A simplified health information model increased the level of knowledge regarding “five a day” and food safety in a city district

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Abstract

Purpose – The aim of this paper was to analyze the effect according to knowledge and behavior, respectively, through a simplified health information model launched in a selected city district.

Design/methodology/approach – The intervention in this study encompasses information meetings where two educational computer programs highlighting the “five a day” concept, and food hygiene were showcased in conjunction with a group discussion. In total, 92 people living or working in a selected city district participated. The effect of the intervention was determined by means of inquiries (multiple-choice) that were carried out prior to, immediately following, and three weeks after the intervention.

Findings – A statistically significant improvement in knowledge of the concepts “five a day”, cross-contamination, and recommended storage temperature (for smoked salmon and raw mince meat) was observed, however, no major change in behavior was reported.

Practical implications – The knowledge improvement suggests that the education programs, in conjunction with discussions, are a useful information model for raising awareness about the notion of “five a day” and food safety. The results of the study make it clear that there are difficulties in getting people to change their behavior, let alone getting them to participate in health education offered locally.

Originality/value – Intervention projects are a communication tool that may be used in order to increase knowledge and produce behavioral change. The project is working from the inside out, i.e. it examines the needs first and then develops solutions for them.

Keywords Health information, “Five a day”, Fruit and vegetable consumption, Food safety, Cross contamination, Simplified information model, Health education

Paper type Research paper

Introduction

The purpose of health communication is to bring about a change in behavior, thereby improving public health (Schiavo, 2007). A prevailing problem is that the principal
recipients of health information are those already advantaged. Thus efforts must be made to reach out to disadvantaged groups, e.g. the elderly. Brug (1999) emphasized that campaigns have often low impact on individual health changes. However, interpersonal counseling is not realistic due to relatively high costs and the fact of being time consuming.

In recent years, several important new channels for health communication have emerged such as interactive computer programs (Brug et al., 2005). Tailored communication is individualized to each person whereas targeted messages are developed to be effective with an entire segment of the populations such as citizens in a city district (Noar et al., 2007). However, as Noar et al. (2007) concluded in a meta-analytic review, although tailored messages may be found to be more effective, the effort that goes into creating such messages is great. In circumstances where time and other resources are limited, targeted interventions should be implemented.

Computer-tailored nutrition education is an attempt to incorporate characteristics of interpersonal counseling in interventions that can possibly reach many people. The project CHANCE focused on the approach of “Community-Building” which is beyond counseling and education campaigns designed for the social and environmental circumstances and aims to initiate the build-up of networks. Thus the recruitment for the present intervention targeted a population based on local networks already established in the selected district.

International organizations recommend a daily consumption of 400 g of fruit and vegetables for better wellbeing (World Cancer Research Foundation (WCRF), 2007; WHO, 2008a). Higher fruit and vegetables consumption has been associated with a reduced risk for cardiovascular disease (Djoussé et al., 2004; John and Ziebland, 2004), cancer (Riboli and Norat, 2003; Nomura et al., 2008 and stroke (He et al., 2006), and reduced mortality (Rissanen et al., 2003; Mente et al., 2009). In addition, the risk of obesity is reduced as fruit and vegetables have low energy content (WCRF, 2007). In Sweden, the National Food Administration recommends eating 500 g of fruit and vegetables per day. Several dietary studies indicate that the Swedish population experiences difficulties attaining the recommended dose (National Board of Health and Welfare, 2009; Winkvist et al., 2009; Simunaniemi et al., 2009). Less than a tenth of the Swedish population eat a quantity of fruit and vegetables in compliance with the recommendations, and less than half (40 percent) eat fruit and vegetables in small amounts (1.3 times per day or less) (National Board of Health and Welfare, 2009). A recent Swedish study aimed to investigate the consumption of various fruit and vegetables types in Swedish adults grouped according to sociodemographic factors and self-reported physical activity (Simunaniemi et al., 2009). The main findings based on a self-administrated 24-hour recall showed that mean consumption was close to the recommended five portions/day:

- 5.4 portions/day among women; and
- 4.7 portions/day among men.

Also results from a food frequency questionnaire (FFQ) showed that women generally consumed more fruit and vegetables than men did (Simunaniemi et al., 2009). Fruit and vegetables were consumed in almost equal amounts, and fresh fruit and vegetables were most popular.
According to WHO’s health targets, the number of food poisoning cases needs to be reduced (WHO, 2008b). Studies from across Europe, North America, Australia and New Zealand suggest that deficient food management at home causes a large share of food poisoning (Redmond and Griffith, 2003). Swedish consumers need to understand better the importance of refrigerator temperature and storage time, and also that temperature varies from place to place inside the refrigerator (Marklinder et al., 2004). Consumers need to be trained in food safety for the betterment of domestic food management (Redmond and Griffith, 2003; Medeiros et al., 2004). When cross-contamination occurs during handling of the common food item minced meat, verotoxin-producing *E. coli* (VTEC) constitutes a risk to public health (National Food Administration, 2007). Today there is a serious lack of knowledge about the bacterium, and efforts need to be made to increase knowledge about it. Cross-contamination is common, especially in hand-to-surface scenarios (Redmond and Griffith, 2003; Andersson et al., 2004; Haysom and Sharp, 2004).

Earlier studies indicate that awareness of sound food hygiene is not always consonant with actual behavior. For example, most people know that washing one’s hands is crucial for preventing food poisoning, yet many people fail to turn this knowledge into better practice (Redmond and Griffith, 2003). Often, consumers lull themselves into a false sense of security, believing that their particular way of handling food and applying hygiene poses no hazard and so proceed with risky behavior (Redmond and Griffith, 2003; Redmond and Griffith, 2005a).

Insofar as attitude affects behavior, it is important that people realize the importance of improving their food hygiene, before strategies such as educational programs aimed at improving behavior are applied (Redmond and Griffith, 2004b). Hence it is essential that the recipients understand that the training is directed specifically at them and for their own benefit (Redmond and Griffith, 2004a; Redmond and Griffith, 2005b).

The use of electronic media has earlier been shown to be an effective tool to promote change in health behaviors (Crutzen et al., 2008; Franko et al., 2008; Griffiths et al. 2006). As time and also other resources were limited, this survey focused on a computerized and simplified health information model. The aim was to analyze the effect according to health knowledge and behavior, respectively, through a simplified and computerized information model targeted towards networks launched in a selected city district.

**Methodology**

Within the EU project CHANCE (2007-2009) (Community Health Management to Enhance Behavior), the focus is both on the needs of the residents of a specific city district and on their living conditions (CHANCE, 2009). It further aimed to encourage socially and disadvantaged groups to seek information and to assume responsibility for their own health. The selected district, in the municipality of Uppsala, lies at an altitude overlooking green open spaces and municipal woodland. Senior citizens make up a larger share of the population than elsewhere in the municipality. Nineteen percent are older than 65 years (Uppsala municipality 14 percent, Sweden in general 16 percent).

In a previous study a questionnaire was conducted in 2008 in a selected city district with 202 respondents between the ages of 20-81. The result of the poll underlines the relevance of the present intervention. The questionnaire showed that the
consumption of fruit and vegetables in the city district was below recommended levels. Barely half (49 percent) ate fruit and vegetables on a daily basis, whereas about one-third ate fruit (34 percent) and vegetables (33 percent), respectively, several times a day. Further, no more than half of the respondents knew the significance of “five a day”; neither did the majority (85 percent) among the elderly (70 + ). More than one-fifth (21 percent) held the view that raw meat being brought into contact with other foodstuffs posed no health risk. Likewise, 43 per cent believed that monitoring the temperature inside the refrigerator held no benefit as far as health was concerned. One-fifth of the elderly stated they saw no risk in tasting raw minced meat when cooking. Thus, based on the weaknesses revealed by the previous survey, namely the poor consumption of fruit and vegetables as well as deficiencies in food handling this intervention study focused on the concept “five a day” as well as food safety.

**Recruitment**

The CHANCE project is working from the inside out, i.e. it examines the needs first and then develop solutions for them. However, in the present part of the project the participants were recruited on a general bases and not according to their individual needs in terms of “five a day” and food safety, respectively.

The inclusion criteria for participation in the intervention were being over 20 years of age and living or working in the selected city district. Several methods were used for the recruitment of participants: information letters on the project along with forms for expressing interest in taking part were sent to approx 600 households, via children attending compulsory school in the selected area. The residents were contacted by phone. In addition, information notes and interest application forms were posted on billboards throughout the city district. Besides, the project manager recruited participants in the center of the city district.

**Implementing the intervention**

The intervention consisted of two information sessions within the same meeting where two educational programs were exhibited: “five a day” and “Food safety” plus two shorter discussions regarding the themes of each program (Figure 1).

The program “5 a day” included a PowerPoint slide show (16 slides) (Table I). The program expounded on the concept of “five a day” and the reasons why a daily consumption of 500 g of fruit and vegetables each day helps us feel well. The presentation “Food safety” (13 slides) detailed valuable facts relating to cooking and food management at home, including the benefits of personal hygiene, how to avoid cross-contamination, storage of food in proper temperatures, as well as data about bacteria in minced meat and the risks of sampling raw minced meat (Table II).

The home economics and computer classrooms at the secondary school were chosen as the principal venues for carrying out the simplified health information model. The participants convened in the home economics classroom to fill out the two questionnaires, whereas the educational programs were on display in the computer room. The pupils of the school got involved in the project and offered assistance when the older participants felt uncomfortable operating the computers. The rest of the intervention meetings took place in the canteens at the school, in the local library and was also shown outdoors in an allotment-garden district using battery-powered laptop computers.
The participants watched the information programs on individual screens. The programs were shown in randomized order, one half of the attendees at the information meeting started out by watching the “five a day” program while the second half got to watch “Food safety” (Figure 1). When the participants numbered five persons or less, they all got to watch the same presentation.

Two short group discussions were held (one following each viewing of the programs) regarding the two themes:

(1) fruit and vegetables; and

(2) food safety.

The discussions were conducted in small groups with between two and five people.

In order to determine the effect of the intervention, the participants were asked before viewing the programs to fill out a questionnaire about their knowledge of the themes and behavioral questions about health. Immediately after viewing the programs, participants were asked to fill out a questionnaire including only knowledge questions, to determine whether the participants had retained what they had learnt and
to examine whether any change had occurred in their behavior. A third questionnaire, including knowledge and behavior questions, was sent to the participants three weeks after the intervention.

The questionnaires comprised multi-choice questions regarding fruit and vegetable consumption and knowledge of the message “five a day” and the meaning of cross contamination, respectively. Further, questions regarding storage – and handling of food as well as if they normally use to taste raw minced meat when cooking. The first and the third questionnaire investigated whether they feel well informed regarding

<table>
<thead>
<tr>
<th>Themes</th>
<th>Powerpoint program – “5 a day”</th>
<th>Powerpoint program – Food safety issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>“5 a day”</td>
<td>Means five portions of fruit and vegetables each day, which equals 500 g</td>
<td>Wash your hands after going to the toilet and before preparing food. Remove your jewellery. Water carries and spreads bacteria</td>
</tr>
<tr>
<td>Basis for the dietary recommendation “5 a day”</td>
<td>Provides the requirement of vitamins and fiber</td>
<td>Wash your hands after going to the toilet and before preparing food. Remove your jewellery. Water carries and spreads bacteria</td>
</tr>
<tr>
<td></td>
<td>Contains fiber that keeps the stomach busy and counteracts constipation</td>
<td>Minced meat might contain the <em>E.coli</em> bacterium (VTEC). A tablespoon is sufficient to cause food poisoning. Prepare it before ingesting</td>
</tr>
<tr>
<td></td>
<td>Helps to control one’s weight</td>
<td>Means bacterial transmission by means of hands or utensils – avoided by cleaning knives, cutting-boards and hands after handling raw products</td>
</tr>
<tr>
<td></td>
<td>Reduces the risk of cardiovascular disease and certain types of cancer</td>
<td>Recommended refrigerator temperature is 4°C</td>
</tr>
<tr>
<td>Price comparison</td>
<td>Exemplifies the amount of fruit and vegetables that 20 SEK buys</td>
<td>Measure the temperature inside the refrigerator to locate the warmest and coldest spots. The recommended maximum temperature for various foodstuffs: fresh fish 2°C, raw minced meat 4°C, milk 8°C, warm smoked and cold smoked salmon 4°C</td>
</tr>
<tr>
<td>Practical advice</td>
<td>How fruit and vegetables fares can be varied</td>
<td>Means bacterial transmission by means of hands or utensils – avoided by cleaning knives, cutting-boards and hands after handling raw products</td>
</tr>
<tr>
<td></td>
<td>How fruit and vegetables may be included in various meals</td>
<td>Minced meat might contain the <em>E.coli</em> bacterium (VTEC). A tablespoon is sufficient to cause food poisoning. Prepare it before ingesting</td>
</tr>
<tr>
<td></td>
<td>How spillage may be avoided</td>
<td>Wash your hands after going to the toilet and before preparing food. Remove your jewellery. Water carries and spreads bacteria</td>
</tr>
<tr>
<td></td>
<td>Boil, mix and mash fruit to make chewing easier</td>
<td>Wash your hands after going to the toilet and before preparing food. Remove your jewellery. Water carries and spreads bacteria</td>
</tr>
<tr>
<td>When can fruit and vegetables be eaten?</td>
<td>E.g. at what time of day does eating fruit and vegetables suit you?</td>
<td>Wash your hands after going to the toilet and before preparing food. Remove your jewellery. Water carries and spreads bacteria</td>
</tr>
<tr>
<td>Recipes</td>
<td>Oven baked vegetables, smoothies, sweet fruit salad etc</td>
<td>Wash your hands after going to the toilet and before preparing food. Remove your jewellery. Water carries and spreads bacteria</td>
</tr>
</tbody>
</table>

Table I. The content and meaning of the two information programs (Powerpoint): “Five a day” and Food safety, respectively administered in randomized order via computers

Table II. The content and meaning of the two information programs (Powerpoint): “Five a day” and Food safety, respectively administered in randomized order via computers
healthy behavior. The first questionnaire also included questions regarding the respondents age, gender and level of education.

Statistics
Descriptive statistics were retrieved in Excel and significant deviation and correlation analyses were carried-out using the statistics program SPSS 16.0 (Statistical Packages for the Social Sciences) (SPSS, 2008). The calculations in SPSS were performed using the McNemans test. The level of significance was set at 5 percent ($p < 0.05$) for securing a statistically significant result. In order to safeguard against errors that may have arisen in conjunction with encoding, 10 percent of the material was sampled for control.

Results
The recruitment process took longer than planned. The number of participants in the intervention was 92, 70 percent were women ($n = 64$) and 30 percent men ($n = 28$). University was the highest level of education attained for slightly more than half (52 percent) of the participants, high school being the highest level attained for a fifth (20 percent), whereas 28 percent had only attained elementary/compulsory school. The majority (61 percent) of the participants were older than 61 years (Figure 2). The external reduction was one percent ($n = 1$) for the questionnaire that had been filled out immediately after the intervention and 17 percent ($n = 16$) for the questionnaire that had been carried out three weeks later.

Change in knowledge
Prior to the intervention, barely half (46 percent) of the participants knew that “five a day” means five portions of fruit and vegetables each day. Right after the intervention, and three weeks later, the majority (84 percent and 86 percent respectively) had an accurate comprehension of the concept (Figure 3). A statistically significant increase in

Figure 2.
Age distribution of participants in the intervention study
knowledge of the meaning of “five a day” was therefore identified for the period between the questionnaire taken before and immediately after the intervention, as well as between the questionnaire taken before and the one three weeks afterwards ($p < 0.001$). Out of the participants who did not know what “five a day” meant prior to the intervention, 39 percent ($n = 30$) understood the concept directly after and 36 percent ($n = 22$) three weeks after.

Slightly more than half (52 percent) of the participants knew what “cross-contamination” meant before the intervention and the majority (87 percent) were able to state the accurate meaning (bacterial transmission by way of hands and utensils) right after and three weeks after the intervention. Total number of respondents: before, $n = 89$; right after, $n = 87$; three weeks after $n = 72$ (Figure 4).

A statistically significant increase in knowledge regarding the understanding of the term was thus established for the period between the initial questionnaire and the one immediately following the intervention, as well as for the period between the initial questionnaire and the one conducted three weeks later ($p < 0.001$). Out of the participants who did not know the meaning of “cross-contamination” before the intervention, 42 percent ($n = 35$) showed they understood it right seeing the programs, and the same was proven for 42 percent ($n = 30$) three weeks later.

The optimal storage temperature for smoked salmon was deemed before the intervention by slightly more than half (61 percent) to be $5^\circ C$ and upwards. The educational program recommended that smoked salmon be stored at $4^\circ C$ maximum. Prior to the intervention, 22 percent stated the recommended temperature. Directly afterwards, 67 percent knew that salmon should be stored at $4^\circ C$. Three weeks later, 45 percent recalled the optimal temperature. Total number of respondents: before, $n = 91$; directly after, $n = 90$; three weeks later, $n = 75$.

A statistically significant increase in awareness regarding the optimal temperature was identified for the period between the questionnaires taken before and directly after the intervention ($p < 0.001$), as well as the period between the questionnaires...
conducted before and three weeks afterwards ($p < 0.002$). Out of the participants who did not know the optimal temperature before the intervention, 53 percent ($n = 47$) showed immediately after the programs that they had learnt that salmon should be stored at 4°C, whereas 34 percent ($n = 25$) showed they had retained this knowledge three weeks later. Total number of respondents: before and directly after, $n = 89$; before and three weeks later, $n = 74$.

The educational program also recommended raw minced meat to be stored at 4°C maximum. Before the intervention 23 percent knew the optimal storage temperature and directly afterwards this rose to 67 percent. Three weeks after the intervention, 54 percent recalled the temperature that had been recommended. Total number of respondents: before, $n = 91$; directly afterwards, $n = 90$; three weeks later, $n = 76$.

Knowledge increased by significant degrees between the first and second questionnaires, as well as between the first and third questionnaires ($p < 0.001$). Among the participants who did not know the optimal temperature before the intervention, 47 percent ($n = 42$) had learnt immediately after that raw minced meat should be stored at 4°C, whereas 41 percent ($n = 31$) had done so three weeks later.

### Behavioral change

About half (48 percent and 55 percent respectively) reported before and directly after the intervention that they ate fruit and vegetables several times a day (in the questionnaire, several was defined as twice or more). Total number of respondents: before, $n = 89$; three weeks after, $n = 74$. About half (55 percent) stated that they ate vegetables several times a day before the intervention, and three weeks afterwards barely half (49 percent) answered that they ate vegetables several times a day. Total number of respondents: before, $n = 89$; three weeks later, $n = 74$.

In order to examine whether those participants who knew the concept “five a day” also ate fruit and vegetables several times a day, fruit and vegetables were added up in a column. The respondents in this column answered as follows:
they ate fruit and vegetables, each of which several times per day; 
- they ate fruit several times per day and vegetables nearly every day; or 
- they ate vegetables several times per day and fruit nearly every day.

The remaining responses were categorized as those not eating fruit or vegetables several times per day. No statistical correlation was identified between the consumption of fruit and vegetables several times per day and knowledge of the “five a day” concept.

Regarding the handling of raw minced meat that might contain the pathogen *E. coli* bacterium VTEC, the majority (80 percent and 88 percent respectively) stated before and three weeks later that they refrained from tasting raw minced meat. Total number of respondents: before, $n = 91$; three weeks after, $n = 74$. No statistically significant difference was found between those who tasted raw minced meat before the intervention and those who had changed their behavior in the wake of the intervention.

Before the intervention, a good half (51 percent) stated that they checked the temperature in their refrigerator regularly. After the intervention, 41 percent said they did. Total number of respondents: before, $n = 90$; three weeks after, $n = 72$. No statistically significant difference was found between those who did not check the temperature in their refrigerator before the intervention and those who did after the intervention. The most frequently-given response to the question of how many days raw minced meat is usually stored, was one day. Total numbers of respondents: before, $n = 90$; three weeks after, $n = 74$.

A statistically significant increase ($p < 0.013$) was found with respect to being well-informed about healthful behavior as regards food hygiene, before as compared to three weeks after the intervention. Total number of respondents: before and three weeks after, $n = 72$. There was no statistically significant difference between the sense of being well-informed about food and nutrition before as compared to after. “Well-informed” was defined as those participants who answered “true” to the question. However, several respondents considered themselves well-informed as regards food and nutrition three weeks after the intervention.

**Discussion**

Managing simplified health information materials by means of computers is flexible and cost-efficient. The materials could easily and inexpensively be distributed to other municipalities. The overall objective of the present study was to evaluate to what extent a simplified health information model (computerized) can be implemented in a city district settings, e.g. healthcare centers, schools, retirement organizations, grocery stores or through various networks.

The study population in the present study was mainly represented by women and elderly (Figure 2). Also the education level was higher than people in general. It should be noted, however, that the purpose of presenting demographic data in the present study was not to analyze differences between age, gender or education level but to make a general description of the study group.

The evaluation tool, i.e. the multiple-choice questionnaire, was developed to be simplified when analyzing the effects regarding knowledge as well as behavioral change. The effect of the discussions following the information by the computer...
programs would have been interesting to analyze. However, in further research a control group should be included and analyzed also by qualitative methods.

Originally the concept “five a day” was created to increase the consumption of fruit and vegetables (Ashfield-Watt et al., 2003; Charlton, 2008). Several participants agreed that they considered themselves well-informed about food and nutrition after the intervention, but no significant difference was identified before and three weeks after the intervention. In this study, the participants asserted that they felt significantly better informed about food hygiene three weeks after the intervention. The result suggests that the participants felt the program “Food and hygiene” gave them new information.

In the present study a significant improvement in knowledge was identified concerning the awareness of the concepts of “five a day” and “cross-contamination” before the intervention, compared to directly after and three weeks after Figure 3 and Figure 4.

In order to get healthy people to participate in interventions involving health, the experiences garnered from the present study suggest that the educational programs should take place in environments where consumers tend to gather of their own accord – for instance in local networks and venues for group activities. Other studies too have determined lack of interest or low prioritization to be the greatest obstacles to implementing health-promoting initiatives (Robinsson et al., 2006).

Behavioral change
The results from this study point to a marked improvement in knowledge but evidence no significant behavioral change. The difficulty of successful communication is precisely the notion that people are not merely expected to grasp the message but also to bring about a change in their behavior. On the other hand, knowledge is a prerequisite for changing one’s behavior in a desired and proper way (WHO, 2004). Positive relationship between food safety knowledge and safe food handling practices have been demonstrated in earlier studies (Kennedy et al., 2005; Medeiros et al., 2004).

The improvement in knowledge shows that the participants indeed understood the content of the programs. The educational programs may thus be useful, along with concomitant discussions, for increasing awareness of proper food hygiene and the importance of “five a day”. The consumption pattern for fruit and vegetables did not undergo any notable change, as gauged before the education compared to three weeks afterwards. That over one-half (55 percent) reported eating vegetables several times per day and that 48 percent ate fruit and berries several times a day might depend on that recruitment was difficult and possibly caught the people who were aware of the concept, and already interested in healthy eating. Whether the consumption satisfied the recommended consumption level as expressed in “five a day” is not clear, since “several times” was defined as twice or more a day.

High income has in a recent Finnish study been found to be associated with fresh fruit and vegetable consumption at different level of education (Lallukka et al., 2010). However, in this survey neither education nor incomes were investigated. Income limitation could be one reason for not increasing fruit and vegetables although knowledge about the “five a day-concept”.

The participants expressed that they checked the temperature in their refrigerators before participating in the intervention; but this result should be regarded with caution,
as a previous study in Uppsala showed that only 21 percent checked refrigerator temperature (Marklinder et al., 2004). The knowledge levels, attitudes and behaviors that consumers themselves reported in inquiries and interviews do not always square with their actual behavior (Redmond and Griffith, 2003). Indeed, three weeks after the intervention, fewer people (41 percent) checked the temperature than before, according to their own statements.

Several previous studies in food management at home, confirm the need for consumers to improve their knowledge about food hygiene (Redmond and Griffith, 2003). A problem that is mentioned in the context of foodstuffs is that most people wish to do things the proper way, but when they are not sure what is the proper way, they tend to keep doing it improperly unbeknownst to themselves (Marchiony, 2004). People also tend to underestimate the risk of incurring food poisoning (Wildermann, 2006) – getting people to appreciate the hazards (Menon et al., 2002) is indeed a great challenge to health communication. Hence there are expectations that once their awareness has been raised, it will soon inform their behavior, prompting them, for example, to check the temperature in their fridges, be wary of their hand hygiene and make sure to use different cutting-boards and appliances for different foods.

It is recommended that interventions pay heed to demographic differences in trying to raise the consumption of fruit and vegetables (Ashfield-Watt et al., 2003; Charlton, 2008). Since there are differences in consumption patterns between men and women, it is suggested that strategies be geared toward gender specificity (Ashfield-Watt et al., 2003). An intervention focusing on health advantages may be conducive toward behavioral change among elderly men, but for it to appeal to young people, factors such as an appealing taste may have to be emphasized more (Charlton, 2008). Moreover, education and age are said to have great significance as to how people comprehend risk factors associated with food (De Boer et al., 2005).

A crucial part of the intervention was the discussion that took place after every program in which the theme of the program was analyzed. Interpersonal communication has previously been hailed as a crucial part of health communication programs (Korhonen et al., 1998; WHO, 2004). Successful intervention studies are characterized by small groups (Ammerman et al., 2002). The import that these discussions may have had for the improvement of knowledge and behavioral change has been left unanalyzed. A Swedish study showed that disadvantaged groups are the ones that benefit the most from local community interventions (Weinehall et al., 2001). Nowadays, health information reaches primarily those groups already advantaged, thus efforts need be made to reach those in dire need.

Many elderly people who grew up in the countryside have first-hand experience with slaughter and preservation techniques. Typically, they consider themselves fully capable of handling foodstuffs. But such skills do not always apply to modern-day foods. For example, new bacterial pathogens have started to appear in raw minced meat. The attitude that one already knows all that is necessary may hamper one’s susceptibility to relevant new health information. Reaching out with health messages or risk-associated information can be problematic in cases where the target group considers itself fully and satisfactorily educated (Tierpstra et al., 2005).

The present findings should emphasize the importance of intentions and planning for behavior change according to Wiedemann et al. (2009). A limitation of the present study was that the participants were recruited in a general sense i.e. based on
knowledge and behavior expressed through the pre study in the selected city district and not in accordance with individually needs. Neither their initial knowledge nor their intention for behavior change were identified in the recruitment process. Further research by our group will include these important factors. In order to achieve substantive behavioral change, one suggestion is to imply the simplified health information model developed by including two meetings with a home assignment in-between in accordance with “Food classes for the elderly” (Nydahl, 2006). Moreover the pre knowledge of the participants would be individually identified.

According to Michie and Prestwich (2010) theory based interventions can aid understanding of why interventions are effective or ineffective. Regarding our own results i.e. no significant behavioral changes, one interesting approach would be to apply the Health Action Process Approach (HAPA) demonstrated by Schwarzer (2008). In a further similar intervention this model could be applied already in the recruitment process as to target people who really are in need for knowledge improvement and behavioral change regarding these health issues. In this multi-stage model self-efficacy is an important factor for translating intentions into behavior (Richert et al., 2010).

This intervention was performed within the CHANCE project and performed during just two years resulting in periods of time limitations. External and internal drop-outs should be considered. In some cases the participants did not fill in a certain question or they did not fill it correctly explaining the fact that the number of participants became different throughout the study. In a further study the objectives would be to include risk persons and to analyze changes in food behaviors over a longer period of time.

Conclusions
A statistically significant improvement in knowledge regarding awareness of the concepts of “five a day” and “cross-contamination”, along with recommended storage temperatures for smoked salmon and raw minced meat, was reported in the aftermath of the intervention. No significant behavioral change was found. The improvement in knowledge demonstrates that the simplified educational programs may be useful in increasing awareness about proper food hygiene and the importance of “five a day”. In order to achieve substantive behavioral change, the recruitment process should target participants based on their actual need of improved knowledge and behavior changes related to health.

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