Nutrición Hospitalaria

Trabajo Original

Otros

The importance of knowing and listening to all those involved in the design and use of nutrition mobile apps. Getting to know the Great GApp

La importancia de conocer y escuchar a todos los implicados en el diseño y uso de las aplicaciones móviles de nutrición. Dando a conocer el Gran GApp

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Abstract

Keywords:

mHealth. eHealth. Mobile applications. Health promotion. Healthy diet.

Almost every country worldwide suffers from one or more types of malnutrition. Mobile technology (mHealth) interventions seem to represent a promising approach to this problem because they help share information about healthy eating patterns, offer motivation for behavioral change, etc. From this perspective we introduce a theoretical model that attempts to explain the gap that currently prevails between the elements involved in the development of nutritional mHealth strategies (which we have called the Great GApp). Evidence tells us that it is necessary to consider all the parts involved to ensure positive outcomes of an mHealth-based nutritional intervention: patients, health care providers, and stakeholders (technological companies). If these elements are not considered in the design of mHealth strategies a Great GApp arises, which may lead to lack of adherence to the proposed change, and decrease the potential for improving the quality of health outcomes.

Resumen

Palabras clave:

mHealth. eHealth. Aplicaciones de móvil. Promoción de la salud. Dieta saludable.

Casi todos los países del mundo sufren uno o más tipos de malnutrición. Las intervenciones con tecnología móvil (mHealth) parecen representar un enfoque prometedor para este problema porque son útiles para compartir información sobre patrones de alimentación saludable y ofrecer motivación para el cambio de comportamiento, entre otras posibilidades. Desde esta perspectiva, introducimos un modelo teórico que intenta explicar la brecha que prevalece actualmente entre los elementos que participan en el desarrollo de estrategias nutricionales de mHealth (que hemos denominado el Gran GApp). La evidencia nos dice que es necesario tener en cuenta a todos los interesados en el proceso para asegurar los resultados positivos de una intervención de nutrición basada en la mHealth: los pacientes, los proveedores de atención de la salud y las empresas tecnológicas. Si estos elementos no se tienen en cuenta en el diseño de las estrategias de mHealth, surge el Gran GApp, que puede conducir a falta de adherencia al cambio propuesto y disminuir el potencial de mejora de la calidad de los resultados en materia de salud.

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MALNUTRITION IS A SIGNIFICANT PROBLEM WORLDWIDE

Almost in every country worldwide people suffer from one or more malnutrition types, and facing this in all its forms may be considered the most significant global health challenge. Evidence has demonstrated that malnutrition (in the forms of wasting, stunting, overweight, or obesity) is globally the leading risk factor of sickness and death. It represents a significant problem for public health because it increases the risk of morbidity and mortality, from the wealthiest to the poorest countries, and represent a substantial burden from the medical, social, and economic points of view, harming families, communities, and states (1).

THE PROBLEM OF OVERWEIGHT AND OBESITY

On the one hand, obesity increases the risk of developing multiple chronic conditions, including cardiovascular disease, diabetes mellitus, etc., which leads to a decrease in quality of life and work productivity, and an increase in healthcare costs (2). In Europe, it is estimated that the total direct and indirect cost attributable to overweight and obesity was higher than 0.50 % of the Global Burden of Disease (3) in 2014. In the US, the health costs linked to obese individuals was US$149.4 billion per annum in the same period (4).

However, the worldwide prevalence of overweight and obesity has doubled since 1980 (2). In 2018, 1.9 billion adults suffered from overweight and 462 million from underweight. Furthermore, 52 million under-fives were wasted, 17 million severely wasted, and 155 million stunted, whereas 41 million infants were obese or overweight (5).

THE PROBLEM OF UNDERNOURISHMENT

On the other hand, wasting and stunting are the most important reasons for child mortality in developing countries, especially during the first five years of life (6). It is estimated that 6.3 million deaths in under-fives were preventable in 2013 (7) through nutritional programs. Besides, disease-related malnutrition is a significant public health problem in America, Europe, and Asia. It is related to higher morbidity (infections, suture dehiscence, delayed fracture healing, etc.), prolonged hospital stay, and increased readmission rates, mortality, and associated costs (8-11).

mHEALTH AND NUTRITIONAL MANAGEMENT

MOBILE TECHNOLOGY AS A GLOBAL SOLUTION FOR MALNUTRITION

Since malnutrition is due to an interaction between environmental, political, cultural, and socio-economic factors (1), several authors have evidenced the need for finding global solutions.

These have to be based on effective theory-driven tools to help individuals manage their eating patterns (12) (and, obviously, on ensuring access to food resources).

In this sense, mobile technology interventions seem to represent a promising approach to this problem because they are useful for sharing healthy eating patterns and offering motivation for behavioral change while being scalable, low-cost, with high acceptance rates (5,12,14,15). Nowadays, these technologies are part of our daily lives, and their role in society has become crucial. Nobody doubts how technical improvements in mobile devices (with larger screens, higher resolution, increasing browsing speed, and development of mobile applications or "apps") have changed the way we live, work, and interact with others (15,16).

WHAT IS mHEALTH?

The term mHealth was first defined at the beginning of the 21st century (17). At the mHealth Summit 2010, organized by the Foundation for National Health Institutes, it was defined as "the delivery of health care services using mobile communication devices" (18). Today, mHealth is globally understood as medical practice and public health based on mobile devices (19). About 40 % of the more than 300,000 applications available on the market are related to health issues, with those for monitoring and managing chronic conditions deserving special mention (20). In other words, mHealth encompasses any strategy based on mobile devices (cell phones, PDAs, activity monitoring bands, etc.) to provide or facilitate health care. Many of the strategies included in mHealth, from simple phone calls or text messages to the use of applications to support clinical decision-making or telemedicine (20), have demonstrated high effectiveness in communication between patients and health professionals, in the adoption of healthy lifestyles, and in increasing adherence to treatments in chronic conditions (21,22).

For instance, a national survey in the US evidenced that 58.23 % of respondents had installed at least one health app in their phones, mainly focused on nutrition and physical activity. However, many had not used these apps, or had uninstalled them, due to lack of usability, interest, or time to introduce the necessary data, among other reasons (23). This high abandonment rate has been stated by other researchers (24,25). They have evidenced the importance of any public or private entities involved in the design and development of a health app considering every part connected in the mHealth strategy since the earliest stage. This approach may ensure that the designed app will demonstrate proper functionality, usability, safety, and capacity to solve and manage different pathologies in real settings (12,15,16).

INCONSISTENCIES IN THE APPLICATION OF mHEALTH STRATEGIES IN REAL SETTINGS

mHealth strategies have been demonstrated to be effective in various studies focused on dietary self-monitoring (26), long-term weight loss (27), managing of type 1 diabetes mellitus (28),
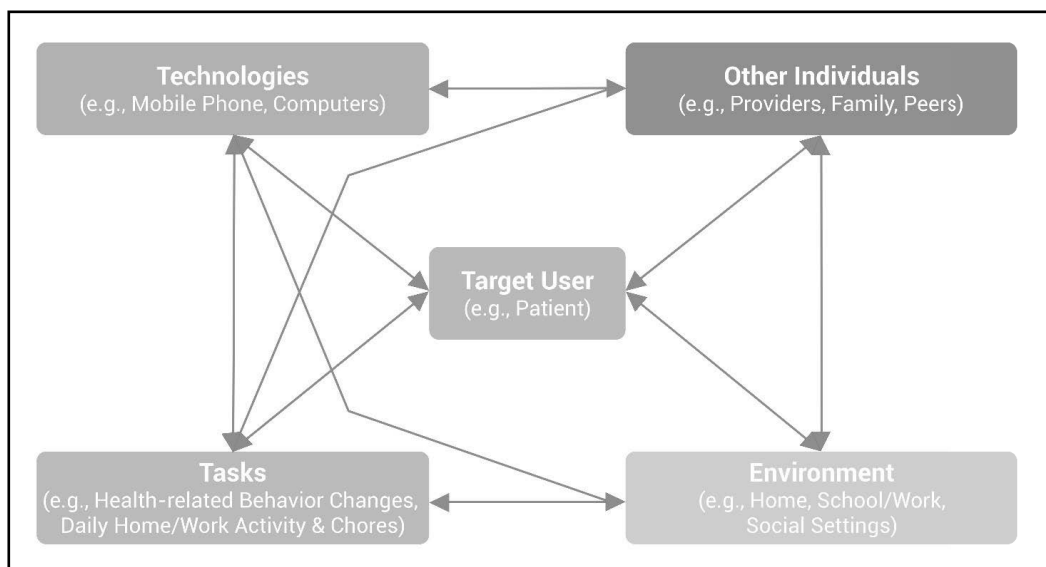
THE IMPORTANCE OF KNOWING AND LISTENING TO ALL THOSE INVOLVED IN THE DESIGN AND USE OF NUTRITION MOBILE APPS. GETTING TO KNOW THE GREAT GApp

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Figure 1.

Sociotechnical system demonstrating the relationship between stakeholders, processes, environments, and technologies (adapted from Graham et al. (43).

improving lipid profile markers in patients with metabolic syndrome (16), offering behavioral change in low- and middle-income countries (29), etc. In addition, it seems that some functionalities such as establishing weight-loss goals (30), self-monitoring (14), granting access to reliable information on healthy eating patterns (13), controlling enteral or parenteral nutrition for undernourishment prevention (31,32), and tracking energy intake (12) have a determinant role.

However, translating to the community setting successful dietary intervention experiences based on mHealth strategies that were effective in experimental studies (12-14,26-30) seems tremendously complicated (29). There are only a few experiences where an mHealth strategy has been evaluated at the population level (33,34). Meanwhile, most research and systematic reviews carried out to evaluate the efficacy of developed apps conclude that further investigations with larger sample sizes or longer interventions are needed (6,12,13,27-30,35-39). Also, most of the apps developed for each of these investigations, even though they showed positive results, are not available in the leading app stores.

On the other hand, we found that mobile nutrition applications on iTunes or PlayStore, with a higher number of downloads and better user ratings (12,26), lack efficacy studies and are often criticized by researchers for lacking a scientific basis to support their contents (12,13,16,40).

Therefore, from this perspective, we would like to introduce a theoretical model that attempts to explain the gap existing between the elements involved in the development of nutritional mHealth strategies. We have called it the Great GApp. However, before going any further into describing this model, it is necessary to have a proper understanding of the processes involved in developing a mobile health application.

DESIGN AND DEVELOPMENT OF A MOBILE HEALTH APPLICATION

The massive development of information and communication technologies has made it possible that any intervention we may wonder about can be implemented in a mobile application. In summary, it is stated that the process should be organized in five stages: i) conceptualization, ii) definition, iii) design, iv) development, and v) publication (41). According to Berlanga et al. (42): i) conceptualization implies generating an application idea considering the users' needs or problems; ii) the definition stage aims to specify the characteristics of users and the objective of the mobile application; iii) the design stage refers to the conceptual, content, and visual design of the app through prototyping; iv) the development stage focuses on programming the source code and performing user tests; and v) in the publication stage, after testing, the application is published in mobile application stores.

However, this approach involves several socio-cultural and technological relationships and interactions between the actors in each phase, which were defined in the model proposed by Graham et al. (43) (Fig. 1). Since the end-user is the focus of the mHealth intervention, it is essential that he/she be placed at the center of the process. That is, consideration must be given to how the designed app fits into the subject's day-to-day life. Furthermore, we must acknowledge that any patient interacts with other actors (health professionals, family, etc.) who directly affect their behavior and, therefore, the application's success. Besides, the user interacts with his or her environment, which may also exert negative or positive influences on adherence to a specific food pattern. The relationship of individuals with technology (including their mobile phones) can also modulate the success of a mHealth intervention.

Last but not least, it should be considered that the patient will be influenced by the number and difficulty of the tasks that are part of the proposed behavior change, and how these may interfere with other mundane aspects such as daily tasks at home or work (43).

This model can be extrapolated to the health professionals (30,43) involved in a mHealth-based intervention. They also need to interact with other individuals (patients, family members, etc.), technologies (e.g., databases with digital medical records), the environment (depending on where they use the technology for work), and tasks of varying complexity (text messages, writing notes, monitoring alarm symptoms or signs, etc.). Although it is unlikely that all potential relationships and interactions will occur in all mHealth experiences, taking them into account in the design and development phases of a mobile health application can remove barriers and increase engagement. Furthermore, there is evidence that attention to user needs through design leads to greater acceptance, understanding, adoption, and commitment rates regarding technology (25,43-46), and increases the potential for improving outcomes (47,48).

GETTING TO KNOW THE GREAT GApp

Therefore, to ensure the positive outcomes of a mHealth-based nutrition intervention it is necessary to take into consideration all stakeholders in the process (25,30,43,46): i) the people who will receive the service (e.g., patients); ii) those who provide it

(e.g., health care providers); and iii) other stakeholders who may be affected by the service (technology companies). This approach is crucial because these stakeholders are committed to the service and therefore affect the intervention's scope and outcomes. It is also necessary to consider the legislation and regulatory policies of each region or country, as they may also influence how mobile health applications are designed and distributed. Regulatory frameworks and legislation provide assurances of safety and increase the mHealth instruments' credibility among patients and providers (49). For all these reasons, it is necessary to understand how all the parties involved interact, from their respective points of view, with each other in this technological process (50,51). If these elements are not considered in the design of mHealth strategies, what we have called the Great GApp may develop (Fig. 2).

Firstly, it is common for health care providers to attempt to develop mHealth-based interventions through the "digital translation" of conventional treatments or high scientific evidence papers (such as clinical practice guidelines), expecting the same results that those traditional interventions have shown (43). In other words, an application's content has a factual scientific basis and possibly responds to real needs that they have detected in real clinical settings. However, these apps may exhibit several deficiencies: these care providers usually do not have technology companies that guarantee adequate implementation and continuity over time (52), they do not have graphics and product designers that favor an adequate user experience (53), and in
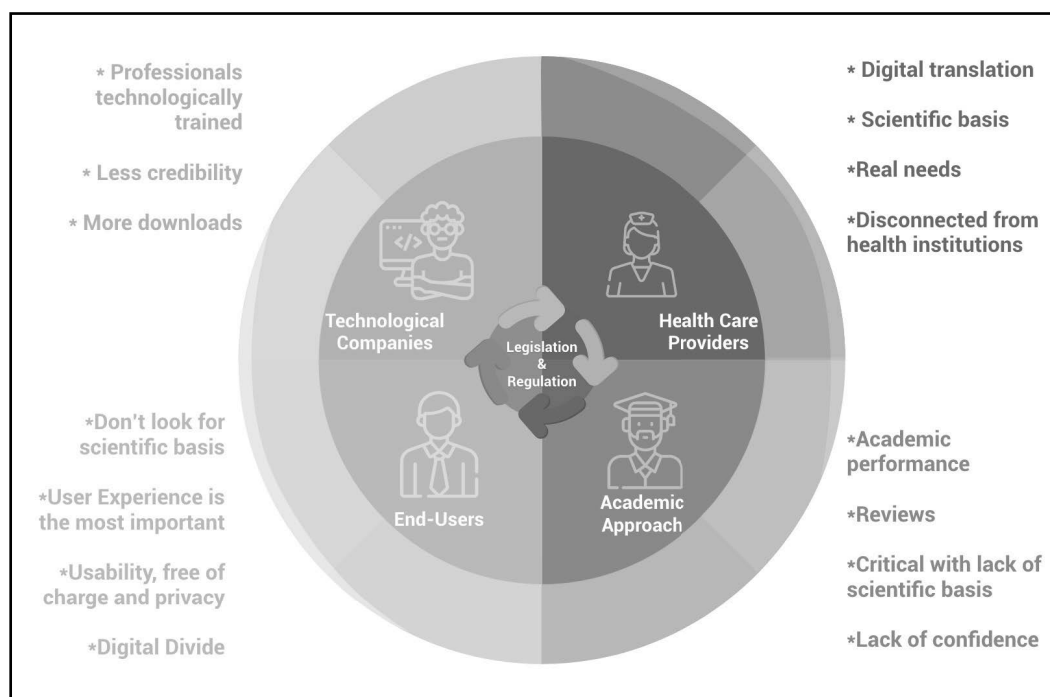

Figure 2.

The Great GApp.

some cases their attempts respond to personal initiatives that are disconnected from public or private health services. This fact makes it difficult for them to be integrated into regular clinical practice (54). In other cases, these public or private health services, without considering the professionals who will have to use these mobile applications, implement them, causing discomfort and poor adherence to using them (47).

A different component of the Great GApp is represented by health professionals who have an academic approach and who, far from seeking to modify clinical practice, focus on evaluating apps already published in application stores and on looking for academic performance (55,56). These researchers point out the lack of scientific basis and of usability of the available apps (13,39,40), or the risk of bias in RCTs carried out in small samples (6,15,16,26,28,37,38). In these cases, they may conclude that an app seems effective and that further research is needed with a larger sample size and longer interventions.

Technological companies are the executing component of the Great GApp. They have technologically trained personnel to design and develop health applications and implement their publication and maintenance in application stores. For this reason, the apps designed and developed by them guarantee that the user experience will be well valued (12,40). However, these applications have less credibility (especially on the part of health professionals, who could recommend them) because they do not usually specify either the scientific grounds they used to develop their content, the professionals who participated, or the scientific degree of evidence their proposals may have. However, these applications represent the most widely downloaded apps on nutrition and physical activity (39,40). Based on this situation, open innovation models have been proposed that allow professionals, users, and technology companies to work together (57).

Another component of the Great GApp, and one which represents the reason for the development of mHealth-based nutritional strategies, is the end user. End users do not usually look for scientific evidence or alignment with international recommendations by scientific societies. For the end user, functionalities and ease of use (especially in data entry), free-of-charge downloading, and to a lesser extent privacy are usually the most critical variables for selecting and using a health app (14,23, 25,30,39,40,45,48,51,52). Another relevant aspect that must be considered during the design phase of a mobile health app focused on the end user is the digital divide. This term refers to the differential rate of cell phone ownership associated with social, cultural, and economic indicators. It is more pronounced in low- and middle-income countries, and highlights the inequality that exists in access to technologies and subsequent technical services (58). Furthermore, this digital divide may also refer to the digital competencies of different generations, and their ability or preference to adhere to mHealth strategies (59). Some authors have proposed focus group sessions before the design and development of mobile health applications where aspects such as studying previous experiences in mHealth or the barriers to adopting this technology as a therapeutic strategy can be addressed (25).

The final component of the Great GApp that can be determinant in how mHealth strategies can reach populations is the legislation and regulatory framework of the region or country where the mHealth-based approach is developed (49). As shown in figure 2, the regulatory framework and legislation on health apps have been placed at the center of the conceptual model. Rather than being a key element in the development and implementation of mHealth apps, what stands out is its potential to influence the attitudes and behavior of all those involved, from the need to trust professionals for prescribing health apps to the reliability or safety perceived by end users. Moreover, traditional methods of evaluating medical devices to establish safety and efficacy are costly, time consuming, and assume that the approved device will not undergo significant changes in content or use (60). Although this framework could be useful for specific medical devices, it is not for applications that are continually being updated with new forms of navigation, functionalities, etc. This situation represents a challenge for clinical evaluation and for establishing the application's version and platform, mainly because the standards apply to the application and not to its associated device. Ultimately, it seems likely that traditional evaluation methods will only be appropriate for a small number of applications that run as traditional medical devices (wearables) and will become barriers to most software developments and innovations (60).

For these reasons, international and national organizations are permanently working on the development of accreditation and certification systems for mobile health applications (42). For instance, the Food and Drug Administration (FDA) has proposed a Policy for Device Software Functions and Mobile Medical Applications (61). The European Commission (EC), in 2015, published the Green Paper on mHealth as a consultation book for citizens, health professionals, public authorities, mobile device manufacturers, and other stakeholders on how to use mobile technology to improve health services in Europe (62). Following this consultation, EC encouraged industry stakeholders to draft and adhere to a code of conduct on mobile health apps, especially on their associated privacy issues. After several revisions, this code is still pending approval and is focused on: user consent, purpose limitation and data minimization, privacy by design and by default, data subject rights and information requirements, data retention, security measures, advertising in mHealth apps, use of personal data for secondary purposes, disclosing data to third parties for processing operations, data transfers, personal data breach, and data gathered from children (63). Once again, regulations move away from essential concepts such as usability, veracity of contents, or the app's effectiveness.

However, the Strategy for Quality and Safety in Mobile Health Applications of the *Junta de Andalucía* (Andalusian government) stands out in Spain at a national level. This initiative has elaborated a list of recommendations for the design, use, and evaluation of health apps, and a quality label called AppSaludable, which recognizes the quality and safety of health apps from public and private initiatives, both Spanish and international. The label ensures that an app complies with a series of recommendations on design and relevance, quality, security of information, service provision,

Table I. Some examples of mHealth strategy development evaluating whether they considered the Great GApp elements and their current availability

Paper	Year	Strategy or mobile application developed	Did the authors consider the elements included in the Great GApp?	Is it currently available in the Apps Stores or in use?	Searching sources
Active 10 - A new approach to increase physical activity in inactive people in England (33)	2019	Active 10 mobile application for Android	Yes	Yes	Play Store
FoodSwitch: a mobile phone app to enable consumers to make healthier food choices and crowdsourcing of National Food Composition Data (34)	2014	FoodSwitch mobile application for Android and iOS	Yes	Yes	Play Store App Store
User-centered design of a tablet waiting room tool for complex patients to prioritize discussion topics for primary care visits (50)	2016	Kaiser Permanente mobile application for Android and iOS (visit planner)	Yes	Yes	Play Store App Store
A smartphone app to promote an active lifestyle in lower-educated working young adults: development, usability, acceptability, and feasibility study (49)	2018	Active coach mobile application for Android	Partially (user-centered design)	No	Play Store
Integrating mobile technology with routine dietetic practice: the case of myPace for weight management (62)	2015	Developed specifically to be embedded into and to support dietetic practice, a platform called myPace (http://mypaceapp.com/)	No	No	http://mypaceapp.com/ Play Store App Store
User-centered design of Learn to Quit, a smoking cessation smartphone app for people with serious mental illness (48)	2018	Learn to Quit application for Android	Partially (experts, user-centered design)	No	Play Store
Push notifications from a mobile app to improve the body composition of overweight or obese women: a randomized controlled trial (14)	2020	Private mobile application for Android	No	No	Play Store App Store

confidentiality, and privacy (64). With the same objectives, the same initiative was launched in 2016 in Catalonia under the name TicSalut (65). It also offers a repository of health apps that have been approved after a quality accreditation process structured in four blocks: usability and design, functionality, technology, and security.

As we indicated above, when these five elements are not connected and involved in the whole process of developing a health app, adherence to the use of a mobile application and, consequently, its impact on health outcomes is reduced. However, different initiatives have tried to connect all the elements of this Great GApp with positive results. Examples include user-centered approaches (25), the Active10 program (33), the FoodSwitch (34) and myPace (66) mobile apps, the creation of The Yale Center for Biomedical Innovation and Technology (CBIT) (52), and cooperative development models based on Crowdsourcing (67) or Open Innovation (57). They all show approaches that allow involvement

of all the actors connected, and therefore avoid the negative effect of the Great GApp (Table I).

CONCLUSIONS

This theoretical model, named the Great GApp, seems to contain and explain the main circumstances that usually occur during the design and development of mobile health applications. These circumstances lead to a disconnection between the elements involved in the implementation of mHealth strategies (end users, health professionals — whether in the clinical or academic field — and technological companies), which results in a gap between the scientific and healthcare settings, and the daily life of the subjects to whom these measures are eventually addressed. As a result, a limited efficiency of these measures is perceived (low effectiveness concerning the high cost that any technological

development usually entails). Taking into account this GApp, and trying to involve all the associated elements from the early stages of design and development of mobile health applications, could increase their success through greater use adherence and better health outcomes.

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