The first evaluation of a Mobile application to encourage social participation for community-dwelling older adults

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Abstract

Both loneliness and social isolation are linked to numerous negative health outcomes and there is no one-size-fits-all solution to reduce that loneliness and social isolation. Therefore, a new social technology (mobile application) which encourages social participation for community-dwelling older adults was developed and deployed. The objective of this study was to assess the usability, end-user experience, and potential added value of this mobile application among community-dwelling older adults. After recruitment and after the weeks of use participants were asked to complete a range of questionnaires, and log-data was gathered to provide information on actual use. Of the 91 older adults who started using the mobile application 41 (80% female, age 73.4 years (SD 7.8)) were willing to participate in this study. On average the application was used for 11 weeks. The usability was acceptable (SUS score of 65.3 (SD18.0)) and 59% of the participants were willing to continue using the application. To conclude, the mobile application to encourage social participation was accepted by community-dwelling older adults and the measured change in quality of life was positive and clinically meaningful. After improving the technology a next step is to assess the effectiveness and cost-effectiveness.

1 Introduction

Among community-dwelling older adults a lack of social contacts, and a social support network, is related to loneliness and social isolation [1, 2]. However, it is important to draw a distinction between loneliness and social isolation [3]. Loneliness can be defined as the subjective feeling of the absence of a social network or of a companion [4] and social isolation can be defined as an objective lack of interactions with others or the wider community [3]. In the literature, both loneliness and social isolation are linked to numerous negative health outcomes [5] comparable to the negative health outcomes of smoking, obesity, lack of exercise and high blood pressure [6]. These negative outcomes do not only affect the individual, but they also affect the community [7] by leading to increased use of health (emergency admissions and GP consultations) and social care services [8]. Given the demographic shift and ageing of the world population [9], there is a need to prevent and ameliorate loneliness and social isolation [10].

There is no one-size-fits-all solution to reduce loneliness and social isolation [7]. Two widely used interventions [11] are group-based and one-to-one interventions but unfortunately, the evidence concerning the effectiveness of these interventions are indistinctive [10, 12]. Revealing a shift from cure to prevention, and as social participation is considered to be the key to prevent loneliness and social isolation, current interventions are more likely to focus on promoting the creation and maintenance of high-quality social relationships [7].

Alongside face-to-face intervention, intervention supported by information and communication technology (ICT) could reduce loneliness and social isolation because, this way, communication in multiple forms, such as textual, audio and/or visual, can connect older adults with others anytime and

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anywhere. These kinds of ICT-supported interventions could be an effective tool to tackle social isolation among older adults [13]. A suitable ICT-supported intervention could be telephone befriending programs [14]. Another promising development is the increased use of social technology among older adults [15] where the number of opportunities to socially connect with others is boosted by the internet, through social networking sites and smartphone technology. There is some evidence that the use of social technologies reduces the level of loneliness and social isolation [15, 16]. In the Netherlands, a new social technology (mobile application) to encourage social participation for community-dwelling older adults is developed and implemented in the municipality of Enschede. Considering the maturity of this mobile application (not market-ready yet) the evaluation of this social technology focussed on the usability, end-user experience and potential added value. Therefore, this paper aims to present the results of an observational study concerning the usability, end-user experience and potential added value of a mobile application (GezelschApp) to encourage social participation in community-dwelling older adults.

2 Methods

2.1 Recruitment

Participants were recruited by flyers and by advertising in a local newspaper. After notifying their interest in using the mobile application a face-to-face appointment was scheduled with a social worker of the local welfare and wellbeing organization. During this home visit, participants received information about the mobile application. The social worker made an estimation of whether or not the interested older adult was a suitable user based on this visit and their experience with the target population. A suitable user was defined as those participants who experience feelings of loneliness and were willing to change their social behaviour. After the introduction of the mobile application, participants were asked to voluntarily participate in the study to assess the added value of the mobile application.

Participants were included in this study when they experience loneliness, they were residents of the municipality of Enschede, had sufficient understanding of the Dutch language and were aged above 60 years. A priori, it was our aim to include 75 older adults. According to Dutch law, the nature of this research did not require formal medical ethical approval and the appropriate ethics committee (METC Twente) ruled that no formal ethics approval was required in this particular study (K17–20). All participants who were willing to participate in this study gave their informed consent prior to starting the study.

2.2 Intervention

The mobile application (GezelschApp) is a social technology to encourage social participation of older adults. Social participation was encouraged by stimulating older adults to visit local activities together with (new) friends. The intervention, the mobile application, was accessible by smartphone, tablet and PC, and gave older adults access to a homepage with a tile for each of six features: an inbox for messages, news, activities, information, tips, and friends. In the inbox, users received messages concerning the current news, activities, information, tips and friend requests but they could also send messages to their friends and to their personal coach. The news tile provided the latest news concerning a healthy and active lifestyle. During the project, all activities in the municipality of Enschede were digitalized and made available online. There were sport activities, social activities, education activities, cultural activities, wellbeing activities, culinary activities, and other activities suitable for older adults. The activities tile listed all activities in the user's neighbourhood. Matching activities were presented based on the interests of the user (profile information and user data). The Information tile listed information concerning social activities, healthy and active ageing, and the use of the application. The Tips tile provided tips to increase the number of social activities and social interactions. Participants can become friends with other users by sending and accepting friend requests. The Friends tile listed all users of the mobile application but only their friends and their coach could see the full contact details of a user. Friends can send each other messages and invite each other for activities.

After inclusion, during the aforementioned face-to-face meeting, participants received training to learn how to use the mobile application. The participant received their personal access code (username and password) and learned how to login to the application. Next, together with the social worker, the participant created a user account and profile information; a screen image, interests and hobbies were added to the account. During this training, the social worker also sent a first friend request to the participant and this request needs to be accepted because, during the use of the mobile application, this social worker will coach him/her to participate in activities and close (online) friendships.

To enhance the coaching activities the social worker can see a clear overview of whether a user sends a friend request, accepts a friend request or participates in activities. With this information, the social worker provided tailor-made coaching to the user with the aim of increasing the use of the application and encouraging social participation. The participants were asked to use the mobile application for at least three months.

2.3 Measurements

Taken into account the maturity of the technology this paper focussed on the endpoints: acceptability of the technology and

potential added value [17, 18]. Therefore, the usability, end-user experience, level of experienced loneliness and quality of life were assessed. Participants were asked to complete questionnaires to assess the level of experienced loneliness and quality of life before starting (pre-test) and after the end (post-test). The questionnaires concerning usability and end-user experience were only completed by the participants post-test. The log-data of the mobile application was gathered to provide information on the actual use of the technology. A comprehensive overview of the evaluation was published in an earlier paper [19]. The social workers were also asked to complete the usability and end-user experience questionnaires post-test.

2.3.1 Questionnaires

The usability of the application was assessed with the System Usability Scale [20]. The SUS presented ten statements about the perceived usability of the application. End-user experience of this application was assessed by means of a questionnaire with summated rating scales, based upon the Technology Acceptance Model (TAM) [21]. We expanded TAM with factors that have been found to shape the user experience of mHealth technology: Enjoyment [22], Aesthetics [23], Control [24], Trust in the technology [25] Ease of use [21] and Intention to use [21]. This questionnaire was also completed post-test by the social workers.

To assess the level of loneliness, the De Jong Gierveld loneliness scale (DJGLS) [26] was used. The DJGLS is composed of eleven items, six negatively formulated and five positively formulated, with the three response categories ("no," "more or less," and "yes"). The total scale score is the sum of the item scores, ranging from 0 (not lonely) to 11 (extremely lonely). A score of three or higher is an indication of loneliness [27].

Quality of life was measured by the 12-item Short Form questionnaire version 1 (SF-12v1) [[28]]. The SF-12 is a generic instrument including 12 items measuring health-related quality of life (HRQoL). Six items are summed into a Physical Component Summary (PCS) and six items are summed into a Mental Component Summary (MCS). The total score for both scales ranges from 0 to 100, with a higher number indicating a higher quality of life.

2.3.2 Log-data

Actual use of the technology was presented by active use per week, friend requests, and viewed content. Active users were defined as those who used the technology at least one time during the week.

2.4 Statistical analysis

All outcome measures were visually inspected for normal distribution of data using corresponding histogram plots, including normal curves and normal probability plots, prior to the selection of appropriate statistical tests. Descriptive statistical methods were applied for each of the outcome measures (demographic characteristics, usability, end-user experience, level of experienced loneliness, and quality of life). The presentation of data was by calculation of mean ± standard deviation (SD), or by median with range. To assess the improved level of experienced loneliness and quality of life (pre-test versus post-test) a paired student t-test was performed. For statistical analysis, the level for significance was set at $\alpha < 0.05$.

3 Results

In total, 91 older adults who were assessed by the social worker as suitable users started to use the GezelschApp during the evaluation period. However, only 41 older adults who met the predefined inclusion criteria were willing to participate in this study. The remaining 50 older adults were willing to use the GezelschAPP, but not to participate in this study and for these participants, no demographic characteristics are gathered. The demographic characteristics of the older adult participants are presented in Table 1. Of the older adults 80% was female and the mean age was 73.4 years (SD ± 7.8). Concerning the living situation, 15% of the participants were living together with a partner or spouse and 85% of the participants were living alone. All participants were community-dwelling older adults and were retired or unemployed. Eight participants were not willing to complete the post-test questionnaires and are considered as dropouts. To increase the total number of participants post-test, the participants who were first not willing to participate were also asked to complete the usability and user-experience questionnaire online post-test. Twenty users responded positively and completed the requested questionnaire (65% female, average age 71.7 years (SD ± 8.1). In total six social workers of the local welfare and wellbeing organization were involved. Four were female and two were male. The average age of the social workers was 54.0 (SD ± 11.7) years old. The total evaluation period was 39 weeks.

3.1 Usability

In total, 51 users of the mobile application completed the System Usability Scale. With a SUS score of 65.3 (SD ± 18.0) these users rated the usability of the GezelschApp as "OK" and the level of acceptability as marginal high. The six social workers were less positive. Their SUS score was 61.3 (SD ± 10.0) indicating a marginal low level of acceptability.

Table 1 The demographic characteristics of the participants (n = 41)

Gender	Male	20%
	Female	80%
Age (years)	73.4 (SD ± 7.8)	
Level of education	elementary school	3%
	lower vocational education	28%
	vocational education	10%
	high school	18%
	higher vocational education or university	41%
Living Situation	together	15%
	alone	85%
Attitude towards technology	positive	22%
	neutral	66%
	negative	12%
Score on DJGLS	5.6 (SD 3.6)	
Level of loneliness	not lonely (score 0, 1 or 2)	25%
	moderate lonely (score 3 through 8)	46%
	severe lonely (score 9 or 10)	22%
	very severe lonely (score 11)	7%

3.2 End-user experience

Overall, 59% of the users were willing to continue using (intention to use) the GezelschApp. Notably, they were especially positive about the "Ease of use". On the other scales the majority of the users was ambiguous and had no clear opinion (positive vs. negative on the constructs). The social workers' opinions tended to be more positive on all constructs of end-user experience (Table 2), with the exception of the construct "Control".

3.3 User statistics

Figure 1 provides an overview of the number of active users per week during the evaluation period. Initially a total of 91 older adults used the GezelschApp and every week on average

there where 10.6 active users (SD ± 4.9). Of the 91 users, 5.5% never used the GezelschApp, 19.8% used the app for less than four weeks, 29.7% used the app between four and twelve weeks, 31.9% used the app between thirteen and twenty-four weeks and 13.2% used the app more than twenty-four weeks. On average the users used the GezelschApp for 11.2 weeks (SD ± 9.3).

In total, 72% of the users accepted a friend request. During the evaluation period, 104 friend requests were accepted (50% with a social worker and 50% with another user). In total 286 posts (7.3 posts a week) were published on the mobile application; there were 135 posts on activities, 100 posts on tips for active and healthy ageing, 27 posts on news and 24 posts with general information on active and healthy ageing. These 286 posts were read 1384 times. On average every post was read by 21 users (range 12–27). The users were most interested in

Table 2 Score on end-user experience for users (n = 51) and social workers (n = 6)

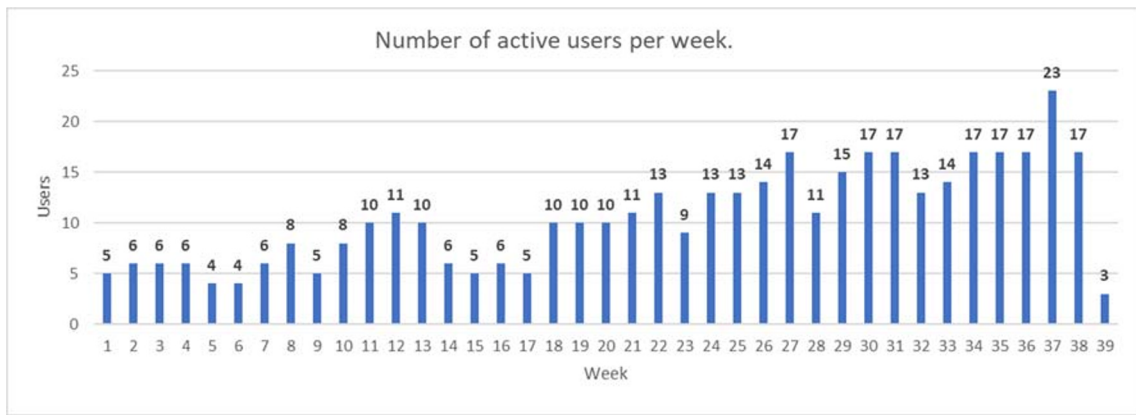|		Users (n = 51)			Social workers (n = 6)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Enjoyment	3.4 (SD ± 1.1)	29%	67%	4%	83%	17%	–
Aesthetics	2.8 (SD ± 1.1)	45%	53%	2%	67%	33%	–
Control	3.1 (SD ± 1.4)	41%	59%	–	33%	67%	–
Trust in technology	3.1 (SD ± 1.0)	35%	63%	2%	67%	17%	17%
Ease of use	2.7 (SD ± 1.4)	57%	39%	4%	67%	13%	–
Intention to use	2.7 (SD ± 1.5)	59%	41%	–	100%	–	–

Fig. 1 Number of active users per week

activities and these posts were on average read by 27 users. The users were less interested in news and these posts were on average read by 12 users.

3.4 Level of experienced loneliness

The level of experienced loneliness did not significantly change ($p \geq 0,442$) after the use of the mobile application. Pre-test, the users ($n = 32$) scored 5.9 (SD ± 3.5) and post-test this score increased slightly to 6.3 (SD ± 3.6). Overall, 31% of the users showed a decrease in their level of experienced loneliness.

3.5 Quality of life

On average, the MCS score of the SF-12 increased by 6 points. This increase is clinically meaningful as there is a general consensus that changes of 2–3 points in SF-12 scores are clinically relevant [29]. In addition to this, the positive change of the Physical Health Component (PCS) is also clinically meaningful (Table 3). Overall, two-thirds of the users showed a clinically meaningful change on the SF-12 MCS or PCS. However, the increase scores on the MCS and the PCS of the SF-12 after the use of the mobile application were not significant ($p \geq 0,062$).

4 Discussion

The aim of this paper was to present the results of an observational study concerning the usability, end-user experience and potential added value of a mobile application to encourage social participation of community-dwelling older adults. The users of the mobile application were enthusiastic; they rated the usability as acceptable, were positive about its ease of use, and the majority was willing to continue using the mobile application.

On average the application was used for 11 weeks by the older adults. During the evaluation period, friend requests were accepted and older adults made new friends. The older adults were most interested in posts on activities in their neighbourhood. The level of experienced loneliness did not change after the intervention period. However, the positive change in the quality of life was clinically meaningful.

A systematic review [30] summarized interventions targeting loneliness and social isolation among older adults. Only four studies included technology such as a companion robot, telephone befriending intervention, internet use and a Care TV intervention. However, this systematic review supports the use of technology interventions since three of these studies reported significant findings for alleviating loneliness and social isolation. They concluded that interventions supported by technology offer a potential, as technology can be tailored to match the specific needs of older adults. It is important to note that, to be successful, sufficient training on how to properly use the technology must be provided for the older adults [30]. This point is stressed in another systematic review [13] on the effect of ICT supported interventions for reducing social isolation in older adults. They conclude that these interventions, in general, are promising tools to tackle social isolation among older adults, but not for every older adult.

The main reason to develop the GezelschApp to reduce social isolation and loneliness in older adults, and not use an existing application such as Facebook, was to secure their safety. It was important to eliminate unwanted relationships from arising such as those that prey on vulnerable and lonely

Table 3 Quality of life (SF-12) score pre- and post-test ($n = 33$)

	Pre-test	Post-test	
SF-12 MCS	61.7 (SD21.8)	67.8 (SD23.7)	$p = 0.062$
SF-12 PCS	60.8 (SD20.9)	64.6 (SD25.2)	$p = 0.256$

older adults. Therefore, a secure and safe (online) environment was requested and a non-public application was developed which imbedded an initial screening contact between the interested older adults and the social worker of the local welfare and wellbeing organization. It was also important to promote the use of the GezelschApp and to help the older adults to participate in activities and close (online) friendships. This is why an active coach was requested, a role which is not foreseen in existing mobile applications.

The implementation of the GezelschApp in daily practice along with a local welfare and wellbeing organization is the key strength of this study. This setting, in contrast to a more controlled setting such as in a lab, allows for a demonstration of the true potential of this mobile application in the real world. As with any other real-world setting, the participants were free to use the mobile application at any time, whenever they liked, and they were not instructed on how much time to spend using it.

A weakness of this study is the selection bias of the participants since using the mobile application was voluntary. The majority of the older adults who were willing to participate were technology-minded and had a basis of skills to use a (smart) phone, tablet or laptop. In addition, female participants were overrepresented in this study. However, as more women than men tend to report loneliness [31] the higher amount of female participants in this study is not surprising. It has also been suggested that disclosing loneliness may be more acceptable for women than for men [1]. This observational study focussed on usability, end-user experience and potential added value and, as no control group was included in this study, no definitive conclusions can be made about the changes in the level of experienced loneliness and quality of life. After improving the technology based on the outcome of this study a next step is to implement and evaluate the GezelschApp in a broader context and to assess the effectiveness and cost-effectiveness. For this future study, a stepped wedges cluster design [32] can be a promising design to gain further insight and to foster implementation.

Given the results of this study, the GezelschApp is a mobile application to encourage social participation for community-dwelling older adults. This social technology is easy to use and a majority of the older adults are willing to continue using the GezelschApp. After a period of use, the older adults experienced a clinically meaningful increase in quality of life.

Compliance with ethical standards Declaration of interest statement.

AF and AN are employees of 8ting, the organization who is responsible for implementation of the Tingit Platform on which the GezelschApp is based on.

Conflict of interest The authors declare that they have no competing of interests.

References

1. Dahlberg L, et al. Predictors of loneliness among older women and men in Sweden: a national longitudinal study. Aging Ment Health. 2015;19(5):409–17.
2. Dykstra PA, van Tilburg TG. And J.d.J. Gierveld, *Changes in Older Adult Loneliness: Results From a Seven-Year Longitudinal Study.* Research on Aging. 2005;27(6):725–47.
3. de Jong Gierveld, J., T. van Tilburg, and P.A. Dykstra, *Loneliness and Social Isolation*, in *The Cambridge Handbook of Personal Relationships*, A.L. Vangelisti and D. Perlman, Editors. 2006, Cambridge University Press: Cambridge p 485-500.
4. *Loneliness : a sourcebook of current theory, research, and therapy*, L.A. Peplau and D. Perlman, Editors. 1982, Wiley: New York :.
5. Leigh-Hunt N, Bagguley D, Bash K, Turner V, Turnbull S, Valtorta N, et al. An overview of systematic reviews on the public health consequences of social isolation and loneliness. Public Health. 2017;152:157–71.
6. Cacioppo JT, Hawkley LC, Norman GJ, Berntson GG. Social isolation. Ann N Y Acad Sci. 2011;1231(1):17–22.
7. Cotterell N, Buffel T, Phillipson C. Preventing social isolation in older people. Maturitas. 2018;113:80–4.
8. Windle, K., J. Francis, and C. Coomber, Preventing loneliness and social isolation: interventions and outcomes. 2011.
9. *World Health Organization. World report on ageing and health.* 2015, Luxembourg.
10. Dickens AP, Richards SH, Greaves CJ, Campbell JL. Interventions targeting social isolation in older people: a systematic review. BMC Public Health. 2011;11:647.
11. Landeiro, F., et al., *Reducing social isolation and loneliness in older people: a systematic review protocol.* BMJ Open, 2017. **7**(5).
12. Gardiner C, Geldenhuys G, Gott M. Interventions to reduce social isolation and loneliness among older people: an integrative review. Health Soc Care Community. 2016.
13. Chen Y-RR, Schulz PJ. The effect of information communication technology interventions on reducing social isolation in the elderly: a systematic review. J Med Internet Res. 2016;18(1):e18–8.
14. Cattan M, Kime N, Bagnall AM. The use of telephone befriending in low level support for socially isolated older people–an evaluation. Health Soc Care Community. 2011;19(2):198–206.
15. Czaja SJ. The role of Technology in Supporting Social Engagement among older adults. Public Policy & Aging Report. 2017;27(4):145–8.
16. Chopik WJ. The benefits of social technology use among older adults are mediated by reduced loneliness. Cyberpsychol Behav Soc Netw. 2016;19(9):551–6.

17. DeChant HK, et al. Health systems evaluation of telemedicine: a staged approach. Telemed J. 1996;2(4):303–12.

18. Jansen-Kosterink S, Vollenbroek-Hutten M, Hermens H. *A renewed framework for the evaluation of telemedicine*. In *8th International Conference on eHealth, Telemedicine, and Social Medicine: eTELEMED (Vol.* 2016*)*. Venice, Italy; 2016.

19. S. Jansen-Kosterink, P. Varenbrink, and A. Naafs, *The GezelschApp - A Dutch Mobile Application to Reduce Social Isolation and Loneliness*. 2018. p. 142–147.

20. J. Brooke, *SUS - a quick and dirty usability scale*, in *Usability Evaluation in Industry*, P.W. Jordan, B. Thoma, and B.A. Weerdmeester, Editors. 1995, Taylor & Francis: London. p. 189–194.

21. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q. 1989;13(3):319–40.

22. Crutzen R, Cyr D, de Vries NK. Bringing loyalty to e-health: theory validation using three internet-delivered interventions. J Med Internet Res. 2011;13(3):e73.

23. Baumel A, Muench F. Heuristic evaluation of Ehealth interventions: establishing standards that relate to the therapeutic process perspective. JMIR Ment Health. 2016;3(1):e5.

24. Hawkins RP, Han JY, Pingree S, Shaw BR, Baker TB, Roberts LJ. Interactivity and presence of three eHealth interventions. Comput Hum Behav. 2010;26(5):1081–8.

25. Van Velsen L, et al. Trust in telemedicine portals for rehabilitation care: an exploratory focus group study with patients and healthcare professionals. BMC Medical Informatics and Decision Making. 2016;16(1):11.

26. de Jong-Gierveld J, Kamphuls F. The development of a Rasch-type loneliness scale. Appl Psychol Meas. 1985;9(3):289–99.

27. van Tilburg TG, de Jong Gierveld J. Reference standards for the loneliness scale. Tijdschr Gerontol Geriatr. 1999;30(4):158–63.

28. Ware J Jr. M. Kosinski, and S.D. Keller, *A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity*. Med Care. 1996;34(3):220–33.

29. Ware, J.E., et al., *SF-12 : how to score the SF-12 physical and mental health summary scales*. 1995, Boston, Mass.: Health Institute, New England Medical Center.

30. Poscia A, Stojanovic J, la Milia DI, Duplaga M, Grysztar M, Moscato U, et al. Interventions targeting loneliness and social isolation among the older people: an update systematic review. Exp Gerontol. 2018;102:133–44.

31. Dahlberg L, Agahi N, Lennartsson C. Lonelier than ever? Loneliness of older people over two decades. Arch Gerontol Geriatr. 2018;75:96–103.

32. Hemming K, Haines TP, Chilton PJ, Girling AJ, Lilford RJ. The stepped wedge cluster randomised trial: rationale, design, analysis, and reporting. BMJ : British Medical Journal. 2015;350.