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Abstract. According to a vision for eHealth launched in 2016 by the Swedish Government, Sweden will be leading the way in using the potential of digitalization and eHealth to help people achieve a good and equal health. To achieve this vision, we argue that initiatives in eHealth need to augment a health promotion perspective. This implies a more preventive approach that transforms the health concept to a continuous participative process over the life course. A stronger emphasis on consumer technologies is needed to understand how interaction with web based and mobile systems may affect health related choices, and how to empower people to pursue a healthy lifestyle. A topic of particular significance is how mobile applications may utilize the theoretical principles for behavior change. In this context, it is relevant to analyze how nudges can be implemented in a mobile context. We propose that more research is needed in this area.

Keywords: eHealth, mobile health, nudging, preventive paradigm

1 Future Welfare Challenges and a Vision for eHealth

Due to the changing demographics in Europe, one of the challenges in the future will be financing high quality welfare. The aging population is a product of a longer life expectancy as well as fewer children who are born per family. As an aging population is associated with higher costs for health care, and a shorter amount of the life span is devoted to labor, these changes increase the load of the demographic dependency ratio and will consequently pose challenges for welfare. [1] In order to ensure equal and efficient health care coverage over the country, Sweden is currently putting a lot of effort in to eHealth. What is more, eHealth is also seen as a facilitator to increase patient participation and influence [2]. In Sweden, the term eHealth is commonly described in line with the definition by the National Board of Health and Wellbeing: “By health, we mean physical, mental and social well-being. E-health is about using digital tools and sharing information digitally to achieve and maintain a good level of health.” [3]

In 2016, the Swedish Government and the Swedish Association of Local Authorities and Regions (SALAR), launched a vision for eHealth:

“In 2025, Sweden will be best in the world at using the opportunities offered by digitization and eHealth to make it easier for people to achieve good and equal health and welfare, and to develop and strengthen their own resources for increased independence and participation in the life of society.” [4]

To fulfill this vision and to build a solid foundation for further eHealth initiatives, an eHealth action plan was also launched for the years 2017-2019. The plan focuses mainly on three strategic areas: regulations, a more standardized use of terminology and standardization from a technical perspective. [5]

The eHealth organizational structure on national level is also introduced in the action plan [5]. A challenge in the implementation of new systems, standards or processes is that the Swedish county councils are self-governed and have their own political organization. In addition, there is also a range of private health care providers.

What is more, the action plan emphasizes the need for more cooperation and exchange of information between caregivers, and from caregiver to patient [5]. This care-oriented side of the eHealth development is undeniably a crucial part of the work that is needed to realize the eHealth vision. However, as the vision also implies individual empowerment and a holistic and participatory perspective of eHealth, we argue that it is equally important to undertake actions and strategies that goes beyond the context of care and social care and includes more of a health promotion perspective. A health promotion perspective involves i.e. focusing on preventive approaches that goes beyond clinical and curative services. It includes creating supportive environments, empowering communities to public participation in health matters, and supporting the public in developing skills to pursue a healthy lifestyle. By addressing the determinants of health and promoting healthy lifestyles, and thus provide the means needed for individuals to make healthy decisions, a large proportion of ill health can be avoided. [6].

In an eHealth context, this approach can be adopted by emphasizing the systems and solutions that are commonly used by the public [7, 8]. Mobile and web-based solutions may need more attention to understand how to empower people to pursue a healthy lifestyle and how information environments online facilitate health decisions in today's society. This would also involve a more holistic approach to the *health* concept in eHealth; from a patient oriented to a public concern, and from a health care-oriented context towards a continuous process taking place where people live, work and play.

1.1 To Achieve a Good Level of Health

The endeavor to “achieve and maintain a good level of health” must be a continuous process over the life course. Some of the largest challenges to health care today are no longer challenges of biomedical nature, but rather connected to lifestyle, health related behaviors and choices [9]. The preventive and proactive perspective of eHealth empowers the individuals to be aware of their health status and, at the same time, it also implies that individuals have responsibility to lead healthy lives [7]. Consequently, this approach comprises numerous decisions that an individual makes in order to adjust one's behavior and lifestyle. Health supporting technologies and mobile health devices play an important role as they can provide information and support for rational decisions. In this context, it is also relevant to explore how nudges can be implemented in a digital context in order to promote preferred behavioral patterns. Nudging is a theoretical concept [10, 11] that describes purposeful design elements within a specific environment, with the aim to alter people's choices in

predictable ways without enforcement. In this work, we use the concept of technology mediated nudging, to emphasize the need for convergence between the digital context and actual real-life choices and behavior.

2 Mobile Health - a Paradigm Shift in the Consumption of Health

The rapid development of mobile systems is transforming how health is consumed, delivered and monitored, with opportunities for more personalized services as well as more effective public health monitoring systems [12]. The potential of this area is emphasized by both the United Nations and the WHO [12] and is often termed mHealth or mobile health. mHealth is described as a sub area for eHealth, where health work is supported by mobile and wireless technologies [12].

The development of mobile health applications, wearables and self tracking trends can be seen as a part of a greater paradigm shift in the consumption of health [7].

Mobile health technologies involve the opportunities to empower patients with tools for measurement, previously only available in health care settings [13]. And also access to information in real time and real-life settings. This may involve a redistribution of power between the health professional and the individual patient [7]. The elements in mobile health involving empowerment and participatory approaches, lifestyle and prevention focus, public access, and real-life environments implies that mobile health approaches can be placed in a health promotion context.

Smartphones have changed our daily habits and are now a necessity for many people. Communication, travel, entertainment, education, finance and many other aspects of life are now managed through this technology, and most people spend several hours a day interacting with their mobile phones [13]. The rapid change, in which we have adapted to smartphones and changed our habits and lifestyles around this small device, reveals some of its persuasive nature. Hence, there is a fair amount of interest in how mobile devices can facilitate behavior change to support people towards a healthier lifestyle. For example by encouraging users to increase their amount of physical activity [14], support smoke cessation [15], weight management [16] and support adherence to medical treatments such as vaccination [17, 18]. But still, many challenges remains as security, regulatory [13], adoption and adherence strategies need more evidence [14]. More research is also needed to understand how mobile-based interventions can be better grounded in theory [14]. A topic of particular significance is how mobile applications may utilize the theoretical principles for behavior change. In this context, it is relevant to analyze how nudges can be implemented in a digital context to promote preferred behavioral patterns.

3 Nudging

Nudging is a concept developed by Thaler and Sunstein [11] within the area of behavioral economics. A nudge is described as a purposeful design element within a specific choice architecture (environment), which may alter people's choices in predictable ways without enforcement. The approach has been used for example in politics, economy, and policymaking and to promote desirable, more sustainable or healthy choices. A few examples are shifting to smaller plates, placing vegetables first in restaurants, or using default options when we want people to choose more wisely [11]. In public health, nudges have shown some promising results and they seem to be more efficient in changing health behaviors than the traditional approach of providing information and expect rational decisions [19].

Nudges are based on the notion that human decision-making is often biased, non-rational and depending on the context. What is more, many behaviors are routine based or automatic, and done using a minimum of cognitive effort [9]. Many examples of non-rational behavior are also expressed in health-related behaviors, or to be more precise, risk behaviors. Smoking, choosing unhealthy food or avoiding exercise are examples of choices or behaviors that most people engage in even though we are aware of the risks. These choices provide often a short-term benefit, or are convenient, in contrast to the long-term health risks they pose. With this being said, a somewhat paternalistic approach may be motivated to facilitate more healthy choices [10, 11]. Thaler and Sunstein [11] further argue that there is no such thing as a neutral design, and it is better to maximize the outcome to facilitate better choices, than leave it for random, or even worse, help people make unhealthy choices. The philosophical idea underpinning this approach is called libertarian paternalism. The idea of libertarian paternalism is that people may need help in making the best decisions, and good design should facilitate good choices. This without using coercion or force, or taking other options out of the equation [10]; i.e. by placing fruit in close reach in a cafeteria, people might choose the healthier option, but they should be free to choose other options if they prefer, hence the idea of liberalism.

Nudges have been successfully implemented in a number of areas to guide behavior and choices [9, 11]. Since an increasing amount of choices today are taking place in digital environments, the design of information in digital interfaces is becoming increasingly important to understand people's choices, hence digital nudging is proposed as an important area of research [20, 21]. It is expected to become increasingly important within information systems research and design, as the progression of knowledge within the behavioral and cognitive sciences are needed in the design of interfaces [21]. This is particularly relevant in the eHealth domain.

Some examples of digital nudging is how information is framed, providing feedback, or setting default options. Previous studies have contributed to causal evidence to the effect on user behavior when manipulating some of these aspects in online environments [22]. In the health area, mobile devices that provide feedback to the user on sleep or physical activity are some examples mentioned in the literature. However, more research is requested, to understand the theoretical basis of nudges in digital interfaces, and how these can inform the design of persuasive systems [21].

4 Challenges and Need for Future Research

Some of the challenges with guiding decisions in digital contexts, are the ethical concerns. Today, many decisions online are affected by personalized environments such as social media, which may in practice “re-inforce poor judgement” and tend to be based on social norms rather than ethical choices [23]. As mobile devices are increasingly used to access information, these interfaces are increasingly important to understand decision making at the moment it takes place [23]. The ubiquitous nature of these devices means that they can inform users at the time and place of almost every decision we make. What is more, how we are affected (nudged) by many environments online is mostly opaque and increasingly dependent on algorithmic selection. This is also important to relate to health decisions, and is an area that may need more research to understand the impact on public health.

When discussing the ethics of nudges, it is important to keep the philosophical ideas of libertarian paternalism in mind, and also Thaler and Sunstein's [11] guidelines that nudges should be transparent, easy to avoid (without too much effort or cost), and also implemented to support the individual to make good decisions for oneself. Herein lies the founding idea of libertarian paternalism (ibid). However, the

idea of libertarian paternalism is in itself criticized, and if these disparate philosophical streams are truly compatible [24]. Also, how to unify this with the idea of individual empowerment in the context of mobile health decisions leave room for further discussions.

If nudges are used to support healthy behavior, it is hence important to clarify - who is being nudged by whom, is the user aware of being nudged, what is the intended outcome [11], and in the context of health -is the strategies and outcome in line with medical evidence? An interesting example is mobile health applications and devices that support exercise. Fitbit is one example mentioned in the literature [21]. Other examples could be to support smoke cessation, dietary behavior, or adherence to medical treatments.

In these cases, one may assume that the individual user have taken an autonomous decision to download or buy the specific technology, presumably with the goal to be more healthy, and hopefully with awareness of the persuasive nature of these technologies. The intended outcome (to increase exercise for example) is in line with medical evidence, even though the strategy (how mobile applications best support this goal) needs more research. In this case, nudging can support mobile health as both an explanatory framework, and also as a guiding process in the design of persuasive applications developed to support behavior change. Given the case described above, these devices can be seen as examples of ethically sound nudges.

The boundaries of nudging are another challenging area, as this approach is moving in to the digital sphere. As traditional nudging is described in the physical environment, and digital nudging is mostly associated with decisions within the digital context [20, 21], more research is needed to clarify the mechanisms for how the digital context can be transferred to a physical behavior. Health supporting technologies and mobile health devices would in this example fall somewhere between traditional and digital nudging. Weinmann, Schneider and vom Brocke [21] propose to apply the concept of digital nudging also when it include offline behavior. But since this dimension may face new and different challenges than only directing activities in a digital interface, we have chosen to use the concept of technology mediated nudging, to emphasize the movement and convergence between the digital and offline contexts when striving to support health behaviors.

To conclude, Sweden as well as many other countries are currently going through demographic changes which will put more strain on welfare in general and on health care in particular. To face these challenges, the Swedish Government and SALAR are focusing on eHealth, which is expressed in the Swedish Vision for eHealth 2025. We argue that initiatives and governmental strategies in eHealth could benefit from incorporating a health promotive perspective. This would also involve focusing more on the systems used by the public. Mobile and web-based solutions may need more attention to understand how to empower people to pursue a healthy lifestyle, thus understand how information environments online facilitates health decisions in today's society. In this context, we propose taking a closer look into how nudges can be implemented in order to promote preferred behavioral patterns. Nudging has been extensively used in policy making and in physical environments to promote better or healthier decisions. More research is needed to understand how nudges can be implemented in digital contexts. Some challenges when implementing nudges to facilitate behavior change, are the ethical implications, as well as the boundaries of the context or "choice architecture" when nudging is transferred between online and offline contexts. The mobile health domain is here of particular interest. We propose that more research is needed in this area.

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