E-health interventions targeting STIs, sexual risk, substance use and mental health among men who have sex with men: four systematic reviews

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Scientific summary

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Scientific summary

Background and rationale

This review synthesises evidence on electronic health (e-health) interventions aiming to reduce the 'syndemic' (simultaneous, mutually reinforcing epidemics) of human immunodeficiency virus (HIV)/sexually transmitted infections (STIs) and sexual risk, substance (alcohol and legal and illegal drug) use and mental ill health among men who have sex with men (MSM).

E-health interventions are delivered via electronic media and devices; previous studies suggest that such interventions can reduce alcohol use and mental ill health among general or mixed populations, and might reduce drug use and sexual risk behaviour. If such interventions are also effective in addressing these outcomes among MSM, there may be value in developing an e-health intervention that targets these outcomes simultaneously among MSM. To our knowledge, no systematic review has assessed the effectiveness of e-health interventions across these outcomes. This systematic review aimed to synthesise theories of change and process, outcome and economic evaluations of e-health interventions targeting sexual risk, substance use and mental ill health among MSM.

Aims and research questions

The aims were to search systematically for, appraise the quality of and synthesise evidence to address the following research questions:

- What approaches and theories of change do e-health interventions employ to prevent HIV, STIs, sexual risk behaviour, alcohol and drug use or common mental illness symptoms among MSM?
- What factors relating to interventions, providers, participants or contexts promote or impede delivery or receipt of such interventions?
- What are the effects of such interventions on HIV and STIs, sexual risk behaviour, alcohol and drug use, and depression and anxiety overall, and by intervention and client subgroup?
- Are such interventions cost-effective in reducing these outcomes?
- Does the existing evidence overall suggest that these outcomes can coherently, feasibly and effectively be addressed by an e-health intervention targeting UK MSM and, if so, what might such an intervention look like?

Methods

Inclusion criteria

Eligible studies focused on e-health interventions providing ongoing support to MSM to prevent HIV, STIs, sexual risk behaviour, alcohol/drug use or common mental illnesses. The review excluded interventions delivering one-off support; addressing HIV self-testing, clinic attendance or STI partner notification only; and/or delivered by human providers via electronic media. Eligible reports described intervention theories of change and/or reported on process, outcome and/or economic evaluations.

Search methods for the identification of studies

Searching information sources

The search strategy included terms covering two core concepts: MSM and e-health. Publication dates were limited from 1995 to date. We initially searched 24 information sources (23 October to 26 November 2018). We conducted an updated search (22–27 April 2020) across 19 information sources.

We searched various websites for additional results throughout 1–26 November 2018, and updated this throughout 22–27 April 2020.

We also searched reference lists from all included studies and contacted subject experts.

Information management and study selection

Citations identified by our searches were uploaded to EndNote [Clarivate Analytics (formerly Thomson Reuters), Philadelphia, PA, USA] and deduplicated before being uploaded to EPPI-Reviewer (version 4.0) [Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre), Social Science Research Unit, Institute of Education, University of London].

Two reviewers double-screened batches of the same 50 references. Disagreements were resolved by discussion, referring to a third reviewer when needed. After reaching an agreement rate of at least 95%, each reference was henceforth single-screened on title/abstract. Retained references were then reviewed on the basis of the full report.

Data collection and assessment

Data extraction

Two reviewers independently extracted data using existing tools. Disagreements were resolved by discussion, referring to a third reviewer when necessary. For theory reports, we extracted data on the constructs and mechanisms described, the evidence presented in support of the theory of change and how the theory of change was developed. For all empirical studies, we extracted data on basic study details, methods and interventions. For process evaluations, we extracted data on how processes of delivery/receipt varied with the characteristics of the interventions, providers, participants or contexts. For outcome evaluations, we extracted data on allocation; sequence generation and concealment (randomised controlled trials); control of confounding (quasi-experimental studies); measures, follow-up and blinding; retention; and outcomes/effects at follow-up(s), both overall and, when available, by sexuality and gender identity, socioeconomic status and ethnicity. For economic evaluations, we extracted data on key issues such as the perspective (direct and indirect costs), evaluation framework, source of effectiveness estimates, critical assumptions, discount rates and cost-effectiveness in the form of either incremental cost-effectiveness ratios or net (health) benefits. We also aimed to report on the key cost-effectiveness drivers.

Assessments of quality and risk of bias

The quality of each report was assessed independently by two reviewers using standard or modified versions of existing tools. The reviewers met to compare their assessments and resolved any differences through discussion, referring to a third reviewer when necessary.

Theory reports were assessed on the basis of the extent to which the theory of change described the path from intervention to outcomes; the clarity with which theoretical constructs were defined; the clarity with which causal inter-relationships between constructs were defined; the extent to which the mechanisms underlying these inter-relationships were explained; and the extent to which the theory of change considered how mechanisms and outcomes might vary by context.

Process evaluations were assessed on the basis of the rigour of sampling, data collection and data analysis; the extent to which the study findings were grounded in the data; whether or not the study privileged the perspectives of participants; breadth of findings; and depth of findings. These assessments were then used to assign to each study a 'weight of evidence' (low, medium or high) to rate the (a) reliability or trustworthiness and (b) usefulness of the findings.

Outcome studies were assessed for risk of bias on the basis of sequence generation, allocation concealment, blinding of participants or personnel, blinding of outcome assessors, incomplete outcome data, selective outcome reporting and other sources of bias. Each study was subsequently identified as being at 'high risk', 'low risk' or 'unclear risk' of bias within each domain.

Economic evaluations were assessed using an adapted version of an existing tool comprising 24 questions ranging from the type of economic evaluation to the time horizon and rationale for the choice of modelling approach. We expanded its questions to ensure that information that was particularly relevant to this review was extracted, such as identifying uptake rates and assumptions regarding the heterogeneity of risk.

Data analysis

Typology of intervention approaches

The intervention descriptions and theories of change were analysed to develop a typology of interventions, which were described in terms of behaviour change techniques.

Theories of change synthesis

We synthesised theories of change using a meta-ethnographic approach. We developed a novel diagrammatic approach to theory synthesis that allowed us to summarise the components of each intervention's theory of change and the relationships between them.

Process data synthesis

We synthesised qualitative and quantitative elements of process evaluation reports using thematic synthesis methods.

Outcome data synthesis

We conducted a narrative synthesis by outcome, grouping effect estimates by post-intervention follow-up duration. When necessary, we rebased follow-up times using the stated intervention duration, but report in our narrative synthesis follow-up times as described in original reports. We produced forest plots for each of our review outcomes, with separate plots for different outcomes and follow-up times, and pairwise comparisons between intervention types (e.g. intervention vs. no treatment control, or vs. another treatment type). Plots included point estimates and standard errors for each study, expressed as standardised mean differences (Cohen's *d*) to ensure comparability across reports.

When data allowed, we calculated pooled effect sizes within each pairwise comparison, accounting for the extent of heterogeneity among the studies. If an indication of substantial heterogeneity was determined with fewer than three studies (e.g. study-level $I^2 > 50\%$), we did not present a pooled estimate by follow-up time or across follow-up times. When we produced pooled estimates, we used a robust variance estimation meta-analysis model to synthesise effect sizes. We estimated separate models for each outcome: HIV, STIs, defined sexual risk behaviours, alcohol use, drug use, anxiety and depression. We regarded follow-up times of < 3 months, 3 months to 1 year and > 1 year post intervention as different outcomes, pooling first by follow-up times and, when appropriate, overall across follow-up times. We used the Grading of Recommendations Assessment, Development and Evaluation to present the quality of evidence.

Synthesis of economic data

Measures of costs, indirect resource use and cost-effectiveness were summarised in a table and adjusted for currency and inflation to the current UK context. These data were used to inform a narrative synthesis of economic evidence and applicability to the UK context.

Stakeholder consultation

We assembled a patient and public involvement stakeholder group and met with members twice during the review. In April/May 2020, stakeholders reviewed slides summarising the main findings in relation to the typology of interventions and to the theory of change and process evaluation syntheses. We asked stakeholders to advise on the feasibility of drawing on the interventions presented to inform the development of an overall intervention addressing the syndemic of sexual risk, substance use and mental ill health among UK MSM. In December 2020, stakeholders reviewed slides summarising the results of the outcome and economic syntheses. We explored with stakeholders whether or not this evidence suggested that it would be worth investing in the development of an e-health intervention to address multiple outcomes among UK MSM, and we sought advice on dissemination and knowledge transfer.

Ethics approval

The research involved no human participants and drew solely on evidence already in the public realm; therefore, research ethics approval was not required.

Results

Included studies

The original searches retrieved 20,727 unique references and 27 eligible reports. The updated search retrieved 5317 unique references and 10 eligible reports. In total, 37 reports on 28 studies of 23 interventions were included: 33 on theories of change, 12 on process evaluations, 16 on outcome evaluations and one on an economic evaluation. Of the included interventions, 20 addressed sexual health, 10 addressed substance use and seven addressed mental health outcomes.

What approaches and theories of change do existing e-health interventions employ to prevent immunodeficiency virus, sexually transmitted infections, sexual risk behaviour, alcohol and drug use or common mental illness symptoms among men who have sex with men?

Interventions fell into two overarching types, each containing subtypes: time-limited/modular (guiding participants sequentially through intervention content from beginning to end) and open ended (not designed as fixed and sequenced bodies of learning intended for all participants to work through).

Among time-limited/modular interventions, 'online modular' interventions were interactive, modular programmes delivered online. The other two subtypes identified were 'computer games' and 'non-interactive interventions'. Among open-ended interventions, the 'content organised by assessment' subtype comprised interventions that tailored the delivery of core content based on user risk assessments. The 'general content' subtype comprised interventions delivering the same content to all participants.

We developed three synthesised intervention theories of change. In the 'cognitive/skills' synthesised theory of change, which drew on the vast majority of intervention theories of change included in this review, information and exercises were theorised to influence behavioural skills directly and via various cognitive factors relating to motivation/intention and self-efficacy/perceived control. The 'self-monitoring' synthesised theory of change focused more narrowly on the role of self-monitoring in triggering reflection, self-reward/critique and behavioural self-regulation. In the 'cognitive therapy' synthesised theory of change, intervention activities were theorised to promote awareness and recognition of a participant's thoughts, feelings and situations and, via either challenging or accepting negative cognitions, aimed to reframe negative emotions to improve mental health.

What factors relating to interventions, providers, participants or contexts promote or impede delivery or receipt of such interventions?

Perceived usefulness was key to intervention acceptability. Acceptability was enhanced when interventions were easy to use and free from technical problems, and when their content was clear and comprehensive, engaging, interactive and aesthetically pleasing. Privacy was an important aspect of acceptability, suggesting that detailed, partner-level questions on sexual behaviour could feel intrusive and that features protecting application (hereafter referred to as 'app') access and obscuring the manifest purpose of apps would promote acceptability. Language and tone were highlighted as important aspects of acceptability. Individual tailoring based on participant characteristics and risk profiles also increased acceptability, and participants valued interventions that presented scenarios and other content that reflected their experiences as MSM. There was little evidence on how intervention receipt varied by participant or provider characteristics.

What are the effects, overall and by intervention and client subgroup, of such interventions on the outcomes of human immunodeficiency virus, sexually transmitted infections, sexual risk behaviour, alcohol and drug use, and depression and anxiety?

Little evidence was available on the effects of included interventions on HIV or STI outcomes. Analysis did not suggest that included interventions were effective at reducing HIV infections, but with low certainty of evidence (based on assessment of bias and statistical imprecision in the evidence): there was an increase in HIV infections in the intervention versus control groups of 0.12 standard deviations [95% confidence interval (CI) −0.34 to 0.59]. A pooled analysis of short-term (< 3 months) effects on STI outcomes found no impact, with very low precision, while the single trial exploring mid-term (3 months–1 year) effects of such an intervention suggested a significant reduction in incident STIs with moderate certainty. The overall analysis across short- and medium-term follow-ups suggested a small and non-significant increase in STIs in the intervention group, compared with the control group (Cohen's $d = 0.07$, 95% CI −0.79 to 0.94).

Pooled estimates suggested a statistically significant impact on sexual risk behaviour at mid-term follow-up, with low or very low certainty. Estimates pooling across measures and follow-up time suggested interventions reduced sexual risk, compared with control groups (Cohen's $d = -0.15$, 95% CI −0.26 to −0.05). We tested whether or not interactivity of interventions (users entering information that determined intervention content) related to intervention impact on sexual risk behaviours, but did not find a significant effect.

The findings for drug use could not be meta-analysed because of study heterogeneity, and were of very low certainty. Studies addressing this outcome did not present consistent evidence of effectiveness, with only one reporting evidence of impact (short term).

Trials did not include data on alcohol use or mental health outcomes.

We found only two studies that examined the effects of e-health interventions on outcomes that spanned sexual health and drug use, with one reporting no effects of an e-health intervention on sexual risk behaviour, but an effect on one measure of drug use, and another reporting effects on measures of sexual risk behaviour and drug use, but not on HIV or STIs. We found no evaluations of e-health interventions reporting effects for other combinations of outcome domains.

Moderation of intervention effectiveness by income, ethnicity and other social variables was not meaningfully addressed by this body of evidence.

Are such interventions cost-effective in reducing these outcomes?

The single eligible study assessing cost-effectiveness suggested that the intervention may have been cost-effective in reducing condomless anal intercourse, but this finding was undermined by a large degree of uncertainty around these results.

Does the existing evidence overall suggest that these outcomes can coherently, feasibly and effectively be addressed by a single, joined-up e-health intervention targeting UK men who have sex with men?

We identified three distinct theory of change pathways underpinning existing e-health interventions for MSM targeting sexual health, substance use and mental health outcomes, two of which underpin interventions targeting all three of these outcomes. Similarly, we identified several factors shaping the receipt of e-health interventions by MSM, which applied across targeted outcomes. However, evidence of effectiveness is currently limited because the majority of interventions were focused on individual outcomes, with patchy effects for the outcomes that were assessed.

Conclusions

Future trials of e-health interventions are needed and these should aim to address the multiple syndemically linked outcomes of HIV, STIs, sexual risk behaviours, drug and alcohol use and mental ill health among MSM, including domains with less existing evidence (HIV/STIs, substance use and mental health). Future studies should involve interventions using common theories of change to address the multiple outcomes, and incorporate follow-up and sample sizes sufficient to detect meaningful impact.

Study registration

This study is registered as PROSPERO CRD42018110317.

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