REVIEW PAPER

Can technology be effective in interventions targeting sexual health and substance use in young people; a systematic review

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Abstract Technology is increasingly used as a method to engage young people in health issues. This review aimed to assess the effectiveness of technology interventions in preventing and reducing substance use and risky sexual health behaviours in young people. The following databases were searched via Ovid: Psychinfo, Medline, Embase. Studies were systematically screened by title, abstract and 2 reviewers assessed the full papers and discrepancies discussed. Inclusion criteria: young people (aged 12–25 years) that constituted at least 50 % of the population; any technological component including telecommunication, computer and internet that constituted at least 50 % of the intervention; any sexual health or substance use outcome; studies meeting evidence level one-four. 1603 papers were identified by the original search. Of these, 30 were included in the review. The majority of studies showed positive intervention effects, however, most targeted educated young people, such as university students. Additionally, the outcome measures were often psychological determinants of behaviour rather than actual behaviours. Technology has a significant role to play in this field. The review identifies components of effective interventions for young people. However more research is required to target vulnerable populations in order reduce inequalities. Studies are required that involve a wider variety of participants with behavioural outcomes.

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1 Introduction

It is recognised that the 21st century has witnessed some of the greatest technological advances known to the modern world [1]. Such advances are particularly relevant to young people given that they are seen as fashionable elements of youth culture. As a result, technology is increasingly being used as a method by which to engage young people in health issues [2]. For example, the NHS is using mobile phone apps around substance use and sexual health behaviours that are aimed at providing young people with information in order to help them make informed decisions in relation to risky behaviours [3, 4]. Although smart phone applications have only recently been introduced, the use of technology to help engage youths has been prevalent for several decades. An alcohol education programme in the USA [5] and a Videotex computer sex education in Switzerland [6] programme being prime examples of earlier work in the field.

Substance use can have a range of negative health and social effects. It is also accepted that substance use, particularly alcohol consumption, is a contributory factor in engaging in risky sexual health behaviours [7]. Therefore technological interventions that aim to reduce, for example, excessive or binge drinking may also play a role in encouraging safer sexual behaviour. Looking at the effectiveness of such interventions, reviews have found that technologies such as the internet and Short Message Service (SMS) can be effective in influencing determinants of behaviours, and behaviours such as condom use and STI testing and are a feasible mode of delivery [8–10]. Similarly computer-based interventions have been found to be effective at reducing alcohol use in college students, however, this was not superior to any other form of intervention in reducing binge drinking [11]. Therefore, there is mixed evidence to date on the effectiveness and 'added value' of technology interventions.

Whilst designing an intervention that is effective in enhancing positive health behaviours is crucial, so is the feasibility of an intervention in engaging young people, since they are the age group most likely to be influenced by their peers and media [12]. Therefore a consideration of young people's preferences for interventions is necessary when reviewing the effectiveness of interventions aimed specifically at young people. Turnbull, van Schaik, van Wersch [13] highlighted young people's preference for internet sites, in a supporting role, in a study examining preferred choices for sources of sex education. Thus indicating the popularity of the internet amongst this population. If the effectiveness of technology interventions is comparable with other modes of delivery, they may make a more acceptable, and therefore engaging, intervention for groups like young people.

Based on what is known so far, it was felt to be beneficial to examine a broader range of technology-based interventions and to look at multiple risk behaviours: alcohol and drug use, along with sexual health. This is due to the links between substance use and risky sexual behaviour. This review therefore aimed to focus on the use of all types of technology interventions for young people (aged 12–25 years) in the prevention and reduction of risky behaviours around substance use—namely alcohol and drug use—and sexual health.

2 Method

2.1 Search strategy

The terms (young people adolescent* teen*) AND (Telecommunication OR Computer OR MP3 players OR Internet OR Mobile* or Technolog*) AND Health (the term 'health' was used to capture as broad a range of studies as possible) were used to search for relevant studies. The following databases were searched via Ovid: Psychinfo (1806- Wk 2 Jan 2011) Medline (1948-Jan Wk 2 2011), Embase (1980-Jan Wk 2 2011).

2.2 Inclusion criteria

2.2.1 Population

Young people (males and females aged 12–25 years) that constituted at least 50 % of the population and who were living in higher income countries.

2.2.2 Intervention

Any technological component including telecommunication, internet, MP3 players or mobile phone, where a minimum of 50 % of the intervention was technology based (for example, if participants received a 1 hour group followed by a 1.5 hour internet intervention, this would be included.)

2.2.3 Outcomes

Behavioural outcome or a psychological determinant of behaviour, such as intention or attitude, relating to sexual health or substance use (alcohol or drug use). Aimed at reducing risky behaviours or preventing adoption of risky behaviours.

2.2.4 Study design

Studies meeting the level one-four level of evidence [14], which includes all RCTs, cohort studies and studies with no control but that report baseline and follow-up measure. Due to the heterogeneous nature of study outcomes, a narrative review was utilised.

3 Results

3.1 Selection of studies

1603 results were generated from the search. Following title selection 372 papers remained (all topics). After abstract selection 66 papers remained. Two reviewers then examined the remaining papers independently and then discussed and agreed on any discrepancies. From this analysis 10 sexual health papers and 20 substance use papers remained.

3.2 Study characteristics

The 30 papers reported (10 sexual health and 20 substance use; see online resource for table of study characteristics) represent only two modes of intervention; computer and internet approaches. Outcome measures for the sexual health papers centred on knowledge, perceptions of risk around sexual behaviour, behavioural outcomes, for example number of safe and risky sexual behaviours practised, and medical outcomes, such as rates of sexually transmitted infections (STI's). The outcome measures for the substance use papers also looked at behaviour, though the psychological determinants were often focused on perceptions of the consequences of substance use. Pre and post-test measures were taken for all the studies however, the length of follow-up varied from between 0 and 12 months. Some studies included a feasibility component which is also discussed. The majority of the samples recruited were from school/university student populations. However a couple of papers did intervene with what could be termed as 'vulnerable' populations.

3.3 Sexual health computer interventions

The seven sexual health computerised interventions all took place in the USA and used school or college students as participants. Each study measured a determinant of behaviour, such as knowledge, beliefs or efficacy to make decisions in relation to sexual health and some measured contraceptive use behaviour. Two of the papers focused exclusively on preventing pregnancy. Paperny and Starn [15] used computer games in order to increase participants 'understanding of the impact and cost of sexual behaviours' (p742) whilst Chewning et al. [16] attempted to engage patients at a family planning clinic in safe sexual practice, by use of a computerised oral contraceptive decision aid. Both interventions were found to be successful in reducing sexual activity/increasing oral contraceptive knowledge respectively. The computer-assisted instruction delivered by Kann [17] attempted to enhance sexual responsibility by taking participants through a series of decision making steps to increase awareness of the potential consequences of sexual decisions, making it comparable to the intervention by Chewning et al. [16]. Kann [17] was successful in improving some of the communication skills necessary for making safer choices. Similarly, Roberto et al. [18] did not focus exclusively on pregnancy or STI prevention but used computer based activities and found improvements in perceived threat, efficacy, attitudes and knowledge concerning pregnancy and STI's. Another study carried out by Roberto et al. [2] was described as a 'computer-internet' intervention. This intervention also targeted both pregnancy and STI prevention through a 7 week course involving online interactive activities and found positive results for the intervention group around sexual activity, knowledge and self-efficacy. Kiene et al's [19] intervention was aimed at condom use and utilised information-motivation-behavioural skill model as a basis for the intervention and evaluation, and also found positive changes behaviour and behavioural determinants. Finally the study by Lightfoot, Comulada & Stover [20] varied from others reported as it focused specifically on STI prevention, worked solely on increasing efficacy, and recruited a vulnerable population—pupils who had been unsuccessful in mainstream education and were at risk of being or were already involved with the juvenile justice system.. The results showed that the intervention was effective with significantly less sexual activity in the intervention group. Overall it can be seen that the majority of these studies were successful in changing behaviour or its determinants.

3.4 Sexual health internet interventions

The three internet interventions identified within the sexual health field all focused on STI prevention. Bowen, Horvath &

Williams's [21] RCT examined the effect of an internet intervention involving a dialogue between an 'expert' and an 'inexperienced man', which was combined with graphics that illustrated key points as well as interactive activities for participants to complete. This study targeted 'rural' men who had sex with men (MSM) and showed significant improvements in attitudes towards safe sex and an increase in HIV/AIDS—related knowledge. Bilardi et al. [22] and Bull, Pratte, Whitesell, Rietmeijer & MacFarlane [23] both investigated the effect of websites on preventing the transmission of STI's within groups of young people. Bilardi et al. [22] used an online sexual assessment tool in an attempt to increase rates of young people being tested for chlamydia before and after their exposure to the intervention. Despite recruiting participants opportunistically through their GP clinic with an associated financial incentive for GPs to recruit individuals, the results showed the intervention was not effective in increasing overall Chlamydia testing rates, with the exception of females aged 16–19 years. Bull et al. [23] also recruited some of their sample in a clinical setting in order to use their website 'Keep it Real'. Results were analysed in terms of recruitment method (internet versus clinical) and a small effect was detected for those recruited online. Compared to the sexual health computerised interventions, the sexual health internet interventions were less successful in achieving positive outcomes, however Bowen et al. [21] and Bull et al. [23] studies did show some promising results.

3.5 Substance use computer interventions

The cluster RCT carried out by Vogl et al. [24] used a teenage drama delivered via a computer to educate adolescents about the dangers of alcohol misuse and improved mediating factors such as increasing knowledge that led to safer drinking choices and decreasing the positive social expectations of alcohol use. This translated to improved behaviour in the form of alcohol related harm, alcohol consumption and excess alcohol consumption in female, but not the male participants. Williams, Griffin, Macaulay, West & Gronewold's [25] CD-ROM study used a computerised intervention in attempt to prevent drug use, successfully improving attitudes, expectations, anxiety and relaxation but not actual substance use. The authors suggest this was partly due to the very low baseline substance use in both the intervention and control groups.

Two comparable studies involved computerised alcohol misuse prevention interventions using participants recruited from hospital Accident and Emergency departments. The study by Walton et al. [26] used a vulnerable population—adolescents with a prior history of violence—to test the effect of motivational interviewing (MI) delivered either by a therapist or computer. Neither group found a reduction in alcohol intake compared to controls, however, both groups reported
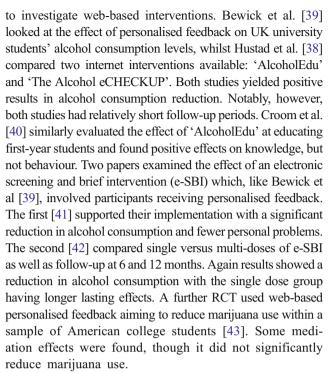
reductions in self-reported alcohol consequences (e.g. missed school or issues with friends) suggesting that MI shows promise. What remains unclear however, is whether the use of a computerised delivery is advantageous over the traditional therapist.

The study by Barnett, Murphy, Colby & Monti [27] also used motivational interviewing as a method to treat mandated college students who had been referred for alcohol education following a related incident. They tested a brief session delivered in person compared with a computerised programme called Alcohol 101 [28]. Like Walton [26] the results for motivational interviewing were unsuccessful. The paper by Maio et al. [29] involved an RCT which investigated the use of a computer program in preventing alcohol misuse among injured adolescents. Compared to the control group there was no significant reduction in the main two outcome measures of alcohol misuse or binge drinking episodes. Overall it can be seen that computerised interventions directed at substance use are quite mixed in their success. However, it appears that there may be more scope for those that take place in schools such as Vogl et al. [24] and Williams et al. [25].

3.6 Substance use internet interventions

Five studies targeted the adolescent female population. Three studies by Schinke, and colleagues [30–32] all aimed to enhance the relationships between adolescent females and their mothers in an attempt to reduce or prevent substance abuse. The intervention involved mother-daughter dyads viewing animated skills demonstrations and jointly completing exercises that sought to improve the mother-daughter relationship. All three studies had positive outcomes in mother-daughter communication [32] and, with longer follow-ups, alcohol risk behaviour [30, 31]. A comparable study [33] found that their interactive web-based skill demonstration and interactive exercise programme was successful in reducing substance use and that participation benefited the mother-daughter relationship by increasing feelings of closeness and improving communication. Schwinn, Schinke and Di Noia [34] used a 12 session internet drug prevention programme involving an interactive web page development and online activities programme. At 6- month follow-up, those in the intervention group had lower drug use and more positive normative beliefs and greater self-efficacy. Three articles published by Newton and colleagues [35–37] used variations of one intervention which was based on testing the efficacy of a programme developed to tackle substance use using 'computerised cartoon-based interactive programmes'. The three studies showed improvements in knowledge and behaviour.

Seven papers focused on using the internet to reduce/prevent alcohol misuse and all of them used University students as participants. Two of these papers [38, 39] carried out RCT's

to investigate web-based interventions. Bewick et al. [39] looked at the effect of personalised feedback on UK university students' alcohol consumption levels, whilst Hustad et al. [38] compared two internet interventions available: 'AlcoholEdu' and 'The Alcohol eCHECKUP'. Both studies yielded positive results in alcohol consumption reduction. Notably, however, both studies had relatively short follow-up periods. Croom et al. [40] similarly evaluated the effect of 'AlcoholEdu' at educating first-year students and found positive effects on knowledge, but not behaviour. Two papers examined the effect of an electronic screening and brief intervention (e-SBI) which, like Bewick et al [39], involved participants receiving personalised feedback. The first [41] supported their implementation with a significant reduction in alcohol consumption and fewer personal problems. The second [42] compared single versus multi-doses of e-SBI as well as follow-up at 6 and 12 months. Again results showed a reduction in alcohol consumption with the single dose group having longer lasting effects. A further RCT used web-based personalised feedback aiming to reduce marijuana use within a sample of American college students [43]. Some mediation effects were found, though it did not significantly reduce marijuana use.

The papers described above involved trying to change participants' behaviour around substances in an interactive and what could be described as a collaborative style. The following paper used a more prescriptive method and looked at the effect of sending postal versus internet 'news letters' about the effects of binge drinking [44]. Although the intervention was successful amongst students already binge drinking, there was no significant difference in outcome measures between sending the information via e-mail compared to through the post. Overall, the internet studies aimed at tackling substance use were largely successful in achieving positive outcomes.

4 Discussion

4.1 Sexual health computerised interventions

All of the papers that used a computerised intervention to target sexual health issues were relatively successful in what they set out to achieve. The study carried out by Roberto et al. [2, 18] appeared to have particularly strong findings since, collectively, improvements were observed for a range of psychological predictors of behaviour and behaviour itself. The success of this intervention may be due to their strong methodological approach and the fact that the intervention took place 'out with school/class' rather than during which was advantageous from a practical perspective.

There may be particular learning to come from Lightfoot et al's [20] computerised programme in a vulnerable population. This intervention had previously shown a large

increase in condom use in adults and adolescents when implemented in its original 'in-person' delivery format. The use of an adapted computerised version of 'Project LIGHT' is according to Lightfoot et al. [20] effective with 'delinquent youths' since they may respond poorly to 'didactic instruction'. This may be beneficial since this group have been reported to respond poorly to traditional forms of education [45]. Lightfoot et al. [20] have therefore taken advantage of an effective intervention and has applied it in a style to suits a population who is at greater risk of becoming infected with STI's.

Using decision making tools appears to be effective in relation to effective contraception use [16, 17]. This could be due to the fact that participants are led through the decision making process under their own volition and without hearing conflicting or dictatorial advice, which is a common problem within adolescent's sexual health care [46]. This form of intervention also highlights the experimental advantage of technological interventions with standardised delivery, as they have higher internal validity in comparison to interventions delivered face to face by multiple people.

In addition, the pregnancy prevention and contraceptive decision making papers were some of the oldest studies included in the review and therefore would have used software that was far less advanced than that currently available. The abandonment of computerised sexual health techniques that are not internet based is perhaps not surprising given the rapid emergence of the World Wide Web. However, the same type of programmes and techniques utilised are transferable to internet based interventions.

4.2 Sexual health internet interventions

The success of the sexual health internet interventions was somewhat limited for a variety of reasons. Bilardi et al. [22] found positive effects only for a sub-group of 16–19 year old females, suggesting that for males and other age groups, further behaviour change techniques may need to be integrated to result in positive changes. It is particularly interesting that it was younger females who the intervention was effective amongst. This may in part be due to this particular intervention being more appealing with younger women who may be commencing sexual relationships and therefore the content is more relevant to them. Furthermore, the mode of intervention being computer based allows for anonymity, which may be especially attractive to younger age groups [47]. It may also be that females are more likely to seek out information about and carry through with testing.

Tailoring interventions to particular sub-groups of populations may increase their effectiveness as found by Bowen et al. [21]. This is therefore an important consideration for those developing interventions. Whilst internet interventions appear to have overtaken computerised interventions as a mode of delivery, computerised interventions were more consistently successful. This may be because computerised modes facilitate use through a programme. Often the use of the internet in interventions was signposting to an internet site, therefore actual use was not monitored. In addition, whilst the current use of internet is highly interactive, even studies published several years ago would have been more limited in the capabilities of the internet to be interactive. Thus, interventions that help facilitate a person through a programme, and involve interactive elements, based on the format used in computer-based interventions may be more likely to be successful due to adherence.

4.3 Substance use computerised interventions

Similar to one of the sexual health studies [22] gender mediated results in a substance use study. Vogl et al [24] found their intervention to be more effective with females, than male participants. This sex difference should be considered carefully by researchers who target both sexes at it may determine whether an intervention is successful. This is particularly pertinent as males, in general, may engage in more risky behaviours than women [48].

Despite appearing effective, Williams et al. [25] substance use study was limited by the fact that none of the participants reported previous marijuana use. This restriction is indicative of a limitation that plagues the majority of the papers included in the review—the use of samples that are not representative of the target population. Maio et al [29] and Walton et al. [26] both recruited adolescents who were patients in Emergency Room Departments and therefore bring greater ecological validity to the results. Regardless of this strength however, the study by Maio et al. [29] proved unsuccessful in reducing alcohol misuse. The study by Walton [26] was somewhat more successful. The most prominent reductions in alcohol misuse and violence however were observed amongst those who received treatment from a therapist rather than the computerised intervention, which perhaps highlights that in the light of an event requiring hospital treatment only higher-level face-to-face interventions are more effective and appropriate. This may also reflect that generally, when the most risky populations are targeted, a much higher level of intervention is required, which may or may not be possible to achieve through technological interventions.

The lack of effects found for MI delivered by computer may be in part be indicative of the intricacies of language and tone used in MI that may not be wholly transferable to a computer setting. The study by Barnett et al. [27] appears to fall into line with this somewhat since they found that students who received a therapist intervention in the form of a brief motivational interview were engaging in more positive behaviours to help reduce alcohol misuse at

follow-up. Furthermore, through intervening with students who had been involved in an 'alcohol-related incident, this study had a higher risk and arguably a more ecologically valid sample. Overall it appears that the use of more representative samples by the studies in this section may partly explain why many of the interventions were not fully effective in their outcomes and questions whether technology interventions may be effective for those at most risk.

4.4 Substance use internet interventions

Internet dyadic interventions can be effective, through improving communication in mother-daughter dyads in the short term, translating to a reduction in substance use in the longer term [30–32]. Therefore illustrating that by strengthening important relationships that adolescents hold, it can act as a buffer to protect them against substance use. This type of work highlights the importance of wider social factors such as family support/communications in engaging young people and health issues and indicated where technology could be potentially very effective. Particular considerations may be needed when adapting interventions for other cultures, since Fang et al. [33] found positive results in an Asian population, however substance use levels are lower in Asian populations [49]. Gender-specific programmes may be particularly effective, with Schwinn et al. [34] finding positive changes at the 6-month follow-up which, like the work done by Schinke and colleagues [30–32], highlights that changes in relation to risk can take time to be integrated [50]. The success of these gender specific interventions again highlights that researchers should consider this when designing an intervention targeted at teenagers. Like the intervention led by Schinke and colleagues [30–32], the papers concerning the CLIMATE programme showed improvements occurred not immediately but rather over a longer period of time. Illustrating again how important long-term follow-up is when studying the adolescents and that they may require time to adapt cognitively, emotionally and behaviourally to any interventions targeted at them [50].

There is mixed support for some programmes, highlighting the importance of multiple trials. Although the findings Hustad et al. [38] were supportive of 'AlcoholEdu', the study by Croom et al. [40] did not find it to be effective in reducing alcohol use despite an increase in alcohol related knowledge. Hustad et al. [38] suggests that this difference may be due to a newer version of 'AlcoholEdu' being used in his study. However, knowledge is seldom enough to result in behaviour change, therefore this may question the effectiveness of the AlcoholEdu intervention. This may similarly account for the lack of significant results found by Moore et al. [44]. Interestingly, greater input in an intervention may not always be beneficial. Kypri et al's.

[42] single-dose session had longer lasting effects compared to the multi-dose sessions, however the reasons for this are unknown.

Overall it appears that the internet interventions targeted at substance use have rather mixed results. They do however show some promise and may be improved upon by considering some of the limitations that will be discussed shortly.

4.5 Feasibility of technology as interventions

The feasibility of interventions, in addition to effectiveness, is essential, and several studies assessed this. Bilardi et al. [22] did not receive enough feedback from young people, however the GP's involved in this study highlighted several issues such as a lack of time during the appointment and embarrassment raising the issue of STI testing, particularly when the patient had presented with a non-sexual health problem. This is interesting since it may tie-in with the issue of anonymity, which females appear to prefer in regard to sexual health. Chewning et al. [16] had favourable reactions from young people around the use of a computerised contraceptive decision aid. This supports the feasibility of technology as a method by which young people can access sexual health information without issues of embarrassment or anonymity and therefore may enhance the reach of an intervention, which has also been found for other areas, such as mental health [51, 52].

Paperny & Starn's [15] computerised pregnancy prevention games were very popular with students and teachers in the schools it was implemented in, suggesting this may be a beneficial way to engage school-aged children. According to Roberto et al. [2] their intervention was popular in both studies, based on the high level of participants who completed the trial. The study carried out Bowen et al. [21] was also well received with participants stating they would take part again. These latter two studies involved online interactive activities. Therefore this would suggest that young people view the usage of recreational type activities as an effective way in which to deliver health behaviour interventions. Far fewer of the substance use papers reported feasibility. The study by Bewick et al. [39] reported that 63 % of participants found the feedback from their web-based intervention useful. Moore et al. [44] investigated the feasibility of an internet versus postal delivered internet intervention and was supportive of its implementation.

This therefore promotes the benefits that the internet provides in terms of efficiency for participants, and that interactive elements may be positively received. In an age of rapid technological advances, the delivery of technology interventions for health will need to continually evolve. For example, social media, including mobile technology, social networking sites, and video hosting sites, is increasingly used by young people, and interventions have already penetrated this market

[53–55]. Social marketing also offers an avenue, which utilises commercial marketing approaches, involves the target population in the development of interventions, tailors accordingly and has the ability to draw on a range of relevant theoretical and evidence-based approaches, whilst competing with an engaging advertising market [56]. Challenges remain though in enabling sufficient reach of such interventions, ensuring campaigns are literate to the population, as well as fully utilising theory in the development [57–59]. There are particular difficulties in evaluating such interventions and particularly implementing and evaluating RCTs [60]. Feasibility evaluations may be possible to achieve through short questionnaire pop-ups, and incentivising the completion of behaviour questionnaires may one way to increase uptake for outcome evaluations. However, as technology advances, delivering effective health interventions will need to develop in line with this accordingly.

4.6 Limitations

There are several limitations of the studies included in the review. As Roberto [2] highlights, the majority of evaluations of technology use in the area of health communication measure mediating factors (such as beliefs, attitudes etc.) as opposed to an actual behaviours. This appears to be consistent with the papers identified by this review and is an area that requires addressing with future research ensuring behavioural outcomes are taken for all studies.

A large number of the studies used young people who were students from higher education establishments such as Universities and Colleges. For instance the study by Fang et al. [33] describes their population as 'socioeconomically advantaged'. This limitation is a major drawback, as engagement in risky behaviours is generally more prevalent amongst vulnerable populations such as individuals from low socio-economic status backgrounds [61]. Therefore more work must be done with groups such as those targeted by Lightfoot et al. [20] who were from 'alternative population schools' who are likely the hardest to reach but also those most in need of interventions.

The issue of gender appropriate studies is led by the fact that two of the studies (Vogl et al. [24] and Bilardi et al. [22]) found their intervention to be successful amongst female participants only. Gender is an issue that should be explored in more detail when it comes to using technology to engage young people in health issues. Overall this suggests several considerations that should be made when designing interventions to tailor them to the target audience. Although this may appear to be a simplified and a general point, it has become increasingly clear that many interventions that are designed for general populations can be detrimental to the efforts of the researchers attempting to engage young people. Finally, it is worth mentioning that not all studies conducted long term follow ups, and may therefore have missed true outcomes due to delayed intervention effects or may reveal only short term results.

Future research and practice in the development of technology interventions would in particular benefit from drawing on the findings of effective interventions to translate this into new media, for example mobile technology and applications. This includes interactive components to maintain interest, tailoring to the specific population based on gender and cultural issues, and targeting wider psychosocial factors such as communication and relationships, as well as the specific health issue. Involving the target population in the development of the intervention may further assist in achieving a feasible engaging intervention [62]. In ensuring an effective intervention for behaviour change, robust longer term evaluations are required, as well as between detailing of intervention components so the effective elements can be drawn out and utilised in future interventions. Behaviour change technique taxonomies may assist authors to define their intervention for the techniques it utilises and therefore assist practitioners and academics design programmes [63].

5 Conclusions

In conclusion, the evidence is mixed when examining the effectiveness of technology in improving health among young people. Key factors that appeared to be supportive of an effective intervention include the use of interventions that assist a young person through an interactive programme, such as those used in computer-based interventions, which may be successful due to their approach making it harder for participants to disengage. Interventions that consider wider social factors such as culture and gender specific strategies appear to be particularly effective, as well as studies targeting relationships and communication. Online interactive activities appear to be particularly feasible to young people, especially when confidentiality is ensured and interventions include interactive elements and/or personal feedback. There are several limitations that occur across the majority of the studies that should be addressed in future research, including the use of behavioural outcomes and research with vulnerable populations. Despite these limitations, technology will become more advanced over the years and in a growing population with fewer resources than needed, the use of technology opens up opportunities to reach a wider population than would otherwise be neglected. This is particularly pertinent when working to address health issues amongst young people, for whom technology interventions may be especially feasible and acceptable.

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