

How Persuasive are Serious Games, Social Media and mHealth Technologies for Vulnerable Young Adults?

Design Factors for Health Behavior and Lifestyle Change Support: Sexual Health Case.

Olga Kulyk¹, Chantal den Daas², Silke David², Lisette van Gemert-Pijnen¹

¹Psychology, Health & Technology, University of Twente, Enschede, The Netherlands
{o.a.kulyk, j.vangemert-pijnen}@utwente.nl

²Centre for Infectious Disease Control, National Institute for Public Health and the Environment, Bilthoven, The Netherlands
{chantal.den.daas, silke.david}@rivm.nl

Abstract. Modern eHealth technologies, such as serious games, social media and mobile applications addressing health behavior support are evolving rapidly. High-risk young adults with low educational background and of foreign origin could especially benefit from personalized health technologies, designed for their special needs. Sexual health is a delicate subject and well-designed and tailored health technologies are needed to meet the needs of the target group and enhance uptake. The aim of this exploratory user study is to identify the persuasive features and design factors that contribute to the use and uptake of existing and new health technologies. Four focus groups were conducted with 37 young adults to gain insights into their needs and attitudes, with sexual health case used in the study. Qualitative data analysis was performed based on Persuasive Design model to identify stimulating, blocking and neutral persuasive features, specific for high-risk young adults, as well as generic design factors. Five generic design factors are formulated based on our findings: (1) *anonymity*, (2) *interactivity*, (3) *portability* (4) *source* and (5) *comprehensibility*. These findings aim at informing the design of health technologies for lifestyle and sexual health behavior change support of high-risk young adults, and could be applicable for young adults in general and other health topics.

Keywords: young adults, eHealth, Persuasive Systems Design model, social media, mHealth, serious gaming, focus groups

1 Introduction

Young adults, especially young adults who are poorly educated, are at higher risk for leading an unhealthy lifestyle on different aspects that have an effect on health behavior, including nutrition, physical activity and sexual health. Among other health topics, there is growing importance of addressing the sexual and reproductive health needs of adolescents (10-19 years) and young people (10-24 years) [1]. The World Health Organisation [2] defines *sexual health* as: 'a state of physical, emotional, men-

tal and social well-being related to sexuality; not merely the absence of disease, dysfunction or infirmity. Sexual health requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence.' Based on surveillance data of sexually transmitted infections (STI) and HIV collected by STI-clinics run by municipal health services, young adults of foreign origin are at increased risk regarding undesired sexual health outcomes [3-5]. The pattern of increased vulnerability for undesired sexual health outcomes is also present among the largest four immigrant groups in the Netherlands who originate from the following countries: Turkey, Surinam, Morocco and The Netherlands Antilles [6].

In the context of sexual health, 'classic' face-to-face consultations are poorly known among vulnerable young adults [7]. Public health surveillance data also show the underrepresentation of (male) young adults of foreign origin [5] at the free sexuality consultations at the municipal health services. They could especially benefit from personalized health technologies, designed for their special needs. Existing online interventions mainly reach highly educated native women, even if they are not the initially intended target group [8-9]. One of the reasons for the limited reach could be the lack of participation of the target group in the development of the health applications. It is well known in (public) health research that the amount of influence people have on their own well-being contributes to actual health and well-being [10]. Participation, therefore, is a powerful means to increase the impact and uptake of health technology.

Efforts within public health and epidemiology research directed towards reaching young adults of foreign origin in the context of sexual health are limited to informative websites and community-based approaches [11-12]. Current public health activities include for instance the provision or distribution of condoms, free anonymous counseling sessions, or specific campaigns (e.g., aimed at raising awareness of the available public health services). Such interventions focus mainly on STI and HIV prevention, lack of evidence on their effectiveness and often do not match the specific needs of low-educated young adults or young adults of foreign origin [13-15].

With the emerging new technologies, such as serious games, social media and mHealth, new opportunities arise for persuasive and personalized health to support behavior change [16-18]. *Behavior Change Support System (BCSS)* can be defined as: "a socio-technical information system with psychological and behavioral outcomes designed to form, alter or reinforce attitudes, behaviors or an act of complying using coercion or deception" [19]. Persuasion is being used to improve adherence and thus the effects of eHealth [20]. Persuasive System Design (PSD) model [21] offers various persuasive techniques that are widely used in design and evaluation of persuasive health technology [22-23]. Among the four categories of persuasive design features, recent research shows that *dialog support* features play a significant role in relation to adherence to web-based health interventions [22]. Persuasive features, from social support category are important in BCSS [24]. Specific user groups such as high-risk young adults have special personal needs and preferences when it comes to design. Therefore, it is essential to identify specific persuasive features and design factors that influence their attitudes and/or behavior, when it comes to the use and uptake of

health technology for behavior change support. For instance, *social support* features seem to play a more important role for young adults than for other age groups, since young adults tend to be influenced by their peers [25]. Despite the fact that social media are often treated as the golden standard for young adults, its suitability for high-risk young adults for health support remains unclear [26-27].

Previous research on the design of persuasive health technologies involving high-risk young adults is lacking. Young adults of foreign origin are a hard to reach target group. There is also little known about their needs for the design of health applications [7, 26]. Interestingly, young adults between 12 and 21 are the most critical users of online technologies, who are impatient with slow unreliable applications [17, 28].

In this study, we investigate how technologies for health behavior support of vulnerable young adults should be designed to meet their needs. This paper presents the results of the exploratory focus groups study on the specific user requirements and conditions for the design and implementation of health technologies for behavior change support of young adults. The primary focus in this study is on social media [29], serious games [30], and mobile applications [31] that are commonly used by young adults [26, 32], with sexual health as a health topic. The ultimate goal of this study is to gain insights into the special needs of this user group, persuasive features and design factors influencing the use and uptake of applications for sexuality, well-being and health behavior support of young adults.

2 Methods

2.1 Participants and procedure

In total, four focus groups were conducted with 37 young adults (51, % male and 48,6% female) with low socio-economical status and from various ethnical backgrounds with average age between 12 and 24 years ($M=17.4$, $SD=3.1$). The birth country of the mother or father determined their ethnic background, where the country of the mother was leading when both parents are from foreign decent. Participants' ethnicity was related to a variety of geographical regions: Turkey, Surinam, Morocco, The Netherlands Antilles, Iraq, and Afghanistan. Sixty percent of the participants were from the first four regions, which represent the four biggest immigrant groups in the Netherlands. Participants were recruited via the municipal health services and the social workers at the local youth centers in three different cities and regions across the Netherlands. All participants signed a consent form prior to the study. Additional consent from parents was collected for participants younger than 16 years. Participants received a cinema gift voucher of €15, goodies (ballpoints and condoms), and refreshments as an incentive. Groups were composed of all male or all female participants to ensure comfort discussing sexually related topics.

2.2 Study setting

The focus groups were held at the local youth community centers as a follow-up of the educational weekly activities organized by the social workers, and lasted between 70 to 75 minutes. Trained moderator and an assistant led the focus groups. The moderators used a discussion guide, during the focus groups important points from the guide were also presented to participants in a PowerPoint presentation. The assistant took notes and answered questions during the subgroups activities. The final version of the guide was developed based on a pilot test group and was used for all four focus groups. Questions were posed in an open-ended manner followed by more specific prompts.

The focus groups discussions were divided into five components. First, moderator gave a short introduction, explaining the purpose of the focus group and the role of the participants. To promote confidentiality, participants were given a choice to use either a first name or an imaginary nickname for the name boards to address each other during the discussion. Participants were asked to fill in a questionnaire on demographics such as age, gender, level of education, ethnical origin of parents and how open the young adults feel about discussing health topics such as sexual health. In the second component, the participants were split in two subgroups (4 - 6 participants per group) to explore two different application types: serious online game 'Can You Fix It?' and mobile application 'Dance4Life' providing information on sexuality and sexual health (see Fig. 1 and Fig. 2). After a free exploration, each subgroup was asked to discuss the usefulness and suitability of the application for them, positive and negative experiences and suggestions for improvement. In the third component, a plenary discussion on opinions and experiences of young adults followed in subgroups.

Next, in the fourth component, the moderator showed and discussed an example of a social media application: a Facebook (FB) page of the regional municipal health services and a YouTube movie on how STI test is done. In the fifth part, examples of possible new applications for health behavior support were discussed. These concerned two concepts: a serious game via Facebook and a Virtual Coach [17] providing anonymous free health consultation. Participants were asked to give their opinion on these alternative concepts and to express their own ideas on technologies for health behavior and lifestyle change support.

2.3 Analysis

Focus group sessions were audio recorded with a digital voice recorder with participants' permission. During the data analysis, audio files were transcribed verbatim, analyzed, coded and categorized. An analysis of the influence of various persuasive features on the response of young adults towards various types of health technology was done (Braun 2006). Persuasive features were coded according to the Persuasive System Design model [21]. In order to validate the coding and avoid bias, a second investigator coded a transcription of a randomly selected focus group session. Discrepancies between coders were discussed and resolved between the investigators.

Overall, the coding was similar with minor differences. Coding scheme was then adjusted accordingly to facilitate cross-case analysis. Prior to the focus groups, experts analyzed all examples of applications to be presented to the participants, in order to identify the present persuasive features and the missing ones, expected to be missing by the users.



Fig. 1. 'Can You Fix It' Sense Love game.



Fig. 2. Screenshot of the Dance4Life app (AppStore, 2014)

3 Results

Persuasive features derived from the focus groups were first categorized into: (a) stimulating, (b) blocking and (c) neutral features, based on the coding scheme used for the data analysis. The identified features are described below with relevant quotes from the focus groups' participants, followed by the generic guidelines to inform the design of public health technologies for behavior change support of young adults.

3.1 Persuasive features

Stimulating features. Stimulating features are perceived as having positive influence on motivating the user, perceived usefulness and/or adherence. Table 1 illustrates the identified stimulating persuasive features, PSD category and quotes, namely: *trustworthiness, expertise, real-world feel, verifiability, liking, simulation* and *tunneling*.

Table 1. Stimulating persuasive features

Persuasive feature	PSD category	Quote
Trustworthiness	System credibility	"The information has to be reliable." (Coach)

Expertise	System credibility	"I want it to be made by someone who has the experience." (FB page)
Real-world feel	System credibility	"If you know that it is from Public Health Services (GGD), than yes. Then people would be more inclined to use it." (FB page)
Verifiability	System credibility	"I want to know who the designer is." (General)
Liking	Dialogue support	"The (virtual) character has to look attractive, then I would like it." (Coach)
Simulation	Primary task support	"I liked that you can choose what you can and cannot do, what should happen and what is wrong" (Game)
Tunneling	Primary task support	"I liked that I could directly see where to navigate and how to search. You get everything just in place" (Mobile app)

Blocking features. Blocking features are perceived as having negative influence on motivating the user. Table 2 illustrates the identified blocking persuasive features with quotes.

Table 2. *Blocking* persuasive features

Persuasive feature	PSD category	Quote
Recognition	Social support	"I really don't want anyone to know that I have been using this app." (Personal coach on FB)

Neutral features. Neutral features are the ones perceived as having no effect on motivating the user, perceived usefulness and/or adherence. Table 1 illustrates the identified neutral persuasive features with quotes.

Table 3. *Neutral* persuasive features

Persuasive feature	PSD category	Quote
Social learning	Social support	"People who don't go outside often can play this and learn how it is in the outside world." (Game)
Rewards	Dialogue support	"The fact that I could win condoms would not influence me" (FB page)

3.2 General design factors

Five general design factors were formulated based on the analysis of the focus group data and the identified persuasive features presented above, namely: (1) *anonymity*, which has implications for the use of social networks, (2) *interactivity*, as it facilitates engagement and ensures better uptake of interventions; (3) *portability* of the technologies, as it ensures privacy and effortless use; (4) *source* of the information within the application has to be visible and reliable to be perceived as trustworthy and (5) *comprehensibility*, meaning more visually aided and easily worded information.

These generic factors aim at informing the design of health technologies for lifestyle and sexual health behavior support of young adults. Incorporating these factors and persuasive features into the design of health technologies for young adults for behavior change support should increase their usefulness and uptake by the target group. Each factor is described below with relevant quotes from the participants.

Anonymity. The participants all agreed that anonymity is a crucial factor for health support: *'If you look it up on a computer your parents can see it on your screen.'* (Mobile app); *'I would go to a friend to use the Internet. Otherwise your mom can come inside or something...'* (Serious game).

Besides the perceived risk of 'being caught in the act', online and mobile applications sometimes also register visit, a feature that was not appreciated by young adults of foreign origin. They are not inclined to look for information on sexual health via social networks such as Facebook or Twitter, as their friends and family can see their activity right away: *'I think it is inappropriate that my family can see that I visit this page.'* (FB page); *'If you 'like' something, friends know right away what you are doing!'* (FB page). Thus, this factor has important implications for the use of social networks for sexual health promotion.

Interactivity. Participants often mentioned interactivity as a missing feature or a feature that is not fully available. For instance, after playing with a serious game during the focus group discussion participants stated that they would have liked to intervene more often during the game than it was actually possible. This is illustrated in the following reaction expressing frustration: *"I find it strange that I couldn't click that often, because I wanted to 'Fix' more often but that was not possible!"* (Serious game).

It is not just the presence of interactivity that is important, but the level of the interactivity seems to be crucial in order to facilitate better engagement. For instance, in the serious game interactivity was incorporated, but could have been expanded further. The mobile application, on the other hand, only allowed navigating through various menu items at all times and yet participants missed an interactivity feature allowing to contact a sexual health care professional: *'I also want to be able to ask questions myself, and get an answers.'* (Mobile app).

Interactivity seems to have a positive effect on the perceived usefulness of the health technology which could especially contribute to a richer and better user experience.

Portability. Portability of the platform on which the health technology is realized plays a crucial role for young adults. Participants had a clear preference for a mobile-based type of platform, as opposed to the web-based platform as it insures privacy and effortless use for this specific target group: *'You always have your mobile phone with you. It is faster.'* Another participant mentioned: *'If you just search for these things (information on sexual health) on the internet, ... you get everything (on your desktop), with a mobile app it's easier.'*

Young adults would rather use the search functions directly on their mobile phone, without a link with social networks: *'If you really need this (search function) you just download it (on your mobile phone) and you know that it is not visible anywhere else.'* (FB page). Participants also preferred to be able to use certain location features of the mobile application offline: *'I want to look up things online but also offline, without WIFI for instance, like these things nearby (location of the free consultation).'* (Mobile app). In the last quote, the participant refers to a location tracking

service on a mobile application that allows a user to find an office of a nearest free sexual health consultation by typing a zip code.

Source. The participants mentioned that the source of the information, independent of the type of platform, is also important for them to be able to evaluate the quality of the information. The source of information has to be explicitly stated, clearly visible and trustworthy: *'It looks attractive, but you want to know what (source) is behind it.'* (Serious game); *'I want it to be made by someone who has experience with it...'* (Personal coach); *'There should not be a name (of the public health care provider), but a logo or something.'* (FB page).

Participants indicated that they would trust the provided health information more when it is clearly stated that the familiar public health organization, such as Municipal Health Services is behind it: *'...If you know it's (information on a page) is from the Municipal Health Services, then yes. Then the people will be willing to use it...'* (Facebook). And another participant said: *'The Municipal Health Services are famous (familiar), that is good.'* (Facebook).

Comprehensibility. Comprehensibility of the health technologies is another important factor, which was divided by two sub-themes specific for young adults with foreign origin: visually aided information and availability of applications in different languages. Overall, the participants appreciated the visual aesthetic of the applications: *'Mostly you would play (use) it more if it looks attractive.'* (General). Several participants described the importance of visually aided information: *'There are so many pictures here, I like that.'* (FB page). Other participants mentioned that not only the design with images was important, but also the colors of those images: *'I would play it if there is a nice image, with different colors'* (Serious game).

Another sub-theme that emerged was the language used in the applications. One of key characteristic of young adults of foreign origin is that they often speak different languages with their families at home. The availability of the applications for lifestyle and health behavior support in other languages (than Dutch) would benefit their use: *'I also want to have an English version of the app.'* (Mobile app). To conclude, persuasive health technology for lifestyle support and health behavior change have to be more visually aided and easily worded, if possible in different languages and the vocabulary of the low-educated young adults as a specific target group.

Next, we discuss the findings and implications for the design and implementation of persuasive health technologies and online interventions for behavior change support.

4 Discussion

This study employed focus groups to get insights into persuasive features and design factors that influence the use and adoption of various forms of modern health technologies for lifestyle and behavior change support among vulnerable young adults, such as low-educated young adults and young adults of foreign origin. Even though this study primarily focused on the sexual health behavior, identified persuasive fea-

tures and design factors might also be applicable for other lifestyle and health topics like physical activity support [17] and interventions targeted towards broader user groups, including young adults in general.

Sexual health is a delicate and sensitive subject independent from ethnic background, however we believe that having a certain ethnical background can increase the sensitivity of this information, for instance due to stigma. This point is also confirmed by the other recent studies, suggesting that stigma around sexual health could affect the use of social media among young adults [11, 26]. In this study, we have not compared young adults of foreign origin with native young adults. However, we believe cultural beliefs, norms and customs, together with the well-known aspects from the STI and HIV prevention, can stress the importance of the persuasive features and design factors that emerged from the focus groups.

Our findings show that even though persuasive health technologies offer unique opportunities for young adults of foreign origin, designers have to take into account the specific needs of this group. Our results indicate that *anonymity* is an important factor, which has major implications for the use of online technology for enhancement of sexual health. This is especially an issue for the social networking websites, such as Facebook, as these media are meant to share information with peers. Despite the expectations from other research on the important role of *social support* features for young adults [25], Facebook and other social networks might be less suitable for deploying applications for sexual health support among vulnerable young adults. However, they are useful as a link to promote other reliable online platforms and BCSS aimed at improving sexual health. In other words, young adults of foreign origin should not be expected to join a group about sexual health or 'like' a Facebook page of the municipal health services on this topic. Several recent studies focusing on social networks use for sexual health promotion confirm this finding [26, 33]. The banner advertisements, which often can be found on the periphery of Facebook pages, could be useful to provide links to other applications for sexual health though.

Additionally, the participants in our focus groups highly appreciated *interactivity*. The presence of interactivity was experienced is less important. The level of the interactivity, on the other hand, seems to be a crucial factor in order to facilitate better engagement. Higher interactivity can be also associated with more challenging and engaging user experience. Rich engaging interaction imbedded in the interfaces of social media applications, mobile apps and serious games may contribute to a better uptake of the intervention, as identified in another study with young adults [26].

Portability was another important factor, as it insures both privacy and effortless use wherever participants are [26]. Persuasive eHealth technology can easily accommodate these needs [17-18]. Our groups of young adults of foreign origin prefer a portable media as platforms. This conclusion coincides with findings of related studies [26, 31]. Young adults search information mostly via (smart-)phones, and prefer also online help with questions on sexuality [26]. Portability, also called mobilization of social media in recent studies [26, 34], stresses the need for accessibility of online health services from anywhere and mobile applications are able to facilitate that need.

Furthermore, independent of what kind of technology is offered, the *source* of information has to be visible and to be perceived as trustworthy. Trust to the provided

source of information can be identified by the recognition and familiarity with the logo of the health organization. Recent research also identifies trustworthiness of the information as a crucial factor for the successful application of the modern technology in sexual health care for young adults [26, 35].

The design factors we mention above could apply to adults of foreign origin, as well as young adults in general. The fifth factor, which is especially connected to young adults of foreign origin, is the *comprehensibility* of the information offered by persuasive health technologies. Specifically, health technologies for behavior change support have to be more visually aided and easily worded, possibly in different languages and the vocabulary of the low-educated target group. Although this seems an obvious conclusion, many public health interventions have not been properly evaluated in cooperation with the specific target groups, such as adults of foreign origin before and after going 'live'. Furthermore, it is essential to involve the target user group in the design of persuasive health technologies for behavior change support.

Additionally, one of the participants said that it would be good if the health applications were designed separately for men and women, or at least tailored towards the specific needs of both genders. Additionally, it seemed that men and women found different design esthetically attractive. Gender specificity did not emerge as a factor, but does give some insights into the reason why existing health interventions might mostly reach women [8-9]. Possibly the design of the currently available interventions is tailored more towards women and more attention should go into the needs of men, specifically young men of foreign origin.

In our study, we focused on identifying the persuasive features and design factors for health behavior change support through persuasive technologies, to meet the specific needs of vulnerable young adults. There is, however, another factor that can be attributed to the success of applications for sexual health support, namely the reach of these applications. The design maybe perfectly tailored towards young adults, but if they do not find and use these applications the effort to improve them is moot. The current practice is to create more demand by more supply. Moreover, there are many online interventions available to promote sexual health in the hopes of reaching their target groups. It remains a challenge to guide the users towards the 'reliable' applications. Trustworthiness of the source and one central platform that combines several high quality health interventions are needed [7, 26].

Our research on sexual health does not include sexual health in all its facets. We have focused on sexual health as in the absence of infections and information about infections. However, sexual health also entails sexual pleasure and the ability to enjoy your sex life [36]. The other side of the coin, sexual pleasure is something that is becoming more and more stressed in sexuality research. This aspect of sexual health might also be an important factor to investigate when designing health applications for young adults. Online technologies, have already taken steps to improve sexual health focusing on sexual pleasure [36]. These technologies could be applied in the future research towards enhancing positive sexual experiences of young adults of foreign origin.

Focus groups are an ideal method to investigate a delicate and sensitive subject as sexual health. On the one hand, focus groups are usually kept small, to facilitate par-

ticipation and profound discussions. On the other hand, keeping the focus groups small also induces some limitations. They can only yield qualitative data. Not all adults of foreign origin that can be found in the Netherlands were part of the current focus groups. However, the four largest immigrant groups were well represented in our study. Furthermore, the various ethnic backgrounds were mixed in the focus groups, possibly making it difficult to express some culturally specific opinions.

The second limitation of our study is that foreign origin and low education are confounded in our study. The young adults who participated also had low educational background. Therefore, it is possible that the factors that emerged were contributable to level of education instead of ethnic background. This is a potential bias, but also a strength, as it gives more insight into the special needs of the vulnerable target group who could potentially benefit from persuasive technologies for sexual health behavior support most. Finally, one focus group had a different moderator but was assisted by the same assistant for taking notes. Both moderators used the same instructions and discussion guide and the audio recordings of all focus groups were transcribed and analyzed by the same investigator using the same coding scheme, as well as cross-checked by the second investigator to avoid bias.

The current results can contribute to future developments of persuasive health technologies, specifically aimed at enhancing healthy lifestyles and health behavior of high-risk young adults. We suggest, for instance, a mobile application as a type of platform, that would optimally assist anonymity and would be accessible from anywhere [31, 37]. Personalized mobile application could provide a low-threshold service to enable contact a health care specialist after the face-to-face consultation. Such service, in combination with playful engaging tasks to raise awareness on own sexual health behavior, could prevent high-risk young adults to fall into the same risky sexual behavior pattern, and ultimately facilitate better continuity and self-management in public sexual health. Of course there are could be other suitable options, such as imbedding the serious gaming elements into a mobile application to raise awareness on the lifestyle and health behavior [30].

5 Conclusion

In conclusion, several stimulating, blocking and neutral persuasive features specific for high-risk young adults were identified in this exploratory study, as well as five generic design factors. Namely, health technologies for young adults should be anonymous, interactive, portable, from a reliable source, and easily comprehensible for the user. These findings aim at informing the design of health technologies for lifestyle and sexual health behavior change support of high-risk young adults, and could be applicable for young adults in general. Incorporating these factors and persuasive features into the design of health technologies for behavior change support, for sexual health and also over health topics, suggest to increase their usefulness and uptake by the target group. As part of the future work, we are currently designing the new personalized health application for self-management support of high-risk young adults, incorporating the identified persuasive features and design factors and involv-

ing the potential users and sexual healthcare professionals in the holistic iterative design approach.

Involvement of the target group throughout the whole development process is crucial, as well as iterative evaluation of the design with them to increase uptake and ensure successful implementation and ultimately better sexual health. Moreover, future research should also focus on the specific evaluation methods to measure the effects of persuasive technologies on the health behavior and lifestyle of young adults. This important topic is highlighted in detail in other studies [22], focusing on the validation of the Perceived Persuasiveness Questionnaire (PPQ) [38-39] and the relation to the PSD model [40]. Further research is required to validate these findings, preferably combining qualitative and quantitative approach. For instance, it would be interesting to compare these results with the additional user evaluation using the existing persuasiveness measures like PPQ.

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