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Enabling healthy choices: is ICT the highway to health improvement?

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ABSTRACT The White Paper *Choosing health* acknowledges that there is no lack of information in the system about healthy lifestyles, but the manner of communication of risk and the level of support for lifestyle change need improvement. Action also has to be taken to address inequalities in health and to focus on securing better access to healthier choices for people in disadvantaged groups or areas. Accordingly, this randomized controlled trial examined whether access to a purpose-built health portal for heart disease could enable patients to manage better their heart conditions. We recruited 108 men and women aged 50–74 from coronary heart disease registries from a deprived area of Greater Manchester. Every participant received a new computer and one-year broadband subscription; however, only the experimental group received access to the *Hearts of Salford* health portal. Our results indicate that the experimental group changed their diet significantly. Specifically, they reported eating ‘bad foods’ (such as chips, sweets, crisps, fried foods, ready meals and cakes/biscuits) significantly less often compared to the controls.

KEYWORDS *health inequalities; heart disease; information technology; Internet*

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Introduction

The UK's White Paper *Choosing health* (Department of Health, 2004) focuses on developing a new demand for *health* while moderating the long-term rising demand for *health care*. It aims to provide better information and support so that people can make healthier choices more easily and sustain them over the long term. Arguably, there is no lack of information in the system about healthy lifestyles, but the manner of communication of risk and the level of support for lifestyle change need improvement. In particular, action needs to be taken to address inequalities in health and to focus on getting information across and securing better access to healthier choices for people in disadvantaged groups or areas (Department of Health, 2004).

The Internet has quickly established itself as a leading source for health information and has become the single largest type of news sought by online users (Milio, 2001; Wong et al., 2005). By 2001 approximately half of those online had used the Internet to obtain health information, and this number was expected to rise (Pew Internet and American Life Project, 2001).

Access to the Internet is under-represented among disadvantaged groups (Cotton and Gupta, 2004). The project reported here focuses on people who are unlikely to have owned or used a computer before. Most studies concentrate on those who already have a computer. Older people from deprived areas tend not to have Internet access or do not see the need for it (Mead et al., 2003; Dutton et al., 2005). In this randomized controlled trial we provided new computers and a one-year broadband subscription to men and women medically diagnosed with coronary heart disease (CHD) and living in a deprived area. In the present article we examine whether having access to a purpose-built health portal might make a difference to patients in how they self-manage their heart disease.

Background

The social circumstances of an individual play a key role in their health behaviour and health status. The socially excluded tend to experience poorer health than the more affluent, creating a 'health divide' (Evans et al., 1994; Link and Phelan, 1995; Wilkinson, 1996). A similar divide exists in the digital world: namely, an uneven distribution of computer ownership and Internet access, which currently has implications for using ICT in disseminating health information and support (Cotton and Gupta, 2004). The two divides, health and digital, seem to follow similar fault lines by class and age, while for gender the divides run in opposite directions to each other. In the health inequalities literature, there are equivalents for the cyber-optimists, sceptics and pessimists that Norris (2001) identifies in the e-Society literature: that is, widely disparate views on whether interventions narrow, widen or leave untouched the inequalities that already exist (Anderson and Tracey, 2002).

Coronary heart disease (CHD) is the most common cause of death in the UK, accounting for some 238,000 deaths in 2002 (Peterson et al., 2004). Approximately 1.3 million people in the UK have had a heart attack and nearly 2 million people suffer from angina, the most common form of CHD (British Heart Foundation, 2005). Although mortality from heart disease has been declining, morbidity has been increasing, which places a huge economic burden on the NHS, informal carers and the economy (Liu et al., 2002).

An examination of heart disease is particularly salient for health inequalities within the UK because, in the UK, heart deaths have a higher social class gradient than in other countries (Petersen et al., 2004). CHD-related mortality and morbidity are particularly prevalent throughout north-west England, especially within inner cities, where this study is located (Prashar, 2000). Our sample is drawn from Salford where nearly half of the electoral wards are in the top 10 per cent of the most materially deprived wards in England, placing residents at increased risk for heart disease (Salford PCT, 2005). Although there have been significant reductions in the death rate from heart disease, the death rate in Salford remains 25 per cent higher than the north-west average and 50 per cent higher than for England and Wales as a whole (Salford PCT, 2005).

One way in which health divides are being tackled is through 'expert patient' programmes that help individuals manage their chronic illness (Department of Health, 2001). They seek to develop patients' quality of life and skills to work in partnership with health professionals (Department of Health, 2001; Wilson, 2001). In principle, expert patients should make less and better use of health professionals' time, have less severe symptoms, more confidence, resourcefulness and self-efficacy (Tattersall, 2002; Wheeler, 2003; Shaw and Baker, 2004; Lindsay et al., 2007). An 'expert patient' agenda is based on patients having quality information, good knowledge-processing skills and appropriate social networks.

Salford's health inequalities strategy acknowledges that focusing efforts only on populations with the capacities to make lifestyle changes can bring about modest improvements to the health of the population overall, but might widen inequalities (Salford Healthy City Forum, 2004). People who experience multiple deprivation typically spend less time in formal institutional settings and may not be as receptive to messages delivered by standard channels (Dooris, 2004). The frequent failure of many health intervention programmes can be largely attributed to inadequate recognition of such aspects of the social context (McKinlay and McKinlay, 1994). It may be critical to have an appropriate fit between the sender's message and the medium in which it is delivered.

The Internet is increasingly used to communicate health knowledge and there is a growing belief that it can help transform both personal and public health (Stout et al., 2001; Wong et al., 2005). Some claim that it has

revolutionized the process of health care delivery by empowering patients to become more active in their care (Kirsch and Lewis, 2004).

Heart health promotion programmes are being made available on the Internet to help prevent poor health (Brekke et al., 2003; Gordon, 2003; Hanusaik et al., 2003). Ikemba et al. (2002) found that people are increasingly using the Internet to educate themselves about heart disease. Scherrer-Bannerman et al. (2000) tested the impact of a web-based education and support programme for patients on the cardiac surgery waiting list. Using two forms of patient education, both a printed form and a website, they found that the web-based format increased social support and decreased anxiety compared to the print-based format. However, this study was limited to people who already owned a home computer.

Older patients who use the Internet for health information are typically employed, significantly younger and better educated than those who do not use it (Wong et al., 2005). Yet health promotion through the Internet may be particularly valuable to groups vulnerable to poor health who are isolated by chronic illness and live in deprived areas. Little is known about Internet use for health purposes among such groups, because few of them have access to it (Lai et al., 2004; Lindsay et al., 2007). Thus, the realistic potential of Internet access for this purpose is yet to be assessed (Kleinke, 2000).

Immediate material circumstances have some bearing on enabling and diffusing changes in both Internet use and health-related behaviour. They probably have less influence than the impact of cumulative material affluence/deprivation on 'embodied' social and cultural capital (Bourdieu, 1984), on how confident they are, their literacy and their capacity to make bridges between their experience and medical knowledge. Yet they may be more likely to learn and to change their pre-existing behaviour if they are able to find appropriate information by themselves and have their learning reinforced by their peers (Toobert et al., 2005). Patients' trust in experts tends to decline following a heart attack (Stout et al., 2001) and so 'interactive learning' approach to chronic disease management may be particularly effective (Stout et al., 2001; Nguyen et al., 2004). Indeed, there is evidence from both formal education and health promotion that the Internet can be an effective substitute for the learning that might take place in more traditional settings (Nie and Hillygus, 2002; Gordon, 2003).

There is also some evidence that ICT can improve patients' knowledge of and control over their conditions (Stout et al., 2001; Lai et al., 2004). Lewis's (1999) review of articles on computer technology in patient education found only 21 that were research-based. Of these, 16 had effect sizes greater than 0.5, suggesting that the issue is both under-researched and worth researching. Among them, Tetzlaff (1997) investigated the perceived needs and preferences for home-based health informatics for parents of children with cancer, to discover that the parents were positively disposed to online solutions. Gustafson et al. (1999) evaluated the computer-based

US Comprehensive Health Enhancement Support System among HIV-positive patients and concluded that such a system can improve a patient's quality of life.

In the past, health promotion has tended to assume that providing information is sufficient by itself to change behaviour. As *Choosing health* (Department of Health, 2004) notes, this will happen only if the receiver is literate in the medium in which the message is sent. It also depends on a match between the sender's and the receiver's views of the relevance of the information to the receiver's needs. Even when all these matches are in place, the receiver might still not act in a healthy manner, but be driven by other beliefs or trust in people other than the sender (Vingilis and Lindsay, 2001; Mead et al., 2003).

The Internet not only provides access to information; it is also a venue for social interaction and maybe social support for patients (Campbell and Wabby, 2003). Using the Internet for health promotion might provide people with the opportunity to exchange information, share illness experiences and promote a sense of shared strength among group participants (Bliss et al., 1998; Lindsay et al., 2007). In general, communication over the Internet is at least as important as finding information there for home users, especially for older age groups. The mutual constitution of online and offline spaces may have particular relevance for health and heart disease.

However, given that virtual communication is concerned primarily with the production and maintenance of bridging social capital or 'weak ties', virtual communities have limitations to the social support they can facilitate (Hampton, 2003). The quality of social ties (especially the extent of instrumental and emotional support they provide) is a stronger predictor of health effects for CHD patients than quantitative measures of the structure of social networks (Seeman, 1996). Arguably, then, the Internet is a poor medium for facilitating practical social support. Its strength may lie rather in increasing informational and network support (Hellowell, 2001; Nettleton et al., 2002).

In summary, while interactive learning and peer interaction are mechanisms by which the Internet might help people to manage their heart disease, the literature is not clear about how far and in what ways it actually does so. The project reported here was designed to answer these questions.

Methods

The over-riding aim of this six-month trial was to test whether community-based, facilitated access to an Internet health portal could improve the capacity of men and women with heart disease to manage their own heart conditions. This randomized controlled trial drew a sample ($N = 108$) of men and women aged 50–74 from GPs' CHD registries. Our sample was drawn from Salford in Greater Manchester, UK because nearly half of the

electoral wards are in the top 10 per cent of the most multiply deprived wards in England, including for increased risk for heart disease (Salford PCT, 2005). The sample was divided at random into an experimental ($n = 54$) and a control group ($n = 54$) of equal sizes. All participants were given new computers and a one-year broadband subscription; however, only the experimental group received training and access to the project portal. A technician installed the computers in the participants' homes and also assisted with any technical difficulties that arose for the duration of the project. Weekly drop-in sessions and phone-in support was also available to both groups although the experimental group was better informed about the drop-in sessions because they were promoted via the portal.

Repeat questionnaires were collected from May 2006 to June 2007 to assess the influence of our health portal on the management of heart conditions before they were given the computers and six months after they were introduced to the Internet health portal. A baseline survey about history of residence, employment, health status, lifestyles and use of health care was administered to five groups of approximately 10 cases and 10 controls in each group at the initial project meetings.

Access to the project website was through a purpose-built, password-protected portal. We have established *Hearts of Salford* (<http://www.heartsofsalford.net/>) where the experimental group could interact in one of five dedicated closed groups, with facilitation from researchers.

The portal social architecture was initially constrained by the terms of the research design, in the sense that mixing between successively recruited groups is prevented until each has had the benefit of six months' facilitated access. This was construed as a period of socialization and familiarization with the online environment, which took place within a safe private space for 10 people who have met one another in person at an introductory meeting and training session.

Our randomized controlled trial focuses not only on people with CHD but also on those aged 50–74 living in multiply deprived areas. The overriding reason for focusing on heart patients, one age group and deprived areas is to minimize the range of variation within the sample and to increase the power of the trial. We also focus on where improvement is most needed in order to provide a critical test of what value the Internet may add. Ethical approval for this study was obtained by the Salford University Research Ethics Board and the local NHS research ethics committee. Over the course of this project, one person died and four people quit.

Two forms of data are brought together in this article: baseline and six-month responses to the same questionnaire by all participants, cases and controls; selected exchanges within *Hearts of Salford* discussion forums by cases over six months.

Variables derived from questionnaires

T-tests and an OLS multiple regression were used to examine the influence of our health portal on health behaviours. Changes in behaviour were determined by calculating the difference from scores in Time 2 (six months) from Time 1 (beginning of the study). Exercise frequency was measured in terms of 'how many days during a typical week you spend in moderate exercise' where a higher score indicates more time spent in exercise. Alcohol consumption was measured by 'how many units of alcohol you drink in a typical week'. Smoking was measured by average number of cigarettes smoked per day while exposure to second-hand smoke was measured by asking 'Approximately how many hours per week are you exposed to second-hand smoke?' Diet was measured by adding a series of variables together, which are standardized from the Health Survey for England and include: 'How often do you eat the following foods: chips, sweets, crisps, fried foods, ready-made meals and cakes/biscuits?' For each option, the participant could select from a scale ranging from 'at least once/day', 'several times/week', 'about once a week', 'rarely' and 'never'. A higher score indicates eating these foods more often. A total score was summed for all of these six items where the scores could range from 6–30. Total sources of health information accessed were summed and included: health professionals, leaflets, books/magazines, word-of-mouth, pharmacist, health shows, newspaper, family/friends, library, therapists, NHS direct (telephone help line), A&E department, local community support groups, NHS direct online, NHS walk-in centres, health audiotapes, radio, health websites and 'other' sources. Mental health was measured by asking, 'How do you feel you have been with the following during the past four weeks: full of life, nervous, down in the dumps, calm and peaceful, lot of energy, downhearted and blue, worn out, happy, tired?' Scales ranged from 1–6 where 1 indicated all of the time and 6 indicating none of the time. Health visits included all visits to a GP, nurse, specialist and other health care providers in the past month.

Qualitative observations from discussion forums

The discussion forums from our project website were sorted, coded and categorized with the aid of NVIVO, a qualitative data analysis program (Richards, 1999). This program assisted in condensing the data and identifying relationships among central themes around the issues of informal learning and peer support. The project drew on interpretive traditions within qualitative research, where researchers seek an in-depth understanding of the participants' learning experiences (Green and Thorogood, 2004). The analysis began by reading through each transcript several times and noting emerging themes and patterns. Analysis gradually evolved into the stage of axial coding, which was concerned with the properties of the themes and their inter-relationships.

Results

A comparison of outcomes after six months for cases and controls

Analysis of the questionnaire responses is set out in Tables 1 to 5. Table 1 shows the descriptive characteristics of the sample. The majority of the sample was men, which is a reflection of the gendered nature of heart disease. The age ranged from 50–74 and the mean was 62.9. Although the majority of participants had used a computer at some point prior to the study (75.9%), less than half of them (43.5%) owned their own home computer. A little over half of the sample (56.5%) had used the Internet before the study but only 36.1 per cent of them had home access to the Internet. There were many challenges to overcome in helping these participants learn how to use the Internet before it could make a difference to their health.

Table 2 shows the changes in health behaviour for the cases (experimental group) over a six-month period. There was a significant increase in health visits (to doctors, nurses and/or specialists) from an average of 2.48 to 3.98. Other notable differences (that were not significant) included a slight improvement in diet and healthy foods eaten. There was a decrease in alcohol consumption (units/week), number of units consumed on heaviest day of drinking and a slight decrease in exposure to second-hand smoke. There was little change in health locus of control, mental health, social support, exercise, confidence in managing health and total sources of health information.

Table 3 shows the changes in health behaviour for the control group over a six-month period. Since the beginning of the project the control group reported drinking significantly fewer units of alcohol per week (7.05 vs 3.72). They experienced significantly less social support over time (16.0 vs 13.77) and significantly poorer mental health (34.7 vs 28.6). Furthermore, controls reported eating 'bad' foods significantly more often (13.71 vs 14.55). They also had significantly more health visits (to doctor, nurse and/or specialist) since the beginning of the project (2.1 vs 3.5). Other notable trends (that

Table 1 Sample characteristics (N = 108)

<i>Characteristics</i>	
Age	mean (62.9)
Income	median (£7,801–13,000/year)
Experimental group	54
Control group	54
Gender (male)	72 (66.7%)
(female)	35 (32.4%)
Ever used a computer	82 (75.9%)
Ever owned a home computer	47 (43.5%)
Ever used the Internet	61 (56.5%)
Home access to the Internet	39 (36.1)

Table 2 Changes in health behaviour, experimental group over six months (N = 54)

<i>Behaviour</i>	<i>Time</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Days/week moderate exercise	1	3.63	1.31	-0.868	.391
	2	3.75	1.01		
Alcohol units/week	1	10.66	11.75	1.25	.215
	2	8.98	11.50		
# units on heaviest day	1	4.48	5.60	1.38	.171
	2	3.89	4.51		
Cigarettes smoked /day	1	2.42	6.28	.814	.419
	2	1.83	4.66		
Hours exposed to 2nd-hand smoke	1	4.52	9.24	.464	.645
	2	4.14	9.21		
Social support score	1	16.62	4.35	-0.454	.652
	2	16.94	4.85		
Mental health score	1	34.51	3.77	1.41	.163
	2	32.83	8.92		
Confidence in managing health	1	3.11	.832	-0.726	.471
	2	3.21	.775		
Health locus of control (internal)	1	23.98	3.93	1.63	.109
	2	22.96	3.78		
Diet (frequency of 'bad' foods)	1	14.26	3.13	1.37	.174
	2	13.76	3.39		
# of new healthy foods eaten	1	3.59	1.64	-0.167	.868
	2	3.63	1.55		
Total sources of health information	1	3.27	2.71	.212	.833
	2	3.18	2.78		
# of health visits	1	2.48	3.04	-2.68	.010**
	2	3.98	2.81		

** $p < .01$

were not significant) included a slight decrease in the number of cigarettes smoked per day, reduced exposure to second-hand smoke and a reduction in sources of health information accessed. There was little improvement in confidence in managing health, health locus of control and eating healthy foods.

Table 4 shows the differences in health behaviour that occurred between the beginning of the study and six months into their involvement with the project. Only one significant difference was found, which was a change in diet. Here a higher score indicates eating 'bad' foods (i.e. crisps, chips, sweets, fried foods, ready meals and cakes) more frequently. Our results indicate that the experimental group improved their diet over time by eating such foods less often compared to the controls. Other notable trends (that were not significant) included improved social support, mental health and the number of sources of health information accessed (for the experimental group). Perhaps it may take more time for changes in these health behaviours to manifest. Next, the significant variable (diet) was explored further in a multivariate model.

Table 5 shows a multiple regression model of predictors of change in diet over a six-month period. Age, gender, income and number of people

Table 3 Changes in health behaviour, control group over six months (N = 54)

<i>Behaviour</i>	<i>Time</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Days/week moderate exercise	1	3.55	1.30	-1.67	.102
	2	3.89	1.08		
Alcohol consumption	1	7.05	10.89	2.37	.021*
	2	3.72	4.72		
Cigarettes smoked /day	1	3.94	7.39	1.24	.217
	2	2.98	5.79		
Hours exposed to 2nd-hand smoke	1	6.37	16.19	1.41	.163
	2	3.62	8.69		
Social support score	1	16.00	4.87	2.37	.021*
	2	13.77	6.84		
Mental health score	1	34.79	6.41	3.00	.004**
	2	28.68	14.36		
Confidence in managing health	1	3.21	.554	-.771	.445
	2	3.28	.583		
Health locus of control (internal)	1	21.97	4.83	-.548	.586
	2	22.34	3.85		
Diet (frequency of 'bad' foods)	1	13.71	3.30	-2.12	.040*
	2	14.55	3.71		
# of new healthy foods eaten	1	3.24	1.69	-1.04	.302
	2	3.53	2.01		
Total sources of health information	1	2.03	2.56	.735	.465
	2	1.81	1.97		
# of health visits	1	2.14	2.13	-3.15	.003**
	2	3.57	2.72		

Note: sample size varies because of missing data.

* $p < .05$; ** $p < .01$

Table 4 Differences in health behaviour between experimental group and control over six months (N = 108)

<i>Behaviour</i>	<i>Group</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Days/week moderate exercise	cases (52)	.122	.899	-.900	.371
	controls (46)	.342	1.25		
Alcohol consumption	cases (54)	-1.68	9.87	.810	.420
	controls (54)	-3.25	10.31		
Cigarettes smoked /day	cases (54)	-.59	5.34	.349	.727
	controls (54)	-.96	5.66		
Hours exposed to 2nd-hand smoke	cases (49)	-.214	5.97	1.28	.203
	controls (44)	-3.31	15.73		
Social support score	cases (51)	.764	4.05	1.55	.124
	controls (45)	-.488	3.82		
Mental health score	cases (51)	.196	3.95	.952	.344
	controls (44)	-.909	7.11		
Confidence in managing health	cases (54)	.096	.955	.191	.849
	controls (54)	.065	.573		

(Table 4 continued)

(Table 4 continued)

<i>Behaviour</i>	<i>Group</i>	<i>Mean</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Health locus of control (internal)	cases (52)	-1.01	4.50	-1.51	.134
	controls (46)	.369	4.57		
Diet (frequency of 'bad' foods)	cases (52)	-.500	2.61	-2.50	.014*
	controls (45)	.844	2.67		
# of new healthy foods eaten	cases (52)	.038	1.65	-.703	.484
	controls (45)	.288	1.85		
Total sources of health information	cases (51)	.098	3.06	.310	.757
	controls (45)	-.066	1.93		
# of health visits	cases (52)	1.84	3.65	-.317	.752
	controls (46)	2.06	3.10		

Note: sample sizes vary because of missing data.

* $p < .05$

Table 5 A multiple regression model of predictors of change in diet (frequency of eating 'bad' foods) over six months (N = 108)

<i>Predictors of change</i>			
Intercept	-4.42	<i>F</i>	4.11***
Case (experimental group)	-1.71**		
Age	.002		
Gender (male)	1.98***		
Income	.009		
# of adults in house	-.298		
Total sources of health information	-.004		
Total social support	.242***		
R^2	.262		

* $p < .05$; ** $p < .01$; *** $p < .001$

living in the house were controlled for. The results indicate that being in the experimental group and accessing the health portal was a significant predictor of change in diet (eating 'bad' foods less frequently). Gender was a significant predictor of change in diet where being male was linked with eating these 'bad' foods more often. Social support was also a predictor of change in diet where higher levels of support were linked with eating 'bad' foods more often. Total sources of health information, age, income and number of adults living in the house were not significant predictors of change in diet. This model was significant and explained 26.2 per cent of the variance in change in diet.

Why might there have been an improvement in the diet of the experimental group?

Our qualitative data from the health portal discussion forums provide some insight on why this change occurred. Many of the participants reflected on what caused their heart disease and the role that diet may have played. People discussed different diets they had been on, difficulties in sticking to a diet and the importance of diet for managing their heart disease. Several discussions took place through the health portal about how people recognized that their diets used to be much better (eating fresh foods and fewer prepared foods) in their childhood compared to the fast-paced lifestyle now, which often leads to eating more prepared foods. They spent a lot of time in the discussion forums reminiscing about what things used to be like in this local area of Salford when they were growing up. One man describes how eating habits have changed over his lifetime:

We had fat in our diets then but meat was a luxury so you never had too much on a weekly basis as part of your diet. Chicken was as rare as sirloin steak and everything then was you could say 'organic'. How did we come to eat all this packaged ready meal trash? (#43, male)

Another woman provides a similar description of how diets have changed over time as the pace of life has also changed:

They blame a lot on our diet these days, but years ago you used to have three good meals a day especially after the war when things stopped being rationed ... The lifestyle is the thing that has changed (i.e. cars everywhere, TV and not sitting at a table all together at set times). It is a materialistic world today the treadmill is going faster and faster ... time seems to be the factor, people want it eaten before it has come out of the packet. (#44, female)

Others said that they did not realize the impact that food had on their health until after they were diagnosed with heart disease. For example, some said:

I had never heard of cholesterol until a few years ago. All those years of working shifts and eating the wrong food did not help. (#83, male)

I think a lot can be blamed on lifestyle plus eating a lot of rich foods. (#12, male)

The trouble was years ago we weren't aware of the problems our diet could cause, and if we did I wonder if we could have made any real changes. It's all hindsight isn't it? (#46, male)

Perhaps some of the information that we provided on our health portal helped them to become more informed about their eating habits. We had a 'diet and nutrition' section in the resources glossary of our website which included links to reputable websites such as the National Heart Forum, the British Nutritional Foundation, the Food Standards Agency 'Eat well' website, the National Institute for Clinical Excellence and the British Heart

Foundation's leaflet on 'Eating for a healthy heart'. One male participant describes his experience after reading some of this information:

I went into one of your suggested sites and found a lot of information on heart problems ... Reading the article reminded me about the importance of self-management regarding diet, sensible exercise and general lifestyle. One can easily fall back into bad habits if not regularly reminded. I have had a tendency to more or less self-manage my condition as long as possible and the article gave me a gentle reminder about getting back on track. (#24, male)

Perhaps simple reminders may have more of an impact than we often anticipate.

Participants were also asked to respond to an effective advertisement from the British Heart Foundation (food4thought) depicting 'what goes into crisps goes into you'. This generated a lot of discussion and seemed to have an impact for some people. The following are some responses to the advertisements:

I think these adverts are cleverly done. It shocked people into eating healthy diets. I like the way it inquires into the daily eating habit and in the end gives a score so one would know that they are on the right pathway or not for keeping healthy. (#37, male)

Very effective. The bottles of oil consumed by eating lots of crisps is excellent. (#43, male)

Having looked at the Ads and seen the screens behind the foods I can see their usefulness. The visual images of what goes into the popular foods identified does give out a strong message. I think a lot of people will be more aware of what they are eating when they are eating the foods shown because of the visual rather than the written image. It will certainly make me think when eating those foods and is likely to make me eat less of them or smaller portions. (#24, male)

Although it is difficult to pinpoint an exact cause for the significant relative improvement in the diet of participants who had access to *Hearts of Salford* that we found, these qualitative discussions offer insight into the processes that may have led to them.

Assessment of the negative results

It is important to address the trends that might have been expected but proved statistically insignificant or else proved statistically significant but lay in the opposite direction to what was expected. Six months is a short period in which to find changes as a result of any health intervention. Moreover, many participants were finding their feet with using the Internet and this might have occupied more of their attention than changing their health-related behaviour. Accordingly, perhaps, both cases and controls improved in frequency of exercise, but neither significantly. Both reduced alcohol consumption per day and on the heaviest day of the week, but only controls did so significantly with respect to units per day. Both reduced the number of cigarettes they smoked, but neither significantly.

Some significant changes in psychosocial aspects of health were not expected but seem to have a plausible ad hoc explanation. There was a significant slide in social support reported by controls that may reflect the situation of older people with chronic illness, other things being equal. It may be that the *absence* of such a trend for cases, indeed a slight opposite trend, is clinically even if not statistically significant. Seemingly in keeping with this, mental health worsened significantly for controls but not so for cases.

The other result of both statistical and theoretical significance concerns frequency of health visits. It may be that this reflects a trend over time with chronic illness, others things being equal. Or it may be that engagement in a project that encourages self-management of chronic illness enhances patients' awareness of their condition and so induces more frequent use of health care.

Discussion and conclusions

The Internet is now a commonly used forum to communicate health knowledge. E-health promotion may be a useful tool for enabling patients to become more active in their care (Wong et al., 2005). This may be particularly relevant for heart disease because leading a healthy lifestyle can help reduce symptoms and extend survival time (British Heart Foundation, 2005). This project addressed an important gap in the literature on e-health and is one of the few of its kind to distribute home computers and free Internet access among an older group of heart patients in a deprived area. Past research has tended to focus on the use of the Internet for health information among those who already have a computer while less is known about the impact on health behaviour change among older populations in a deprived area (Diaz et al., 2002; Lindsay et al., 2007). Further, there are few randomized controlled trials assessing the impact of online health portals on behaviour change.

Our findings suggest that the *Hearts of Salford* portal may have helped those who were at greater risk for poor health by increasing their knowledge to self-manage their disease. Specifically, our portal may have helped to provide patients with a better understanding of their eating habits. The findings reported here are consistent with the results from our pilot study which indicated that participants found the Internet useful for increasing their knowledge of healthy eating, especially the fat contents of foods and trying out new recipes they found online (Lindsay et al., 2007). Our study is also consistent with Wise et al. (2000) who found that online communication was linked with an improvement in diet. Having an improved knowledge of what constitutes a healthy diet is critical for heart patients because it can have a protective effect on health (British Heart Foundation, 2005).

Although we found no evidence of this sample increasing their 'healthy' foods, a reduction in eating 'bad foods' is a step in the right direction. Having

home access to our Internet health portal for heart disease influenced participants' eating behaviours, especially in relation to 'bad' foods. Diet, especially a high intake of saturated fats and salt along with a low consumption of fruit and vegetables, plays a key role in contributing to heart disease. Reducing the proportion of fat in your diet, especially saturated fat, can help to reduce blood cholesterol levels (British Heart Foundation, 2005). Further, it is estimated that 75 per cent of salt intake in the UK comes from salt added to commercially prepared food (National Heart Forum, 2007). Thus, a reduction in eating ready meals (which are typically high in salt) may help to reduce blood pressure levels.

Dietary behaviour is particularly susceptible to social influences (Gallant, 2003). Our findings suggest that higher levels of social support have an influence on eating 'bad' foods more often. This may be a result of the context in which these interactions take place. For example, if these sources of social support involve 'bonding' capital they may be more embedded in habitus, and thus may work to reinforce rather than to change behaviours. On the other hand, if the source of social support is more from 'bridging' capital, which ought to have been the case for this study, patients may be more susceptible to change their behaviour. Past evidence suggests that negative sources of social support can provide dietary advice that directly conflicts with self-management of one's condition and perhaps an unwillingness of family members to change their own diet (Gallant, 2003).

Our findings also indicated a gender difference in regard to changing diet where being a man was a predictor of eating 'bad foods' more often. This is consistent with previous research that suggests that dietary restraint is much more prevalent in women than in men (Herbert et al., 1997). Similarly, a study by Wardle et al. (2004) found that women were more likely than men to report avoiding high-fat foods, eating fruit and fibre and limiting salt.

These findings also have implications for the health divide. Both Salford's Health Inequalities Strategy and also ethnographic studies connecting poor health to insecurity in a socially divided urban environment point towards a mixture of 'strong' and 'weak' ties, spatial communities and networks, as the key to sustainable health (Popay et al., 2003; Salford Healthy City Forum, 2004). The Internet's intrinsic properties can only be part of the answer. It remains to be seen whether a peer-to-peer network that is grounded in both shared interests and local communities, and which meshes physical with virtual contact, facilitates the appropriate kind of social networking to improve individual and community health.

Attention must be paid not only to whether the intervention makes a significant difference to health-related behaviour and health quality of life for heart patients, but also whether the balance of benefits and costs in economic terms to the health services and wider society is favourable.

Health policy and online health promotion initiatives should target everyday settings in order to reach marginalized groups because these

domains are safe and familiar environments that people use for other reasons (Robson, 2001). It may also be useful to design online health portals that are responsive to the needs of deprived communities so that they can enhance improvements in health. ICT may be a 'highway to health improvement' for some aspects such as diet, and may work for some people, but we should not underestimate the amount of time and resources it takes to help people overcome barriers in learning how to use a computer. Further research needs to explore why this change has occurred, whether such changes can be sustained over the longer term and whether other changes in health may become more apparent over the longer term.

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