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## IS THE USE OF MOBILE HEALTH APPS HEALTHY OR TOXIC TO CONSUMERS?

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**Abstract.** Increasingly omnipresent and powerful mobile technology has the potential to address long-standing issues in the healthcare sector. mHealth (mobile health) apps can be used by consumers or patients for their wellness, prevention or treatment management. This study explored the scale of awareness of mHealth apps and the perception of using mHealth apps for monitoring health in Mauritius. The study also explored the barriers they faced. The results have shown that the people of Mauritius are aware and have downloaded and used mHealth apps. Fitness seems to be important, as most of the respondents find the fitness training app most useful. The findings have also shown that biggest barrier that prevents the respondents from using a mHealth app is cost concerns and privacy or security. Hence, it is recommended that the cost of mobile apps be investigated. Furthermore, there should be communication from app creators about the benefits of using a particular app, as well as the security measures and protection of private users and their information.

**Keywords:** medical apps; Mauritius; health; fitness; wellness; mobile health apps

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**JEL Classifications:** I10, M00

### 1. Introduction

There has been a renewed focus on health worldwide and people are more engaged on what they consume than even a decade ago. The mHealth app is emerging due to the increase in the development of apps in healthcare. According to Research2Guidance (2017), there were around 3.7 billion of downloads of mHealth apps around the globe and there are 325,000 health apps (health, fitness and medical apps) available on all major app stores – the most there has ever been. At this pace, the global market for health apps is projected to reach \$102.43 billion by 2022 (Medium, 2017).

Due to the growth in the interest and use of apps, the management of these apps are important. mHealth apps can be used by consumers or patients as part of their wellness, prevention or treatment regimens. In this report, we share the results of a study we have undertaken to look more closely at the usage of healthcare apps among the

Mauritian population. We also look at the barriers to usage of the apps and propose recommendations on how to benefit from using mHealth apps.

## **2. Defining mobile health**

mHealth can be defined as “medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices” (World Health Organisation, 2011). Mobile health technologies allow individuals to easily and conveniently manage and access to their health information (mHealth. Use of mobile healthtools in pharmacy practice, 2019). The focus on mHealth is budding due to the rise in the production of smartphones and tablets (Krishna, Boren, & Balas, 2009; Klonoff, 2013). Wireless sensors present in smartphones support new methods for continuous monitoring of health at high precisions (Mosconi, Radrezza, Lettieri, & Santoro, 2019).

## **3. Literature review**

A Google scholar search revealed articles on the topic under discussion. Research on which the articles are based, are mainly conducted in Western society in developed countries such as United States of America, England and Italy. What makes the research at hand different is that it was conducted in a developing country that is part of the Eastern African sub region (Kiprop, 2018).

Research conducted by the most popular types of apps used and installed among nurses were related to drug information, health calculators, and health guidelines, and for Kayyali, Peletidi, Ismail, Hasjim, Bandeira, and Bonnah (2017) the most used apps are health related and lifestyle apps. Health data; calorie counter; healthy eating; nutrition and general health lifestyle are informative in nature as well as fitness training (physical training apps) are regarded as useful. The findings of the research at hand is supporting the research conducted by Bhuya, Lu, Chandak, Kim, Wyant, Bhatt, Kedia and Chang (2016) and Mayer, Rodríguez, Blanco, and Torrejon (2019). According to these authors the difference in the use of health apps are caused by personal need and concerns. Protecting personal health information, technology effectiveness and failure, preference for face-to-face interaction with their surgeon, level of effort required, and ability of the older adults to navigate mobile health technology.

By 2020, mobile apps are forecasted to generate around \$189 billion in revenues via app stores and in-app advertising. As of fourth quarter of 2019, there were 2.57 million available apps at Google Play Store and 1.84 million apps available in the Apple’s App Store, the two leading app stores in the world (Statista, 2019). The growth of download numbers is driven mainly by downloads from Android and iOS. As per mHealth Solutions Market (2019), the global mHealth solutions market is predicted to reach USD 90.49 Billion by 2022. The growing demand of healthcare applications and advanced connectivity have led to the growing interest in the development of mHealth apps.

A mobile application (or mobile app) is a software application designed to run on smartphones, tablet computers and other mobile devices. They are usually available through application distribution platforms, which are typically operated by the owner of the mobile operating system, such as the Apple App Store, Google Play (Android), Windows Phone Store, and BlackBerry App World. Table 1 shows some applications that have been developed and their functionalities.

**Table 1.** Some mHealth apps and their functionalities

Name of App	Major Functionality
Android	
Fooducate	Nutrition
Lifesum	Diet and Exercise
MyFitness Pal	Keep track of eating
Runtastic Running and Fitness Tracker	Run and walking tracker
StrongLifts 5X5	Workout
iPhone	
Nike Training Club	Workout
Fitocracy	Gamification to improve fitness
Calm	Meditation
Fitbit	Health and Fitness
Weight Watchers	Calorie counter
Both	
MySugr	Diabete tracker

*Source:* compiled by the authors

In a report by IMS Institute for Healthcare Informatics (2016), over 165 000 healthcare consumer qualified apps were selected for review from both the Apple iOS and Google app platforms. Through review and selection criteria, to include prioritisation of the most downloaded apps, 26 864 were selected as representative of the most widely used mHealth apps by consumers. mHealth apps can be divided into two main categories: those which facilitate overall wellness such as exercise and diet, and those which specifically focus on disease management. However, the awareness and knowledge of these apps need to be increased to reach out to both the public and healthcare professionals in using the apps.

The systematic review by Mosa, Yoo, & Sheets (2012) acknowledged the importance of mHealth in medicine and healthcare. The Economist Intelligence Unit in PwC report (2014) examined the current state and potential of mHealth apps in developed and emerging markets, the ongoing barriers to its adoption and the implications for companies in the field. It was found that consumers have high expectations for mHealth apps, particularly in developing countries due to increasingly omnipresent mobile technologies and mobile subscriptions. Based on the research, the key findings were:

- Widespread adoption of mHealth apps will require changes in behaviour of actors who are trying to protect their interests.
- Patients want more convenient provision of healthcare, but they also want greater control.
- Patients in emerging markets are much more likely to use mHealth apps or services than those in developed countries.
- Widespread mHealth app adoption requires services and products that appeal to current payers because patients, highly sensitive to price, will provide little income.

Mobile health (mHealth) apps have shown to improve health indicators, but concerns remain about the inclusion of populations from low and middle-income countries in these new technologies.

**4. Aim and methodology**

The aim of this study was to explore the scale of awareness of mHealth apps and the perception of using mHealth apps for monitoring health in a middle-income country like Mauritius. The study also explored the barriers they faced.

This study involved a survey in the form of questionnaires for the general public. The questionnaires consisted of demographic-related questions and Likert-scale questions to determine whether respondents owned a smartphone, used apps, were aware of mHealth apps and barriers preventing them from using these apps. The questionnaire was piloted to distribution on a sample of 10 members of the public where it was found to be viable.

Based on convenient sampling, 385 questionnaires were distributed across the Mauritian population in August 2018. According to the Worldmeter (2018 Mauritius had a population of 1 268 315 people in 2018 and a sample of 385 at a 95% confidence level and 5% margin of error. A total of 141 useable questionnaires were received back, that is an 8.25% margin of error at a 95% confidence level at a 50% response distribution (Raosoft, 2004). The questionnaires were distributed both electronically and by hand through a researcher in Mauritius. The statistical package SPSS was used for analysing the data after it was captured and cleaned.

The demographic profile of the respondent group is presented in table 2 below. The majority of respondents (43.3%) were between 25 and 34 years of age. The gender split for the respondent group is male dominated, with 56% of the respondents being male. All (100%) of the respondents owned a smartphone and the majority, 85.8% (n =121) reported that they were aware of mHealth apps.

**Table 2.** Demographic profile

	% of Total	Total (n = 141)
<b>Age group</b>		
18-24	28.4	40
25-34	43.3	61
35-44	24.1	34
45-54	2.8	4
55-64	1.4	2
<b>Gender</b>		
Male	56	79
Female	44	62
<b>Own a Smartphone</b>		
Yes	100	141
No	0	0

**5. Results**

The respondents were asked a series of questions regarding mHealth apps to determine whether they are aware of mHealth apps, the identification and use of the mHealth apps. Questions regarding the usefulness and barriers that prevent the use of mHealth apps were also asked.

### 5.1. Awareness

Most of the respondents (85.8%, n=121) are aware of mobile health applications for smartphones, figure 1.

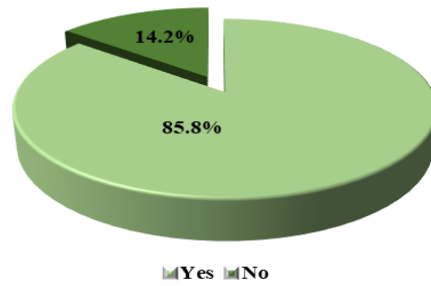


Figure 1. Aware of mHealth apps for smartphones

### 5.2. Identification

Note the question regarding the identification of mHealth apps is a multiple response question and therefore the groups of respondents for the different apps are not independent. This is why the percentages of cases add up to more than 100%, see figure 2.

On average, each respondent selected 2.56 apps that they are aware of. The best-known app is SamsungHealth with more than 50% (54.5%, n=72) of the respondents having selected it. GoogleFit (37.1%, n=49) is the second-best known app, followed by FloPeriodOvulationTracker (31.8%, n=42). Of those that selected FloPeriodOvulationTracker, 53.3% (n=32) are female.

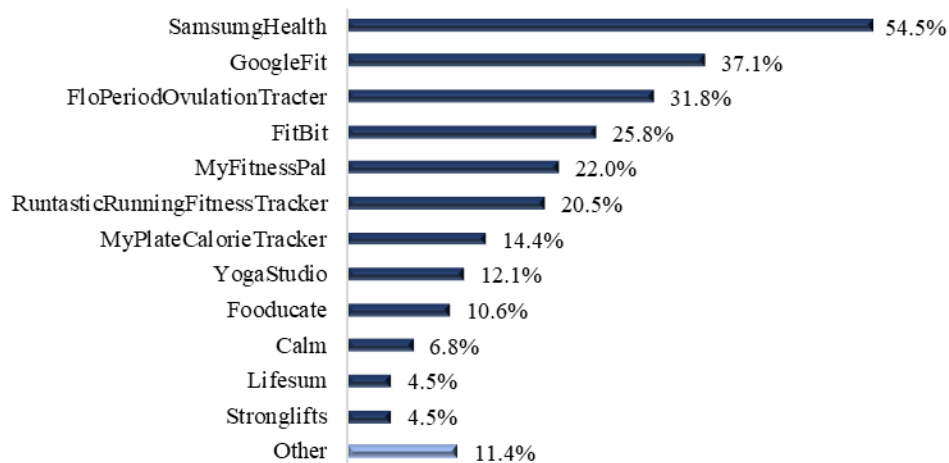


Figure 2. Awareness of mHealth apps

### 5.3. Downloads and/or use of mHealth apps

Note the question regarding the download and/or use of mHealth apps is a multiple response question and therefore the groups of respondents for the different apps are not independent. This is why the percentages of cases add up to more than 100%.

On average, each respondent selected 1.76 apps that they have used or downloaded, see figure 2. The most popular app is SamsungHealth with more than 50% (52.7%, n=58) of the respondents having selected it. GoogleFit (24.5%, n=27) is the second most popular app, followed by FloPeriodOvulationTracker (23.6%, n=26). Of those that selected FloPeriodOvulationTracker, 42.0% (n=21) are female, see figure 3.

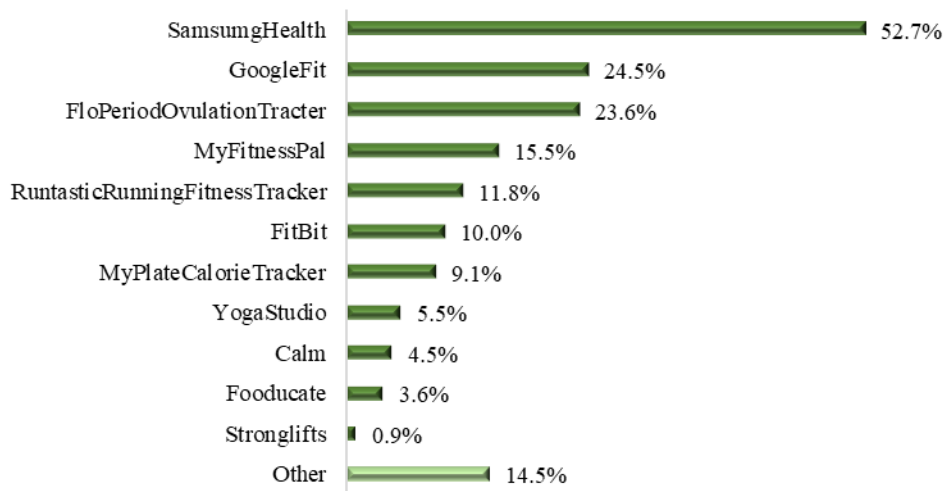


Figure 3. Downloads and/or use of mHealth apps

The respondents were requested to indicate what factors do they considered as important when downloading the mHealth app. The variables were firstly treated as categorical and secondly as numerical in the measurement level.

*Treating the variables as categorical in the measurement level.*

Considering the combined size of the Important and Very important proportions in the graph below, one can see that Cost of App (78.0%, n=110) is the most important factor when deciding which mHealth app to download, see figure 4.

	Not at all Important	Slightly Important	Neutral	Important	Very Important	Total
Rating of The App	6 4.3%	7 5.0%	19 13.5%	62 44.0%	47 33.3%	141 100.0%
Cost	1 0.7%	7 5.0%	23 16.3%	46 32.6%	64 45.4%	141 100.0%
Friend Family Recommendation	6 4.3%	21 14.9%	32 22.7%	65 46.1%	17 12.1%	141 100.0%
Appearance of App	4 2.8%	16 11.3%	31 22.0%	66 46.8%	24 17.0%	141 100.0%
Brand Reputation	3 2.1%	11 7.8%	36 25.5%	66 46.8%	25 17.7%	141 100.0%
Suitability of App	1 0.7%	9 6.4%	19 13.5%	66 46.8%	46 32.6%	141 100.0%
Other	3 2.1%	6 4.3%	115 81.6%	9 6.4%	8 5.7%	141 100.0%

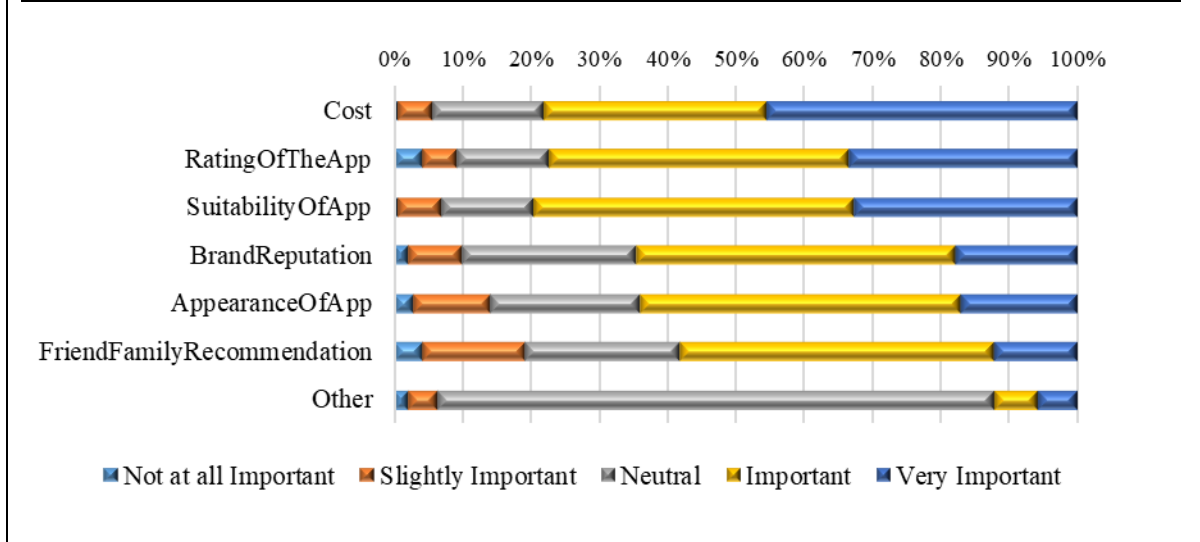
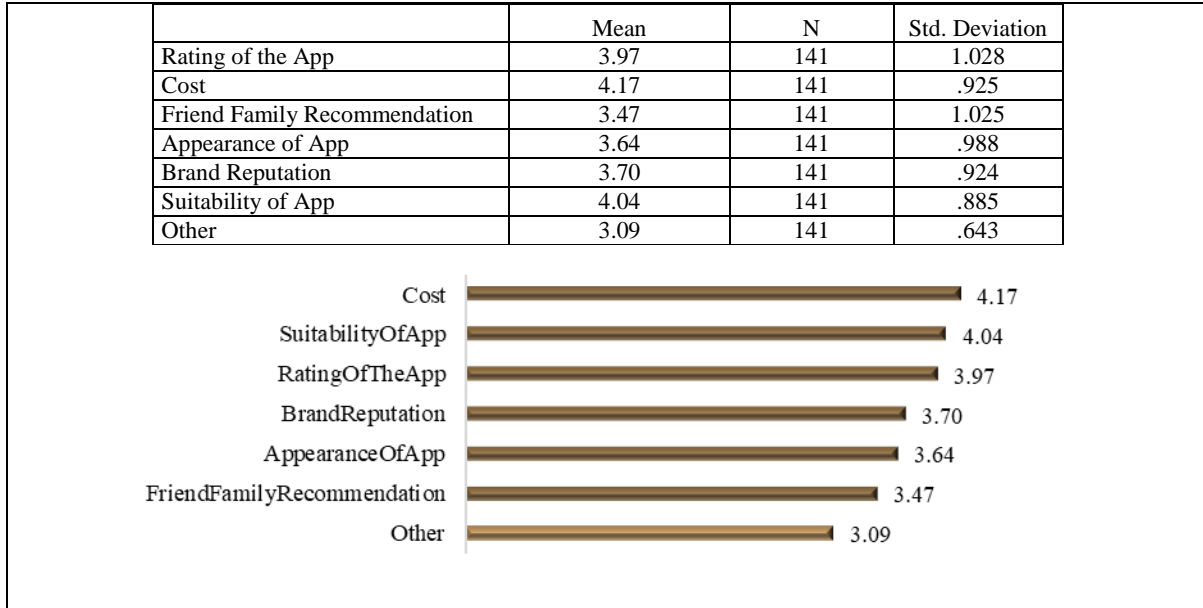


Figure 4. Factors considered when downloading the mHealth app: categorical measurement

*Treating the variables as numerical in the measurement level.*

These variables are Ordinal (categorical) in measurement level and as such, they are sometimes treated as numerical (scale in measurement level), provided that the number of values in the scale is no less than four. However, when interpreting the mean scale values for these variables, it must always be done relative to the scale. By no means should a mean value be construed as the average importance of the influencing factor. The mean scale value should be interpreted relative to the middle value of the scale (in this case it is 3). For example, if the mean of the scale values is higher than the middle value of the scale, then you can deduce that the respondents tended more to consider this factor to be important rather than not important.

On average, Cost (M=4.17, SD=0.925) is rated as the most important influencing factor when deciding which mHealth app to download, see figure 5. These results carry the same information as the previous section in a more parsimonious way.



**Figure 5.** Factors considered when downloading the mHealth app: numerical measurement

#### 5.4. Usefulness of mHealth apps

Respondents were asked to rate the usefulness of the mHealth apps on a 5-point Likert scale ranging from not useful at all to very useful. The variables were firstly treated as categorical and secondly as numerical in the measurement level.

*Treating the variables as categorical in the measurement level.*

Considering the combined size of the not useful at all to very useful proportions in the graph below (figure 6) one can see that Fitness Training Apps (83.7%, n=118) is the most useful mHealth app.



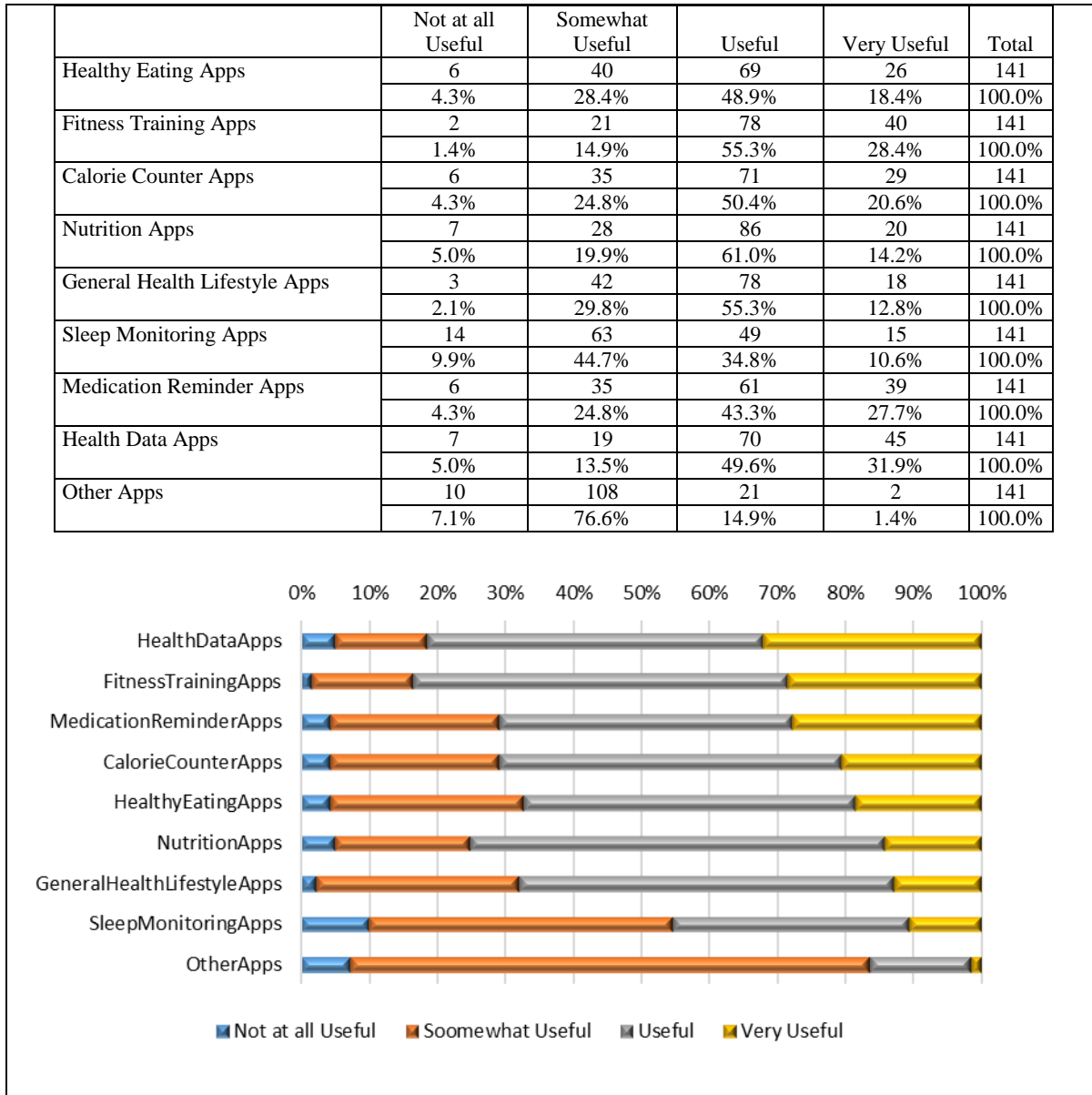


Figure 6. Usefulness of the mHealth apps: categorical measurement

*Treating the variables as numerical in the measurement level.*

These variables are Ordinal (categorical) in measurement level and as such, they are sometimes treated as numerical (scale in measurement level), provided that the number of values in the scale is no less than four. However, when interpreting the mean scale values for these variables, it must always be done relative to the scale. By no means should a mean value be construed as the average usefulness of the app. The mean scale value should be interpreted relative to the middle value of the scale (in this case it is 2.5). For example, if the mean of the scale values is higher than the middle value of the scale, then you can deduce that the respondents tended more to find this app to be useful rather than not.

On average, Fitness Training Apps (M=3.11, SD=0.694) is rated as the most useful app, see figure 7. These results carry the same information as the previous section in a more parsimonious way.

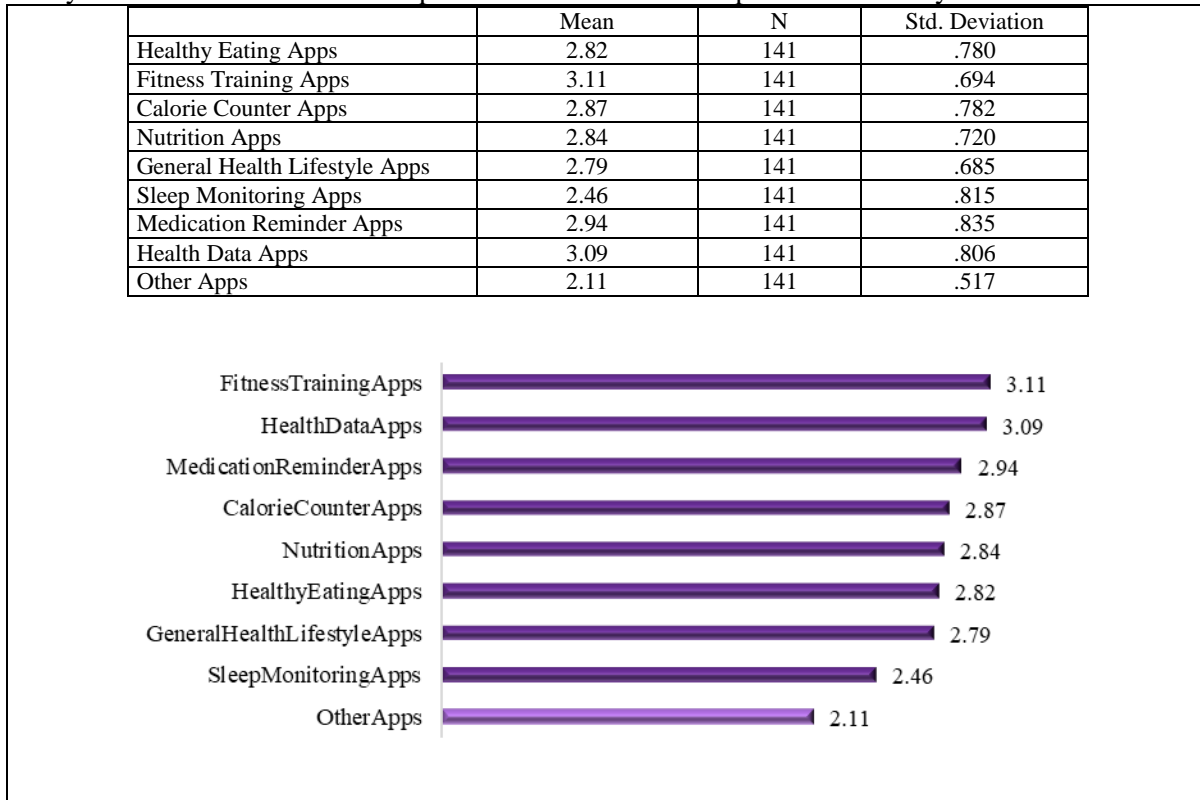


Figure 7. Usefulness of the mHealth apps: numerical measurement

### 5.5. Barriers that prevent the use of the mHealth app

Respondents were asked to indicate barriers that prevent people from using the (mHealth apps on a 5-point Likert scale ranging from not strongly disagree to strongly agree. The variables were firstly treated as categorical and secondly as numerical in the measurement level.

#### *Treating the variables as categorical in the measurement level*

Considering the combined size of the Agree and Strongly agree proportions in the graph below, one can see that there is a close tie with Cost concerns (78.8%, n=111) and privacy or security (78.0%, n=110) for being the biggest barrier that prevents people from using a mobile health app, see figure 8.

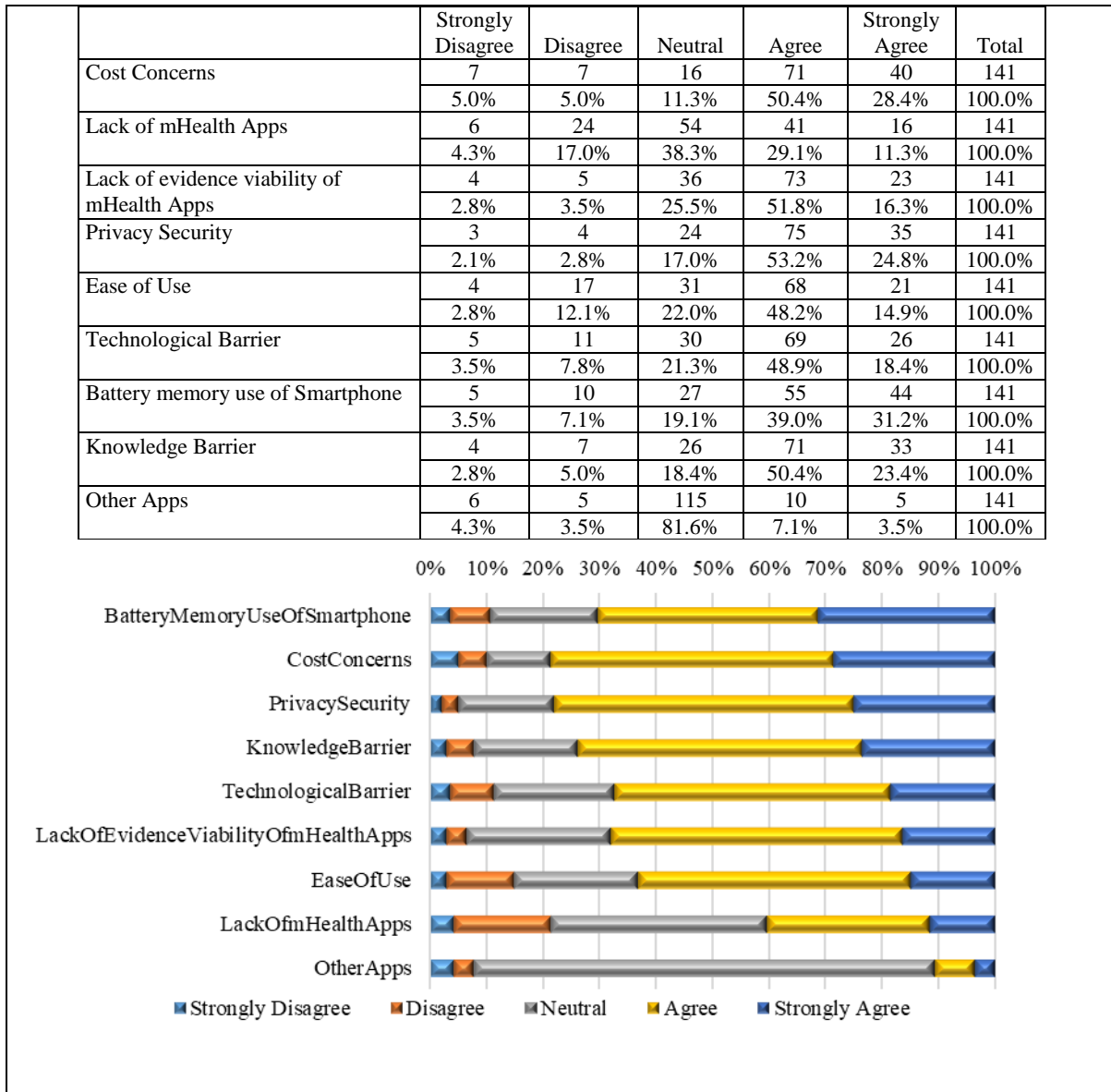


Figure 8. Barriers that prevent the use of the mHealth app: categorical measurement

These variables are Ordinal (categorical) in measurement level and as such, they are sometimes treated as numerical (scale in measurement level), provided that the number of values in the scale is no less than four. However, when interpreting the mean scale values for these variables, it must always be done relative to the scale. By no means should a mean value be construed as the extent to which this factor is a barrier to using a mobile health app on average. The mean scale value should be interpreted relative to the middle value of the scale (in this case it is 3). For example, if the mean of the scale values is higher than the middle value of the scale, then you can deduce that the respondents tended more to find this factor to be a barrier rather than not.

On average, privacy or security (M=3.96, SD=0.852) is rated as the strongest barrier to using a mobile health app, followed closely by Cost concerns (M=3.92, SD=1.022), see figure 9. These results carry the same information as the previous section in a more parsimonious way.

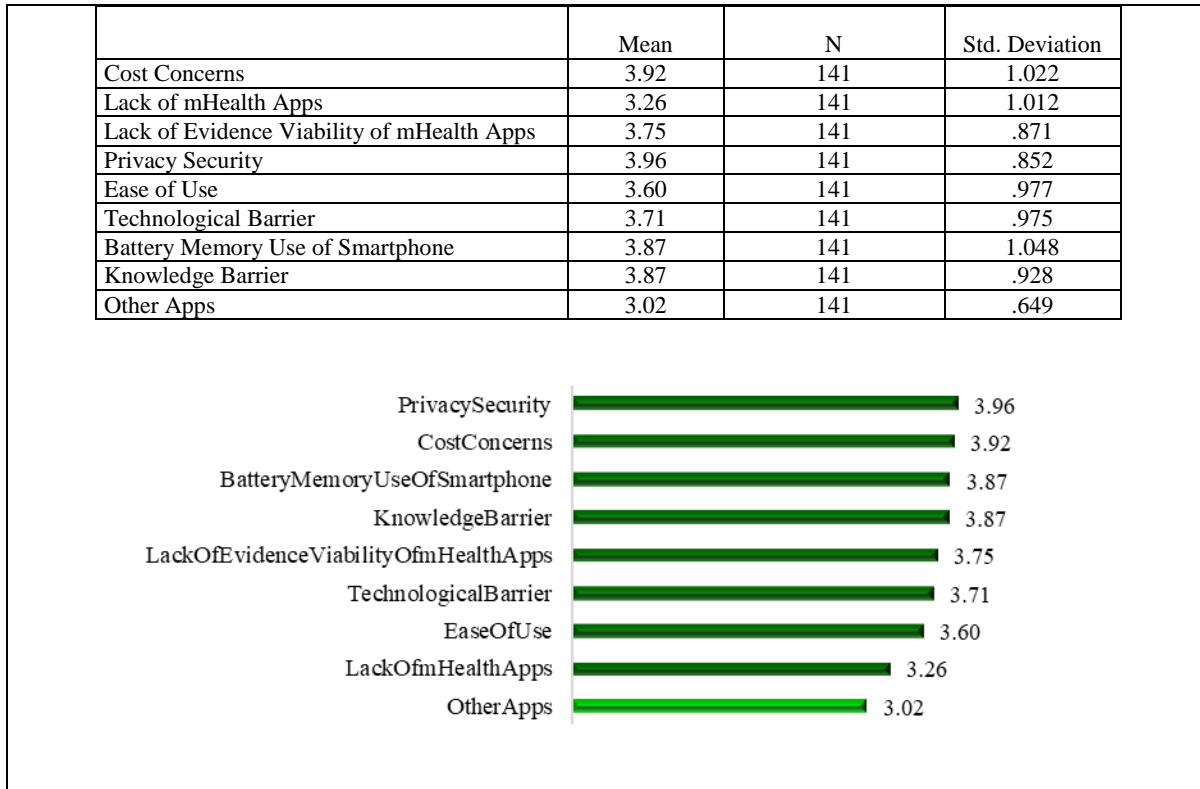


Figure 9. Barriers that prevent the use of the mHealth app: numerical measurement

## 6. Discussion

A mobile app is software programs that are designed for mobile devices such as a tablet computer or a smartphone and requires an operating system to run. Apps are designed for the end user and allow the user to perform specific tasks. Mobile apps were originally intended for productivity assistance, but the demand for apps caused a rapid expansion into other areas for instance retailing, gaming, medicine etcetera, there are literally millions of apps available. One such an app is mobile health or mHealth that provides health related services for smartphones and tablet PCs. As these apps are accessible from both home and on-the-go, health apps are of the movement towards mobile health programmes in health care (Rouse 2011).

The aim of the article is to explore the scale of awareness of mHealth apps and the perception of using mHealth apps for monitoring health in a middle-income country like Mauritius.

The research revealed that all respondents have smartphones and that the majority of the respondents are aware of mHealth apps and that the best known and most downloaded mHealth app by the respondents is SamsungHealth. About 54.5% are aware of the SamsungHealth apps and 52.7% of the respondents had downloaded it. Respondents consider the cost, suitability and rating of the apps before downloading it. According to the

respondents the most useful apps are apps dealing with fitness training, health data and medical reminders. The biggest barrier that prevents the respondents from using a mobile health app is cost concerns and privacy or security.

### Conclusions and recommendations

Smartphones are mobile devices that are readily available and used every day in a middle-income country like Mauritius. The people of Mauritius have knowledge of apps and are aware specialised of mobile applications (apps) such as mHealth. Fitness seems to be important as most of the respondents find the fitness training app use most useful. As can be expected from a middle-income country, the people are concerned about cost of downloading and associated costs such as data, as data is a prerequisite for using apps. Besides the cost aspect, privacy is very important to the people and is therefore seen as a barrier that prevents them from using apps. It is recommended that the cost of mobile apps be investigated. Furthermore, there should be communication and education from app creators regarding the benefits of using a particular app, as well as the security measures and protection of private users and their information.

Based on the findings of the research it seems that the type of health app used as well as the barriers to using these apps are similar in developed and developing countries. There is also not a significant difference between the type of app used and barriers to use in a Western society and Africa.

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