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Eriksson-Backa, Kristina; Nguyen, Hai

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Health information-seeking styles and health information literacy in relation to anticipated health-promoting behaviour - results from an online diabetes risk test survey

Kristina Eriksson-Backa* and Hai Nguyen

Åbo Akademi University
Information studies
Fänriksgatan 3B
FI-20500 Åbo, Finland
Email: kristina.eriksson-backa@abo.fi
Email: thi.nguyen@abo.fi
*Corresponding author

Abstract: The paper presents results from a survey of users of an online diabetes risk test. We studied relationships between information-seeking styles and everyday health information literacy, as well as anticipated behaviours in case of risk for type 2 diabetes for 184 respondents who had taken the risk test prior to responding to the survey. We assessed active, moderate and passive health information-seeking styles, as well as low, basic and high everyday health information literacy and tested them against health-promoting information-related activities and health behaviour. Significant relationships occurred between information-seeking styles and four activities: 'check further information', 'make an appointment', 'increase the amount of physical activities' and 'do nothing'. Education level was significantly related to two health-promoting behaviours, whereas level of everyday health information literacy was related to only one. Despite limitations, the results of this exploratory study open up for further research about the role of information-seeking styles and health-promoting behaviour.

Keywords: diabetes risk test; e-health services; Finland; health information literacy; health-promoting behaviour; information-seeking styles; online self-assessments.

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Biographical notes: Dr Kristina Eriksson-Backa is a University teacher and postdoctoral researcher in Information Studies at Åbo Akademi University, Turku, Finland. She holds the title of docent (adjunct professor) at the same university. Her main research interests are information about food and health in the media, health information behaviour, especially among older adults, understanding of health information, health communication, and e-health. She has published internationally in several journals including *Information Processing and Management*, *Information Research*, *Informatics for Health and Social Care* and *Health Informatics Journal*.

Dr Hai Nguyen holds a Bachelor from National Economics University of

Author

Hanoi, M.Sc. from Sydney University, and Ph.D. from Waseda University, Japan. She is currently working in different research projects regarding information systems management at Åbo Akademi University, Turku, Finland. Her research focuses on information system adoption, dynamic capabilities, strategies and e-health. Her and her colleagues' work has appeared in e.g. Information Processing and Management and Journal of Information Systems for Developing Countries.

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1 Introduction

Diabetes is a noncommunicable disease regarded as one of the leading causes of mortality in the world (World Health Organization, 2016). In Finland, the estimated number of persons with diabetes type 2 is 300,000, with an additional 150,000 persons being undiagnosed. This constitutes nearly one-tenth of the country's population (Finnish Diabetes Association, 2016). Thus, it is motivated to pay increased attention to diabetes screening tools, as well as to behaviours that could possibly prevent an outbreak of the disease. Enwald et al. (2012) found that information could influence persons with an elevated risk for diabetes type 2 in an intervention study: 70% of the attendants changed their diet and 40% changed their physical behaviour. Especially e-health solutions have shown to influence health behaviour in a positive way in intervention studies (Kreps and Neuhauser, 2010; Neuhauser and Kreps, 2010). As e-health is a broad concept, several kinds of services, including patient forums, electronic patient records, mobile health services and online self-management, can be seen as e-health services (Ludwig et al., 2012; Ma et al., 2015; Miah et al., 2014; Vedel et al., 2013).

Prior literature reviews (e.g., Harris et al., 2008; Zwar et al., 2006) suggest that by implementing self-management programmes, patients at least to some extent could have improvements in their health status, and this was most effective especially for patients with diabetes, heart disease and hypertension. According to Chobanian et al. (2003), people are more interested in self-assessments for certain health conditions such as diabetes and mental depression, and healthcare commonly accepts this service as an essential component of continuous patient care. However, despite increasing popularity and anticipated benefits and usefulness of online self-assessments, these types of e-health services have not been largely researched. Hence, there has been a call for additional research on online services and self-assessments (e.g., Kauer et al., 2014; Torrent-Sellens et al., 2016).

In addition, studies on self-assessments show varying results. The use of an online test for assessing the risk for breast cancer increased the interest in information about the disease (van Erkelens et al., 2017), whereas an online screening test for anxiety disorders

Title

encouraged about half of the respondents to seek help (Van Ameringen et al., 2015). Online health information can influence users for instance to become more engaged during visits to physicians, to adhere better to advice from physicians, and to change their diet (Iverson et al., 2008). Studies on online mental health services, however, showed that the users of these seldom sought help from professionals afterwards (Kauer et al., 2014).

Furthermore, previous studies show that information behaviour - how people need, seek and use information (Wilson, 1999) - related to health can cause inequalities. Relationships between, for example, more active health information behaviour or better health literacy and better health (Eheman et al., 2009; Ek and Heinström, 2011; Lee et al., 2004) or higher levels of everyday health information literacy and healthier behaviour (Hirvonen et al., 2016) have been found. It has been claimed that policy makers and system designers as well as health promotion might benefit from better insights in the fact that people approach health information in different ways and have differing information practices (Greyson and Johnson, 2016; Johnson, 2014). Information-seeking styles as assessed in this study and their relationship to health-promoting behaviours have, however, to the best of our knowledge, not been studied before.

Therefore, this paper presents results from a survey about health-related online self-assessments (i.e., an online diabetes risk test) with background factors, experience and behaviour of users of this test. It also aims to closer study the relations between demographic variables, information-seeking styles, health information literacy, and anticipated behaviours that promote health, which include both information-related activities and actual health behaviours, in the case of an elevated risk for type 2 diabetes.

2 Earlier research on health and information seeking

2.1 E-health service use and demographic variables

The interest in using e-Health services often depends on demographic variables. Despite some exceptions (Gazibara et al., 2016), women are generally more interested in seeking health information online than men are (Bidmon and Terlutter, 2015; Hallyburton and Evarts, 2014; Yan, 2010). In a vast European study, Torrent-Sellens et al. (2016) found that women and respondents who had an upper secondary level education showed more interest in e-health, which can be seen in the fact that health-related information in forums, blogs, and search engines is used more frequently by women than men (Bidmon and Terlutter, 2015). Furthermore, possibilities to rank health professionals, hospitals or medications, as well as health-related social networking sites, interest women more (Thackeray et al., 2013). Women consequently more often utilise online tests and risk tests, as well (Kauer et al., 2014; Nijhof et al., 2008). Men, on their hand, show more interest in using applications designed for health information searching on mobile devices (Bidmon and Terlutter, 2015).

Higher education level is often related to a more frequent use of the internet (Flynn et al., 2006; Lustria et al., 2011; Yan, 2010) although there are some studies that have not found any significant differences in education level between internet users and non-users (Taha et al., 2009). A higher level of education has also been linked to a more frequent use of mobile health technology as well as to consulting health-related online rankings or reviews more actively (Bosak and Park, 2017; Thackeray et al., 2013). Tatara et al.

Author

(2017) found that both education and digital skills were related to use of e-health for self-care of type 2 diabetes.

The connection between health status and e-health use is more complex. Taha et al. (2009) did not find any significant differences between users and non-users concerning either general health or health compared with others, whereas other studies show that illness or poor health is a common reason for seeking health information online (Flynn et al., 2006; Kim, 2012). In a study that included data from 13 European countries, the researchers did not find any significant differences between self-perceived general health status and a more active use of e-health services, however. Respondents with either very good health or poor health seemed more prone to use these services more intensively, however. Illnesses including diabetes did increase the use, though (Torrent-Sellens et al., 2016). Tatara et al. (2017) found negative relationships among Pakistani immigrants in Norway between general health status and use of ICT in general to communicate with only a few acquaintances about self-care of type 2 diabetes in closed online environments. Otherwise, neither health nor gender were important factors for e-health use.

2.2 Information seeking styles

Wilson (1999) divided information behaviour, defined as needing, seeking, and using information, into four types: passive attention, passive search, active search and ongoing search. Health information behaviour is then information behaviour in the context of health. Pálsdóttir (2008) divided this behaviour into passive, moderately passive, moderately active, or active. The way people seek information, in other words their information-seeking styles, can depend on, for example, personality traits or coping styles [Johnson and Case, (2012), pp. 102-103] and styles related to health information seeking have previously been divided into either active, moderately active or passive (Eheman et al., 2009). Also Kelly et al. (2010) divided engagement with cancer information sources into more active, deliberate information seeking and information scanning, the latter being passive acquisition of information while being exposed to sources, although this still differs from a completely passive exposure. It seems that scanning is a more common behaviour than active seeking is (Kelly et al. 2010). In the current study, we identified three different styles as well, but differing from previous studies, we assessed them based on actual information practices. McKenzie (2003) identified three more active information practices such as active seeking, active scanning and non-directed monitoring and the more passive practice of acquiring information by proxy, which means being told something without asking for it. Niemelä (2006; cf. Hirvonen et al., 2012), on his part, added to these a total avoidance of information as a fifth practice.

2.3 Health information literacy

Health information literacy is a concept originally developed by the Medical Library Association in the USA. It includes a person's self-rated capability to recognise that there is a need for health information, as well as to know how and where to find the needed information and, furthermore, how to evaluate and use the found information in everyday life in order to make good health decisions (Shipman et al., 2009). Health information literacy has been studied in different ways among different populations both qualitatively (e.g., Yates et al., 2012) and quantitatively (e.g., Enwald et al., 2016; Eriksson-Backa et

Title

al., 2012; 2018; Hirvonen et al., 2016; Mayer, 2018; Nengomasha et al., 2015; Niemelä et al., 2012). Niemelä and colleagues (2012) designed a screening tool that contains ten items in order to measure so-called everyday health information literacy (EHIL) quantitatively. This screening tool has been used by, among others, Hirvonen et al. (2016), whose studies showed that lower EHIL scores to some extent were associated with unhealthy behaviours (concerning physical activity, substance use and eating). Enwald and colleagues (2016), on their hand, studied EHIL among different groups including healthy young men and adults with a risk for metabolic syndrome, which is a pre-stage of diabetes type 2.

3 Research Methodology

3.1 Data collection

A survey was organised to understand the background factors, experience and behaviour of online diabetes risk test users in Finland. This risk test consists of eight items. The test inquires about age, body mass index, waist circumference, physical activity and consumption of fruit and vegetables. Additional items ask about risk factors such as elevated blood pressure and blood sugar levels, and presence of diabetes among family members and close relatives. Different responses give different risk points and in the end, the sum of these indicates the risk of developing type 2 diabetes within the next ten years.

The questionnaire developed for this study was available in Finnish, Swedish and English and contained a section for background information, as well as questions on user experience and health and information behaviour. A pre-test of the questionnaire was completed with four individuals who had experience in using e-health services, and the questionnaire was slightly revised to consist of the respondents' background, their user experience and information behaviour. The data were collected online using Webropol (www.webpolsurveys.com) for ten months, starting from November 2017.

We aimed at targeting anyone who is interested in knowing about his or her risk of having or developing diabetes. Therefore, we attached the survey to the diabetes risk test on the website of the national Finnish Diabetes Association (<https://www.diabetes.fi/riskitesti>). The website of the diabetes association is one of the addresses that is popular when people search for information about this disease. According to the annual report of the association, the website had about 890,300 individual visitors in 2017, and in total more than 4.5 million visits to the pages (Finnish Diabetes Association, 2017). In fact, many of our respondents answered that they had found the risk test when they searched the web or used Google to search for information about diabetes. We, furthermore, used a press release from the university to advertise about the survey and to reach potential respondents. In addition, we asked colleagues from our own department to circulate the survey within their networks.

3.2 Measures

We used a 5 point scale (from strongly agree to strongly disagree) to assess information-seeking styles, everyday health information literacy and anticipated

Author

behaviours that can promote health. We developed five items that contained statements assessing activity of health information seeking based on different modes of information practices (cf., Hirvonen et al., 2012; McKenzie, 2003; Niemelä, 2006). We, furthermore, assessed everyday health information literacy, that is, the ability to seek, find, evaluate and use health-related information sources, by using the tool developed by Niemelä et al. (2012). Furthermore, seven items contained statements about what the respondents would do if the result of the online risk test shows that they have an elevated risk of developing diabetes type 2. We divided these seven items into two groups: Group 1 included three statements concerning information-related activities while Group 2 had four statements about health-promoting behaviour. Two additional items measured how frequently the respondents used the internet (range: daily to never) and whether they use other e-health services, as well (yes/no). Another two items asked about the frequency of use of the diabetes risk test and other e-health services (range: weekly to never). Appendix 1 contains the final versions of the studied items in the questionnaire.

3.3 Data analysis

When we closed the survey in August 2018, 201 respondents had taken it and 184 of them could be included in this study, as they had ticked all the five items measuring information-seeking style. We calculated the three levels of everyday health information literacy in the same manner as Niemelä et al. (2012) and Hirvonen et al. (2016). For the analysis, we assigned the response 'strongly agree' 5 points and the response 'strongly disagree' 1 point. For four negatively worded items (the ones containing the word 'difficult', see Appendix 1), we used a reversed grading. A summative score for the aggregated scores was, then, calculated and the three levels low (≤ 30 points, $n=18$), basic (31-38 points, $n=96$) and high (≥ 39 points, $n=61$) were assessed for all 175 of the 184 included respondents who had ticked all ten items. We assessed the three information-seeking styles in a similar manner and assigned higher points for more positive responses to the three more active items. For the two passive items, we assigned reversed points. We calculated a summative score also for the information-seeking styles, and the three information-seeking styles passive (≤ 15 , $n=28$), moderate (16-19 points, $n=114$) and active (≥ 20 points, $n=42$), were assessed. For comparison, we tested the background factors, which according to previous research might influence use of online health information and e-health services (gender, education level and current self-rated health) against general internet use and use of the online diabetes risk test and other e-health services, as well as the anticipated information seeking activities and actual behaviours promoting health. We used cross-tabulation, chi-square tests and a significance level of .05 for the analysis.

4 Results

4.1 Sample characteristics

Table 1 shows frequencies of the background variables of the included respondents. As can be seen, a vast majority of nearly 70% of the respondents were female. The education levels varied more, with representatives from all levels fairly equally. More than one-half of all attendants rated their current health as good or very good and nearly

Title

40%, furthermore, as fair. Only a small number (6%) of those who took part in the study rated their own health as poor or very poor.

4.2 Demographic variables, current health, information seeking, information literacy and anticipated activities after taking the test

4.2.1 Demographic variables and self-rated health

The analysis of demographic background variables and self-rated current health and their relations to internet and e-health use only showed a significant relationship between education level and frequency of risk test use ($\chi^2=28.870$, $p=.025$). Most often, those who had a basic education stated that they rarely or never use the test. Furthermore, current self-rated health was related to frequency of use of the risk test ($\chi^2=34.923$, $p=.004$), as all those who rated their health as very good rarely or never used it and those who rated their health as good or fair used it slightly more frequently. We also tested the background variables against information-seeking style and level of everyday health information literacy, but could not find any significant relationships.

The demographic variables did, furthermore, not show any significant relationships with any of the anticipated information-related activities and for health-promoting behaviour only the education level and the statements about changing one's diet ($\chi^2=27.677$, $p=.035$) and not doing anything ($\chi^2=48.468$, $p=.000$) were significantly related. Around 40% of the respondents who had either a basic or a postgraduate education, strongly agreed that they would change their eating, while this was the case for only 25% of those who had an upper secondary level of education. Nearly half of those with a basic education strongly disagreed with the statement that they would not do anything, and among the ones with an upper secondary or postgraduate education, these figures were slightly lower, whereas having been educated to a bachelor's degree level was clearly more connected to being neutral to the statement.

Current self-rated health was significantly related to most activities, however. Although that particular relationship was not significant, those who rated their health as very good were the most interested in checking more information (with 75% strongly agreeing). They, furthermore, most strongly anticipated that they would change their eating ($\chi^2=42.532$, $p=.000$, 58% strongly agreed) as well as strongly disagreed with 'do nothing' ($\chi^2=34.146$, $p=.005$, 50% strongly disagreed). It was, however, those who rated their health as poor, who more often strongly agreed with the statements that they would: discuss with others ($\chi^2=46.463$, $p=.000$, 44% strongly agreed), make an appointment ($\chi^2=59.412$, $p=.000$, 67% strongly agreed), increase their physical activity ($\chi^2=35.925$, $p=.003$, 44% strongly agreed), and decrease substance use ($\chi^2=32.749$, $p=.008$, 56% strongly agreed).

4.2.2 Information Seeking and Everyday Health Information Literacy (EHIL)

Author

A significant relationship occurred between an active information-seeking style and active anticipated information-related activities for two of the three items, as Table 2 shows. For anticipated health behaviours, significant relationships occurred for the intention to increase physical exercise and the alternative not to do anything, and the plan to change one's diet behaviour was quite strong, as well. The cross-tabulation showed that the active seekers more often than especially the passive ones strongly agreed to check more information, make an appointment, increase the amount of physical activity, and change their diet. The active ones, furthermore, most often strongly disagreed with the statement that they would not do anything (Table 2).

Everyday health information literacy level (EHIL), on the other hand, was related significantly only to the statement 'do nothing' ($\chi^2=16.519$, $p=.036$), where those who had a higher level of EHIL were more prone to disagree or strongly disagree with the statement. However, although the relationship was not significant, the respondents with a higher level of EHIL more strongly agreed to seek more information and to discuss with others. EHIL and information seeking style were, furthermore, significantly related with each other ($\chi^2=15.519$, $p=.004$). Having a higher level of EHIL also seemed to mean that a person was more active at seeking information.

5 Discussion

5.1 Aim and comparisons with previous research

This study aimed at addressing a research gap, and examined the information-seeking style and self-perceived capability to find and use health information, that is, the everyday health information literacy, of users of an online diabetes risk test. These variables are studied in relation to the respondents' anticipation of behaviours that intend to promote health, including information-related activities and health behaviours, in case the test results indicate an elevated risk for type 2 diabetes. The current study indicated that not solely the use of health-related information, but also the intensity of the interaction can be connected to a person's tendency to act, because a link was found between a more active information-seeking style and being more positive towards two out of three information-related activities. This increases the risk of creating the loop of the rich becoming richer and the poor becoming poorer in health information, leading to the healthy becoming healthier and the weak even weaker, as persons who actively seek information are often more healthy (e.g., Ehemann et al., 2009; Ek and Heinström, 2011).

Although one could expect that illness and diagnoses would act as factors that motivate actual behaviour change (cf. Enwald et al., 2012, Torrent-Sellens et al., 2016), this is not always the case. Newsom and colleagues (2012) found that not even actual diagnoses of chronic illnesses largely influenced health behaviour for the better. Those who were diagnosed with diabetes were, however, most likely to decrease smoking and drinking, and to increase physical activity and fruit and vegetable intake. In this study, we asked what the respondents think that they would do if the test informed them that they were at a higher risk of developing diabetes. The questionnaire did not inquire about whether the risk test had actually shown an elevated risk. Still, the results of this study showed that possibilities (that either come from imagining situations or online test results, but not from actual diagnoses by doctors) of being at higher risk of a disease

Title

could act as a factor that could motivate people to start thinking about a behaviour change.

Previous studies show complex results regarding the relationship between health status and information seeking. For example, Jafaar et al. (2017) showed that sicker persons were more inclined to seek more health information and illness or poor health has been connected to online health information seeking, as well (Flynn et al., 2006; Kim, 2012), but the connections between health status and use of e-health are not evident (Tatara et al., 2017; Torrent-Sellens et al., 2016). Although there was a link between current self-rated health and use of the risk test and several anticipated information-related and health-promoting activities, the current study did not show any clear relationship between current self-rated health and information-seeking style. Rating the current health as better was, however, strongly or significantly related to intentions to perform some activities such as checking more information and changing one's diet, and rating the health as poor was related to other activities such as discussing with others, making an appointment with a specialist, increasing physical exercise and decreasing use of alcohol or tobacco. These results are, hence, similar to those of Torrent-Sellens et al. (2016).

It seems that the results of this study concerning active information seeking and healthier behaviour are mainly comparable with those of Pálsdóttir (2008). There was a strong relationship between EHIL and information seeking style, and Eriksson-Backa et al. (2018) found similar links between health information literacy and health information seeking, as well. One of the most surprising findings of this study was, however, that EHIL was significantly related to only one of the anticipated health-promoting activities despite information-seeking style being related to four. This clearly differs from the study by Hirvonen et al. (2016), who found strong connections between low levels of EHIL and less healthy behaviour. Furthermore, our results differ from previous research, which shows that demographic background, internal beliefs such as, for example, internal locus of control or self-efficacy, or everyday health information literacy can influence how people take actions for their health conditions (e.g., Deeks et al., 2009; Ehemann et al., 2009; Ek and Heinström, 2011; Hirvonen et al., 2012; Hirvonen et al., 2016; Jafaar et al., 2017; Pálsdóttir, 2008). In our study, we found only a few significant links for these kinds of factors in the current population, whereas there was a significant relationship between information-seeking style and four out of seven statements. Our results, hence, open the question for future studies on the role of information-seeking styles. Researchers have also earlier emphasised that health information seeking can be empowering and perceived as a way to take care of one's well-being and promote an increased perception of control (Manafa and Wong, 2012).

5.2 Limitations and further research

The study is not without limitations. Firstly, there was an imbalance in the gender ratio, which can influence the trustworthiness of the analysis. A vast majority of the respondents were female, which is, on the other hand, not surprising, because the survey was administered after having taken the diabetes risk test. Kauer et al. (2014) and Nijhof et al. (2008) found that women use self-assessments more actively, whereas Iverson et al. (2008) showed that women respond to surveys about online health information behaviour

Author

more frequently than men do. A reason for this might be that women are more likely to feel that it is their responsibility to seek advice on disease prevention (Deeks et al., 2009).

Secondly, the number of respondents was quite small and most participants rated their current health as good or very good, so the respondents probably represent the general public rather than patients with chronic illnesses. The respondents were, however, not random citizens but consisted of people who had taken the diabetes self-test, meaning that they were prone to be more interested in and motivated to seek information related to diabetes and perhaps also other health issues than the average were. This might explain why so few of the respondents were assessed as passive information seekers, as well.

Lastly, the method of assessing information-seeking styles is new and no one has yet applied it on other populations. The results are, thus, not generalisable, and the study is mainly exploratory. We recommend conducting further studies on larger populations in order to, for example, test the suggested relationships. Furthermore, we asked the participants to indicate their opinions, intentions and choice of activities but within this study, we could not observe whether they actually did change their behaviour. Hence, future research could aim at confirming relations between information-seeking styles and actual health promoting behaviour by observing actual behaviours.

5.3 Implications

The results of the survey can be useful for all providers of health information, within both healthcare, health services development, and the information field. Especially developers of health information technology can benefit from these insights. Tatara et al. (2017) claimed that it is important to know about the association between user factors and e-health use when designing and developing e-health services. According to Johnson (2014), both policy makers and system designers should develop more appreciation of people's different approaches to health information seeking. Greyson and Johnson (2016), on their hand, noted that acquaintance with research on information practice could lead to a better science of health promotion. Deeper insights into information-related activities could strengthen public health information interventions. There might be challenges with the practical implications as it might not be easy to influence the information-seeking style of people, but some practical steps are possible to take. As suggested by Hirvonen et al. (2012), it is important to tailor or target both the content and the delivery channels of health-promoting information in order to appeal to those who are not already motivated to obtain information. For example, provided health information should be easy to understand and easily accessed to attract those, who either do not want to seek information actively or are less capable of doing so (Eriksson-Backa et al., 2012). To avoid the negative spiral of the rich becoming richer and the poor becoming poorer in health information, more information that is relevant should be provided readily on the website of e-health services. This could include displaying links to information about diet or physical activities after completed online self-assessments. In addition, Eriksson-Backa et al. (2018) suggested enhancing people's health information literacy because there is a relationship between higher confidence in seeking abilities and actual information-seeking activity and this can influence health-related behaviour, as well. Information professionals who can provide the right information in the right format already now often carry out this task (e.g., Shipman et al., 2009). Providing access to more and varied information both electronically and in paper formats, freely and easily

Title

available, in places that people visit frequently including libraries or information centres, could be one way of increasing seeking activity.

5.4 Conclusions

The results of this study suggested a strong link between people's general health information-seeking style and their anticipated health-promoting behaviour while facing the risk of developing a chronic illness, type 2 diabetes. This link proved to be stronger than that between anticipated behaviour and other variables that previous research has suggested to be factors behind certain health behaviour, including demographic background and health information literacy. Current self-rated health was, on the other hand, also a strong factor behind certain behaviours, especially for those who rated their health as either very good or poor. The role of health information-seeking activity should be taken into consideration when delivering health-promoting information to the public, as it might influence the reception of it, as well as the actions that are taken based on that information.

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References

Bidmon, S. and Terlutter, R. (2015) 'Gender differences in searching for health information on the internet and the virtual patient-physician relationship in Germany: Exploratory results on how men and women differ and why', *Journal of Medical Internet Research*, 17(1), e156 [online] <https://www.jmir.org/2015/6/e156/> (Accessed 27 February 2019)

Bosak, K. and Park, S.H. (2017) 'Characteristics of adults seeking health care provider support facilitated by mobile technology: secondary data analysis', *Journal of Medical Internet Research: Human Factors* 4(4), e33 [online] <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5754563/> (Accessed 27 February 2019)

Chobanian, A.V., Bakris, G.L., Black, H.R., Cushman, W.C., Green, L.A., Izzo, J.L. Jr, Jones, D.W., Materson, B.J., Oparil, S., Wright, J.T. Jr and Roccella, E.J. (2003) 'The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report', *Journal of the American Medical Association*, Vol. 289 No. 19, pp. 2560-2572

Deeks, A., Lombard, C., Michelmore, J. and Teede, H. (2009) 'The effects of gender and age on health related behaviors', *BMC Public Health* 9(213) [online] <https://bmcpubhealth.biomedcentral.com/articles/10.1186/1471-2458-9-213> (Accessed 27 February 2019)

Author

Eheman, C.R., Berkowitz, Z., Lee, J., Mohile, S., Purnell, J., Rodriguez, E.M., Roscoe, J., Johnson, D., Kirshner, J. and Morrow, G (2009) 'Information-seeking styles among cancer patients before and after treatment by demographics and use of information sources', *Journal of Health Communication*, Vol. 15 No. 5, pp. 487-502

Ek, S. and Heinström, J. (2011) 'Monitoring or avoiding health information - the relation to inner inclination and health status', *Health Information and Libraries Journal*, Vol. 28 No. 3, pp. 200-209

Enwald, H., Hirvonen, N., Huotari, M.-L., Korpelainen, R., Pyky, R., Savolainen, M., Salonurmi, T., Keränen, A.M., Jokelainen, T. and Niemelä, R. (2016) 'Everyday health information literacy among young men compared with adults with high risk for metabolic syndrome – a cross-sectional population-based study', *Journal of Information Science*, Vol. 42 No. 3, pp. 344-355

Enwald, H.P.K., Niemelä, R.M., Keinänen-Kiukaanniemi, S., Leppäluoto, J., Jämsä, T., Herzig K.-H., Oinas-Kukkonen, H. and Huotari, M.-L.A. (2012) 'Human information behaviour and physiological measurements as a basis to tailor health information. An explorative study in a physical activity intervention among prediabetic individuals in Northern Finland', *Health Information and Libraries Journal*, Vol. 29 No. 2, pp. 131-140

Eriksson-Backa, K., Ek, S., Niemelä, R. and Huotari, M.-L. (2012) 'Health information literacy in everyday life: a study of Finns aged 65-79 years', *Health Informatics Journal*, Vol. 18 No. 2, pp. 83-94

Eriksson-Backa, K., Enwald, H., Hirvonen, N. and Huvila, I. (2018) 'Health information seeking, beliefs about abilities, and health behaviour among Finnish seniors' *Journal of Librarianship and Information Science*, Vol. 50, No. 3, pp. 284-295

Finnish Diabetes Association (2016). *One out of ten has diabetes*. [online] https://www.diabetes.fi/en/finnish_diabetes_association/diabetes_in_finland (Accessed 27 February 2019)

Finnish Diabetes Association (2017). *Diabetesliiton toimintaa vuonna 2017*. [online] https://www.diabetes.fi/files/9961/Diabetesliiton_vuosikertomus_2017_grafiikkana.pdf (Accessed 14 August 2019)

Flynn, K.E., Smith, M.A. and Freese, J. (2006) 'When do older adults turn to the internet for health information? Findings from the Wisconsin Longitudinal Study', *Journal of General Internal Medicine*, Vol. 21 No. 12, pp. 1295-1301

Gazibara, T., Kurtagic, I., Kusic-Tepavcevic, D., Nurkovic, S., Kovacevic, N., Gazibara, T. and Pekmezovic, T. (2016) 'Computer and online health information literacy among Belgrade citizens aged 66-89 years', *Health Promotion International*, Vol. 31 No. 2, pp. 335-343

Greyson, D.L. and Johnson, J.L. (2016) 'The role of information in health behavior: a scoping study and discussion of major public health models', *Journal of the Association for Information Science and Technology*, Vol. 67 No. 12, pp. 2831-2841

Hallyburton, A. and Evarts, L.A. (2014) 'Gender and online health information seeking: A five survey meta-analysis', *Journal of Consumer Health on the Internet*, Vol. 18 No. 2, pp. 128-142

Harris, M., Williams, A., Dennis, S., Zwar, N. and Davies, G. (2008) 'Chronic disease self-management: implementation with and within Australian general practice', *Medical Journal of Australia*, Vol. 189 No. 10, pp. S17-S20

Hirvonen, N., Huotari, M.-L., Niemelä, R. and Korpelainen, R. (2012) 'Information behavior in stages of exercise behavior change', *Journal of the American Society for Information Science and Technology*, Vol. 63 No. 9, pp. 1804-1819

Title

Hirvonen, N., Ek, S., Niemelä, R., Pyky, R., Ahola, R., Korpelainen, R. and Huotari, M.-L. (2016) 'Everyday health information literacy in relation to health behaviour and physical fitness: a population-based study among young men', *Library & Information Science Research*, Vol. 38 No. 4, pp. 308-318

Iverson, S.A., Howard, K.B. and Penney, B.K. (2008) 'Impact of internet use on health-related behaviors and the patient-physician relationship: a survey-based study and review', *The Journal of the American Osteopathic Association*, Vol. 108 No. 12, pp. 699-711

Jafaar, N.I., Ainin, S. and Yeong, M.W. (2017) 'Why bother about health? A study on the factors that influence health information seeking among Malaysian healthcare consumers', *International Journal of Medical Informatics*, Vol. 104, pp. 38-44

Johnson, J.D. (2014) 'Health-related information seeking: Is it worth it?', *Information Processing and Management*, Vol. 50 No. 5, pp 798-717

Johnson, J.D. and Case, D.O. (2012). *Health information seeking*. Peter Lang Publishing, New York.

Kauer, S.D., Mangan, C. and Sanci, L. (2014) 'Do online mental health services improve help-seeking for young people? A systematic review', *Journal of Medical Internet Research* 16(3), e66 [online] <https://www.jmir.org/2014/3/e66/> (Accessed 27 February 2019)

Kelly, B., Hornik, R., Romantan, A., Schwartz, J.S., Armstrong, K., DeMichele, A., Fishbein, M., Gray, S., Hull, S., Kim, A., Nagler, R., Niederdeppe, J., Ramirez, A.S., Smith-McLallen, A. and Wong, N. (2010) 'Cancer information scanning and seeking in the general population', *Journal of Health Communication*, Vol. 15 No. 7, pp. 734-753

Kim, Y.-M. (2012) 'Is seeking health information online different from seeking general information online?', *Journal of Information Science*, Vol. 41 No. 2, pp. 228-241

Kreps, G.L., Neuhauser, L. (2010) 'New directions in eHealth communication: opportunities and challenges', *Patient Education and Counseling*, Vol. 78 No. 3, pp. 329-336

Lee, S.Y., Arozullah, A.M. and Cho, Y.I. (2004) 'Health literacy, social support, and health: a research agenda', *Social Science & Medicine*, Vol. 58 No. 7, pp. 1309-1321

Ludwig, W., Wolf, K.-H., Duwenkamp, C., Gusew, N., Hellrung, N., Marschollek, M., Wagner, M. and Haux, R. (2012) 'Health-enabling technologies for the elderly – An overview of services based on a literature review', *Computer Methods and Programs in Biomedicine*, Vol. 106 No. 2, pp. 70-78.

Lustria, M.L.A., Smith, S.A. and Hinnant, C.C. (2011) 'Exploring digital divides: an examination of eHealth technology use in health information seeking, communication and personal health information management in the USA', *Health Informatics Journal*, Vol. 17 No. 3, 224-243

McKenzie, P.J. (2003) 'A model of information practices in accounts of everyday-life information seeking', *Journal of Documentation*, Vol. 59 No. 1, pp. 19-40

Ma, Q., Chen, K., Hoi, A., Chan, S. and Teh, P.-L. (2015). 'Acceptance of ICTs by older adults: a review of recent studies' in Zhou, J. and Salvendy, G. (eds) *Human Aspects of IT for the Aged Population. Design for Aging*. ITAP 2015. Lecture Notes in Computer Science, vol. 9193. Springer, Cham, pp. 239-249.

Manafo, E. and Wong, S. (2012) 'Exploring older adults' health information seeking behavior', *Journal of Nutrition Education and Behavior*, Vol. 44 No. 1, pp. 85-89

Author

- Mayer, A.-K. (2018) 'Examining the factorial structure and validity of the everyday health information literacy screening tool', *Cogent Medicine*, Vol. 5 No. 1, pp. 1-14
- Miah, S.J. (2014) 'Information and communication technology-based innovations for aging healthcare: a literature review', *International Journal of Computers in Healthcare*, Vol. 2, No. 1, pp. 28-42
- Nengomasha, C., Abankwah, R., Uutoni, W. and Pazvakawambwa, L. (2015) 'Health information literacy of University of Namibia students', *Journal for Studies in Humanities and Social Sciences*, Vol. 4 No. 1-2, pp. 179-192
- Neuhauser, L., Kreps, G.L. (2010) 'eHealth communication and behavior change: promise and performance', *Social Semiotics*, Vol. 20 No. 1, pp. 9-27
- Newsom, J.T., Huguet, N., Ramage-Morin, P.L., McCarthy, M.J., Bernier, J., Kaplan, M.S. and McFarland, B.T. (2012) 'Health behavior changes after diagnosis of chronic illness among Canadians aged 50 or older', *Health Reports*, Vol. 23 No.4, pp. 49-53
- Niemelä, R. (2006) *Ikääntyneiden informaatiokäyttäytyminen. Laadullinen tutkimus arkielämän informaatiokäytännöistä ja toimintaan aktivoitumisesta*. [Information behaviour of older adults. Qualitative study on information practices and enactment in everyday life]. Oulu University Press, Oulu.
- Niemelä, R., Ek, S., Eriksson-Backa, K., Huotari, M.-L. (2012) 'A screening tool for assessing everyday health information literacy', *Libri: International Journal of Libraries and Information Services*, Vol. 62 No. 2, pp. 125-134
- Nijhof, N., ter Hoeven, C.L., de Jong M.D.T. (2008) 'Determinants of the use of a diabetes risk-screening test', *Journal of Community Health*, Vol. 33 No. 5, pp. 313-317
- Pálsdóttir, Á. (2008) 'Information behaviour, health self-efficacy beliefs and health behaviour in Icelanders' everyday life', *Information Research*, 13(1), paper 334 [online] <http://www.informationr.net/ir/13-1/paper334.html> (Accessed 27 February 2019)
- Shipman, J.P., Kurtz-Rossi, S. and Funk, C.J. (2009) 'The health information literacy research project', *Journal of the Medical Library Association*, Vol. 97 No. 4, pp. 293-301
- Taha, J., Sharit, J. and Czaja, S. (2009) 'Use for and satisfaction with sources of health information among older internet users and nonusers', *The Gerontologist*, Vol. 49 No. 5, pp. 663-673.
- Tatara, N., Hammer, H.L., Andreassen, H.K., Mirkovic, J. and Kjøllestad, M.K.R (2017) 'The association between commonly investigated user factors and various types of eHealth use for self-care of type 2 diabetes: case of first-generation immigrants from Pakistan in the Oslo area, Norway'. *Journal of Medical Internet Research: Public Health & Surveillance* Vol. 3 No. 4, e68 [online] <https://publichealth.jmir.org/2017/4/e68/> (Accessed February 27th 2019)
- Thackeray, R., Crookston, B.T. and West, J.H (2013) 'Correlates of health-related social media use among adults', *Journal of Medical Internet Research*, Vol. 15 No. 1, e21 [online] <https://www.jmir.org/2013/1/e21/> (Accessed 27 February 2019)
- Torrent-Sellens, J., Díaz-Chao, Á., Soler-Ramos, I. and Saigí-Rubió, F. (2016) 'Modelling and predicting eHealth usage in Europe: a multidimensional approach from an online survey of 13,000 European Union internet users', *Journal of Medical Internet Research* Vol. 18 No. 7, e188 [online] <https://www.jmir.org/2016/7/e188/> (Accessed 27 February 2019)
- Van Ameringen, M., Simpson, W., Patterson, B. and Turna, J (2015) 'Internet screening for anxiety disorders: treatment-seeking outcomes in a three-month follow-up study', *Psychiatry Research*, Vol. 230 No. 2, pp. 689-694

Title

van Erkelens, A., Sie, A.S., Manders, P., Visser, A., Duijm, L.E., Mann, R.M., ten Voorde, M., Kroeze, H., Prins, J.B. and Hoogerbrugge, N. (2017) ‘Online self-test identifies women at high familial breast cancer risk in population-based breast cancer screening without inducing anxiety or distress’, *European Journal of Cancer*, Vol. 78, pp. 45-52

Vedel, I., Akhlaghpour, S., Vaghefi, I., Bergman, H. and Lapointe, L. (2013) ‘Health information technologies in geriatrics and gerontology: a mixed systematic review’, *Journal of the American Medical Information Association*, Vol. 20 No. 6, pp. 1109–1119

Wilson, T.D. (1999) ‘Models in information behaviour research’, *Journal of Documentation*, Vol. 55 No. 3, pp. 249-270

World Health Organisation (2016). *Noncommunicable diseases (NCD)*, *Global Health Observatory (GHO) data*. [online] <http://www.who.int/gho/ncd/en/> (Accessed 27 February)

Yan, Y.Y. (2010) ‘Online health information seeking behavior in Hong Kong: an exploratory study’, *Journal of Medical Systems*, Vol. 34 No. 2, pp. 147-153

Yates, C., Stoodley, I.D., Partridge, H.L., Bruce, C.S., Cooper, H., Day, G. and Edwards, S.L. (2012) ‘Exploring health information use by older Australians within everyday life’, *Library Trends* Vol. 60 No 3, pp. 460-478

Zwar, N., Harris, M., Griffiths, R., Roland, M., Dennis, S., Powell Davies, G. and Hasan, I. (2006) *A systematic review of chronic disease management*. [online] Research Centre for Primary Health Care and Equity, School of Public Health and Community Medicine, University of New South Wales.

http://files.aphcri.anu.edu.au/research/final_25_zwar_pdf_85791.pdf (Accessed 27 February 2019)

Table 1 Frequencies of background variables of the included respondents (n=184)

| Variables | % (n) |
|------------------------|------------------|
| Gender | |
| Female | 69.0 (127) |
| Male | 30.4 (56) |
| Missing | 0.5 (1) |
| <i>Total</i> | <i>100 (184)</i> |
| Education level | |
| Basic | 19.0 (35) |
| Upper secondary | 27.7 (51) |
| Bachelor | 27.7 (51) |
| Postgraduate | 22.3 (41) |
| Other | 1.6 (3) |
| Missing | 1.6 (3) |
| <i>Total</i> | <i>100 (184)</i> |

Author

| Self-rated health | |
|--------------------------|------------------|
| Very good | 6.5 (12) |
| Good | 47.3 (87) |
| Fair | 39.7 (73) |
| Poor | 4.9 (9) |
| Very poor | 1.1 (2) |
| Missing | 0.5 (1) |
| <i>Total</i> | <i>100 (184)</i> |

Table 2 Frequencies of respondents with different information-seeking styles strongly agreeing with the statements, and the results of the chi-square test.

| Anticipated activities | Active % (n) | Moderate % (n) | Passive % (n) | Chi- squared (p value) |
|---|-----------------|-------------------|------------------|------------------------------|
| Check further information from different sources | 73.8 (31) | 43.4 (49) | 14.3 (4) | 29.499 (.000)** |
| Discuss with family or friends about the services | 26.2 (11) | 21.9 (25) | 7.1 (2) | 10.850 (.210) |
| Make an appointment to see a specialist | 45.2 (19) | 23.0 (26) | 10.7 (3) | 19.522 (.012)* |
| I plan to increase the amount of physical activities | 54.8 (23) | 29.2 (33) | 14.3 (4) | 18.077 (.021)* |
| I plan to reduce the use of substances, e.g. tobacco or alcohol | 36.6 (15) | 22.3 (25) | 14.3 (4) | 5.981 (.649) |
| I plan to change my diet behaviour | 47.6 (20) | 31.0 (35) | 10.7 (3) | 15.192 (.056) |
| Do nothing (note: strongly disagree) | 59.5 (25) | 38.9 (44) | 21.4 (6) | 15.658 (.048)* |

Note: * ≤ 0.05 , ** ≤ 0.001

Appendix 1 Questionnaire items and scales used in the paper

| Items | Scales |
|-------|--------|
| | |

Title

| Health information literacy | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|--|----------------|-------|---------|----------|-------------------|
| It is difficult to know who to believe in health issues | | | | | |
| Health related terminology and statements are often difficult to understand | | | | | |
| It is difficult to find health information from the Internet | | | | | |
| It is difficult to find health information from printed sources (magazines and books). | | | | | |
| It is important to be informed about health issues. | | | | | |
| I like to get health information from a variety of sources. | | | | | |
| I know where to seek health information. | | | | | |

Author

| | | | | | |
|--|----------------|-------|---------|----------|-------------------|
| I apply health related information to my own life and/or that of people close to me. | | | | | |
| It is easy to assess the reliability of health information on the Internet. | | | | | |
| It is easy to assess the reliability of health information in printed sources (magazines and books). | | | | | |
| Health information-seeking style | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
| I seek health information that is important to me actively and systematically | | | | | |
| I keep my eyes and ears open for health information that can be important for me | | | | | |

Title

| | | | | | |
|---|----------------|-------|---------|----------|-------------------|
| I accidentally find health information that is important to me without actively looking for it | | | | | |
| I am sometimes told by people around me about health information that is important to me without asking for it | | | | | |
| I avoid health information | | | | | |
| Information-related activity What do you do if the test result shows that you belong to the risk group? | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
| Check further information from different sources | | | | | |
| Discuss with family or friends about the services | | | | | |
| Make an appointment to see a specialist | | | | | |

Author

| Health-promoting behaviour What do you do if the test result shows that you belong to the risk group? | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
|---|----------------|---------|---------|----------|-------------------|
| I plan to increase the amount of physical activities | | | | | |
| I plan to reduce the substance use | | | | | |
| I plan to change my diet behaviour | | | | | |
| Do nothing | | | | | |
| Use of Internet and e-health services | | | | | |
| How often have you used the Internet? | Daily | Weekly | Monthly | Rarely | Never |
| How often have you used the following online services: The diabetes risk assessment? | Weekly | Monthly | Yearly | Rarely | Never |
| How often have you used the | Weekly | Monthly | Yearly | Rarely | Never |

Title

| | | | | | |
|---|-----|----|--|--|--|
| following online service: Other online health services? | | | | | |
| Have you used other online health services? | Yes | No | | | |