
Public Health Genomics 2014, 17(3), 127-140.

Copyright: © 2014 S. Karger AG, Basel

The definitive version of this article, published by S. Karger AG, 2014, is available at:

http://dx.doi.org/10.1159/000358851

Always use the definitive version when citing.

Further information on publisher website: http://www.karger.com/

Date deposited: 10th October 2014

Version of file: Author Manuscript

This work is licensed under a Creative Commons Attribution-NonCommercial 3.0 Unported License

http://eprint.ncl.ac.uk
Understanding consumer evaluations of personalised nutrition services in terms of the privacy calculus: a qualitative study

Aleksandra Berezowska¹*, Arnout RH Fischer¹, Amber Ronteltap², Sharron Kuznesof³, Anna Macready⁴, Rosalind Fallaize⁴, Hans CM van Trijp¹

¹Wageningen University and Research Centre, The Netherlands
²LEI, Part of Wageningen University and Research Centre, The Netherlands
³Newcastle University, UK
⁴University of Reading, UK

*Contact details corresponding author: Wageningen University and Research Centre, Department of Social Sciences, Marketing and Consumer Behaviour Group, Hollandseweg 1, 6706 KN Wageningen, The Netherlands

aleksandra.berezowska@wur.nl,
Phone: +31 (0)317 482406
Fax: +31 (0)317 484361
Summary

Background: Personalised nutrition (PN) may provide major health benefits to consumers. A potential barrier to the uptake of PN is consumers’ reluctance to disclose sensitive information upon which PN is based. This study adopts the privacy calculus to explore how PN service attributes contribute to consumers’ privacy risk and personalisation benefit perceptions.

Methods: 16 focus groups ($N = 124$) were held in 8 EU countries, and discussed 9 PN services that differed in terms of personal information, communication channel, service provider, advice justification, scope, frequency, and customer lock-in. Transcripts were content analysed.

Results: The personal information that underpinned PN contributed to both privacy risk perception and personalisation benefit perception. Disclosing information face-to-face mitigated the perception of privacy risk and amplified the perception of personalisation benefit. PN provided by a qualified expert and justified by scientific evidence increased participants’ value perception. Enhancing convenience, offering regular face-to-face support, and employing customer lock-in strategies were perceived as beneficial.

Conclusion: This study suggests that to encourage consumer uptake, PN has to account for face-to-face communication, expert advice providers, support, a lifestyle-change focus, and customised offerings. The results provide an initial insight into service attributes that influence consumer uptake of PN.

Keywords: Personalised nutrition, consumers, adoption, privacy calculus, business models, focus groups, Food4Me
Introduction

As nutritional needs are known to differ within a population [1,2], nutritional intake recommendations differentiate for population segments such as children, adults, pregnant women and diabetics [3,4]. Technological advances in the fields of Genomics, Transcriptomics, Proteomics and Metabolomics [5,6] make it possible to further specify nutritional intake recommendations by tailoring them to individuals rather than sub-groups of a population. A detailed overview of the technological advances and their applications is provided by García-Cañas et al. [7].

The individual approach to dietary intake recommendations, called personalised nutrition (PN), is often associated with Nutritional Genomics [8-10]. Comprising both Nutrigenomics (i.e. the influence of nutrients on gene expression) and Nutrigenetics (i.e. the influence of genes on the response to nutrients), Nutritional Genomics studies the relationship between the genome, nutrition, and health [11]. PN is, however, not limited to the application of DNA [12]. It can also be based on phenotypic information such as blood chemistry, weight and height, or lifestyle information such as dietary intake [13,14].

Individually tailored dietary recommendations may be associated with major health benefits. Compared to advice aimed at population segments, tailoring dietary recommendations to the individual not only generates more appropriate recommendations, but it also increases the perceived (added) value of the recommendations in the eyes of the consumer [15]. In turn, such increased value perception is likely to contribute to higher levels of involvement in, satisfaction with and loyalty to personalised dietary recommendations [16-18]. The current drive for preventive PN applications comes from commercial enterprises, which are not necessarily
supported by regular health care services [19,20]. This implies that the uptake of PN largely depends on Direct-to-Consumer advertising rather than medical prescription. Regardless of the ethical desirability of Direct-to-Consumer PN applications and the need to regulate this development [21], at this stage it is reasonable to expect that the potential benefits of PN depend on the uptake and adoption of PN by consumers.

Central to the concept of PN is the use of personal and potentially sensitive information about the individual to generate personalised dietary recommendations. Once PN has reached its maturity, the specificity and with that value of the dietary recommendations will depend on the individuality and detailedness of the available information [22]. Receiving highly relevant and personalised dietary recommendations (i.e. personalisation benefit) will, therefore, come at the price of disclosing very personal and potentially sensitive information (i.e. privacy risk) about the self. With DNA being the most, and lifestyle being the least, personal and sensitive form of information.

In the Information Systems literature [23-25], tension between information disclosure risks and information disclosure benefits is considered typical for many (personalised) services, and is often dissolved in the privacy calculus. The privacy calculus [26,27] is a trade-off between information disclosure risk and associated (personalisation) benefits, which assumes that consumers will agree to disclose sensitive information about themselves as long as they expect to benefit from it. With the emergence of online banking, shopping, and governance, the privacy calculus has gained broad attention in the Information Systems literature. Nevertheless, it has not yet been widely used in relation to health. Limited evidence, however, shows that the privacy calculus can be relevant to the health domain [28-30] (figure 1).
Since PN advice cannot be generated without personal information, reducing the risk-benefit tension by fully removing the risk component is impossible. Consequently, ensuring that during the privacy calculus personalisation benefits will exceed privacy risks can only be achieved by mitigating privacy risk perceptions and/or amplifying personalisation benefit perceptions [31,32]. Hence, to consolidate the uptake of PN an acceptable balance between privacy risks and personalisation benefits needs to be established. Such balance may be created by focusing on the process of PN provision. The provision of PN is characterised by an information exchange process between a consumer and a service that generates PN advice [22]. This information exchange process involves three critical stages: 1) the consumer discloses personal information to the PN service; 2) using the personal information the PN service generates nutrition advice and initiates arrangements that stimulate consumers to adhere to the advice; and 3) the PN service provides the nutrition advice to the consumer. The three stages have been identified as essential elements of PN business models, of which nine “archetypes” (Table 1) are currently present in the market place [19].
To date, none of the commercial PN services available in the market place seems to have succeeded in attracting large groups of customers [19]. This suggests that none of the current PN services has managed to create a widely acceptable balance between privacy risks and personalisation benefits. Building on the nine archetypical PN business models, this study aims to explore consumer evaluations of PN services and clarify how these evaluations contribute to an individual’s privacy calculus. Such an understanding will provide guidance for the development of PN services that are considered worthwhile by consumers. Ultimately, an increased uptake and adoption of PN services could improve public health and thus contribute to both economic and social wealth. As improved public health is a vital goal for all EU member states [33-35], data was collected in eight EU countries.

Methods

Design and participants

Sixteen focus groups were held; two in each of 8 European countries (Greece, Spain, the Netherlands, Ireland, UK, Germany, Poland, and Norway) that were selected for this study. All 124 participants were recruited through a market research company or the national data collection centres. Participants perceived themselves as healthy and were aged 18-65. Socio-demographics are provided in Table 2. Ethical approval was granted in accordance with international standards, and written consent was obtained from all participants.

---INSERT TABLE 2 HERE---
The focus groups followed an extensive semi-structured interview protocol. The protocol was developed in English and translated into Dutch. The Dutch protocol was piloted in a focus group of 7 participants. The pilot study resulted in some minor amendments that were incorporated into the English protocol. The English protocol was translated into the national languages of the participating centres.

A local moderator and observer were assigned to conduct the focus groups within each centre. All moderators were trained to use the protocol during a two day workshop. The focus group discussions were audio-recorded and transcribed verbatim. Participants’ individual deliberations were captured in a response booklet.

To assure translation quality, the protocol, transcripts and individual deliberations were checked by means of back-translations [36], following which translations were adjusted.

Stimuli and materials

Nine flyers representing fictitious PN services based on the business models identified by Ronteltap et al. [19], were used to facilitate discussion. Each flyer included all service attributes that are relevant for the three information exchange process stages (see Figure 2). Flyers were shown to the participants in three sets of three flyers. Per flyer set, only the service attributes that related to a particular information exchange stage varied across the flyers. The service attributes that did not represent the stage explored in a flyer set remained unvaried, with minor variations to enhance the realness and credibility of the flyers. The first flyer set contained flyers that differed with regard to the service attributes “personal information” (dietary intake, phenotype, DNA) and
“communication channel” (online, mail, personal contact). The second flyer set differed on the service attributes “service provider” (dietitian, company, government/employer), “advice justification” (scientific evidence, alternative medicine, success stories) and “customer lock-in” (high initial payment followed by cheap follow up, support group, free service dependent on good results). The third flyer set varied on the service attributes “advice scope” (diet plan, diet plan/exercise plan/personal food preferences, diet plan/exercise plan/shopping list/exercise facilities/lifestyle advice), “advice frequency” (one-off, once every 3 months, once a week) and “communication channel” (online, mail, personal contact). Table 3 provides an overview of the stimulus material.

---INSERT FIGURE 2 HERE---

---INSERT TABLE 3 HERE---

Data generation procedure

Participants were welcomed to the focus group. The moderator, observer and participants, introduced themselves. The moderator explained the ground rules (e.g. only one person speaks at a time) of the discussion.

As a warm-up, each participant wrote three words or short sentences about what PN meant to him/her in the provided response booklet. Half way through the warm-up, the definition of PN (i.e. healthy eating advice that is tailored to suit an individual) was presented to the
participants. Participants were invited to voice their understanding of PN. All words or phrases that were mentioned aloud were written down on a flipchart.

After the warm-up, printed A5 full colour flyers were handed to the participants one set at a time. Participants ranked the flyer sets individually, and recorded the rankings and reasons for their preferred order in the response booklet. Then individual preferences were compared and discussed within the group. When relevant or new discussion points ceased to emerge, the next set of flyers was introduced. There was a 10 minute break between the second and the third flyer set.

After all three flyer sets had been discussed, all nine flyers were ranked simultaneously. Each participant individually listed one flyer as ”best” or “worst”, two flyers as “moderately good” or “moderately bad” and three flyers as “neutral” in his/her response booklet. This ranking method was inspired by the Q-sort methodology [37]. A group discussion on the best and the worst flyer followed. To close the discussion, participants were asked to describe their “ideal” PN service. Table 4 provides an overview of the focus group protocol.

Each focus group consisted of 5-10 participants and lasted approximately 2.5 hours. Participants received a monetary payment equivalent to €35 as a compensation for their time.

---INSERT TABLE 4 HERE---

Data analysis
First, the individual opinions written down in the response booklets were content coded using a predefined coding scheme that consisted of all service attribute levels (e.g. personal contact, dietitian, DNA) (see Table 3). Opinions were coded according to positive and negative attribute level evaluation. Positive codes were assigned to arguments for ranking a flyer as “best”. Negative codes were assigned to arguments for ranking a flyer as “worst. If a participant ranked a flyer as “worst”, but clearly stated that he/she liked one of its attribute levels, the attribute level was coded as positive and vice versa. If a participant evaluated the presence of an attribute level as positive, and the absence of that same attribute level as negative, only the positive evaluation was coded.

Second, discussion transcripts were content analysed starting from the code book that was used for the analysis of the individual opinions, but allowing for the identification of new codes. Transcripts were examined for rationales underpinning positive and negative attribute level evaluations. In order to form code families, three of the authors discussed how to assign the codes to the eight service attributes that were incorporated in the flyers. To limit the impact of isolated remarks, codes had to occur in at least two different focus groups. Data saturation was reached, as the last two transcripts did not generate any new codes.

**Results**

Based on the total sample (N=124), a clear pattern of preferred services emerged (Table 5). Across all countries, the “health club” (52%) or the “face-to-face” (27%) service stood out as most preferred business models. Identifying the “health club” and the “face-to-face” services as the two most appreciated services was consistent across countries, with small deviations. For
example, in the Netherlands the “employee lifestyle guidance” was among the two most popular services, while in Spain the “standing strong together” service was one of the two favourite services. Table 3 provides detailed information regarding the content of the different services.

---INSERT TABLE 5 HERE---

Opinions regarding the “worst” service were more diverse. Across all countries, however, the “all-in-lifestyle guidance” and the “employee lifestyle guidance” services stood out as the least appreciated business models. Spanish participants (81%) were particularly averse to the “employee lifestyle guidance” service. The Polish, German, and in particular the Dutch participants seemed to hold less negative attitudes towards the “employee lifestyle guidance” service. Spanish, German and Norwegian participants also seemed to hold less negative attitudes towards the DNA-based “all-in lifestyle guidance” service. Finally, the majority of the Norwegian participants (55%) chose the “standing strong together” service as the worst service, while in all other countries opinion regarding the “standing strong together” service were positive or mixed.

*Disclosing personal information*

Individual opinions about *personal information* show that PN based on phenotype (e.g. blood, height, weight) generated unanimously positive opinions. Remarks regarding dietary-
intake-based PN were mixed in terms of valence. Comments concerning DNA-based PN were primarily negative, although a few participants expressed positive associations with DNA-based PN (Figure 3).

---INSERT FIGURE 3 HERE---

In the group discussions participants indicated that medical tests are required to make PN truly personalised. Phenotypic information was considered a good foundation for PN, because measures such as weight, height and blood seemed very familiar, medical and informative about health:

“But blood actually tells a lot about someone’s state of health and I think everyone is used to going to the doctor for a blood test, it does at least have a context.”

(Germany)

Even though dietary intake should be accounted for during the development of a PN advice, dietary intake alone was considered too general to establish a proper personalised diet plan. With regard to DNA, participants often did not understand how DNA could contribute to the development of PN:

“I thought that my DNA has little to do with my food. DNA has been determined at birth. So that has little to do with healthy eating.”

(The Netherlands)
In addition to not understanding how DNA could contribute to PN advice, taking a DNA test at home without the help of a professional was regarded as unreliable or even impossible.

Furthermore, DNA was seen as very personal and privacy intrusive. Mailing DNA to an unknown company, as was the case in the “All-in lifestyle guidance” service, was unacceptable.

To prevent misuse of sensitive information like DNA, participants preferred to disclose DNA face-to-face, on location, to someone whom they trusted (i.e. hospital, doctor or dietitian):

“That you do the DNA test yourself and send it by mail and then you have no idea who receives it. I find that a bit disturbing.”

(Norway)

With regard to the communication channel individual opinions indicated that personal contact stood out to the participants as a positive and vital service attribute level. Online communication and communication through mail were hardly mentioned by participants (Figure 3). Results from the group discussions point out that perception of the vital role of personal contact was engendered by the belief that being able to meet the service provider would increase the trustworthiness of the service:

“I would not want to provide my personal information to anyone online who I don’t know, a company I don’t know… if I had to choose one it would be flyer 3 [the service where] I’m actually going to see someone.”

(UK)

Furthermore, personal contact made communication easier and more flexible, since it allowed for the use of, for example, body language. In addition, personal contact encouraged participants to reveal honest and complete information about themselves. Being able to communicate with the
service provider face-to-face, therefore, assured participants that their PN advice would be based on accurate and complete information:

“I assumed when I saw “personal interview” that I would be able to add in anything that I thought was important that might not have gone on the website form.”

(Ireland)

The fact that personal contact was vital and highly appreciated did not dismiss internet communication. Communicating via the internet was perceived as convenient and by no means an obstacle as long as it was supported by personal contact. However, communicating via the internet was perceived as being unfeasible to those unable to use the internet:

“(…) older people would struggle more with Internet, or with receiving emails or writing them, than people who are working. (…) I’m not sure if my mother could write an email.”

(Germany)

In summary, participants were highly sceptical about the extent to which different types of personal information, and the way they were measured, are suitable to generate a valuable and personalised dietary advice. Furthermore, in the case of DNA, the concern of possible information misuse emerged. Disclosing information in person increased participants’ trust in the service and as a result decreased the perception of potential privacy loss.

Generating advice and advice adherence
The individual opinions relating to the service provider suggested that the involvement of a qualified expert (e.g. dietitian) was perceived as positive and highly appreciated. Opinions on the employer and the government as service providers were most often negative. Comments regarding an independent company as service provider were hardly made (Figure 4).

---INSERT FIGURE 4 HERE---

According to the group discussions, participants agreed that PN should be provided by a trustworthy, qualified, expert advice provider. Factors that contributed to the trustworthiness of a provider were credentials, positive word-of-mouth and portrait images. A physician was not always considered to be a qualified expert, because (s)he would neither have the time nor the expertise to discuss nutritional problems. Views on the government as a service provider were divided. Some participants supported the involvement of the government, because the government seemed to be trustworthy. Other participants did not favour the involvement of the government, as the government was considered to have a hidden agenda:

“It’s very Big Brother is watching you.”

(UK)

Also on the subject of the employer as an advice provider, opinions were divided. Participants who regarded an employer’s involvement as positive argued that it was nice to see an employer care for his/her employees. Another advantage of the involvement of the employer was that it was good to have an intervention in the workplace, so that one could combine PN with one’s job and have the support of colleagues. Participants who considered the involvement of the employer
as negative thought that the employer could not be trusted and stated that they did not want to be treated as a workhorse or lose their job. Another argument against the involvement of an employer was that PN should not be forced upon employees as it has nothing to do with the workplace. Lack of privacy and the service only being available to employed individuals were the final two reasons for the dismissal of employer-driven services.

Individual opinions concerning customer lock-in reflected an almost equal division between opponents to and advocates for support group meetings as a way to generate advice adherence. Not having to pay for the service dependent on good results was mainly perceived as a negative lock-in, but simultaneously also accounted for positive reactions. Monthly subscription fees and paying a substantial amount of money for the first consultation while receiving a discount on the following consultations did not receive much attention from the participants (Figure 4).

Group discussions show that the strong polarisation on support group meetings was caused by the individual difference of wanting to share personal matters with a group. Not having to pay for the service dependent on good results was regarded as a customer lock-in that could stimulate advice adherence by increasing motivation to comply:

“A plus to it was that the Human Resources department contributed to it, that could be a great motivational factor if you did not have to pay 2600 kroner.”

(Norway)

Nevertheless, opponents of this lock-in argued that it had a very negative vibe. Not having to pay dependent on good results was very threatening, almost like blackmail. It was also quite risky, because at the end one might end up paying a large amount of money. Not wanting to pay for the
service might even drive a person to extremes such as starvation. Not having to pay for a service also implied that the service provider could let someone fail on purpose just to obtain the money:

“The main objective of a company is to earn money, so if they're telling you they are going to earn money if you don't get [good] results, I think, they are going to do something in order to not make me succeed.”

(Spain)

Additionally, the lack of clarity concerning what constitutes “good results” and who would define “good results” was raised as an argument against a lock-in dependent on good results.

According to some participants having to pay a substantial amount of money in order to get PN advice was strong lock-in. Furthermore, the possibility of having to pay for a PN advice also served as an indicator of quality:

“I always think that when something is for free it’s not worth the money. Then it’s something you wouldn’t value a lot.”

(Norway)

Participants claimed that their commitment to PN would be highest if they would see that the advice really works.

Individual opinions with regard to applied advice justifications did not evoke many comments. There seemed to be a tendency to dislike alternative medicine as PN advice justification (Figure 4).
Group discussions revealed that alternative medicine and organic products were two service attribute levels that stood out to the participants, in both a positive and a negative way. Some participants were quite interested in, and in favour of, alternative medicine:

“Alternative medicine is interesting, I’d really like to hear something on that topic, and organic products too.”

(Poland)

Participants who did not appreciate the idea of PN advice that is justified by alternative medicine and organic products argued that such advice is more expensive, vague, unreliable, and not scientific.

The few remarks that were made about success stories pointed out that participants liked reading success stories, but that they did not regard successes stories as a reliable advice justification:

“Success stories always make me suspicious you know, because you wonder do they just sit down and make up this stuff.”

(Ireland)

To summarise, PN being provided by a qualified expert increased participants’ value perception of the dietary advice. Furthermore, value perception was determined by the approach that justified the advice. Stimulating advice adherence was perceived as beneficial as long as it fitted the individuals’ views and personality. Being able to trust the service provider determined participants’ general willingness to engage in a PN service.

Providing advice
Individual opinions concerning advice scope indicated that providing exercise advice, in addition to dietary advice, was perceived as a positive feature of PN services. In line with the importance of exercise, providing exercise facilities was considered a valuable addition to PN advice. Furthermore, a shopping list and lifestyle advice were seen as valuable extensions to PN. Accounting for personal food preferences was considered negative as well as positive (Figure 5).

---INSERT FIGURE 5 HERE---

Group discussions reflected that PN should have a broader focus than merely weight loss.

Participants agreed that PN should aim at changing someone’s lifestyle:

“Personalised nutrition should become lifestyle, to learn how to eat right or put exercise in our life, not because we have to, for losing weight, but because... it’s good for my health.”

(Greece)

In line with this lifestyle focus and the fact that diet and exercise were often seen as inextricably linked, exercise was one of the most important advice extensions:

“Everyone knows that that is the best... Diet and exercise.”

(The Netherlands)

In addition, advice extensions like exercise facilities and a shopping list were regarded as valuable, because they increased convenience and therefore made adhering to the advice easier.
Advice adherence was also stimulated by progress measurement and support, especially when these were provided face-to-face:

“*When someone is monitoring you, then you follow the diet, because you get embarrassed the next time you go to a meeting and say you did not lose a gram.*”

(Greece)

Moreover, some participants perceived accounting for personal food preferences as an attribute that contributed to advice adherence. Yet, other participants stated that personal food preferences did not belong in a proper/healthy diet because they often are unhealthy:

“The [personal food] preferences were the very reason that you now need to diet.”

(The Netherlands)

Addressing psychological issues and teaching individuals how to eat healthily, were two attributes that came up without being mentioned in any of the service flyers.

Individual opinions relating to *advice frequency* indicated that most participants appreciated weekly meetings. However, a few participants considered weekly meetings to be too often. A one-off advice was regarded quite negatively. Receiving updated advice once every three months did not generate many comments, although the participants who did comment on this advice frequency level perceived it as insufficient (Figure 5).

Group discussions offered more insight into participants’ underlying reasoning by revealing that regular meetings to measure progress and provide support were considered important, as they generated motivation for advice adherence. The meaning of “regular” varied strongly between
participants. For some, regular meetings were weekly, while for others, regular meetings came down to once or twice a month. According to the participants, at the beginning of the lifestyle-change-process, frequent meetings were essential for compliance. Once one is accustomed to the new lifestyle, meeting frequency could be phased out:

“In the beginning you might have the need for close follow up and then, when you start to gain more control, then you don’t need it that often.”

(Norway)

Regardless of the advice frequency, follow-up should always be based on an individual’s progress:

“One you are providing somebody with information of how you’re changing and how you’re sticking to your diet a follow up diet is useless.”

(Ireland)

One-off advice was regarded as insufficient, not only because it did not provide motivation or advice updates, but also because services that offered one-off advice seemed untrustworthy:

“With flyer 5 (once off advice) it does seem like it’s, we’re going to take your money and run. (...) It just seems like a £50 payment to have one diet plan and we’ll never speak to you again, what’s the point. You know, you need to change, it needs to change with you. Yeah that just seems really dodgy.”

(UK)

Furthermore, the perception of service trustworthiness was decreased by having to pay one single payment in advance:

“To begin we only have to pay this three hundred fifty zloty once, (...) and then we don’t know what comes next. If we have some questions, doubts, will they send us answers?”
In line with the results that were found for the disclosure of personal information, personal contact was again the most appreciated communication channel. Both the individual opinions and the group discussions mirrored the previously discussed results regarding the disclosure of personal information (Figure 5).

In summary, PN extending beyond pure dietary advice was perceived to be beneficial, as the added extras often increased convenience and stimulated advice adherence. Advice adherence was also stimulated by regular face-to-face meetings. Furthermore, participants used meeting frequency to assess the trustworthiness of a service. Paying in advance for one-off services was regarded as particularly risky.

Discussion

Using structured focus group discussions in 8 EU member states, this study explored consumer evaluations of different PN services. PN requires consumers to disclose personal and potentially sensitive information about themselves. This study adopted the privacy calculus (i.e. the trade-off between privacy risks and personalisation benefits) as its underlying framework, and linked it to the three stages of PN provision: disclosing personal information, generating PN advice and advice adherence, and providing PN advice. Service attributes of all three stages were expected to influence consumer uptake of PN through the perception of privacy risks and/or the perception of personalisation benefits.
The results suggest that, in contrast to disclosing phenotypic or dietary intake information, most participants were rather negative about disclosing DNA to a PN service. The reluctance to disclose DNA was in part triggered by consumer scepticism about how DNA can contribute to the generation of PN advice. This finding is in line with recent research [38-40], which states that consumers are often not familiar with the link between DNA and nutrition advice. Ignorance about the fact that DNA is relevant for the generation of PN might have lowered the perception of personalisation benefit. In addition to perceiving DNA as irrelevant to PN, and consistent with studies into consumer attitudes [41-43], disclosing DNA to a PN service was identified as very privacy sensitive. Participants, for example, mentioned that DNA should not fall into the wrong hands. Worrying about how DNA might be used for purposes beyond the creation of PN advice may have increased participants’ privacy risk perception. Concerns regarding privacy loss were not, however, prominent when utilising dietary intake and phenotypic information. Given that DNA-based PN failed to provide clear benefits [44] and simultaneously accounted for a high awareness of potential privacy loss, it is not surprising that DNA was often seen as the least favourite foundation of PN. Nevertheless, we should be cautious about fully dismissing DNA-based PN as not all consumers hold a negative attitude towards genetic testing [45]. This may be especially true of individuals with an above average risk of developing chronic diseases, as they are more prepared to undergo genetic testing for the purpose of PN [46].

Consumer perception of privacy risk and personalisation benefit did not merely depend on the required personal information. A substantial part of the trade-off between privacy risks and personalisation benefits could be explained by the design of a PN service. Especially the presence of face-to-face communication was important in determining the extent to which
597 personalisation benefits and privacy risks were perceived. Being able to communicate face-to-
598 face was perceived vital for the quality of the PN advice and as a consequence the perception of
599 personalisation benefit. According to the participants, disclosing information in person resulted
600 in more accurate and detailed information, which is necessary for truly personal dietary advice.
601 Furthermore, communicating face-to-face induced the feeling of interacting with a “real” person
602 with whom one is “acquainted”. Experiencing such feeling may have given participants a greater
603 sense of control over service provision, which determines the extent to which consumers trust
604 that service provision will proceed as agreed [47]. Therefore, trust induced by the feeling of
605 perceived control may have contributed to a decreased perception of privacy risk [48-50].
606 Face-to-face communication did, however, fail to mitigate privacy risk perception when
607 participants perceived the service provider as untrustworthy. Service providers that appeared to
608 be driven by financial gain or information misuse, as was often the case with the employer and
609 the government, were generally perceived as untrustworthy. Participants gave the impression of
610 being more comfortable with scientifically trained experts related to a dietitian’s practice or a
611 fitness club. Placing trust in experts who are focused on health improvement rather than financial
612 gain or information misuse, corresponds with the three drivers of service trustworthiness,
613 namely: ability, integrity and benevolence [51]. Perceiving the service provider as being able,
614 having integrity, and being benevolent might have mitigated privacy risk perception and
615 amplified personalisation benefit perception, because these characteristics ensure that a service
616 provider will keep to his word [52]. The preference for scientifically trained experts related to a
617 tangible service might also be explained by the fact that when it comes to health western
618 consumers are accustomed to personal interaction [53] with qualified professionals trained in
619 conventional medicine [54]. Often, consumers tend to choose services to which they are
accustomed, because such services strengthen their confidence in the success of service provision
[55]. Consequently, having confidence in the success of the service provision may decrease
privacy risk perception and increase personalisation benefit perception.

Participants argued that for them to take full benefit from the provided PN advice, a PN
service should aim at changing an individuals’ lifestyle rather than merely serving as a weight-
loss tool. To achieve this aim, the incorporation of exercise was essential. Moreover, to increase
benefit perception PN should be convenient and include a level of support that stimulates advice
adherence. Participants did not agree on the way in which advice adherence should be stimulated.
The desirability of an advice adherence strategy depended on the extent to which the strategy was
perceived as risky. Some participants were, for example, not keen on support group meetings,
because attending such meetings required sharing personal matters and with that giving up one’s
privacy. To maximise convenience and advice adherence, PN services should be tuned to
individual preferences. This finding is in line with the study of Stewart-Knox et al. [56], which
states that PN should indeed be tailored to consumers’ lifestyle, motivations, and efficacy. Since
attempts to change dietary habits often fail [57,58], paying attention to individual needs
regarding advice adherence may prove vital to make engaging in PN attractive.

Although the focus groups yielded a wealth of information, this study is not without
limitations. It should be kept in mind that focus group discussions are a qualitative research
method that provides purely indicative results. In addition, focus group discussions are not
suitable to identify specific cross-country differences, which places cross-cultural comparison
beyond the scope of this study. Hence, to identify cultural differences, quantify the results, and
firm the findings a large-scale quantitative data collection stream is required. Furthermore, the
fact that lay-out, wording and price differed across the nine flyers used as stimulus material may
have influenced participants’ opinions regarding the different PN services. However, since the
two most (79%) and two least (58%) appreciated services accounted for a large proportion of
participants’ preferences for PN services, we can assume that the effect of flyer lay-out, wording,
and price was limited. Furthermore, the group discussions did not give the impression that
participants placed greater importance on lay-out and wording than on content. Using different
lay-outs and wordings may, however, have helped participants to perceive the flyers as different
PN services, making ranking easier, more realistic, and more useful.

Conclusion

As a basis for quantification in future research, this study provides an initial insight into
service attributes that influence consumer uptake of PN. The qualitative results confirm that
disclosing personal information in order to receive PN advice may encounter resistance due to a
high perception of privacy risk (i.e. DNA) and/or a low perception of personalisation benefit (i.e.
dietary intake). This finding supports the assumption that consumers evaluate PN services
according to a privacy calculus. Adoption of PN could be increased if in its positioning PN
services would account for attributes that reduce privacy risk perceptions and amplify
personalisation benefit perceptions. This study suggests that to do so, PN services should include
face-to-face communication, exercise in addition to diet, and trustworthy expert advice providers.
Furthermore, it is important to include service attributes that increase advice adherence. Even
though including such attributes would most likely amplify benefit perception, advice adherence
strategies that are not in line with consumers’ needs may have the opposite effect or even
increase risk perception. Hence, service attributes that enhance advice adherence should be
tailored to the needs of specific consumer segments. Above all, consumers’ benefit perception of
PN could be amplified by contextualising PN services as lifestyle instead of dietary advice
focused.

Acknowledgments

This research was carried out within the context of Food4Me, which is the acronym of the
EU FP7 project “Personalised nutrition: an integrated analysis of opportunities and challenges”
(Contract no. KBBE.2010.2.3-02, Project no.265494), http://www.food4me.org/. The authors
would like to thank the focus groups moderators and their assistants for conducting, transcribing
and translating the focus group discussions.

References

1 German JB, Zivkovic AM, Dallas DC, Smilowitz JT: Nutrigenomics and personalized
diets: What will they mean for food?; in Doyle MP, Klaenhammer TR (eds): Annual review of
2 Bouchard C, Ordovas JM: Fundamentals of nutrigenetics and nutrigenomics. Progress in
3 Joost HG, Gibney MJ, Cashman KD, Gorman U, Hesketh JE, Mueller M, van Ommen B,
Williams CM, Mathers JC: Personalised nutrition: Status and perspectives. British Journal of
4 de Roos B: Personalised nutrition: Ready for practice? Proceedings of the Nutrition
5 Little J, Hawken S: On track? Using the human genome epidemiology roadmap. Pub
Health Genomics 2010;13:256-266.
6 Fenech M, El-Soehmy A, Cahill L, Ferguson LR, French TAC, Tai ES, Milner J, Koh
WP, Xie L, Zucker M, Buckley M, Cosgrove L, Lockett T, Fung KYC, Head R: Nutrigenetics
and nutrigenomics: Viewpoints on the current status and applications in nutrition research and


Rimbach G, Minihane AM: Nutrigenetics and personalised nutrition: How far have we progressed and are we likely to get there? Proc Nutr Soc 2009;68:162-172.


Pavlou PA: State of the information privacy literature: Where are we now and where should we go? MIS Quarterly 2011;35:977-988.


Wendel S, Dellaert BGC, Ronteltap A, van Trijp HCM: Consumers' intention to use health recommendation systems to receive personalized nutrition advice. BMC Health Services Research 2013;13

Li Y: Theories in online information privacy research: A critical review and an integrated framework. Decision Support Systems 2012


30


Figure 1. Conceptual framework

Figure 2. Schematic overview of the PN information exchange process and its attributes

Figure 3. Evaluations of the “Disclosing personal information” service attribute levels

Figure 4. Evaluations of the “Generating advice and advice adherence” service attribute levels

Figure 5. Evaluations of the “Providing advice” service attribute levels
<table>
<thead>
<tr>
<th>Business model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &quot;Employee lifestyle guidance&quot;</td>
<td>An employer offering a lifestyle advice program to its employees</td>
</tr>
<tr>
<td>2 &quot;Standing strong together&quot;</td>
<td>Enhancing healthy lifestyle through social support (e.g. Weightwatchers)</td>
</tr>
<tr>
<td>3 &quot;Health club&quot;</td>
<td>A fitness club enabling lifestyle change by providing training facilities and coaching</td>
</tr>
<tr>
<td>4 &quot;Do-it-yourself-healthy-diets&quot;</td>
<td>An internet based business model, with little or no follow up</td>
</tr>
<tr>
<td>5 &quot;Step in, step out&quot;</td>
<td>An (often) internet based business model allowing for personal contact, which provides optional follow up on monitored progress</td>
</tr>
<tr>
<td>6 &quot;Test and run to the finish&quot;</td>
<td>An (often) internet based business model allowing for personal contact, which provides repeated follow up on consumers’ progress and the possibility to adjust the dietary advice</td>
</tr>
<tr>
<td>7 &quot;All-in lifestyle guidance&quot;</td>
<td>Enhancing healthy lifestyle through a broad DNA based lifestyle advice</td>
</tr>
<tr>
<td>8 &quot;Face 2 face&quot;</td>
<td>Traditional dietitian’s practice</td>
</tr>
<tr>
<td>9 &quot;We told you so&quot;</td>
<td>Healthy lifestyle advice offered through mass-media communication channels by non-profit organisations to improve public health</td>
</tr>
</tbody>
</table>

**Table 1.** Descriptions of archetypical PN business models
Table 2. Socio-demographic characteristics of the sample (N = 124)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>20.2%</td>
</tr>
<tr>
<td>30-45</td>
<td>39.5%</td>
</tr>
<tr>
<td>45-65</td>
<td>38.7%</td>
</tr>
<tr>
<td>Not recorded</td>
<td>1.6%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>49.5%</td>
</tr>
<tr>
<td>Female</td>
<td>49.5%</td>
</tr>
<tr>
<td>Not recorded</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>47.6%</td>
</tr>
<tr>
<td>Lives with partner</td>
<td>16.1%</td>
</tr>
<tr>
<td>Divorced</td>
<td>4.0 %</td>
</tr>
<tr>
<td>Single</td>
<td>29.0%</td>
</tr>
<tr>
<td>Other</td>
<td>1.6%</td>
</tr>
<tr>
<td>Not reported</td>
<td>1.7%</td>
</tr>
<tr>
<td><strong>Education¹</strong></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>11.3%</td>
</tr>
<tr>
<td>Secondary</td>
<td>36.3%</td>
</tr>
<tr>
<td>Higher</td>
<td>50.0%</td>
</tr>
<tr>
<td>Not reported</td>
<td>2.4%</td>
</tr>
<tr>
<td><strong>Modal wage²</strong></td>
<td></td>
</tr>
<tr>
<td>Less than modal</td>
<td>20.2%</td>
</tr>
<tr>
<td>Approximately modal</td>
<td>16.1%</td>
</tr>
<tr>
<td>Higher than modal</td>
<td>42.7%</td>
</tr>
<tr>
<td>No answer</td>
<td>21.0%</td>
</tr>
</tbody>
</table>

¹ Primary = levels 0,1 and 2 of the international standard classification of education.
¹ Secondary = levels 3 and 4 of the international standard classification of education.
¹ Higher = level 5 and 6 of the international standard classification of education
² Compared to the national modal wage of the participant’s country of origin
### Table 3. Overview of the stimulus material

<table>
<thead>
<tr>
<th>Business model</th>
<th>Personal information</th>
<th>Communication channel (C2S)</th>
<th>Service provider</th>
<th>Advice justification</th>
<th>Customer Lock-in</th>
<th>Advice scope</th>
<th>Advice frequency</th>
<th>Communication channel (S2C)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“We told you so”</td>
<td>Dietary intake</td>
<td>Online</td>
<td>Company</td>
<td>Scientific</td>
<td>€ 175</td>
<td>Diet plan</td>
<td>1x 2 months</td>
<td>Online</td>
</tr>
<tr>
<td>“All-in lifestyle guidance”</td>
<td>DNA</td>
<td>Mail</td>
<td>Company</td>
<td>Scientific</td>
<td>€ 195</td>
<td>Diet plan</td>
<td>1x 3 months</td>
<td>Online</td>
</tr>
<tr>
<td>“Step in, step out”</td>
<td>Phenotype</td>
<td>Personal contact</td>
<td>Company</td>
<td>Scientific</td>
<td>€ 185</td>
<td>Diet plan</td>
<td>1x 3 months</td>
<td>Online</td>
</tr>
<tr>
<td><strong>Set 2</strong></td>
<td></td>
<td></td>
<td>Dietitian</td>
<td>Scientific</td>
<td>First 2 consultations € 200, all following consultations € 20</td>
<td>Diet plan, lifestyle advice</td>
<td>1x per week</td>
<td>Personal contact</td>
</tr>
<tr>
<td>“Face-to-face”</td>
<td>Phenotype</td>
<td>Personal contact</td>
<td>Company</td>
<td>Alternative medicine &amp; organic products</td>
<td>Support group meetings/subscription</td>
<td>Diet plan, lifestyle advice</td>
<td>1x per week</td>
<td>Personal contact</td>
</tr>
<tr>
<td>“Standing strong together”</td>
<td>Phenotype</td>
<td>Personal contact</td>
<td>Government/Employer</td>
<td>Success stories</td>
<td>Getting the service for free in depending on good results</td>
<td>Diet plan, lifestyle advice</td>
<td>2x per month</td>
<td>Personal contact</td>
</tr>
<tr>
<td>“Employee lifestyle guidance”</td>
<td>Phenotype</td>
<td>Personal contact</td>
<td>Government/Employer</td>
<td>Success stories</td>
<td>Getting the service for free in depending on good results</td>
<td>Diet plan, lifestyle advice</td>
<td>2x per month</td>
<td>Personal contact</td>
</tr>
<tr>
<td><strong>Set 3</strong></td>
<td></td>
<td></td>
<td>Dietitian</td>
<td>Success stories</td>
<td>€ 50</td>
<td>Only once</td>
<td>Mail</td>
<td></td>
</tr>
<tr>
<td>“Do-it-yourself-healthy-diets”</td>
<td>Dietary intake</td>
<td>Online</td>
<td>Dietitian</td>
<td>Success stories</td>
<td>€ 50</td>
<td>Only once</td>
<td>Mail</td>
<td></td>
</tr>
<tr>
<td>“Test and run to the finish”</td>
<td>Dietary intake</td>
<td>Online</td>
<td>Dietitian</td>
<td>Success stories</td>
<td>€ 75</td>
<td>Only once</td>
<td>Mail</td>
<td></td>
</tr>
</tbody>
</table>

Note: The table includes three sets of stimulus material, each with different business models, personal information, communication channels, service providers, advice justifications, customer lock-ins, advice scopes, advice frequencies, and communication channels. Each set is described with specific details regarding diet plans, advice, and service delivery methods.
Table 4. Overview of the focus group protocol

<table>
<thead>
<tr>
<th>Protocol stage</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Introduction of the staff and participants, clarification of discussion ground rules.</td>
</tr>
<tr>
<td>Warm-up</td>
<td>Defining the meaning of PN before and after definition</td>
</tr>
<tr>
<td>Round 1: Disclosing personal</td>
<td>• Individual ranking of flyer set 1</td>
</tr>
<tr>
<td></td>
<td>• Plenary discussion of flyer set 1 ranking</td>
</tr>
<tr>
<td>Round 2: Providing advice</td>
<td>• Individual ranking of flyer set 3</td>
</tr>
<tr>
<td></td>
<td>• Plenary discussion of flyer set 3 ranking</td>
</tr>
<tr>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>Round 3: Generating advice and</td>
<td>• Individual ranking of flyer set 2</td>
</tr>
<tr>
<td>advice adherence</td>
<td>• Plenary discussion of flyer set 2 ranking</td>
</tr>
<tr>
<td>Round 4: Overall ranking</td>
<td>• Individual ranking of all flyers</td>
</tr>
<tr>
<td></td>
<td>• Plenary discussion of best/worst flyer</td>
</tr>
<tr>
<td>Wind-down</td>
<td>Discussion on the “ideal” PN service</td>
</tr>
<tr>
<td>Wrap-up</td>
<td>Final thoughts and word of thanks</td>
</tr>
</tbody>
</table>
Table 5. Observed service preference in percentages per country

<table>
<thead>
<tr>
<th>Service</th>
<th>Total sample (N=124)</th>
<th>Ireland (N=20)</th>
<th>UK (N=17)</th>
<th>Netherlands (N=19)</th>
<th>Norway (N=11)</th>
<th>Spain (N=16)</th>
<th>Greece (N=13)</th>
<th>Germany (N=14)</th>
<th>Poland (N=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best</td>
<td>Worst</td>
<td>Best</td>
<td>Worst</td>
<td>Best</td>
<td>Worst</td>
<td>Best</td>
<td>Worst</td>
<td>Best</td>
</tr>
<tr>
<td>&quot;Health club&quot;</td>
<td>&quot;Face-to-face&quot;</td>
<td>&quot;Standing strong together&quot;</td>
<td>&quot;Employee lifestyle guidance&quot;</td>
<td>&quot;Step in, step out&quot;</td>
<td>&quot;Do-it-yourself-healthy-diets&quot;</td>
<td>&quot;All-in lifestyle guidance&quot;</td>
<td>&quot;We told you so&quot;</td>
<td>&quot;Test and run to the finish&quot;</td>
<td></td>
</tr>
<tr>
<td>&quot;Health club&quot;</td>
<td>52%</td>
<td>55%</td>
<td>88%</td>
<td>12%</td>
<td>63%</td>
<td>5%</td>
<td>46%</td>
<td>5%</td>
<td>46%</td>
</tr>
<tr>
<td>&quot;Face-to-face&quot;</td>
<td>27%</td>
<td>25%</td>
<td>12%</td>
<td>5%</td>
<td>63%</td>
<td>5%</td>
<td>46%</td>
<td>5%</td>
<td>46%</td>
</tr>
<tr>
<td>&quot;Standing strong together&quot;</td>
<td>9%</td>
<td>11%</td>
<td>5%</td>
<td>10%</td>
<td>12%</td>
<td>11%</td>
<td>5%</td>
<td>12%</td>
<td>5%</td>
</tr>
<tr>
<td>&quot;Employee lifestyle guidance&quot;</td>
<td>5%</td>
<td>32%</td>
<td>5%</td>
<td>30%</td>
<td>29%</td>
<td>16%</td>
<td>5%</td>
<td>27%</td>
<td>9%</td>
</tr>
<tr>
<td>&quot;Step in, step out&quot;</td>
<td>3%</td>
<td>2%</td>
<td>5%</td>
<td>2%</td>
<td>12%</td>
<td>5%</td>
<td>5%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>&quot;Do-it-yourself-healthy-diets&quot;</td>
<td>3%</td>
<td>2%</td>
<td>5%</td>
<td>2%</td>
<td>12%</td>
<td>5%</td>
<td>5%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>&quot;All-in lifestyle guidance&quot;</td>
<td>1%</td>
<td>26%</td>
<td>40%</td>
<td>18%</td>
<td>18%</td>
<td>58%</td>
<td>9%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>&quot;We told you so&quot;</td>
<td>1%</td>
<td>14%</td>
<td>5%</td>
<td>18%</td>
<td>5%</td>
<td>11%</td>
<td>9%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>&quot;Test and run to the finish&quot;</td>
<td>14%</td>
<td>15%</td>
<td>12%</td>
<td>16%</td>
<td>9%</td>
<td>6%</td>
<td>15%</td>
<td>29%</td>
<td>7%</td>
</tr>
</tbody>
</table>
Figure 1
Figure 2

1. Personal information
   Communication channel (C2S)

2. Service provider
   Advice justification
   Customer lock-in

3. Advice scope
   Advice frequency
   Communication channel (S2C)
**Figure 3**

<table>
<thead>
<tr>
<th>PERSONAL INFORMATION</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on (only) dietary intakes</td>
<td>15</td>
<td>8</td>
<td>39</td>
</tr>
<tr>
<td>Based on phenotype</td>
<td>40</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Based on (only) DNA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION CHANNEL (CF5)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Person-to-person contact</td>
<td>59</td>
</tr>
<tr>
<td>Online communication</td>
<td>3</td>
</tr>
<tr>
<td>Mail</td>
<td>0</td>
</tr>
</tbody>
</table>
Figure 4

--- SERVICE PROVIDER ---
- Expert/Doctor
  - Government: 5
  - Employer: 12
  - Company: 5

--- CUSTOMER LOCK-IN ---
- Group meeting: 20
- Free depending on good results: 23
- High initial payment: 3
- Subscription: 2

--- ADVICE JUSTIFICATION ---
- Alternative medicine: 5
- Organic products: 2
- Scientific evidence: 2
- Success stories: 2
**Figure 5**

### Advice Scope
- Diet & Exercise
- Lifestyle advice
- Exercise facilities
- Nutrition
- Shopping list

Based on personal food preferences

### Advice Frequency
- Telephone/face-to-face: 2
- Updates 2x per month: 4
- Meetings 1x per month: 1

### Communication Channel (52C)
- Personal contact: 56
- Online communication: 1
- Mail: 1

<table>
<thead>
<tr>
<th>Service</th>
<th>Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>-5</td>
<td>4</td>
</tr>
<tr>
<td>-3</td>
<td>32</td>
</tr>
<tr>
<td>46</td>
<td>1</td>
</tr>
<tr>
<td>56</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>