Acceptability of and Demand for a Tobacco-Related Health Game Application in Early Adolescents with Different Gender, Age and Gaming Habits

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Abstract: The purpose of this pilot evaluation was to study the acceptability of and demand for a tobacco-related mobile health game in early adolescents with different gender, age and gaming habits. The early adolescents (n=61) participated first to a guided play session with the health game called *Fume*, and then, had possibility to use it based on their own interest for two weeks via own mobile devices. They evaluated the game after the usage period. Their actual use of the application was tracked. The data were analyzed using statistical tests. The results revealed that the early adolescents enjoyed the game and used it for many times. No statistically significant differences were found in the acceptability of or demand for the game across different gender, age and gaming habits with the current sample. As a conclusion, it seems that early adolescents with different backgrounds can be reached with a health game.

Keywords: Health game, Tobacco, Adolescents, Acceptability, Demand

1. Introduction

Hazards of tobacco products, such as conventional (Jha, Ramasundarahettige, Landsman, Rostron, Thun, Anderson et al., 2013) and electronic cigarettes (Pepper & Eissenberg, 2014), and snus (Lee, 2013), is one of the health topics needed to address regularly during health visits in school health care (MSAH & Stakes, 2002) and at school in general (FNAE, 2014). Tobacco use remains the most common cause of preventable death and it can compromise both tobacco user's own health and those exposed to secondhand smoke (Eriksen, Mackay, Schluger, Gomeshtapeh & Drope, 2015).

First tobacco initiations usually take place in early adolescence. In 11-year-olds weekly smoking is still rare, but of 15-year-olds 12% smoke at least once a week (Inchley, Currie, Young, Samdal, Torsheim, Augustson et al., 2016). New tobacco-preventive methods that are equally effective for both girls and boys are needed (Thomas, McLellan & Perera, 2013). Health games represent one kind of gamified approach to health promotion that can be used in young target groups (Parisod, Pakarinen, Kauhanen, Aromaa, Leppänen, Liukkonen, et al., 2014). Interest towards health games has increased during the last decade (Kharrazi, Lu, Gharghabi & Coleman, 2012).

Adolescents are interested in games and play actively for entertainment (Mäyrä Karvinen, & Ermi, 2016). The most popular game genres among adolescents are puzzle games (57.0%), adventure games (50.6%) and sports games (41.6%), and they play the games most commonly with mobile devices. Of them, 12.4% also play educational games at least once a month. (Mäyrä et al., 2016.) Thus, adolescents may find mobile health games as an interesting option, but little is known how different gender, aged and adolescents with different gaming habits react to these kind of games designed for health promotion purposes.

The purpose of this pilot evaluation was to study the acceptability of and the demand for a tobacco-related mobile health game application in 10- to 13-year-old early adolescents with different backgrounds. The research questions were:

1) Are there differences across early adolescents with different gender, age and gaming habits in their opinion of a tobacco-related health game application?
2) Are there differences across early adolescents with different gender, age and gaming habits in their actual use of a tobacco-related health game application?

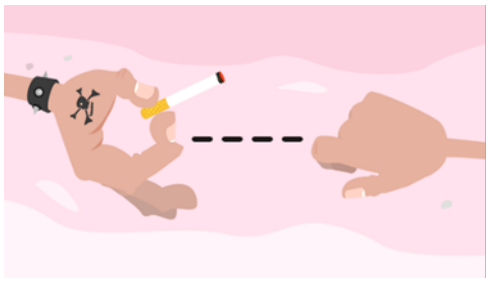
2. Methods

2.1 Study Design

This evaluation is part of a larger feasibility study that used a three-armed cluster randomized controlled trial design (ClinicalTrials.gov Identifier: NCT02717910) and evaluated acceptability, demand and short-term effectiveness of a health game application called *Fume*. The study was conducted in spring 2016. First, three large municipalities (Population Registration Center, 2015) with high (11.4% or higher) adolescent tobacco prevalence (Sotkanet.fi, 2013) from Southwest Finland were randomly chosen to the study, and then, randomly allocated either to health game intervention group, web page intervention group or control group. Two schools from each municipality were asked to participate in the study. The purpose was to recruit the school from the city center and one of the medium sized or large suburb schools. However, only in one of the municipalities (the control group) the school located in the city center was willing to participate. For this reason, in the other municipalities (the health game and web page intervention groups), the two participating schools were recruited among the suburb schools. Contacting the suburb schools was made based on a list including the schools in a random order. In each school, pupils from 4th, 5th and 6th grades (10 to 13 years of age) were invited to participate in the study. At a later phase, one additional suburb school was recruited using the same protocol to the study for both the health game and web page intervention groups due to difficulties in recruitment.

2.2 The Health Game Intervention

The health game used in the study, *Fume*, is a mobile game application that aims at supporting tobacco-related health literacy (i.e. motivation and ability to access, understand and use tobacco-related information) and a tobacco-free life in early adolescence (Fig. 1 and 2). The game application was developed together with adolescents, multidisciplinary research group from the University of Turku and game company *NordicEdu*. The version of the game application used in the study (version 1.1.0) contains five minigames concentrating on tobacco-related topics. Playing the game through takes from few minutes up to tens of minutes depending on the player's performance. The game application also contains fact sheets providing some textual information connected to the tobacco-related topics included in the minigames. The game application was made freely available from mobile stores (*Google Play*, *iStore* and *Windows App Store*) after the data collection.



Figures 1 and 2. Screenshots of *Fume.*

The health game intervention consisted of parts conducted during school day and at free time. First, all early adolescents in the health game intervention group participated to a 20-minute guided play session with *Fume* during school day. *Fume* was downloaded to the early adolescents' own Android mobile devices (smart phones or tablets) at school. Those early adolescents using either iOS or Windows devices got an invitation link and instructions for downloading the game at home. Then, the early adolescents had two weeks' time of free usage of *Fume* via their own devices during free time and they were instructed to use the game based on own interest.

2.3 Data Collection and Outcome Measures

The data reported in this paper were collected from those early adolescents allocated to the health game intervention group. The acceptability of *Fume* was evaluated with a questionnaire and early adolescents' answer to a 4-point Likert scale question about their opinion of *Fume* (How did you find the game?) after the two weeks' usage period.

The demand was evaluated with their actual use of *Fume*. The usage was tracked during the two weeks' period with a random individual code generated to each downloaded game application, log files and *GameAnalytics* tool. The following data were collected: number of separate visit days in the health game application, number of game application openings, number of game starts, total duration (min) of game play, and number of times the fact sheets included in the application were opened.

Ethical pre-statement for the study plan was applied for and received from the Ethics Committee of the University of Turku before conducting the study. Permissions to carry out the data collections at schools were received from the municipalities and the principals of the participating schools. The participation was voluntary and written informed consent was asked first from the early adolescents themselves. If the early adolescent was willing to participate in the study, written informed consent was required from one of the guardians.

2.4 Statistical Analysis

The statistical program SPSS 23.0 was used to perform the data analysis. Descriptive statistics (number of observations, percentage, range, median) were used to characterize variables. Fisher's exact and non-parametric tests (Mann-Whitney U and Kruskal-Wallis tests) were used to test the differences across early adolescents with different backgrounds (age group, gender and gaming habits). Non-parametric tests and median were used as normal distribution assumptions were not met based on Shapiro-Wilk test. All statistical tests were performed with the level of significance of 0.05 two-tailed.

3. Results

In total, 151 early adolescents participated in the study and 61 of them were allocated to the health game intervention group, 47 to the web page intervention group and 43 to the control group.

This paper and evaluation focuses on those early adolescents in the health game intervention group (n=61). Of these early adolescents, 52.5% (n=32) were girls, and 65.6% (n=40) were daily, 23.0% (n=14) weekly and 11.5% (n=7) occasional players. The age median was 11 years.

Of the 61 early adolescents, 59 answered to the question concerning their opinion of *Fume*. Majority of them (78%, n=46/59) evaluated *Fume* either quite or very nice. None of the early adolescents considered the game as very boring. No statistically significant differences were found in opinion of *Fume* across different gender (P=0.74), age (P=0.066) and gaming habits (P=0.64) (Table 1).

Table 1. Opinion of *Fume.*

		How did you find the game?				
		1=very boring *n (%)*	**2=quite boring** *n (%)*	**3=quite nice** *n (%)*	**4=very nice** *n (%)*	**P**
All early adolescents	Data available n=59 n/a n=2	0 (0.0%)	13 (22.0%)	31 (52.5%)	15 (25.4%)	
Early adolescents by gender	**Girls** (n=31)	0 (0.0%)	8 (25.8%)	16 (51.6%)	7 (22.6%)	0.74
	Boys (n=28)	0 (0.0%)	5 (17.9%)	15 (53.6%)	8 (28.6%)	
Early adolescents by age	**10-year-olds** (n=20)	0 (0.0%)	4 (20.0%)	9 (45.0%)	7 (35.0 %)	0.066
	11-year-olds (n=12)	0 (0.0%)	4 (33.3%)	3 (25.0%)	5 (41.7%)	
	12-year-olds (n=19)	0 (0.0%)	3 (15.8%)	15 (78.9%)	1 (5.3%)	
	13-year-olds (n=8)	0 (0.0%)	2 (25.0%)	4 (50.0%)	2 (25.0%)	
Early adolescents by gaming habits	**Daily players** (n=38)	0 (0.0%)	8 (21.1%)	21 (55.3%)	9 (23.7 %)	0.64
	Weekly players (n=14)	0 (0.0%)	2 (14.3%)	7 (50.0%)	5 (35.7%)	
	Occasional players (n=7)	0 (0.0%)	3 (42.9%)	3 (42.9%)	1 (14.3%)	

Data concerning the actual use of *Fume* was available for 40 of the 61 early adolescents. On average (all values presented as medians), these early adolescents visited the health game application on 3 separate days and 4 times during the two weeks' usage period. The game was played 9 times and the play sessions took in total 19 minutes on average. The different fact sheets included in the application containing textual information about tobacco-related topics were opened 9 times on average. No statistically significant differences were found in the actual use of *Fume* across different gender, age and gaming habits (Table 2).

Table 2. Actual use of *Fume.*

		Tracked *Fume* usage									
		Number of separate visit days		Number of game application openings		Number of game starts		Total duration (min) of game play		Number of times the fact sheets were opened	
		median (range)	*P*	*median (range)*	*P*	*median (range)*	*P*	*median (range)*	*P*	*median (range)*	*P*
All early adolescents	Data available n=40, n/a n=21	3 (1–10)		4 (2–50)		9 (2–61)		19 (0–219)		9 (0–23)	
Early adolescents by gender	**Girls** (n=19)	3 (1–10)	0.45	5 (2–50)	0.47	9 (2–61)	0.29	18 (0–219)	0.92	9 (0–23)	0.98
	Boys (n=21)	3 (1–7)		4 (2–18)		6 (2–18)		19 (6–77)		9 (0–19)	
Early adolescents by age	**10-year-olds** (n=15)	3 (1–6)	0.51	4 (2–13)	0.76	6 (2–18)	0.70	16 (0–54)	0.36	7 (0–23)	0.24
	11-year-olds (n=7)	2 (1–8)		5 (2–50)		9 (5–61)		26 (14–168)		9 (4–22)	
	12-year-olds (n=12)	3 (2–10)		5 (3–18)		9 (2–12)		20 (6–219)		13 (0–21)	
	13-year-olds (n=6)	3 (1–7)		5 (2–18)		9 (4–18)		24 (13–77)		12 (8–19)	
Early adolescents by gaming habits	**Daily players** (n=31)	3 (1–8)	0.17	4 (2–50)	0.26	8 (2–61)	0.38	18 (1–168)	0.73	8 (0–23)	0.086
	Weekly players (n=6)	2 (2–7)		4 (2–18)		8 (2–18)		22 (0–77)		13 (0–19)	
	Occasional players (n=3)	5 (3–10)		8 (5–18)		11 (9–12)		31 (11–219)		16 (14–21)	

4. Discussion

Adolescents play games actively for entertainment (Mäyrä et al., 2016). Even though 13.3% of girls and 11.5% of boys play educational games along with entertaining ones at least once a month, these kinds of applied games are not among their most popular game genres (Mäyrä et al., 2016). Hence, health games and other applied games need to compete for adolescents' attention. Another possible challenge from the perspective of implementation of applied games is that experienced players may have great expectations for new games introduced to them. However, results of this pilot evaluation revealed that the early adolescents enjoyed the tobacco-related health game *Fume* and used it in their free time. Many of the participants played the game voluntarily for several times. Our results with the current sample also indicated that the opinion and actual use of *Fume* did not differ across early adolescents with different gaming habits. No significant differences were either found across different gender or age early adolescents. However, due to small effect sizes and small number of participants the results need to be interpreted with caution and further evaluation is needed to make more reliable conclusions.

School health care has a crucial role in health promotion of youngsters. At the same time, it balances with limited resources (Knauer, Baker, Hebbeler & Davis-Alldritt, 2015) and has several other obligations (MSAH & Stakes, 2002). Based on the activity of the participants of our study, tobacco-related health game could offer a supportive method to traditional health education provided during school day. Further analysis will be conducted to evaluate the effectiveness of *Fume*. Plans for further development of the game will be made based on the results.

There were some challenges in this study with tracking the actual use of *Fume*. For this reason, there were usage data missing from 21 of the early adolescents. These aspects need to be considered when conducting further research or implementing *Fume* or other similar mobile applications. The downloading of the application required Internet access. The guardians of some of the early adolescents had restricted the use of the Internet in their child's mobile device. For this reason, downloading at school was not possible with some of the early adolescents and they were given instructions for downloading the application at home. Also, the owners of iOS and Windows devices had to download the game afterwards at home using a private invitation link. The early adolescents and their guardians were instructed to contact the researcher if they did not receive the link or could not download the game application successfully, but still not all of them contacted. There were also some technical difficulties with the application partly due to old models of some early adolescents' mobile devices. Due to the downloading and other technical challenges, some of the early adolescents (n=9) did not have access to the application apart from the guided play session at school. For an unknown reason, there were also some data missing from the *GameAnalytics* tool even the game was downloaded to these early adolescent's mobile device. This concerned 11 of the early adolescents. In addition, one of the early adolescents did not send to the researchers the tracking code from the downloaded game application.

5. Conclusion

No statistically significant differences were found with the current sample in the acceptability of or demand for the tobacco-related health game application in early adolescents with different gender, age and gaming habits. It seems that early adolescents can be reached similarly with a tobacco-related health game for health promotion purposes regardless of gender, age or previous gaming habits, but further evaluation is needed to make more reliable conclusions.

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