

DELIVERABLE 1.4B

DEFINITION OF THE BEHAVIOUR CHANGE PROGRAMME

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Acknowledgements

Thank you to all end-users across sites who took the time to participate in this research. We appreciate your time and effort.

National funding agencies

COUNTRY	FUNDING AGENCY FULL NAME
Switzerland	State Secretariat for Education, Research and Innovation
Ireland	Enterprise Ireland
Belgium	Agentschap Innoveren & Ondernemen

Document history

REV.	APPROVAL DATE	DESCRIPTION
V0.1	04/04/2017	Draft Version
V1.0	23/06/2017	Final Version
V1.1	30/06/2017	Release of D1.4a after peer review
V1.2	12/06/2018	Integration of the trials results
V1.3	02/07/2018	Release of D1.4b after peer review

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List of Abbreviations

ABBREVIATION	FULL	DESCRIPTION
WP	Work Package	Category of tasks which details the description of work
BCW	Behaviour change wheel	Health behaviour change theory
IoT	Internet of things	inter-networking of devices which enable the collection and exchange data.

1 Introduction

It is important to acknowledge that as people age and their functional capacities decline, one's environment becomes increasingly important in facilitating independence, self-efficacy and well-being (Lawton, Nehemow, Elsdorfer & Lawton, 1973). Vizier strives to improve the lives of the elderly by providing them with the tools to live longer independently. Vizier proposes a commercially viable "open architecture" solution will be designed and developed for utilizing popular modern online services, as well as innovative and affordable Internet of Things (IoT) appliances already available on the market.

Through this stream-lining of technology into an intuitive and elderly friendly interface, Vizier can be a key platform for 'successful ageing' increasing confidence, independence and ultimately empowering older adults in a world saturated with technology. 'Successful aging' embodies three key components: low risk of disease and disease-related disability; maintenance of high mental and physical function; and continued engagement with life, including interrelationships and productive activity (Rowe & Kahn, 2015). This aligns with key Vizier goals (i.e., to encourage the elderly to improve the management of their daily lives, to stay physically, mentally and socially active and to ensure the elderly safety and wellbeing).

This can be achieved through new connected technologies whereby a simple interface can combine many off-the-shelf components together underpinned by key behaviour change techniques to stimulate the elderly to stay physically, mentally and socially active. An important strength of Vizier is how it is underpinned by health behaviour change theory. Evidence-based, technology-enabled behaviour change is part of the wider solution to empower individuals to take greater responsibility for their health and well-being. Technology platforms can augment existing health behaviours and also increase the level of social support and interaction that an older adult can receive remotely from their own homes.

To ensure that the user requirements of the older adults are appropriately met a behaviour change programme must be appropriately designed for and tested within the target group. The current report details the definition of the behaviour change programme and the testing of the behaviour change programme in the pre-trial.

1.1 Rationale for health behaviour change programme

Guidelines recommend that older adults (65 + years) engage in at least 150 min moderate (or 75 min vigorous) physical activity per week, and muscle-strengthening activities on at least two days a week. However, the global trend is that older adults engage in less physical activity than younger adults and that this gap increases with age (Hallal et al., 2012). The 2012 Health Survey for England shows that only 7% of females and 13% of males aged 65 and older reported meeting all the recommended physical activity guidelines (Scholes & Mindell, 2013).

Increasing physical activity in older adults can result in large increases in health benefits, improved mood, improved self-esteem and quality of life (Rejeski & Mihalko, 2001). Furthermore, physical activity has been shown to help maintain physical and cognitive function, thereby reducing the risk of falls and dementia, both major obstacles to retaining independence (UK Department of Health, 2011).

From available evidence and exploration of data from D1.1 user requirements, it is clear that many of the end users do not reach minimum physical activity guidelines. Therefore, we will take an approach whereby there will be health behaviour change programme around the reduction of sedentary behaviour and the increase of light to moderate physical activity (e.g., gardening, walking, golfing etc.) as already identified by users as key aspects which give joy and pleasure. Social interaction will also be a key motivation for participation.

Walking is popular, accessible and acceptable form of activity particularly among populations who are the most physically inactive (Morris et al.,1997). Walking also does not require special equipment and has low risk of injuries. Further, a meta-analysis of relevant research found that increased walking led to increased fitness, decreased body weight, Body Mass Index, percentage body fat and resting diastolic blood pressure in previously sedentary adults (Murphy et al., 2007). Walking interventions that targeted older adults were found to be more efficacious than those that targeted younger adults. This is a key finding taking into account the growing proportion of people aged over 60 years and the challenge of public health to maximize the health and functional capacity of this population.

Kassavou, Turner & French (2013) found promising evidence that supports the idea that walking interventions which provide social support relationships for behaviour change may lead to greater maintenance of behaviour change (Rothman, 2000). This is therefore a key area that Vizier can target to encourage the end-users to engage in physical activity.

1.1.1 Literature review: Key points for the implementation of Vizier

Key themes from the systematic review reported by Devereux and colleagues (2016) provides core component information for acceptability and the implementation of the health behaviour change programme within Vizier. These themes will be explored further in relation to the Vizier health behaviour change programme and any relevant information will be incorporated into the behaviour change programme.

TABLE 1 KEY THEMES FROM SYSTEMATIC REVIEWS

KEY THEMES FROM SYSTEMATIC REVIEW (DEVEREUX ET AL., 2016)
The role of perceived value
Enjoyment is key
The Impact of experience
Delivery is as important as content

1.1.1.1 The role of perceived value

The perceived value older adults placed on engaging in physical activity largely affected the acceptability of such behaviour. Older adults' understanding of benefits that could result from engagement directly affected this value. Previous studies have found appreciation of physical health benefits across most studies to some degree, particularly: maintaining or improving functional ability (Patel et al., 2011), with many older adults appreciated the mental health benefits of engaging in physical activities (Fox et al., 2007). However, there was no evidence of awareness of the cognitive protective benefits. This is an opportunity for Vizier to link the work of the health behaviour change programme with memory club functionalities and to educate the target users about protective cognitive factors that may provide motivation to engage in healthy lifestyle behaviours.

Oftentimes older adults have lower perceived value of physical activity due to doubts about their capabilities, or fear of causing themselves harm, particularly if they were unfamiliar with it (Schneider et al., 2003). There were also doubts whether there was any point in engaging in physical activity in older age (Dionigi and Cannon, 2009). Doubts about the need for physical activity were also apparent in those who felt they were healthy enough (Schneider et al., 2003). Others felt that low levels of day-to-day activity was enough for older adults, suggesting a low perceived value of older adults engaging in physical activity as an activity in itself (Grossman and Stewart, 2003). Education and goal-setting around appropriate goals in line with healthy adult guidelines is important to be implemented within Vizier.

Maintaining independence through taking control of one's own health seemed to increase the perceived value of engaging in physical activity (Henwood et al., 2011). The desire to remain an active family member also played a part in the perceived value of engaging in physical activity (Henwood et al., 2011). This also provides an opportunity to facilitate social interaction with family members through physical activity.

Perceived value of engaging in physical activity was also impacted by interactions with health professionals (Gillis et al., 2002). Medical supervision seemed to increase value through increasing the perceived safety of the intervention, particularly for those who had doubts about physical activity being suitable for them, ensuring that Vizier is seen as a part of the allied health professional team is key in the trust in the Vizier system and initiating use of the system.

1.1.1.2 Enjoyment is key

Enjoyment of social interaction was apparent, particularly for those who found solo activities boring (Stathi et al., 2010). Anticipated enjoyment of social interaction was a motivator (Hildebrand and Neufeld, 2009). Becoming more integrated into their local community was raised, as well as belonging in a broader sense. This was particularly noticeable in light of changes to lifestyle or to offset a loss such as retirement (Sims-Gould et al., 2012).

1.1.1.3 The impact of experience

Positive physical activity experiences increased the perceived value of physical activity (Dionigi, 2007). Pleasant surprise at their own achievements was noted (Sharon et al., 1997). The increase in self-efficacy from first-hand experience increased the value of activities previously perceived as unachievable (Patel et al., 2011). Initial concerns about novel activities (e.g., gym (Dionigi, 2007)

gave way to enjoyment after personal instruction and experiencing the benefits (Dionigi, 2007). Providing opportunities for older adults to safely experience novel physical activities appeared to increase self-efficacy. This theme then transferred to activities in daily life via objective feedback on performance (e.g., how much weight lifted in strength training), which backed up subjective experience of outcomes (e.g., increased ability to perform daily tasks; (Dionigi, 2007). Acknowledging the role physical activity played in improved function or resilience to injury was an important factor in increased awareness of the effect of inactivity (Henwood et al., 2011). Increased energy was also an important effect, which seemed to surprise some participants (Henwood et al., 2011).

Again the importance of the social element of physical activity for older adults was highlighted. There needs to be a focus on building and retaining the social bonds which may help overcome such issues when an intervention ends. Unsurprisingly in light of the above, many older adults wish to remain in the familiar setting that the intervention took place in, rather than seek out a new physical activity environment, which could explain why an effective study may not translate into real-world increases in physical activity levels (Stathi et al., 2010). Therefore, Vizier is excellently placed to deliver long-term maintenance of behaviour given how the behaviour was initiated and supported within the home throughout habit formation.

1.1.1.4 Delivery is as important as content

How a physical activity intervention was delivered affected the experience older adults have of engaging in physical activity, which in turn affected both the value and enjoyment of such engagement. It was important that the person delivering the activity was seen to have sufficient training to allow older adults to take part without fear, particularly if they had a health condition (Schneider et al., 2003). This has important implications for Vizier as the recommendations for physical activity need to be perceived as best practice guided by a health professional for optimal engagement.

Sensory or cognitive impairments may cause barriers to older adults engaging in physical activity (Grossman and Stewart, 2003). An understanding of the impact of such impairments is also necessary for acceptable delivery of a physical activity programme for older adults (Beaudreau, 2006). Components of interventions used for self-report of behaviour, such as activity logs or diaries, were often seen as onerous or unpleasant (Gillis et al., 2002). Therefore, if possible within Vizier, sensing technology and physical activity tracking must be automatic and not intrusive.

Older adults found incremental program increases that gradually raised their self-efficacy highly acceptable. This collaborative approach empowered older adults to engage in physical activity on their own terms, whilst safely challenging self-limiting expectations (Stathi et al., 2010).

Another important aspect of delivery was accessibility. For many older adults the closer to home a physical activity took place, the more acceptable it would be (Grossman and Stewart, 2003). Keeping costs to a minimum was important as many older adults have limited incomes (Schneider et al., 2003). Many older adults had a variety of caring, working, volunteering, social and medical routines impacting on their availability (Hildebrand and Neufeld, 2009), therefore Vizier needs to implement a flexible programme that still resonates with the participant as having an obligation [as listed above]. There may be a need for greater instrumental support to get older adults to initially engage

in physical activity. Previous physical activity interventions found that proactive face-to-face strategies such as individual discussions and personal invitations were far more effective when engaging older adults to consider physical activity initiation (Hildebrand and Neufeld, 2009). This suggests that when older adults are given the time and opportunity to discuss their individual needs and seek reassurance, that increased engagement in physical activity can be facilitated. This has implications for how the behaviour change programme is initially presented to the participant.

1.1.2 User requirements gathering: Key points for implementation of Vizier

1) The low levels of participation in physical activity in older adults suggest that their wants and needs are not being met. The specific type of physical activity itself may be key, as some interventions such as walking groups have proven more efficacious in promoting physical activity for older adults than for the general adult population (Kassavou, Turner & French, 2013). This may be due to the relative ease of walking and the social aspects of group activities.

- Walking seen as acceptable: will explore walking group literature (these will be examined for inclusion within the Vizier health behaviour change programme).

2) Often older adults are often motivated to engage in physical activity as a way to increase their social connections, particularly at transitional times in life such as retirement.

- Recent review found that promoting fun rather than just health and fostering social interaction within interventions can lead to older adults' enjoyment of physical activity programmes. Franco et al. (2015, show the importance of social interaction for older adults, but it goes further in suggesting that fun and social interaction should perhaps be the focus of physical activity interventions for non-clinical older adults, as this may be more acceptable and relevant to them.
- Therefore, must be based around social events insofar as possible.
- Implementing interventions in existing community-based programmes allows retention of social bonds post-intervention and removes transitional barriers. Therefore, linking with local events important [this ties in with user requirements which noted the need for local event information].

3) The perceived value of physical activity is increased by encouraging awareness that personally relevant psychosocial and physical benefits being experienced are a direct result of becoming more active.

- A programme delivered by trusted professionals with some one-to-one attention and collaboratively agreed incremental increases to safely challenge any self-limiting expectations is highly acceptable to older adults. Increased confidence in their capabilities within physical activity interventions often translates into increased physical activity in other areas of older adults' lives.
- Therefore, we must ensure the goal are tailored to each individual and that the user is reassured that the health behaviour change programme was developed by a health care professional.

4) Suggests that a health-based message may not be optimal for the non-clinical older adult population when it comes to increasing their physical activity levels., many older adults who are aware of the health benefits of being physically active still do not value physical activity enough to engage in it.

- Therefore, simply providing information on health benefits as suggested by Franco et al. (2015) would not appear to be an effective route to increase physical activity levels.
- However, there appears to be a lack of knowledge on the protective cognitive effects of physical activity and so this information may be useful, particularly for those who do not perceive themselves to be in need of physical health benefits.
- Links with user requirements of more information on memory and ties in very well with memory club function.

5) Some older adults place a low value on structured physical activity, believing that their daily living tasks deem them active enough (Grossman & Stewart, 2003)

- Need to educate not only on the need for moderate to vigorous physical activity requirements per week but encourage less sedentary behaviour.

6) There is some evidence that behaviour change techniques (BCTs) for use in the general adult population may not be optimal for use with older adults. French, Olander, Chisholm & McSharry (2014) suggest this may be due to decreased executive function in older age resulting in more effort being required to plan or control behaviour.

- Therefore, health behaviour change programme needs to be based around short term goals and clear planning.

2 Theoretical basis for the Vizier Behaviour change programme: The COM-B and Behaviour Change Wheel (BCW)

The COM-B model and behaviour change wheel were developed by Michie, Atkins and West (2014) as a systematic method of understanding behaviour and linking this understanding to behaviour change techniques. The COM-B model is a behaviour system whereby an individual’s capability, opportunity and motivation interact to generate behaviour and in turn that behaviour influences these components (see figure 2). Capability is defined as the individuals psychological and physical capacity to engage in the desired behaviour e.g. having the skills and knowledge necessary to initiate and maintain the behaviour. Opportunity is defined as the external factors that make the behaviour possible or encourage it. Motivation is characterized as the brain processes that energize and direct behaviour, not just goals and conscious decision-making (Michie et al., 2014). This model provides a basis from which interventions aimed at behaviour change, such as Vizier can be designed. The model ensures that an individual’s capability, opportunity and motivation are targeted in order to initiate behaviour change.

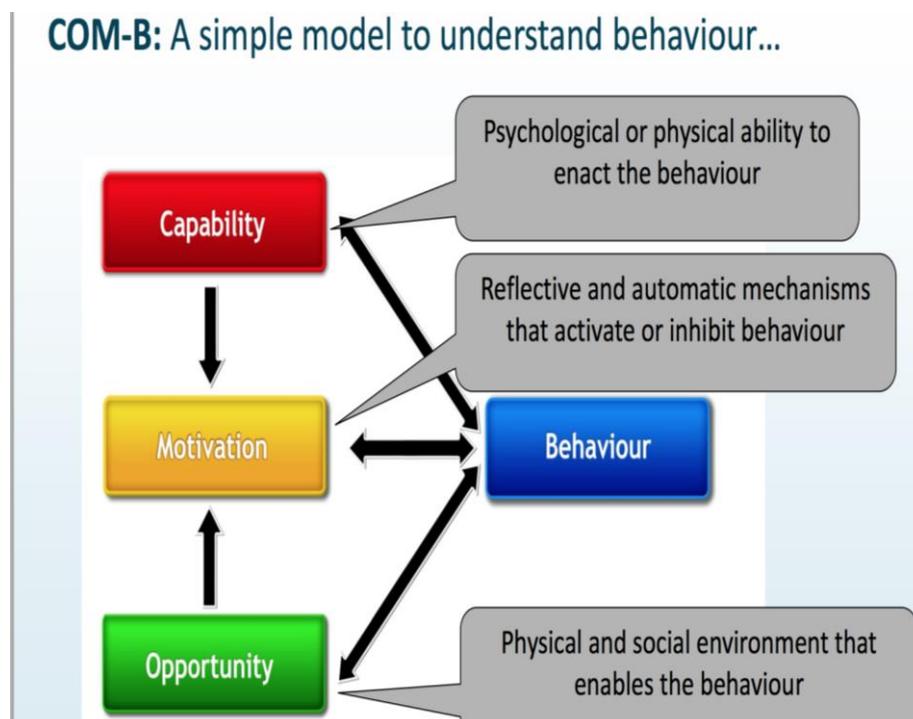


FIGURE 1 COM-B MODEL OF BEHAVIOUR CHANGE

COM-B model component (definition)	Example
Physical capability (Physical skill)	Having the skill to take a blood sample
Psychological capability (The capacity to engage in the necessary thought processes - comprehension, reasoning)	Awareness of the impact of CO ² on the environment
Reflective motivation (Reflective processes, involving evaluations and plans)	Deciding to buy fridge based on its energy performance rating
Automatic motivation (Automatic processes involving emotions and impulses that arise from associative learning and/or innate dispositions)	Deciding to buy a car based on the attractive model in the advertising campaign
Physical opportunity (Opportunity afforded by the environment)	Being able to go running because you own running shoes.
Social opportunity (Opportunity afforded by the cultural milieu that dictates the way that we think about things (e.g., the words and concepts that make up our language))	Being able to smoke in the house of someone who smoked but not in the middle of a boardroom meeting

FIGURE 2 DEFINITION OF COM-B COMPONENTS WITH WORKED EXAMPLES



FIGURE 3 BEHAVIOUR CHANGE WHEEL

The BCW is an approach to developing behaviour change interventions, beginning with identifying a target behaviour needed to change. The intervention is then designed to consist of intervention functions and behaviour change techniques, as well as the delivery mode which takes into account policy categories. The BCW consists of three layers (See figure 3). The hub of the wheel is formed by the COM-B model, which identifies the sources of behaviour which may be prime targets for the intervention. The next layer comprises of nine intervention functions to choose from depending on the particular COM-B analysis one arrives at. The outer layer is made up of seven types of policy that can be used to deliver the intervention functions.

Michie and colleagues (2013) also developed a behaviour change technique taxonomy that links to the behaviour change wheel, identifying 93 hierarchically clustered techniques that are the active components of behaviour change interventions. The core components of these techniques are 1) shaping knowledge, 2) comparison of outcomes, 3) comparison of behaviour, 4) self-belief, 5) natural consequences, 6) social support, 7) antecedents, 8) goal setting and planning, 9) feedback and monitoring, 10) associations, and 11) repetition and substitution. The use of behaviour change techniques forms a crucial part of the current evidence based development and delivery of complex behaviour change interventions. It provides researchers with a systematic way of developing and characterizing interventions that enables their outcomes to be linked to mechanisms of action and it can also help to diagnose why an intervention may or may not have achieved its desired outcome.

2.1 The Behaviour Change Wheel Process

The following steps outline the process of using the Behaviour Change Wheel to the Vizier behaviour change programme

2.1.1 Stage 1: Understanding the Behaviour

Table 2 specifies the target behaviour with regard to: i) who needs to perform the behaviour, ii) what the person needs to do differently to achieve the desired behaviour, iii) when they will do the behaviour, iv) where they will do it, v) how often and vi) with whom.

TABLE 2 SPECIFICATION OF THE TARGET BEHAVIOUR BASED ON THE BEHAVIOUR CHANGE WHEEL'S STAGE ONE PROCESS

THE TARGET BEHAVIOUR	WHO NEEDS TO PERFORM THE BEHAVIOUR?	WHAT DOES THE PERSON NEED TO DO DIFFERENTLY TO ACHIEVE THE DESIRED CHANGE?	WHEN WILL THEY DO IT?	WHERE WILL THEY DO IT?	HOW OFTEN WILL THEY DO IT?	WITH WHOM WILL THEY DO IT?
To increase minutes of light to moderate intensity physical activity	Vizier end users	Engage with the Vizier system and engage in regular independent physical activity	independent PA throughout the week	At home and within the local area	Progressively increase PA levels throughout engagement with Vizier, including a reduction of sedentary behaviour with the aim of being active 5 days a week	Fellow Vizier participants Family and friends Alone

TABLE 3 IDENTIFICATION OF WHAT NEEDS TO CHANGE USING THE COM-B MODEL

COM-B COMPONENTS	FINDINGS FROM THE USER NEEDS GATHERING	WHAT NEEDS TO BE IMPLEMENTED FOR THE TARGET BEHAVIOUR TO OCCUR? (I.E., INTERVENTION COMPONENTS THAT HAVE BEEN IDENTIFIED BASED ON THE USER NEEDS GATHERING AND THE REVIEW OF THE LITERATURE)	WHAT WAS IMPLEMENTED FOR THE TARGET BEHAVIOUR TO OCCUR.
PHYSICAL CAPABILITY	CO-MORBIDITIES	APPROPRIATE EXERCISE LEVELS; EMPHASIS ON WALKING PROGRAMMES AND REDUCTION OF SEDENTARY BEHAVIOUR	PARTICIPANTS WILL WEAR AN ACTIVITY TRACKING DEVICE TO TRACK ACTIVITY INTENSITY, STEP COUNT AND WILL HAVE PROMPTS TO REDUCE SEDENTARY BEHAVIOUR.
PSYCHOLOGICAL CAPABILITY	CLEAR PLANNING; SHORT TERMS GOALS; EDUCATION ON HEALTH BENEFITS [APPROPRIATE TO TARGET GROUP]	NEED TO LIMIT COGNITIVE BURDEN	PARTICIPANTS WILL HAVE A DAILY AGENDA INCLUDING THEIR PLANS FOR EACH DAY AND WILL BE REMINDED OF THESE PLANS EACH MORNING

PHYSICAL OPPORTUNITY	EQUIPMENT OR ABILITY TO SCHEDULE EVENTS APPROPRIATE TO THEM	AUTOMATIC PHYSICAL ACTIVITY TRACKING	PARTICIPANTS WILL WEAR AN ACTIVITY TRACKING DEVICE AND WILL HAVE THE ABILITY TO SCHEDULE ACTIVITIES INTO THEIR AGENDA
SOCIAL OPPORTUNITY	WANTS SOCIAL INTERACTION; GROUP CONNECTION	ENJOYABLE GROUP ACTIVITIES WHERE THE MAIN AIM IS SOCIAL INTERACTION [PHYSICAL ACTIVITY AS THE BY PRODUCT].	PARTICIPANTS WILL HAVE THE ABILITY TO SCHEDULE SOCIAL ACTIVITIES SUCH AS WALKING ACTIVITIES INTO THEIR AGENDA
REFLECTIVE AND AUTOMATIC MOTIVATION	HEALTH; FAMILY COMMITMENTS; FUNCTIONAL INDEPENDENCE	WEIGHT TRAINING; FLEXIBILITY TRAINING; WALKING PROGRAMMES	PARTICIPANTS WILL WEAR AN ACTIVITY TRACKER FOR MOTIVATION AND TO TRACK ACTIVITY AND PARTICIPANTS CAN ALSO SCHEDULE IN THESE ACTIVITIES INTO THEIR AGENDA

3 Results for the Pre-Trials

Twenty four participants across two sites (Dublin and Flanders) were included in the pre-trial. The protocol for the pre-trial is available in Appendix 1, page 26. Images 1-4 below were taken during the pre-trial. All participants completed an entry questionnaire, participants were then exposed to the Vizier system for between 20-45 minutes and then participants completed an exit questionnaire. The entry questionnaire asked participants to rank how useful they would find applications on the smart device in their daily on a five point Likert scale of 5 being “very useful” and 1 “not useful”. The exit questionnaire then presented participants with a series of statements regarding the system and asked them to rank these statements on a five point Likert scale: 1- “strongly disagree” and 5- “strongly agree.” Participants included both potential users and carers, ranging between 28- 86 years of age. In line with the behavioural change programme for physical activity in the Vizier system, this deliverable will focus on the activity tracking device and any applications that help participants plan their activity.



FIGURE 4 FITBIT – ACTIVITY TRACKER

The results of the entry questionnaire was largely positive:

- 14 out of 19¹ participants reported that they would find an activity tracker to inform participants of steps taken and cardiovascular performed and calories burned would be useful,
- 13 out of 19 participants reported that they would find seeing the weather forecast, bus timetables and activities near them would be useful,
- 9 out of 18 participants reported that they would find prompts for physical activity and health information notes or recommendations would be useful,
- 11 out of 19 participants reported that they would find movement detectors to notify when movement has not been detected for a prolonged period of time would be useful.

Similarly the results of the exit questionnaire were positive towards the use of a an activity tracker:

- 15 out of 19 participants strongly disagreed/disagreed that the activity tracker was uncomfortable,
- 8 out of 17 participants strongly disagreed /disagreed that the activity prompts were annoying
- 15 out of 19 participants agreed/ strongly agreed that the step tracking was very useful

The results of the pre- and post-trial questionnaire that relate specifically to physical activity are presented in Table 4.

¹ Where less than 24 are indicated, this is due to not all participants responding to the question



FIGURE 5 TIME TO TAKE A WALK



FIGURE 6 MEMORY CLUB LEVEL 1



FIGURE 7 VIZIER HARDWARE

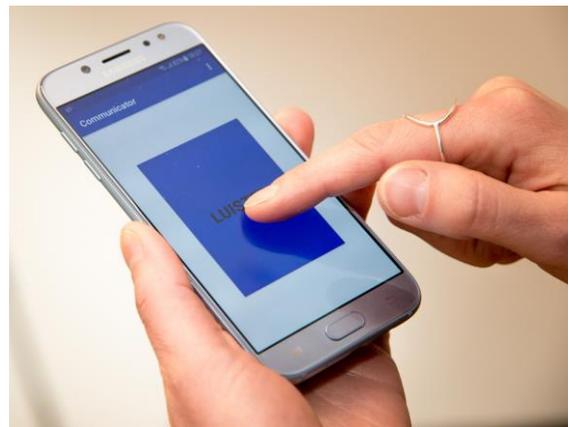


FIGURE 8 COMMUNICATOR

TABLE 4 SUMMARY RESULTS OF THE ENTRY AND EXIT QUESTIONNAIRE FOR THE PRETRIAL

ENTRY QUESTIONNAIRE		N=
An activity tracker to inform you of the amount of steps taken, cardiovascular activity performed and calories burned	Very useful (5)	7
	4	7
	3	3
	2	1
	Not useful (1)	1
Assistance with searching the weather forecast, bus timetable, new, television programmes activities near you	Very useful (5)	9
	4	4
	3	4

	2	2
	Not useful (1)	0
	Very useful (5)	5
Prompts for physical activity and physical health information notes/recommendations	4	4
	3	3
	2	5
	Not useful (1)	1
Movement detectors to notify when movement has not been detected for a prolonged period of time	Very useful (5)	9
	4	2
	3	5
	2	1
	Not useful (1)	2
EXIT QUESTIONNAIRE		N=
It was difficult to insert the social activity /walking group into the agenda	Strongly agree (5)	4
	Agree	5
	Neutral	0
	Disagree	3
	Strongly Disagree (1)	4
The wrist watch was uncomfortable	Strongly agree	2
	Agree	2
	Neutral	0
	Disagree	2
	Strongly Disagree	13
The activity prompts were annoying	Strongly agree	1
	Agree	3
	Neutral	5
	Disagree	5
	Strongly Disagree	3

The step tracking was useful	Strongly agree	9
	Agree	6
	Neutral	4
	Disagree	0
	Strongly Disagree	0

Participants were asked post-trial to rank the Vizier applications in the order they found most useful: 9 out of 19 listed the activity tracker/prompts in their top 3, while 8 out of 19 listed the agenda (in order to plan their physical activity).

The results of the pre-trial assessment revealed that most participants enjoyed the idea and use of an activity tracker to monitor their step count and did not find prompts annoying. This confirms the inclusion of an activity tracker as useful and appropriate for the behaviour change programme. The following rules will be used to encourage and monitor physical activity: the users is congratulated for the physical activity, this is to encourage behaviour change, this will be triggered by three different rules associated with step count or heart rate (smart watch) and the arrival sensor (smart things) as indicated in Table 5. There are also two rules in reduce sedentary behaviour and to prompt the user to engage in physical activity (Table 5), these are triggered by the step count on the smart watch and the motion sensor (smart things).

TABLE 5 VIZIER SYSTEM RULES FOR PHYSICAL ACTIVITY

TASK DETECTION	DESCRIPTI ON	PURPOSE OF DETECTION	DATA SOURCE	DATA TYPE	PRECONDITI ON	HOURLY THRESHIL DS	WEEKLY THRESH OLDS	METHOD OF ACTIVATION
Moderate physical activity	Brisk walk that warms you up	To ensure achievement of minimum physical activity goals.	Smart watch	Step counter	Number of steps in sequence	n/a	150 minutes	Congratulates physical activity
Moderate physical activity	Brisk walk that warms you up	To ensure achievement of minimum physical activity goals.	Smart watch	Heart rate	Heart rate elevate >90bpm for more than 5 minutes	n/a	150 minutes	Congratulates physical activity
Moderate physical activity	Brisk walk that warms you up	To ensure achievement of minimum physical activity goals.	Smart things	Arrival sensor		n/a	5 exits / 5 returns	Congratulates physical activity

Sedentary behaviour	Sitting for prolonged period	Sitting for long periods without moving has a negative impact on one's health	Smart watch	Step counter		20 minutes	n/a	Prompts to physical activity/movement
Sedentary behaviour	Sitting for prolonged period	Sitting for long periods without moving has a negative impact on one's health	Smart things	Motion sensor/ Presence sensor	Detect no motion for extended period while presence sensor indicates presence	20 minutes	n/a	Prompts to physical activity/movement

Some participants had difficulty inserting social activity/walking into their agenda, future participants may require increased training for this.

4 Conclusions

The current report aimed to summarise key findings from D1.1 and previous literature to ensure that the user requirements of the older adults are appropriately met within the Vizier health behaviour change programme. As can be seen from previous studies, any physical activity programme for older adults must appropriately designed for the target group to increase acceptability and adherence. The current report details the definition of the behaviour change programme, the testing of this in the pre-trial and the results of the pre-trial.

Users identified light to moderate exercise as the key physical activity of choice with an emphasis on outcomes such as functional independence. This means that the behavioural change strategy was built around facilitating motivation to maximize these lifestyle changes. The results of the pre-trial demonstrated that participants perceived and found the use of the activity tracker and prompts to be useful in increasing physical activity and reducing sedentary behaviour. Future work will include the findings of this task in the design and development such that participants are given feedback and encouragement if they reach physical activity guidelines monitored by the activity tracker.

5 References

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6 Appendices

6.1 Appendix 1 Protocol for pretrial

Setup:

- Upon arrival the participants will be introduced to the team present for the pre-trial *
- Prior to pre-trial participants will be given a Plain Language Statement and an Informed Consent Form to complete. *
- They will be asked for the necessary information to setup the Vizier system - first name e.g. Karen. *
- They will be logged into MClub *
- They will be fitted with the FitBit activity tracker and given the “keys” with presence sensor fob attached to have on their person for the evaluation. *
- If they have not already completed the pre-questionnaire, they will be invited to do so *
- They will be notified of the whereabouts of the fixed sensors *
- We will execute a test voice command/response to see that they understand this element *

The scripted protocol has been developed by the Vizier consortium is as follows:

- User sits at the breakfast table. (**Start Conversation**)
- Vizier greets him and reminds him of his agenda for today and asks if he wants to view the items. (**Check Agenda**)
- On the tablet is one recommendation for a local activity later this week. The user can schedule it in his agenda.
- The user takes out the trash and forgets to close the door. The system detects the door has been opened for a long time and alerts the user. (**Door Open**)
- A family member sent a message. The user writes a short message back (**Check Messaging**).
- The user gets a medication reminder (voice + pop-up on tablet) and can confirm that he took the medication. (**Check Medication**)
- The user takes place in the couch and works with the Memory Club (gamified memory training application) on the tablet. The program can be jump started with pre-made user accounts. The user will watch the video for the first module and do the quiz (this will take max. 15 minutes).
- After a while the system notes he’s been sedentary for a long time and invites him to do start the daily physical exercises. This will be a walk. The user will take a short 10-minute walk at an easy pace– accompanied by one of the research team around the mall. This activity will be detected by the activity tracking wristwatch. (**CheckPhysicalActivities, and then ActivityIn15Min**)

- Once returned from the walk the technical evaluation will be complete. (**UserReturnFromEvent**)

Post-pretrial interview:

- The participant will be invited to complete an exit interview about the system and give their feedback