Review

Is mobile health (mHealth) the magic bullet? A short review of the impact of mHealth on adolescent sexual health

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Adolescent sexual and reproductive health (ASRH) remains a major public health and developmental issue worldwide. The stage of adolescence is typically characterised by a desire for information, curiosity and experimentation. Adolescent social interactions, relationships and sexual behaviour are intimately linked to information available to them during this transition period and ASRH programmes deliver sexual and reproductive health (SRH) information through a varying number of intervention strategies. The proliferation of mobile phones ownership and use across all populations worldwide has created opportunities for new interventions in health. Its use in SRH especially for adolescents and young people has been researched in a number of studies. This article explores the potential and impact of the use of mobile health (mHealth) for ASRH promotion. This study is a literature review based on analysis of secondary data from published literature. An electronic database search was conducted on Global health, Web of science, Popline, PubMed and Google-scholar. Findings of the review show that most published studies on mHealth interventions were from developed countries. The mHealth based interventions recorded positive effects on improving knowledge and promoting some aspects of positive sexual behaviour like sexually transmitted infection (STI) testing and seeking SRH information. However, the effect on other aspects of sexual behaviour like condom use and sex-partner behaviour was inconsistent. It is concluded that mobile phones can be an effective tool for engaging with adolescents concerning their SRH however, further research with randomised controlled trials are encouraged with special focus on adolescents in developing countries.

Key words: Adolescent, reproductive health, mobile phones, mHealth.

INTRODUCTION

Mobile health (mHealth) is the use of mobile communications technology and portable electronic devices such as personal digital assistants (PDAs) and mobile phones to provide health services and information (Vital-wave, 2009). About 5 billion mobile phone subscriptions exist worldwide; around 60% of these users are in developing countries. This high penetration has resulted in mobile phones being considered as a viable option for assisting the provision of healthcare services including sexual and reproductive health (SRH) (WHO, 2011).

Adolescent SRH has been an area of focused interest...
in the health sector. Adolescents are a group of the population between the ages of 10-19 years characterised by experiences of series of rapid developmental changes which impact their SRH (WHO, 2010). Access to SRH education and services is essential for this group as they are exposed to significant risks of sexually transmitted infections (STIs) as a result of interrelated factors like low risk perception, low confidence, socio-cultural values and issues of trust, confidentiality, poor judgement and knowledge of sexual health. All these result in risky sexual behaviour like early sexual debut, poor condom use and multiple sex-partners (Malbon and Romo, 2013; WHO, 2010).

Mobile phone ownership and access among adolescents is increasing, bringing attention to how this application can aid in bridging the gaps in adolescent sexual health. Recent publications have reported that mHealth interventions like short message service (SMS) have been successful in promoting behaviour change for smoking, diet and physical activity in young people (Gold et al., 2011a). Mobile phones have also been used in health successfully in the area of data collection, monitoring, disease/epidemic outbreak-tracking, health-education and others (WHO, 2011).

This paper reviews literature on the subject-topic to ascertain if mHealth interventions have an effect on promoting positive sexual behaviour among adolescents.

**METHODOLOGY**

This is a study review based on analysis of secondary data from published literature. An electronic database search was conducted on Global health, Web of science, Plopline, PubMed and Google-scholar. Keywords related to the research question (mHealth, mobile health, sexual health, adolescents, young people) were used for basic and advanced search of the databases. Keyword truncation was initially employed to broaden the search while keywords combination was done using Boolean characters “and” or “or” to limit the initial search. Citation snowballing from selected articles reference list was also done to identify related articles.

**Criteria**

**Inclusion:** Articles/publications on:

1. Mobile phone use in SRH.
2. On adolescents and young people.
3. Published between 2004 to 2014.

**Exclusion:** All non-English publications.

**Justification**

1. Focus on mHealth research has increased over the 10 years with several pilot studies ongoing.
2. Young people are included because their age range (15 to 24) overlaps with adolescents (12 to 19).
3. Limited language proficiency necessitates the exclusion of non-English publications.

Articles identified from the keyword search strategies were subjected to a selection process depicted by a Prisma flow diagram illustrated in Figure 1. Abstracts and contents of search results were comprehensively reviewed for relevance to the question and finally 8 articles were selected.

**Limitations**

The exclusion of non-English publications and 10-year restriction limits the number of available publications which may contain important findings.

**LITERATURE REVIEW/ANALYSIS**

Mobile health interventions have been shown to be effective in improving knowledge (WHO, 2011), yet translation of knowledge gained to sexual behaviour change varies. Results from studies measuring the effect of mobile phone interventions on sexual behaviour of adolescents do not show uniformly significant effects. The sexual behaviour of adolescents assessed in most studies reviewed include: risky sexual behaviour (condom use and multiple sex partners), STI testing, clinic attendance and seeking sexual health information. These form the themes for the review.

**Risky sexual behaviour: Condom use, multiple sex-partners**

The effect of mobile SMS on risky sexual behaviour of adolescents has been shown to have mixed outcomes. Gold et al. (2011a) in a randomised control trial (RCT) of 7,606 Australian young people (adolescents and young adults) evaluated the use of mobile phone advertising to promote positive sexual behaviour and sun safety. Participants were randomised to receiving text messages for sexual health and sun safety as intervention and control groups, respectively. An example of one of the messages sent to the intervention group reads “Roses are red, daises are white, use a condom if you get lucky tonight. Happy Valentines Day!”. The study reported the intervention group as having fewer multiple sex-partners and more likely to use a condom with a new partner than the control group (Gold et al., 2011a). Although the small proportion of enrolled participants who actually completed the baseline and follow-up survey (<5%) threatened the validity of the study, the study design ensured the findings were nonetheless significant.
**Figure 1.** The search process in PRISMA flow diagram.

In another study in the United States of America, Cornelius et al. (2013) who focused on HIV prevention intervention for African-American adolescents delivered via mobile phones also recorded increased condom use along with increased knowledge of human immunodeficiency virus (HIV) (Cornelius et al., 2013). A similar effect on condom use was recorded among young people in Kenya and Tanzania in another prospective pilot study reported by Namirembe and Hoefman (Namirembe and Hoefman, 2012). However, mixed results were reported by Juzang et al. (2011) in their non-randomised controlled trial of mobile texts for HIV prevention in the United States. Although there was a significant reduction in participants engaging with multiple sex-partners, there was no change in condom use. However, the small sample of 30 per group may have resulted in a low powered study, impacting the findings (Juzang et al., 2011). In contrast to the positive effect on risky sexual behaviour reported, an RCT on 994 Australian young people by Lim et al. (2012) reported no significant change in condom use in the intervention group after sending SMS for 12 months. This occurred despite the reported increase in awareness of sexual risk and favourable reception of messages by participants (Lim et al., 2012).

In the United States, another RCT assessing impact of mobile voice-calls for 12 months on contraceptive use by 805 adolescent female clinic patients reported no change
in condom use between the 2 groups (Kirby et al., 2010). Only 2.7 out of 9 voice-calls specified by study protocol were completed suggesting that using phone calls may be a less feasible mHealth delivery strategy for this purpose. The completion rates of 75% for the study, 39% by Lim et al. (2012) and the long duration of the studies (12-months) gave the results a better validity than the RCT by Gold et al. (2011a) (with <5% completion-rate).

### STI testing and reproductive clinic attendance

The effect of SMS on promoting STI testing was reported by Levine et al while evaluating SEXINFO, a free sexual health mobile text messaging information and referral service for young people in the United States (Levine et al., 2008). They sampled 322 young patients on sexual behaviours and SEXINFO use at clinics where SEXINFO users were commonly referred for sexual health consultation/testing. Findings reported 11% of respondents had used the SEXINFO service and a significantly large number resided in campaign target areas, suggesting that SEXINFO had a positive effect on encouraging STI testing. They also found that those within the adolescent age group were both more likely to be aware and make use of the service. The survey method for assessment helped reduce bias associated with self-reporting for STI testing. The report was however ambiguous about the status of surveyed patients as it didn't clearly state if they were new or returning clients.

Gold et al. (2011a) in a large prospective study (1771 participants) on the impact of SMS on youth sexual promotion also reported a significant increase in STI testing in both sexes (Gold et al., 2011b) unlike results from the RCT by Lim et al. (2012) which reported increased STI testing only among females. The large sample size used by Gold et al. (2011a) strengthens the validity of the results however the study design employed without randomisation and controls implies confounders were not excluded. Randomization is important because it provides the strongest evidence for causal inference. It is therefore impossible to clearly say if the increased STI-treatment recorded was due to the SMS or other ongoing SRH-promotion programmes. Namirembe and Hoefman (2012) reported a significant increase in SRH-clinic attendance and uptake of family planning services by young people in Kenya and Tanzania following SMS intervention (Namirembe and Hoefman, 2012). In contrast, the RCT by Gold et al. (2011a) on Australian youths reported no improvement in STI testing and clinic attendance after 4 months of intervention (Gold et al., 2011a).

### Seeking sexual health information

Studies showed an improvement in sexual health information-seeking behaviour after mHealth intervention. Lim et al. (2011) in their RCT reported a significant increase in seeking sexual-health information among females in the intervention group only, most females reported seeking and discussing sexual health issues with a clinician following the mobile SMS (Lim et al., 2012). The evaluation results of the SEXINFO program (Levine et al., 2008) also reported increased text inquiries for sexual health information. It recorded 4,500 inquiries in 6 months with more than half leading to referrals and more information. The program encourages young people to take up the responsibility of seeking SRH information for themselves through their mobile phones unlike previous studies above that sent out SRH information on a regular basis. This is similar to the “pull” component of the “pull-and-push” concept and mobile health interventions designed to combine this two modes of delivery may result in more promising results. However, this mode of delivery needs more research with robust study designs. Most of the literature reviewed used SMS as the delivery method for mobile phone interventions on sexual health probably because SMS are cheap and popular among adolescents and young people, meeting their needs for relevant, accurate information, privacy and confidentiality for sexual health promotion (Perry et al., 2012).

### CONCLUSION

The findings of the review as summarised in Table 1 show that mHealth interventions improve knowledge and have some effect on promoting positive sexual behaviour albeit non-uniformly. Although STI testing and seeking SRH information showed improvements following interventions, the same cannot be said for condom use and sex-partner behaviour. Further research into this area is necessary to unravel underlying reasons and help plan more effective interventions. Future reports should also be disaggregated by gender to identify any differences for possible focus. The deployment of mHealth for adolescent sexual health promotion in developing countries also needs to be intimately researched with RCTs as they provide the strongest evidence for causal inference and none were retrieved during the search for this review. Although mobile phone ownership/access and willingness to access sexual-health information is high among adolescents in developing countries (Akinfaderin-Agarau et al., 2012; Mitchell et al., 2011), socio-economic and gender-cultural issues/barriers need to be considered in designing studies. Mobile phones can be an effective tool for engaging with adolescents who tend to be enthusiastic and adapt easily to new technology. Although mHealth is not a ‘magic bullet’, it has a strong potential to address barriers, improve access to required SRH information and promote positive sexual behaviour among adolescents and young people.
Table 1. Summary of findings.

<table>
<thead>
<tr>
<th>Source</th>
<th>Population targeted</th>
<th>Country</th>
<th>Design/sample size</th>
<th>Mhealth strategy used</th>
<th>Risky sexual health behaviour: Condom use, multiple sexual partners</th>
<th>Seeking sexual health information</th>
<th>STI testing and clinic attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold et al. (2011a)</td>
<td>16 – 29 years</td>
<td>Australia</td>
<td>RCT (7606)</td>
<td>SMS</td>
<td>Increased condom use; reduced multiple sexual partners</td>
<td>NR</td>
<td>No improvement</td>
</tr>
<tr>
<td>Lim et al. (2012)</td>
<td>16 – 29 years</td>
<td>Australia</td>
<td>RCT (994)</td>
<td>SMS</td>
<td>No change</td>
<td>Improved in females only</td>
<td>Improved in females only</td>
</tr>
<tr>
<td>Kirby et al. (2010)</td>
<td>14-18 years</td>
<td>USA</td>
<td>RCT (805)</td>
<td>Voice-calls</td>
<td>No change</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Levine et al. (2008)</td>
<td>12 - 24 years</td>
<td>USA</td>
<td>Prospective (322)</td>
<td>SMS</td>
<td>NR</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td>Gold et al. (2011b)</td>
<td>16 - 29 years</td>
<td>Australia</td>
<td>Prospective (1171)</td>
<td>SMS</td>
<td>NR</td>
<td>NR</td>
<td>Increased</td>
</tr>
<tr>
<td>Namirembe and Hoefman (2012)</td>
<td>12 years and above</td>
<td>Kenya, Tanzania</td>
<td>Prospective</td>
<td>SMS</td>
<td>Increased condom use</td>
<td>Increased</td>
<td>Increased family planning uptake</td>
</tr>
<tr>
<td>Juzang et al. (2011)</td>
<td>16 – 20 years</td>
<td>USA</td>
<td>Non-randomised controlled (60)</td>
<td>SMS</td>
<td>Unchanged condom use; Reduced multiple sexual partners</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Cornelius et al. (2013)</td>
<td>13 – 18 years</td>
<td>USA</td>
<td>Prospective (40)</td>
<td>SMS</td>
<td>Increased Condom use</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

NR: Not reported.

Conflict of interest

Author have none to declare.

REFERENCES


