The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review


CRD summary
This review assessed interventions using mobile technologies delivered to consumers for health behaviour change or disease management. The authors concluded that text messaging increased adherence to antiretroviral therapy and smoking cessation and should be considered for implementation in similar settings. Other interventions required further evaluation. The conclusions reflect the limitations of the evidence base and seem appropriate.

Authors' objectives
To assess the effectiveness of mobile technology-based interventions delivered to health care consumers for health behaviour change and disease management.

Searching
The authors searched seven bibliographic databases (including MEDLINE, EMBASE, PsycINFO and The Cochrane Library) from 1990 up to September 2010. Search terms were reported. Reference lists of included trials were searched. No language restrictions were imposed. Searches were repeated in November 2012 to locate any new studies.

Study selection
Controlled trials that used any mobile technology intervention (mobile phones, smartphones and other technologies listed in the paper) to improve or promote health or health service use or quality were eligible for inclusion. Participants could be men or women of any age. Primary outcomes were defined as any objective measure of health, health service delivery or use. Secondary outcomes were self-reported outcomes related to health behaviour, disease management, health service delivery or use, or cognitive outcomes. This paper reported interventions directed at consumers; interventions to support health professionals were reported separately (see Other Publications of Related Interest).

The included trials covered a wide range of technologies in interventions delivered to consumers to change health behaviour (for example smoking cessation, diet and physical activity) or support disease management (for example providing pulmonary resuscitation instructions or supporting control of diabetes, hypertension or asthma). Interventions included information, reminders and mobile counselling and varied widely in duration (one minute 15 seconds to one year). Most trials were conducted adults in high-income countries (including 10 UK trials).

Two reviewers independently selected studies for inclusion.

Assessment of study quality
Quality was assessed by two reviewers independently based on Cochrane Collaboration criteria which covered sequence generation, allocation concealment, blinding of outcome assessors and data analysts, completeness of follow-up, selective outcome reporting and other potential sources of bias. Discrepancies were resolved by discussion with a third reviewer.

Data extraction
Risk ratios (RR) or mean differences (MD) and associated 95% confidence intervals (CI) were extracted or calculated for included studies. Techniques used in behaviour change interventions were classified using the taxonomy of Abraham and Michie. Trial authors were contacted for additional information where required.

Two reviewers independently extracted data. Discrepancies were resolved by discussion with a third reviewer.

Methods of synthesis
Interventions were divided into those that promoted behaviour change and those designed to support disease management. A narrative synthesis was presented under these main headings. Primary and secondary outcomes were analysed separately.
Pooled outcome measures were calculated using a random-effects model where two or more trials used the same mobile technology for the same disease or behaviour and reported a common outcome. Heterogeneity was assessed visually from forest plots and by using $\chi^2$ and $I^2$.

Risk of publication bias was assessed using funnel plots.

**Results of the review**

Seventy-five trials were included: 26 trials of behaviour change interventions (10,706 participants) and 49 trials of disease management interventions (6,832 participants). It appeared that 25 of the behaviour change trials were individually randomised controlled trials (RCT). Disease management trials comprised 34 individual RCTs and three cluster RCTs. Two trials in behaviour change and two in disease management were at low risk of bias for all domains.

**Behaviour change: Meta-analyses** showed no significant effect of diet or diet and physical activity interventions on weight change (both based on two studies). A meta-analysis of two studies of SMS text messaging showed a doubling of smoking cessation in the intervention group compared with control (RR 2.16, 95% CI 1.77 to 2.62). Results of single trials and for secondary outcomes were reported in the text and tables.

**Disease management:** Meta-analyses indicated that SMS text messaging decreased glycated haemoglobin in diabetes (MD -0.27%, 95% CI -0.48 to -0.06; five studies) and reminders increased vaccine attendance (RR 1.36, 95% CI 1.27 to 1.47; three studies) but with high heterogeneity ($I^2=96.6\%$). Interventions had no effect on medication adherence (two studies). In single trials at low risk of bias, text messaging to promote antiretroviral adherence reduced high viral load but had no significant benefit on mortality. Extensive results for secondary outcomes were reported. Trials of interventions for other conditions suggested benefits in some cases but results were not consistent.

There was no evidence of publication bias.

**Authors’ conclusions**

Text messaging interventions increased adherence to antiretroviral therapy in low income settings and smoking cessation in high income settings and should be considered for inclusion in services in similar settings.

**CRD commentary**

The review question and inclusion criteria were broad but generally clear. The search covered a wide range of sources without language restrictions. Publication bias was assessed and no evidence of bias was found. Appropriate methods were used to minimise risk of reviewer errors or bias.

Study quality was assessed using standard criteria and studies at low risk of bias were emphasised in the synthesis. Methods of synthesis seemed appropriate; meta-analysis was used where possible. Few of the included studies were at low risk of bias and the meta-analyses were based on small numbers of trials. Much of the evidence was related to specific settings.

Overall, this was a well-conducted review and the authors’ conclusions and research recommendations appropriately reflect the limitations of the evidence base.

**Implications of the review for practice and research**

**Practice:** The authors stated that text messaging-based interventions for antiretroviral drug adherence and smoking cessation should be considered for implementation in the types of setting where they had been shown to be effective.

**Research:** The authors stated that further well-designed randomised trials were required to establish the long-term effects of mobile health technologies on clinical outcomes. Trials in low- and middle-income countries were required.

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