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Using digital interactive television for the promotion of health and wellness

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Digital interactive television (iDTV) is often seen as a platform with great potential to deliver health and wellness content and services directly to people. Despite the advantages of e-Health, public engagement with such services is still limited. Our research assumes that health literacy plays a key role on users' engagement with these kinds of services and we postulate that it is one of the main predictors of users' attitudes and behaviours towards iDTV health and wellness services. Our main goal was to identify and describe the factors that limit the efficiency of e-Health interventions and the potential depicted in this context by specific technologies – i.e. iDTV. The proposed research design adopts a mix of quantitative and qualitative methods and techniques. The studies were conducted in a southern European country – Portugal – between 2012 and 2013. We found that 51.7% of the respondents showed high probability (+50%) of having limited health literacy (low literacy) and they are more likely to be men/women with an average age of 49.81, fourth grade or less, belonging to status group D/E and showing less interest and less perception of the utility of e-Health interventions. The groups that depict limited e-Health literacy are also the ones least interested in digital TV services related to health and wellness. Following this, we propose that in order for people to realize the actual benefits of using these applications, it is essential to tailor both content and services in accordance with the depicted level of e-Health literacy.

Keywords: healthcare; wellness; digital; television; ICTs

Introduction and objectives

Health and wellness services provision via digital technology (e-Health) have been studied in the past, several authors suggesting that digital interactive television (iDTV) has the potential to deliver health and social care to people in their homes (Blackburn, Brownsell, and Hawley 2011). However, we are still far from a clear and consensus understanding on how different audiences engage with these technologies and how it allows them to enrich their overall experience (Hardiker and Grant 2010).

This paper deals mainly with the relationship between media technology and health communication, aiming to contribute to a deeper understanding on the role of iDTV technology adoption and diffusion, as a valuable health and wellness promotion tool, and on the factors that influence the most users' engagement with this particular technology. More precisely, we are interested in determining the elements that enable or dissuade iDTV potential for the provision of health and wellness services and how these elements are dependable on individual and social factors, namely the level of health literacy

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depicted by a specific population. One of our main goals was to assess whether e-Health interventions that resort to iDTV should include health literacy evaluation on a target audience at the time of designing and testing.

Therefore, the central objective of this paper was to discuss the factors that most probably limit the efficiency of e-Health interventions and the potential depicted in this context by specific technologies – i.e. iDTV. Our main hypotheses is that iDTV offers a set of features ('immediacy'; 'mobility'; 'rich media'; 'participation'; 'search'; 'customization' and 'time shifting') that are relevant and valuable for audiences when dealing with health and wellness-related subjects (H1). Our secondary hypothesis states that the level of health literacy depicted by the individuals and their attitudes towards media use, in this particular context, determines the degree of success of an e-Health intervention measured by the level of technology and content diffusion. Drifting from this second assumption, we propose that iDTV allows for greater and richer levels of content and experience tailoring in the context of e-health interventions (H2.1.).

Our theoretical approach is grounded on the Uses and Gratifications (U&G) theory and on the assumption that the prior knowledge users have of their actual needs (Dutta 2009) forms their attitudes and moulds the activities they conduct when resorting to iDTV health applications. These hypotheses are in line with Ruggiero's (2000) that stress the potential of this theory for the study of digital media. Dutta (2009) stresses that, by emphasizing the motivation-based perspective of media use, the application of U&G theory in health contexts also helps to understand why there is within-population variance in people's motivations for using health-oriented media content.

The theoretical framework and results presented in this paper are part of a larger research project on digital technologies, namely iDTV technology and its potential to promote health and wellness in general public, more precisely in the elderly. The research design of the project includes several stages that mix different methods of analysis, combining both qualitative and quantitative techniques of analysis and allowing a more comprehensive and holistic overview of the whole process. The final stage of the project includes the development and deployment of a specific prototype designed for elderly people, for health and wellness information provision and communication facilitation, namely in relation with diabetes. In this particular paper, we will approach data from the initial stages of the project, which served as the basis for the development of the prototype, and discuss theoretical and empirical implications of these findings.

Literature review – e-Health

E-Health, the delivery of health information and services via the Internet and related technologies (Eysenbach 2001), provides new opportunities for interventions on health. However, there is a clear need for further theory and evidenced theoretical approaches in the research design and evaluation of e-Health interventions (Mackert et al. 2013)

There are a number of factors that inhibit the effectiveness of technology in e-Health, such as problems with access and systems usability, level of personalization and the ability to motivate the audience (Blackburn et al. 2011). Previous research suggests that research designs in the e-Health field should start by looking at users and their health literacy levels (Cameron 2013), indicating health literacy as a core element in the development of new technological solutions.

Hardiker and Grant (2010) claim that public engagement with e-Health varies across age, ethnicity, socio-economic status, educational attainment and degree of motivation. Similarly, aspects such as health conditions and lack of information can motivate or inhibit

public engagement with e-Health services, which indicates that access does not guarantee usage (Hardiker and Grant 2010). So far, the potential of iDTV to deliver health and social care on a large scale has been overshadowed by the lack of evidence regarding clinical and cost-effectiveness of iDTV applications (Blackburn, Brownsell, and Hawley 2011). Moreover, Collins et al. (2012) draw attention to the crucial task of tailoring e-Health applications to appropriate health literacy levels, public needs and preferences.

As mentioned before, our theoretical framework is mainly based on U&G theory (Katz 1960). This theory suggests that media and content choices are motivated by users' desire to gratify a range of needs, motivations and functions at a given time (Livaditi et al. 2002). In this context, a number of scholars, namely Dutta-Bergman (2006), Duffy and Thorson (2009) and Weaver et al. (2010), have identified several health-related information functions of information and communication technologies (ICTs), stating that these serve different functions for different users, in different contexts (Stein 2011). Specifically, digital health ICT will respond to motivations as information seeking, and fulfil functions as information surveillance, reinforcement of self-identity, social interaction and entertainment (Stein 2011).

Roger's (2003) diffusion of innovations theory can also provide an interesting complementary framework to understand the use of electronic media as health communication tools. The diffusion of innovation model explains the process by which a new innovation, as a product, practice, idea or technique, is diffused throughout populations (Vishwanath and Barnett 2011). Diffusion of innovations theory can also be applied to health communication (Dutta 2009). Stein (2011) retrieves the Schooler, Flora, and Farquahar (1993) analysis to the intersection between diffusion of innovations theory and the two-step flow model (Katz and Lazarsfeld 1955) to suggest that there are two steps of individual engagement with health information. In the first stage, individuals are confronted with general information about health in mass media. Second, exposure to mass media information may call people's attention to health issues, and even lead individuals to change their behaviours related to health. In this step, when individuals are already motivated to change attitudes, they may spend some time seeking additional information in order to apply these general health issues to their particular situation.

The described approaches point to the e-Health potential to the improvement of healthcare systems (Stein 2011), but also to some of its drawbacks. Although there are several advantages in using e-Health, public engagement with these kinds of services is still dubious (Cline and Haynes 2001). Some studies tried to find the causes for the lack of engagement with e-Health. Hardiker and Grant (2010) suggests that there are five key themes that influence public engagement: characteristics of users, technological issues, e-Health services features, social aspects of use and e-Health services in use. Factors such as increasing age, low socio-economic status, lack of motivation, interest or engagement with health and e-Health services, as well as lack of perceived usefulness or relevance, work as barriers to this kind of services.

As previously stated, our project proposes that health literacy constitutes a key aspect when discussing e-Health interventions, presupposing that specific health literacy profiles have distinctive outcomes. Following previous studies (Collins et al. 2012), we also assume that there is a clear dependency relation between the level of e-health literacy depicted by the subjects and the overall quality and impact of the interventions, adding to this the presupposition that in the particular case of iDTV, such adaption between literacy and media content/technology is easier and more efficient. Health literacy is the ability to read, understand and act correctly with the provided information related to health. When

patients have low levels of health literacy, their ability to perceive and act with the proper medical information available is poor, and they may even put their health at risk (Ad Hoc Committee on Health Literacy 1999; Nielsen-Bohlman, Panzer, and Kindig 2004).

In order to better understand the literacy levels of a given population, there are several health literacy measures such as Rapid Estimate of Adult Literacy in Medicine (Davis et al. 1993), Test of Functional Health Literacy in Adults (TOFHLA) and its short version (S-TOFHLA) (Parker et al. 1995) and Newest Vital Sign (NVS) (Weiss et al. 2005).

It has been shown that e-Health interventions designed specifically to meet the needs of low health literate audiences can be both educational and user-friendly (Whitten et al. 2008), and the full potential of e-Health can only be reached if such technology is designed and implemented thinking of the users' health literacy (Mackert et al. 2013)

Method

As mentioned before, the present paper will focus on the initial stages of the project which adopt a mix of quantitative and qualitative methods of analysis in the context of an exploratory and descriptive analysis focusing on the relation between e-Health literacy and media technologies.

Our main hypothesis (H1) states that iDTV offers a set of features that are relevant and valuable for audiences when dealing with health and wellness-related subjects. From this hypothesis, we also state that (H2) the level of health literacy depicted by the individuals and their attitudes towards media use, in this particular context, determines the degree of success of an e-Health intervention measured by the level of technology and content diffusion. We also argue that iDTV technology allows for greater and richer levels of content and experience tailoring in the context of e-health interventions (H2.1).

In order to answer these hypotheses, the following research design was devised:

- A quantitative stage involving a cross-sectional inquiry applied to a representative sample of the Portuguese population, dealing with health literacy and new ICTs use – Internet, mobile phones and iDTV. This survey was applied to 1207 individuals aged between 18 and 93 (average age 45.63). The participants were selected by a quota method, based on a matrix which crossed variables gender, age, education level, occupation, region and place of residence. Overall, the instrument was composed of a total of 26 questions, 13 characterization items and also the Newest Vital Sign measure. The survey was applied by the market studies company GfK between 2012 and 2013, at the participants' households, through a direct and personal interview. The data were analysed with IBM SPSS Statistics 19 software (SPSS, Inc., Chicago, IL, USA)
- A level of significance of 95% was used in all analysis performed. χ^2 and one-way ANOVA tests were used as the most suitable methods. A qualitative stage involving interviews to the main stakeholders in this area, including representatives of healthcare units, health professionals, health institutions, and insurance companies with health insurances and others. A set of 13 semi-structured interviews were collected – by e-mail (4) and face-to-face (9) – between September and December 2011. Among the institutions represented within the group of interviews, one can find an institute for medical education, an association of physiotherapists, governmental organisms and health professionals unions. The interviews addressed mainly the stakeholders' perspective on the potential of new technologies, particularly, digital television, in the context of healthcare and wellness. The

software NVivo (NVIVO10 – QDA/QRS International, Melbourne, Australia) was used as a tool to support content analysis: the categories were derived from the interviews’ content.

Quantitative survey results

This survey analysed the attitudes and perceptions regarding digital TV and its application in the realm of personal health care and wellness support. The survey was applied to 1207 individuals aged between 18 and 93 (average age 45.63); of them, 47.6% were male and 52.4% were female, and 93.9% of the participants in the survey were Portuguese.

Results from NVS on health literacy indicate that 51.7% of the respondents have high probability (+50%) of limited health literacy (low literacy), 22.6% may have limited literacy (average literacy) and 25.7% have an adequate health literacy level (Figure 1).

In order to determine the literacy profile, we crossed several demographic variables with the three levels of health literacy. Between gender and level of health literacy variables, we have not found any significant difference ($\chi^2(2) = 3.585; p > 0.05$). We observed a statistically significant difference between age and NVS literacy levels ($F(1204.2) = 45.942; p < 0.001$). Participants with high probability of low literacy level are likely to be older ($M = 49.81$; $SD = 17.755$) than the participants with average health literacy level ($M = 43.86$; $SD = 16.769$) and with adequate health literacy level ($M = 38.77$; $SD = 15.311$). Comparisons indicated that the mean age of low literacy group was significantly different from the mean age of average literacy group ($p < 0.001$) and the mean age of adequate literacy group ($p < 0.001$). We also verified that the mean age between the average and adequate literacy groups was significantly different ($p = 0.001$). Moreover, we found statistically significant differences between the number of correct answers on NVS test and age ($F(1201.5) = 19.470; p < 0.001$) (Tables 1 and 2).

Regarding educational level attained, again, we observed a statistically significant difference between the variables educational level attained and NVS literacy levels ($\chi^2(14) = 99.126; p < 0.001$) indicating that participants with a higher level of education are more likely to have an adequate level of health literacy (Table 3).

Figure 1. Newest vital sign.

Table 1. Literacy levels × age.

	Mean age	N
Low literacy	49.81	625
Average literacy	43.86	272
Adequate literacy	38.77	310

Table 2. Literacy levels $\times$ correct answers.

	Mean correct answers	N
18–24	2.50	143
25–34	2.09	250
35–44	1.77	230
45–54	1.60	219
55–64	1.46	168
≥ 65	0.88	197

Table 3. Literacy levels $\times$ education level.

	NVS		
	Low literacy %	Average literacy %	Adequate literacy %
University level	2.9	2.9	11
Bachelor degree	0.8	0.4	3.5
On university	0.8	1.8	2.3
12th grade	14.9	20.2	17.7
9th grade	16	20.6	20
6th grade	16.5	17.3	22.9
4th grade	40.3	32.7	21.3
Illiterate/incomplete 4th grade	7.8	4	1.3

In what concerns to the status of participants, we found a statistically significant difference, namely that participants with higher status level (A, B) are more likely to have adequate health literacy level than individuals in the less favoured groups (D, E) ($\chi^2(8) = 47.502$; $p < 0.001$) (Table 4).

Next, participants were asked three questions about how much a digital television health service can be useful (from a scale from 1 to 10) and, from a given list, which digital television services they use and find interesting. Regarding the most interesting services, TV Guide (63.1%) and high definition channels (62.3%) were the most mentioned services. Relevant for this study is the percentage that the health and wellness service obtained, being the third most chosen digital TV service, with a range of 61.7% (Figure 2).

More specifically, in the context of the health and wellness service, statistically significant differences were found between the variables interest and NVS literacy levels ($\chi^2(2) = 28.770$; $p < 0.001$). This result indicates that people with an adequate literacy

Table 4. Literacy levels $\times$ status.

	NVS		
	Low literacy %	Average literacy %	Adequate literacy %
A	0.6	0.4	3.9
B	10.1	9.9	19.4
C	16.6	22.4	19.7
D	54.9	48.2	40
E	17.8	19.1	17.1

Figure 2. And which of these digital television services do you find interesting?

level consider a digital TV health service more interesting than those with low literacy level (Table 5 and Figure 3).

The next question focused on the content or functionalities which may be included in a future Health and Wellness digital TV service. Participants were asked to indicate what they would like to see included in a digital TV health service. The possibility of doing medical appointments was the most selected options by the interviewees (35%). The second most selected option from the ones listed was to contact emergency care (32.5%) (Figure 4).

In what concerns to the utility level (1–10) that the respondents attribute to a digital TV health service, collected data indicate a statistically significant difference between NVS literacy levels and utility level ($F(1086.2) = 92.436$; $p < 0.001$). Participants with adequate health literacy are likely to think that a digital TV health service is more useful ($M = 7.70$; $SD = 1.753$) than the individuals with average health literacy level ($M = 7.08$; $SD = 2.239$) and with low health literacy level ($M = 7.03$; $SD = 2.123$).

Table 5. Literacy levels $\times$ interest.

	NVS		
	Low literacy %	Average literacy %	Adequate literacy %
Yes	55	64.7	72.7
No	45	35.3	27.3

Figure 3. Why don't you use the digital television services? ($n = 597$ – those who answer 'do not use' to all services).

Figure 4. What information and facilities would you like to see included in a health and wellness digital TV service?

Comparisons indicated that the mean of utility level of the adequate literacy group was significantly different from the mean of the average literacy group ($p < 0.001$) and the mean of low literacy group ($p = 0.001$) (Table 6).

Qualitative survey results

The qualitative study was of an exploratory nature, focusing on what can be expected from the use of iDTV applications by healthcare and wellness professionals. Three main trends were found: those who highlight the informative aspect of these services; those who privilege the role of communication and those who consider that these services can have a relevant role in what concerns mobility and accessibility. On what concerns the informative role, it was indicated that ICTs can have a relevant part in minimizing the consequences of low health literacy. Of the 13 interviewees, 8 have emphasized this aspect. For instance, a representative of a Portuguese health professional union stresses the potential still to be explored of ICT, mainly to overcome the barrier of the hermetic style of the clinical information, as well as to fight against the low literacy in this subject:

I think that technologies of information are an objective tool, that is allowing some things to happen and are likely to allow further more things. It might be a proximity tool between the citizens and the health providers (...) even for the reason that generally the health language is very hermetic and needs to be decoded for the common citizen, belonging to a population framed with a great illiteracy and a greater illiteracy when speaking of health.

As for the communication role, it was mentioned that the essential ICTs role in healthcare should be to make communication easier between all involved (5 out of 13

Table 6. Literacy levels $\times$ perception of utility.

	Average level of utility	N
Low literacy	7.03	543
Average literacy	7.08	253
Adequate literacy	7.70	293

stakeholders have mentioned this aspect). As a representative of a governmental institution has explained, besides the sharing of knowledge among health providers, ICT makes the communication between doctor and the patient easier:

There are two possible ways and two clear facilities: The first is the inter-pair communication (...) The second is naturally the support to the population, to the patients themselves. Not only to alert but also to monitoring, self-monitoring and to create routines.

Finally, on what concerns the role of ICTs as enablers of the conditions of accessibility and mobility, the following aspects are to be highlighted: ubiquity of the physical support; physical demobilization (meaning that it may allow for remote actions) and services improvement.

As for the potentially negative aspects of ICTs, several aspects were mentioned: low levels of technological literacy that do not allow their extended use; too much of an out-of-context and general information that ends up being of no practical use and the costs and difficulties in maintaining an effective structure.

Discussion

The purpose of this study was to discuss aspects that could limit the efficiency and effectiveness of e-Health via ICT and in particular digital television.

Our main hypothesis (H1) is that iDTV provides a set of features, such as ‘immediacy’; ‘mobility’; ‘rich media’; ‘participation’; ‘search’; ‘customization’ and ‘time shifting’, that are relevant in healthcare and wellness contexts. The qualitative study helped to confirm this hypothesis, since stakeholders’ answers reinforced iDTV potential to enable the audiences’ accessibility and mobility. Stakeholders stressed that iDTV can increase the chances of effective e-Health interventions in a wider population. Furthermore, the quantitative study found that respondents were very interested in information and utilities associated to e-Health.

Also, our results suggest that individuals’ characteristics and health literacy level have a significant role on people’s engagement with such technology (Blackburn, Brownsell, and Hawley et al. 2011; Hardiker and Grant 2010; Mackert et al. 2013) which goes in accordance to our second hypothesis (H2). Both qualitative and quantitative approaches indicate iDTV as a valuable technology that allows for diverse levels of content and a richer experience in the context of e-Health interventions, which confirms our secondary hypothesis (H2.1).

Additionally, we sought to draw the profiles of the studied population in terms of health literacy levels. As Dutta (2009) pointed out, understanding that there are ‘within-population differences’ that lead to ‘within-population variance in people’s motivations’ will allow health communicators to identify the underserved segments of the population and better tailor new solutions.

After analysing data from the Newest Vital Sign tool, it is possible to verify that 51.75% of individuals have a high probability of limited literacy, while 22.6% may have limited literacy and only 25.7% may have an adequate health literacy level. Thus, according to our survey, we propose the following profiles for each of the three health literacy levels given by NVS:

- Limited literacy individuals are more likely to be men/women with an average age of 49.81, fourth grade or less, belonging to status group D/E. Adequate literacy individuals are more likely to be men/women with an average age of 43.86, 9th–12th grade, belonging to status group C. Adequate literacy individuals are more likely to be men/women with an average age of 38.77, university level, belonging to status group A/B, living in major cities.

These profiles are in line with the Paasche-Orlow et al. (2005) statement that elderly individuals with low education level and a lower socioeconomic status are those who have more probability of low health literacy.

The collected data also enabled us to conclude that digital services to promote health and wellness are perceived by respondents as the third most interesting digital service to be offered. These data lead us to think that target population care about their health and welcomes these innovations. Regarding the potential usefulness of health digital TV service, once more, it is the adequate literacy group the one that more strongly valorizes this type of service and considers it useful.

These outputs confirm our secondary hypotheses. These results were expected since the limited literacy group has several characteristics that Hardiker and Grant (2010) has previously identified, such as increasing age, low social-economic status or interest on e-Health services, which works against the perception of usefulness and relevance of a certain service, lowering the engagement considerably. Thus, in order to reach the biggest spectrum possible of the population, it is crucial that future services are tailored taking into account the main characteristics of the low/average literacy level individuals.

One possible limitation of this study is that we neglected individuals' social context, so our results may not accurately reflect all individual variables.

In conclusion, we can affirm that the results of crossing several demographic variables with the three identified levels of health literacy call attention to users' motivation factors, especially health literacy, as the key factor affecting e-Health interventions effectiveness. In this sense, it is important to ensure that future digital TV services, which aim to help people by informing, entertaining and supporting them in their daily lives, are tailored to the target audience levels of health literacy.

Notes

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