User Needs and Wants for Disease Self-management Devices

Author:
Keli Chen
Master Health Sciences
Track: Health Technology Assessment
University of Twente

Supervisors:
Dr. Janine van Til
Department of Health Technology and Services Research (HTSR)
University of Twente, School of Management & Governance

Dr. Karin G.M. Groothuis-Oudshoorn
Department of Health Technology and Services Research (HTSR)
University of Twente, School of Management & Governance

Ph.D Marieke Weernink
Department of Health Technology and Services Research (HTSR)
University of Twente, School of Management & Governance

Table of content

Abstract

Background

Chronic disease is the leading cause of death all over the world nowadays. In chronic disease self-management practice, self-testing device is developed at the basis of providing patient with more regular check of their health condition. Besides, the convenient use of self-testing device also increases patients' participation and motivation of disease self-management. The highly demand of self-testing device brings great opportunity for medical technology companies to develop productions according to people's needs and wants. However, the preference of self-testing device is unclear. Our aim is to investigate the preference of the general public towards self-testing devices and the influence factors of people's willingness to perform self-test in managing their disease and/or health.

Method

An online questionnaire was designed. We included the EuroQol Group 5-Dimension Self-Report Questionnaire score (EQ5D) with 5 levels to measure the perceived health state. We selected six items from the instrument used in the three-year European Health Literacy project to investigate functional health literacy. We made the self-efficacy questions based on the standard scale in Stanford patient education program. Moreover, we built scenarios to test people's attitude towards self-testing. In order to elicit the preference, best worst scaling method was used with case 2 and case 3 format. The online survey was carried out in British sample.

Result

512 respondents completed the entire questionnaire. The average age was 43.0 (*SD*=23.7). 27.0% (169/625) of the respondents had chronic disease. Asthma was selected for 53 times, being the most in our research sample. There were 33 respondents indicated that they had two chronic diseases at the same time. Most of the respondents perceived good health state. Between chronic disease and non-chronic disease samples, there was statistical significance in EQ5D. More than 78.44% of the respondents thought it was easy to understand health information on average. 74.0% of chronic disease patients managed their disease. The results of correlation analysis indicated gender, age, ethnic, health literacy, and self-efficacy had impact on the attitude of self-management. Respondents had good self-efficacy for self-management and self-testing. Convenience and ease of use were the main reasons for people to perform self-testing. In BWS case 2 the log likelihood = -17677.59, p = 0.001 in conditional logistic regression model. Respondents considered attribute 1 '*portability*' as the most important. There was similar result in BWS case 3. The average time respondents spent to complete the questionnaire was 24 minutes 5 seconds.

Conclusion

'*Pen size*', '*onetime cost £ 300*', '*daily use*', '*good technical and skill need*', '*performance score feedback indicating if the result is good or not*', '*feedback within 10 minutes*' were the most desirable characteristics of a self-testing device. Besides, people's willingness may change when

they were equipped by confidence, skills, and knowledge. This research provides useful information for stakeholders to make decisions about the design, development, and investment of a device. The finding is of great importance for medical technical company to design self-testing devices according to user' needs and wants. Also the information is useful for stakeholders to make decisions about investment and reimbursement of a self-testing device.

1. Introduction

As the economy development and life style changes, the world population is undergoing a tendency of aging, resulting in the spectrum of disease shifts. According to the World Health Organization (WHO), chronic diseases, such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading cause of mortality all over the world. It represents 63% of all deaths, from which out of the 36 million people died from in 2008. Another significant impact brought by chronic disease is the high rate of the multimorbidity especially among older patients. Chronic disease not only causes great harm to population health, but also poses heavy burden on health expenditure of every country. For instance, health expenditures in the United States neared $2.6 trillion in 2010, and it is expected to grow faster than national income over the foreseeable future (Centers for Medicare and Medicaid Services, 2012). Almost 75% of the health care dollars goes to treatment of chronic diseases. As a developed and high-income country, the Netherlands shares similar health care problems as the U.S, for example, more than 800,000 people with diabetes are known to the general practitioner. According to an investigation by the RIVM in 2011, 87.000 new people came in with diabetes in the year. The number of people with diabetes is increasing sharply since 2000. Because of the growth and aging of the population, the number of diabetics in the next 20 years by about 30% increase (RIVM., 2013b). In OECD report the health expenditure in the Netherlands was 4,914, accounted for 12.0% of its GDP, which was the second highest in this index all over the world at that time (Squires, 2012). Research in Ireland showed high multimorbility increased health care utilization and cost in primary care (Glynn et al., 2011). In UK, comorbidity of chronic disease is increasingly common and has caused great burden to national primary care expenditure (Brilleman et al., 2013). Besides, the prevalence of chronic disease also poses heavy burden on health carers. According to RIVM, 14 percent of caregivers feel quite heavy dutiable, which will continue in the coming future for the intensive and prolonged care needed by the aging population (RIVM., 2013a).

The rising prevalence of chronic condition threats the sustainability of the health care system while the quality of service provided remains sub-optimal (E. H. Wagner, 1998). As the demand for home care services increases, it is inevitably to involve patients in monitoring and treatment of their disease in co-operation with the health professionals (Schou, Ostergaard, Rasmussen, Rydahl-Hansen, & Phanareth, 2012). In order to manage the serious situation in disease management, Chronic Care Model (CCM) is developed and self-management has been identified as the key component of the model. Patients' role is emphasized in their disease self-management (E. H. Wagner et al., 2001). Increasingly evidences indicate self-management can both improve quality of life and save money. The costs throughout the whole process to see a doctor, such as transportation, registry, and loss of labor time can be reduced during a regular chronic self-management process (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Morrow, Haidet, Skinner, & Naik, 2008). A two-year low-cost program suggests promoting health self-management can improve elements of health states while reducing health care costs in populations with diverse chronic diseases (Lorig, Ritter, Stewart, & Sobel, 2001; Lorig, Sobel, Ritter, Laurent, & Hobbs, 2001). Moreover, the shift of responsibility is helpful for health care professionals to focus on more urgent situation, which can make the health system work more

efficiently. Therefore, disease self-management, especially for the chronic disease, is highlighted by governmental health policy (Wilkinson & Whitehead, 2009).

Since medical device has become one of the fastest growing industries, it permeates health care delivery systems throughout the world (Cheng, 2003). Major innovations in electronics, computerization, biomaterials and other scientific and technical fields lead to the development of life-saving, life-supporting and other critical devices at a staggering pace (Eccleston, 2001). This technological revolution, has saved lives and improved the quality of life for millions of people, and will keep on into the foreseeable future. Along with the developing nature of technology, the changes of demography and spectrum of disease also increase the need of advanced technology which results in high cost of health care and heavy burden of health system. One solution of the problem brought by the increasing demand of health care and the high cost of itself is to reduce the unnecessary expenditure during health care procedure.

Since disease self-management has been introduced several decades ago, along with its development in recent years, advanced medical devices have been produced to support this disease management strategy. Current technology developments present growing opportunities for individual to manage their disease and take certain health care procedures like monitoring or diagnosis outside hospitals and clinics (Pivik, Rode, & Ward, 2004). Using technology to provide health and social care services at home has been identified as a viable means to reduce costs, increasing coverage and improving the quality of life for those in care (Chidzambwa, 2013). High-precision, user-friendly devices have been produced such as coagulometers, self-monitoring device for blood glucose, pregnancy test device, device for detecting the antibodies associated with coeliac disease. Patients are able to achieve a more regular testing to detect the disease at an early stage, thereby significantly reducing the number of complications and improving quality of life (Ansell, Jacobson, Levy, Voller, & Hasenkam, 2005). Moreover using self-testing device increases patients' opportunity to participate and to be more motivated in their disease self-management (Gaikwad & Warren, 2009; Reverdin et al., 2011).

From the current disease management perspective, patient is the center role of this involvement activity. It is a patient-dominated collaborative partnership between patient and health care providers (Lawn, McMillan, & Pulvirenti, 2011). Within the Poulton (1997) framework, patient involvement was distinguished into different levels.

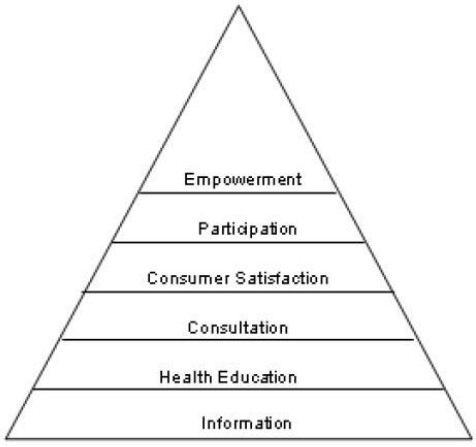


Figure 1 Poulton framwork

In the highest level 'empowerment', patient accepted responsibility to manage their own conditions with information from professionals. Empowering patient, especially in chronic disease management, has the core concept called self-efficacy, which was about building up confidence to carry out behavior necessary to reach a desired goal and was said to have far more importance than the external motivation (Bodenheimer et al., 2002). There are substantial evidences from more than 400 published articles indicate that interventions designed to promote patients' roles in the management of chronic conditions are associated with improved outcomes (WHO, 2002). Effective self-management is about having a collaboratively developed integrated care plan that recognizes and priorities patients decision making and responsibility for day to day health and related decisions and behaviors. Along with the development of patient-centered care, patients' attitude and requirements of medical device have changed. According to the project "EU Patient Attitudes & Medical Devices 2011"made by TG2, the communication pattern between consumer and medical device has been through a great change since 2005 (Figure 2).

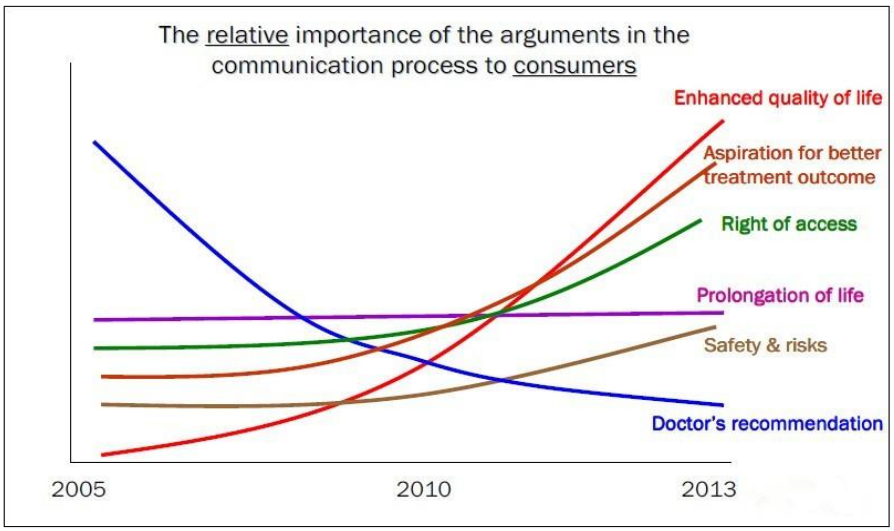


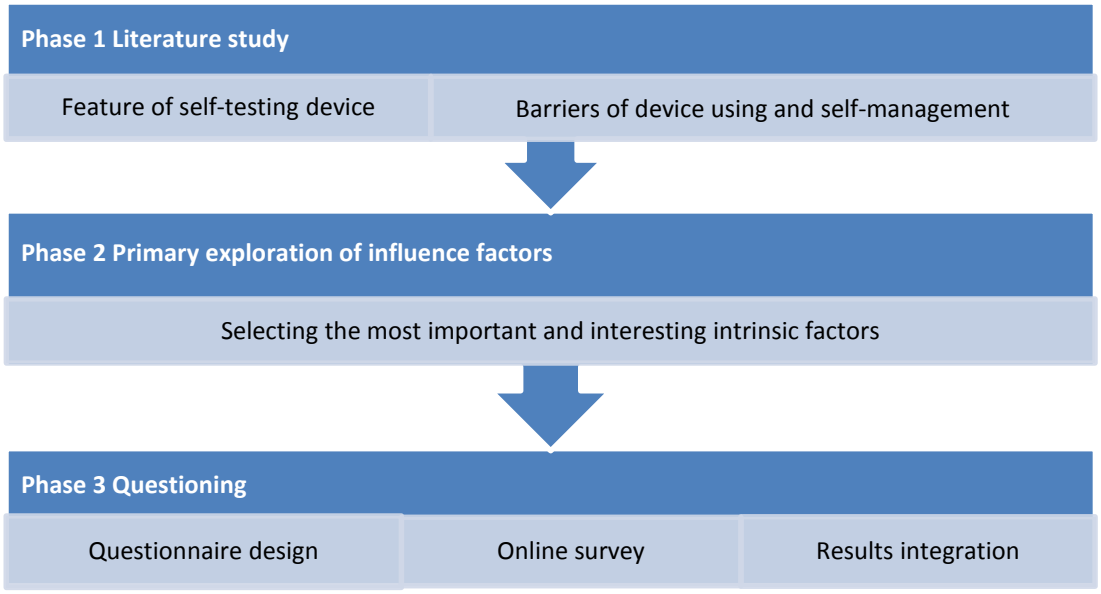
Figure 2 EU Patient Attitudes & Medical Devices 2011

Knowing people's needs and preference has great importance for health professionals and health service providers to improve the quality of care as well as to develop better production. Until now, it remains unclear that how is the preference of self-management device at a general public level. In this research, we aimed to investigate people's preference towards self-testing device. Secondary goals were to describe the influence factors of the willingness for self-management and self-testing.

2. Method

2.1 General design

We followed three steps to launch our research.



2.1.1 Phase 1 Literature study

In the first phase, we performed a scoping review into self-management into the most commonly used databases. We retrieved literatures from most commonly used databases, such as Medline, ScienceDirect, Scopus and Google Scholar with keywords: patient self-management, disease management, patient self-testing, self-testing device, self-monitoring device, attitude, perception, chronic disease, chronic care model, patient involvement, and barrier. The aim of this phase was to indentify 1) characteristics of self-testing device, 2) barriers and facilitators for self-testing and self-management. By extensively studying literatures, we extracted features of self-testing device and influence factors for patient to use self-testing device and perform self-management.

2.1.2 Phase 2 Primary explorations of influence factors

In this phase, we built our own model to identify the acceptance of self-testing device, and the relations among device and self-testing and self-management. The technology acceptance model (TAM), introduced by Davis (1989), explained which was the general influence factor of the willingness to use a technology.

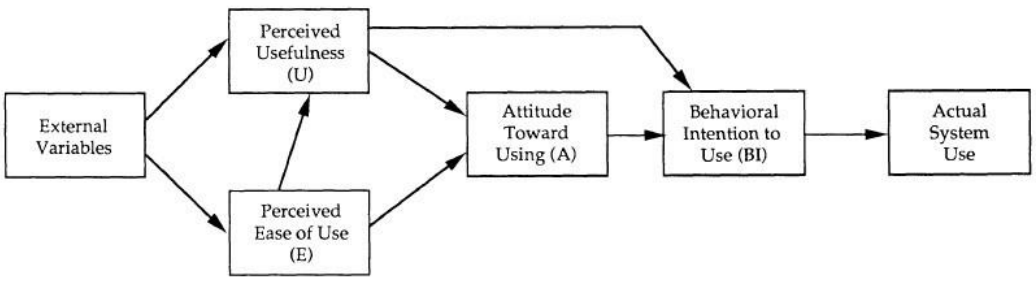


Figure 3 Technology acceptance model (TAM)

Based on the TAM model, we made our own model to fit for our aim in this research. Unlike the TAM model, we included not only the features of device, but also the influence factors of self-testing and self-management.

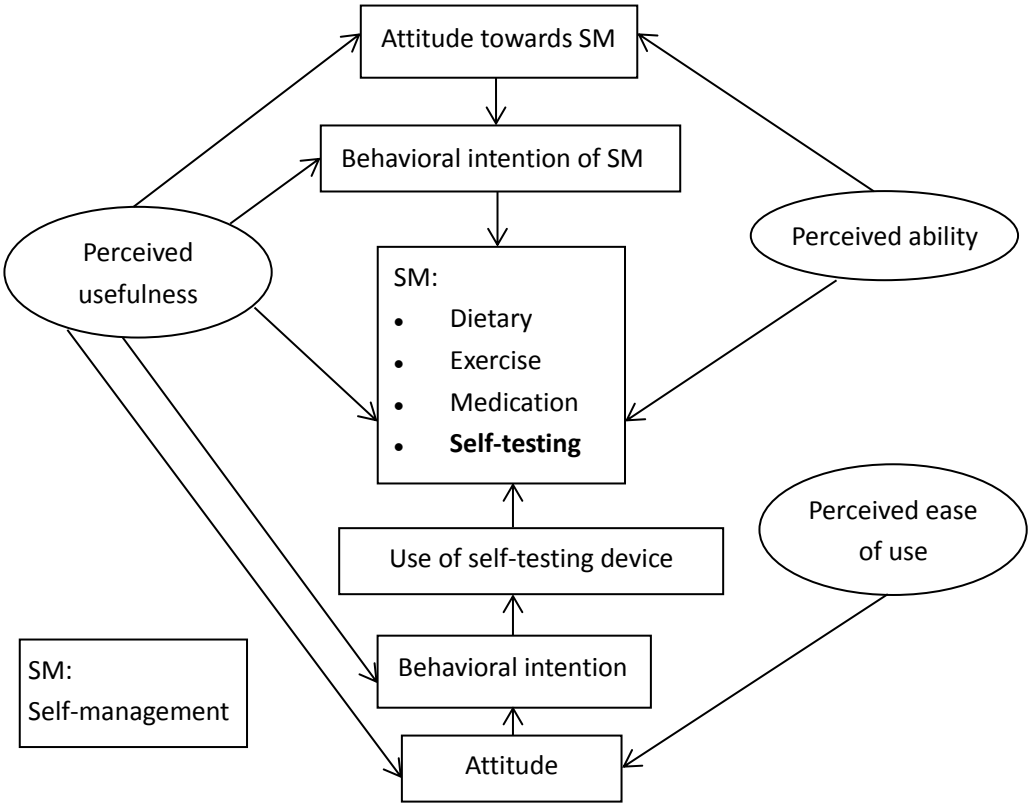


Figure 4 Adjusted device acceptance model

The perceived usefulness and ease of use were the determinants to patient's attitude towards the utilization of medical device. Similar to that, in our model the perceived usefulness and perceived ability were the influence factor of people's motivation for systematic performance of self-testing and self-management. Incorporated with the finding from literature review in phase 1, we described our extensive model with influence factors in result part.

2.1.3 Phase 3 Questioning

Based on the comprehensive literature study, we identified several barriers and facilitators for self-management and actual self-testing. The results are presented in table 3 in result part. Thus we built up our questionnaire by combining multiple choice questions, well-accepted scale, scenarios, and BWS tasks to collect different information that we needed.

In the first part, we designed multiple choice questions to collect the basic information of respondents, such as gender, age, education level, ethnic background, and monthly income. Besides we asked respondents about their disease condition in order to assign them into groups with different questions. According to the dataset from the Eastern Region Public Health Observatory, ERPHO (2010), after the age 45, chronic disease incidence grew sharply. Thus we

divided the sample into two age groups with the age 45 in order to see if our sample fits the real situation. We also selected the type of chronic disease based on the data from ERPHO (2010).

In the second part, we introduced the EuroQol Group 5-Dimension Self-Report Questionnaire score (EQ5D) with 5 levels and visual analogue scale to measure the perceived health state of respondents, including perceived health state, physical condition, and depression level. Because chronic disease is a long term condition and could not be cured, chronic disease patient might go through a bad health state for a long time, which lasted for more than 6 months. As a result, the chronic disease patients were asked to finish the questions of their perceived health condition in 6 months and today. Meanwhile non-chronic disease respondents only needed to complete the questions of health condition today.

To investigate functional health literacy, we introduced the instrument used in the three-year European Health Literacy project in the third part. We selected six most representative items associated with the general understanding of health information and asked respondents to choose how easy or difficult it was for them to fulfill certain tasks. The choice of 'very difficult ' or 'fair difficult' meant respondents felt difficult to complete the task, while the choice of 'very easy' or 'fair easy' meant it was easy for them to do that. Following the existing researches about health literacy (Doyle, Cafferkey, & Fullam, 2012; HLSEU, 2012), we calculated the proportion of the entire difficult and the proportion of entire easy to see respondents' health literacy. If a respondent felt easy to fulfill one task, then this meant he/she had good health literacy of this task, and vice versa.

In part 4 of the questionnaire, we firstly asked if respondents had performed self-management before, and the type of actions they had done in their disease self-management. In addition, we invited the respondents who did not perform self-management to give their reasons in a multiple choice question. In later parts, we designed a group of questions to investigate the attitude towards self-management. There were five choices in each question which described different level of agreement of the subject. Here we defined both 'strongly agree' and 'agree' were the positive attitude towards self-management, while 'disagree' and 'strongly disagree' stood for the negative attitude. We also took the experience of self-management into consider, it might vary in different group of people. Thus we designed two groups of questions. For the chronic disease patient who had managed their disease, they were asked to indicate their attitude based on their experience. Meanwhile we asked these inexperienced respondents to imagine if they had chronic disease, how they would agree with these statements.

In part 5, we built the self-efficacy questions based on the standard scale of Stanford patient education program with a similar format but different questions adjusted to our research objective and asked respondents to score their ability to complete certain tasks involved in self-management. A score equal to or above 6 meant respondent felt confident to carry out the behavior.

We investigated respondents' attitude towards self-testing in part 6. Firstly we came up with two multiple choice questions to know people's familiarity of existing self-tests. Additionally, we designed 6 questions to test the self-efficacy for self-testing, which had the same measurement as the self-efficacy questions in part 5.

In part 7 & 8, we used two mathematical psychology-based techniques to arrange the questions and elicit preference. Best-worst scaling (BWS) invented by Jordan Louviere is rooted in the theory random utility theory (RUT) (Louviere, Flynn, & Carson, 2010). There are three types of BWS. In our research, we used BWS (case 2), which is also called 'attribute' case or case 2 BWS. The profile case of case 2 BWS requires people to choose the best level and the worst level in an attribute included in a profile. About BWS case 2, researchers found out there were advantages when comparing to the traditional methods, such as it was easier for respondents to finish case 2 BWS questions (Potoglou et al., 2011). Another type of BWS we used is case 3 BWS, also the multiprofile BWS and best worst discrete choice experiments (BWDCE). This method requires individual to choose the least attractive profile and in addition to the most attractive one (Lancsar, Louviere, Donaldson, Currie, & Burgess, 2013).

As the experimental design used by Potoglou et al. (2011), the choice situations were specified with an orthogonal main effects plan. The order of appearance of case 2 and case 3 choices was listed in Table 1. Each respondent was assigned to one of the ordering sequences at random, so as to control the systematic ordering effects. In each version, there were ten choice situations, and each respondent was invited to make ten choice pairs in each version.

Table 1 Order of appearance of BWS choice set

	Order of appearance	
Randomization number	1st	2nd
1	Case 2 version 1	Case 3 version 1
2	Case 2 version 2	Case 3 version 2
3	Case 3 version 3	Case 2 version 3
4	Case 3 version 4	Case 2 version 4

According to our interests and research objective, we arranged the BWS task by focusing on seven attributes from portability, one-time cost, frequency of use, operability, feedback on test result, time it takes to get the result to accuracy. In case 2, as the sample presented below, participants were asked to choose their most desirable and their least desirable feature within a device.

Most desirable characteristic		Least desirable characteristic
○	 Hand held, mobile phone sized	○
○	One time cost £ 15	○
○	Monthly use	○
○	A person with good technical knowledge can use it	○
○	 The device will give you a chart indicating the trends of results over time	○
○	Feedback within 10 minutes	○
○	Error or false reading in 1 out of 50 tests	○

Figure 4 Example of BWS case 2

In case 3, respondents were asked to select their most desirable and their least desirable device with different combinations of features among three devices.

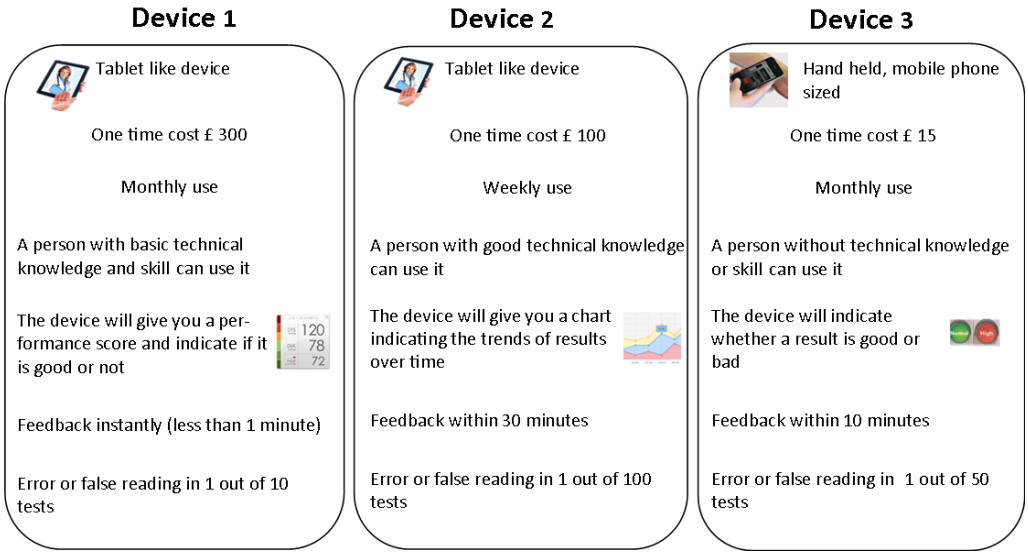


Figure 5 Example of BWS case 3

By using BWS, we understood which characteristic was considered most by people which was crucial in device design. At the end of this part, we asked respondents'' opinion about these two kinds of BWS questions formats.

Part 9 is the 5 scenarios about self-testing and self-management. We aimed to know how people made trade-off about the time of health gain and body samples under different circumstances. In this part, we provided stool test, urine test, blood pressure test, blood sample test, and saliva test with corresponding action involved. The frequency of test varied from five years to one year, yearly to monthly, monthly to daily, and etc. In each scenario, we started with a description followed by a question of people's willingness to perform certain self-test. After that, we arranged qualitative questions for people to explain their reasons for the corresponding answers of their willingness or unwillingness.

At the last part of our questionnaire we made multiple choice questions to collect people's opinion of purchasing a self-testing device.

2.2 Data collection

After the carefully investigation of current self-testing device market, we found that there were several self-tests launched in UK and chronic self-management was encouraged by their national health service (NHS), which was good for us to collect data. Consequently we chose British population as our research sample. Online questionnaire was launched through LimeSurvey.

2.3 Data analysis

Table 2 Data analysis content

Questions	Content	Description	Comparison method	Comparison group	Significance
Part 1	Basic information	Percentage Mean±SD			Assigning disease groups
Parts 2	EQ5D & VAS	Percentage Mean±SD	ANOVA *t* test	Chronic disease, acute disease and healthy sample	Different health state
Part 3	Health literacy	Percentage	Non-parametric test Chi square	Chronic disease, acute disease and healthy sample Self-managed or non-self-managed sample	Ability to understand health information
Part 4	Attitude towards self-management	Percentage	Non-parametric test	Chronic disease, acute disease and healthy sample	Attitude and health belief
Part 5	Self-efficacy for self-management	Mean±SD	ANOVA *t* test	Chronic disease, acute disease and healthy sample Self-managed or non-self-managed sample	Self-efficacy for self-management
Part 6	Attitude towards self-testing	Percentage	Non-parametric test	Chronic disease, acute disease and healthy sample	Attitude and health belief
Part 7 & 8	Preference for self-testing device		Case 2 (MNL) Case 3 sequential best worst MNL		Preference for features of self-testing device
Part 9	Five scenarios	Percentage Qualitative questions		Chronic disease, acute disease and healthy sample Self-managed or non-self-managed sample	The willingness and unwillingness for self-testing
Part 10	Opinion of purchasing	Percentage	Non parametric	Chronic disease, acute disease and healthy sample Self-managed or non-self-managed sample	Willingness of purchasing

Demographic data, health state, health literacy, self-efficacy, attitude data were described with basic statistics. Apart from the statistical analysis mentioned in table correlation analysis was applied to investigate the relations between demographic information, health state, health literacy, self-efficacy and attitude towards self-management, as well as the attitude towards self-testing. The analysis mentioned above was carried out in Statistical Product and Service Solutions, SPSS (version 20.0). Qualitative answers were summarized. Best worst scaling data analysis was carried out in STATA with clogit process.

3. Results

3.1 Literature review

We explored the literatures and listed the influence factors in Table 3. Among these factors, we included the most importance ones in our questionnaire based on our objective and interests. In table we also attached the references of these factors to support our decision.

Table 3 Influence factors

Self-testing	**Reference**
Knowledge and skills	(Shapiro, 2008), (Shah & Robinson, 2011), (Mitzner, Boron, & Fausset, 2010), (Reverdin et al., 2011), (Chudyk, Shapiro, Russell-Minda, & Petrella, 2011)
Ethnic/culture	(Karter, Ferrara, Darbinian, Ackerson, & Selby, 2000), (Levine et al., 2009)
Cost (reimbursement)	(Wittkowsky, Sekreta, Nutescu, & Ansell, 2005) (Shapiro, 2008), (Karter et al., 2000), (Chudyk et al., 2011), (Levine et al., 2009), (Shah & Robinson, 2011) (Shah, Barnett, Kuljis, Hone, & Kaczmarski, 2013)
Age	(Shah et al., 2013), (Mitzner et al., 2010)
Concerning of unintended self-management	(Wittkowsky et al., 2005), (Shapiro, 2008)
Influence factors for self-management	
Self-efficacy	(Rodriguez, 2013), (Kiser et al., 2012) (Nam, Chesla, Stotts, Kroon, & Janson, 2011) (Morrow et al., 2008), (Kawi, 2013), (van der Meer et al., 2007) (Nagelkerk, Reick, & Meengs, 2006) (Novak, Costantini, Schneider, & Beanlands, 2013)
Functional health literacy	(Rodriguez, 2013), (Jerant, von Friederichs-Fitzwater, & Moore, 2005), (Kawi, 2013), (Thomas-Hawkins & Zazworsky, 2005), (Mead, Andres, Ramos, Siegel, & Regenstein, 2010)
Knowledge and skills	(Rodriguez, 2013), (WHO, 2002), (Nagelkerk et al., 2006) (Ayele, Tesfa, Abebe, Tilahun, & Girma, 2012) (Bayliss, Ellis, & Steiner, 2007)
Attitude and health belief	(Rodriguez, 2013), (Nam et al., 2011)
Health state/ Physical symptoms/ Depression	(Rodriguez, 2013), (Bayliss et al., 2007), (Jerant et al., 2005)
Ethnic/culture/language	(Rodriguez, 2013), (Kiser et al., 2012), (Nam et al., 2011) (Mead et al., 2010), (Novak et al., 2013)
Cost (insurance coverage)	(Mead et al., 2010), (Nam et al., 2011), (Jerant et al., 2005) (Rodriguez, 2013), (Kawi, 2013), (Novak et al., 2013)
Education level/Literacy skills	(Kiser et al., 2012), (Mead et al., 2010)

Services and resources	(Rodriguez, 2013), (Ayele et al., 2012), (Nam et al., 2011) (Nagelkerk et al., 2006), (Jerant et al., 2005), (Kawi, 2013)
Medication adherence	(Rodriguez, 2013), (Nam et al., 2011), (Nagelkerk et al., 2006)

Based on previous work, we made an elaborate model to show the interactions among device, self-testing and self-management.

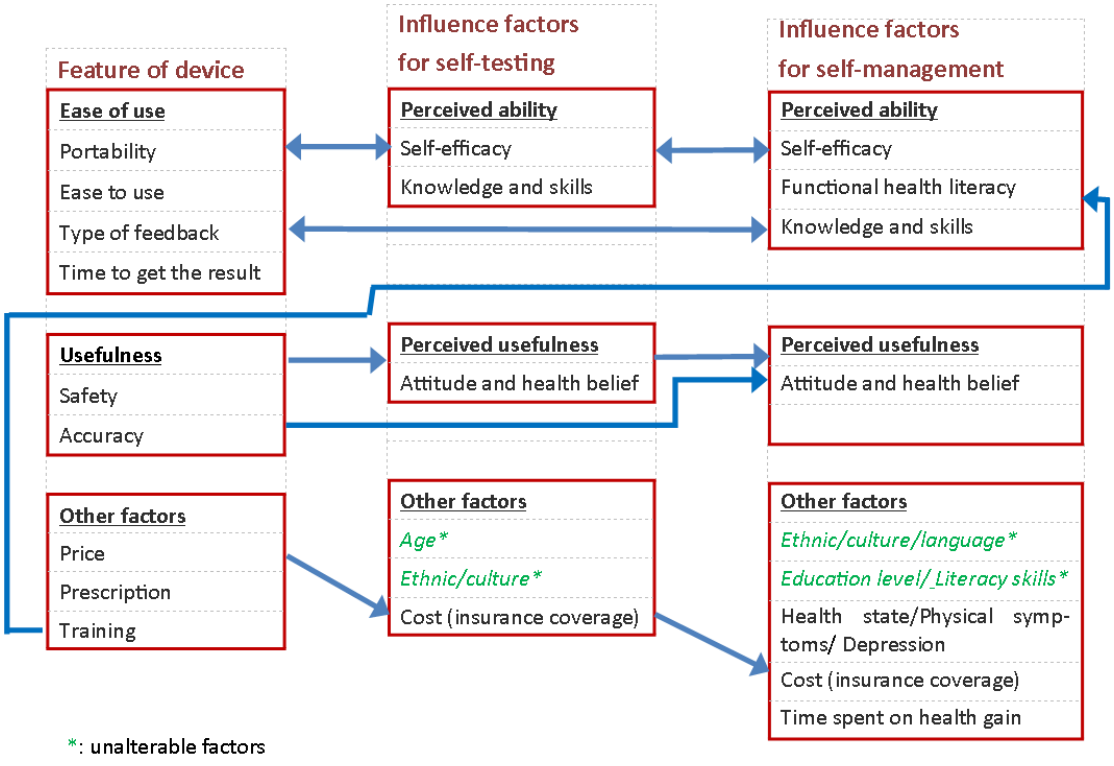


Figure 6 Elaborate model of self-testing model

3.2 Demographic result

There were 512 respondents who completed the entire questionnaire. The mean age of respondents was 43.0 (*SD*=23.7). 54.7% of the participants were younger than 45 years of age. Among the respondents 56.2% was female, while 42.9% was male. The description of education level, monthly income and ethnic group is listed in the table below.

Table 4 Education, income and ethnic background

Background information	Frequency (%)
Education level	
Primary school	12 (2.0)
High school	236 (39.2)
Vocational school	104 (17.3)
Bachelor	172 (28.6)
Master	29 (4.8)
Postgraduate	49 (8.1)
Monthly income	

	Below £ 1700	291 (47.5)
	£ 1700~2500	138 (22.5)
	Above £ 2500	87 (14.2)
	I don't want to share this	97 (25.8)
Ethnic background		
	White	538 (87.1)
	Mixed	10 (1.6)
	Asian	40 (6.5)
	Black	10 (1.6)
	Other	6 (1.0)
	I don't want to share this	14 (2.3)

3.3 Health state and health literacy

3.3.1 Health state

The questions on basic disease indicated that 169 respondents had chronic disease at which accounted for 27.0% of the research sample. Another, 103 respondents had acute disease (16.5%). The age-specified disease condition is present in Table 5 below.

Table 5 Age-specific disease condition

Disease condition		Age group	
		Below 45	45 and above
		Number (%)	Number (%)
Do you currently suffer from	Yes	69 (40.8)	100 (59.2)
chronic disease?	No	273 (60.8)	176 (39.2)
Do you suffer from acute	Yes	61 (59.2)	42 (40.8)
disease recently?	No	281 (54.5)	235 (45.5)

In terms of chronic disease type, asthma was selected 53 times, which was the most common disease in our research sample. Diabetes mellitus was selected 33 times, followed by hypertension (21 times), chronic obstructive pulmonary disease (9 times), and chronic kidney disease (8 times). 128 respondents mentioned at least one type of chronic disease, while 33 respondents indicated that they had two chronic diseases. The number of people who had three types of chronic disease was 3.

With respect to perceived health state respect, most of the respondents felt good about their health state regardless of the disease condition. In the participants with chronic disease, people had more problems in performing usual activities, more pain/discomfort, more anxiety/depression than problems with mobility and self-care. Between chronic disease and non-chronic disease samples, there was statistical significance in EQ5D index and VAS. Details are listed in Table 6.

Table 6 EQ5D in different health condition

	Chronic disease population		Non-chronic disease population
	Health state in 6 month	Health state today	Health state today
	Frequency (%)	Frequency (%)	Frequency (%)
Mobility			
L1	75 (48.7)	81 (52.9)	345 (83.3)
L2	31 (20.1)	28 (18.3.)	48 (11.6)
L3	30 (19.5)	29 (19.0)	14 (3.4)
L4	15 (9.7)	13 (8.5)	5 (1.2)
L5	3 (1.9)	2 (1.3)	2 (0.5)
Self-care			
L1	107 (69.5)	68 (44.4)	390 (94.2)
L2	26 (16.9)	42 (27.5)	20 (4.8)
L3	14 (9.1)	26 (17.0)	2 (0.5)
L4	6 (3.9)	12 (7.8)	1 (0.2)
L5	1 (0.6)	5 (3.3)	1 (0.2)
Usual activities			
L1	63 (40.9)	68 (44.4)	339 (81.9)
L2	46 (29.9)	42 (27.5)	52 (12.6)
L3	31 (20.1)	26 (17.0)	17 (4.1)
L4	10 (6.5)	12 (7.8)	5 (1.2)
L5	4 (2.6)	5 (3.3)	1 (0.2)
Pain/discomfort			
L1	38 (24.7)	42 (27.5)	246 (59.4)
L2	42 (27.3)	48 (31.4)	122 (29.5)
L3	48 (31.2)	38 (24.8)	33 (8.0)
L4	17 (11.0)	18 (11.8)	11 (2.7)
L5	9 (5.8)	7 (4.6)	2 (0.5)
Anxiety/depression			
L1	53 (34.4)	61 (39.9)	232 (56.0)
L2	42 (27.3)	44 (28.8)	105 (25.4)
L3	34 (22.1)	29 (19.0)	48 (11.6)
L4	16 (10.4)	12 (7.8)	17 (4.1)
L5	9 (5.8)	7 (4.6)	12 (2.9)
	Mean (*SD*)	Mean (SD)	Mean (SD)
Index in UK population*			
	0.6 (0.3)	0.6 (0.3)	0.8 (0.2)
VAS*			
	57.2 (25.3)	60.8 (25.2)	75.5 (19.9)

*Comparison results indicated the difference between chronic and non-chronic disease population was statistically significant at 0.05 level (EQ5D t=-8.605, p=0.001; VAS t=-6.728, p=0.001).

3.3.2 Health literacy

On average 78.44% of the respondents felt it was easy to understand health information while a small proportion of them consider it very difficult.

Table 7 Health literacy in research sample

	Very difficult %	Fairly difficult %	Fairly easy %	Very easy %	Total difficult %	Total easy %
Seek for help	3.7	20.6	49.0	26.6	24.3	75.7
Understand doctor	3.2	12.3	53.8	30.7	18.8	81.2
Understand leaflet	3.0	15.8	54.0	30.7	9.2	90.8
Understand instruction	1.2	8.0	43.2	47.6	24.9	75.1
Healthy behavior judgment	3.7	21.1	52.2	22.9	30.6	69.4
Decision making	4.3	26.3	47.4	22.0	15.5	84.5
Average percentage	2.96	15.56	50.44	31.7	21.56	78.44

3.4 Attitude and self-efficacy for self-management

In the patients that indicated they suffered from chronic disease, the number of patients who managed disease by themselves was 125, which was 74.0% of the chronic disease sample. 94 of them closely monitored their own symptoms and responded with appropriate actions. 79 of them adhered to their medication regimes even with some inconvenience and side effect, while 76 of them had made major lifestyle change because of disease self-management. This question reflected if a person was familiar with disease self-management or not. There were 46 respondents that performed all three actions in their disease management while 40 only took one action. For most respondents who did not perform self-management the reason was '*I don't have enough knowledge or skills to perform self-management'* (14), closely followed by '*I am not able to keep on taking care of my own health for a long time*' (9). Only four people chose '*It is the responsibility of the health professionals, not patients* as their reason to not to perform self-management. Referring to the attitude towards self-management in Table 1 & 2 in appendix, in both chronic patients and non-chronic sample, most of the respondents agreed or strongly agreed with the importance of several actions involved in self-management as well the positive outcome brought by self-management.

The results of correlation analysis indicated gender, age, ethnic, health literacy and self-efficacy had impact on the attitude of self-management in both experienced self-management population and inexperienced population. Of respondents who in the past or present performed self-management, female thought it was more important on '*involvement of self-management*' and '*education or training needs*' than male. Younger respondents thought they needed more support from fellow patients than older ones. People with higher income were more positive about '*goal setting*', '*improved knowledge*', '*changed behavior ', 'improved control over health/disease*'. Participants with higher self-efficacy had positive relations with most of the

attitude descriptions except '*support needed from family or friends*', '*support needed from fellow patients*'. Respondents had better health literacy had positive attitude, except in '*support from health professional*', '*support from family and friends '*, '*support from fellow patients*', '*improved knowledge'*, '*changed behavior*'. Detail is listed in Table 3 in appendix.

For respondents who did not perform self-management, female thought it would be less important than male on '*support needed from fellow patients*'. Younger respondents considered it would be more important on '*improved knowledge*' than older ones. People with higher income reached more importance in agreement with 'self-management would *improve knowledge*'. People from different ethnic background had different attitude to self-management. Better health state (higher index in EQ5D) was associated with more positive attitude in '*goal setting*', '*support from fellow patients*', '*improved knowledge'*, '*changed behavior*', '*improved control over health/disease*', '*improved quality of life*'. Higher self-efficacy had a positive relation with most of the attitude descriptions except '*support needed from fellow patients*'. Better health literacy related with positive attitude, except in '*support from family and friends*', '*support from fellow patients*', '*improved knowledge*'. Details are listed in in appendix Table 4.

Table 8 Self-efficacy for self-management

Self-management action	Mean (SD)
Judging a symptoms	6.460 (2.1)
Adjusting medication after instruction from a health professional	7.215 (2.2)
Making decisions on the needs to see a doctor	7.509 (2.1)
Reducing (other than taking medication) the effect of an illness	7.023 (2.1)
Monitoring own symptoms of disease	7.117 (2.1)
Responding with appropriate actions	7.215 (2.1)
Making a major lifestyle change	6.856 (2.3)
Adhering to medication regimens even with inconvenient or side effects	7.291 (2.0)
Total	56.68 (13.5)

Table 8 lists respondents' self-efficacy for self-management. All the means were higher than 6, which indicated respondents were confident to complete the tasks mentioned above.

3.5 Familiarity in self-testing and self-efficacy of self-testing

All the means of self-efficacy for self-testing were higher than 6, which indicated respondents were confident to get these samples, with the lowest self-efficacy in getting blood sample by themselves. There were significant differences between respondents who were experienced with self-management compared to those who were not. These differences were in getting blood sample with t (145) =2.951, p=0.004, in getting urine sample with t (145) =3.351, p=0.001, in reading a test strip with t (145) =2.019, p=0.045.

Table 9 Self-efficacy for self-testing

Self-testing action	Mean (SD)
Get own blood sample	6.819 (3.1)
Get own saliva sample	8.479 (2.0)

Get own urine sample	8.778 (1.8)
Get own stool sample	7.805 (2.6)
Read results from a test strip	7.967 (2.2)
Operate an electronic self-management device	8.183 (2.0)
Total	48.0 (10.7)

In terms of the familiarity of self-testing devices, 85.4% of the respondents had heard of blood pressure meter. With regard to actual use, only 30.0% of them had used it before. More than half of the participants had heard of at least three types of devices mentioned in the questionnaire, and 73.4% of them had used at least one type of these devices. Detail can be found in Table 10.

Table 10 Familiarity of self-testing device

Type of self-testing device	Have you heard of these devices?		Have you ever used these devices?	
	N (%)	Percent of Cases (%)	N (%)	Percent of Cases (%)
Blood pressure meter	472 (23.5)	85.4	166 (23.9)	30.0
Blood glucose meter	337 (16.8)	60.9	68 (9.8)	12.3
Pregnancy test	474 (23.6)	85.7	92 (13.2)	16.6
HPV self-test	72 (3.6)	13.0	10 (1.4)	1.8
Oral anticoagulation test	51 (2.5)	9.2	5 (0.7)	0.9
Antibodies test for coeliac disease	57 (2.8)	10.3	9 (1.3)	1.6
Rapid HIV test	98 (4.9)	17.7	9 (1.3)	1.6
Colon polyps test	63 (3.1)	11.4	7 (1.0)	1.3
Prostate test	146 (7.3)	26.4	11 (1.6)	2.0
Cholesterol Self-test	205 (10.2)	37.1	26 (3.7)	4.7
None	29 (1.4)	5.2	286 (41.2)	51.7
Other	4 (0.2)	0.7	6 (0.9)	1.1
Total	2008 (100.0)	363.1	695 (100.0)	125.7

When asked about the preferable recommendation source, more than half of respondents chose doctors and nurses. Nearly half of the respondents preferred to get self-testing device from the pharmacy with a prescription, followed by those who chose '*over the counter*'. More than half of the respondents considered at least two ways to get self-testing device. When being asked if they were willing to pay for a self-testing device, half of the participants chose '*yes*', while 26.6% of them had no opinion about the question and the rest of them refused to spend money on it. Detail is listed in Table 5 & 6 in appendix.

3.6 Attitude towards self-testing in different scenarios

More than half of the participants were willing to perform the self-test in every scenario, which is showed in Figure 7. Then we summarized the qualitative answers about the reason of each choice.

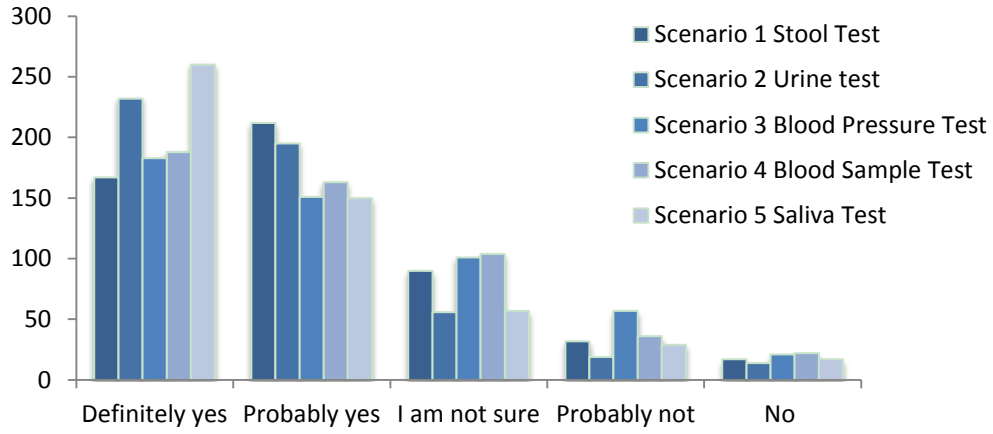


Figure 7 Willingness to perform self-test in different scenarios

In general, respondents shared some similarities in their choice in each scenario. In table 11, we can see, people chose to perform self-test mostly because of the time saving feature, convenience and ease to use of a device. Without going to see a GP was the second reason for them to perform self-test. The answers to not to have the test by themselves was the trust to professional skill, unconfident of themselves, and doubt about the accuracy of a test. The reasons to be unsure about the self-test were similar with the reason to say no, except for concerning about the cost of a test.

Table 11 Summary of five scenarios

Reason to choose 'yes'	Total Frequency of answer
Timesaving, convenience and easy to use	1151
Without going to see the GP, which might be embarrassing and costly	163
More regular check and early detection of disease	154
Privacy, independence, self-awareness	135
Feel confident to do it	36
Reason to choose 'no'	**Total Frequency of answer**
Professional is more trustworthy with experience and skills	76
Unconfident to perform it on their own	17
Doubt about the accuracy	16
Reason to choose 'unsure'	**Total Frequency of answer**
Professional is more trustworthy with experience and skills	64
Unconfident to perform it on their own	51
Doubt about the accuracy	42
Cost	5

Apart from that, there were some specialties in each scenario. In scenario 1, around 73% of respondents were willing to take a yearly stool self-test instead of testing by a health professional every five years. The reason why people chose to have the self-test mostly was because of the convenience and easy use of it which could save their time. Also some of them considered it might be a way to release the embarrassment of and to save the cost to see a doctor. Moreover privacy and self-awareness of disease condition were emphasized by some respondents. Among the reason why not take this self-test, the respondents thought professional with experience and skills were more trustworthy. The reason to be unsure about the self-test was the trust of

professionals and unconfident to perform it. In scenario 2, nearly 83% of the participants would like to perform urine self-test. The convenience, ease of use and time saving were the most reason for respondents to perform this test. And under this circumstance, people thought it would be good to check the urine sample more regularly and keep watch of their disease condition. Besides the trust of professionals and not being self-confident, other cause of unwilling to take this self-test was the doubt of its accuracy. The respondents chose 'unsure' had similar reason with the ones said 'no'. In scenario 3, almost 65% of the participants were willing to check their blood pressure by themselves. Except for the similar reason as the former two scenarios, respondents felt confident to check their blood pressure by themselves. However, for most of the participants who chose not to perform this self-test was because wearing a blood pressure monitor 24 hours a day seemed a burden to them. Similar situation could be seen in scenario 4, people might not feel like to prick the blood by themselves, which was the most reason for them to be unwilling or unsure to perform this self-test. In scenario 5 except the participants who chose 'yes', the rest of them thought it was unnecessary to have a saliva self-test to prove they were stressful because it was a natural feeling of human beings, for which there were 24 respondents giving this reason.

In scenario 1 and 2, younger respondents were more likely to test it by themselves than the elder ones. In these five scenarios respondents with higher self-efficacy of self-management and self-testing were more likely to indicate that they were willing to perform self-test. People with better health literacy to some extent tended to perform self-testing in scenarios 2 and scenarios 4. Detail can be found in Table 7 to Table 13 in appendix.

3.7 Preference of self-testing device

3.7.1 Result of BWS case 2

The result in Table 12 suggests the feature '*Pen sized and weighted*' of a self-testing device was chosen as the most desirable by most respondents, followed by '*Hand held, mobile phone sized*'. Also respondents selected the different technical knowledge and skill levels for a mount of times as their most desirable features, all of which belonged to the attribute operability. Negatively the levels in 'Time to get the result' and 'Accuracy' were chosen to be the least desirable feature of a device, which indicated they were less preferred by respondents comparing to other attributes.

The first part of Table 13 indicates the importance of attribute, and attribute 7 is least important one. In each attribute, level 3 is the reference level. The results of conditional logistic regression in Table 13 show in attribute 1 'portability' level 3 '*Pen sized and weighted*' had the highest *z* score. Attribute 2 'one-time cost' level 3 '£ 300' has the highest *z* score. Level 1 'daily' in attribute 3 'frequency of use' is the highest. The highest *z* score goes to level 3 'good technical knowledge needs' attribute 4 'operability'. In attribute 5 'feedback on the test result' level 2 'the device will give you a performance score and indicate if it is good or not' has the highest *z* score. In attribute 6 'time it takes to get the result' level 2 'within 10 minutes' has the highest *z* score. Attribute 7 level 1 '*Error or false reading in 1 out of 100 tests*' had the highest *z* score. The level with the highest *z* score indicated this level is the most desirable one over all.

Table 12 Summary of BWS 2

Attributes	Levels	Times appeared N	Best count N (%)	Worst count N (%)	Best minus worst
1.Portability	1. Hand held, mobile phone sized	567	470 (9.2)	97 (1.9)	373
	2. Tablet like device	506	339 (6.6)	167 (3.3)	172
	3. Pen sized and weighted	688	593 (11.6)	95 (1.9)	498
2.One-time Cost	4. £ 15	301	119 (2.3)	182 (3.6)	-63
	5. £ 100	268	147 (2.9)	121 (2.4)	26
	6. £ 300	171	120 (2.3)	51 (1.0)	69
3.Frequency of use	7. Daily	298	208 (4.1)	90 (1.8)	118
	8. Weekly	300	168 (3.3)	132 (2.6)	36
	9. Monthly	309	188 (3.7)	121 (2.4)	67
4.Operability	10. A person without technical knowledge or skill can use it	430	313 (6.1)	117 (2.3)	196
	11. A person with basic technical knowledge and skill can use it	469	368 (7.2)	101 (2.0)	267
	12. A person with good technical knowledge can use it	547	446 (8.7)	101 (2.0)	345
5.Feedback on test result	13. The device will indicate whether a result is good or bad	337	185 (3.6)	152 (3.0)	33
	14. The device will give you a performance score and indicate if it is good or not	406	230 (4.5)	176 (3.4)	54
	15. The device will give you a chart indicating the trends of results over time	427	238 (4.6)	189 (3.7)	49
6.Time it takes to get the result	16. Instantly (less than 1 minute)	475	40 (0.8)	435 (8.5)	-395
	17. Within 10minutes	504	150 (2.9)	354 (6.9)	-204
	18. Within 30 minutes	449	87 (1.7)	362 (7.1)	-275
7.Accuracy	19. Error or false reading in 1 out of 100 tests	891	246 (4.8)	645 (12.6)	-399
	20. Error or false reading in 1 out of 50 tests	1055	236 (4.6)	819 (16.0)	-583
	21. Error or false reading in 1 out of 10 tests	842	229 (4.5)	613 (12.0)	-384

Table 13 Conditional logistic regression estimates for BWS case 2

		Coefficient	Standard error	*z*	*p*	95% Confident interval
Attribute impact						
1.Portability		1.671	0.065	25.84	0.001	(1.54, 1.80)
2.One-time Cost		0.979	0.069	14.26	0.001	(0.84, 1.11)
3.Frequency of use		0.933	0.068	13.79	0.001	(0.80, 1.07)
4.Operability		1.475	0.066	22.35	0.001	(1.35, 1.60)
5.Feedback on test result		0.895	0.065	13.77	0.001	(0.77, 1.02)
6.Time it takes to get the result		0.260	0.065	3.98	0.001	(0.13, 0.39)
7.Accuracy		-	-	-	-	-
1.Portability	Level values					
	Hand held, mobile phone sized	-0.124	0.064	-1.93	0.053	(-0.25, 0.01)
	Tablet like device	-0.555	0.066	-8.23	0.001	(-0.67, -0.41)
	Pen sized and weighted	0.679				
2.One-time Cost	£ 15	-0.329	0.070	-4.70	0.001	(-0.46, -0.19)
	£ 100	-0.120	0.070	-1.71	0.086	(-0.25, 0.02)
	£ 300	0.449	-	-	-	-
3.Frequency of use	Daily	0.129	0.069	1.86	0.063	(-0.01, 0.26)
	Weekly	-0.068	0.069	-0.99	0.324	(-0.20, 0.07)
	Monthly	-0.061	-	-	-	-
4.Operability	A person without technical knowledge or skill can use it	-0.295	0.067	-4.44	0.001	(-0.43, -0.17)
	A person with basic technical knowledge and skill can use it	-0.137	0.067	-2.06	0.039	(-0.27, -0.01)
	A person with good technical knowledge can use it	0.432	-	-	-	-
5.Feedback on test result	The device will indicate whether a result is good or bad	-0.027	0.069	-0.39	-0.695	(-0.16, 0.11)
	The device will give you a performance score and indicate if it is good or not	0.022	0.068	0.32	0.747	(-0.11, 0.15)
	The device will give you a chart indicating the trends of results over time	0.005	-	-	-	-
6.Time it takes to get the result	Instantly (less than 1 minute)	-0.293	0.067	-4.37	0.001	(-0.42, -0.16)
	within 10 minutes	0.179	0.067	2.68	0.007	(0.05, 0.31)
	within 30 minutes	0.114	-	-	-	-
7.Accuracy	**Error or false reading in 1 out of 100 tests**	**0.067**	**0.067**	**1.00**	**0.318**	**(-0.06, 0.20)**
	Error or false reading in 1 out of 50 tests	-0.181	0.065	-2.8	0.005	(-0.31, -0.5)
	Error or false reading in 1 out of 10 tests	0.114	-	-	-	-

Reference attribute: Accuracy Reference level: error false reading in 1 out of 10 tests N = 214914 LL = -17677.59 p = 0.001 Pseudo R^2 = 0.0757

3.7.2 Result of BWS case 3

In BWS case 3, each attribute level 3 is the reference level. The results in Table 14 suggested similar results as BWS case 2, except attribute 7 with the highest z score in level 2 'Error or false reading in 1 out of 50 tests'.

Table 14 Estimates of BWS case 3

Level of attributes	Coefficient	Standard error	*z*	*p*	95% Confident interval
Hand held, mobile phone sized	-0.660	0.031	-21.60	0.001	(-0.72, -0.60)
Tablet like device	-0.277	0.030	-9.35	0.001	(-0.33, -0.22)
Pen sized and weighted	0.937	-	-	-	-
£ 15	-0.033	0.029	-1.16	0.247	(-0.09, 0.02)
£ 100	-0.058	0.029	-2.00	0.045	(-0.12, -0.01)
£ 300	0.091	-		-	
Daily	0.078	0.029	2.67	0.008	(0.02, 0.14)
Weekly	-0.040	0.030	-1.34	0.180	(-0.10, 0.02)
Monthly	-0.038	-	-	-	-
A person without technical knowledge or skill can use it	-0.623	0.031	-19.84	0.001	(-0.68, -0.56)
A person with basic technical knowledge and skill can use it	-0.798	0.032	-25.14	0.001	(-0.86, -0.74)
A person with good technical knowledge can use it	1.421	-	-	-	-
The device will indicate whether a result is good or bad	-0.123	0.025	-4.87	0.001	(-0.17, -0.07)
The device will give you a performance score and indicate if it is good or not	0.012	0.026	0.47	0.636	(-0.04, 0.06)
The device will give you a chart indicating the trends of results over time	0.111	-	-	-	-
Instantly (less than 1 minute)	-0.057	0.030	-1.88	0.060	(-0.12, 0.01)
within 10 minutes	0.182	0.030	6.09	0.001	(0.12, 0.24)
within 30 minutes	-0.125	-	-	-	-
Error or false reading in 1 out of 100 tests	-0.061	0.031	-2.00	0.046	(-0.12, -0.01)
Error or false reading in 1 out of 50 tests	**0.003**	**0.030**	**0.10**	**0.919**	**(-0.06, 0.06)**
Error or false reading in 1 out of 10 tests	-0.058	-	-	-	-
N=25100 LL=-8327.2748 *p*=0.001					

3.8 Questionnaire

The average time respondents spent to finish the questionnaire is 24 minutes 5 seconds with the median time 17 minutes 22 seconds. We also asked respondents about their preferable question format, 56.3% of them chose case 3 (making choices among devices) while the rest of them preferred case 2 (making choice within a device). Most of them liked this survey, while some of them considered it had provided useful information about self-testing.

4. Discussion

The aim of this study is to elicit people's preference towards self-testing devices and investigate the barriers and facilitators of self-management and self-testing. In general, self-management is a highly recommended way to take care of one's own health condition, especially in case of the chronic disease population (Vassilev et al., 2013). It fits well with the patient-centered care cognition (Robinson, Callister, Berry, & Dearing, 2008). The results of this study indicate 75% of participants with chronic disease had performed self-management so far, and most of them adhered the medication even though it might be uncomfortable or with side effect. With regard to the attitude to self-management, both the participants with and those without chronic disease have positive attitude towards self-management. This could be concluded from our findings that respondents agreed with the importance of the actions needed in self-management process and the positive outcome brought by practicing managing disease themselves. In our sample, people with better health state, higher self-efficacy in self-management, higher health literacy, more income, tended to agree more with the importance of actions involved in self-management. These results are confirmed by previous research. Rodriguez (2013) indicated patients presented with higher self-efficacy tended to take the responsibility of self-management. Nam et al. (2011) mentioned in his article, patients' attitude and health belief have positive relation.Onwudiwe et al. (2011) found out in his research, higher health literacy helped to more access to self-management. Among the respondents who had chronic condition but who did not perform self-management, inadequate knowledge and skill and lack of confidence of self-care were the main reasons for them to say no to self-management. Similar situation can be found in the attitude towards self-testing.

The majority of respondents were willing to perform self-testing. The main reason was the convenience and ease of use of a device, which was also stated by John (2010). Another reason was because self-test can help avoid the embarrassment of going to see a GP. Moreover respondents believed that self-testing could save time and cost in the process to go to the clinic. Similar findings could be seen in Martine's research (Ickenroth et al., 2011; Ickenroth et al., 2010). Privacy and self-awareness of own health condition from self-testing was also emphasized by some respondents, as well as regular check for better knowing of their health.

We also found out different opinions according to frequency of the use of a device, body material and disease condition when respondents came up with different self-testing scenarios. As we mentioned more frequent check of the health condition was preferable. However, wearing a blood monitor device for 24 hours a day resulted in the refuse to perform this self-test. In addition, type of body material is a big matter for self-testers. Some respondents were not willing to send their stool sample or urine sample by post, others felt afraid to take their blood sample by themselves. Moreover, knowledge about health and disease caused different attitude of undertaking self-testing. Some respondents believed stress was a natural feeling of people which did not need to be tested. This caused them being unsure or unwilling to take the saliva self-test. Respondents also doubted about the accuracy of a self-test, by contrast, they trusted health professional for their experience and skills.

In BWS case 2, portability, operability, and one-time cost were the most three important features. Portability was the determinant element of convenience. It decided to which extent the device could be carried around. Operability of a device is closely associated with the ease of use, which might require a certain level of technical knowledge and skill. One-time cost reflects to what extent people can afford to buy a self-testing device. These three features were mostly concerned by people when they were considering whether to use the self-testing device. Among the levels belonged to different attributes, '*pen sized and weighted*', '*one time cost £ 300*', '*daily use*', '*good technical knowledge and skill needs*' and '*The device will give you a performance score and indicate if it is good or not*', 'feedback in 10 minutes' were the preferable specified features. BWS case 3 represents similar results as case 2, except for attribute 7, in which people preferred level 2 '*Error or false reading in 1 out of 50 tests*'. Thus we found out people's preference of self-testing devices, which is of great significance for the design and development of a device.

There are some specialties of our research. Firstly, based on the traditional model, we made a new model to describe the relations of between facilitators and barriers of disease self-management and self-testing according to our objective. The new adapted model is the basis of our questionnaire design. In the model, we included most of the important influence factors based on the literature study and aimed to fulfill our research goal. Secondly, we used BWS method to elicit preference for self-testing device, which is an innovative solution to address the important feature of a device at a general level. Based on the results from BWS, we can conclude the most desirable features of general public, which has great significance of design and development of a self-test device. Third, we built up five scenarios to investigate the attitude for self-testing under several circumstances with both qualitative and quantitative questions. From that we understand the reason for people to make such choice, which is also helpful to improve health care service and to design better self-testing devices.

There are several limitations of this research. First, in order to investigate different influence factors, we referred to some existing scale. These scales have been widely applied and well tested, however the validity and reliability were unknown when they were combined into the one questionnaire. Secondly our research was based on the UK sample. Consequently the results can only be applied in the UK market. Further local information needed to adjust it to other countries outside the UK.

5. Conclusion

This research provided useful information about the people's preference for a self-testing device and the influence factors of self-testing and self-management. Portability, operability, feedback on the test result and accuracy were the features which respondents considered most when they choose a self-testing device. The former three features were associated with the ease of use of a device, while the last one was related to the perceived usefulness of a device. According to our model, these two key components could generate the attitude to use the device and the behavioral intention to use it. In detail, '*pen size*', 'onetime cost £ 300', 'daily use', '*good technical and skill need*', '*performance score feedback indicating if the result is good or not*', 'feedback within 10 minutes' were the most desirable characteristics in each attribute both in BWS case 2 and case 3. Hence we found out people's opinion of an ideal self-testing device. Moreover, the type of body material was concerning to people in self-testing. Thus to release their fear or dislike in taking certain body sample may increase the acceptance of self-testing device. Besides, people's willingness may change when they were equipped by confidence, skills, and knowledge. Thus alterable factors, such as self-efficacy and health literacy can be a breakthrough to increase the acceptance of self-management and self-testing, from which the policy maker can take advantage of by launching education programs and helping people become more confident in managing their health and disease. The finding is helpful for medical technical company to design self-testing devices according to user' needs and wants. Also the information is useful for

stakeholders to make decisions about investment and reimbursement of a self-testing device.

Future research can be carried out to investigate the preference for self-testing device in certain specified group, such as gender, age group, income level. Additionally, quantitative research, such as face to face interview, can be launched to know people's willingness and unwillingness of self-testing in depth. The combination of qualitative and quantitative results will be significant in self-testing device design and development.

7. Reference

Ansell, J., Jacobson, A., Levy, J., Voller, H., & Hasenkam, J. M. (2005). Guidelines for implementation of patient self-testing and patient self-management of oral anticoagulation. International consensus guidelines prepared by International Self-Monitoring Association for Oral Anticoagulation. *Int J Cardiol, 99*(1), 37-45.

Ayele, K., Tesfa, B., Abebe, L., Tilahun, T., & Girma, E. (2012). Self care behavior among patients with diabetes in Harari, Eastern Ethiopia: the health belief model perspective. *PLoS One, 7*(4), e35515.

Bayliss, E. A., Ellis, J. L., & Steiner, J. F. (2007). Barriers to self-management and quality-of-life outcomes in seniors with multimorbidities. *Ann Fam Med, 5*(5), 395-402.

Bodenheimer, T., Lorig, K., Holman, H., & Grumbach, K. (2002). Patient Self-management of Chronic Disease in Primary Care. *JAMA, 288*(19), 2469-2475.

Brilleman, S. L., Purdy, S., Salisbury, C., Windmeijer, F., Gravelle, H., & Hollinghurst, S. (2013). Implications of comorbidity for primary care costs in the UK: A retrospective observational study. *British Journal of General Practice, 63*(609), e274-e282.

Centers for Medicare and Medicaid Services. (2012). *National Health Care Expenditures Data*. Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/tables.pdf.

Cheng, M. (2003). MEDICAL DEVICE Globe overview and guiding principles (pp. 1-57). Geneva: WHO.

Chidzambwa, L. (2013). The social considerations for moving health services into the home: A telecare perspective. *Health Policy and Technology, 2*(1), 10-25. doi: 10.1016/j.hlpt.2012.12.003

Chudyk, A., Shapiro, S., Russell-Minda, E., & Petrella, R. (2011). Self-monitoring technologies for type 2 diabetes and the prevention of cardiovascular complications: perspectives from end users. *Journal of diabetes science and technology, 5*(2), 394-401.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Q, 3*(3), 319-340.

Doyle, G., Cafferkey, K., & Fullam, J. (2012). European Health Literacy Survey (HLSEU) Executive Summary.

Eccleston, R. E. (2001). A model Regulatory Program for Medical Devices An Internal Guide (H. S. a. S. Development, Trans.) (pp. 1-77). Washington: Pan American Health Orgnization, WHO.

ERPHO. (2010). Chronic disease prevalence by age, sex, SHA and UK country in 2008. In I. Tennison, R. Tovey, J. Flowers & F. Hill (Eds.), (V1 ed.). UK: ERPHO.

Fisher, W. A., Cornman, D. H., Kohut, T., Schachner, H., & Stenger, P. (2013). What Primary Care Providers Can Do to Address Barriers to Self-Monitoring of Blood Glucose. *Clinical Diabetes, 31*(1), 34-42.

Ford, A. (2006). Coagulation analyzers (point of care, self-monitoring) (pp. 70-76).

Gaikwad, R., & Warren, J. (2009). The role of home-based information and communications technology interventions in chronic disease management: a systematic literature review. *Health Informatics J, 15*(2), 122-146.

Glynn, L. G., Valderas, J. M., Healy, P., Burke, E., Newell, J., Gillespie, P., & Murphy, A. W. (2011). The prevalence of multimorbidity in primary care and its effect on health care utilization and cost. *Family Practice, 28*(5), 516-523.

HLSEU. (2012). Appendix of the Comparative Report on Health Literacy in Eight EU Member States.

Ickenroth, M. H., Grispen, J. E., Ronda, G., Tacken, M., Dinant, G. J., NK., d. V., & T., v. d. W. (2011). Motivation and experiences of self-testers regarding tests for CV risk factors. *Health Expectations*. doi: 10.1111/j.1369-7625.2011.00733.x

Ickenroth, M. H., Ronda, G., Grispen, J. E., Dinant, G. J., NK., d. V., & T., v. d. W. (2010). How do people respond to self-test results - A cross-sectional survey. *BMC Family Practice, 11*(77), 1-8. doi: 10.1186/1471-2296-11-77

Jerant, A. F., von Friederichs-Fitzwater, M. M., & Moore, M. (2005). Patients' perceived barriers to active self-management of chronic conditions. *Patient Educ Couns, 57*(3), 300-307.

John, A. (2010). The Evidence to Support Point-of-Care Testing. *Clin Biochem Rev, 31*, 111-119.

Johnston, S., Irving, H., Mill, K., Rowan, M. S., & Liddy, C. (2012). The patient's voice: an exploratory study of the impact of a group self-management support program. *BMC Fam Pract, 13*, 65.

doi: 10.1186/1471-2296-13-65
Karter, A. J., Ferrara, A., Darbinian, J. A., Ackerson, L. M., & Selby, J. V. (2000). Self-monitoring of blood glucose: Language and financial barriers in a managed care population with diabetes. *Diabetes Care, 23*(4), 477-483.
Kawi, J. (2013). Self-Management and Support in Chronic Pain Subgroups: Integrative Review. *The Journal for Nurse Practitioners, 9*(2), 110-115.e115.
Kiser, K., Jonas, D., Warner, Z., Scanlon, K., Shilliday, B. B., & DeWalt, D. A. (2012). A Randomized Controlled Trial of a Literacy-Sensitive Self-Management Intervention for Chronic Obstructive Pulmonary Disease Patients. *J Gen Intern Med, 27*(2), 190-195.
Lancsar, E., Louviere, J., Donaldson, C., Currie, G., & Burgess, L. (2013). Best worst discrete choice experiments in health: methods and an application. *Soc Sci Med, 76*(1), 74-82.
Lawn, S., McMillan, J., & Pulvirenti, M. (2011). Chronic condition self-management: expectations of responsibility. *Patient Educ Couns, 84*(2), e5-8.
Levine, D. A., Allison, J. J., Cherrington, A., Richman, J., Scarinci, I. C., & Houston, T. K. (2009). Disparities in self-monitoring of blood glucose among low-income ethnic minority populations with diabetes, United States. *Ethn Dis, 19*(2), 97-103.
Lorig, K. R., Ritter, P. L., Stewart, A. L., & Sobel, D. S. (2001). Chronic Disease Self-Management Program: 2-Year Health Status and Health Care Utilization Outcomes. *Medical Care, 39*(11), 1217-1223.
Lorig, K. R., Sobel, D. S., Ritter, P. L., Laurent, D., & Hobbs, M. (2001). Effect of self-management program on patients with heart disease. *Eff Clin Pract, 4*, 256–262.
Louviere, J. J., Flynn, T. N., & Carson, R. T. (2010). Discrete Choice Experiments Are Not Conjoint Analysis. *Journal of Choice Modelling, 3*(3), 57-72.
Mead, H., Andres, E., Ramos, C., Siegel, B., & Regenstein, M. (2010). Barriers to effective self-management in cardiac patients: the patient's experience. *Patient Educ Couns, 79*(1), 69-76.
Mitzner, T. L., Boron, J. B., & Fausset, C. B. (2010). Older adults talk technology: technology usage and attitudes. *Comput Human Behav, 26*(6), 1710-1721.
Moll, S. (2012). INR Self Testing (D. o. Medicine, Trans.) (pp. 1-12): HEMO P H I L I A A N D T H ROM B O S I S C E N T E R UNIVERSITY OF NORTH CAROLINA.
Morrow, A. S., Haidet, P., Skinner, J., & Naik, A. D. (2008). Integrating diabetes self-management with the health goals of older adults: a qualitative exploration. *Patient Educ Couns, 72*(3), 418-423.
Nagelkerk, J., Reick, K., & Meengs, L. (2006). Perceived barriers and effective strategies to diabetes self-management. *Journal of Advanced Nursing, 54*(2), 151-158.
Nam, S., Chesla, C., Stotts, N. A., Kroon, L., & Janson, S. L. (2011). Barriers to diabetes management: patient and provider factors. *Diabetes Res Clin Pract, 93*(1), 1-9.
Novak, M., Costantini, L., Schneider, S., & Beanlands, H. (2013). Approaches to Self-Management in Chronic Illness. *Seminars in Dialysis, 26*(2), 188-194.
Onwudiwe, N. C., Mullins, D., Winston, R. A., Shaya, F. T., Pradel, F. G., Laird, A., & Saunders, E. (2011). Barriers to self-management of diabetes A qualitative study among low-income minority diabetics. *Ethnicity and Disease, 21*(1), 27-32.
Pivik, J., Rode, E., & Ward, C. (2004). A consumer involvement model for health technology assessment in Canada. *Health Policy, 69*(2), 253-268.
Potoglou, D., Burge, P., Flynn, T., Netten, A., Malley, J., Forder, J., & Brazier, J. E. (2011). Best-worst scaling vs. discrete choice experiments: an empirical comparison using social care data. *Soc Sci Med, 72*(10), 1717-1727.
Poulton, B. C. (1997). Consumer Feedback and Determining Satisfaction with Services. *In Achieving Quality in Community Health Care Nursing*. London: Macmillan Press.
Reverdin, S., Schnetzler, B., Gagneux, G., Gavignet, C., Boehlen, F., & De Moerloose, P. (2011). Implementation of an INR self-testing and self-management programme in common ambulatory private practice: our experience with 90 patients. *Swiss Medical Weekly, 141*(5), 141:w13199.
RIVM. (2013a). *220 duizend Nederlanders voelen zich zwaar belast door mantelzorg*. Retrieved from http://www.rivm.nl/Bibliotheek/Algemeen_Actueel/Nieuwsberichten/2013/220_duizend_Nederlanders_voelen_zich_zwaar_belast_door_mantelzorg.
RIVM. (2013b). *Meer dan 800.000 mensen met diabetes in Nederland; toename fors*. Retrieved from http://www.rivm.nl/Bibliotheek/Algemeen_Actueel/Nieuwsberichten/2013/Meer_dan_800_

000_mensen_met_diabetes_in_Nederland_toename_fors.
Robinson, J. H., Callister, L. C., Berry, J. A., & Dearing, K. A. (2008). Patient-centered care and adherence: definitions and applications to improve outcomes. [Review]. *J Am Acad Nurse Pract, 20*(12), 600-607. doi: 10.1111/j.1745-7599.2008.00360.x
Rodriguez, K. M. (2013). Intrinsic and extrinsic factors affecting patient engagement in diabetes self-management: perspectives of a certified diabetes educator. *Clin Ther, 35*(2), 170-178.
Schou, L., Ostergaard, B., Rasmussen, L. S., Rydahl-Hansen, S., & Phanareth, K. (2012). Cognitive dysfunction in patients with chronic obstructive pulmonary disease--a systematic review. *Respir Med, 106*(8), 1071-1081.
Shah, S. G., Barnett, J., Kuljis, J., Hone, K., & Kaczmarski, R. (2013). Factors determining patients' intentions to use point-of-care testing medical devices for self-monitoring: the case of international normalized ratio self-testing. *Patient Prefer Adherence, 7*, 1-14.
Shah, S. G., & Robinson, I. (2011). Patients' perspectives on self-testing of oral anticoagulation therapy: content analysis of patients' internet blogs. *BMC Health Serv Res, 11*(1), 25.
Shapiro, N. L. (2008). Patient barriers and solutions for INR self-testing. *J Thromb Thrombolysis, 25*, 14-15.
Squires, D. A. (2012). Explaining High Health Care Spending in the United States: An International Comparison of Supply, Utilization, Prices, and Quality. *Commonwealth Fund 15*, 1-11.
Thomas-Hawkins, C., & Zazworsky, D. (2005). Self-Management of chronic kidney disease. *AJN, 105*(10), 40-48.
Tomky, D., & Albuquerque, N. M. (2010). BD Getting Started™Self-Monitoring of Blood Glucose. In B. Drive (Ed.), (pp. 1-10).
van der Meer, V., van Stel, H. F., Detmar, S. B., Otten, W., Sterk, P. J., & Sont, J. K. (2007). Internet-based self-management offers an opportunity to achieve better asthma control in adolescents. *Chest, 132*(1), 112-119.
Vassilev, I., Rogers, A., Blickem, C., Brooks, H., Kapadia, D., Kennedy, A. P., . . . Reeves, D. (2013). Social Networks the Work and Work Force of Chronic Illness Self-Management A Survey Analysis of Personal Communities. *PLoS ONE, 8*(4), 1-13. doi: 10.1371/journal.pone.0059723.t001
Wagner, E. H. (1998). Chronic disease management: what will it take to improve care for chronic illness? *Effective Clinical Practice, 1*(1), 2-4.
Wagner, E. H., Austin, B. T., Davis, C., Hindmarsh, M., Schaefer, J., & Bonomi, A. (2001). Improving chronic illness care: translating evidence into action. *Health Aff (Millwood), 20*, 64–78.
Wagner, J., Malchoff, C., & Abbott, G. (2005). Invasiveness as a barrier to self-monitoring of blood glucose in diabetes. *Diabetes Technology and Therapeutics, 7*(4), 612-619.
WHO. (2002). Innovative Care for Chronic Diseases-WHO-global report Building Blocks for Action (1 ed., pp. 1-103): Noncommunicable Diseases and Mental Health World Health Organization.
Wilkinson, A., & Whitehead, L. (2009). Evolution of the concept of self-care and implications for nurses: a literature review. *Int J Nurs Stud, 46*(8), 1143-1147.
Wittkowsky, A. K., Sekreta, C. M., Nutescu, E. A., & Ansell, J. (2005). Barriers to Patient Self-Testing of Prothrombin Time: National Survey of Anticoagulation Practitioners. *Pharmacotherapy, 25*(2), 265-269.

8. Appendix

8.1 Features of self-testing device

Different from the traditional way of disease testing, self-testing device shifted the process out of the labs and gave patients more priority to manage the situation by themselves. There several features of self-testing device which support the out-of lab testing to realize.

Portability

This could be one of the most marked characteristic from other kinds of medical devices. Generally speaking, a self-testing device is portable for patient to carry it home and can be used in a smaller room rather than in an ample space such as the lab. The ***size*** is not big or the ***weight*** is not heavy, which allow patient to reach it in convenience for frequent use. Despite using at home, it might also be used in somewhere else, for example patient can take it for self-monitoring when they are on a trip. Currently the oral anticoagulation self-testing devices for warfarin management are good examples (Ford, 2006; Moll, 2012).

Operability

This feature is important because of the reason that the user is patient rather than these experienced professionals. Self-management devices were designed for easy use so as to minimize the problems brought by literature capacity and operation skills of different patients. Additionally a short time of training might needed before patients started to use them, as well as reading the operation manual which should be easy to understand (John, 2010; Tomky & Albuquerque, 2010).

Safety

Safety is always an important feature of medical devices. The operator is the patient, which is determinant to the high safety of self-testing device. Only little or small ***invasiveness*** is allowed, otherwise, the patient may not able to manage the testing process themselves (Fisher, Cornman, Kohut, Schachner, & Stenger, 2013; Moll, 2012).

Price

Price of some well-accepted self-testing device was set to a rational level, which was affordable by patient, such as the glucose self-monitoring device, pregnancy test device and blood pressure self-monitoring device (Tomky & Albuquerque, 2010). Meanwhile the current coagulation testing devices are more expensive comparing to these devices mentioned above. Price varies due to the prevalence of certain disease and the demand of the general public.

Prescription

The glucose self-monitoring device, pregnancy test device and blood pressure self-monitoring device are over the counter product, while the coagulation testing device is prescription needed.

Training

To ensure that patients have qualified skills to test their own blood pressure, blood glucose, or

PT/INR, training and instruction were performed before they started to practice all by themselves.

Feedback

After patients got their results from the devices, they can compare them with the normal values and/or visit their doctors regularly for suggestions. Some of the self-testing devices can transfer the results to the information system, such as CoaguChek S System for Prothrombin Time Testing and INRatio PT/INR (Ford, 2006).

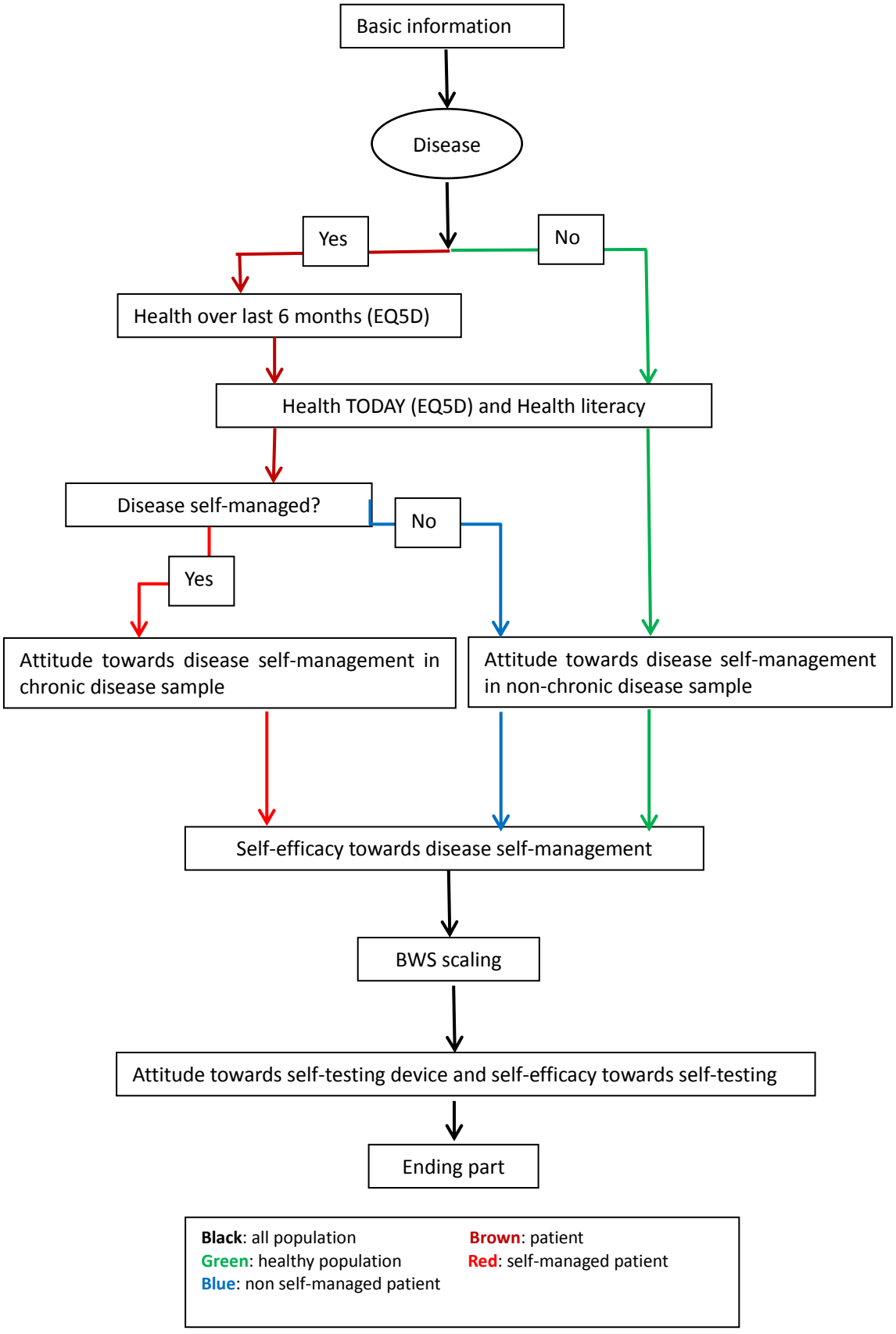
8.2 Factors affected patient-involvement of disease self-management

Intrinsic factors affected patient self-management		
Factors	**Explanation**	**References**
Attitude and health belief	Psychosocial factors such as health beliefs and attitudes toward the disease, self-efficacy, affect, mood, perceived quality of life, and distress	(Rodriguez, 2013) (Nam et al., 2011)
Depression	The patient's ability to implement daily self-care is significantly challenged in the presence of depression	(Rodriguez, 2013) (Jerant et al., 2005) (Bayliss et al., 2007)
Self-efficacy	Patient's self-perceived ability to undertake self-management activities	(Rodriguez, 2013) (Nam et al., 2011) (Morrow et al., 2008), (Kawi, 2013) (van der Meer et al., 2007) (Nagelkerk et al., 2006) (Novak et al., 2013)
Knowledge and skills	Evidence clearly supports the effectiveness of self-management training among individuals with type 2 diabetes. Knowledge about the target blood glucose and blood pressure goal and the importance of those values.	(Rodriguez, 2013) (WHO, 2002) (Ayele et al., 2012) (Nagelkerk et al., 2006) (Bayliss et al., 2007)
Ethnic /cultural /language perspectives	Cultural influences are related to ethnicity, customs, traditions, beliefs,and decision-making practices, affect engagement in diabetes-related health practices.	(Rodriguez, 2013) (Mead et al., 2010) (Nam et al., 2011) (Novak et al., 2013)
Services and resources		(Jerant et al., 2005) (Johnston, Irving, Mill, Rowan, & Liddy, 2012) (Mead et al., 2010) (Kawi, 2013) (Nagelkerk et al., 2006)
Physical symptoms	Limited mobility, particularly fatigue (Diabete)	(Jerant et al., 2005) (Johnston et al., 2012)
Functional health literacy	The patients' ability to navigate the health care system, share information with providers, participate in self-care, and embark on effective decision making	(Rodriguez, 2013)
Medication adherence	Patients' intention to take the medicine and manage disease themselves.	(Rodriguez, 2013) (Nam et al., 2011) (Nagelkerk et al., 2006)
Literacy skills		(Mead et al., 2010)
Cost	Insurance coverage (Diabete)	(Jerant et al., 2005) (Johnston et al., 2012) (Rodriguez, 2013) (Mead et al., 2010) (Nam et al., 2011) (Novak et al., 2013) (Bayliss et al., 2007)

Factors affected access to self-testing/monitoring		
Factor	Specification	Reference
Cost / reimbursement Financial statue	Device maintenance Strip cost Training cost	(Wittkowsky et al., 2005) (Shapiro, 2008) (Karter et al., 2000) (Chudyk et al., 2011) (Levine et al., 2009)

		(Shah et al., 2013) (Shah & Robinson, 2011)
Concerning of unintended self-management		(Wittkowsky et al., 2005) (Shapiro, 2008)
Knowledge and Skills about of self-testing	Knowing that self-testing could be an option to deal with disease. Patients' ability to getting a large enough drop of blood report.	(Shapiro, 2008) (Shah & Robinson, 2011) (Reverdin et al., 2011) (Chudyk et al., 2011)
Invasiveness		(J. Wagner, Malchoff, & Abbott, 2005) (Chudyk et al., 2011) (Mitzner et al., 2010)
Racial/ ethic		(Levine et al., 2009)
Age		(Shah et al., 2013) (Mitzner et al., 2010)

8.3 Structure of questionnaire



8.4 Table

Table 1 Attitude towards self-management in chronic disease sample

Questions	Strongly agree N (%)	Agree N (%)	I don't know N (%)	Disagree N (%)	Strongly disagree N (%)
1. It is important to me to be involved in the management of my health and/or disease.	88 (70.4)	28 (22.4)	4 (3.2)	1 (0.8)	1 (0.8)
2. It is important to me to be educated and trained on how to take care of my own health.	81 (66.4)	37 (30.3)	2 (1.6)	2 (1.6)	0
3. It is important to me to set goals in my health and/or disease management.	43 (35.2)	67 (54.9)	8 (6.6)	4 (3.3)	0
4. It is important to me to plan how to reach my goals in my health and/or disease management	48 (39.3)	67 (54.9)	6 (4.9)	1 (0.8)	0
5. It is important to me to have support from health professionals in the management of my health and/or disease.	66 (54.1)	49 (40.2)	4 (3.3)	3 (2.5)	0
6. It is important to me to have support from family and friends in the management of my health and/or disease.	53 (43.4)	55 (45.1)	5 (4.1)	7 (5.7)	2 (1.6)
7. It is important for me to have support from fellow patients in the management of my disease	15 (12.3)	29 (23.8)	44 (36.1)	24 (19.7)	10 (8.2)
8. Self-management has improved my knowledge about my health and/or disease.	46 (37.7)	59 (48.4)	14 (11.5)	3 (2.5)	0
9. Self-management has changed my behavior towards health and/or disease.	39 (32.0)	57 (46.7)	21 (17.2)	4 (3.3)	1 (0.8)
10. Self-management has resulted in improved control over my health and/or disease.	40 (32.8)	54 (44.3)	19 (15.6)	7 (5.7)	2 (1.6)
11. Self-management has improved my quality of life.	30 (24.6)	54 (44.3)	28 (23.0)	8 (6.6)	2 (1.6)

Table 2 Attitude towards self-management in non-chronic disease sample

Questions	Strongly agree N (%)	Agree N (%)	I don't know N (%)	Disagree N (%)	Strongly disagree N (%)
1. It would be important to me to be involved in the management of my health and/or disease.	243 (56.0)	161 (37.1)	26 (6.0)	2 (0.5)	2 (0.5)
2. It would be important to me to be educated and trained on how to take care of my own health.	227 (56.0)	146 (36.0)	28 (6.9)	3 (0.7)	1 (0.2)
3. It would be important to me to set goals in my health and/or disease management.	184 (42.4)	196 (45.2)	49 (11.3)	4 (0.9)	1 (0.2)
4. It would be important to me to plan how to reach my goals in my health and/or disease management	191 (44.0)	204 (47.0)	34 (7.8)	5 (1.2)	0
5. It would be important to me to have support from health professionals in the management of my health and/or disease.	206 (50.9)	157 (38.8)	35 (8.6)	6 (1.5)	1 (0.2)
6. It would be important to me to have support from family and friends in the management of my health and/or disease.	201 (46.3)	182 (41.9)	42 (9.7)	7 (1.6)	2 (0.5)
7. It would be important for me to have support from fellow patients in the management of my disease	74 (18.3)	151 (37.3)	130 (32.1)	41 (10.1)	9 (2.2)
8. Self-management will improve my knowledge about my health and/or disease.	171 (39.4)	212 (48.8)	38 (8.8)	13 (3.0)	0
9. Self-management will change my behavior towards health and/or disease.	140 (32.3)	195 (44.9)	81 (18.7)	18 (4.1)	0
10. Self-management will result in improved control over my health and/or disease.	146 (33.6)	207 (47.7)	69 (15.9)	11 (2.5)	1 (0.2)
11. Self-management will improve my quality of life.	159 (36.6)	194 (44.7)	74 (17.1)	7 (1.6)	0

Table 3 Correlation associated with attitude of self-management and influence factors in chronic disease self-management sample

	Attitude towards self-management										
	Q1 r (*p*)	Q2 r (*p*)	Q3 r (*p*)	Q4 r (*p*)	Q5 r (*p*)	Q6 r (*p*)	Q7 r (*p*)	Q8 r (*p*)	Q9 r (*p*)	Q10 r (*p*)	Q11 r (*p*)
Gender	-0.3(0.005)	-0.3(0.002)									
Age							-0.2(0.035)				
Age group											
Education level											
Income level				0.2(0.041)				0.2(0.044)	0.2(0.010)	0.2(0.026)	
Ethnic background											
EQ5D index											
Self-efficacy	0.4(0.001)	0.5(0.001)	0.5(0.001)	0.5(0.001)	0.2(0.008)			0.5(0.001)	0.4(0.001)	0.5(0.001)	0.5(0.001)
Health literacy											
Seek for help											
Understand doctor	0.2(0.014)	0.2(0.030)									
Understand leaflet											
Understand instruction	0.2(0.047)									0.2(0.041)	
Healthy behavior judgment	0.2(0.029)	0.2(0.006)	0.3(0.001)							0.2(0.011)	0.2(0.023)
Decision making	0.2(0.022)	0.3(0.002)	0.4(0.001)	0.3(0.004)						0.4(0.001)	0.5(0.001)

Table 4 Correlation associated with attitude of self-management and influence factors in inexperienced chronic disease self-management sample

	Attitude of self-management										
	Q1 r (*p*)	Q2 r (*p*)	Q3 r (*p*)	Q4 r (*p*)	Q5 r (*p*)	Q6 r (*p*)	Q7 r (*p*)	Q8 r (*p*)	Q9 r (*p*)	Q10 r (*p*)	Q11 r (*p*)
Gender						-0.1(0.032)					
Age							-0.1(0.019)				
Age group							-0.1(0.009)				
Education level		0.1(0.009)									
Income level							0.1 (0.039)				
Ethnic background						-0.1(0.026)	0.1(0.014)		0.1(0.003)	0.1(0.005)	0.1(0.014)
EQ5D index				0.1(0.046)			0.1(0.027)	0.1(0.001)	0.1(0.024)	0.2(0.001)	0.2(0.001)
Self-efficacy	0.2(0.001)	0.2(0.001)	0.2(0.001)	0.2(0.001)	0.1 (0.008)		0.1(0.023)	0.2(0.001)	0.2(0.001)	0.2(0.001)	0.2(0.001)
Health literacy											
Seek for help	0.2(0.001)			0.1(0.041)			-0.1(0.047)			0.1(0.032)	0.1(0.020)
Understand doctor	0.1(0.007)	0.1(0.022)	0.1(0.028)	0.1(0.019)						0.1(0.050)	
Understand leaflet		0.1(0.024)						0.1(0.039)		0.1(0.002)	0.1(0.039)
Understand instruction	0.1(0.027)	0.1(0.008)	0.1(0.016)	0.1(0.012)						0.1(0.029)	0.1(0.004)
Healthy behavior judgment	0.1(0.006)	0.1(0.018)	0.1(0.030)	0.1(0.018)					0.1(0.026)	0.1(0.002)	0.2(0.001)
Decision making	0.2(0.001)	0.2(0.002)	0.2(0.001)	0.2(0.001)				0.2(0.001)	0.2(0.001)	0.2(0.001)	0.2(0.001)

Table 5 Preferable recommendation source of self-testing device

Recommendation source	N (%)	Percent of Cases (%)
Doctors	472 (50.0)	92.2
Nurses	302 (32.0)	59.0
Family member	93 (9.9)	18.2
Website	48 (5.1)	9.4
Mass media	18 (1.9)	3.5
Other	11 (1.2)	2.1
Total	944 (100.0)	184.4

Table 6 Preferable purchase tunnel of self-testing device

Purchase tunnel	N (%)	Percent of Cases (%)
Hospital	200 (20.8)	39.1
Pharmacy with prescription	405 (42.1)	79.1
Over the counter	244 (25.4)	47.7
Online	106 (11.0)	20.7
Other resource	6 (0.6)	1.2
Total	961 (100.0)	187.7

Table 7 Correlation between influence factors and willingness of self-testing in different scenarios

	Scenario1 r (*p*)	Scenario 2 r (*p*)	Scenario 3 r (*p*)	Scenario 4 r (*p*)	Scenario 5 r (*p*)
Gender					
Age	-0.1 (0.026)	-0.2 (0.001)		-0.2 (0.001)	-0.1 (0.011)
Age group	-0.1 (0.035)	-0.1 (0.002)		-0.1 (0.001)	-0.1 (0.004)
Education level					
Income level					
Ethnic background		0.2 (0.001)		0.1 (0.013)	
EQ5D index					
Self-efficacy of self-management	-0.2 (0.001)	-0.3 (0.001)	-0.1 (0.010)	-0.2 (0.001)	-0.1 (0.004)
Self-efficacy of self-testing	-0.3 (0.001)	-0.4 (0.001)	-0.2 (0.001)	-0.4 (0.001)	-0.3 (0.001)
Health literacy					
Seek for help					
Understand doctor		-0.1 (0.008)			
Understand leaflet					
Understand instruction		-0.2 (0.001)		-0.1 (0.012)	
Healthy behavior judgment					
Decision making					

Table 8 Attitude in scenarios

Attitude	Stool test N (%)	Urine test N (%)	Blood pressure test N (%)	Blood sample test N (%)	Saliva test N (%)
Definitely yes	167 (32.3)	232 (45.0)	183 (35.7)	188 (36.6)	260 (50.7)
Probably yes	212 (40.9)	195 (37.8)	151 (29.4)	163 (31.8)	150 (29.0)
I am not sure	90 (17.4)	56 (10.9)	101 (19.7)	104 (20.3)	57 (11.1)
Probably not	32 (6.2)	19 (3.7)	57 (11.1)	36 (7.0)	29 (5.7)
No	17 (3.3)	14 (2.7)	21 (4.1)	22 (4.3)	17 (3.3)
Total	518	516	513	513	513

Table 9 Summary of scenario 1

Reason to choose 'yes'	Frequency of answer
Timesaving, convenient and easy to use	159
Without going to see the GP, which might be embarrassing and costly	87
Privacy, independence, self-awareness	48
More regular check and early detection of disease	46
Certainty	1
Reason to choose 'no'	**Frequency of answer**
Professional is more trustworthy with experience and skills	26
Do not want to take stool sample; do not want to send it in a post.	8
Machine cannot replace a doctor	4
Doubt about the accuracy	2
Cross contamination	1
Reason to choose 'unsure'	**Frequency of answer**
Professional is more trustworthy with experience and skills	31
Unconfident to perform it on their own	27
Cost	2
Do not want to send it in a post.	2
Doubt about the intention of this test (they check for other health issues)	1
Unsure what to do	1
Doubt about the accuracy	1

Table 10 Summary of scenario 2

Reason to choose 'yes'	Frequency of answer
Timesaving, convenient and easy to use	252
More regular check and early detection of disease	45
Privacy, independence, self-awareness	39
Without going to see the GP, which might be embarrassing and costly	36
Saving time of NHS and GP	3
Feel confident to do it	3
Cost	1
Seems to be complicated to do, but worthwhile	1
Reason to choose 'no'	**Frequency of answer**
Professional is more trustworthy with experience and skills	14
Unconfident to perform it on their own	8
Doubt about the accuracy	4
Would be very inconvenient every month	1
Might easily forget	1
Cost	1
Reason to choose 'unsure'	**Frequency of answer**
Unconfident to perform it on their own	22
Professional is more trustworthy with experience and skills	11
Doubt about the accuracy	8
Cost	1
Not comfortable with the idea to handle their own urine	1
Would panic at bad results	1

Table 11 Summary of scenario 3

Reason to choose 'yes'	Frequency of answer
Timesaving, convenient and easy to use	185
More regular check and early detection of disease	38
Privacy, independence, self-awareness	20
Without going to see the GP, which might be embarrassing and costly	18
Saving time and cost of NHS and GP	8
Feel confident to do it	1
Wearing it 24hrs a day would be annoying, but worthwhile	1
Reason to choose 'no'	**Frequency of answer**
It would be uncomfortable and too restrict to wear it 24/7	45
Professional is more trustworthy with experience and skills	13
Doubt about the accuracy	5
Unconfident to perform it on their own	1
Reason to choose 'unsure'	**Frequency of answer**
It would be uncomfortable and too restrict to wear it 24/7	41
Doubt about the accuracy	27
Professional is more trustworthy with experience and skills	8
Unconfident to perform it on their own	2
Cost	1
It would depend on how comfortable the device was	1

Table 12 Summary of scenario 4

Reason to choose 'yes'	Frequency of answer
Timesaving, convenient and easy to use	224
Feel confident to do it	20
Privacy, independence, self-awareness	20
More regular check and early detection of disease	19
Without going to see the GP, which might be embarrassing and costly	13
Saving time and cost of NHS and GP	5
Improved quality of care, improved health knowledge	4
Cost	2
Example or more information needed	2
Pricking finger is not comfortable, but worth trying	2
Reason to choose 'no'	**Frequency of answer**
Dislike blood, dislike to prick finger by their own	20
Professional is more trustworthy with experience and skills	16
Unconfident to perform it on their own	7
Doubt about the accuracy	4
Infection	1
Unsuccessful experience	1
Reason to choose 'unsure'	**Frequency of answer**
Dislike blood, dislike to prick finger by their own	47
Doubt about the accuracy	19
Professional is more trustworthy with experience and skills	10
It would depend on how the disease progressed	9
Cost	1

Table 13 Summary of scenario 5

Reason to choose 'yes'	Frequency of answer
Timesaving, convenient and easy to use	331
Feel confident to do it	12
Without going to see the GP, which might be embarrassing and costly	9
Privacy, independence, self-awareness	8
It is useful	7
More regular check and early detection of disease	6
Saving time and cost of NHS and GP	3
Cost saving	3
Reason to choose 'no'	**Frequency of answer**
Do not need to measure the degree of stress, everybody can feel that	18
Professional is more trustworthy with experience and skills	7
Unsure	3
Doubt about the accuracy	1
Unconfident to perform it on their own	1
It cannot help to change the level of stress	1
Cannot afford to buy over the counter products	1
Reason to choose 'unsure'	**Frequency of answer**
Unsure about it	21
Do not need to measure the degree of stress, everybody can feel that	5
Professional is more trustworthy with experience and skills	4
Doubt about the accuracy	2
Everyone experiences stress its part of life	1
Never be affected by stress	1

8.5 Questionnaire

Dear Sir or Madam
Thank you very much for your participation in our study.

Why is this study?
This study focuses on people's opinions towards self-management of health and disease and their attitude and preferences towards self-testing devices.
With the results of this study, we aim to improve the content and organization of self-management programs and the design of self-management devices.
What we ask you to do.
In the following questions, we will ask you about your current health, your experience with and attitude towards self-management and your needs and wants with regard to self-testing devices. There are 8 parts in this questionnaire and it will take approximately 20 minutes.

Part 1 Basic information

A1 What is your gender	
Female	Male
A2 What is your age?	
Number of years	
A3 What is your level of education?	
• Primary school • High school • Vocational school • Bachelor • Master • Postgraduate • Other	

A4 Do you currently suffer from chronic disease? Chronic Disease is a long-lasting condition that can be controlled but not cured.	
Yes (go to A5)	No (go to A6, then go to B7-B12, then go to C1-C6, then D15)
A5 What kind of disease do you have? *(there could be more than one answer)	
• Atrial fibrillation • Asthma • Cancer • Coronary heart disease • Chronic kidney disease • Chronic obstructive pulmonary disease • Dementia • Diabetes mellitus • Hypertension • Stroke • Other	
A6 Do you suffer from acute disease recently? Acute disease is a disorder with sudden onset and short duration of symptoms that can be cured.	
Yes	No

The following two questions are only for confidential use. If you don't want to, you don't need to answer these questions.
A7 Your monthly income
• Below 1700 £ • 1700~2500 £ • Above 2500 £ • I don't want to share this
A8 What is your ethic background?
• White

• Mixed • Asian • Black • Other • I don’t want to share this

Part 2 Your health over the last 6 months

Under each heading, please select ONE that best describes your health OVER THE LAST 6 MONTHS.
B1 Mobility
• I have no problems in walking about • I have slight problems in walking about • I have moderate problems in walking about • I have severe problems in walking about • I am unable to walk about
B2 Self-care
• I have no problems washing or dressing myself • I have slight problems washing or dressing myself • I have moderate problems washing or dressing myself • I have severe problems washing or dressing myself • I am unable to wash or dress myself
B3 Usual activities (e.g. work, study, housework, family or leisure activities)
• I have no problems doing my usual activities • I have slight problems doing my usual activities • I have moderate problems doing my usual activities • I have severe problems doing my usual activities • I am unable to do my usual activities
B4 Pain/discomfort
• I have no pain or discomfort • I have slight pain or discomfort • I have moderate pain or discomfort • I have severe pain or discomfort • I have extreme pain or discomfort
B5 Anxiety/depression
• I am not anxious or depressed • I am slightly anxious or depressed • I am moderately anxious or depressed • I am severely anxious or depressed • I am extremely anxious or depressed
B6 From 0-100, how would you rate your health statue **OVER THE LAST 6 MONTHS** in the scale below?

Part 2 Your health TODAY

Under each heading, please select ONE that best describes your health TODAY
B7 Mobility
• I have no problems in walking about • I have slight problems in walking about • I have moderate problems in walking about • I have severe problems in walking about • I am unable to walk about
B8 Self-care
• I have no problems washing or dressing myself • I have slight problems washing or dressing myself • I have moderate problems washing or dressing myself • I have severe problems washing or dressing myself • I am unable to wash or dress myself
B9 Usual activities (e.g. work, study, housework, family or leisure activities)
• I have no problems doing my usual activities

• I have slight problems doing my usual activities • I have moderate problems doing my usual activities • I have severe problems doing my usual activities • I am unable to do my usual activities
B10 Pain/discomfort
• I have no pain or discomfort • I have slight pain or discomfort • I have moderate pain or discomfort • I have severe pain or discomfort • I have extreme pain or discomfort
B11 Anxiety/depression
• I am not anxious or depressed • I am slightly anxious or depressed • I am moderately anxious or depressed • I am severely anxious or depressed • I am extremely anxious or depressed
B12 From 0-100, how would you rate your health statue **TODAY** in the scale below?

Part3 Your ability to read, understand and use health care information

In this part, we would like to know your ability to understand the health information. In the scale below, please choose from very easy to very difficult, how easy would you say it is to:			
C1 ... find out where to get professional help when you are ill?			
• Very difficult	• Fairly difficult	• Fairly easy	• Very easy
C2 ... understand what your doctor says to you?			
• Very difficult	• Fairly difficult	• Fairly easy	• Very easy
C3 … understand the leaflets that come with your medicine?			
• Very difficult	• Fairly difficult	• Fairly easy	• Very easy
C4 … understand your doctor's or pharmacist's instruction on how to take a prescribed medicine?			
• Very difficult	• Fairly difficult	• Fairly easy	• Very easy
C5 … judge which everyday behavior is related to your health?			
• Very difficult	• Fairly difficult	• Fairly easy	• Very easy
C6 … make decisions to improve your health?			
• Very difficult	• Fairly difficult	• Fairly easy	• Very easy

Part 4 Disease Self-management

Self-management is a process in which individuals manage their own health with support from a collaborative system of care which involves a range of people and organizations, from family to policy level decisions.

Self-management is aimed at changing patients' behavior by increasing the patients' self-efficacy and knowledge about disease. Improved behavior is expected to lead to better disease control which should, in turn, lead to better patient outcomes.

Self-management can consist of one or more of the following actions:

*Closely monitor your own symptoms and responding with appropriate actions (adjust medications, initiate call to a health care coach, schedule a doctor visit) when the symptom level indicates a problem.

*Make major lifestyle changes (e.g., stop smoking, reduce alcohol consumption, modify diet, lose weight, and increase exercise).

*Adhere to medication regimens, some of which are inconvenient or produce side effects.

D1 Do you manage your chronic disease by yourself?	
• Yes (go to D2)	• No (go to D3)

D2 If yes. Which of the following actions do you perform?
• Closely monitor your own symptoms and responding with appropriate actions (adjust medications, initiate call to a health care coach, schedule a doctor visit) when symptom levels indicate a problem. • Make major lifestyle changes (e.g., stop smoking, reduce alcohol consumption, modify diet, lose weight, and increase exercise). • Adhere to medication regimens, some of which are inconvenient or produce side effects. • Other …..
D3 If no. Why not? (go to D15)
• It is the responsibility of the health professionals, not patients'. 1 • I don't think patient can manage their disease. 2 • I don't have enough knowledge or skills to perform self-management. 3 • I am not able to keep on taking care of my own health for a long time. 4 • Other….

Part 4 Your perception of self-management

Self-management is a process in which individuals manage their own health with support from a collaborative system of care. It is aimed at changing patients' behavior by increasing the patients' self-efficacy and knowledge about disease, leading to better disease control and outcomes.

Self-management consist several actions, such as monitoring your symptom, appropriate responding, making life style change and adhering to medication regimens.

In the next questions, we ask you to give your opinion about the importance of self-management. Please indicate the degree in which you agree with each statement.				
D4 It is important to me to be involved in the management of my health and/or disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D5 It is important to me to be educated and trained on how to take care of my own health.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D6 It is important to me to set goals in my health and/or disease management (i.e. 5 kg weight loss in a month).				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D7 It is important to me to plan how to reach my goals in health and/or disease management (i.e. healthy food, daily exercise).				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D8 It is important to me to have support from health professionals in the management of my health and/or disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D9 It is important to me to have support from family and friends in the management of my health and/or disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D10 It is important for me to have support from fellow patients in the management of my disease. (only in case of chronic disease)				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D11 Self-management has improved my knowledge about my health and/or disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D12 Self-management has changed my behavior towards health and/or disease				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D13 Self-management has resulted in improved control over my health and/or disease				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D14 Self-management has improved my quality of life				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree

Part 4 Your perception of self-management in managing health and disease population

Self-management is a process in which individuals manage their own health with support from a collaborative system of care. It is aimed at changing patients' behavior by increasing the patients'

self-efficacy and knowledge about disease, leading to better disease control and outcomes.

Self-management consist several actions, such as monitoring your symptom, appropriate responding, making life style change and adhering to medication regimens.

In this part, we would like to know your perception towards disease self-management. Imagine yourself having a chronic disease. Please indicate the degree in which you agree with each statement.				
D15 It would be important to me to be involved in the management of my health and/or disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D16 It would be important to me to be educated and trained on how to take care of my own health.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D17 It would be important to me to set goals in my health and/or disease management (i.e. 5 kg weight loss in a month).				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D18 It would be important to me to plan how to reach goals in health and/or disease management (i.e. eat healthy, exercise daily).				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D19 It would be important to me to have support from health professionals in the management of my health and/or disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D20 It would be important to me to have support from family and friends in the management of disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D21 It would be important for me to have support from fellow patients in the management of my health and/or disease.				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D22 Self-management will improve my knowledge about health and/or disease				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D23 Self-management will change my behavior towards health and/or disease				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D24 Self-management will result in improved control over my health and/or disease				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree
D25 Self-management will improve quality of life				
• Strongly agree	• Agree	• I don't know	• Disagree	• Strongly disagree

Part 5 Self-efficacy in self-management

Self-management is a process in which individuals manage their own health and/or disease with support from a collaborative system of care.

Self-efficacy in self-management is the confidence to carry out certain behavior and achieve the goals in self-management.

For each of the following questions, please choose the number that corresponds to your confidence that you are or would be able do the task required for self-management.										
E1 How confident are you in judging if symptoms are a sign of disease?										
Not confident at all	1	2	3	4	5	6	7	8	9	10 Totally confident
E2 How confident are you in adjusting your medication levels yourself (after instruction from a health professional?										
Not confident at all	1	2	3	4	5	6	7	8	9	10 Totally confident
E3 How confident are you in making decisions on the need to see a doctor?										
Not confident at all	1	2	3	4	5	6	7	8	9	10 Totally confident
E4 How confident are you that you can do things other than taking medication to reduce how much an illness affects your everyday life?										
Not confident at all	1	2	3	4	5	6	7	8	9	10 Totally confident
E5 How confident are you in closely monitoring your own symptoms of disease?										
Not confident at all	1	2	3	4	5	6	7	8	9	10 Totally confident
E6 How confident are you in responding with appropriate actions (adjust medications, initiate call to a health care coach, schedule a doctor visit) when the symptom level indicates a problem?										
Not confident at all	1	2	3	4	5	6	7	8	9	10 Totally confident
E7 How confident are you in making major lifestyle changes (e.g., stop smoking, reduce alcohol consumption,										

modify diet, lose weight, and increase exercise)?											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident
E8 How confident are you in adhering to medication regimens, even some are inconvenient or produce side effects?											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident

Part 6 Attitude towards self-testing device

Self-testing in disease means that individual can use medical devices to test indicators of their own health and/or disease. Testing takes place by obtaining samples of bodily fluids such as blood, saliva, urine or stool and either testing them at home or sending them out to a laboratory. Self-testing enables an individual to test for the presence of disease or monitor disease or symptom progression, without direct interference of a health professional.

F1 Of the following self-testing devices, which have you heard of?
Blood pressure meter
Blood glucose meter
Pregnancy test
HPV Self-Test
Oral anticoagulation test
Antibodies test for coeliac disease
Rapid HIV test
Colon polyps test
Prostate test
Cholesterol Self-test
Other…
None

F2 Of the following self-testing devices, which of these have you used or are you using in the management of your own health or disease?
Blood pressure meter
Blood glucose meter
Pregnancy test
HPV Self-Test
Oral anticoagulation test
Antibodies test for coeliac disease
Rapid HIV test
Colon polyps test
Prostate test
Cholesterol Self-test
Other…
None

Self-testing using medical devices would require different actions on your part. Please choose the number

that corresponds to your confidence to perform the following actions?											
F3 How confident are you that you can get your blood sample by yourself? This requires pricking the finger with a pin and putting a drop of blood on a test strip.											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident
F4 How confident are you that you can get your saliva sample by yourself? This requires swabbing inside of your mouth and with a cotton roll and putting the roll into a clean container.											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident
F5 How confident are you that you can get your urine sample by yourself? This requires peeing into a clean specimen cup and putting a test strip into the cup.											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident
F6 How confident are you that you can get your stool sample by yourself? This requires taking a sample of your stool and putting it into a clean container.											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident
F7 How confident are you that you can read results from a test strip? This requires comparing color changes of the test strip with a result chart.											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident
F8 How confident are you that you can operate an electronicself-management device? This requires steps such as pressing on buttons or touching screen of the device based on instructions provided on screen.											
Not confident at all	1	2	3	4	5	6	7	8	9	10	Totally confident

Part 7 & part 8 BWS scaling

People's willingness to use a device depends on the characteristics of a device. For example, the size of the device, the costs of the device, the frequency of use etc.

Here we list seven main characteristics of a device, classified in three levels/categories.

We would like to know your needs and wants towards self-testing devices by asking your preference for different devices. In each question three devices are presented.

We will start with an example:
For each device, please indicate which device is the most desirable and which device is the least desirable. In this example, device 1 is the most desirable and device 3 is the least desirable.

Click on 'Next' to start the 11 questions. Each page shows 2 questions, except for the last page (3 questions).

Table of attributes and levels	
Attributes	**Levels**
G1 Portability	• Hand held, mobile phone sized • Tablet like device -> with picture • Pen sized and weighted
G2 One-time Cost	• £ 15 • £ 100 • £ 300
G3 Frequency of use	• Daily • Weekly • Monthly
G4 Operability	• A person without technical knowledge or skill can use it • A person with basic technical knowledge and skill can use it • A person with good technical knowledge can use it
G5 Feedback on test result	• The device will indicate whether a result is good or bad.(for example, green light on the screen indicates a good result while a red one indicate a bad result) • The device will give you a performance score and indicate if it is good or not. (for example, the score 120 is provide and indicates the result is good) • The device will give you a chart indicating the trends of results over time (for example, a line chart is provided showing the trends of the results) • For example, a progress chart will be provided to visualize the trend of

	observations.)
G6 Time it takes to get the result	• Instantly (less than 1 minute) • within 10minutes • within 30 minutes
G7 Accuracy	• Error or false reading in 1 out of 100 tests • Error or false reading in 1 out of 50 tests • Error or false reading in 1 out of 10 tests

G8 Difficulty of questions	
In the previous parts of the questionnaire you have answered questions about the desirability of self-testing devices and their characteristics. Which response format do you prefer based on the ease of use?	
• Making choices within a device	• Making choices among devices

Part 9

In this part, we will present some scenarios about self-testing device, please choose the answer which described your feeling about each statement or the one described your real situation.

Scenario 1				
Imagine that you are currently participating in a national screening program for bowel cancer. At present, you are tested every 5 years by a health professional. Instead, you are being asked to perform the test yourself on a yearly basis. It requires you to take a sample of stool and send it to a laboratory. The result will be send to you through mail to you and your GP.				
H1 Would you be willing to use it instead of going to see the health professional every 5 years?				
• Definitely yes	• probably yes	• I am not sure	• Probably not	• No
*If "definitely yes" to "*probably yes*", go to H2. If "probably not" and "no", go to H4. If not sure, go to H3*				
H2 What are your main reasons for being willing to self-test?				
H3 What are your main reasons for being unsure?				
H4 What are the reasons that you would not be willing to use it?				

Scenario 2				
Imagine that you are at high risk for kidney disease. At present, your kidney function is tested every year by a health professional. Instead, you are being asked to perform the test yourself on a monthly basis. It requires you to take a sample of urine, placing a dipstick in the sample and putting it in an electronic device which will give you a reading. If this is deviant, you need to contact your GP.				
H5 Would you be willing to use this self-test instead?				
• Definitely yes	• probably yes	• I am not sure	• Probably not	• No
*If "definitely yes" to "*probably yes*", go to H6. If "probably not" and "no", go to H8. If not sure, go to H8*				
H6 What are your main reasons for being willing to perform this self-test? Please specify				
H7 What are your main reasons for being unsure?				
H8 What are the reasons that you would not be willing to use it?				

Scenario 3
Imagine that you are at high risk for cardiovascular disease. At present, your blood pressure is tested every month by a health professional. Instead, you are being asked to perform the test yourself on a daily basis. It requires you to wear a blood pressure monitor 24 hours a day. If the readings are deviant, you receive a warning

signal and you need to contact your GP.
H9 Would you be willing to perform this self-test?
• Definitely yes • probably yes • I am not sure • Probably not • No
*If "definitely yes" to "*probably yes*", go to H10. If "probably not" and "no", go to H12. If not sure, go to H11*
H10 What are your main reasons for being willing to it?
H11What are your main reasons for being unsure?
H12 What are the reasons that you would not be willing to use it?

Scenario 4
Imagine that you were recently diagnosed with Parkinson's Disease. You need to take daily oral drugs. To check the effect of treatment and to decide how much of the drug you need, weekly tests of the drug levels in your blood are necessary. A self-testing device is available that you can use it at home to test your blood. It requires you to prick your finger to get the blood sample, put it on a stick and put it in an electronic device. If the readings are deviant, you receive a warning signal and you need to change the amount of medication you take.
H13 Would you be willing to use this self-testing device?
• Definitely yes • probably yes • I am not sure • Probably not • No
*If "definitely yes" to "*probably yes*", go to H14. If "probably not" and "no", go to H16. If not sure, go to H15*
H14 What are your main reasons for being willing to perform this self-test?
H15 What are your main reasons for being unsure?
H16 What are the reasons that you would not be willing to use it?

Scenario for 5
Imagine that you have been working intensively for 12 hours a day for 2 weeks and your feel tired and stressed out. A self-test is available at your local pharmacy that enables you to test for the levels of stress hormone in your blood. It requires you to take a saliva swab, put it on a stick and put it in an electronic device. If the readings are deviant, you receive a warning signal.
H17 Would you be willing to perform this saliva self-test?
• Definitely yes • probably yes • I am not sure • Probably not • No
*If "definitely yes" to "*probably yes*", go to H18. If "probably not" and "no", go to H20. If not sure, go to H19*
H18 What are your main reasons for being willing to perform this test?
H19 What are your main reasons for being unsure? [unsure5]
H20 What are the reasons that you would not be willing to use a self-testing device?

Part 10 Purchasing a self-testing device

I8 From who would you willing to take the recommendation to use a self-testing device.				
• Doctors	• Nurses	• Family members	• Website	• Mass media
I9 Where do you think would be convenient for you to get a self-testing device?				
Hospital	Pharmacy with prescription	Over the counter	Online	Other resource
I10 Would you be willing to pay for a self-testing device?				
• Definitely yes	• Probably yes	• I don't know	• Probably not	• No

Thank you very much for your participation.
If you have any question or suggestions, please feel free to write it down in the textbox below.

I11 If you have any question or suggestions, please feel free to write it down in the textbox below.