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Review

Use of m-Health in polio eradication and other immunization activities in developing countries

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ABSTRACT

Introduction: Reaching the children that are chronically missed by routine immunization services has been a key pillar of success in achieving progress toward polio eradication. The rapid advancement and accessibility of mobile technology (“mHealth”) in low and lower middle income countries provides an important opportunity to apply novel, innovative approaches to provide vaccine services. We sought to document the use and effectiveness of mHealth in immunization programs in low and lower middle income countries. We particularly focused on mHealth approaches used in polio eradication efforts by the Global Polio Eradication Initiative (GPEI) to leverage the knowledge and lessons learned that may be relevant for enhancing ongoing immunization services.

Methods: In June 2016, the electronic database PubMed was searched for peer reviewed studies that focused on efforts to improve immunization programs (both ongoing immunization services and supplemental immunization activities or campaigns) through mobile technology in low and lower middle income countries.

Results: The search yielded 317 papers of which 25 met the inclusion criteria. One additional article was included from the hand searching process. mHealth was used for reminder and recall, monitoring and surveillance, vaccine acceptance, and campaign strategic planning. Mobile phones were the most common mobile device used. Of the 26 studies, 21 of 26 studies (80.8%) reported that mHealth improved immunization efforts.

Conclusion: mHealth interventions can effectively enhance immunization services in low and lower middle income countries. With the growing capacity and access to mobile technology, mHealth can be a powerful and sustainable tool for enhancing the reach and impact of vaccine programs.

Contents

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1. Introduction

Infectious diseases are major causes of morbidity and mortality worldwide. Although immunization already averts some 2–3 million deaths annually, the World Health Organization (WHO) estimates that an additional 1.5 million deaths could be avoided per year if vaccine coverage improves globally. In 2015, an estimated 19.4 million infants worldwide (nearly one out of five) failed to receive the most basic childhood immunizations [1]. In 2015, WHO's Strategic Advisory Group of Experts identified several factors that would reduce these gaps in coverage including improving quality and use of data, community involvement, access to immunization services for marginalized and displaced populations, strengthening health systems, and securing and sustaining supply of vaccines at all levels. Given the rapid advancement, increased accessibility, and improved capacity of mobile technology in low and lower middle income countries, it is ethical and necessary to take advantage of mobile health (mHealth[1]) to address these factors and to increase global vaccine coverage. The need is more urgent in low and lower middle income countries [2]. Of those missing vaccines, most live in low and lower middle income countries with more than 60% living in the following 10 countries: Angola, the Democratic Republic of Congo, Ethiopia, India, Indonesia, Iraq, Nigeria, Pakistan, the Philippines, and Ukraine [1]. Mobile technology has the potential to help alleviate the remaining burden caused by vaccine preventable diseases.

As access to mobile technology continues to grow, mHealth's potential to enhance immunization programs also increases. Worldwide, 95% of the population now lives in an area with access to a mobile-cellular network while mobile-broadband subscriptions have grown at double digit rates in developing countries [3]. mHealth's capacity to reduce human error, expedite tasks, and expand an intervention's reach can provide researchers and program managers with the tools needed to address challenges that thwart the progress of immunization programs. mHealth may be an important component of enhancing access to immunization services, data quality and use, and identification of marginalized populations [1].

The purpose of this review is to determine both how mHealth has been used thus far in immunization programs and whether these initiatives have been effective tools for improving immunization programs in low and lower middle income countries. Reaching the children that are chronically missed by routine immunization services has been a key pillar of success in achieving progress toward polio eradication. Thus, we particularly focused on mHealth approaches used in polio eradication efforts by the Global Polio Eradication Initiative (GPEI) to leverage the knowledge and lessons learned that may be relevant for enhancing routine immunization services.

2. Methods

In June 2016, the electronic database PubMed was searched for peer reviewed studies that focused on efforts to improve immunization programs (both ongoing immunization services and supplemental immunization activities or campaigns) through mobile technology in low and lower middle income countries. The key search terms included (cell phone OR cell phones OR mobile phone OR mobile phones OR "mhealth" OR telemedicine OR text message OR sms message OR personal technology OR telehealth OR "ehealth" OR digital health OR ICT OR mobile device) AND (immunization OR immunized OR immunize OR vaccination OR vaccine). A filter that limited the results to studies published within the last 10 years was applied to acknowledge rapid development and implementation of new technologies. Additionally, we hand searched the references section of each eligible paper for relevant articles that may not have emerged in the search term results.

Studies that mentioned a mobile technology and its impact on immunization were included (Fig. 1). Both the title and abstract of each search term result were scanned for eligibility. Common reasons for excluding studies included using technology that was not mobile or use of mobile technology for purposes other than immunization. Articles that did not involve a low or lower middle income country (as defined by the World Bank [4]), or were not complete were also excluded from this review.

3. Results

3.1. General characterizations of included publications

The search yielded 317 papers of which 26 met the inclusion criteria (Fig. 1). One additional article was identified through the hand searching process. Mobile phones were the most common mobile device used among these studies with 21 out of 26 studies using mobile phones, 3 using mobile tablets, 1 using a personal digital assistant (PDA), and 1 unspecified.

Of the 26 studies, 21 (80.8%) reported that mHealth improved immunization efforts (Table 1); 4 studies reported no significant impact as a result of using mobile technology while 1 study found that the standard intervention was more effective than the mHealth intervention. While most studies provided evidence that mHealth is an effective strategy to improve immunization programs, authors generally suggested that studies on larger scale should be conducted before widespread implementation of these initiatives and that external factors not corrected for could have contributed to the reported outcomes.

Among the 26 studies, mHealth was used for reminder and recall (n = 8), monitoring and surveillance (n = 7), campaign strategic planning (n = 5), and vaccine acceptance (n = 1). Five studies were literature reviews on similar but not identical topics. The results of these studies are summarized in Table 1.

3.2. Reminder and recall

Vaccination reminder and recall text messages to patients or mother of patients was the most common use of mHealth (Table 1). The purpose of using mHealth for reminder and recall was not only to increase vaccination coverage overall but also to reduce vaccination delays. Of the eight reminder recall specific studies, eight found that the mHealth intervention increased vaccination coverage [5–11]. A Guatemalan study found a non-significant increase in vaccine coverage among study participants [30]. Additionally, all 4 studies that mentioned timely vaccination found that the text

[1] The World Health Organization defines mHealth as the use of "mobile technologies and their advancements in their innovative application to address health priorities." (WHO 2011).