WHO USES QUIDDY AND WHY? A CROSS-SECTIONAL MIXED METHODS STUDY OF THE SMOKING CESSATION APP FOR YOUNG ADULTS IN THE NETHERLANDS

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Abstract

The high rates of smoking young adults in the Netherlands led to the creation of the smoking cessation app Quiddy. In the current cross-sectional study, the buddy-system feature of the app was researched using mixed methods, since young adults have indicated that they want to quit with help of a peer. 94 participants were included in the quantitative analysis of the user data (aged 16-25). A logistic regression analysis was conducted to test to which extent the use of the buddy-system is determined by characteristics of the users. Furthermore, 6 previously conducted interviews with app users were analyzed, and an additional 3 interviews were conducted and analyzed to supplement the quantitative analysis. No significant quantitative results were found, suggesting that there was no relation between app user characteristics (age, number of cigarettes, motivation for smoking cessation, gender) and the use of the buddy-system. Qualitative results include overall positivity about the app. However, there were mixed opinions about the buddy-system feature. Resulting in the conclusions that it should be improved by matching buddies based on level of activity and lowering the threshold of adding a buddy. Limitations, implications and suggestions for future research were discussed.

Keywords: smoking cessation, young adults, Quiddy, application, buddy-system

Samenvatting

Het hoge percentage rokende jongvolwassenen in Nederland heeft geleid tot de ontwikkeling van de stoppen-met-roken app Quiddy. In het huidige cross-sectionele onderzoek is de buddy-systeem functie van de app onderzocht met behulp van gemengde methoden, aangezien jongvolwassenen hebben aangeven dat ze willen stoppen met behulp van een leeftijdsgenoot. 94 participanten namen deel aan de kwantitatieve analyse van de gebruikersdata (leeftijd 16-25). Er werd een logistische regressie analyse uitgevoerd om te testen in hoeverre het gebruik van het buddy-systeem wordt bepaald door de kenmerken van de gebruikers. Bovendien werden 6 eerder gehouden interviews met app-gebruikers geanalyseerd en werden 3 extra interviews gehouden en geanalyseerd ter aanvulling op de kwantitatieve analyse. Er werden geen significante kwantitatieve resultaten gevonden, wat suggereert dat er geen verband is tussen de kenmerken van app-gebruikers (leeftijd, aantal sigaretten, stopmotivatie, gender) en het gebruik van het buddy-systeem. Uit het kwalitatieve deel blijkt dat over het algemeen de app als positief beschouwd werd. Er waren echter wisselende meningen over het buddy-systeem. Dit leidt tot de conclusie dat het verbeterd moet worden door buddy's te matchen op basis van activiteit en de drempel voor het toevoegen van een buddy te verlagen. Beperkingen, implicaties en suggesties voor toekomstig onderzoek zijn besproken.

Sleutelwoorden: stoppen-met-roken, jongvolwassenen, Quiddy, applicatie, buddy-systeem

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Introduction

Yearly, tobacco use causes more than eight million deaths worldwide (WHO, 2022), with nineteen thousand of those deaths occurring in the Netherlands (Trimbos, 2022b). In 2021, more than 20% of Dutch adults smoked. Among young adults aged between 16 and 24, the percentage of smokers is the highest, with 27.6% in 2021 (Bommelé & Willemsen, 2022).

In general, 80% of smokers in the Netherlands wants to quit smoking (Trimbos, 2022a), but smoking cessation proves to be very challenging. A longitudinal study suggests that, on average, smokers need thirty quit attempts before they successfully stop smoking for more than a year (Chaiton et al., 2016). However, smoking cessation is important, since it increases life expectancy (Bergh et al., 2017). Furthermore, it is found that if a smoker quits before the age of 35, the life expectancy does not significantly differ from that of a non-smoker (Pourtau et al., 2019; Watkins et al., 2020). This indicates the importance of targeting young adults for smoking prevention and cessation. However, many young adults do not think they are addicted to smoking nor do they notice the health risks yet (Trimbos, 2021). Therefore, they do not seek help, even though more than half of the smoking youth wants to quit (now or in the future) (Trimbos, 2021). Moreover, smoking cessation campaigns do not always reach this age group or motivate young adults enough to quit. As a result, a significant proportion continues to smoke (Trimbos, 2021).

To make smoking cessation more facilitating, eHealth interventions such as apps can be used (Trimbos, 2021). The advantages of using an app include accessibility, as almost every young adult uses a smartphone; it can be used at any time, it is customizable, cost-efficient, and allows young adults to quit without aid from others (Trimbos, 2021).

As of March 2022, a new smoking cessation app called Quiddy has been available to download, and was researched in the current study using a mixed methods approach. Quiddy is designed with the needs and opinions of young adults in mind, and is primarily intended for those between the ages 16 and 25, who are motivated to quit smoking. A notable feature that sets Quiddy apart from other smoking cessation apps is the buddy-system that has a chat function. This allows users to match with a buddy, with whom they can chat. They can support and motivate each other during the smoking cessation process. The matching process is based on age, motivation to quit, and/or pitfalls. Examples of other features in the app include motivational rewards through badges, an emergency button than enables users to send a message to their buddies, call or chat with the Quitline (Stoplijn in Dutch), or distract themselves by playing games or reading articles about smoking cessation.

Theoretical substantiation

   The buddy-system is expected to be especially effective for young adults who want to quit smoking with help of a peer, rather than seeking outside help with healthcare professionals (Trimbos, 2021). This notion is supported by the social support theory, which suggest that emotional support reduces the likelihood of delinquency and crime (Kort-Butler, 2017), and can also be applied to smoking cessation. Social support is considered a crucial element in the smoking cessation process (Burns et al., 2014), as it improves the individual's feelings and emotions, making them better equipped to control undesirable behaviors like smoking (Cohen and Wills, 1985). Additionally, social support buffers the effect of stressful life events (Cohen and Wills, 1985). Since smoking cessation can be seen as stressful for smokers, social support may help with smoking cessation.

   The social influence of peers is found to be one of the main predictors of smoking cessation (Dijk et al., 2007). The benefits of peer-support in smoking cessation include improved socialization, positive role-modeling and showing that abstinence and recovery are achievable (Ford et al., 2013). Furthermore, peers could have a better credibility than health professionals, who do not have the same life experiences as young adults (Ford et al., 2013). Hence, the influence and support of peers hold great significance in the context of smoking cessation of young adults. In addition, since young adults indicated that they want to quit with help of a peer (Trimbos, 2021), it is essential to investigate if they actually use peers when trying to quit smoking.

    Several characteristics of smokers can influence the usage of a smoking cessation app and it functions. The following section will provide more information about motivation for smoking cessation, the number of cigarettes per day, and gender.

Motivation

   Higher levels of intrinsic motivation of smokers have been associated with more readiness to quit smoking and a better abstinence of smoking compared to extrinsic motivation to quit smoking (Curry et al., 1997). Smokers that are more ready to quit, could be more likely to use interventions such as Quiddy. In a Norwegian study, younger men were more likely to quit smoking because they wanted to improve physical fitness, while women were less likely to quit for reasons related to their own health (Grøtvedt & Stavem, 2005). However, women were more likely to quit smoking because of their children. Therefore, it appears that intrinsic motivators play a greater role in men's smoking cessation, whereas

women are more influenced by extrinsic motivators. Based on the results from the study by Curry et al. (1997), the following hypothesis follows:

H1: Intrinsic motivation for smoking cessation is positively related to use of buddy-system.

Number of cigarettes

Apart from motivation, the number of cigarettes per day is another factor that can influence smoking cessation. Smoking cessation is more difficult for people who smoke more than ten cigarettes a day compared to those smoking less, as they are more likely to experience withdrawal symptoms (Gezondheid en wetenschap, n.d.). This could increase the need of support during the smoking cessation process, resulting in the following hypothesis:

H2: The number of smoked cigarettes is positively related to use of the buddy-system.

Gender differences

A review conducted by Reynoso et al. (2005) found gender differences in smoking cessation, with women being less likely to quit smoking and to maintain cigarette abstinence compared to men. Similar findings have been reported in other review studies (LaGrotta, 2021; Smith et al., 2016), raising the question whether smoking cessation tools work differently for men and women. Moreover, men were found to be more likely to be daily smokers compared to women (Chinwong et al., 2018). In a sample of students, women reported having more social support than men, while the opposite was observed in a sample of working adults (Olson & Shultz, 1994). Furthermore, gender has multifariously found to be a moderator in the relationship between social support and various variables (Matud et al., 2003). However, gender has not been tested as a moderator in the relation between smoking cessation and social support. In addition, in a review study it was concluded that there is unclarity of the role of social support for men and women in smoking cessation (Reynoso et al., 2005). Since it is unclear how gender could moderate the relation between characteristics and the use of the buddy-system, gender will be included in the current study as moderator without a specific direction.

H3: Gender moderates the relation between characteristics of app users (motivation and number of cigarettes) and use of the buddy-system.

The gap

There is a need for further research on buddy-systems. Ford et al. (2013) noted in their review study that four previous review studies found little rigorous evidence supporting the effectiveness of buddy-systems. Professional help, on the other hand, has been multifariously found to more effective in smoking cessation compared to self-care methods (Viswesvaran & Schmidt, 1992). However, young adults prefer buddy-systems over professional help, which highlights the need to optimize the effectiveness of buddy-system though further research.

In previous research, the initial feedback on Quiddy has been qualitatively researched, which yielded some conclusions and recommendations for improvement and further research (Dijkstra, 2022). Overall, the app has been evaluated as "good". Users were positive about the buddy-system, however, there were some problems with its effectiveness, due to lack of response or a lack of personal connection or trust. Furthermore, from this research emerged the conclusion that there is a need to examine the buddy-system further and to research the user data. This will enable a better understanding on how the app features are utilized and how they can be improved. By quantitatively researching the user data, more reliable scientific conclusions can be drawn about the features of the app. Besides, the results of quantitative research are perceived as more generalizable for the population (Nikolopoulou, 2023). Additionally, it was recommended in the previous study of Quiddy to conduct additional qualitative research since some users, that were interviewed, were passive users that shared expectations rather than experiences (Dijkstra, 2022). By further researching the app and using a mixed methods approach, it is possible to get a better understanding of who uses specific functions of Quiddy and why, and identify any necessary adjustments to improve the app. This is essential as this allows Quiddy to be optimized and better tailored to the target group's needs.

The current study

In the current study (see Figure 1), Quiddy was researched by answering the following main research question using a combination of qualitative and quantitative research methods: Which characteristics of Quiddy users influence the use of the buddy-system among young adults who want to quit smoking in the Netherlands? To answer the main research question, the following sub-questions were answered using a quantitative method: What is the influence of characteristics of app users (number of cigarettes, motivation for smoking cessation) on the use of the buddy-system? In addition the following question was answered: Does gender moderate the relation between the characteristics of app users and the use of the buddy-

system? The following sub-question was answered to supplement the quantitative research using a qualitative method: What are the experiences of young adults in the Netherlands who want to quit smoking with Quiddy, and in specific with the buddy-system feature of Quiddy?

Figure 1

Conceptual Model of the Characteristics in Relation to Use of the Buddy-system
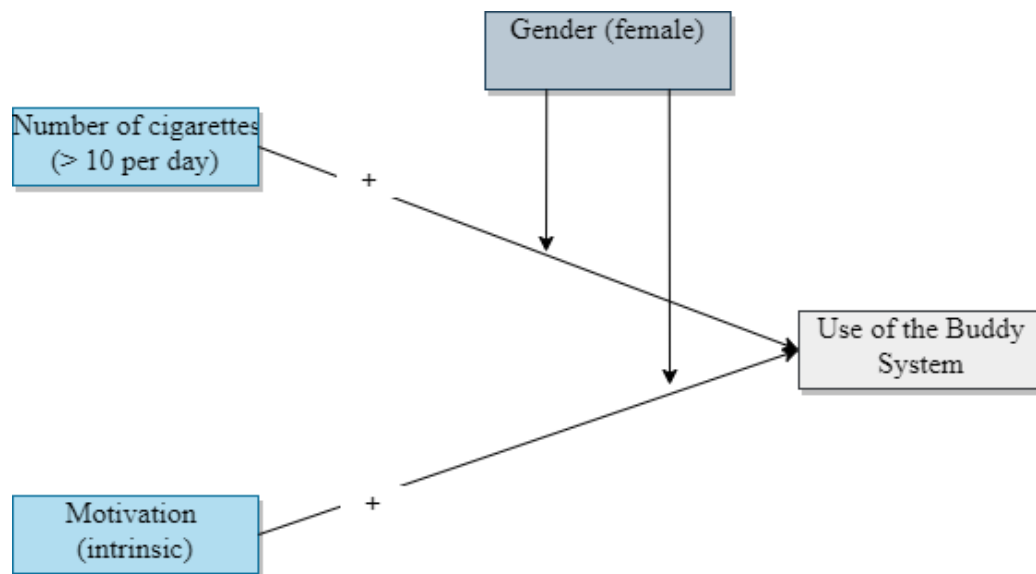
Methods

Mixed methods

In the current study, mixed methods were used to answer the main research question. An embedded design was used, with the main focus lying on quantitative research and qualitative research supplementing this. Benefits of using this research method include providing more depth of information, expanding the opportunities for research (Almalki, 2016), and additionally gaining a more complete understanding of the research problem (Doyle et al., 2009).

Quantitative research

Participants

The data collection method involved using the user data of Quiddy. After the new version of Quiddy was launched on April 3rd 2023, a promotion campaign by the Trimbos institute was used to promote Quiddy on social media to gain more app users. The campaign was launched on the 18th of April. At the end of April, Quiddy was downloaded more than 10.000 times.

Figure 2

Overview of Sample Selection

| 11.721 app users | → | 2805 users with registration of datasharing | → | 996 users with permission for datasharing | → | 291 users with registred events | → | Target group: N=94 (32.3%) |
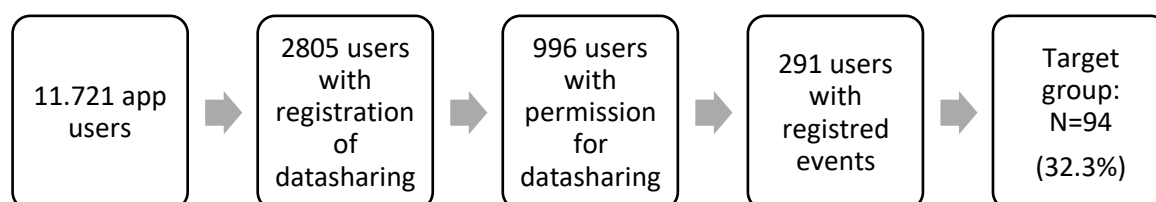
The questionnaire presented when downloading Quiddy is included in Appendix 3. The target population of both the quantitative and qualitative research was defined as Dutch young adults between 16 and 25 years old who wanted to quit smoking and downloaded Quiddy. Only app users who gave active permission for the usage of their analytics for research purposes were included in the sample (see Figure 2). The application of the inclusion criterium for age for this study resulted in *N=94*. Only app users that identified as female or male were included (43.6% female). The mean age was 21.77 (SD: 2.84). Frequencies of the educational levels is shown in Table 1. The new version of Quiddy where the analytics were included went live on the 3rd of April and data was collected until the 5th of June.

Post-hoc separate univariate power analyses in R showed that the sample size was too small (see Appendix 4). The required sample size ranged between 159 and 28017, depending on the different variables. The power of the current study ranged between .05 and .58, depending on the different variables.

No compensation of any kind was issued. Ethical approval had been obtained from the FERB (FETC 23-0859) prior to this study and from the Trimbos Ethical Committee (TET) before launching the app. The data was automatically pseudonymized.

Table 1

Crosstabulation. Gender & Education

		VMBO	HAVO / VWO	MBO	HBO / WO	Other	Rather not say	Total
				Education*				
Gender	Male	8	3	15	13	9	5	53
	Female	1	1	19	18	1	1	41
Total		9	4	34	31	10	6	94

MBO = Vocational training; HBO = University of applied sciences; VWO = Pre-academic; WO = Academic university

Measurements and procedure

The operationalization of the variables can be found in Table 2. The data management plan is included in Appendix 5a. The data was checked and cleaned in SPSS. Outliers were checked using Mahalanobis distance. There were no outliers and no participants with unreliable data. Moreover, there were no missings in the data, since all questions were mandatory.

A logistic regression analysis was conducted, using SPSS version 27. The analysis included *use of the buddy-system* as dependent variable, *number of cigarettes* and *motivation for smoking cessation* as independent variables, *age* as control variable, and *gender* as moderator. Prior to the analysis the assumptions of a logistic regression were checked.

Table 2

Operationalization of Variables

	Variable	Question	Answer options	Level of measurement
Use of buddy-system	Dependent variable	Activities in the app	Added at least 1 buddy	Dichotomous (no buddy / at least 1 buddy)
Number of cigarettes	Independent variable	Number of cigarettes	0-100 per day or 0-100 per week	Dichotomous (<10 per day / > 10 per day)
Motivation	Independent variable	'What is your motivation to quit?'	'Save money', 'I want to live more healthy', 'Smell and looks', (all 3 intrinsic) or 'For friends and family' (extrinsic)	Dichotomous (extrinsic / intrinsic)
Gender	Moderator	'What is your gender?'	'Male', 'Female', or 'Other'	Dichotomous (male / female)
Age	Control variable	'How old are you?'	Open answer	Continuous (ratio)

Qualitative research

Participants

A combination of the voluntary response sampling method and the purposive sampling method was used to gain participants for the qualitative research. They were recruited via social media, offline flyers (see Appendix 6), via a notification in Quiddy and an e-mail to (60) Quiddy users asking them to participate in an interview for the current study. In addition, one participant was recruited via the snowball method. The potential participants could leave their contact information in a Lime Survey or Google Forms document. Afterwards, they were contacted personally and received an invitation to participate in the study. In total, 15 potential participants left their information, but most of them didn't respond to the invitation to participate in the study or to the following reminding e-mail.

It was aimed to have at least 5 participants. In total, 3 participants participated in the study. Therefore, in order to get more and better results, the interviews conducted in the previous study by Dijkstra (2022) were included in the current study as well. Only interviews conducted with users of Quiddy were included. This resulted in a total of 9 participants. Demographics of the participants are included in Table 3. The participants of the interviews of the current study received a €20,- gift card as a token of appreciation for their time and effort, provided by the Trimbos institute.

Table 3

Demographics of Interview Participants

Participants	Age	Gender	Cigarettes Per Day	Education*	Year	Buddy
1	22	Female	7	HBO	2023	0
2	21	Female	3	HBO	2023	0
3	25	Female	15	MBO	2023	1
4	23	Female	20	WO	2022	1
5	17	Female	3	VWO	2022	0
6	22	Female	7	HBO	2022	1
7	21	Female	11	HBO	2022	1
8	20	Female	10	HBO	2022	2
9	22	Female	20	HBO	2022	0

*MBO = Vocational training; HBO = University of applied sciences; VWO = Pre-academic; WO = Academic university

Measurements

Prior to conducting the interviews, the potential participants received several documents by e-mail, which included information about the research purposes of the study, an informed consent form, and information about the data processing. Before the start of the interview, participants were verbally informed about their right to stop the interview at any time and withdraw from the study. Permission was asked for audio recording and the informed consent was discussed and signed. Ethical approval had been obtained prior to the interviews from the ethical committee of Trimbos (TET 202204).

Semi-structured interviews were conducted using an interview guide. This guide is an adapted version of the one used in previous research by Dijkstra (2022) (see Appendix 7). The personal and practical information were adapted. The interviews were conducted using Microsoft Teams. The interviews were conducted in Dutch and took approximately 30 minutes. At the end of the interview, participants were asked if they had more questions or comments.

Procedure

The interviews were transcribed in Dutch and anonymized. The parts of the interviews that were relevant for the current study were subsequently coded using MAXQDA. Open, axial and selective coding techniques were used for the interviews (see Appendix 8). The results between participants were compared and described using quotes. The quotes were translated to English. The data management plan can be found in Appendix 5b. Personal data were stored securely and other data was treated as confidential.

Results

Quantitative research

Descriptive analyses are included in Table 4, together with the Spearman's correlations of the variables used in the analysis (*N=94*). There is a significant negative correlation between gender and cigarettes, which indicates that females are more likely to smoke less than ten cigarettes a day in the current sample. In the sample, 43.62% was female (*N=41*), 93.62% reported that they had intrinsic motivation for smoking cessation (*N=88*), 9.57% smoked more than 10 cigarettes per day (*N=9*), and 31.91% used the buddy-system (*N=30*).

Table 4

Descriptive Statistics and Correlations of Variables

Variable	*M*	*SD*	*Range*	*Spearman's Correlation test*			
				1	*2*	*3*	*4*
1. Age	21.77	2.84	16-25				
2. Cigarettes[a]	.10	.30	0-1	.40			
3. Motivation[b]	.94	.25	0-1	.09	-.06		
4. Gender[c]	.44	.50	0-1	.16	-.21*	.06	
5. Buddy-system[d]	.32	.47	0-1	.00	.10	.41	.03

*Note: N=94. *. Correlation is significant at the 0.05 level (2-tailed).*
[a]Reference category = less than 10, [b]Reference category = extrinsic, [c]Reference category = male, [d]Reference category = no use of buddy-system.

All assumptions of a binary logistic regression were met, except for the large sample size. To test the hypotheses and answer the research questions, a logistic regression analysis was conducted in SPSS version 27. In Block 1 (see Table 5), the dependent variable *use of buddy-system* and the control variable *age* were added. The model including *age* explained 0% (Nagelkerke R^2) of the variance in *use of buddy.* An increase in *age* was not significantly associated with an increased likelihood in *use of buddy-system* (*p*=1, OR=1, 95% CI=0.86 to 1.17).

Table 5

Variables in the Equation

		B	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Step 1[a]	Age	0.00	1.00	1.00	0.86	1.17
	Constant	-0.76	0.66	0.47		

a. Variable(s) entered on step 1: Age.

In Block 2 (see Table 6), the independent variables *number of cigarettes* and *motivation for smoking cessation* were included to test hypotheses 1 and 2. The model including *age, cigarettes* and *motivation* explained 1.2% (Nagelkerke R^2) of the variation in *use of buddy-system*. Smoking more than 10 cigarettes per day was not significantly associated with an increased likelihood of using the buddy-system ($p=0.88$, OR=1.12, 95% CI=0.26 to 4.89). Having intrinsic motivation was not significantly associated with an increased likelihood of using the buddy-system as well ($p=0.42$, OR=2.49, 95% CI=0.28 to 22.55).

Table 6

Variables in the Equation

		B	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Step 1[a]	Age	-0.06	0.94	0.99	0.85	1.16
	Cigarettes[b]	0.11	0.88	1.12	0.26	4.89
	Motivation[c]	0.91	0.42	2.49	0.28	22.55
	Constant	-1.50	0.45	0.22		

a. Variable(s) entered on step 1: Cigarettes, Motivation. [b]Reference category = less than 10, [c]Reference category = extrinsic.

Lastly, in Block 3 (see Table 7), the moderator *gender* and interaction term of the moderator and the independent variables were added. The model including *age, cigarettes, motivation, gender, cigarettes x gender,* and *motivation x gender* explained 1.26% (Nagelkerke R^2) of the variation in *use of buddy-system*. The model correctly classified 69.1% of the cases. Being female was not significantly associated with an increased likelihood of using the buddy-system ($p=1$, OR=0.00). Additionally, an increase in the interaction terms *gender x cigarettes* ($p=1$, OR=1676726191.67) and *gender x motivation* ($p=1$, OR=1376427421.37) were not

significantly associated with an increased likelihood of *use of buddy-system.* The odds-ratio is extremely high, which could indicate that there are too many variables for the number of participants.

Table 7

Variables in the Equation

		B	Sig.	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Step 1[a]	Age	-0.02	0.79	0.98	0.83	1.15
	Cigarettes[b]	0.17	0.85	1.18	0.20	6.90
	Motivation[c]	-0.08	0.95	0.92	0.08	10.10
	Gender[d]	-19.97	1.00	0.00	0.00	
	Cigarettes x Gender	21.24	1.00	1676726191.67	0.00	
	Motivation x Gender	21.04	1.00	1376427421.37	0.00	
	Constant	-0.71	0.72	0.49		

a. Variable(s) entered on step 1: Gender, Cigarettes x Gender, Motivation x Gender. [b]Reference category = less than 10, [c]Reference category = extrinsic, [d]Reference category = male.

Qualitative research

The following section gives an overview of the main findings of the qualitative interviews to supplement the quantitative analysis. The characteristics of the participants can be found in Table 3 in the method section.

Characteristics

Almost all of the participants were daily smokers (77.78%). One of the participants mentioned that she wanted to quit now, because she wasn't a daily smoker yet. The number of cigarettes on average per day ranged from 3 to 20. All participants downloaded Quiddy to help them quit smoking. Their main motivation for smoking cessation was related to health. One participant wanted to quit smoking due to her pregnancy.

"You can adjust your motivation in the app, so I added my positive pregnancy test as photo with 'you can do it mommy', because I want to quit [smoking] for the little one in my belly. (...) I kind of have social pressure on me that I just can't smoke in front of other people, because I get judged right away because I'm pregnant." – P3

The buddy-system

More than half of the participants (*N=5*) added one or more buddies in the app. Even though they were positive about the possibility to add a buddy, it didn't work well for them in practice. The buddies didn't respond to their messages, or there was no connection. One participant added a buddy they knew in real life and therefore didn't chat in Quiddy itself, but via other instant messaging apps. Two participants mentioned that they already had a real life buddy and therefore didn't need one.

"I think I found it [adding a buddy] a bit awkward, and not necessary, because I do not smoke every day. And I had [name classmate] too, as sort of real life buddy" – P2

Multiple participants mentioned that the threshold of adding a buddy was too high, because they found it a bit scary, but were open to it if others added and messaged them.

"I think that I would find it a bit scary. [...]. I think that I would not seek contact myself, but if someone sought contact with me I would think 'oh I'll answer, just to see what they have to say or what's going on with them'" – P1

The app users who didn't add a buddy yet, were also positive about the option to chat with a buddy, even though they didn't need it.

General opinions and suggestions

In general, all participants were positive about Quiddy. Specifically, they were positive about the statistics including how much money they saved, the health-related facts, and about the badges they could earn. One participant mentioned that she was overall very positive about the app, but since she was doing a second quit attempt using Quiddy, the data wasn't accurate. The amount of cigarettes per day, the money saved, motivation, age, and difficult moments were no longer true. In addition, she mentioned that she was using another app to see how many cigarettes she didn't smoke and it would be better if Quiddy included this as well. Another participant mentioned that she wouldn't recommend Quiddy due to her experience with the buddy-system. A suggestion to improve this was to match buddies based on their level of activity in the app. Another suggestion was to show if a buddy is online, so users know who to contact and might get more response. All other participants would recommend Quiddy to others.

Discussion

The aim of the current study was to analyse and evaluate the buddy-system of Quiddy using mixed methods. Different characteristics including age, motivation, number of cigarettes and gender were included in the quantitative research. A binary logistic regression showed that there were no significant results, meaning that first of all, older participants were not more likely to use the buddy-system. This can be explained by that Quiddy already focused on a specific target group, in line with the recommendation of Grøtvedt & Stavem (2005). They stated that interventions should be tailored to age, gender, and motivation for smoking cessation.

Secondly, contradictory to hypothesis 1, the analysis showed that there is no relationship between motivation for smoking cessation and use of the buddy-system, when comparing intrinsic and extrinsic motivation. This hypothesis was based on the conclusion by Curry et al. (1997) that intrinsic motivation of smokers is associated with more readiness to quit smoking, which could indicate a higher likeliness to use an intervention such as Quiddy. A potential explanation for the contradiction can be that current study solely focused on the buddy-system feature, rather than researching the entire app. Meaning that there could be a difference between intrinsic and extrinsic motivation in relation to using an intervention as a whole. The current study didn't research the same aspects as the study by Curry et al. (1997).

In addition, women were not more likely to quit smoking due to extrinsic reasons, which is contradictory to the findings in the study by Grøtvedt & Stavem (2005), who concluded that women were indeed more likely to quit due to extrinsic reasons. The contradiction can be explained by that in the current study it is highly possible that many women didn't have children or weren't pregnant due to the specific age group. Children are one of the most important extrinsic motivators for smoking cessation, which was more likely to occur in the study of Grøtvedt & Stavem (2005), since their target group was older.

Thirdly, hypothesis 2 is rejected as well, since no relationship between number of cigarettes and use of the buddy-system was found. Even though it has been stated (Gezondheid en wetenschap, n.d.) that smoking is more difficult for people who smoke more than ten cigarettes per day, it seems that there is no indication that they are more likely to use peer support. This indicates that Quiddy is accessible for 'light' and 'heavy' smokers.

Lastly, to test hypothesis 3, gender was still included as moderator, even though there was no main effect. Matud et al. (2003) stated that gender has been multifariously found to be a moderator in the relation between social support and various different variables. However,

in the current study this has not been found, which is explainable by the non-significant main effect between the independent and dependent variables. The relation between motivation and use of the buddy-system and the relation between number of cigarettes and use of the buddy-system were not stronger for females. However, gender differences were found. Women were more likely to smoke less than ten cigarettes per day, which adds to the finding that women are less likely to be daily smokers (Chinwong et al., 2018).

Interviews

The results from the new interviews were in line with the findings of previous research about Quiddy (Dijkstra, 2022). The users were positive about the app, despite that the buddy-system didn't work properly for them, mainly due to lack of response from their buddies. The quantitative analysis also showed that the buddy-system wasn't used much. It emerged that some participants found the threshold for adding a buddy too high, but were open to being added and messaged by others. Suggestions to improve the buddy-system include matching based on the level of activity and showing if a buddy is online.

Strengths

The current study was the first to quantitatively research the smoking cessation app Quiddy. Cautiously, it can be stated that there is no difference between users who use a specific app feature, which is contradictory to the study by Grøtvedt & Stavem (2005), who concluded that interventions need to be tailored to gender, age, and the reason for smoking cessation. In the current study there is no indication that different characteristics are associated with the use of the buddy-system, which is beneficial for Quiddy, since it seems that the buddy-system doesn't target a specific group of smokers. Another strength is the power analyses that were conducted. They provided more insight into the results. Additionally, the mixed methods design provided more insight into the use of the buddy-system and provided a better understanding of Quiddy in general.

Limitations

The current study has certain limitations. When interpreting the quantitative results of the current study, it is important to keep in mind that the current study was underpowered, which could have resulted in unreliable results. There is a possibility that there was an effect of the independent variables on the use of the buddy-system, but it was not detected due to the small sample size. For example, when analyzing the univariate relation between motivation

and use of the buddy-system, there's only a 43.7% chance that we would actually detect the observed relation. It is also important to keep in mind that most variables were self-report. In particular, the variable age is susceptible to the self-report bias. App users were unable to fill in an age below 16, so it is likely that age is not completely accurate. The recruitment method for the interviews also had a limitation; the self-selection bias, which was mitigated by asking the participants why they agreed to participate in the study. This can help with evaluating to what extent their motivation could have influenced the responses.

The activities (analytics) were collected since April 3rd 2023, so there is a possibility that users that used the buddy-system prior to this were now classified as non-users of the buddy-system. Only 32.3% of the app users were between 16 and 25 years old when downloading the app, so most users didn't fit the target group. As already mentioned, the sample size was too small, resulting in a low power. This results in the following suggestions for future research.

Suggestions for future research

The first suggestions for future research is to conduct this research with a larger sample size (N>500). A power analysis showed that the power of the current study is low, resulting in somewhat unreliable results. Furthermore, it might be interesting to look at other app features of Quiddy, such as the game feature or the app as a whole, specifically looking at motivation in relation to the app as a whole. In addition, in the current study a cross-sectional design was used. To make more conclusions about the causality of the relations, a longitudinal design should be used by for example including the evaluation form of the app, which users receive 28 days after their quit date. It can be researched if the use of Quiddy features leads to a successful quit attempt. By longitudinally researching the app, more conclusions about its effectiveness can be drawn.

Conclusion

From previous research (Trimbos, 2021) emerged the notion that young adults want to quit smoking with help of a peer. However, the quantitative data shows that less than a third of the Quiddy users between 16-25 years old has actually used the buddy-system. Additionally, keeping in mind that the study was underpowered, there was no difference in the use of the buddy-system looking at gender, number of smoked cigarettes, and motivation for smoking cessation. This means that Quiddy and the buddy-system are accessible for different types of smokers.

The interviews show that users that did use the buddy-system weren't positive about it and weren't motivated to use the feature again. Suggestions were given to improve the buddy-system; users should be matched based on their level of activity in the app, so the needs of the buddies match and no frustrations about the inactivity of the buddy will emerge. The reason why the buddy-system wasn't used as much as expected is due to the threshold of adding a buddy. No clear suggestions were given to lower this. However, users indicated that they would chat with a buddy if they were added by that buddy. In general, users were positive about the app, and Quiddy helped the young adults in their quit attempt. By improving the buddy-system, more users can benefit from the support of a peer.

References

Almalki, S. G. (2016). Integrating Quantitative and Qualitative Data in Mixed Methods

Research—Challenges and Benefits. *Journal of Education and Learning*, *5*(3), 288.

https://doi.org/10.5539/jel.v5n3p288

Bergh, D. R. C. M. M., Harteloh, P. P. M., & Croes, E. A. (2017, September 15).

Doodsoorzaak nr. 1 bij jonge Nederlanders: de sigaret. NTvG. Retrieved February

15, 2023, from https://www.ntvg.nl/artikelen/doodsoorzaak-nr-1-bij-jonge-

nederlanders-de-sigaret

Bommelé, J., & Willemsen, M. (2022). *Kerncijfers roken 2021 – Trimbos-instituut.*

https://www.trimbos.nl/aanbod/webwinkel/af1998-kerncijfers-roken-

2021/#:~:text=In%202021%20rookte%2020%2C6,het%20gebruik%20van%20elektro

nische%20sigaretten.

Burns, R. M., Rothman, A. J., Fu, S. S., Lindgren, B. R., & Joseph, A. M. (2014). The

Relation between Social Support and Smoking Cessation: Revisiting an Established

Measure to Improve Prediction. *Annals of Behavioral Medicine*, *47*(3), 369–375.

https://doi.org/10.1007/s12160-013-9558-7

Chaiton, M., Diemert, L., Cohen, J. E., Bondy, S. J., Selby, P., Philipneri, A., & Schwartz, R.

(2016). Estimating the number of quit attempts it takes to quit smoking successfully in

a longitudinal cohort of smokers. *BMJ Open*, *6*(6), e011045.

https://doi.org/10.1136/bmjopen-2016-011045

Chinwong, D., Mookmanee, N., Chongpornchai, J., & Chinwong, S. (2018). A Comparison of

Gender Differences in Smoking Behaviors, Intention to Quit, and Nicotine

Dependence among Thai University Students. *Journal of Addiction*, *2018*, 1–8.

https://doi.org/10.1155/2018/8081670

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98*(2), 310–357. https://doi.org/10.1037/0033-2909.98.2.310

Curry, S. J., Grothaus, L. C., & McBride, C. M. (1997). Reasons for quitting: Intrinsic and extrinsic motivation for smoking cessation in a population-based sample of smokers. *Addictive Behaviors*, *22*(6), 727–739. https://doi.org/10.1016/s0306-4603(97)00059-2

Dijk, F., Reubsaet, A., De Nooijer, J., & De Vries, H. (2007). Smoking status and peer support as the main predictors of smoking cessation in adolescents from six European countries. *Nicotine & Tobacco Research*, *9*, 495–504. https://doi.org/10.1080/14622200701587060

Dijkstra, I. (2022). *Evaluation of the new smoking cessation application for young adults: Quiddy. A qualitative research to provide recommendations for improvements* [Thesis]. Vrije Universiteit Amsterdam.

Doyle, L., Brady, A., & Byrne, G. (2009). An overview of mixed methods research. *Journal of Research in Nursing*, *14*(2), 175–185. https://doi.org/10.1177/1744987108093962

Ford, P. J., Clifford, A., Gussy, K., & Gartner, C. (2013). A Systematic Review of Peer-Support Programs for Smoking Cessation in Disadvantaged Groups. *International Journal of Environmental Research and Public Health*, *10*(11), 5507–5522. https://doi.org/10.3390/ijerph10115507

Gezondheid en wetenschap. (n.d.). *Stoppen met roken · Gezondheid en wetenschap*. gezondheidenwetenschap.be. https://www.gezondheidenwetenschap.be/richtlijnen/stoppen-met-roken#:~:text=Vooral%20als%20je%20veel%20rookt,het%20stoppen%20met%20roken%20moeilijker.

Grøtvedt, L., & Stavem, K. (2005). Association between age, gender and reasons for smoking cessation. *Scandinavian Journal of Public Health*, *33*(1), 72–76. https://doi.org/10.1080/14034940410028361

Ik wil nu stoppen met roken | Thuisarts. (n.d.). thuisarts.nl. Retrieved April 11, 2023, from https://www.thuisarts.nl/stoppen-met-roken/ik-wil-nu-stoppen-met-roken

Kort-Butler, L. A. (2017). Social Support Theory. *The Encyclopedia of Juvenile Delinquency and Justice*, 1–4. https://doi.org/10.1002/9781118524275.ejdj0066

LaGrotta, C. (2021). Gender Differences in Addiction. *Current Addiction Reports*, *8*(1), 64–70. https://doi.org/10.1007/s40429-021-00355-x

Matud, M. P., Ibáñez, I., Pérez, J. M. B., Marrero, R. J., & Carballeira, M. (2003). Structural gender differences in perceived social support. *Personality and Individual Differences*, *35*(8), 1919–1929. https://doi.org/10.1016/s0191-8869(03)00041-2

Nikolopoulou, K. (2023, March 3). *What Is Generalizability? | Definition & Examples*. Scribbr. https://www.scribbr.com/research-bias/generalizability/

Olson, D. A., & Shultz, K. S. (1994). Gender Differences in the Dimensionality of Social Support1. *Journal of Applied Social Psychology*, *24*(14), 1221–1232. https://doi.org/10.1111/j.1559-1816.1994.tb00555.x

Pourtau, L., Martin, E., Menvielle, G., El Khoury-Lesueur, F., & Melchior, M. (2019). To smoke or not to smoke? A qualitative study among young adults. Preventive Medicine Reports, 15, 100927. https://doi.org/10.1016/J.PMEDR.2019.100927

Reynoso, J., Susabda, A., & Cepeda-Benito, A. (2005). Gender Differences in Smoking Cessation. *Journal of Psychopathology and Behavioral Assessment*, *27*(3), 227–234. https://doi.org/10.1007/s10862-005-0638-2

Smith, P. L., Bessette, A., Weinberger, A. H., Sheffer, C. E., & McKee, S. A. (2016).
Sex/gender differences in smoking cessation: A review. *Preventive Medicine*, *92*, 135–140. https://doi.org/10.1016/j.ypmed.2016.07.013

Trimbos. (2021, December 8). *Stoppen-met-rokenhulp in je broekzak: kunnen jongvolwassenen zo stoppen?* https://www.trimbos.nl/actueel/blogs/stoppen-met-rokenhulp-in-je-broekzak-kunnen-jongvolwassenen-zo-stoppen/

Trimbos. (2022a, October 25). *Stoppen met roken: feiten en cijfers*. Trimbos-instituut. Retrieved February 16, 2023, from https://www.trimbos.nl/kennis/hulp-bieden-bij-stoppen-met-roken/feiten-en-cijfers/

Trimbos. (2022b, November 9). *Hoeveel mensen gaan er jaarlijks in Nederland dood door roken?* ROKENinfo.nl. Retrieved from https://www.rokeninfo.nl/cijfers/hoeveel-mensen-gaan-er-jaarlijks-in-nederland-dood-door-roken

Viswesvaran, C., & Schmidt, F. L. (1992). A meta-analytic comparison of the effectiveness of smoking cessation methods. *Journal of Applied Psychology*, *77*(4), 554–561. https://doi.org/10.1037/0021-9010.77.4.554

Watkins, S. L., Thrul, J., Max, W., & Ling, P. M. (2020). Real-World Effectiveness of Smoking Cessation Strategies for Young and Older Adults: Findings From a Nationally Representative Cohort. Nicotine & Tobacco Research, 22(9), 1560. https://doi.org/10.1093/NTR/NTZ223

WHO. (2022, May 24). *Tobacco*. https://www.who.int/news-room/fact-sheets/detail/tobacco

Appendices

Appendix 1: Interdisciplinarity

The importance of interdisciplinarity in research is that researchers can address more complex problems than that is possible with just separate disciplines by better understanding the problem. In addition, it can also lead to more innovative solutions for problems. It can also help bridge the gap between research and practice.

The transactional model of development of Sameroff[1] can be used to categorize the variables I will use in my study. This model emphasizes the dynamic and bidirectional interactions between the individual and their environment. It highlights the need to understand both the individual as well as the environment in order to understand development. In Sameroff's model, 'use of the buddy-system' is considered a social and environmental variable that reflects the interplay between the individual and the social environment. In the current study, use of the buddy-system is defined as adding a buddy in the smoking cessation app Quiddy. This buddy is a peer that has the same goal; quitting smoking. The buddy can act as a social support person, and help with the smoking cessation process. Furthermore, use of the buddy can be influenced by individual factors including motivation, number of cigarettes, age and gender.

By including sociological factors, individual factors, and environmental factors, a more comprehensive understanding of Quiddy users can be provided. Sociological, individual, and environmental factors all provide unique perspectives on human behavior. Sociological factors, such as social structures and cultural norms, can provide insight into how individuals are shaped by their environment and how they interact with others in society. Individual factors, such as genetics, personality, and cognition, can influence behavior and development of an individual. Environmental factors, such as physical surroundings and neighborhood, can also influence the behavior and development of an individual. In addition, all these factors in turn influence each other. Combining these perspectives can give a more complete understanding, and can help to identify potential risk factors and solutions. This understanding can help with the development of effective interventions and policies, such as Quiddy.

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[1] Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. Child Development 81(1), 6-22. doi:10.1111/j.1467-8624.2009.01378.x

Appendix 2: Data contracts

Appendix 2a: Contract research project RIT

Research Project Agreement

Student: Rianne van Ravenhorst

Graduation variant: RIT/Master's in Youth Studies

Supervising lecturer: Gaëlle Ouvrein (thesis) & Margot Peeters (internship supervisor University)

Tel: -

Faculty: Faculty of Behavioral and Social Sciences

Second assessor: Gerdien van Eersel

Internship information

Institution: Trimbos instituut

Address: Da Costakade 45,

Postcode and Town/City: 3521 VS Utrecht

External supervisor: Sigrid Troelstra

Starting and ending dates: 06-02-2023 – 30-06-2023

Agreements

Submission date for work plan/research proposal: 20/03/2023

Period during which the lecturer will review the final product and any interim products: 06/06/23 – 30/06/23

Number of working days/working hours per week: 36 hours per week

Topic: Quiddy: a smoking cessation app

Agreements concerning papers to be submitted in the interim: abstract in week 19

The client (host institution or faculty/programme) will provide the facilities needed in order to conduct the assignment properly.

If applicable: Form and frequency of supervision within the host institution:

Once a week a meeting with the internship supervisor & a colleague who is also working on Quiddy

Number of conferences between the supervising lecturer and the supervisor within the host institution: 2 (halfway evaluation and final evaluation)

Prescriptions concerning the confidentiality of information:

All described in the Trimbos protocol. "De stagiair houdt zaken geheim waarvan hij/zij weet of kan vermoeden dat het vertrouwelijk is. Voorbeelden hiervan zijn: - Persoonsgegevens, zoals namen, e-mailadressen, telefoonnummers. - Gevoelige informatie bijvoorbeeld over de organisatie, zoals de financiële situatie van het Instituut. Deze afspraak geldt ook nadat de stage is afgelopen."

Ownership of the research data, in the event of deviation from the rule (see 16):

Trimbos-instituut

Right to publish based on the research data:

Trimbos-instituut

Internship report or thesis can be published by the student with approval of Trimbos

Signed as approved,

Location/date: Utrecht, 23-02-2023

Signature of the student: [   ]

Signature of the supervising lecturer: [   ]

Signature of the external supervisor (if applicable)   [   ]

Signature of the Course Coordinator   [   ]

Utrecht University

Appendix 2b: Contract data-use TED track

Utrecht, 2023

This letter constitutes formal confirmation of the fact that the data from the Utrecht University 2022-2023 Master's program Youth Studies have been made available to Rianne van Ravenhorst of Utrecht University.

These data will not be made available to others, and the data may be used only for analysis and reporting on topics for the thesis, about which agreement has been reached with Sigrid Troelstra.

Rianne van Ravenhorst will receive access to the data from the dataset in order to answer the following research questions within the framework of the thesis:

Main research question: Which characteristics of Quiddy users influence the use of the buddy-system among young adults who want to quit smoking in the Netherlands?
Sub questions quantitative: What is the influence of characteristics of app users (number of cigarettes, motivation for smoking cessation) on the use of the Buddy-system? Does gender moderate the relation between the characteristics of app users and the use of the buddy-system?
Sub question qualitative: What are the experiences of young adults in the Netherlands who want to quit smoking with Quiddy, and in specific with the buddy-system feature of Quiddy?

The following variables will be used:
Dependent variable: 'use of the buddy-system'
Independent variables: 'number of cigarettes', 'motivation'
Other variable: 'Age' (control variable), 'gender' (moderator)

No report based on the data from the project entitled Quiddy will be made public, unless permission has been obtained in advance from the Project Coordinator of Quiddy.

After the expiration of this contract, dated 30-06-2023, Rianne van Ravenhorst shall delete the Quiddy data.

Dates and signature:

23-02-2023

Name of student: Name of Project Coordinator:
Rianne van Ravenhorst   Sigrid Troelstra

Appendix 3: Questionnaire quantitative research

Appendix 3a: Questionnaires (in Dutch)

Gender – Wat is je geslacht?
- Vrouw
- Man
- Anders

Kies een gebruikersnaam
Let op! Deze gebruikersnaam is zichtbaar voor je buddy's en kan niet gewijzigd worden. Je gebruikersnaam moet minimaal uit 5 tekens bestaan.
- Open

Randomize functie

Wat is je leeftijd?
- Open

Welke opleiding heb je gedaan of doe je?
- VMBO
- HAVO / VWO
- MBO
- HBO / Universiteit
- Zeg ik liever niet
- Anders

Rook je?
- Ja
- Nee ik rook niet meer!

Kies je stopdatum
- Datum
- Ik wil dit later invullen

Wat is je motivatie om te stoppen? 1 optie mogelijk:
- Geld besparen
- Ik wil gezonder leven
- Voor vrienden en familie
- Geur en looks

Moeilijke momenten - Wanneer vind je het moeilijk om niet te roken (meerdere opties):
- Tijdens het uitgaan
- Bij stress

- Na het eten
- Thuis
- Onder vrienden
- Bij verveling

Hoeveel sigaretten rook(te) je?
- Per dag 0-100
- Per week 0-100

Wat is de prijs van één pakje sigaretten of shag?
- Open

Hoeveel sigaretten zitten er in een pakje / rol je uit een pakje?
- Open

Help ons Quiddy te verbeteren!
Mogen wij je data gebruiken voor wetenschappelijk onderzoek? We gaan vertrouwelijk om met je gegevens.
- Nee
- Ja

Eventlog
Per actie gebruikersidentificatie en moment (tot op minuut nauwkeurig).
- App geopend (duur gebruik en aantal keer gebruikt per dag/week)
- Dashboard geopend
  - Aanpassen motivatie in dashboard
  - Behaalde badges
- Tips en tricks geopend
  - Specifieke artikelen tips en tricks geopend
  - Specifiek artikelen tips en tricks aangemerkt als favoriet
- Chat geopend
  - Aantal chatberichten verstuurd
  - Aantal chatberichten ontvangen
  - Positieve stellingen verstuurd
  - Serieuze stellingen verstuurd
  - Nieuwe onbekende buddy toegevoegd
  - Nieuwe bekende buddy toegevoegd
  - Buddy verwijderd (met reden)
  - Badges gedeeld met buddy
- Noodknop geopend
  - Noodmelding naar alle buddy's verstuurd
  - Noodmelding naar specifieke buddy's verstuurd
  - Afleiding spelletje geopend
  - Afleiding video geopend
  - Hulp van de stoplijn: bellen geopend

- o Hulp van de stoplijn: chat geopend
- Profiel
  - o Stopdatum aangepast
  - o Bio ingevuld
  - o Avatar gewijzigd
- Notificaties
  - o Motiverende berichten aan/uit
  - o Chatberichten aan/uit
  - o Noodmelding buddy's aan/uit
  - o Matching in chat aan/uit

Appendix 3b: Questionnaire (in English)

Start questionnaire
Gender - What is your gender?
- Female
- Male
- Other

Choose a username
Attention! This username is visible to your buddies and cannot be changed. Your username must be at least 5 characters.
- Open

Randomize function

What is your age?
- Open

What education have you done or are you doing?
- VMBO
- HAVO / VWO
- MBO
- HBO / University
- I would rather not say
- Other

Do you smoke?
- Yes I do
- No I don't smoke anymore!

Choose your quit date
- Date
- I want to complete this later

What is your motivation to quit? 1 option possible:
- Save money
- I want to live more healthy
- For friends and family
- Smell and looks

Difficult moments - When do you find it difficult not to smoke (multiple options):
- While going out
- During stress
- After dinner

- At home
- Among friends
- When bored

How many cigarette(s) do you smoke?
- Per day 0-100
- Per week 0-100

What is the price of one pack of cigarettes or rolling tobacco?
- Open

How many cigarettes are in a pack/roll out of a pack?
- Open

Help us improve Quiddy!
May we use your data for scientific research? We will handle your data confidentially.
- No.
- Yes.

Per action user identification and moment
- App opened (duration of use and number of times used per day/week)
- Dashboard opened
    - Adjust motivation in dashboard
    - Achieved badges
- Tips and tricks opened
    - Specific articles tips and tricks opened
    - Specific articles tips and tricks marked as favourite
- Chat opened
    - Number of chat messages sent
    - Number of chat messages received
    - Positive statements sent
    - Serious statements sent
    - New unknown buddy added
    - New known buddy added
    - Buddy removed (with reason)
    - Badges shared with buddy
- Emergency button opened
    - Emergency notification sent to all buddies
    - Emergency notification sent to specific buddies
    - Distraction game opened
    - Distraction video opened
    - Help from the stop line: call opened
    - Help from the stop line: chat opened
- Profile
    - Stop date updated

- o Bio filled in
- o Avatar changed
- Notifications
    - o Motivational messages on/off
    - o Chat messages on/off
    - o Emergency notification buddies on/off
    - o Matching in chat on/off

Appendix 4: Power analyses

Output power analyses in R using wp.logistic from package WebPower
The power and sample size analyses were conducted to gain more insight into the results, even though post-hoc analyses are usually argued against. We performed post-hoc power and sample size analyses for univariate logistic regression, but have not done so for the eventual multivariate model. While this is possible to perform through simulation, it extends beyond the scope of the current study, partly due to the complex computation. However, given our study appeared fairly underpowered for the univariate analyses, we can safely assume this is also the case for more complex, multivariate models.

Calculate N at a power of 0.80
Cigarettes
```
      p0       p1     beta0     beta1
 0.3176471 0.3333333 -0.7646061 0.07145896
      n alpha power
 28016.65  0.05   0.8
```

Gender
```
  p0       p1     beta0   beta1
 0.2264151 0.4390244 -1.228665 0.983543
      n alpha power
 158.5378  0.05   0.8
```

Motivation
```
  p0       p1     beta0     beta1
 0.1666667 0.3295455 -1.609438 0.8991963
      n alpha power
 227.6553  0.05   0.8
```

Calculate power at N=94
Gender
```
p0       p1     beta0   beta1  n
 0.2264151 0.4390244 -1.228665 0.983543 94
 alpha   power
  0.05 0.578218
```
Motivation
```
p0       p1     beta0     beta1
 0.1666667 0.3295455 -1.609438 0.8991963
  n alpha    power
 94  0.05 0.4366308
```

Cigarettes
```
p0       p1     beta0     beta1
 0.3176471 0.3333333 -0.7646061 0.07145896
  n alpha    power
 94  0.05 0.0530221
```

Appendix 5: Data management plan

Appendix 5a: Data management plan quantitative

The data management plan of this study is based on the data management plan of Trimbos-Institute.

General project information

The title of the current study is: 'Who uses Quiddy and why? A mixed methods study of the smoking cessation app for young adults in the Netherlands', with project code 64-2303. The project leader is S. Troelstra and other project employees are Rianne van Ravenhorst and Lisa Koster. The start date is the 6th of February 2023, and it will end on the 30th of June. It is financed by the ministry of Health, Welfare and Sports (VWS). The project was submitted to the Ethics Review Board of the Faculty of Social & Behavioural Sciences of Utrecht University (FERB).

Data planning

Participants were app users who gave permission to share their analytic data and characteristics. Inclusion criteria included app users that gave active permission for datasharing, app users between 16-25 years old, and app users of whom events were registered. The first data was received on May 22nd 2023 and the second was received on June 5th 2023, which was used as final data. The output, syntax, raw dataset and dataset were stored according to the standard procedure of structure of the _DATLOC folder (see Figure 3). The owner of the data is Trimbos-institute. The research applicant is VWS, but they are not owners. Direct users of the data are S. Troelstra and Ilse Rianne van Ravenhorst.

Data collection

Rianne van Ravenhorst is the one that analysed the data and made sure that everything is stored in the right way. S. Troelstra provided her with guidance to ensure that everything was done correctly. The raw data was expected to be delivered at the beginning of April but was at the end of May. The expectation was that the final data will be delivered at the end of May or the beginning of June. Final data was delivered in June.

Data storage

Trimbos' network drives are backed up automatically at various times during the day by ICT. During data collection, the following people have access to the data: S. Troelstra, L. Koster, C. de Neree, K. Bolt, R. Andree, M. van Aerde and R. van Ravenhorst. These individuals have access to everything within the folder '64-2013 Innovatie tabaksontmoediging'. Only S. Troelstra, L. Koster, and R. van Ravenhorst have access to the personal data, as this will be stored in a locked file. The research data will be kept for ten years. Employees of the Trimbos-institute who have access to the '_DATLOC' folder will keep it once the internship is completed.

Appendix 5b: Data management plan qualitative

The data management plan of this study is based on the data management plan of Trimbos-Institute.

General project information

The title of the current study is: 'Who uses Quiddy and why? A mixed methods study of the smoking cessation app for young adults in the Netherlands', with project code 64-2303. The project leader is S. Troelstra and other project employees are Rianne van Ravenhorst and Lisa Koster. The start date is the 6th of February 2023, and it will end on the 30th of June. It is financed by the ministry of Health, Welfare and Sports (VWS). The project was not subjected to the WMO but has been previously approved by the ethical review committee of Trimbos-Institute in 2022 (TET). The documents of the research that has been conducted have been slightly adapted to fit the current study. The documents that have been reviewed in 2022 include a project plan, information letter for participants and professionals, information about processing personal data, questionnaire about ethical aspects of the study, and drafts of the interview guides. Documents of the current study include information letter, information about processing personal data, informed consent, and the interview guide. These documents will be stored in a specific map: F: → 64-2013 Innovatie Tabaksontmoediging → Quiddy → Stage Rianne → _DATLOC.

Data planning

The main recruitment methods were spreading flyers on social media and offline in schools. Moreover, an article has been written and published in Quiddy with more information about this research and 60 app users received an e-mail with an invitation to participate in the study. Interested young adults had to fill in a Google Form with contact information or a Lime Survey questionnaire, to receive an email with more information about participation and the processing of personal data. Inclusion criteria included people aged 16 till 25 who (have) smoke(d) and know about Quiddy and its functions. Participants that did not fully complete the research were excluded.

Data has been collected via interviews, either via Teams or in real life. The number of measures is 1. Interviews have been analysed with the software MAXQDA. The owner of the data is Trimbos-institute. The research applicant is VWS, but they are not owners. An informed consent was sent to the participants prior to the data collection. The informed consent and permission for audio recording were be asked again before starting the interview. Direct users of the data are S. Troelstra and Ilse Rianne van Ravenhorst. The structure of the _DATLOC folder is according to the standard procedure of Trimbos (see Figure 3) with all files being anonymised.

Data collection

Rianne van Ravenhorst is the one that collected data and made sure that everything is stored in the right way. S. Troelstra provided her with guidance to ensure that everything was done correctly. The raw data was expected to be delivered at the beginning of April but was at the end of May. The expectation was that the final data will be delivered at the end of May or the beginning of June. Final data was delivered at the beginning of July.

Data storage

Trimbos' network drives are backed up automatically at various times during the day by ICT. During data collection, the following five people have access to the data: S. Troelstra, L. Koster and R. van Ravenhorst. These individuals have access to everything within the folder '64-2013 Innovatie tabaksontmoediging'. Only S. Troelstra and Rianne van Ravenhorst have access to the personal data, as this will be stored in a locked file. The research data will be kept for ten years, the contact data and informed consent for five years, audio recording will be deleted at the end of the research project and only the transcripts will be stored for a longer period. The transcripts are anonymised. Employees who have access to the '_DATLOC' folder will keep it once the internship is completed.

Figure 3

Trimbos project folder structure

- 1. General
- 2. Instruments
- 3. Raw data
- 4. Data transition
- 5. Final data
- 6. Informed consents

Appendix 6: Flyer interviews

Appendix 7: Interview guide

The relevant topics for the current study are highlighted

Ik wil je allereerst bedanken dat je mee wilt doen aan dit onderzoek. Ik zal mezelf even kort voorstellen.

Ik ben Rianne en ik ben bezig met de master Youth studies / Jeugdstudies aan de Universiteit Utrecht en hiervoor ben ik begonnen met mijn stage bij het Trimbos instituut. Ik ben aan het werk op de tabaksafdeling en ik ga onderzoek doen naar de stoppen-met-roken app, Quiddy. Ik ga verschillende interviews doen met gebruikers van de app en ik ga ook de gegevens in de app zelf analyseren. Het doel van de interviews is vooral de ervaringen met Quiddy en de meningen over Quiddy zelf en de functies van Quiddy in kaart brengen. Zo kan de app verbeterd worden.

Tijdens het gesprek van vandaag ben ik benieuwd naar jouw ervaringen en ideeën over Quiddy. Ik wil graag weten wat voor jou belangrijk is, wat voor ideeën en bedenkingen jij hebt. Er zijn geen goede of foute antwoorden. Het gaat erom wat jij vindt, en waarom jij dit vindt.

Voordat we verder gaan met het interview wil ik nog wat algemene informatie vertellen. Het interview zal ongeveer een halfuur tot driekwartier duren. Je mag op elk moment aangeven dat je een vraag niet wil beantwoorden of dat je wil stoppen met het onderzoek. Voorafgaand aan dit gesprek heb ik jou informatie gestuurd over de verwerking van persoonsgegevens, het doel van dit gesprek, en een toestemmingsverklaring. Dit houdt eigenlijk in dat de informatie uit dit gesprek zal worden gebruikt voor wetenschappelijk onderzoek, dat de persoonsgegevens beveiligd worden opgeslagen en dat de data anoniem verwerkt zal worden. Hiervoor wil ik jouw toestemming vragen. Daarnaast wil ik je vragen of je het goed vindt als ik dit gesprek opneem voor de analyse. Jouw naam zal hierop niet te horen zijn. Als laatste kan je aan het eind van dit gesprek bij mij aangeven of je een samenvatting van het gesprek wil ontvangen.

Ik zal zo de opname starten. Heb je daarvoor nog vragen?
Oké dan gaan we beginnen.
Na het starten van de opname
- Als je een opfrisser van Quiddy nodig hebt, heb ik een paar screenshots bij mij die ik je kan laten zien. Ook kan ik je een korte samenvatting geven van de functies van Quiddy. Wil je dit graag?

Met Quiddy wordt je gematcht aan een leeftijdsgenoot die dezelfde motivatie en valkuilen heeft als jij tijdens het stoppen met roken. Met de app kan je zien hoeveel dagen je al bent gestopt, hoeveel geld je hebt bespaard, en kan je op verschillende manieren beloningen verdienen in de vorm van badges. Je kan meer informatie lezen over onderwerpen die gerelateerd zijn aan roken, maar er zijn ook tips te vinden. Bijvoorbeeld voor je eerste stopdag. Daarnaast heeft het een noodknop die je kan inschakelen als je trek hebt in een sigaret. Zodat je kan chatten met een buddy, een spelletje kan spelen, met de Stoplijn kan bellen of een filmpje kan kijken voor afleiding.
1. Zou je misschien wat over jezelf willen vertellen? *(Leeftijd, opleidingsniveau, geslacht; hoe identificeer jij jezelf?)*

2. <mark>Ik neem aan dat je hebt gerookt of rookt, kan je hier misschien wat meer over vertellen?</mark> *(rookgedrag: hoeveel sigaretten in de week bijvoorbeeld, op wat voor momenten)*

3. Hoe ben jij in aanraking gekomen met Quiddy?
   a. Op welke manier zou je in aanraking willen komen met Quiddy?
   b. Heb je de sociale media campagne gezien voor Quiddy?
      Zo nee: Eerst laten zien
      i. Wat vind je hiervan?
      (Spreekt het aan? Waarom wel/niet? Is de 'call to action' duidelijk? Is het een goede manier om jongvolwassenen te bereiken?)
   c. Hoe kunnen we volgens jou jongvolwassenen bereiken zodat zij Quiddy gaan downloaden?

4. Wat waren de redenen dat jij Quiddy hebt gedownload? *(kan over alles gaan, bijvoorbeeld omdat ze de social media campagne hebben gezien)*
   a. Had jij doelen voor het gebruik van Quiddy? *(bijvoorbeeld stoppen met roken, minder roken etc.)*
      i. *Zo ja:* Wat waren deze doelen?
   b. Waarom heb je besloten om Quiddy te gebruiken om je doelen te bereiken?
   c. Op welke manier helpt Quiddy om jouw doelen te bereiken?
   d. Merk jij veranderingen nadat je Quiddy bent gaan gebruiken?
      (*Dit kan rookgedrag zijn, maar ook andere aspecten die zij eventueel willen benoemen*)
      i. *Zo ja:* Zijn deze veranderingen in lijn met jouw doel?

5. Heb je al eerder hulpmiddelen gebruikt bij het stoppen met roken?
   a. Zo ja, welke?
   b. Wat zijn volgens jou de **voordelen** van Quiddy ten opzichte van die andere stoppen-met-roken hulpmiddelen?
   c. En wat zijn volgens jou de **nadelen** van Quiddy ten opzichte van die andere stoppen-met-roken hulpmiddelen?

6. Maak jij op dit moment gebruik van Quiddy?
   a. Waarom wel/waarom niet?
   b. *Als ze Quiddy nu niet (meer) gebruiken:* Heb je Quiddy gebruikt?
      i. Zo ja: Waarom ben je ermee gestopt?
   c. *Hoelang gebruik je of heb je Quiddy gebruikt?*

7. Hoe gebruik je Quiddy? **Of** Hoe heb je Quiddy gebruikt?
   (manier van vragen afhankelijk van de vorige vraag) (laat screenshots zien waar nodig)
   a. Toepassen op de verschillende onderdelen. Wat gebruik je, hoe en wat vind je ervan? Of waarom gebruik je het niet?
      i. Chatfunctie
      ii. Noodknop

        iii.   Tips & info
        iv.   Dashboard (statistieken, badges, persoonlijke motivatie, motiverende quotes)
        v.   Profiel (Bio)

8. Over de verschillende functies van Quiddy:
   - Chatfunctie (hoe gebruik jij de chatfunctie?) → goed uitvragen
     - Verstuur je stellingen?
     - Waar heb je het over met elkaar?
     - Suggesties voor verbetering?
     - Wat zou je ervan vinden als een professional je buddy kan zijn en dat je daarmee kan chatten, zou dan de drempel lager zijn om professionele hulp te vragen?
     - Voeg je liever zelf mensen toe of wil je liever toegevoegd worden door anderen?
     - Zou je meer mogelijkheden in de chat willen zien? (zoals bijvoorbeeld zelf stellingen bedenken?)
   - Noodknop
     - Welke optie(s) kies je dan? En waarom die?
   - Tips & info
     - Welke artikelen lees je?
     - Wat spreekt je aan? En waarom?
     - Wat vind je van de 'wist je datjes?'
   - Dashboard
     - Wat vind je van de statistieken?
     - Wat vind je van de badges die je kan verdienen?
     - Heb je een motivatie foto of tekst ingevuld en waarom wel/niet? En wat vind je van de persoonlijke motivatie?
     - Wat vind je van de motiverende quotes?
   - Profiel
     - Heb jij je bio ingevuld?
     - Lees jij de bio van anderen weleens?

9. Hoe kan Quiddy verbeterd worden voor mensen zoals jij?
   a. Wat zijn dingen die je nog mist, en zou willen toevoegen?
   b. Welke dingen zou je weglaten?
   c. Ben je van plan om Quiddy te (blijven) gebruiken na dit gesprek?
      i. Waarom wel/waarom niet?
   d. Zou jij Quiddy aanraden aan je vrienden?
      i. Waarom wel/waarom niet?

Dat was de laatste vraag. Heb je nog vragen of zijn er nog dingen die je graag zou willen toevoegen?
Ik wil je nogmaals bedanken voor je deelname in dit onderzoek.

Link YT filmpje: https://www.youtube.com/watch?v=zJrI0sYZE34

Appendix 8: Codebook

Code System

Code System	Memo	Frequency
Code System		248
Kenmerken		0
Stopdoel en motivatie		0
Minderen haalbaarder		1
Zwangerschap als stopmotivatie		1
App met statistieken		1
Willen stoppen		7
Huid		1
Rokershoest		1
Niet verslaafd		1
Geld besparen		3
Gezondheid		9
Minderen en stoppen met roken		1
Persoonlijke kenmerken		0
MBO		1
25 jaar		1
VWO		1

17	1
23	1
WO	2
21 jaar	2
HBO	4
Vrouw	3
22	3
Rookgedrag	0
1 per dag huidige stoppoging	1
15 per dag voor huidige poging	1
20 per dag vorige stoppoging	1
Vrienden partner roken	1
Sigaretten trek blijft terugkomen	1
Stopmotivatie is zwangerschap	1
10 per dag	1
Sinds 16e	1
Op 17e/18e feestjes	1
Anderhalf jaar vast	1
Gestopt tijdje	1
Door omgeving	1

Ouders rookten	1
Vriendinnen roken	1
Dagelijks	1
Duur, vies, stinkt	1
11 per dag	1
Gezellig	1
pakje per week	1
Door vrienden	2
SInds 15e	2
Stress /druk	1
Soms dag zonder	1
Op 14e geprobeerd	1
Sinds 15e vast	1
7 per dag	1
20 per dag	1
Groepsdruk	1
5 jaar gerookt	1
Sinds 18e	1
Begonnen op 18e	1
Begonnen op feestjes	1

Uiteindelijk vast roken	1
Feestjes	4
Hoeveelheid ligt aan omgeving	1
Pakje per dag	1
Verveling	1
3 per dag	1
Vooral met anderen	2
Afwisselend	1
momentje voor jezelf in drukte	1
Gezelligheidsroker	1
2 jaar	1
6 a 7 per dag	1
Rookt sinds 19e	1
Vaste roker	1
Gewoonte roker	1
Onder vrienden	1
Vriendengroep rookt	1
Alcohol en roken	3
Mening over Quiddy	0
Positief	0

Fijne app	1
Quiddy aanraden	1
Quiddy logo sprak aan	1
Voor veels apps betalen	1
Positief over spelletje	3
Laagdrempelig	1
Vooral bij mentale gedeelte van stoppen met roken	1
Noodknop	1
Artikelen hielpen ook	1
Goede hoeveelheid badges	1
Positieve ervaringen	1
Anonimiteit	1
Idee spelletje goede afleiding	1
Motiverende quote	3
Badges	1
Buddy	1
Artikelen	2
Trek weg na afleiding artikel	1
Badges	2
Positief over afleidings spel en artikelen	2

Positief over Quiddy	1
Leuke wistje datjes	1
Geen nadelen	1
Andere app lelijker en minder gebruiksvriendelijk	1
Meer interactief door badges	1
Mooie app	1
Statistieken	1
Mooie layout	1
Badges	9
Zo lang gestopt	1
Gezondheidsfeitjes	3
Mogelijkheid om buddy aan te vragen	1
Algemeen tevreden	3
Hoeveelheid badges	1
Geld statistieken	6
Dag statistieken	2
Goede app	1
Negatief / verbeteringen	0
Mogelijkheid aanpassen gegevens	1
Quiddy mist bepaalde functies	1

Leefdtijd niet aanpasbaar	1
Quiddy toegankelijker voor zwangeren	1
Niet zichtbaar hoeveel sigaretten niet gerookt	1
Volledig zelfstandig	1
motivatie foto verdwijnt	1
Stoplijn dicht op moeilijke momenten	1
Moeilijk momenten niet veranderbaar	1
Nieuw account nodig voor accurate gegevens	1
Hoeveelheid sigaretten niet aanpasbaar	1
Stopdoel niet veranderbaar	1
Concreter doel kunnen invullen	1
Stopmotivatie persoonlijker maken	1
Idee om gewenste chatfrequentie te vragen en daarop de matchen	1
Quiddy niet aanraden vanwege problemen met buddy	1
Trek vermindert niet (omdat het niet medicatie oid is)	1
Motivatiefoto overbodig	1
Mogelijkheid mensen met verkeerde bedoelingen op de app	1
Te veel keuze uit spelletjes	3
Zichtbaar als buddy online is	1

Chatfunctie Stoplijn offline	2
Customizen van Quiddy	1
Zelf afleidingsdingen invullen	1
Dashboard klein en vol	1
Meer duidelijkheid over meerdere buddy's	1
Persoonlijkere motivatie	1
Mogelijkheid om bredere motivatie toe te voegen	1
Niet duidelijk dat je meerdere buddy's kan toevoegen	1
Frequentie badges neemt af	1
App ook zonder internet gebruiken	2
Buddy functie onduidelijk (1)	1
Helemaal geen meldingen	1
Geen melding badges	2
Buddy systeem gebruik	0
Buddy functie	0
Wel open voor toegevoegd worden door anderen	1
Motivatie foto toegevoegd	1
Geen zin meer na 2 buddy's die niet (meer) reageerden	1
Geen reactie buddy's	1
2 buddy's	1

Buddy lijkt handig	1
Benieuwd naar chatten met buddy's	1
Als behoefte er is wel chatten	1
Niet gechat met buddy	1
Bekende buddy	1
Geen reactie van buddy	2
Onbekende buddy	1
Wil wel onbekende buddy	1
Mogelijkheid random buddy onbekend	1
Geen mogelijkheid tot bekende buddy	1
Te veel berichten van buddy	1
Gechat	1
1 buddy	4
Liever real life	1
Real life buddy	2
Niet nodig	1
Ongemakkelijk	1
Geen buddy	3
Geen behoefte	3
Alternatief buddy	1

Buddy functie onduidelijk	1
Spannend om buddy aan te vragen	4
Zonder buddy proberen	1
Liever toegevoegd worden	2
Drempel buddy aanvragen	2