Hakemli - Süreli - Bilimsel Dergi
İNTERNET UYGULAMALARI ve YÖNETİMİ
Journal of
INTERNET APPLICATIONS and MANAGEMENT
2018 / 9(2)

Expectations from Personal mHealth Apps through Kano's Model [1]

Kişisel mSağlık uygulamalarından Kano Modeli ile beklentilerin belirlenmesi

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The main purpose of this study is to contribute to the development of mHealth apps more effectively with the Kano model, which better defines user expectations and measures the effects of these expectations for satisfaction. Assessing users' expectations from mHealth apps is crucial. The Kano model is an efficient method in categorizing users' expectations and guiding mHealth apps designers. Moreover, Kano model allows mHealth apps designers to classify their design requirements, depending on the value they deliver to their users, and to recognize when some design requirements/characteristics are redundant. In this way, designers and developers can avoid wasting valuable time, money and energy. In the research part of this study, the Kano model was applied in the elicitation of design characteristics for mHealth Apps. The findings of this descriptive research, which encompasses 317 students attending Pamukkale University, Denizli, Turkey are presented in detail. In the light of the Kano analysis, one-dimensional, attractive and indifferent attributes for mHealth apps design characteristics were identified.

Keywords: *Health industry, mHealth apps, Kano model*

Jel Codes: *I10, L86, M31*

Bu çalışmanın temel amacı, kullanıcı beklentilerini daha iyi tanımlayan ve bu beklentilerin kullanıcı memnuniyeti üzerindeki etkilerini ölçümleyen Kano modeli ile mSağlık uygulamalarının daha etkin bir şekilde geliştirilmesine katkıda bulunmaktır. Kullanıcıların mSağlık uygulamalarından beklentilerinin değerlendirilmesi önemlidir. Kano modeli, kullanıcıların mSağlık uygulamalarından beklentilerini gruplandıran ve mSağlık uygulama tasarımcılarına yol gösteren etkin bir yöntemdir. Bunun yansıra Kano modeli, mSağlık uygulama tasarımcılarının kullanıcılarına sundukları değere bağlı olarak tasarımın teknik gereksinimlerini sınıflandırması ve tasarımda dikkate alınmaması gereken gereksinmelerin / özelliklerin tanımlanmasına imkan verir. Bu model sayesinde tasarımcılar ve geliştiriciler değerli zaman, para ve enerji israfını önleyebilirler. Bu çalışmanın araştırma bölümünde, mSağlık uygulamaları tasarım özelliklerinin ortaya çıkarılmasında Kano modeli kullanılmıştır. Pamukkale Üniversitesi'nde (Denizli-Türkiye) öğrenimlerine devam eden 317 öğrenciyi kapsayan bu tanımlayıcı araştırmanın bulguları detaylı olarak sunulmuştur. Kano analizinin ışığında, mSağlık uygulamaları tasarımı için beklenen, heyecan verici ve fark yaratmayan tasarım özellikleri belirlenmiştir.

Anahtar Kelimeler: *Sağlık sektörü, mHealth uygulamaları, Kano model*

Jel Kodları: *I10, L86, M31*

[1] This study was presented in the X.International Balkan and Near Eastern Social Sciences Congresses, Ohrid/Macedonia, October 27-28, 2018.

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1. INTRODUCTION

Improvements in mobile communication technologies and smartphones are evident in all walks of life from lifestyles to businesses. We can inevitably see one of their impacts on health industry. In literature, an "m" is put right before the concepts related to the mobile technology, industry and communications, just as "e" is placed before the concepts associated with the Internet (Barutçu, 2007; Barutçu, 2008; Barutçu, 2010). Therefore, the term "mHealth" apps is preferred instead of "mobile health" apps.

Smartphones or tablets on which mHealth apps are downloaded will be linked with hospital systems anywhere, and mHealth apps will offer abundant potential in improving healthcare synchronization between patients, doctors and healthcare institutions. Therefore, the importance of mHealth is not going unnoticed currently, and mHealth apps should be designed to meet their needs and expectations as well as their wants. The key is how to translate these demands into the design characteristics of mHealth apps. In the present study, the Kano Model, devised by Noriaki Kano in the 1980s, is used to prioritize the mHealth design requirements of personnel to increase user satisfaction based on four indicators. Besides, what kind of characteristics mHealth apps should have can be determined by using the Kano Model.

The main purposes of this study are to (1) draw the attention of mobile-app designers and entrepreneurs to mHealth apps, (2) highlight what is needed to increase user satisfaction with mHealth apps, (3) learn what satisfies them, and (4) analyze the design requirements of mHealth apps by using the Kano Model to boost user satisfaction. Surveys and interviews were conducted on mHealth apps users in an attempt to define their needs. Kano Questionnaire results, Evaluation table, User Satisfaction Coefficient for mHealth apps, Customer Satisfaction Coefficient Diagram are illustrated in accordance with the Kano Analysis. The results of the study and some managerial implications are presented in addition to recommendations to mHealth apps designers who need to take the design requirements into account for a higher level of satisfaction.

2. CONCEPTUAL FRAMEWORK

2.1. Mobile Revolution in Health Industry

As in a wide range of industries from business to marketing, there has been a mobile revolution in health industry, too. Not only has mHealth industry witnessed a rapid growth, but the mHealth research output has also been on the rise. Many reports, articles, studies and workshops about mHealth exist in the market in order to improve healthcare efficiency and achieve patient and doctor satisfaction. There is some scientific evidence that mHealth proves to be more efficient than some other ordinary healthcare tools by increasing delivery of healthcare services with its potential to augment access, decrease healthcare costs and produce positive results (Chow et al 2016). Being quite significant to the medical and pharmaceutical industries nowadays, mHealth is envisaged to transform patient care through diverse usages because regulatory bodies now tend to ratify mHealth apps as medical devices (Cameron et al., 2017; Onodera and Sengoku, 2018).

New mobile phone technology and smartphones have paved the way for multiple types of technology, including global positioning system (GPS), apps counting the steps taken,

devices showing sleep cycles, and tools tracing down the heart rate that old-style phones cannot. Moreover, a large number of mHealth apps have utilized the connection of mobile devices and data transfer to promote life quality, ranging from physical daily activity to user-controlled mHealth data that increase motivation (Chow et al 2016).

In reference to the World Health Organization report, mHealth is conceptualized as new horizons for health through mobile technologies (Kay et al. 2011), and the presence of mHealth offers great opportunities for the delivery of health services and the hope of providing efficient and affordable health services to wider populations (Chow et al 2016).

No standardized definition of mHealth can be found in the report by World Health Organization, and different definitions exist in the pertaining literature. To Kay et al. (2011), mHealth refers to any communal and medicinal health activity based on mobile devices, such as personal digital assistants, mobile phones, patient screening tools, and some wireless gadgets by Global Observatory for eHealth. Istepanian et al. (2004) and Istepanaian and Zhang (2012) define mHealth as mobile computing, medicinal sensor, and mobile technologies for healthcare-based individualized systems, seamless mobility and worldwide medicinal connectivity. While Akter et al. (2013) views mHealth as the exploitation of mobile devices primarily to receive medical service or obtain information, Singh and Landman (2018) describe it as wireless technologies that not only provide better and more efficient healthcare service but also improve the pertaining research and its results. To Kumar et al. (2013), mHealth refers to using mobile applications as well as wearable and sensing devices to track medical conditions, achieve better health status, diagnose a condition or simply facilitate clinical decisions.

As far as literature is corncerned, Kaplan (2006) has highlighted the successful use of smartphones to support further operative delivery of healthcare services to sustain telemedicine and remote healthcare in developing nations. Presenting an ontological view to describe the mHealth field and specify a roadmap, Cameron et al. (2017) stressed that the four outcomes, namely efficiency, quality, safety, and parity, play a key role in proper exploitation of both healthcare system in general and mHealth system in particular. In addition, Bashshur et al. (2011) proposed the four mechanisms of the mHealth area as clinical support, health worker support, remote data collection, and helpline. Fox et al. (2017) offered a plan for educational activities focusing on creating a mHealth course sequence and a mHealth app. Ni et al. (2018) aim to devise a mobile system to improve medication adherence among patients with coronary heart disease. Besides, Barutçu (2020) highlighted mHealth revolution and mHealth apps presented as improving doctors' effectiveness and healthcare quality, and defined doctors' wants from mHealth apps using Quality Function Deployment (QFD) in his forthcoming study.

It should also be underlined that mHealth apps can be deemed convenient for emergency conditions (Chow et al., 2016). For example, Neubeck et al. (2015) emphasized that mHealth apps can potentially prevent lifelong risk of cardiovascular disease and minimize the disparities in the precautions against cardiovascular diseases, though the adoption of mHealth technology among the elderly is significantly low (Hoque and Sorwar, 2017). mHealth can also function as a means of safeguarding old people and chronic disease sufferers, who make up a large proportion of the population in China with wide-ranging

health demands (Ni et al., 2018). Moreover, there are some examples, such as tools to track blood pressure (Blood Pressure Log), apps targeted at stopping smoking (QuitSTART), apps designed to lose weight (Weight Watchers) and apps to maintain fitness (MyFitnessPal) to get rid of some health problems (Chow et al., 2016).

Improving people's health can be accomplished by designing efficient mHealth apps, using mHealth apps which increase the quality of healthcare as well as shifting performance to strengthen prevention, decreasing medical errors, avoiding expensive interventions, and broadening access to healthcare (Qiang et al., 2011; Hamel et al., 2014). Not to mention the above-stated benefits, the Kano model is particularly important in that it helps to increase mHealth apps design efficiency as well as user satisfaction.

2.2. Kano Model

Not only is specifying consumer needs inadeaquate on its own, but how these needs affect customer satisfaction should also be taken into account in order for a business to be successful. In 1984, Noritaki Kano set out to investigate the satisfaction level of each customer's needs and expectations. To this end, he developed a theoretical model to illustrate and identify quality attributes for research aims and to classify the product and service characteristics that will meet customer needs.

Diverse examples of Kano models have been applied in different industries ranging from new process, product and service developments to m-shopping (mobile shopping) app designs (Schvaneveldt et al., 1991; Matzler and Hinterhuber, 1998; Gustafsson et al., 1999; Shen, et al., 2000; Sa Moura and Saraiva, 2001; Zhang and Von Dran, 2002; ; Bhattacharyya and Rahman, 2004; Szmigin and Reppel, 2004; Nilsson-Witell and Fundin, 2005; Fundin, 2005; Lehtola and Kauppinen, 2006; Sireli et al., 2007; Zhu et al., 2010; Hueiju and Hsien-Tang, 2012; Barutçu et al., 2015). More recently, Barutçu et al., (2015) have used the Kano model in developing m-shopping apps, while Demirbağ and Çavdar (2016) used it to identify requirements for smartphones, and Mei-Ling et al. (2018) to develop m-security apps.

Developed by Noriaki Kano and several colleagues from Japan, the Kano model can be described as a system of developing a product and improving satisfaction level of consumers by categorizing their preferences. They labelled customer attributes under four heading as must-be, one-dimensional, attractive and indifferent. Having investigated these categories, they suggested a bilateral quality model predicated on perception and experience of consumers. In the end, they came up with a handy graph analyzing customer needs (Kano et al., 1984; Berger et al., 1993; wikipedia.org/wiki/Kano_model). Over time, the Kano Model has been revised by subsequent researchers (Lee et al., 2011; Tontini, 2000; Matzler et al., 1996; Berger et al., 1993). This model serves both as a valuable resource in recognizing customer needs and expectations and as an operative approach in classifying them into various groups since they are key to raising customer satisfaction (Shen et al., 2000). Through the Kano Model, researchers are able to designate quality attributes and characteristics as must-be, one-dimensional, attractive, and indifferent for customers. The data to categorize quality attributes and characteristics are gathered through a Kano questionnaire comprised of question pairs (one positive and one negative) (wikipedia.org/wiki/Kano model: Kano et al., 1984).

Four important identifiers in Kano analysis can be described as must-be (basic/threshold) attributes, one-dimensional (performance) attributes, attraction (exciters/delighters) attributes and indifferent attributes. These attributes under each group are evaluated by Kano Evaluation Table and by creating a matrix with functional and dysfunctional attributes.

From the perspective of mHealth apps users, one-dimensional quality is the typical quality that mHealth user is satisfied when this quality element has been fulfilled. Attractive quality is the quality attribute to increase user satisfaction. If mHealth apps do not have the quality attributes, it does not lead to dissatisfaction and still remains acceptable for mHealth users. Must-be quality is the quality attribute which customers tend to take for granted. If mHealth apps do not fulfill the must-be quality attribute, it leads to dissatisfaction. Indifferent quality is the quality attribute that does not affect an mHealth apps user's satisfaction level because quality attribute and mHealth apps user satisfaction are irrelevant to each other. Reverse quality is the quality attribute with which customer satisfaction has nothing to do. Therefore, the reverse quality attribute should not be taken into consideration in the mHealth apps design process. Consequently, these identifiers potentially help to gauge user satisfaction with mHealth apps. These identifiers are applied to researched development or design consistent with the ascending primacy sequence as must-be> one-dimensional> attractive > indifferent. The existing research is designed to identify these four different Kano quality attributes for 22 important mHealth apps characteristics.

3. RESEARCH METHODOLOGY

The main purposes of this research are to (1) contribute to the development of mHealth apps more effectively with the Kano model, which provides a better understanding of mHealth apps users' expectations, (2) find out how users evaluate and classify mHealth apps design requirements, and (3) measure the effect of these mHealth apps design requirements and users' satisfaction expectations. The primary data was collected through a survey. The survey is composed of two parts: the first one is aimed at profiling the respondents as gender, age, educational background, and mobile phone brand names. The second one is a Kano questionnaire addressing the 22 mHealth apps design characteristics with two-dimensional quality attributes. These characteristics were determined through focus group discussions, literature survey and personal recommendations. As far as the scales in the questionnaire are concerned, there were 26 questions in two parts, 4 of which are about demographic characteristics of respondents with nominal scales, and 22 of which are created as pair questions with interval scales designed by the Kano Model.

After the users expectations were defined, the Kano survey was prepared to analyze and classify these expectations. The respondents were supposed to answer the two-dimensional questionnaire to understand patient or user expectations and figure out the differences for each mHealth apps design characteristics. In the questionnaire, mHealth apps users were asked 22 questions about the characteristics available in the mHealth apps. Basically, Kano surveys consist only of the following two questions, each of which are asked once per mHealth apps characteristics: the first functional question "How would you feel if mHealth apps have emergency service/ambulance call button which makes direct medical assistance request?, and the first dysfunctional question "How would you feel if mHealth apps do not have emergency service/ambulance call button which makes direct medical assistance

request?". For the answer of each question, 1- I like it very much (Like), 2- I expect it to be (Must be), 3- I do not care (Neutral), 4- I don't like but I can tolerate it (Live With) and 5- I don't like it (Dislike) were used for response options.

The survey sample frame was the students attending Pamukkale University, Denizli, Turkey. By using the convenience sampling method, 350 questionnaires were distributed to students from different faculties and vocational schools of higer education. 33 questionnaires were left out in the analysis because of some missing data in them. Consequently, 317 questionnaires were used for frequency and Kano analysis.

4. RESEARCH METHOD

Out of the 350 questionnaires distributed, 317 questionnaires have full answers that can be analyzed. As seen in Table 1, among the 317 respondents, 53,9% were female, 46,1% were male. 49,5% of the respondents were aged between 19 and 20, and 72,6% were undergraduate students. 41,3% have Samsung, whereas 29,7% have Apple, and 30% have other brands, such as Huawei, LG, General Mobile, Sony, Vestel-Venüs and Casper.

Table 1. Respondents' demographic characteristics and mobile phone brands

Gender	**N**	**%**	**Education Level**	N	**%**
Female	171	53,9	Associate Degree	62	19,6
Male	146	46,1	Undergraduate Degree	230	72,6
Total	317	100,0	Graduate Degree	25	7,9
Age	**N**	**%**	**Total**	317	100,0
≤ 19	32	10,1	**Mobile Phone Brand Name**		
20-22	157	49,5	Apple	94	29,7
23-25	105	33,1	Samsung	131	41,3
≥ 26	23	7,3	Others	92	30,0
Total	317	100,0	**Total**	317	100,0

Kano's analysis begins to calculate two values for defining the category of each mHealth apps characteristic. The mHealth apps attributes of each characteristic by respondent are specified by applying the Kano evaluation table to their scores (Table 2). In order to evaluate the results after applying the Kano survey, the Kano evaluation table below analyzes the intersection of each participant's responses to the positive and negative forms of mHealth apps characteristics.

Table 2. Kano evaluation table

Customer Needs/Expectations		**DYSFUNCTIONAL**				
		Like	Must be	Neutral	Live With	Dislike
FUNCTIONAL	Like	Q	A	A	A	O
	Must be	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live With	R	I	I	I	M
	Dislike	R	R	R	R	Q
	O = One-dimensional	M = Must-Be		R = Reverse		
	A = Attractive	I = Indifferent		Q = Questionable		

Source: Berger et al. (1993: 6)

Some methods can determine which categories the customer needs belong to in the Kano model. First, the distribution of statistical modes between categories is used in Table 3 within the framework of this study. Secondly, the satisfaction and dissatisfaction coefficients were calculated using equations in Table 4 which were developed to maintain the propagation between categories, notably in the cases where the values between the categories were very close to each other. According to the first method, the category with the highest mode was selected. It means if the value of the category is higher, then the attribute property of mHealth apps falls into that category. However, uncertainty sometimes arises because the values of categories are very close to each other. In such a case, satisfaction and dissatisfaction coefficients are used to eliminate the uncertainty over which category the customer needs will be included in (Berger et al., 1993).

The Kano survey results are illustrated in Table 3 and Table 5. In the category of Emergency Service/Ambulance call button, 117 out of 317 respondents perceived it as one-dimensional, which is the highest value among all the other quality attributes in this part. In this category, 71 participants regarded it as indifferent, 64 as attractive, 4 as must-be, and 1 as reversed attributes. On the other hand, with respect to showing the drugs used before, 157 respondents considered it an indifferent attribute. The results of the Kano analysis reveal that all mHealth apps characteristics could be classified as either one-dimensional or indifferent quality attributes. 13 mHealth apps characteristics are classified as one-dimensional attributes, while 9 characteristics are categorized as indifferent (Table 3).

As seen in Table 3, some of the mHealth apps characteristics were listed as emergency service/ambulance call button, receiving messages about basic information/recommendations about the diagnosed disease, Receiving messages for abnormal/critical test results, receiving reminder messages for drug intake times, indicating medications causing allergy, safely protecting personal health information, saving messages for doctors in case of emergency, monitoring vital data via mobile phone sensors, sending messages to family physicians, writing comments about the health services received, sharing experiences with other patients with similar health conditions, receiving remind messages for examination/post-treatment, and having a practical menu. These are categorized as one-dimensional quality attributes, indicating that mHealth users tend to favour the apps with these characteristics.

The other characteristics do not have any effects on either user satisfaction or dissatisfaction. Although the users do not take notice of these characteristics, some values are close to the category of attractive quality attributes, thereby requiring further analysis as the following. The effects of all mHealth apps characteristics corresponding to users' expectations on users' satisfaction are not the same. Whereas some user expectations have a significant impact on satisfaction, the others have lower rates. As a result, the mHealth user satisfaction coefficient should be calculated to show the degree to which user satisfaction level increases if the mHealth apps design characteristics are used. In other words, the calculation of satisfaction coefficient should be able to indicate the degree to which mHealth user satisfaction level decreases, if these characteristics are not used. Therefore, satisfaction and dissatisfaction coefficients are calculated to define better mHealth apps characteristics. The positive coefficient, the relative value of satisfying the users' expectations, is called the coefficient of satisfaction, while the negative coefficients, the relative the relative cost of not satisfying the

users' expectations, is called the dissatisfaction coefficient. User satisfaction and dissatisfaction coefficients are calculated by the formulas as seen in Table 5 (Matzler and Hinterhuber, 1998; Berger et al., 1993).

Table 3. Kano analysis questionnaire results

mHealth Apps Characteristics	A*	O*	M*	I*	R*	Q*	Total	C*
Emergency Service / Ambulance call button which makes direct medical assistance request	64	177	4	71	1	0	317	O
Diet / food recommendations based on the diagnosis	63	118	11	124	1	0	317	I
Receiving messages about basic information/ recommendations about the diagnosed disease	58	217	1	39	2	0	317	O
Receiving messages for abnormal/critical test results	60	140	26	88	2	1	317	O
Receiving reminder messages for drug intake times	49	153	6	100	9	0	317	O
Showing the drugs you used before	53	87	1	157	19	0	317	I
Indicating medications causing allergy (if any)	34	223	3	49	8	0	317	O
Recording your physical activities (walking and running)	73	84	13	145	2	0	317	I
Safely protecting your personal health information	20	272	15	8	2	0	317	O
Saving messages for your doctors in case of emergency	50	174	20	71	2	0	317	O
Suggesting vaccinations for your age and health background	26	104	27	143	17	0	317	I
Sending recommendation messages about your health according to the information in the system	20	110	1	176	10	0	317	I
Adding data about your health condition (blood pressure, sugar, etc.)	44	76	43	138	16	0	317	I
Monitoring vital data via mobile phone sensors	75	145	6	81	10	0	317	O
Sending messages to your family physicians / doctors	73	139	0	96	9	0	317	O
Providing information about health institutions around you (address, occupancy etc.)	56	156	0	103	2	0	317	O
Writing comments about the health services that you receive	73	144	1	97	2	0	317	O
Sharing your experiences with other patients that have similar health conditions	53	116	7	137	4	0	317	I
Video calling for control after the surgical operation by doctors	58	86	9	151	13	0	317	I
Receiving remind messages for examination / post-treatment	83	160	21	44	9	0	317	O
Finding your personal health information	44	76	43	138	16	0	317	I
Having a practical menu	7	229	15	64	2	0	317	O

* A: attractive; O: one-dimensional; M: must-be; I: indifferent R: reverse; Q: questionable

The mHealth apps users' satisfaction coefficient can range from 0 to 1. If one of the mHealth apps satisfaction coefficients is close to 1, it indicates that this mHealth apps characteristic has a great impact on mHealth users' satisfaction. On the other hand, if it is close to 0, the

mHealth apps characteristics indicates that the effect on mHealth users' satisfaction is very low. In a similar vein, the dissatisfaction coefficient of mHealth apps users ranges from -1 to 0. If one of the mHealth apps satisfaction coefficient is close to -1, it suggests that the effect of the failure to fulfill the mHealth apps characteristics is strong. Moreover, when dissatisfaction coefficient is close to 0, it reveals that the failure to fulfill the mHealth apps characteristics causes user dissatisfaction (Matzler and Hinterhuber, 1998). Moreover, according to functional and dysfunctional coefficient calculations, the quality attributes can be analyzed under four sections, and the impacts of each characteristic on mHealth apps satisfaction can be explained for each category (Table 4).

Table 4. Determination of categories with functional coefficients and dysfunctional coefficients

(Functional Coefficients)	(Dysfunctional Coefficients)	Category
(0,00 –0,49)	(0,50 up - 1,00)	M (must-be)
(0,50 up -1,00)	(0,50 up - 1,00)	O (one-dimensional)
(0,50 up -1,00)	(0,00 - 0,49)	A (attractive)
(0,00 - 0,49)	(0,00 - 0,49)	I (indifferent)

Adapted from Demirbağ and Çavdar (2016: 23)

As seen in Table 4, if functional and dysfunctional coefficient value is above 0.5, these are O category attributes that increase mHealth user satisfaction and decrease dissatisfaction by improving the design quality. If functional coefficient value is above 0.5 and dysfunctional coefficient values are below 0.49, these refer to "A" category attributes that create a wider impact on user satisfaction with preferable quality fulfillment, thus requiring more attention. On the contrary, if functional coefficient value is below 0.5 and dysfunctional coefficient values are above 0.5, these are called "M" category attributes. If the value of functional and dysfunctional coefficients is below 0.5, these become "I" category attributes that have low impact on user satisfaction and dissatisfaction, making them redundant in mHealth apps design. According to the satisfaction and dissatisfaction coefficients, it is possible to see which categories are included in Table 5.

As seen in Table 5, most of the mHealth apps characteristics are located in one-dimensional, attractive and indifferent categories. According to Matzler et al., (1996), the usual order of must-be > one-dimensional > attractive > indifferent should be implemented to specify priorities for the design process progressing from product development to app design. Firstly, some characteristics, such as emergency service / ambulance call button, receiving messages about basic information or recommendations about the diagnosed disease, receiving messages for test results, receiving reminder messages for drug intake times, indicating medications causing allergy, protecting personal health information, saving messages in case of emergency, having a practical menu, and receiving remind messages for examination are considered highly essential for mHealth apps users. As a result, mHealth apps designers should take heed of these "one-dimensional attributes" which enable to increase user satisfaction and receive more attention from the designers. Secondly, some other characteristics, such as diet recommendations based on the diagnosis, monitoring vital data via mobile phone sensors, sending messages to family physicians, providing information about health institutions around, writing comments about the health services

and sharing experiences with other patients that have similar health conditions are defined as "attractive attributes". Just as one-dimensional attributes are instrumental to achieving higher user satisfaction, so are attractive attributes in enhancing user satisfaction. On the other hand, if mHealth apps lack these attractive attributes, it does not necessarily lead to dissatisfaction but still remain acceptable for mHealth users. Last but not the least, the rest of the mHealth apps characteristics, such as showing the drugs used before, recording physical activities, suggesting vaccinations for age and health background, sending recommendation messages about health, adding data about health condition, video calling for control after the surgical operation by doctors, and finding personal health information, are designated as "indifferent attributes". Since these attributes do not exert an influence on user satisfaction, mHealth apps users regard these seven attributes as redundant currently.

Table 5. User Satisfaction Coefficients for mHealth Apps

mHealth Apps Characteristics	(A+O)/ (A+O+M+I) Better (Enhanced Satisfaction Coefficients)	(O+M)/ (A+O+M+I)*-1 Worse (Reduced Satisfaction Coefficients)	**Category***
Emergency Service / Ambulance call button which makes direct medical assistance request,	0,762658228	-0,57278481	O
Diet / food recommendations based on the diagnosis,	0,57278481	-0,408227848	A
Receiving messages about basic information / recommendations about the diagnosed disease,	0,873015873	-0,692063492	O
Receiving messages for abnormal/critical test results,	0,636942675	-0,52866242	O
Receiving reminder messages for drug intake times,	0,655844156	-0,516233766	O
Showing the drugs you used before	0,469798658	-0,295302013	I
Indicating medications causing allergy (if any)	0,83171521	-0,731391586	O
Recording your physical activities (walking and running)	0,498412698	-0,307936508	I
Safely protecting your personal health information	0,926984127	-0,911111111	O
Saving messages for your doctors in case of emergency	0,711111111	-0,615873016	O
Suggesting vaccinations for your age and health background	0,433333333	-0,436666667	I
Sending recommendation messages about your health according to the information in the system	0,423452769	-0,361563518	I
Adding data about your health condition (blood pressure, sugar, etc.)	0,398671096	-0,395348837	I
Monitoring of vital data via mobile phone sensors	0,716612378	-0,491856678	A
Sending messages to your family physicians / doctors	0,688311688	-0,451298701	A
Providing information about health institutions around you (address, occupancy etc.)	0,673015873	-0,495238095	A
Writing comments about the health services that you receive	0,688888889	-0,46031746	A
Sharing your experiences with other patients that have similar health conditions	0,539936102	-0,392971246	A
Video calling for control after the surgical operation by doctors	0,473684211	-0,3125	I
Receiving remind messages for examination / post-treatment	0,788961039	-0,587662338	O
Finding your personal health information	0,398671096	-0,395348837	I
Having a practical menu	0,749206349	-0,774603175	O

* A: attractive; M: must-be; R: reverse; O: one-dimensional; Q: questionable; I: indifferent

5. MANAGERIAL IMPLICATIONS AND CONCLUSIONS

As in many other industries, mobile communication systems and smartphones have also penetrated into health industry because these new technologies can potentially improve the quality of healthcare service as well as preventing health problems. A growing body of reports, studies, research and journals are being published as regards mHealth industry and its tools. The importance of mHealth apps lies in linking users with hospital information systems. Moreover, mHealth apps are also recognized as medical devices saving steps walked, tracking heart rate and sleep cycles, and proposing health-related activities, thus these apps ought to be designed properly to meet user expectations. From the technology-based viewpoint, mHealth utilizes mobile technology and smartphones for healthcare, sports and wellness activities. From the health service-based viewpoint, mHealth can be positioned as a means to increase access to healthcare and provide better healthcare quality.

Whether devised for healthcare, sports and wellness, or for improved healthcare quality, mHealth apps should be designed from users' perspectives. In this sense, the Kano model proves quite instrumental to specifying design characteristics for these apps, understanding mHealth users' expectations, and analyzing their satisfaction level through mHealth apps attributes which are predicated on a functional and dysfunctional questionnaire corresponding to Herzberg's two-factor theory of job satisfaction. In general, the main objectives of the Kano model as regards mHealth apps development can be listed as (1) understanding users needs or expectations from mHealth apps, (2) helping mHealth apps designers better understand user expectations, (3) classifying user wants as six quality attributes for mHealth apps designers, (4) illustrating how each attribute affects satisfaction and dissatisfaction with mHealth apps, (5) providing a system to prioritize user expectations for their satisfaction, and (6) analyzing how design characteristics increase or decrease satisfaction with mHealth apps.

In this study, the design characteristics of mHealth apps that are key to enhanced user satisfaction have been defined through Kano analysis whose results seem valuable for app designers. In the light of focus group discussions, literature survey and personal recommendations, 22 design characteristics for efficient mHealth apps are identified along with their relative importance to users by using the Kano Model that prioritized user expectations. Categorized as one-dimensional attributes, 9 design characteristics outweigh other attributes in ensuring higher user satisfaction, thereby requiring more careful attention in the designing process. Although 6 design characteristics, considered as attractive attributes, play a remarkable role in achieving higher user satisfaction, they do not necessarily lead to user dissatisfaction with mHealth apps. 7 mHealth apps design characteristics, classified as indifferent attributes, are subordinated to the other attributes for users in that they have limited impact on user satisfaction or dissatisfaction. Accordingly, these 15 mHealth apps characteristics should be taken into account by designers while developing mHealth apps. However, one research limitation of the existing study is that the findings may not apply to all mHealth apps users, hence further studies should be carried out to include larger sample and wider regions to generalize the survey results.

ACKNOWLEDGMENTS

This study has been supported by the Scientific Research Project Coordination Center of Pamukkale University, Turkey. (ADEP/2018_PAU_BAP_Project Number: 2018KRM002-228).

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