

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email editorial.bmjopen@bmj.com

BMJ Open

Engaging older people in an Internet platform for cardiovascular risk self-management: a qualitative study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-019683
Article Type:	Research
Date Submitted by the Author:	19-Sep-2017
Complete List of Authors:	Van Middelaar, Tessa; Academic Medical Center, Neurology; Radboud University Medical Center, Neurology Beishuizen, Cathrien; Academic Medical Center, Neurology Guillemont, Juliette; University of Toulouse, Epidemiology and public health Barbera, Mariagnese; University of Eastern Finland, Clinical Medicine/Neurology Richard, Edo; Academic Medical Centre, Neurology; Radboud University Medical Center, Neurology Moll van Charante, Eric; Academic Medical Center, General Practice
Primary Subject Heading:	Qualitative research
Secondary Subject Heading:	Cardiovascular medicine, General practice / Family practice
Keywords:	eHealth, prevention and control, primary health care, cardiovascular diseases, QUALITATIVE RESEARCH, implementation

SCHOLARONE™
Manuscripts

only

1
2
3 **Engaging older people in an Internet platform for cardiovascular risk self-management: a**
4
5 **qualitative study**
6

7 T. van Middelaar^{1,2}, C.R.L. Beishuizen¹, J. Guillemont³, M. Barbera⁴, E. Richard^{1,2}, E.P. Moll van
8 Charante⁵, on behalf of the HATICE consortium*

9
10
11
12
13 ¹ *Department of Neurology, Academic Medical Center (AMC), Amsterdam, the Netherlands.*

14
15 ² *Department of Neurology, Donders Institute for Brain, Cognition and Behaviour, Radboud University*
16 *Medical Center, Nijmegen, the Netherlands.*

17
18 ³ *INSERM, University of Toulouse UMR 1027, Toulouse, France.*

19
20
21 ⁴ *Institute of Clinical Medicine/Neurology, University of Eastern Finland,*
22 *Kuopio, Finland*

23
24
25 ⁵ *Department of General Practice, Amsterdam Public Health research institute, Academic Medical*
26 *Center (AMC), Amsterdam, the Netherlands.*

27
28
29 **The list of HATICE consortium members is stated at page19.*

30
31
32
33
34 **Short title:** Engaging older people in eHealth

35
36 **Manuscript category:** Research article for BMJ open

37
38 **Word count:** abstract 257, manuscript 4143, references 27, table 1, box 1.

39
40
41
42
43 **Corresponding author:**

44
45 T. van Middelaar

46
47 Department of Neurology, Academic Medical Center

48
49 Meibergdreef 9, 1105 AZ Amsterdam, the Netherlands

50
51 Telephone: +31-20-5663446

52
53 E-mail: t.vanmiddelaar@amc.uva.nl

Abstract

Objectives - To study older peoples' experiences with an interactive Internet platform for cardiovascular self-management, to assess which factors influence initial and sustained engagement.

To assess their views on future use within primary care.

Design - Qualitative semi-structured interview study, with thematic analysis.

Setting - Primary care in the Netherlands.

Participants - People ≥ 65 years with an increased risk of cardiovascular disease who participated in the 'Healthy Ageing Through Internet Counselling in the Elderly' (HATICE) trial. Participants were selected using a purposive sampling method based on gender, age, level of education, cardiovascular history, diabetes, duration of participation and login frequency.

Results - We performed 17 interviews with 20 participants, including three couples. In the initial phase, platform engagement was influenced by perceived computer literacy of the participants, user-friendliness, acceptability and appropriateness of the intervention, and the initial interaction with the coach. Sustained platform use was mainly facilitated by a relationship of trust with the coach. Other facilitating factors were regular automatic and personal reminders, clear expectations of the platform, incorporation into daily routine, social support and a loyal and persistent attitude.

Perceived lack of change in content of the platform could work both stimulating and discouraging.

Participants supported the idea of embedding the platform into the primary care setting.

Conclusions - Human support is crucial to initial and sustained engagement of older people in using an interactive Internet platform for cardiovascular self-management. Regular reminders further facilitate sustained use and increased tailoring to personal preference is recommended. Embedding the platform in primary health care may enhance future adoption.

Keywords: eHealth, prevention and control, primary health care, cardiovascular diseases, qualitative research, implementation

Strengths and limitations of this study

- We focused on the experiences of older people which is of increasing importance in view of global ageing.
- We iteratively adapted our interview guide to separately address influential factors on sustained engagement, as long-term adherence to lifestyle changes is a major challenge in cardiovascular prevention.
- Data collection with semi-structured interviews and our purposive sampling method provided us with a broad view of people's experiences and provided insight into individual differences.
- We only interviewed Dutch people, potentially limiting the scope to the Dutch health care setting.

Funding

The HATICE trial is funded by the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 305374. TvM was supported by an EU Joint Programme - Neurodegenerative Disease Research (JPND) project. The project is supported through the following funding organisations under the aegis of JPND – www.jpnd.eu: Finland, Suomen Akatemia (Academy of Finland, 291803); France, L'Agence Nationale de la Recherche (The French National Research Agency, ANR-14-JPPS-0001-02); Germany, Bundesministerium für Bildung und Forschung (BMBF) (The Federal Ministry of Education and Research, FKZ01ED1509); Sweden, Vetenskapsrådet (VR) (Swedish Research Council, 529-2014-7503), The Netherlands, ZonMw (The Netherlands Organisation for Health Research and Development, 733051041).

Competing interest

None to declare.

Author contributions

T. van Middelaar: study design, data acquisition, data analysis, data interpretation, drafting the manuscript.

C.R.L. Beishuizen: study design, data acquisition, data analysis, data interpretation, drafting the manuscript.

J. Guillemont: data interpretation, critical revision of manuscript.

M. Barbera: data interpretation, critical revision of manuscript.

E. Richard: study design, data interpretation, critical revision of manuscript.

E.P. Moll van Charante: study design, data interpretation, critical revision of manuscript.

Data sharing statement: Data will not be made publicly available. For more information, please contact the corresponding author.

INTRODUCTION

In view of global ageing and the associated increasing burden of cardiovascular disease (CVD), prevention has become crucial.¹ The effectiveness of preventive interventions is indisputable, even in old age.^{2,3} However, adherence to long-term lifestyle and medication regimens remains a daunting challenge. Average adherence rates for chronic illnesses are as low as 50%.⁴ Currently, in several countries, cardiovascular risk management programmes are implemented into primary care and delivered by practice nurses.⁵ eHealth is a promising tool for delivery of prevention, by enabling self-management and improving the reach and sustainability of pre-existing preventive programs.⁶ In particular, an eHealth platform combined with human support (i.e. a blended approach) has shown beneficial effects on cardiovascular risk factors.⁷ The effectiveness of eHealth interventions on cardiovascular risk factors declines over time, especially after one year follow-up.⁷ This is probably due to a decreased long-term adoption, which is potentially influenced by factors such as perceived appropriateness and accessibility of the intervention.^{7,8} To increase the chance of successful implementation of an eHealth intervention, it is important to assess the views of end-users.^{9,10} Our primary aim was to study older peoples' experiences with an interactive Internet platform for cardiovascular self-management, to assess which factors influence initial and sustained engagement. Our secondary aim was to assess older people's views on implementation of such a platform in the primary care setting.

METHODS

Setting and participants

This qualitative study with semi-structured interviews was performed among participants of the 'Healthy Ageing Through Internet Counselling in the Elderly' (HATICE, ISRCTN48151589) trial.¹¹ HATICE is designed to investigate whether an Internet platform for cardiovascular self-management can improve the cardiovascular risk profile. People ≥ 65 years with an increased risk of cardiovascular disease were recruited to participate in HATICE in the Netherlands, Finland and France. Computer

1
2
3 illiteracy, defined as the inability to send an email, was an exclusion criteria for the trial. Through a
4 thorough design and validation process we developed the Internet platform for cardiovascular self-
5 management, adapted to meet the specific requirements of older people.^{12 13} The platform offers
6 blended care by remote support of a health-coach trained in motivational interviewing techniques
7 and the 'stages of change' model.^{14 15} Participants can send messages and receive feedback from
8 their coaches within the platform. Other functionalities of the platform include the ability to set
9 lifestyle goals, record measurements (e.g. blood pressure, weight), receive information on
10 cardiovascular risk and healthy lifestyle, and subscribe to lifestyle groups. The layout and navigation
11 structure were kept simple to make the platform user-friendly for older people. The content was
12 regularly updated with news items on relevant developments in cardiovascular prevention. The
13 intervention was solely delivered via the platform, except for an initial in-person meeting with their
14 coach at baseline, during which first lifestyle goals were set, and a phone call after 12 months follow-
15 up.

16
17 This qualitative sub-study was only performed among Dutch intervention participants. They were
18 purposively sampled on gender, age, level of education, history of CVD, diabetes, duration of
19 participation, and login frequency. Participants that prematurely ended their participation were also
20 invited. Twenty out of 32 participants that were invited by telephone were willing to partake in the
21 interview. Main reasons for people to decline participation were lack of time and too little overall use
22 of the platform, even though we specifically aimed to also include these participants. The HATICE
23 trial and this qualitative sub-study were approved by the medical ethics committee of the Academic
24 Medical Centre in the Netherlands. All participants provided written informed consent.

25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 **Data collection**

50
51 Between July 2016 and January 2017 three researchers (TvM [MD], CB [MD] and Suzanne van
52 Rhijn[MSc]) held semi-structured interviews following an interview guide (Appendix 1), focusing on
53 participant experiences with the platform. We iteratively adapted the interview guide during the
54
55
56
57
58
59
60

1
2
3 data collection period. For example, we decided to separately address initial and sustained use as
4
5 distinct phases in the engagement and adoption of the intervention, as sustained engagement is
6
7 especially challenging in lifestyle interventions.⁷ During the interviews, participants were asked to log
8
9 onto the platform to stimulate the discussion. The interviewers all had experience with conducting
10
11 qualitative interviews. Two of the interviewers (TvM and CB) were involved in the design and
12
13 maintenance of the platform (the participants were not made aware of this) and one (SvR) in the
14
15 logistical support of the trial. The interviewers and participants had no professional relationship prior
16
17 to the interview. Participants were interviewed in private at their homes and the interviews lasted
18
19 approximately 50 minutes. No repeat interviews were deemed necessary. Interviews were
20
21 audiotaped and transcribed verbatim and during the interviews field notes were taken.
22
23
24
25

26 **Coding and analysis**

27
28 Two researchers (TvM and CB) thematically analysed the transcripts in an iterative process.¹⁶ First,
29
30 each researcher independently coded transcripts following an inductive approach; next the
31
32 researchers discussed each other's codes to achieve inter-observer agreement. Subsequently, the
33
34 researchers together categorized the codes to generate a structure of main themes and subthemes.
35
36 Themes were derived from the data and were not hypothesized prior to data collection. After the
37
38 first seven interviews, an interim analysis was performed to fine-tune the interview guide, leading to
39
40 a better distinction between initial and sustained engagement with the platform. Questions about
41
42 initial engagement were asked to all participants and about sustained engagement to participants
43
44 who had been in the study for at least six months. After 17 interviews, data saturation was reached
45
46 as no new (sub)themes or issues emerged.
47
48
49
50

51 **RESULTS**

52
53 We performed 17 interviews with 20 participants (Table 1). Three interviews took place with couples
54
55 participating in the HATICE trial together, one of which had prematurely dropped out from the trial.
56
57
58
59

1
2
3 The age of the participants ranged from 65 to 84 years. Ten (50%) participants had a history of CVD
4 and six (30%) had diabetes. Length of participation in the trial ranged from short (2-3 months, n=8
5 [40%]), intermediate (7-11 months, n=6 [30%]), to long (14-17 months, n=6 [30%]).
6
7
8
9

10 11 **Initial platform engagement**

12 *User-friendliness for older people*

13 Participants found the layout of the platform clear and simple which facilitated platform use.
14
15 However they stated that a more attractive platform could have encouraged them to log in more
16
17 often:
18
19

20
21 *"You should have a website that makes you think, when you have some spare time at night or*
22 *in the afternoon, why don't I just have a look at HATICE." [P8]*
23

24
25 Technical difficulties in using the platform, for example login difficulties, discouraged participants.
26
27 Also, the notion of being inexperienced or incompetent with a computer or with the Internet could
28
29 hamper exploration of the platform and platform use. Sometimes, participants, together with their
30
31 coach, found creative ways to use the platform when this was considered difficult:
32
33

34 *"I'm not a computer freak. (...) Once I receive a message then I answer it. And then she*
35 *[coach] says, you should also complete it in the category that it belongs to [measurement]. To*
36 *me it is not easy to find that [...] But then later I notice that she has neatly entered it [in the*
37 *measurement functionality]. I think that's fine." [P12]*
38
39
40
41

42 People who regarded themselves as inquisitive or eager to learn said this stimulated them in
43
44 exploring the different functionalities of the platform.
45
46
47
48

49 *Coach: the basis for a relationship of trust*

50
51 For participants, trusting the coach was a prerequisite to talk about their health behaviours and
52
53 potential lifestyle goals. The in-person baseline consultation with their coach was much appreciated,
54
55
56
57
58
59

1
2
3 and formed a basis to build a relationship of trust. If the coach responded quickly and adequately to
4
5 messages sent after the baseline visit, this stimulated platform engagement:

6
7 *“At first I wanted... I really had no... I mean, I was actually curious. I did not think well this*
8
9 *will... for me... At a certain moment, also because of her [coach], I immediately received a*
10
11 *message back and she stimulated me, she said ‘oh well done’ and I don’t know what more.*
12
13 *That made me say, OK I will continue with this.” [P12]*

14
15 Instead, if messages were not answered timely, participants became discouraged to continue using
16
17 the platform. Some participants found personal contact through the messaging system insufficient to
18
19 build a relationship and missed face-to-face or telephone contact.
20
21

22 23 *Appropriateness of the intervention*

24
25 During their first encounter with the platform, participants tended to focus on a small number of
26
27 functionalities that appeared useful and relevant, and continued with these over time. This mostly
28
29 concerned the messaging and measurement functionalities:
30
31

32 *“When I receive an email I will go to the website and log in. And then I see what happened*
33
34 *[message] and have a look. And sometimes I’m asked to complete a questionnaire and I do*
35
36 *that. And other times, as is the case now, I’ll go to the practice nurse; well then I have my*
37
38 *blood and urine tested, and I send those along [send results to the coach].” [P16]*

39
40 Some participants reported affinity with self-management and self-measuring of cardiovascular risk
41
42 factors. They perceived the measurement functionality as useful and appropriate, facilitating
43
44 platform use. Conversely, limited affinity with self-management could form a barrier to use this
45
46 functionality:
47
48

49 *“And I absolutely do not want my own blood pressure monitor. I did not want that when it*
50
51 *[blood pressure] was too high and I certainly do not want it now that it is too low. Because I*
52
53 *get very uh... It will influence me and I don’t want that. I will not make myself crazy.” [P3]*
54
55
56
57
58
59
60

1
2
3 Participants who were aware of their cardiovascular risk status, in some cases because of a previous
4
5 CVD, deemed the content of the platform relevant. Participants with limited perceived need to
6
7 improve their lifestyle did not see how the platform could help them and tended to make limited use
8
9 of it:

10
11 *“I notice that it’s about CVD. That is all fine, but I don’t have that [history of CVD], so I will not*
12
13 *engage any further with it [the platform]. [...] Indeed, if I do encounter it [CVD], than I would*
14
15 *do it, but at this moment...” [P5]*

16
17 Age also played a role as one of the oldest participants no longer prioritised adapting a healthier
18
19 lifestyle because of his old age. Participants rarely adjusted or replaced the goals that were set at
20
21 baseline. Limited use was made of the suggestions for lifestyle groups; participants expressed several
22
23 reservations related to this functionality, such as that they thought that signing up created an
24
25 obligation to participate and that groups would be dominated by older people with very limited
26
27 functionalities.
28

31 32 **Sustained platform engagement**

33 34 *Coach: long-term relationship of trust*

35
36 As mentioned above, the coach was important to stimulate initial use of the platform. The coach also
37
38 appeared pivotal in sustained platform use. If participants felt connected to the coach, participants
39
40 felt inclined to keep using the platform and adhere to goals for lifestyle changes:
41

42
43 *“Yes, because the coach makes you try to accomplish certain things. [...] That would be more*
44
45 *difficult without the coach. I don’t know if... every time with the website... no, I don’t think*
46
47 *that that would work on its own [platform without coach].” [P9]*

48
49 The message content was also important; a positive and personal tone could boost someone’s
50
51 motivation. One interviewee also mentioned that a change in coach during the trial had a negative
52
53 effect on the connection with the coach, however he stated this did not hamper platform use.
54

Reactive use of the platform

In many interviews, participants expressed difficulty to take initiative in using the platform, and found it easier to use the platform in a reactive way, e.g. responding to automatic or personal reminders:

“Look, I like to participate in such a study, but... Perhaps I’m a bit more passive, that I think even if I have to have ten visits a year, that is fine. We will have a conversation; I will complete lists; that is all fine. But a website is... to figure things out, and to write things down, that is something... [Interviewer: Maybe you can call that initiative?] Yes I suppose that could be it.” [P14]

Participants who considered themselves as being loyal or persistent noted this stimulated sustained platform use:

“I was told to make contact once a month. And so I... It’s stated here in my iPad: remember HATICE, report! And so we plan to do that.” [P11]

Lifestyle change: expectations and experiences

Being motivated for lifestyle change was a reason to continue using the platform and vice versa. This could be related to the reason to participate in the HATICE trial. Some participants were aware that the trial entailed active participation and hoped that they might benefit from it. Others, who participated to contribute to scientific progress, seemed to expect a more passive participation; i.e. questionnaires or tests for which no self-initiative was required, and were not inclined to use the platform for self-management. Secondly, if people managed to reach their lifestyle goals and experienced its positive effects on their health, this stimulated sustained participation:

“Five kilometre laps. Yes, that is the minimum distance that I would like to walk each time. And I can achieve that quite nicely. And in that, I noticed that I started to feel fitter. That was really surprising. I always thought that I would stumble along through the rest of my life. And now I can... you get more fit. You have more enthusiasm to tackle things.” [P14]

1
2
3 In contrast, some participants felt setting a goal was an unpleasant burden. If they did not manage to
4 reach their goal, they refrained from registering this on the platform or informing their coach, also,
5 because they felt embarrassed or demotivated:
6
7

8
9 *“You got sort of forced to... Because you had to make certain promises, like ‘I will make sure*
10 *to exercise so many times a day’ and ‘I will make sure I will lose weight’. Those kinds of*
11 *things. Yes, that went against my gut feeling. [...] You were sort of embarrassed if you said,*
12 *well I actually did not do anything.” [P7]*
13
14
15
16

17 Participants appreciated the automatic feedback on entered measurements as it gave a reassuring
18 feeling of having their health monitored. This facilitated regular logging in.
19
20
21
22

23 *Incorporation into personal life*

24 Participants said that it was easier for them to keep using the platform if they had incorporated their
25 platform use into their daily or weekly routine:
26
27
28
29

30 *“Yes I like it. It works as a sort of support. In life you have all kinds of support systems, with*
31 *your habits and your things, and this is one of them. It has become a part of... Yes well*
32 *sometimes I can use it and sometimes I can’t. But it has become a part of everything.” [P2]*
33
34
35

36 Disruption of daily routines, such as illnesses, negatively affected platform use. Social support, on the
37 other hand, was an incentive for sustained use. This was especially true for couples participating in
38 the HATICE trial together:
39
40
41

42 *“I said, ‘We should do something.’ Then I started to fill those [questionnaires] in. And I said,*
43 *‘Are you going to do that?’ [Response partner:] ‘Yes I will do that, but I am very busy.’ I said,*
44 *‘It will only take a minute.’” [P10]*
45
46
47
48

49 Another important factor that facilitated platform-adherence was that the platform could improve
50 the perceived continuity of support in self-management. In contrast to nurse-led periodic
51 consultations, which are typical of secondary cardiovascular prevention programs, the platform felt
52 like a source of continuous support that they could direct to any time:
53
54
55
56
57
58
59
60

1
2
3 *"I already visit the practice nurse, but there is a lot of time in between [visits] and then yes...*
4
5 *Of course together we assess the results, look at it and discuss it. But when I'm gone, it [the*
6
7 *support] is also gone. Unless, of course, it turns out that I have to... that it's not quite OK. But*
8
9 *then it's gone again. And this is, the continuity that you're always working on it, that is good.*
10
11 *" [P2]*

12
13 Participants with frequent visits to a health professional stated that because they already received
14
15 enough care the added value of the platform was limited. Some participants found using the
16
17 platform was time-consuming, which worked as a barrier. This could occur because of the
18
19 misconception that they were obliged to regularly add measurements. In contrast, if participants felt
20
21 the platform did not take too much of their time they were inclined to keep using it.
22
23

24 25 26 *Perceived lack of change in the platform*

27
28 Most participants were not aware of any changes made to the platform content, although others
29
30 noted that news items were regularly updated. While several participants appreciated the stable
31
32 content, others would have liked to see more changes over time, to stimulate their sustained
33
34 engagement:
35

36 *"Well I read that [information on cardiovascular risk] a little in the beginning and then that is*
37
38 *that. Well now... And that does not change. I'm almost certain that this is the same as it was*
39
40 *1,5 year ago. [...] So that is not inviting; to keep looking if there is something new." [P15]*
41
42

43 The coach could influence this by varying the themes of conversation.
44
45

46 47 **Future implementation**

48
49 Participants indicated that the level of incorporation into the regular health care system was limited,
50
51 and therefore some of them felt the platform had no clear added value on top of the nurse-led
52
53 cardiovascular risk management they already received within the primary health care. Regarding
54
55 future implementation, participants felt positive toward incorporation of the platform into the
56
57

1
2
3 existing primary care structure. Especially if the practice nurse were to become their coach, thus
4
5 contributing to continuity of support, and if all measurements performed at home, and within
6
7 primary and secondary care were integrated into the platform:

8
9 *'The visit to the practice nurse is of course the real measurement. So I feel it's important to*
10
11 *keep that, because it monitors your health, or at least a part of your health. That is important.*
12
13 *But if all those measurements could be incorporated into this study, that would of course be*
14
15 *very positive, because than you can compare it over several years or you can use it to look*
16
17 *things up.'*[P9]
18

19 A concern of some of the participants was that this incorporation would lead to substitution of
20
21 valued, in-person contacts with health care professionals by more anonymous exchange of messages
22
23 via the platform. A participant suggested to add regular in-person visits with measurements to
24
25 increase motivation, as a solution.
26
27
28
29

30 DISCUSSION

31 Summary

32 We have found that the support of a coach is crucial to initiate and sustain engagement of older
33
34 people with an interactive Internet platform for cardiovascular self-management. Factors associated
35
36 with initial platform engagement are perceived computer literacy and acceptability and
37
38 appropriateness of the platform, with special attention to the computer skills and preferences of
39
40 older people. Factors associated with sustained platform engagement are regular automatic and
41
42 personal reminders, clear expectations, incorporation into daily routine, and social support.
43
44

45 Incorporation into primary healthcare could facilitate implementation of the platform and could
46
47 improve the perceived continuity of support in self-management.
48
49
50
51
52

53 Strengths and limitations

54
55
56
57
58
59
60

1
2
3 The main strength of our study is that through our purposive sampling method we included both
4 participants with a short, intermediate and long follow-up duration. This contributed to a clear
5 distinction in motives for initial and sustained engagement. We used an iterative analysis method
6 with multiple analysis rounds and adaptation of the interview guide throughout the process. Also, we
7 followed the consolidated criteria for reporting qualitative research (COREQ) guidelines to facilitate
8 reproducibility of study results.¹⁷ A limitation of our study is that we only interviewed Dutch
9 participants, potentially limiting the scope to the Dutch health care setting. Furthermore, the sample
10 is prone to bias as our participants were willing to partake in both the HATICE trial and our qualitative
11 sub-study. This could have led to selection of people with a relative positive view on the intervention
12 and with a high education level.¹⁸ We minimised this potential bias by purposively sampling
13 participants on education level and login frequency. Another possible source of bias is the fact that
14 two of the interviewers and researchers analysing the data were involved in the development and
15 maintenance of the platform. This could have influenced the intonation of questioning and
16 interpretation of the data, however their knowledge of the platform could also have stimulated the
17 discussion.

36 **Comparison with existing literature**

37 We found that the coach is crucial in initial and sustained use of a preventive eHealth intervention.
38 This has previously been described in a non-digital multi-domain preventive intervention.¹⁹ In our
39 study, the initial in-person contact was important to establish a relationship of trust between the
40 participant and coach. For most people maintenance of this relationship via a messaging system
41 appeared to work well for a longstanding personal connection. The importance of this kind of
42 blended care is emphasised by a meta-analysis showing a more pronounced effect on cardiovascular
43 risk reduction.⁷ Despite the use of motivational interviewing techniques and coaches following the
44 'stages of change' model,^{14 15} it was difficult to engage people unaware of risks or unmotivated for
45 lifestyle change. In general, motivational interviewing techniques delivered through eHealth have
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 proven effective in inducing behavioural changes.²⁰ Nevertheless, a complete in-person approach
4
5 might be preferable for participants in the first 'stages of change'. A reactive approach, i.e.
6
7 responding to automatic and personal reminders, rather than a proactive approach seemed to suit
8
9 most participants best. Previous studies have shown that electronic reminders are a useful tool to
10
11 increase medication adherence and lower cardiovascular risk.^{21 22} They can stimulate engagement,
12
13 but can also lead to 'alert fatigue'.²³ Even though limited computer experience is an important barrier
14
15 in platform use, and this may prohibit large-scale implementation, increasing use of Internet by older
16
17 people is likely to overcome this limitation in the near future.²⁴
18
19
20
21
22

23 **A tailored platform**

24
25 Our study shows that many aspects of multi-domain eHealth interventions rely heavily on personal
26
27 preferences. The HATICE platform has been adjusted to the need for a personalised platform, by not
28
29 imposing any obligations on which functionalities to use and giving participants the opportunity to
30
31 tailor the frequency of automatic reminders to personal preferences. However, during the
32
33 interviews, it appeared that people prefer an even more personalised platform. For instance,
34
35 engagement was dependent on personal preference with regard to how much the content of the
36
37 platform changes over time and the complexity of the platform, affinity with self-measurement,
38
39 whether or not confrontation with lifestyle goals was appreciated, the ideal amount of time invested,
40
41 and the optimal frequency of reminders. A potential solution would be a self-learning system that
42
43 automatically tailors to personal characteristics, needs and wishes.²⁵
44
45
46
47
48

49 **Implications for practice**

50
51 During the HATICE trial, the platform was offered independently from regular care. Participants
52
53 mentioned this separation as a barrier to platform use and agreed with the suggestion to incorporate
54
55 it into the current primary care structure. Preventive eHealth interventions provide the opportunity
56
57
58
59
60

1
2
3 to optimize continuity in support of self-management and reach individual targets with limited
4
5 resources. In addition, implementation may improve sustained engagement with such an
6
7 intervention.²⁶ Suggestions for this incorporation are to have the practice nurse work as coach, link
8
9 measurements from electronic health records directly to the platform, and align this with additional
10
11 in-person visits for nurse-led cardiovascular risk management. Nevertheless, opportunities to
12
13 implement the platform probably differ based on the health care system. It is therefore crucial to
14
15 properly evaluate the health care context and views of end-users and health care professionals to
16
17 support successful implementation.¹⁰ Especially in health care systems with long distances or low
18
19 resources, a preventive eHealth intervention may provide opportunities to improve existing
20
21 preventive care.²⁷
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Acknowledgements

We would like to thank all HATICE participants that agreed to participate in this qualitative substudy.

Our gratitude also goes out to Suzanne van Rhijn for her help in interviewing participant and Sinem

Kurt-Bayrakci for transcribing part of the interviews.

For peer review only

HATICE consortium members

Academic Medical Center (AMC), Amsterdam, the Netherlands: Edo Richard, Pim van Gool, Eric Moll
van Charante, Cathrien Beishuizen, Susan Jongstra, Tessa van Middelaar, Lennard van Wanrooij,

Marieke Hoevenaar-Blom

University of Eastern Finland (UEF), Kuopio, Finland: Hilka Soininen, Tiia Ngandu, Mariagnese

Barbera

Karolinska Institutet/Stockholm University, Stockholm, Sweden: Miia Kivipelto, Francesca

Mangialasche

INSERM, University of Toulouse, Toulouse, France: Sandrine Andrieu, Nicola Coley, Juliette

Guillemont

NOVAPTEN, Paris, France: Yannick Meiller

VitalHealth Software, Ede, the Netherlands: Bram van de Groep

Cambridge Institute of Public Health, University of Cambridge, Cambridge, UK: Carol Brayne

REFERENCES

1. Abegunde DO, Mathers CD, Adam T, et al. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet* 2007;370(9603):1929-38. doi: 10.1016/S0140-6736(07)61696-1
2. Mons U, Muezzinler A, Gellert C, et al. Impact of smoking and smoking cessation on cardiovascular events and mortality among older adults: meta-analysis of individual participant data from prospective cohort studies of the CHANCES consortium. *BMJ* 2015;350:h1551. doi: 10.1136/bmj.h1551
3. Chow CK, Jolly S, Rao-Melacini P, et al. Association of diet, exercise, and smoking modification with risk of early cardiovascular events after acute coronary syndromes. *Circulation* 2010;121(6):750-8. doi: 10.1161/CIRCULATIONAHA.109.891523
4. World Health Organization (2003). *Adherence to long-term therapies: evidence for action*. http://www.who.int/chp/knowledge/publications/adherence_report/en/ (accessed 24-04-2017).
5. Nouwens E, van Lieshout J, van den Hombergh P, et al. Shifting cardiovascular care to nurses results in structured chronic care. *Am J Manag Care* 2014;20(7):e278-84.
6. Griffiths F, Lindenmeyer A, Powell J, et al. Why are health care interventions delivered over the internet? A systematic review of the published literature. *J Med Internet Res* 2006;8(2):e10. doi: 10.2196/jmir.8.2.e10
7. Beishuizen CR, Stephan BC, van Gool WA, et al. Web-Based Interventions Targeting Cardiovascular Risk Factors in Middle-Aged and Older People: A Systematic Review and Meta-Analysis. *J Med Internet Res* 2016;18(3):e55. doi: 10.2196/jmir.5218
8. Eysenbach G. The Law of Attrition. *Journal of Medical Internet Research* 2005;7(1):e11. doi: 10.2196/jmir.7.1.e11
9. Peters DH, Adam T, Alonge O, et al. Implementation research: what it is and how to do it. *BMJ* 2013;347:f6753. doi: 10.1136/bmj.f6753

- 1
2
3 10. Glasgow RE, Phillips SM, Sanchez MA. Implementation science approaches for integrating eHealth
4
5 research into practice and policy. *Int J Med Inform* 2014;83(7):e1-11. doi:
6
7 10.1016/j.ijmedinf.2013.07.002
8
9 11. Richard E, Jongstra S, Soininen H, et al. Healthy Ageing Through Internet Counselling in the
10
11 Elderly: the HATICE randomised controlled trial for the prevention of cardiovascular disease
12
13 and cognitive impairment. *BMJ Open* 2016;6(6):e010806. doi: 10.1136/bmjopen-2015-
14
15 010806
16
17 12. Becker SA. A study of web usability for older adults seeking online health resources. *ACM Trans*
18
19 *Comput Hum Interact* 2004;11:387-406.
20
21 13. Jongstra S, Beishuizen C, Andrieu S, et al. Development and Validation of an Interactive Internet
22
23 Platform for Older People: The Healthy Ageing Through Internet Counselling in the Elderly
24
25 Study. *Telemed J E Health* 2016 doi: 10.1089/tmj.2016.0066
26
27 14. Rollnick S, Miller WR, Butler CC. Motivational interviewing in health care: helping patients change
28
29 behavior. New York: The Guilford Press, 2008.
30
31 15. Prochaska JO, Diclemente CC, Norcross JC. In Search of How People Change - Applications to
32
33 Addictive Behaviors. *Am Psychol* 1992;47(9):1102-14. doi: Doi 10.1037/0003-066x.47.9.1102
34
35 16. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*
36
37 2006;3(2):77-101.
38
39 17. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a
40
41 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19(6):349-57.
42
43 doi: 10.1093/intqhc/mzm042
44
45 18. Rothwell PM. External validity of randomised controlled trials: "to whom do the results of this
46
47 trial apply?". *Lancet* 2005;365(9453):82-93. doi: 10.1016/S0140-6736(04)17670-8
48
49 19. Ligthart SA, van den Eerenbeemt KD, Pols J, et al. Perspectives of older people engaging in nurse-
50
51 led cardiovascular prevention programmes: a qualitative study in primary care in the
52
53 Netherlands. *Br J Gen Pract* 2015;65(630):e41-8. doi: 10.3399/bjgp15X683149
54
55
56
57
58
59

- 1
2
3 20. Shingleton RM, Palfai TP. Technology-delivered adaptations of motivational interviewing for
4 health-related behaviors: A systematic review of the current research. *Patient Educ Couns*
5 2016;99(1):17-35. doi: 10.1016/j.pec.2015.08.005
6
7
8
9 21. Vervloet M, Linn AJ, van Weert JC, et al. The effectiveness of interventions using electronic
10 reminders to improve adherence to chronic medication: a systematic review of the literature.
11 *J Am Med Inform Assoc* 2012;19(5):696-704. doi: 10.1136/amiajnl-2011-000748
12
13
14 22. Chow CK, Redfern J, Hillis GS, et al. Effect of Lifestyle-Focused Text Messaging on Risk Factor
15 Modification in Patients With Coronary Heart Disease: A Randomized Clinical Trial. *JAMA*
16 2015;314(12):1255-63. doi: 10.1001/jama.2015.10945
17
18
19 23. Alkhalidi G, Hamilton FL, Lau R, et al. The Effectiveness of Prompts to Promote Engagement With
20 Digital Interventions: A Systematic Review. *J Med Internet Res* 2016;18(1):e6. doi:
21 10.2196/jmir.4790
22
23
24 24. Eurostat. Internet access and use statistics - households and individuals. Available from:
25 [http://ec.europa.eu/eurostat/statistics-](http://ec.europa.eu/eurostat/statistics-explained/index.php/Internet_access_and_use_statistics_-_households_and_individuals)
26 [explained/index.php/Internet access and use statistics - households and individuals](http://ec.europa.eu/eurostat/statistics-explained/index.php/Internet_access_and_use_statistics_-_households_and_individuals)
27 (accessed 24-04-2017).
28
29
30
31
32
33 25. Conway N, Webster C, Smith B, et al. eHealth and the use of individually tailored information: A
34 systematic review. *Health Informatics J* 2016 doi: 10.1177/1460458216641479
35
36
37 26. Brown LL, Lustria ML, Rankins J. A review of web-assisted interventions for diabetes
38 management: maximizing the potential for improving health outcomes. *J Diabetes Sci*
39 *Technol* 2007;1(6):892-902. doi: 10.1177/193229680700100615
40
41
42
43
44
45 27. Saner H, van der Velde E. eHealth in cardiovascular medicine: A clinical update. *Eur J Prev Cardiol*
46 2016;23(2 suppl):5-12. doi: 10.1177/2047487316670256
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Tables 1. Characteristics of the participants

Participant characteristics				Study characteristics				
Nr.	Gender	Age	Education level*	CV D	DM	FU duration (mos.)	Partner partic. in HATICE	Login frequency (per mo.)
1	M	73	High	+	-	2.6	+	0.6
	F	66	Intermediate	-	-	2.6	+	0.5
2	F	67	Intermediate	+	+	2.2	-	3.2
3	F	84	Low	-	-	3.2	-	2.7
4	M	71	High	-	-	2.4	-	4.4
5	F	67	Intermediate	-	-	2.3	-	0.3
6	M	68	High	-	-	2.3	+	0.4
	F	70	Intermediate	-	-	2.3	+	0.7
7**	F	71	Intermediate	+	+	10.5	+	0.7
	M	74	Intermediate	-	-	10.3	+	0.9
8	M	65	Low	+	+	8.4	-	0.6
9	M	67	High	+	-	7.8	-	1.1
10	F	66	High	-	-	14.7	+	2.6
11	F	68	Intermediate	-	-	14.7	-	0.5
12	M	66	Low	+	+	7.1	-	1.8
13	F	74	High	-	-	9.4	-	4.7
14	M	65	Intermediate	+	+	15.8	-	0.8
15	M	67	Low	+	+	14.8	-	3.1
16	F	83	Intermediate	+	-	15.8	-	5.1
17	M	84	Low	+	-	16.6	-	3.2

*The characteristics are divided into participant characteristics and HATICE study characteristics. *Low education level indicates primary education or lower secondary education; intermediate, upper*

1
2
3 *secondary education and post-secondary non-tertiary education; high, short-cycle tertiary education.*

4
5 *** Interview 7 was performed with participants that had recently (prematurely) ended their*

6
7 *participation in HATICE. Nr. indicates number; CVD, history of cardiovascular disease; DM, diabetes*

8
9 *mellitus; FU, follow-up; mo, month; partic., participating; M, male; F, female.*

10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Box 1. Themes and subthemes identified in the interviews of the facilitators (+) and barriers (-) in initial and sustained platform use

Initial platform use	Sustained platform use
User-friendliness for older people	Coach: long-term relationship of trust
<ul style="list-style-type: none"> • Layout: simplicity, attractiveness (+/-) 	<ul style="list-style-type: none"> • Personal connection (+)
<ul style="list-style-type: none"> • Technical difficulties (-) 	<ul style="list-style-type: none"> • Content of messages (+/-)
<ul style="list-style-type: none"> • Perceived computer literacy (+/-) 	<ul style="list-style-type: none"> • Continuity of person (-)
Coach: the basis for a relationship of trust	Reactive use of the platform* (+) Lifestyle
<ul style="list-style-type: none"> • In-person baseline consultation (+) 	change: expectations and experiences
<ul style="list-style-type: none"> • Timing and content of messages (+) 	<ul style="list-style-type: none"> • Expectations of platform (+/-)
Appropriateness of the intervention	<ul style="list-style-type: none"> • Benefits of lifestyle changes (+)
<ul style="list-style-type: none"> • Affinity with platform functionalities 	<ul style="list-style-type: none"> • Setting a goal is burdensome (-)
(including self-management) (+/-)	<ul style="list-style-type: none"> • Monitoring health (+)
<ul style="list-style-type: none"> • Awareness of cardiovascular risk (+/-) 	Incorporation into personal life
<ul style="list-style-type: none"> • Motivation for lifestyle change with 	<ul style="list-style-type: none"> • Incorporation into daily routine (+/-)
increasing age (-)	<ul style="list-style-type: none"> • Social (partner) support (+)
	<ul style="list-style-type: none"> • Continuity of care (+/-)
	<ul style="list-style-type: none"> • Time investment (+/-)
	Perceived lack of change in the platform (+/-)

*Reactive use indicates the preference of participants to use the platform in response to automatic or personal reminders.

ONLINE SUPPLEMENT

Supplement to:

Engaging older people in an Internet platform for cardiovascular risk self-management: a qualitative study

T. van Middelaar, C.R.L. Beishuizen, J. Guillemont, M. Barbera, E. Richard, E.P. Moll van Charante, on behalf of the HATICE consortium

Table of content

Page 2 - Interview guide

Interview guide

Opening question: *Could you tell me about your experiences with the HATICE platform?*

1. Use, experiences and opinion about the platform

General

Did you ever log onto the platform? What pages do you usually visit when you are logged on? What do you use the most and why? What don't you use and why? What do you think about the platform? Does the platform motivate you to change your lifestyle? Why?

Baseline

Why did you choose to participate in HATICE? Did your coach introduce you to the platform during the second visit? What did the coach mention about the platform? What was your first impression? What were your expectations of the platform? What was expected of you?

Initial phase

What were your first experiences with logging onto the platform? What parts of the platform did you use then? What appealed you to use the platform? And what repelled you to use the platform?

Adherence phase

How is that now? Do you use the platform differently now in comparison to the beginning? Why? Are there things that could have increased your use of the platform? If it would be possible, would you keep using the platform after the study ended? Why?

Coach

1
2
3 *How do you experience the contact with your coach? What do you like? What don't you like? Do you*
4 *feel that the coach is of added value to the platform? Would you prefer having telephone contact*
5 *with your coach?*
6
7
8
9

10 11 **2. Interaction with regular care**

12
13 *Do you feel that the platform is of added value to regular care? To what extent? Have you consulted*
14 *you general practitioner/practice nurse about the platform (or are you going to)? Why?*

15
16
17 *Would you like it if the general practitioner/practice nurse had insight into data from your personal*
18 *platform? Why? If yes, what data would you like to share and what not?*

19
20
21 *(If applicable) Are there advantages or disadvantages to the platform in comparison to the care of*
22 *your practice nurse?*
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description	Page
Domain 1: Research team and reflexivity			
Personal Characteristics			
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?	6
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>	6
3.	Occupation	What was their occupation at the time of the study?	7
4.	Gender	Was the researcher male or female?	1,6
5.	Experience and training	What experience or training did the researcher have?	7
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	7
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	7
8.	Interviewer	What characteristics were	7

No	Item	Guide questions/description	Page
	characteristics	reported about the interviewer/facilitator? e.g. <i>Bias, assumptions, reasons and interests in the research topic</i>	
Domain 2: study design			
Theoretical framework			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. <i>grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	7
Participant selection			
10.	Sampling	How were participants selected? e.g. <i>purposive, convenience, consecutive, snowball</i>	6
11.	Method of approach	How were participants approached? e.g. <i>face-to-face, telephone, mail, email</i>	6
12.	Sample size	How many participants were in the study?	7
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	6
Setting			

No	Item	Guide questions/description	Page
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	7
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	7
16.	Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i>	7,8
Data collection			
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Suppl.
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	7
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	7
20.	Field notes	Were field notes made during and/or after the interview or focus group?	7
21.	Duration	What was the duration of the interviews or focus group?	7
22.	Data saturation	Was data saturation discussed?	7
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	n.a.
Domain 3: analysis and			

No	Item	Guide questions/description	Page
findingsz			
Data analysis			
24.	Number of data coders	How many data coders coded the data?	7
25.	Description of the coding tree	Did authors provide a description of the coding tree?	25
26.	Derivation of themes	Were themes identified in advance or derived from the data?	7
27.	Software	What software, if applicable, was used to manage the data?	n.a.
28.	Participant checking	Did participants provide feedback on the findings?	n.a.
Reporting			
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i>	8-14
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	8-14
31.	Clarity of major themes	Were major themes clearly presented in the findings?	25
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	8-14

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

n.a. indicates not applicable

For peer review only

BMJ Open

Engaging older people in an Internet platform for cardiovascular risk self-management: a qualitative study among Dutch HATICE participants

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-019683.R1
Article Type:	Research
Date Submitted by the Author:	07-Nov-2017
Complete List of Authors:	Van Middelaar, Tessa; Academic Medical Center, Neurology; Radboud University Medical Center, Neurology Beishuizen, Cathrien; Academic Medical Center, Neurology Guillemont, Juliette; University of Toulouse, Epidemiology and public health Barbera, Mariagnese; University of Eastern Finland, Clinical Medicine/Neurology Richard, Edo; Academic Medical Centre, Neurology; Radboud University Medical Center, Neurology Moll van Charante, Eric; Academic Medical Center, General Practice
Primary Subject Heading:	Qualitative research
Secondary Subject Heading:	Cardiovascular medicine, General practice / Family practice
Keywords:	eHealth, prevention and control, primary health care, cardiovascular diseases, QUALITATIVE RESEARCH, implementation

SCHOLARONE™
Manuscripts

1
2
3 1 **Engaging older people in an Internet platform for cardiovascular risk self-management: a**
4
5 2 **qualitative study among Dutch HATICE participants**

6
7 3 T. van Middelaar^{1,2}, C.R.L. Beishuizen¹, J. Guillemont³, M. Barbera⁴, E. Richard^{1,2}, E.P. Moll van
8
9 4 Charante⁵, on behalf of the HATICE consortium*

10
11
12
13 6 ¹ *Department of Neurology, Academic Medical Center (AMC), Amsterdam, the Netherlands.*

14
15
16 7 ² *Department of Neurology, Donders Institute for Brain, Cognition and Behaviour, Radboud University*
17
18 *Medical Center, Nijmegen, the Netherlands.*

19
20 9 ³ *INSERM, University of Toulouse UMR 1027, Toulouse, France.*

21
22 10 ⁴ *Institute of Clinical Medicine/Neurology, University of Eastern Finland,*
23
24 *Kuopio, Finland*

25
26 12 ⁵ *Department of General Practice, Amsterdam Public Health research institute, Academic Medical*
27
28 *Center (AMC), Amsterdam, the Netherlands.*

29
30 14 **The list of HATICE consortium members is stated at page 19.*

31
32
33
34 16 **Short title:** Engaging older people in eHealth

35
36 17 **Manuscript category:** Research article for BMJ open

37
38 18 **Word count:** abstract 263, manuscript 4751, references 29, table 1, box 1.

39
40
41 19
42
43 20 **Corresponding author:**

44
45 21 T. van Middelaar

46
47 22 Department of Neurology, Academic Medical Center

48
49 23 Meibergdreef 9, 1105 AZ Amsterdam, the Netherlands

50
51 24 Telephone: +31-20-5663446

52
53 25 E-mail: t.vanmiddelaar@amc.uva.nl

54
55
56 26

1
2
3 27 **Abstract**

4 28 Objectives - To study older peoples' experiences with an interactive Internet platform for
5 29 cardiovascular self-management, to assess which factors influence initial and sustained engagement.

6
7
8
9 30 To assess their views on future use within primary care.

10
11 31 Design - Qualitative semi-structured interview study, with thematic analysis.

12
13 32 Setting - Primary care in the Netherlands.

14
15 33 Participants - People ≥ 65 years with an increased risk of cardiovascular disease who used the
16
17 34 'Healthy Ageing Through Internet Counselling in the Elderly' (HATICE) Internet platform with remote
18
19 35 support of a coach. Participants were selected using a purposive sampling method based on gender,
20
21 36 age, level of education, cardiovascular history, diabetes, duration of participation and login
22
23 37 frequency.

24
25 38 Results - We performed 17 interviews with 20 participants, including three couples. In the initial
26
27 39 phase, platform engagement was influenced by perceived computer literacy of the participants, user-
28
29 40 friendliness, acceptability and appropriateness of the intervention, and the initial interaction with the
30
31 41 coach. Sustained platform use was mainly facilitated by a relationship of trust with the coach. Other
32
33 42 facilitating factors were regular automatic and personal reminders, clear expectations of the
34
35 43 platform, incorporation into daily routine, social support and a loyal and persistent attitude.

36
37 44 Perceived lack of change in content of the platform could work both stimulating and discouraging.

38
39 45 Participants supported the idea of embedding the platform into the primary care setting.

40
41 46 Conclusions - Human support is crucial to initial and sustained engagement of older people in using
42
43 47 an interactive Internet platform for cardiovascular self-management. Regular reminders further
44
45 48 facilitate sustained use and increased tailoring to personal preference is recommended. Embedding
46
47 49 the platform in primary health care may enhance future adoption.

48
49
50
51 50

52 51 **Keywords:** eHealth, prevention and control, primary health care, cardiovascular diseases, qualitative
53
54 52 research, implementation

53

54 Strengths and limitations of this study

- 55 • We focused on the experiences of older people which is of increasing importance in view of
56 global ageing.
- 57 • We iteratively adapted our interview guide to separately address influential factors on
58 sustained engagement, as long-term adherence to lifestyle changes is a major challenge in
59 cardiovascular prevention.
- 60 • Data collection with semi-structured interviews and our purposive sampling method
61 provided us with a broad view of people's experiences and provided insight into individual
62 differences.
- 63 • We only interviewed Dutch people, potentially limiting the scope to the Dutch health care
64 setting.

65

66 Funding

67 The HATICE trial is funded by the European Union Seventh Framework Programme (FP7/2007-2013)
68 under grant agreement n° 305374. TvM was supported by an EU Joint Programme -
69 Neurodegenerative Disease Research (JPND) project. The project is supported through the following
70 funding organisations under the aegis of JPND – www.jpnd.eu: Finland, Suomen Akatemia (Academy
71 of Finland,291803); France, L'Agence Nationale de la Recherche (The French National Research
72 Agency, ANR-14-JPPS-0001-02); Germany, Bundesministerium für Bildung und Forschung (BMBF)
73 (The Federal Ministry of Education and Research, FKZ01ED1509); Sweden, Vetenskapsrådet (VR)
74 (Swedish Research Council, 529-2014-7503), The Netherlands, ZonMw (The Netherlands Organisation
75 for Health Research and Development, 733051041).

76

77 Competing interest

78 None to declare.

1
2
3 79

4
5 80 **Author contributions**

6
7 81 T. van Middelaar: study design, data acquisition, data analysis, data interpretation, drafting the
8
9 82 manuscript.

10
11 83 C.R.L. Beishuizen: study design, data acquisition, data analysis, data interpretation, drafting the
12
13 84 manuscript.

14
15 85 J. Guillemont: data interpretation, critical revision of manuscript.

16
17 86 M. Barbera: data interpretation, critical revision of manuscript.

18
19 87 E. Richard: study design, data interpretation, critical revision of manuscript.

20
21 88 E.P. Moll van Charante: study design, data interpretation, critical revision of manuscript.

22
23
24 89

25
26 90 **Data sharing statement:** Data will not be made publicly available. For more information, please

27
28 91 contact the corresponding author.
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

92 INTRODUCTION

93 In view of global ageing and the associated increasing burden of cardiovascular disease (CVD),
94 prevention has become crucial.¹ The effectiveness of preventive interventions is indisputable, even in
95 old age.^{2,3} However, adherence to long-term lifestyle and medication regimens remains a daunting
96 challenge. Average adherence rates for chronic illnesses are as low as 50%.⁴ Currently, in several
97 countries, cardiovascular risk management programmes are implemented into primary care and
98 delivered by practice nurses.⁵ eHealth, i.e. a method to deliver health services and information using
99 the Internet and related technologies, is a promising tool for delivery of prevention.⁶ It can enable
100 self-management and improve the reach and sustainability of pre-existing preventive programs.⁷ In
101 particular, an eHealth platform combined with human support (i.e. a blended approach) has shown
102 beneficial effects on cardiovascular risk factors.⁸

103 Previous research on eHealth interventions identified several important influential factors of
104 engagement; personal motivation, incorporation into personal life, and quality of the eHealth
105 intervention.⁹ However, it is unclear whether these are the same for initial and sustained
106 engagement. For cardiovascular prevention, sustained engagement seems crucial, as the
107 effectiveness of eHealth interventions on cardiovascular risk factors declines over time, especially
108 after one year follow-up.⁸ Also, an eHealth intervention specifically targeted at older people should
109 have a specific age-friendly design.¹⁰ It is important to assess the views of end users of an eHealth
110 intervention to improve its chances of successful implementation.^{11,12}

111 Our primary aim was to study older peoples' experiences with an interactive Internet platform for
112 cardiovascular self-management, to assess which factors influence initial and sustained engagement.

113 Our secondary aim was to assess older people's views on implementation of such a platform in the
114 primary care setting.

115

116 METHODS

117 **Setting and participants**

118 This qualitative study with semi-structured interviews was performed among participants of the
119 'Healthy Ageing Through Internet Counselling in the Elderly' (HATICE, ISRCTN48151589) trial.¹³
120 HATICE is designed to investigate whether an Internet platform for cardiovascular self-management
121 can improve the cardiovascular risk profile. People ≥ 65 years with an increased risk of cardiovascular
122 disease were recruited to participate in HATICE in the Netherlands, Finland and France. Computer
123 illiteracy, defined as the inability to send an email, was an exclusion criteria for the trial. Through a
124 thorough design and validation process we developed the Internet platform for cardiovascular self-
125 management, adapted to meet the specific requirements of older people.^{10 14} The intervention is
126 based on Bandura's social-cognitive theory for self-management and behaviour change and
127 incorporated Michie's taxonomy for standardised definitions of behaviour change interventions.^{15 16}
128 The platform offers blended care by remote support of a health-coach trained in motivational
129 interviewing techniques and the trans-theoretical (or stages of change) model.^{17 18} Participants can
130 send messages and receive feedback from their coaches within the platform. Other functionalities of
131 the platform include the ability to set lifestyle goals, record measurements (e.g. blood pressure,
132 weight), receive information on cardiovascular risk and healthy lifestyle, and subscribe to lifestyle
133 groups. The layout and navigation structure were kept simple to make the platform user-friendly for
134 older people. The content was regularly updated with news items on relevant developments in
135 cardiovascular prevention. The intervention was solely delivered via the platform, except for an
136 initial in-person meeting with their coach at baseline, during which first lifestyle goals were set, and a
137 phone call after 12 months follow-up.

138 This qualitative sub-study was only performed among Dutch intervention participants. They were
139 purposively sampled on gender, age, level of education, history of CVD, diabetes, duration of
140 participation, and login frequency. Participants that prematurely ended their participation were also
141 invited. Twenty out of 32 participants that were invited by telephone were willing to partake in the
142 interview. Main reasons for people to decline participation were lack of time and too little overall use

1
2
3 143 of the platform, even though we specifically aimed to also include these participants. The HATICE
4
5 144 trial and this qualitative sub-study were approved by the medical ethics committee of the Academic
6
7 145 Medical Centre in the Netherlands. All participants provided written informed consent.
8

9 146

10 11 147 **Data collection**

12
13 148 Between July 2016 and January 2017 three researchers (TvM [MD], CB [MD] and Suzanne van Rhijn
14
15 149 [MSc]) held semi-structured interviews following an interview guide (Appendix 1), focusing on
16
17 150 participant experiences with the platform. We iteratively adapted the interview guide during the
18
19 151 data collection period. For example, we decided to separately address initial and sustained use as
20
21 152 distinct phases in the engagement and adoption of the intervention, as sustained engagement is
22
23 153 especially challenging in lifestyle interventions.⁸ During the interviews, participants were asked to log
24
25 154 onto the platform to stimulate the discussion. The final part of the interview guide focused on the
26
27 155 interaction with regular care, during which participants were asked if they preferred the platform to
28
29 156 be incorporated in primary health care. The interviewers all had experience with conducting
30
31 157 qualitative interviews. Two of the interviewers (TvM and CB) were involved in the design and
32
33 158 maintenance of the platform (the participants were not made aware of this) and one (SvR) in the
34
35 159 logistical support of the trial. The interviewers and participants had no professional relationship prior
36
37 160 to the interview. Participants were interviewed in private at their homes and the interviews lasted
38
39 161 approximately 50 minutes. No repeat interviews were deemed necessary. Interviews were
40
41 162 audiotaped and transcribed verbatim and during the interviews field notes were taken.
42
43 163

44 45 46 47 164 **Coding and analysis**

48
49 165 Two researchers (TvM and CB) thematically analysed the transcripts in an iterative process.¹⁹ First,
50
51 166 each researcher independently coded transcripts following an inductive approach; next the
52
53 167 researchers discussed each other's codes to achieve inter-observer agreement. Subsequently, the
54
55 168 researchers together categorized the codes to generate a structure of main themes and subthemes.
56
57
58
59
60

1
2
3 169 Themes were derived from the data and were not hypothesized prior to data collection. At several
4
5 170 points during the analysis process results were discussed with other team members to ensure
6
7 171 independent interpretation. After the first seven interviews, the interview guide was adapted based
8
9 172 on one of these discussions, leading to a better distinction between initial and sustained engagement
10
11 173 with the platform. Questions about initial engagement were asked to all participants and about
12
13 174 sustained engagement to participants who had been in the study for at least six months. After 17
14
15 175 interviews, data saturation was reached as no new (sub)themes or issues emerged.
16
17 176

177 **RESULTS**

178 We performed 17 interviews with 20 participants (Table 1). Three interviews took place with couples
179 participating in the HATICE trial together, one of which had prematurely dropped out from the trial.
180 The age of the participants ranged from 65 to 84 years. Ten (50%) participants had a history of CVD
181 and six (30%) had diabetes. Length of participation in the trial ranged from short (2-3 months, n=8
182 [40%]), intermediate (7-11 months, n=6 [30%]), to long (14-17 months, n=6 [30%]). The main themes
183 and subthemes of factors that influence initial and sustained platform engagement are presented in
184 box 1 and further explained in the text below.

185

186 **Initial platform engagement**

187 *User-friendliness for older people*

188 Participants found the layout of the platform clear and simple which facilitated platform use.
189 However they stated that a more attractive platform could have encouraged them to log in more
190 often:

191 *“You should have a website that makes you think, when you have some spare time at night or*
192 *in the afternoon, why don’t I just have a look at HATICE.” [P8]*

193 Technical difficulties in using the platform, for example login difficulties, discouraged participants.

194 Also, the notion of being inexperienced or incompetent with a computer or with the Internet could

1
2
3 195 hamper exploration of the platform and platform use. Sometimes, participants, together with their
4
5 196 coach, found creative ways to use the platform when this was considered difficult:

6
7 197 *"I'm not a computer freak. (...) Once I receive a message then I answer it. And then she*
8
9 198 *[coach] says, you should also complete it in the category that it belongs to [measurement]. To*
10
11 199 *me it is not easy to find that [...] But then later I notice that she has neatly entered it [in the*
12
13 200 *measurement functionality]. I think that's fine."* [P12]

14
15 201 People who regarded themselves as inquisitive or eager to learn said this stimulated them in
16
17 202 exploring the different functionalities of the platform.

18
19 203

20
21 204 *Coach: the basis for a relationship of trust*

22
23 205 For participants, trusting the coach was a prerequisite to talk about their health behaviours and
24
25 206 potential lifestyle goals. The in-person baseline consultation with their coach was much appreciated,
26
27 207 and formed a basis to build a relationship of trust. If the coach responded quickly and adequately to
28
29 208 messages sent after the baseline visit, this stimulated platform engagement:

30
31 209 *"At first I wanted... I really had no... I mean, I was actually curious. I did not think well this*
32
33 210 *will... for me... At a certain moment, also because of her [coach], I immediately received a*
34
35 211 *message back and she stimulated me, she said 'oh well done' and I don't know what more.*
36
37 212 *That made me say, OK I will continue with this."* [P12]

38
39 213 Instead, if messages were not answered timely, participants became discouraged to continue using
40
41 214 the platform. Some participants found personal contact through the messaging system insufficient to
42
43 215 build a relationship and missed face-to-face or telephone contact.

44
45 216

46
47 217 *Usefulness and perceived benefit of the intervention*

48
49 218 During their first encounter with the platform, participants tended to focus on a small number of
50
51 219 functionalities that appeared useful and relevant, and continued with these over time. This mostly
52
53 220 concerned the messaging and measurement functionalities:

1
2
3 221 *“When I receive an email I will go to the website and log in. And then I see what happened*
4
5 222 *[message] and have a look. And sometimes I’m asked to complete a questionnaire and I do*
6
7 223 *that. And other times, as is the case now, I’ll go to the practice nurse; well then I have my*
8
9 224 *blood and urine tested, and I send those along [send results to the coach].” [P16]*

10
11 225 Some participants reported affinity with self-management and self-measuring of cardiovascular risk
12
13 226 factors. They perceived the measurement functionality as useful and appropriate, facilitating
14
15 227 platform use. Conversely, limited affinity with self-management could form a barrier to use this
16
17 228 functionality:

18
19 229 *“And I absolutely do not want my own blood pressure monitor. I did not want that when it*
20
21 230 *[blood pressure] was too high and I certainly do not want it now that it is too low. Because I*
22
23 231 *get very uh... It will influence me and I don’t want that. I will not make myself crazy.” [P3]*

24
25
26 232 Participants who were aware of their cardiovascular risk status, in some cases because of a previous
27
28 233 CVD, deemed the content of the platform relevant. Participants with limited perceived need to
29
30 234 improve their lifestyle did not see how the platform could help them and tended to make limited use
31
32 235 of it:

33
34 236 *“I notice that it’s about CVD. That is all fine, but I don’t have that [history of CVD], so I will not*
35
36 237 *engage any further with it [the platform]. [...] Indeed, if I do encounter it [CVD], than I would*
37
38 238 *do it, but at this moment...” [P5]*

39
40 239 Participants who already frequently visited their health care professional(s) stated they did not
41
42 240 expect important additional benefit. Age also played a role as one of the oldest participants no
43
44 241 longer prioritised adapting a healthier lifestyle because of his old age. Participants rarely adjusted or
45
46 242 replaced the goals that were set at baseline. Limited use was made of the suggestions for lifestyle
47
48 243 groups; participants expressed several reservations related to this functionality, such as that they
49
50 244 thought that signing up created an obligation to participate and that groups would be dominated by
51
52 245 older people with very limited functionalities.

53
54
55 246

247 **Sustained platform engagement**

248 *Coach: long-term relationship of trust*

249 As mentioned above, the coach was important to stimulate initial use of the platform. The coach also
250 appeared pivotal in sustained platform use. If participants felt connected to the coach, participants
251 felt inclined to keep using the platform and adhere to goals for lifestyle changes:

252 *“Yes, because the coach makes you try to accomplish certain things. [...] That would be more*
253 *difficult without the coach. I don’t know if... every time with the website... no, I don’t think*
254 *that that would work on its own [platform without coach].” [P9]*

255 The message content was also important; a positive and personal tone could boost someone’s
256 motivation. One interviewee had experienced a change in coach during the trial. He stated this did
257 not clearly change his platform use, although it did negatively impact his connection with the coach.

259 *Reactive use of the platform*

260 In many interviews, participants expressed difficulty to take initiative in using the platform, and
261 found it easier to use the platform in a reactive way, e.g. responding to automatic or personal
262 reminders:

263 *“Look, I like to participate in such a study, but... Perhaps I’m a bit more passive, that I think*
264 *even if I have to have ten visits a year, that is fine. We will have a conversation; I will*
265 *complete lists; that is all fine. But a website is... to figure things out, and to write things down,*
266 *that is something... [Interviewer: Maybe you can call that initiative?] Yes I suppose that could*
267 *be it.” [P14]*

268 Participants who considered themselves as being loyal or persistent noted this stimulated sustained
269 platform use:

270 *“I was told to make contact once a month. And so I... It’s stated here in my iPad: remember*
271 *HATICE, report! And so we plan to do that.” [P11]*

272

1
2
3 273 *Lifestyle change: expectations and experiences*

4
5 274 Being motivated for lifestyle change was a reason to continue using the platform and vice versa. This
6
7 275 could be related to the reason to participate in the HATICE trial. Some participants were aware that
8
9 276 the trial entailed active participation and hoped that they might benefit from it. Others, who
10
11 277 participated to contribute to scientific progress, seemed to expect a more passive participation; i.e.
12
13 278 questionnaires or tests for which no self-initiative was required, and were not inclined to use the
14
15 279 platform for self-management. Secondly, if people managed to reach their lifestyle goals and
16
17 280 experienced its positive effects on their health, this stimulated sustained participation:

18
19 281 *“Five kilometre laps. Yes, that is the minimum distance that I would like to walk each time.*

20
21 282 *And I can achieve that quite nicely. And in that, I noticed that I started to feel fitter. That was*
22
23 283 *really surprising. I always thought that I would stumble along through the rest of my life. And*
24
25 284 *now I can... you get more fit. You have more enthusiasm to tackle things.” [P14]*

26
27
28 285 In contrast, some participants felt setting a goal was an unpleasant burden. If they did not manage to
29
30 286 reach their goal, they refrained from registering this on the platform or informing their coach, also,
31
32 287 because they felt embarrassed or demotivated:

33
34 288 *“You got sort of forced to... Because you had to make certain promises, like ‘I will make sure*
35
36 289 *to exercise so many times a day’ and ‘I will make sure I will lose weight’. Those kinds of*
37
38 290 *things. Yes, that went against my gut feeling. [...] You were sort of embarrassed if you said,*
39
40 291 *well I actually did not do anything.” [P7]*

41
42
43 292 Participants appreciated the automatic feedback on entered measurements as it gave a reassuring
44
45 293 feeling of having their health monitored. This facilitated regular logging in.

46
47 294

48
49 295 *Incorporation into daily routines*

50
51 296 Participants said that it was easier for them to keep using the platform if they had incorporated their
52
53 297 platform use into their daily or weekly routine:

1
2
3 298 *"Yes I like it. It works as a sort of support. In life you have all kinds of support systems, with*
4
5 299 *your habits and your things, and this is one of them. It has become a part of... Yes well*
6
7 300 *sometimes I can use it and sometimes I can't. But it has become a part of everything."* [P2]

8
9 301 Disruption of daily routines, such as illnesses, negatively affected platform use. Social support, on the
10
11 302 other hand, was an incentive for sustained use. This was especially true for couples participating in
12
13 303 the HATICE trial together:

14
15 304 *"I said, 'We should do something.' Then I started to fill those [questionnaires] in. And I said,*
16
17 305 *'Are you going to do that?' [Response partner:] 'Yes I will do that, but I am very busy.' I said,*
18
19 306 *'It will only take a minute.'" [P10]*

20
21 307 Another important factor that facilitated platform-adherence was that the platform could improve
22
23 308 the perceived continuity of support in self-management. In contrast to nurse-led periodic
24
25 309 consultations, which are typical of secondary cardiovascular prevention programs, the platform felt
26
27 310 like a source of continuous support that they could direct to any time:

28
29
30 311 *"I already visit the practice nurse, but there is a lot of time in between [visits] and then yes...*
31
32 312 *Of course together we assess the results, look at it and discuss it. But when I'm gone, it [the*
33
34 313 *support] is also gone. Unless, of course, it turns out that I have to... that it's not quite OK. But*
35
36 314 *then it's gone again. And this is, the continuity that you're always working on it, that is good.*
37
38 315 *" [P2]*

39
40 316 Some participants found using the platform was time-consuming, which worked as a barrier. This
41
42 317 could occur because of the misconception that they were obliged to regularly add measurements. In
43
44 318 contrast, if participants felt the platform did not take too much of their time they were inclined to
45
46 319 keep using it.

47 48 49 320 50 51 321 *Perceived lack of change in the platform*

52
53 322 Most participants were not aware of any changes made to the platform content, although others
54
55 323 noted that news items were regularly updated. While several participants appreciated the stable

1
2
3 324 content, others would have liked to see more changes over time, to stimulate their sustained
4
5 325 engagement:

6
7 326 *“Well I read that [information on cardiovascular risk] a little in the beginning and then that is*
8
9 327 *that. Well now... And that does not change. I’m almost certain that this is the same as it was*
10
11 328 *1,5 year ago. [...] So that is not inviting; to keep looking if there is something new.” [P15]*

12
13 329 The coach could influence this by varying the themes of conversation.

14
15 330

16 17 331 **Future implementation**

18
19 332 Participants indicated that the level of incorporation into the regular health care system was limited,
20
21 333 and therefore some of them felt the platform had no clear added value on top of the nurse-led
22
23 334 cardiovascular risk management they already received within the primary health care. Regarding
24
25 335 future implementation, participants felt positive toward incorporation of the platform into the
26
27 336 existing primary care structure. Especially if the practice nurse were to become their coach, thus
28
29 337 contributing to continuity of support, and if all measurements performed at home, and within
30
31 338 primary and secondary care were integrated into the platform:

32
33 339 *‘The visit to the practice nurse is of course the real measurement. So I feel it’s important to*
34
35 340 *keep that, because it monitors your health, or at least a part of your health. That is important.*
36
37 341 *But if all those measurements could be incorporated into this study, that would of course be*
38
39 342 *very positive, because than you can compare it over several years or you can use it to look*
40
41 343 *things up.’[P9]*

42
43 344 A concern of some of the participants was that this incorporation would lead to substitution of
44
45 345 valued, in-person contacts with health care professionals by more anonymous exchange of messages
46
47 346 via the platform. A participant suggested to add regular in-person visits with measurements to
48
49 347 increase motivation, as a solution.

50
51 348

52 53 349 **DISCUSSION**

1
2
3 350 **Summary**

4
5 351 We have found that the support of a coach is crucial to initiate and sustain engagement of older
6
7 352 people with an interactive Internet platform for cardiovascular self-management. Factors associated
8
9 353 with initial platform engagement are perceived computer literacy, usability and anticipated benefits
10
11 354 of the platform, with special attention to the computer skills and preferences of older people.
12
13 355 Factors associated with sustained platform engagement are regular automatic and personal
14
15 356 reminders, clear expectations, incorporation into daily routine, and social support. Incorporation into
16
17 357 primary healthcare could facilitate implementation of the platform and could improve the perceived
18
19 358 continuity of support in self-management.
20

21
22 359

23
24 360 **Strengths and limitations**

25
26 361 The main strength of our study is that through our purposive sampling method we included both
27
28 362 participants with a short, intermediate and long follow-up duration. This contributed to a clear
29
30 363 distinction in motives for initial and sustained engagement. We used an iterative analysis method
31
32 364 with multiple analysis rounds and adaptation of the interview guide throughout the process. Also, we
33
34 365 followed the consolidated criteria for reporting qualitative research (COREQ) guidelines to facilitate
35
36 366 reproducibility of study results.²⁰ A limitation of our study is that we only interviewed Dutch
37
38 367 participants, potentially limiting the scope to the Dutch health care setting. Furthermore, the sample
39
40 368 is prone to bias as our participants were willing to partake in both the HATICE trial and our qualitative
41
42 369 sub-study. This could have led to selection of people with a relative positive view on the intervention
43
44 370 and with a high education level.²¹ We minimised this potential bias by purposively sampling
45
46 371 participants on education level and login frequency. Another possible source of bias is the fact that
47
48 372 two of the interviewers and researchers analysing the data were involved in the development and
49
50 373 maintenance of the platform. This could have influenced the intonation of questioning and
51
52 374 interpretation of the data, however their knowledge of the platform could also have stimulated the
53
54
55
56
57
58
59
60

1
2
3 375 discussion. Independent analysis was ensured by incorporation of several analysis rounds with other
4
5 376 team members.

6
7 377

8 9 378 **Comparison with existing literature**

10
11 379 Part of our results are in line with previous studies on engagement with eHealth interventions, such
12
13 380 as on the influence of usability, perceived benefit and expectations of the intervention and the
14
15 381 incorporation into personal life.⁹ A new finding that is especially relevant for eHealth interventions
16
17 382 on cardiovascular prevention is the crucial role of continuous support by a coach for sustained
18
19 383 engagement. This has previously been described in a non-digital multi-domain preventive
20
21 384 intervention.²² In our study, the initial in-person contact was important to establish a relationship of
22
23 385 trust between the participant and coach. For most people maintenance of this relationship via a
24
25 386 messaging system appeared to work well for a longstanding personal connection. The importance of
26
27 387 this kind of blended care is emphasised by a meta-analysis showing a more pronounced effect on
28
29 388 cardiovascular risk reduction.⁸ Despite the use of motivational interviewing techniques and coaches
30
31 389 following the trans-theoretical model,^{17 18} it was difficult to engage people with a low perceived
32
33 390 benefit of the intervention. In general, motivational interviewing techniques delivered through
34
35 391 eHealth have proven effective in inducing behavioural changes.²³ Nevertheless, a complete in-person
36
37 392 approach might be preferable for participants in the pre-contemplation phase, when there is no
38
39 393 intention to change behaviour, as even reading information about cardiovascular risk on the platform
40
41 394 requires some level of initiative.¹⁵ A reactive approach, i.e. responding to automatic and personal
42
43 395 reminders, rather than a proactive approach seemed to suit most participants best. Previous studies
44
45 396 have shown that electronic reminders are a useful tool to increase medication adherence.²⁴
46
47 397 However, it is uncertain whether this reactive approach sufficiently supports self-efficacy.¹⁵ In line
48
49 398 with the degrees of self-management proposed by Schermer this might be seen as compliant self-
50
51 399 management.²⁵ Even though the interactive and flexible quality of the HATICE platform facilitates
52
53 400 adoption of concordant self-management, i.e. incorporation of the lifestyle advice into their personal
54
55
56
57
58
59

1
2
3 401 life, this is not employed by everyone. Limited computer experience is an important barrier to
4
5 402 platform use which may prohibit large-scale implementation. Increasing use of Internet by older
6
7 403 people is likely to overcome this limitation in the near future.²⁶
8
9

10 404

11 12 405 **A tailored platform**

13
14 406 Our study shows that many aspects of multi-domain eHealth interventions rely heavily on personal
15
16 407 preferences. The HATICE platform has been adjusted to the need for a personalised platform, by not
17
18 408 imposing any obligations on which functionalities to use and giving participants the opportunity to
19
20 409 tailor the frequency of automatic reminders to personal preferences. However, during the
21
22 410 interviews, it appeared that people prefer an even more personalised platform. For instance,
23
24 411 engagement was dependent on personal preference with regard to how much the content of the
25
26 412 platform changes over time and the complexity of the platform changes, affinity with self-
27
28 413 measurement, whether or not confrontation with lifestyle goals was appreciated, the ideal amount
29
30 414 of time invested, and the optimal frequency of reminders. As suggested by Bandura et al. it might be
31
32 415 useful to tailor the platform content and the way it is provided based on a participants readiness to
33
34 416 change.¹⁵ This could for example be incorporated in a self-learning system that automatically tailors
35
36 417 to personal characteristics, stages of change, needs and wishes.²⁷
37
38

39 418

40 41 42 419 **Implications for practice**

43
44 420 During the HATICE trial, the platform was offered independently from regular care. Participants
45
46 421 mentioned this separation as a barrier to platform use and agreed with the suggestion to incorporate
47
48 422 it into the current primary care structure. Preventive eHealth interventions provide the opportunity
49
50 423 to optimize continuity in support of self-management and reach individual targets with limited
51
52 424 resources. In addition, implementation may improve sustained engagement with such an
53
54 425 intervention.²⁸ Suggestions for this incorporation are to have the practice nurse work as coach, link
55
56
57
58
59
60

1
2
3 426 measurements from electronic health records directly to the platform, and align this with additional
4
5 427 in-person visits for nurse-led cardiovascular risk management. Nevertheless, opportunities to
6
7 428 implement the platform probably differ based on the health care system. It is therefore crucial to
8
9 429 properly evaluate the health care context and views of end-users and health care professionals to
10
11 430 support successful implementation.¹² Especially in health care systems with long distances or low
12
13 431 resources, a preventive eHealth intervention may provide opportunities to improve existing
14
15 432 preventive care.²⁹

1
2
3 433 **Acknowledgements**

4
5 434 We would like to thank all HATICE participants that agreed to participate in this qualitative sub-study.

6
7 435 Our gratitude also goes out to Suzanne van Rhijn for her help in interviewing participant and Sinem

8
9 436 Kurt-Bayrakci for transcribing part of the interviews.
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 437 **HATICE consortium members**

4
5 438 Academic Medical Center (AMC), Amsterdam, the Netherlands: Edo Richard, Pim van Gool, Eric Moll

6
7 439 van Charante, Cathrien Beishuizen, Susan Jongstra, Tessa van Middelaar, Lennard van Wanrooij,

8
9 440 Marieke Hoevenaar-Blom

10
11 441 University of Eastern Finland (UEF), Kuopio, Finland: Hilikka Soininen, Tiia Ngandu, Mariagnese

12
13 442 Barbera

14
15 443 Karolinska Institutet/Stockholm University, Stockholm, Sweden: Miia Kivipelto, Francesca

16
17 444 Mangialasche

18
19 445 INSERM, University of Toulouse, Toulouse, France: Sandrine Andrieu, Nicola Coley, Juliette

20
21 446 Guillemont

22
23 447 NOVAPTEN, Paris, France: Yannick Meiller

24
25 448 VitalHealth Software, Ede, the Netherlands: Bram van de Groep

26
27 449 Cambridge Institute of Public Health, University of Cambridge, Cambridge, UK: Carol Brayne

28
29
30 450
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

451 **REFERENCES**

- 452 1. Abegunde DO, Mathers CD, Adam T, et al. The burden and costs of chronic diseases in low-income
453 and middle-income countries. *Lancet* 2007;370(9603):1929-38. doi: 10.1016/S0140-
454 6736(07)61696-1
- 455 2. Mons U, Muezzinler A, Gellert C, et al. Impact of smoking and smoking cessation on cardiovascular
456 events and mortality among older adults: meta-analysis of individual participant data from
457 prospective cohort studies of the CHANCES consortium. *BMJ* 2015;350:h1551. doi:
458 10.1136/bmj.h1551
- 459 3. Chow CK, Jolly S, Rao-Melacini P, et al. Association of diet, exercise, and smoking modification with
460 risk of early cardiovascular events after acute coronary syndromes. *Circulation*
461 2010;121(6):750-8. doi: 10.1161/CIRCULATIONAHA.109.891523
- 462 4. World Health Organization (2003). *Adherence to long-term therapies: evidence for action*.
463 http://www.who.int/chp/knowledge/publications/adherence_report/en/ (accessed 17-10-
464 2017).
- 465 5. Nouwens E, van Lieshout J, van den Hombergh P, et al. Shifting cardiovascular care to nurses
466 results in structured chronic care. *Am J Manag Care* 2014;20(7):e278-84.
- 467 6. Pagliari C, Sloan D, Gregor P, et al. What is eHealth (4): a scoping exercise to map the field. *J Med*
468 *Internet Res* 2005;7(1):e9. doi: 10.2196/jmir.7.1.e9
- 469 7. Kohl LF, Crutzen R, de Vries NK. Online prevention aimed at lifestyle behaviors: a systematic review
470 of reviews. *J Med Internet Res* 2013;15(7):e146. doi: 10.2196/jmir.2665 [published Online
471 First: 2013/07/19]
- 472 8. Beishuizen CR, Stephan BC, van Gool WA, et al. Web-Based Interventions Targeting Cardiovascular
473 Risk Factors in Middle-Aged and Older People: A Systematic Review and Meta-Analysis. *J*
474 *Med Internet Res* 2016;18(3):e55. doi: 10.2196/jmir.5218
- 475 9. O'Connor S, Hanlon P, O'Donnell CA, et al. Understanding factors affecting patient and public
476 engagement and recruitment to digital health interventions: a systematic review of

- 1
2
3 477 qualitative studies. *BMC medical informatics and decision making* 2016;16(1):120. doi:
4
5 478 10.1186/s12911-016-0359-3 [published Online First: 2016/09/16]
6
7 479 10. Becker SA. A study of web usability for older adults seeking online health resources. *ACM Trans*
8
9 480 *Comput Hum Interact* 2004;11:387-406.
10
11 481 11. Peters DH, Adam T, Alonge O, et al. Implementation research: what it is and how to do it. *BMJ*
12
13 482 2013;347:f6753. doi: 10.1136/bmj.f6753
14
15 483 12. Glasgow RE, Phillips SM, Sanchez MA. Implementation science approaches for integrating eHealth
16
17 484 research into practice and policy. *Int J Med Inform* 2014;83(7):e1-11. doi:
18
19 485 10.1016/j.ijmedinf.2013.07.002
20
21 486 13. Richard E, Jongstra S, Soininen H, et al. Healthy Ageing Through Internet Counselling in the
22
23 487 Elderly: the HATICE randomised controlled trial for the prevention of cardiovascular disease
24
25 488 and cognitive impairment. *BMJ Open* 2016;6(6):e010806. doi: 10.1136/bmjopen-2015-
26
27 489 010806
28
29
30 490 14. Jongstra S, Beishuizen C, Andrieu S, et al. Development and Validation of an Interactive Internet
31
32 491 Platform for Older People: The Healthy Ageing Through Internet Counselling in the Elderly
33
34 492 Study. *Telemed J E Health* 2016 doi: 10.1089/tmj.2016.0066
35
36 493 15. Bandura A. Health promotion by social cognitive means. *Health education & behavior : the official*
37
38 494 *publication of the Society for Public Health Education* 2004;31(2):143-64. doi:
39
40 495 10.1177/1090198104263660 [published Online First: 2004/04/20]
41
42 496 16. Michie S, Richardson M, Johnston M, et al. The behavior change technique taxonomy (v1) of 93
43
44 497 hierarchically clustered techniques: building an international consensus for the reporting of
45
46 498 behavior change interventions. *Annals of behavioral medicine : a publication of the Society of*
47
48 499 *Behavioral Medicine* 2013;46(1):81-95. doi: 10.1007/s12160-013-9486-6 [published Online
49
50 500 First: 2013/03/21]
51
52 501 17. Rollnick S, Miller WR, Butler CC. Motivational interviewing in health care: helping patients change
53
54 502 behavior. New York: The Guilford Press, 2008.

- 1
2
3 503 18. Prochaska JO, Diclemente CC, Norcross JC. In Search of How People Change - Applications to
4
5 504 Addictive Behaviors. *Am Psychol* 1992;47(9):1102-14. doi: Doi 10.1037/0003-066x.47.9.1102
6
7 505 19. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*
8
9 506 2006;3(2):77-101.
10
11 507 20. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a
12
13 508 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19(6):349-57.
14
15 509 doi: 10.1093/intqhc/mzm042
16
17 510 21. Rothwell PM. External validity of randomised controlled trials: "to whom do the results of this
18
19 511 trial apply?". *Lancet* 2005;365(9453):82-93. doi: 10.1016/S0140-6736(04)17670-8
20
21 512 22. Ligthart SA, van den Eerenbeemt KD, Pols J, et al. Perspectives of older people engaging in nurse-
22
23 513 led cardiovascular prevention programmes: a qualitative study in primary care in the
24
25 514 Netherlands. *Br J Gen Pract* 2015;65(630):e41-8. doi: 10.3399/bjgp15X683149
26
27 515 23. Shingleton RM, Palfai TP. Technology-delivered adaptations of motivational interviewing for
28
29 516 health-related behaviors: A systematic review of the current research. *Patient Educ Couns*
30
31 517 2016;99(1):17-35. doi: 10.1016/j.pec.2015.08.005
32
33 518 24. Vervloet M, Linn AJ, van Weert JC, et al. The effectiveness of interventions using electronic
34
35 519 reminders to improve adherence to chronic medication: a systematic review of the literature.
36
37 520 *J Am Med Inform Assoc* 2012;19(5):696-704. doi: 10.1136/amiainl-2011-000748
38
39 521 25. Schermer M. Telecare and self-management: opportunity to change the paradigm? *Journal of*
40
41 522 *medical ethics* 2009;35(11):688-91. doi: 10.1136/jme.2009.030973 [published Online First:
42
43 523 2009/11/03]
44
45 524 26. Eurostat. Internet access and use statistics - households and individuals. Available from:
46
47 525 [http://ec.europa.eu/eurostat/statistics-](http://ec.europa.eu/eurostat/statistics-explained/index.php/Internet_access_and_use_statistics_-_households_and_individuals)
48
49 526 [explained/index.php/Internet access and use statistics - households and individuals](http://ec.europa.eu/eurostat/statistics-explained/index.php/Internet_access_and_use_statistics_-_households_and_individuals)
50
51 527 (accessed 24-04-2017).
52
53
54
55
56
57
58
59
60

- 1
2
3 528 27. Conway N, Webster C, Smith B, et al. eHealth and the use of individually tailored information: A
4
5 529 systematic review. *Health Informatics J* 2016 doi: 10.1177/1460458216641479
6
7 530 28. Brown LL, Lustria ML, Rankins J. A review of web-assisted interventions for diabetes
8
9 531 management: maximizing the potential for improving health outcomes. *J Diabetes Sci*
10
11 532 *Technol* 2007;1(6):892-902. doi: 10.1177/193229680700100615
12
13 533 29. Saner H, van der Velde E. eHealth in cardiovascular medicine: A clinical update. *Eur J Prev Cardiol*
14
15 534 2016;23(2 suppl):5-12. doi: 10.1177/2047487316670256
16
17
18 535
19
20 536
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

537 **Tables 1. Characteristics of the participants**

Participant characteristics				Study characteristics				
Nr.	Gender	Age	Education level*	CV D	DM	FU duration (mos.)	Partner partic. in HATICE	Login frequency (per mo.)
1	M	73	High	+	-	2.6	+	0.6
	F	66	Intermediate	-	-	2.6	+	0.5
2	F	67	Intermediate	+	+	2.2	-	3.2
3	F	84	Low	-	-	3.2	-	2.7
4	M	71	High	-	-	2.4	-	4.4
5	F	67	Intermediate	-	-	2.3	-	0.3
6	M	68	High	-	-	2.3	+	0.4
	F	70	Intermediate	-	-	2.3	+	0.7
7**	F	71	Intermediate	+	+	10.5	+	0.7
	M	74	Intermediate	-	-	10.3	+	0.9
8	M	65	Low	+	+	8.4	-	0.6
9	M	67	High	+	-	7.8	-	1.1
10	F	66	High	-	-	14.7	+	2.6
11	F	68	Intermediate	-	-	14.7	-	0.5
12	M	66	Low	+	+	7.1	-	1.8
13	F	74	High	-	-	9.4	-	4.7
14	M	65	Intermediate	+	+	15.8	-	0.8
15	M	67	Low	+	+	14.8	-	3.1
16	F	83	Intermediate	+	-	15.8	-	5.1
17	M	84	Low	+	-	16.6	-	3.2

538 *The characteristics are divided into participant characteristics and HATICE study characteristics. *Low*539 *education level indicates primary education or lower secondary education; intermediate, upper*

1
2
3 540 *secondary education and post-secondary non-tertiary education; high, short-cycle tertiary education.*

4
5 541 *** Interview 7 was performed with participants that had recently (prematurely) ended their*

6
7 542 *participation in HATICE. Nr. indicates number; CVD, history of cardiovascular disease; DM, diabetes*

8
9 543 *mellitus; FU, follow-up; mo, month; partic., participating; M, male; F, female.*

10
11
12 544
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

545 **Box 1. Themes and subthemes identified in the interviews of the facilitators (+) and barriers (-) in**
 546 **initial and sustained platform use**

Initial platform use	Sustained platform use
User-friendliness for older people	Coach: long-term relationship of trust
<ul style="list-style-type: none"> • Layout: simplicity, attractiveness (+/-) • Technical difficulties (-) • Perceived computer literacy (+/-) 	<ul style="list-style-type: none"> • Personal connection (+) • Content of messages (+/-) • Continuity of person (-)
Coach: the basis for a relationship of trust	Reactive use of the platform* (+) Lifestyle
<ul style="list-style-type: none"> • In-person baseline consultation (+) • Timing and content of messages (+) 	change: expectations and experiences
Usefulness and perceived benefit of the intervention	<ul style="list-style-type: none"> • Expectations of platform (+/-) • Benefits of lifestyle changes (+) • Setting a goal is burdensome (-)
<ul style="list-style-type: none"> • Affinity with platform functionalities (including self-management) (+/-) 	• Monitoring health (+)
<ul style="list-style-type: none"> • Awareness of cardiovascular risk (+/-) 	Incorporation into daily routine
<ul style="list-style-type: none"> • Motivation for lifestyle change with increasing age (-) 	<ul style="list-style-type: none"> • Incorporation into daily routine (+/-)
	<ul style="list-style-type: none"> • Social (partner) support (+)
	<ul style="list-style-type: none"> • Continuity of care (+/-)
	<ul style="list-style-type: none"> • Time investment (+/-)
	Perceived lack of change in the platform (+/-)

547 **Reactive use indicates the preference of participants to use the platform in response to automatic or*
 548 *personal reminders.*

ONLINE SUPPLEMENT

Supplement to:

Engaging older people in an Internet platform for cardiovascular risk self-management: a qualitative study among Dutch HATICE participants

T. van Middelaar, C.R.L. Beishuizen, J. Guillemont, M. Barbera, E. Richard, E.P. Moll van Charante, on behalf of the HATICE consortium

Table of content

Page 2 - Interview guide

Interview guide

Opening question: *Could you tell me about your experiences with the HATICE platform?*

1. Use, experiences and opinion about the platform

General

Did you ever log onto the platform? What pages do you usually visit when you are logged on? What do you use the most and why? What don't you use and why? What do you think about the platform? Does the platform motivate you to change your lifestyle? Why?

Baseline

Why did you choose to participate in HATICE? Did your coach introduce you to the platform during the second visit? What did the coach mention about the platform? What was your first impression? What were your expectations of the platform? What was expected of you?

Initial phase

What were your first experiences with logging onto the platform? What parts of the platform did you use then? What appealed you to use the platform? And what repelled you to use the platform?

Adherence phase

How is that now? Do you use the platform differently now in comparison to the beginning? Why? Are there things that could have increased your use of the platform? If it would be possible, would you keep using the platform after the study ended? Why?

Coach

How do you experience the contact with your coach? What do you like? What don't you like? Do you feel that the coach is of added value to the platform? Would you prefer having telephone contact with your coach?

2. Interaction with regular care

Do you feel that the platform is of added value to regular care? To what extend? Have you consulted you general practitioner/practice nurse about the platform (or are you going to)? Why?

Would you like it if the general practitioner/practice nurse had insight into data from your personal platform? Why? If yes, what data would you like to share and what not?

(If applicable) Are there advantages or disadvantages to the platform in comparison to the care of your practice nurse?

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description	Page
Domain 1: Research team and reflexivity			
Personal Characteristics			
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?	6
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>	6
3.	Occupation	What was their occupation at the time of the study?	7
4.	Gender	Was the researcher male or female?	1,6
5.	Experience and training	What experience or training did the researcher have?	7
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	7
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	7
8.	Interviewer	What characteristics were	7

No	Item	Guide questions/description	Page
	characteristics	reported about the interviewer/facilitator? e.g. <i>Bias, assumptions, reasons and interests in the research topic</i>	
Domain 2: study design			
Theoretical framework			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. <i>grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	7
Participant selection			
10.	Sampling	How were participants selected? e.g. <i>purposive, convenience, consecutive, snowball</i>	6
11.	Method of approach	How were participants approached? e.g. <i>face-to-face, telephone, mail, email</i>	6
12.	Sample size	How many participants were in the study?	7
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	6
Setting			

No	Item	Guide questions/description	Page
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	7
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	7
16.	Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i>	7,8
Data collection			
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Suppl.
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	7
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	7
20.	Field notes	Were field notes made during and/or after the interview or focus group?	7
21.	Duration	What was the duration of the interviews or focus group?	7
22.	Data saturation	Was data saturation discussed?	7
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	n.a.
Domain 3: analysis and			

No	Item	Guide questions/description	Page
findingsz			
Data analysis			
24.	Number of data coders	How many data coders coded the data?	7
25.	Description of the coding tree	Did authors provide a description of the coding tree?	25
26.	Derivation of themes	Were themes identified in advance or derived from the data?	7
27.	Software	What software, if applicable, was used to manage the data?	n.a.
28.	Participant checking	Did participants provide feedback on the findings?	n.a.
Reporting			
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i>	8-14
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	8-14
31.	Clarity of major themes	Were major themes clearly presented in the findings?	25
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	8-14

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

n.a. indicates not applicable

For peer review only