WHO, 2003). Hence, educating the population on best oral health practices can help increase the quality of life and possibly reduce other related medical risks. Women could be a good target for oral health interventions, since they are involved in care of their families. mHealth has promise in reaching women who are hard to reach, because of geographical location or social status.

Background.

The importance of oral health

Oral health is an essential component of health. WHO (2012) defines oral health as “a state of being free from chronic mouth and facial pain, oral and throat cancer, oral sores, birth defects such as cleft lip and palate, periodontal (gum) disease, tooth decay and tooth loss, and other diseases and disorders that affect the oral cavity. Risk factors for oral diseases include unhealthy diet, tobacco use, harmful alcohol use, and poor oral hygiene”. Therefore, individuals’ quality of life and their participation in society and economic productivity is highly affected by oral health status (FDI World Dental Federation, 2014).

Oral Health care. Key issues in Latin America.

According to the World Dental Federation (2014) most oral health diseases can be prevented. The WHO (2012) has identified that oral health conditions are the fourth most expensive conditions to treat, whereas preventing is more cost-effective (WHO, 2012). In many
developing countries the education on best oral health practices and the access to professional services is limited (WHO, 2012). South American countries can be described similarly. The Pan American Health Organization (PAHO) (2005) has implemented different strategies in order to enhance oral health in the whole region A lot of initiatives for oral health promotion and prevention have resulted in the decrease in the rate of oral health disease as shown in Figure 1.

![Figure 1. Trends in DMF index scores at age 12 for Latin American countries.](image)

Most of the initiatives were supported by efforts from governments of the region. They tried to incorporate best practice into policies for oral health disease prevention, such as water and salt fluoridation, as well as introducing Atraumatic Restorative Treatment (ART) as a school based program (PAHO, 2005). Nonetheless, there are still parts of the population that are not reached by the multiple efforts of these programs, so that as shown in the maps in Appendix IV
that the level of the Dental caries in 12 years old children and adults from 35 to 44 years is medium or high in a lot of countries throughout Latin America.

*Oral health in Peru.*

The Peruvian government is committed to making the citizens’ quality of life better, it has worked hard to improve and extend access to healthcare. As a result, they have included oral health care provision in National Health Insurance plans (EsSalud, 2013; MINSA, n.d.). However, only 65% Peruvians are insured (Global Development Network, 2013 March), so 45% of the Peruvian population is not served. The situation with oral health in Peru still remains problematic. The oral health disease burden is very high. In 2002, the national evaluation of school children’s health in Peru showed 90.5% prevalence of caries in the age group from 6 to 15 (Malmö University, 2002). The last reported WHO (2003, July) statistics on the oral health situation in Peru shows that the average Decayed Missing and Filled Teeth (DMFT) index is very high (5.7) compared to the significantly lower numbers for the region shown in Figure1.

Not surprisingly, as in many developing countries, the oral health provision system has been neglected in Peru. According to a WHO report in 2010, there were 3570 dentists for all the population in Peru, or 1.3 per 10,000 individuals. The prevalence of caries among children younger than 12 years in Peru is 90.5% (Malmö University, 2002), and among adults from 35 to 44 years is more than 13.9% (high) (WHO, 2003, July).

As indicated by the Peruvian Ministry of Health (MINSA) the second key reason for any health care consultation in all national health facilities according to the latest data available from 2011 (MINSA, 2011) was dental caries. Even though there is such a high demand, especially in rural areas, most oral healthcare providers, 30.5%, are based in Lima, the capital city. This
creates a high demand for dental specialists in rural areas, and increases the waiting time for obtaining dental services, which discourages people from seeking oral health care (MINSA, 2011).

**Oral health education in Peru.**

Different studies (Bhardwaj et al., 2013; Nakre & Harikiran, 2013) have shown oral health education to be effective in improving knowledge, attitude and practice on oral health hygiene and reducing plaque, caries increment and overall gingival health.

WHO (2003) highly recommends the dissemination of education on the best oral health practices through schools. Peru is trying to address the health education in area of oral health. For example, Ministry of Health of Peru is implementing an oral health educational campaign at schools via “Plan de salud escolar 2013-2016” (MINSA, 2013). However, Delgado-Angula et al. (2009), found that children living in poor households are twice as likely to get dental caries. Additionally, evidence gathered by WHO (2003) in different developing countries shows that knowledge provided by teachers and parents could be inadequate, and it could negatively affect the adherence of oral health best practices. The MINSA program, launched in 2013, was not evaluated, so it is hard to draw conclusions on its effectiveness, especially on our target population, Peruvian women living in poverty.

**Promises and challenges of providing oral health education in LMICs**

*Experience to date*

Evidence-based strategies that have been proven to be very effective in promoting oral health education in particular include individually tailored education and showing family-focused educational videos.
Individually tailored education on best oral health practices dissemination is stated to be very effective (Jönsson et al., 2009). In a randomized control trial individually tailored messages were based on “cognitive behavioral principles”, and it was tailored to “each participants' thoughts, intermediate, and long-term goals, and oral health status”. Evaluation of the program’s effect on gingivitis, oral hygiene and participants’ global rating of treatment showed the effectiveness of the intervention in all evaluated domains. However, it is a highly human resource intensive intervention, which needs funding and logistical and organizational support.

Regarding family-focused educational videos, different studies stated showed that this is a promising health education dissemination method (Wilson et al., 2013), but it can be very challenging due to technical issues, and not convenient for the targeted population.

Many studies have shown value in targeting women as a population for health care related issues, because they are important agents in health promotion within their households (Barrera, 1990; Cleland et al, 1988; Cleland et al, 1989; Shultz, 1990). Female (mothers) are also believed to be important agents in oral health behavior change in their children. A quasi-experimental study on Brazilian schoolchildren showed the effectives of comprehensive preventive program with parental involvement (Buischi et al. 1994). Also, systematic review that analyzed different oral health education programs in both developing and developed countries showed oral health education programs in school children to be more effective when teachers and parents are involved (Nakre & Harikiran, 2013).

*The promise of mobile technology*

Technical progress is developing very quickly in all parts of the world, with Peru not being an exception, therefore allowing newer lower-cost and more easily distributed approaches
to be considered for health promotion and education. Mobile phone based interventions is one possible approach to be harnessed. The rate of mobile phone subscriptions per 100 people according to the World Bank (2014) in Peru increased from 85 in 2009 to 103 in 2014. Every year more and more people get access to mobile phones, and it’s becoming an inevitable part of people’s everyday life. All health education campaigns need a channel to disseminate knowledge. Communication through mobile phones is evolving as a means of health education dissemination.

Therefore, mHealth could be considered as a great tool that could help to reach the targeted population in any place, at a convenient time. It potentially could address the needs on oral health education of women living in poverty, and subsequently their children.

**Evidence regarding utilization of the mHealth tools for health awareness, education and behavior change**

**Utilization of the mHealth tools for health education**

mHealth tools have been implemented in health promotion and education in different settings increasingly over the past decade, since they are cost-effective and can cover the population in a large geographic area (Cole-Lewis & Kershaw, 2010). Evidence demonstrates that mobile phones have been successfully implemented in promoting adherence to the treatment and creating demand for health services in HIV testing and antenatal care (Hall et al., 2014; de Tolly et al., 2012; Lund et al., 2012).

There are several RCTs on the effectiveness of mHealth for Antiretroviral treatment (ART) adherence (Pop-Eleches, 2011; Lester et al., 2010; da Costa et al., 2012). For instance, two RCT studies in Kenya and Brazil showed the effectiveness of mHealth intervention for improving ART adherence. Additionally, different systematic reviews on ART adherence
recognize mHealth as an evolving and promising tool for behavioral change, especially in low resource settings (Horvatz et al., 2012; Anglada-Martinez et al., 2014).

Creating demand for healthcare services is another area where utilizing mHealth tools is very promising. To illustrate, one study identified SMS to be very effective in creating demand for HIV testing in the intervention group (de Tolly et al., 2012). Another RCT that evaluated the effectiveness of SMS in seeking skilled attendance at birth in Zanzibar, also presented successful and promising results. The study indicated that tailored short messages delivered through mobile phones (SMS mHealth intervention) significantly increased skilled delivery attendance, and created a high demand for that service (Lund et al., 2012). On the whole, different RCTs and quasi-experimental studies are presenting evidence that tailored SMS has the opportunity to create demand for health-related actions.

mHealth tools have a constantly growing evidence-base and are widely supported by the WHO (2011) as having great potential in achieving health objectives. Moreover, there is increasing evidence that mHealth interventions can be effective and efficient in low and middle income countries (Hall et al., 2014).

**Utilization of mHealth tools for oral health education**

There is relatively weak evidence on mHealth effectiveness in oral health education dissemination and its effects on changing oral health hygiene and health seeking behavior over other methods. However, there are several individual examples, such as a study done in Belgaum, a city in India, comparing text messaging to pamphlets. Text messaging was found to be effective in dissemination of oral health education messages (Sharma et al., 2012). Another recently created, promising mHealth intervention in oral health is project “Text2Floss”, developed by A.T.Still University in 2012 (Text2Floss, n.d.). It has been implemented only within the USA. A randomized control trial on Text2Floss showed that text messaging improved
mothers’ oral health behaviors and knowledge, as well as mothers’ behavior on children’s oral health (Hashemian et al., 2015).

Utilization of the mHealth tools for healthcare in Peru.

Peru has been implementing mHealth strategies in different areas of health care provision. In fact, the Peruvian Ministry of Health (MINSA) started implementing different mHealth projects and programs since 2002 (Ruiz et al, 2015). A systematic review done on mHealth projects in Peru has identified that mHealth tools are used in multiple areas, for purposes of telemedicine, epidemiological vigilance, and treatment adherence (Ruiz et al, 2015).

The Peruvian government first started implementing mHealth tools in 2002, through the Navy’s Department of Health project “Alerta-DISAMAR”. This project was implemented for sharing timely and accurate information. Another example of a project that was implemented on a national scale is project “Nacer”. It is still being implemented as a tool to connect healthcare workers in different remote areas with specialists from a central city (Ruiz et al, 2015).

In brief, the described experience about use of mHealth tools in Peru and elsewhere does demonstrate the potential for using these tools to disseminate oral health education to foster oral health hygiene and dental healthcare seeking behavior change in Peruvian women living in poverty. The mHealth infrastructure is present, the environment for mHealth programs is welcoming, and it's aligned with the national health strategy. However, as described previously, there is still not enough evidence for the effectiveness of these tools in oral health behavior change and health-seeking behavior change promotion. Therefore, before implementing such a program at a large national scale, it should first be piloted by NGOs that work with the Peruvian women living in poverty, such as ProMujer and CARE. A program plan for how this should be done is now described.

Model for a Program Plan
This program plan was developed with the reference to the approach proposed by Issel (2009). According to that approach development of the program should start from understanding the context in which program will be implemented. Then, stating the problem, and developing a program theory, which forms the foundation for program plan. Next step includes developing a logic model for program delivery and implementation, developing program objectives and goals.

**Program Description:** Distribution of information via mHealth tools to enhance knowledge about best oral health practice and improve oral health behavior in Peruvian women living in poverty.

**Aim:** to improve overall knowledge about oral health hygiene, increase dental care seeking behavior, and improve oral health behavior.

**Program goal:**

The program will aim to improve the knowledge and adherence to the best oral health practices, and increase dental healthcare seeking behavior in Peruvian women living in poverty, by providing education and awareness through the implementation of mHealth tools, in order to lessen oral disease burden.

**Program Theory:**

The program design, goals and objectives are aligned with The Health Belief Model (USDHHS, 2005). It underlines the factors and constructs that are crucial for implementation to succeed. Constructs that explain the desire of person to avoid illness, or get well, as well as those that explain individual’s belief that a specific action will prevent or cure disease. It has six domains. This program will focus on four domains, which are described in the table below.

*Table 1. Health Belief Model applied to the program (USDHHS, 2005).*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Health Belief Model (general)</th>
<th>Health Belief Model (for this program)</th>
<th>Example of messages that will address perceived</th>
</tr>
</thead>
</table>

9
<table>
<thead>
<tr>
<th>Perceived susceptibility</th>
<th>Perceived severity</th>
<th>Perceived benefits</th>
<th>Perceived barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explains individual’s subjective perception of his/her risk to develop disease</td>
<td>Expresses individual’s feelings on the seriousness of developing disease or leaving disease untreated</td>
<td>Individual’s perception on efficacy of advised actions to reduce risk or seriousness of the disease</td>
<td>Individual’s opinion on obstacles that appear while performing recommended health actions</td>
</tr>
<tr>
<td>Tailored messages will develop understanding of risk that can be caused by oral cavity diseases to overall health and well being. Additionally, messages will be targeted to develop understanding of lifestyle factors leading to the development of caries and other oral cavity diseases, such as dietary habits, oral hygiene, and the use of fluoride and sealant.</td>
<td>Messages will be tailored to increase understanding of severity on developing oral cavity diseases and its effect on overall well being.</td>
<td>Not applicable</td>
<td>We will address the factors that discourage the target population from following best oral health practices, and dental health care seeking behavior. Tailored messages can potentially match users with dental healthcare providers. If implemented through a NGO platform that is already providing dental services, messages explaining the dental healthcare options will be implemented.</td>
</tr>
<tr>
<td>1. If you have dental caries, you’ll have a tooth pain; 2. Your chances of getting dental caries if you don’t brush or floss your teeth two times a day are great; 3. Giving your child milk before going to bed after brushing increases your child chances of getting caries. 4. Sugar plays a harmful role in tooth decay.</td>
<td>1. If you have tooth pain, you would have difficulties with eating food; 2. It is hard to smile if you have dental problems.</td>
<td>Not applicable</td>
<td>1. You can have access to dental services through “NGO”, healthcare centers; 2. There will be a Mobile Clinic with dentist in your area; 3. Your children can access dental healthcare through school (MINSA, 2013); 4. Brushing your teeth twice a day will help you to save time, since it will...</td>
</tr>
</tbody>
</table>
could be included. Using the mHealth tool will eliminate the timing barrier, since users will not spend time on training or transportation for training. Moreover, promoting best practices on oral health, could potentially increase individual’s participation at work, or school, which could be costly to individual. So that, it will address the personal costs barriers. keep your teeth healthy; 5. You will not skip work because of tooth pain, if you brush your teeth twice a day, don’t consume a lot of sugar and sugary beverages, and check your teeth at least once a year etc.

<table>
<thead>
<tr>
<th>Cue to action</th>
<th>Motivations needed to trigger recommended health actions.</th>
<th>All messages will be developed in order to motivate the target population to follow the best oral health practices.</th>
<th>1. Brush your teeth to be able to smile without shame; 2. Consume less sugar in order to prevent dental caries; 3. Go check your teeth with local dentist, if you have pain, or bleeding during brushing your teeth etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>Individual level of confidence in his/her ability to perform recommended health actions</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**Program Logic model**

**Inputs**

Before designing and implementing the program, it will be necessary to secure funding, an example of the budget with description summary is attached as Appendix II and III. The launch of the program will require human resources, marketing materials for recruitment, content and hardware components. The content will be developed in accordance with program theory constructs. It is recommended to include in content the first obligatory message for recruitment purposes with opt-out options. Hardware component of the platform consist of platform itself,
platform provider and data storage, that should be identified and contracted during preparation stage. The personnel needed for operation of program are project manager/program planner, content developer, project evaluator/researcher, and project evaluation and monitoring coordinator.

**Actions**

The actions on a program plan would include developing content and disseminating it. The content would be developed after conducting analysis of dental health related beliefs, or using the results of already conducted analysis. Specialists who have skills in creating tailored messages will be used to create the content.

There is not enough evidence on identifying right dosage of mHealth intervention in oral health promotion. In regards to that, dissemination strategies were modeled after the intervention used by Text2Floss program (Text2Floss, n.d.) and program implemented in Belgaum city (Sharma et al. 2011). These interventions are only mHealth intervention in oral health promotion area. In both programs intervention lasted for seven days. Text2floss intervention is an automated, a multichannel two-way SMS system, so that the dosage is regulated with the user (Hashemian et al. 2014). In the program implemented in Belgaum city the SMS were sent three times a day, and there were twenty-one SMS in total (Sharma et al. 2011). Analyzing all that practices I have decided to deliver content in three blocks. The first block will have messages on best practices of tooth brushing techniques. The second block, would incorporate messages on how nutritional habits, tobacco and alcohol use affect dental health status. The third block will incorporate messages on best oral health practices for children. Every block will consist of twenty-one short messages. The SMS will be sent three times a day as in program implemented in Belgaum city (Sharma et al. 2011).
Motivational messages will be delivered in all blocks and will promote routine two times teeth brushing and encouragement to see a dental health provider. It is also important to provide information on availability of dental health services in the area.

The first step of dissemination is identifying the ways to reach out to target population. It is very important to identify the sources of obtaining contact information (telephone numbers) of the target population before implementing this program. The agency, that will be implementing the program should already have presence in the community and have an established network. Otherwise, it will need to reach out to other agencies or community organizations that work with women living in poverty.

The second step of dissemination consists of sending out the first recruiting message, which will have opt-out option. For instance, it could ask participants who don’t want to participate to send “NO” to specific number.

The third step is sending out the SMS messages according to the design mentioned above. Blocks will be delivered in numerical order. Every participant will receive three messages per day, for one week. Next block will be delivered in one month.

**Outputs**

The main output will be a developed and disseminated content.

**Outcomes**

**Short-term objectives:**

1. By year 1, at least 100% of women, who have subscribed for to the program in Peru will receive education on best oral health practices through the program platform.
2. By year 1, at least 50% of women, who have subscribed to the program and received education through the program platform will report following proposed guidelines.
3. By year 1, expand reach of the program, and double the number of participants in comparison with the number of users after six months.

**Long-term objectives:**

1. By year 3, at least 50% of women, who have subscribed to the program and have received education will report using dental services for prophylaxis.

2. By year 5, at least 70% of women, who have subscribed to the program and have received education on best oral health practices through the program platform will report adhering to them.

3. By year 5, increase subscription rate form the initial rate evaluated after year 1 for 30%.

**Impacts:**

If implemented successfully program have a great potential to positively impact on the rates of dental prophylaxis services usage, and adherence to best oral health practices within targeted population. mHealth tools also have a great potential to be used in other different health education campaigns. In the long run, the program could positively impact on economic development and empowerment, because of school and work time lost decrease, as well as improving overall oral health outcomes in targeted population

**Implementation plan:**

*Implementation Approach*

The program will be implemented in 3 phases. Phase 1 will be a preparation phase. During this stage all content will be developed and some of the components will be evaluated, and improved.
Phase 2 will be a pilot test stage, which will consist of different core components such as hardware evaluation and adjustment, pilot test participant and the execution of the pilot test. After, the pilot test results will be evaluated and analyzed, they will be used for the different improvement cycles.

Phase 3 will consist full implementation of the program. It will consist of constant recruitment, execution of the program, and constant monitoring and evaluation. Evaluation will include evaluation of adherence to the promoted guidelines and evaluation of the knowledge survival in users, who have participated in the program, six months after completion.

**Implementation drivers**

*Source Fixsen et al. 2005*
For successful implementation, the Implementation Drivers Framework (Fixsen et al., 2005), developed by the National Implementation Research Network will be utilized. This framework identifies the critical components that need to be in place to ensure implementation quality. These drivers are shown in Figure 2 and consist of Competency Drivers, Organizational Drivers, and Leadership Drivers. Competency Drivers include selection, coaching and training of staff. Organizational Drivers involve creating a supporting organizational environment. Leadership Drivers identify technical and adaptive leadership support needed to make intervention successful.

*Implementation Challenges*

The main challenges for implementation are financial resources and sustainability of the program. There is the need to identify funding agencies that might be interested in funding this type of intervention in low and middle income countries. For example, The Norwegian Agency for Development Cooperation (Norad), has made a commitment of US$9.9 million to support UN Secretary General’s *Every Woman, Every Child* global strategy, which supports mHealth programs to improve maternal, newborn and child health (UNO, n.d.).

The World Dental Development Fund (WDDF) also has different grant for developing and implementing innovative solutions for oral health education in low and middle income countries.

Funding received from these type of grants could be utilized for the setup of the program.

Secondly, the promotion of oral health hygiene and dental health-seeking behavior is only one part of an overall oral health package that will also need to include getting hygienic tools (tooth paste, tooth brush), readiness of oral healthcare infrastructure and cost of dental
healthcare services. The challenge of dental healthcare infrastructure and its cost could be addressed by using NGOs such as ProMujer, which provides oral healthcare through their facilities on different below market price basis to their clients.

**Evaluation plan:**

*Rationale and approach to the evaluation:*

The program should be monitored and evaluated in order to assess success and to obtain community and government buy-in. Identifying program weaknesses early in the implementation stages will allow the opportunity for improvement to help the program reach its full potential. Moreover, it is crucial to evaluate each phase of program implementation, to make sure that each core component of implementation is being implemented correctly. As defined by the program logic model, evaluation should measure the improvement of the knowledge and adherence to the best oral health practices and the change in dental healthcare seeking behavior in Peruvian women living in poverty.

*Measures.*

Process measures:

These measures will be used to assess the quality and fidelity of program implementation. The program implementation process will be evaluated at all phases. Some process measurements will be:

- The number of users that received educational messages through the mHealth platform
- Ease of using the SMS service
- Wait time to receive the response from platform
- Technical problems while using platform
- Whether it was convenient to receive messages twice a day
- Users’ satisfaction with the delivery system etc.

Proposed program’s main outcome measures are knowledge and adherence. The adherence to best oral practices will be tested by asking questions such as:

1. Do you remember to brush your children’ teeth twice a day?
2. Do you brush your children’ teeth before going to sleep?
3. Did you brush your teeth today?
4. Did you brush your teeth before going to bed?
5. Did you go to dentist for prophylactic visit this year?
6. Did you go to dentist for cleaning this year?
7. Did you go to dentist with your children to apply fluoride?
8. Did you go to dentist with your children to apply sealants?
9. Do you buy tooth past with fluoride?
10. How many sugared drinks/sodas per day users consume?
11. Do you give your children milk before going to sleep?

Knowledge will also be assessed on these topics, through questions such as:

1. Does consuming sugared beverages increase your chances on getting tooth decay?
2. Would you go to dentist if you have bleeding during brushing your teeth?
3. Would you buy tooth past with fluoride?
4. How frequent should you brush your teeth?
5. When children should start brushing their teeth?
6. Should you go to dentist only if you have a toothache?

Proposed framework for evaluation design and methods
Since the program consists of the three phases, they all should be followed by evaluation, as well as evaluated annually for the whole program period of five years. First, it is crucial to evaluate the developed content. It is favorable to realize the evaluation during first year of implementation. It is important to evaluate the content impact, so that one possible way of doing it could be testing it in small groups’ session interviews with the groups of volunteers-users. This would involve qualitative evaluation of content, which will assess if the messages are understandable, tailored to targeted population and if the form of delivery is more appealing than other methods (pamphlets, video, ads, and message through social media etc.). In Phase 2, the pilot study of the program, both program satisfaction and effectiveness will be measured, through an SMS survey and qualitative follow-up to give more insights and understanding on the effectiveness of content, delivery method and the hardware performance. Analysis of this evaluation would be helpful for improving the message and the overall process. In Phase 3, primarily the outcomes will be evaluated, via SMS surveys. It would also be helpful to evaluate knowledge survival and dental health services usage among users in six-month increments after they have completed the program, by sending a short mobile friendly (SMS) survey.

This is only a model of the evaluation plan. Agencies implementing this plan should develop a more detailed evaluation plan, once the program is in place. It is also recommended to have external evaluation after three or five years of implementation, since the proposed program is relatively new, and is not based on a large body of evidence.

Conclusion

To sum up, there is a great burden in Peru, especially in women living in poverty and their families. The most cost-effective method of addressing this burden is incorporating health education on best oral health practices. Even though the Peruvian government is implementing a
lot of different programs in order to decrease this burden, it does not address the needs of women living in poverty in Peru. mHealth tools have the promise to be effective in reaching the target population with health education purposes to help disseminate information in best oral health practices and to improve health-seeking behavior. The model of plan that could be used for that purpose is presented in this paper, along with some details of implementation and evaluation. While just a skeleton, we believe this will be a good starting point for NGOs such as CARE and Pro Mujer to use as a template to build a more detailed plan.
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de Tolly, K., Skinner, D., Nembaware, V., & Benjamin, P. (2012). Investigation into the use of short message services to expand uptake of human immunodeficiency virus testing, and whether content and dosage have impact. Telemedicine and e-Health, 18, 18–23.


**Appendices**

**Appendix I**

Logic model

<table>
<thead>
<tr>
<th>Inputs:</th>
<th>Actions:</th>
<th>Outputs</th>
<th>Outcomes:</th>
<th>Impacts:</th>
</tr>
</thead>
</table>
| Platform | - Content development  
- Hardware: identifying platform, contracting platform provider, identifying and creating data storage  | - Deliverable content development, content test and evaluation, content improvement in accordance with evaluation result.  
- Identifying and contracting platform with local network provider, identification of data storage and its creation  | - Developed content  
- Active platform  
- Data storage  
- Content evaluation report and analysis  | By year 1, at least 30% of women, who have subscribed for to the program in Peru will receive education on best oral health practices through the program platform.  | High rate of targeted audience will:  
- Have higher level of usage of prophylaxis services and check-up visits in dental health  
- Report adherence to best oral health practices oral health practices |
| Human Resources: | - Program planner/Project manager  
- Content developer  
- Project evaluator/researcher  
- Project evaluation and monitoring coordinator  
- Hardware specialist  | - Contracting Program planner/project manager  
- Contract content developer  | Not applicable  | By year 1, at least 50% of women, who have subscribed to the program and received education through the program platform will report |

**Phase 1**

- Evaluation of hardware work, it’s improvement

**Phase 2**

- Hardware evaluation and improvement (in case if needed)

**Phase 3**

- Constant monitoring and evaluation of hardware  
- Constant monitoring and evaluation of messages content

- Ongoing monitoring and evaluation of the content
<table>
<thead>
<tr>
<th>Phase 3</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Keep positions of Program planner/project manager, evaluator/researcher, Project evaluator/researcher, Project evaluation and monitoring coordinator.</td>
<td>- Creation of 1st message content for recruiting process: the obligatory message sent to all clients, with opt-out option</td>
<td>- Using developed marketing materials in order to recruit clients for the pilot test</td>
<td>- Using developed marketing materials in order to constantly recruit clients for program</td>
</tr>
<tr>
<td>Not applicable</td>
<td>- 1st recruitment message with opt-out option</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>By year 1, expand reach of the program, and double the number of participants in comparison with the number of users after six months.</td>
<td>By year 3, at least 50% of women, who have subscribed to the program and have received education will report using dental services for prophylaxis.</td>
<td>By year 5, at least 70% of women, who have subscribed to the program and have received education on best oral</td>
<td>Positive impact on economic development and empowerment, because of school and work time loss decrease</td>
</tr>
<tr>
<td>More constructs of health education would be disseminated through mHealth tools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1</td>
<td>Phase 2</td>
<td>Phase 3</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>No action needed</td>
<td>Not applicable</td>
<td>health practices through the program platform will report adhering to them.</td>
<td></td>
</tr>
<tr>
<td>- Recruiting clients for the pilot test of program</td>
<td>- Pilot test evaluation report and analysis</td>
<td>- Improved oral health outcomes in targeted population</td>
<td></td>
</tr>
<tr>
<td>- Execute program’s pilot test: divide recruited clients into 3 randomized groups, each group will pilot test different blocs.</td>
<td>- Improvement of content in accordance with the results of pilot test</td>
<td>- Generally improved program</td>
<td></td>
</tr>
<tr>
<td>- Evaluation of pilot test</td>
<td>- Improvement of overall program components</td>
<td>- Pilot test evaluation report and analysis</td>
<td></td>
</tr>
<tr>
<td>- Evaluation of the knowledge survival in clients, who have undergone the program, 6 month after completion</td>
<td>- Annual evaluation and analysis reports</td>
<td>- Evaluation report and analysis of dental health services usage among clients who have undergone health education through the program by the end of 3rd year of intervention</td>
<td></td>
</tr>
<tr>
<td>- Analysis of 1st year evaluation forms</td>
<td>- Evaluation report and analysis of adherence to best oral health practices of clients who have undergone health education through the program by the end of 5th year of intervention implementation</td>
<td>- Implementation report and analysis of adherence to best oral health practices of clients who have undergone health education through the program by the end of 5th year of intervention implementation</td>
<td></td>
</tr>
<tr>
<td>- Evaluation of dental health services usage among clients who have undergone health education through the program by the end of 3rd year of intervention implementation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
-Evaluation of adherence to the best oral health practices of clients who have undergone health education through the program by the end of 5th year of intervention implementation

Appendix II

The program budget

Direct cost

Year 1

A. Personnel

<table>
<thead>
<tr>
<th>Name/Position</th>
<th>Computation</th>
<th>Period</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program planner/ manager</td>
<td>$50,590 x 40%</td>
<td>1 year</td>
<td>$20,236 (Glassdoor, n.d.)</td>
</tr>
<tr>
<td>Program evaluator/researcher</td>
<td>$50,590 x 40%</td>
<td>1 year</td>
<td>$20,236 (Glassdoor, n.d.)</td>
</tr>
<tr>
<td>Content developer</td>
<td>TBA. It’s possible to wage that part of cost, and use free content provided by Text2Floss. Or to use already developed content and adapt it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program monitoring and evaluation coordinator</td>
<td>$14,000 x 100%</td>
<td>1 year</td>
<td>$14,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$ 54,472 +TBD</strong></td>
</tr>
</tbody>
</table>

Year 2-5

<table>
<thead>
<tr>
<th>Name/Position</th>
<th>Computation</th>
<th>Period</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name/Position</td>
<td>Benefit</td>
<td>Computation</td>
<td>Cost</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Program planner/manager</td>
<td>$50,590 x 20%</td>
<td>4 year</td>
<td>$10,118 (Glassdoor, n.d.)</td>
</tr>
<tr>
<td>Program evaluator/researcher</td>
<td>$50,590 x 20%</td>
<td>4 year</td>
<td>$10,118 (Glassdoor, n.d.)</td>
</tr>
<tr>
<td>Program monitoring and evaluation coordinator</td>
<td>$14,000 x 100%</td>
<td>4 year</td>
<td>$56,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$ 76,236</strong></td>
</tr>
</tbody>
</table>

### B. Fringe benefit

#### Year 1

<table>
<thead>
<tr>
<th>Name/Position</th>
<th>Benefit</th>
<th>Computation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program planner/manager</td>
<td>Income tax 15% (for Peru citizens (PKF, 2013))</td>
<td>$ 20,236 * 15%</td>
<td>$ 3,035.4</td>
</tr>
<tr>
<td></td>
<td>Health Insurance</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Program evaluator/researcher</td>
<td>Don’t have to be physically in the country. Fringe benefits depends on country of contractor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program monitoring and evaluation coordinator</td>
<td>Income tax 15% (for Peru citizens (PKF, 2013))</td>
<td>$ 14,000 * 15%</td>
<td>$ 2,100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$ 5,135.4 + TBD</strong></td>
</tr>
</tbody>
</table>

#### Year 2-5

<table>
<thead>
<tr>
<th>Name/Position</th>
<th>Benefit</th>
<th>Computation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program strategist/evaluator</td>
<td>Income tax 15% (for Peru citizens (PKF, 2013))</td>
<td>$ 10,118 * 15% * 4 years</td>
<td>$ 6,070.8</td>
</tr>
<tr>
<td></td>
<td>Health Insurance</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Program evaluator/researcher</td>
<td>Don’t have to be physically in the country. Fringe benefits depends on country of contractor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program monitoring and evaluation coordinator</td>
<td>Income tax 15% (for Peru citizens (PKF, 2013))</td>
<td>$ 14,000 * 15% * 4 years</td>
<td>$ 8,400</td>
</tr>
<tr>
<td>Item</td>
<td>Computation</td>
<td>Cost</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>Health Insurance</td>
<td>TBD</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$14,470.8 +2TBD</td>
<td></td>
</tr>
</tbody>
</table>

C. Platform provider and data storage

Year 1

<table>
<thead>
<tr>
<th>Item</th>
<th>Computation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Outgoing messages</td>
<td>$2.53 (16) * 6.24</td>
<td>$15.8</td>
</tr>
<tr>
<td>(package for 10 day – 500 SMS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Incoming message</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>• Platform use</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>• Data storage</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$15.8 +2 TBD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Computation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Outgoing messages</td>
<td>$2.53 (16) * 9051</td>
<td>$22,896.5</td>
</tr>
<tr>
<td>(package for 10 day – 500 SMS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Incoming message</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>• Platform use</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>• Data storage</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$22,896.5 +2 TBD</td>
</tr>
</tbody>
</table>

Pilot project

N= 120, 14 SMS per person + 1 SMS recruitment + 1 SMS recruitment answer +10 SMS evaluation = 26 SMS
3120 SMS

N = 61,149, Project

1st round - 14 SMS per person + 1 SMS recruitment + 10SMS evaluation = 26 SMS - 1,528,874 SMS

2nd round - 14 SMS per person + 10 SMS evaluation = 24 SMS - 1,467,576

3rd round - 14 SMS per person + 10 SMS evaluation = 24 SMS - 1,467,576

Total SMS 4,525,026 / 500 SMS = 9051 packages

<table>
<thead>
<tr>
<th>Item</th>
<th>Computation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation: (10 SMS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Outgoing messages (package for 10 day – 500 SMS)</td>
<td>$ 2.53 (16) * 1223</td>
<td>$3,094.14</td>
</tr>
<tr>
<td>• Incoming message</td>
<td>$ 0</td>
<td>$0</td>
</tr>
<tr>
<td>• Platform use</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>• Data storage</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$ 3,094.14 +2 TBD</td>
</tr>
</tbody>
</table>

Year 2-5
No data - TBD

D. Equipment

Year 1

<table>
<thead>
<tr>
<th>Item</th>
<th>Computation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>$1,300 * 2 (Lenovo, n.d.)</td>
<td>$1,000</td>
</tr>
<tr>
<td>USB internet</td>
<td>$35/month * 2* 12 months</td>
<td>$ 840</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$ 1,840</td>
</tr>
</tbody>
</table>
Year 2-5

<table>
<thead>
<tr>
<th>Item</th>
<th>Computation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>$1,300 * 2 (Lenovo, n.d.)</td>
<td>$1,000</td>
</tr>
<tr>
<td>USB internet</td>
<td>$35/month * 2* 48 months</td>
<td>$ 3,360</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td><strong>$ 4,360</strong></td>
</tr>
</tbody>
</table>

E. Total expenses

Year 1

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>$54,472 +TBD</td>
</tr>
<tr>
<td>Fringe benefits</td>
<td><strong>$ 5,135.4 + TBD</strong></td>
</tr>
<tr>
<td>Platform provider and data storage</td>
<td>$ 26,006.5+ 4 TBD</td>
</tr>
<tr>
<td>Equipment</td>
<td>$ 1,840</td>
</tr>
<tr>
<td>Total direct cost (90%)</td>
<td><strong>$87,453.9 + 7TBD</strong></td>
</tr>
<tr>
<td>Indirect cost (10%)</td>
<td><strong>$8,745.39 +0.7 TBD</strong></td>
</tr>
<tr>
<td>Total cost</td>
<td><strong>$96,199.29+7.7TBD</strong></td>
</tr>
</tbody>
</table>

Year 2-5

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td><strong>$ 76,236</strong></td>
</tr>
<tr>
<td>Fringe benefits</td>
<td><strong>$ 14,470.8 +2TBD</strong></td>
</tr>
<tr>
<td>Platform provider and data storage</td>
<td>TBD</td>
</tr>
<tr>
<td>Equipment</td>
<td>$ 4,360</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Total direct cost (90%)</td>
<td>$95,006.8 + 3 TBD</td>
</tr>
<tr>
<td>Indirect cost (10%)</td>
<td>$9,500.68 +0.3TBD</td>
</tr>
<tr>
<td>Total cost</td>
<td>$104,567.48 + 3.3 TBD</td>
</tr>
</tbody>
</table>

**Appendix III.**

**Budget justification summary**

In order to calculate expenses for the program I choose to apply the method of “Activity-based budgeting. Activities theoretically will obtain 90% of the budget, which will be a direct cost, and 10% will go forward indirect cost (Issel, 2009).

Program consists of 3 Phases and is planned to be implemented during five years. All three phases will be implemented during first year. From second to the fifth year the main activity will be sustaining, monitoring and evaluating the program. Phase 1 or preparation stage, will include hiring program planner/project manager, contracting content developer or obtaining content of already created program, as well as other activities for content development. Alongside with content development, project manager will contract platform provider and identify data storage, also include into budget. Program manager will not need an office space in any of the activities described. Ideally, program manager should be a local person, who will be able to form local partnerships with platform providers, and represent this initiative on different levels, as well as be aware of cultural coherence of the content. It’s planned to contract a local person with required competencies, work expertise and experience in Republic of Peru for that position. It will reduce the rate of travel and accommodation cost, and alleviate the communication difficulties in forming relationships and engagement between platform providers, and monitoring content development. Since, program planner/project manager is not needed all
the time during Phase 1, it’s planned to have employee to be partly employed for 50% of the time. Furthermore, the equipment expenses are included into preparation phase expenses.

Phase 2 will require hiring program evaluator/researcher, and program evaluation and monitoring coordinator. They will be responsible for execution of evaluation. Program manager will still be monitoring overall process, and work along with program evaluator/researcher and program evaluation and monitoring coordinator, in order to address and implement activities for improvement of stages, that will appear after Pilot test. Program evaluator/researcher will be responsible for overall evaluation and analysis, which doesn’t require his/her personal presence, so that this position could also be filled by local personnel. Program evaluator/researcher is not needed for full time position, since evaluation will be not everyday activity, and would form on obtained data after Pilot test, and annually. The first year involvement would be 40%, and it will decrease for 20% in subsequent years. On the other hand, hiring a local program coordinator to the administrative work, is very crucial. Employee on this position, will be a lower cost alternative to the higher skill based positions such as program planner, project manager and evaluator. The cost of SMS sending are included and will appear during that Phase. The scheme of the SMS delivery: 1st SMS for recruitment (outgoing) + 1 SMS answer (incoming to system, outgoing from client) + 14 SMS educational messages (outgoing from system) + 5 SMS evaluation questions (outgoing from system) + 5 SMS evaluation answers (outgoing from client). All cost of the SMS are planned to be covered by the project budget, and are indicated in budget. For pilot study it was calculated for 120 participants.

Phase 3 is actual large scale execution of the program’s core components, so all budgetary expenses will be involved in addressing the technical cost, such as sending for content delivery through SMS and usage of the data storage, the evaluation and monitoring cost. Since
the model for NGO that could implement this program was ProMujer the cost of SMS delivery from both system and client was calculated for all clients of ProMujer in Peru as of for 2014.

After first year of implementation, project will be executed via multiple cycles of Phase 3, so that it will require constant monitoring, gathering and storing evaluation materials and annual evaluation of the project. In addition, the annual evaluation will include evaluation of adherence to the promoted guidelines and the evaluation of the knowledge survival in clients, who participated in the program. All of that are included in operational cost for subsequent years. All rates in budget were calculated in accordance with average in Peru and world.

There are not enough information on some aspects of the budget such as the data storage and the platform use, the content development cost and some fringe benefits. The data storage and the platform use cost will depend on contractor and agreements made with the provider. Additionally, the plans payment for SMS delivery and sending is constantly changing. There are options of obtaining unlimited SMS (for clients’ side of SMS sending), so that cost is shifting and the cost of the agreement with the platform provider could be counted as global cost not for the SMS package or single SMS. Content development is also a subject to not clear cost, since there are evidence-based worldly renown tool, called “Text2Floss”, which can be used for free as indicated on the website. All costs that are not determined are indicated as TBD.

This is a subject to change as certain unforeseen events may cause amendments to the projected hiring and compensation of our desired staff. As with any program initiative, it is imperative that the teams learn how to make prompt adjustments should be budgeting limitations become an issue.
Appendix IV

Dental caries levels in Latin American Countries.

Picture 1. Dental caries levels (Decayed, Missing and Filled Teeth (DMF index) among 12-years old in Latin America, December 2004 (WHO, 2004)
*Picture 2.* Dental caries levels (Decayed, Missing and Filled Teeth (DMF index) among 35-44 years old in Latin America, December 2004 (WHO, 2004)