

THEMATIC ANALYSIS OF GOOGLE PLAY REVIEWS OF LIFESTYLE APPS

Veronika Keller

University of Győr

Hungary

ORCID 0000-0002-7759-7613

Ida Ercsey

University of Győr

Hungary

ORCID 0000-0002-4076-7922

Abstract: *Worldwide, numerous studies have been conducted on m-health applications and the results show that, if well-designed, they can regulate and track medication and reduce healthcare costs. The aim of this research is to analyze the experiences of users connected to different lifestyle apps, in particular (1) to explore the negative, neutral and positive topics in the reviews, and (2) to discover the role of health improvement among the comments. The present paper is part of a complex empirical research project. A qualitative and quantitative content analysis was conducted of the user reviews in the Google Play store for the 16 lifestyle apps selected during the first phase of the empirical research (quasi experiment). All in all, 2,835 comments were analyzed. The negative comments mentioned unreliable tracking functions, problems with updates, or high prices. The neutral comments outlined some missing functions or problems with the operation of the app. The positive comments were related to health improvement, usefulness, ease of use, engagement and willingness to recommend the app. Physical activity, facilitating a specific diet, weight loss, wellbeing, tracking progress and health awareness were among the common health aspects of the lifestyle apps. The results of this research will be particularly useful for consumers, app developers and service providers who focus on health awareness and health promotion.*

Keywords: *m-health market, lifestyle app, content analysis, Google Play reviews*



INTRODUCTION

The m-health market shows dynamic development both on the supply and demand side. The mobile health market is expected to continue to grow in the upcoming years and is predicted to exceed 300 billion U.S. dollars by 2025 (STATISTA, 2021). That would be a threefold increase from around 99 billion dollars in 2021. Lifestyle applications (LA), the most common health-related applications, include fitness apps, nutrition and diet apps, and meditation apps (Pires et al., 2020). Based on the available data, revenue in lifestyle applications on the international market was projected to reach 23.55 billion dollars in 2022. Fitness applications provide the most revenue, followed by meditation and lastly nutrition applications. These apps aim to assist users in health maintenance and prevention of illness. Within LA, the use of fitness apps is the most common and there is a significant increase year by year. The use of fitness applications was the highest in the EU-27 (estimated rate of user penetration - 21.29%), followed by Hungarian use (17.10%), and finally the international penetration rate (11.06%) in 2021 (STATISTA, 2022a). Interestingly, Hungarians do not prefer nutrition applications - the usage rate is less than four percent; meanwhile the average proportion of those using meditation applications in the European Union countries and Hungary is between 8 and 10 percent. Therefore, compared to the worldwide penetration rate, the use of LA apps in Hungary is significant, but it lags behind the average of EU member states. This finding justifies the focus on the Hungarian target audience in the analysis of the usability of apps that positively influence lifestyle.

The use of m-health applications is also greatly influenced by how different applications are available and how much money is spent on using them. Domestic data on the use of applications clearly indicate that Hungarians prefer free available applications over paid applications, both in terms of fitness, meditation and nutrition applications. Relying on the data of STATISTA, we can gain insight into the top 10 global (STATISTA, 2022b) and Hungarian (MobileAction, 2022) most popular fitness and sports applications in the Google Play and Apple App Store by monthly downloads, and the leading health and fitness apps (STATISTA, 2022c) (*Appendix 1*).

According to recent results the m-health adoption may improve health outcomes (Jaana et al., 2019). After using m-health apps the patients perceive health benefits such as improved health habits and they are likely to use them on a regular basis (Ross et al., 2020; Desveaux et al., 2018). The perceived usefulness is not always related to illness, but may provide different health benefits such as better physical condition or relaxation, a more favorable mental state, and an enhanced quality of sleep. Shabir et al. (2022) investigated lifestyle apps, including apps related to sports and fitness, diet and nutrition, stress management and disease prevention by reviewing qualitative studies.

With the emergence of mobile app stores, researchers have paid attention to the user evaluations and reviews posted in the app stores. Previous studies examined the relationships between the features of m-health apps and the user ratings (Pagano & Maalej, 2013; Mendiola et al., 2015; Schumer et al., 2018), and the features and user feedback (Franco et al., 2016). Some research focused on the specific questions related to the applications, namely complaint aspects (Fu et al., 2013), error and user evaluation (Bavota et al., 2015), the features of nutrition apps in detail (Briggs et al., 2021), the quality factors (Stoyanov et al., 2015, 2016), gamification (Schmindt-Kraepelin et al., 2020), and the user-documented food consumption

data (Maringer et al., 2018). Another important area in the research of m-health applications is the assessment of the change in user behavior and the analysis of the impact on health (Banerjee et al., 2020; McKay et al., 2019). Some authors investigated the wide range of mobile applications, which can be divided into thirty different categories, including the category of health and fitness (Bavota et al., 2015; Fu et al., 2013; Pagano & Maalej, 2013). More researchers focused on only one specific LA app, like diet and nutrition apps (Franco et al., 2016; Schumer et al., 2018; Briggs et al., 2021; Maringer et al., 2018), and calorie-counting apps (Banerjee et al., 2020). Furthermore, in previous studies m-health apps in general were analyzed (Martin et al., 2015; Schmidt-Kraepelin et al., 2020), and some types of m-health apps, like well-being and mental health apps (Stoyanov et al., 2015), and medical, health, and fitness apps (Mendiola et al., 2015). In several studies, authors applied two main parameters to select the m-health applications for analyses: the most-downloaded apps and the minimum value of average user rating in App Stores.

This research is a part of complex empirical research (Figure 1). The authors conducted an exploratory study, a quasi-experiment among 22 university students for a 14 week period. The subjects of the experiment chose 16 different lifestyle apps to use over a semester. The authors aimed to highlight the usability aspects of LA apps, and the perceived health improvement. Participants related their experiences in a focus group interview and they also completed a questionnaire which aimed at discovering the usability aspects (MAUQ scale) of the app. Now the authors present the results of the 2nd step of the research, namely the results of the content analysis. A broad range of comments on the Google Play Store were analyzed relating to 16 different lifestyle apps. Based on the literature review many authors have analyzed reviews and apps but the majority of the studies focused on specific LAs, like fitness and nutrition apps. In this paper we try to add insight into more types of lifestyle apps and determine the factors of negative, neutral and positive opinion, in addition to highlighting the role of health improvement in the review process. Previous research results certified that user comments have an impact on the adoption and evaluation of applications, therefore we analyzed the content of the opinions relating to the use of the four (fitness, diet, meditation, and other health management) LA applications in detail. As one of the main advantages of LA is disease prevention, we see the analysis of the impact of LA apps on health, based on user experience and opinions, as a priority issue. Since the marketing aspect of the usability of lifestyle applications based on the opinions of app stores has not yet been analyzed in the marketing literature, this study fills this gap.

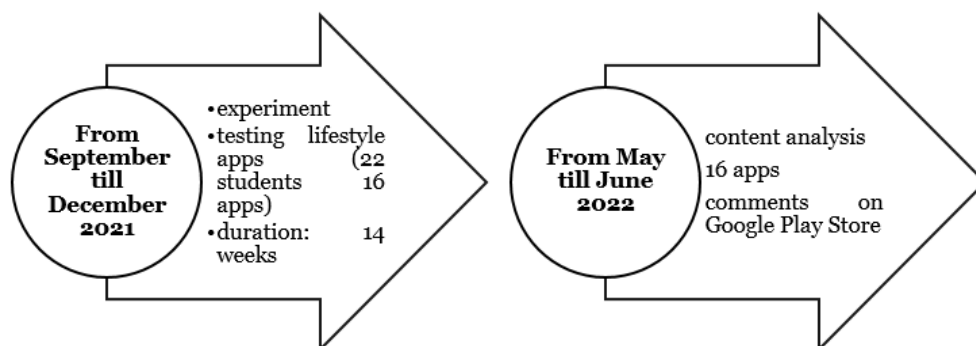


Figure 1. The stages of the empirical research.
[Source: own compilation]

The remainder of this paper is structured as follows: First we review the theoretical background and formulate the research questions. Second, we discuss data usage and the methodology. Third we summarize the findings of the empirical results. After this we present the discussion. Finally, this paper is ended with conclusions and implications.

LITERATURE REVIEW

With the emergence of mobile app stores such as the Apple App Store and Google Play Store, researchers have increasingly focused on analyzing user ratings and reviews posted in these app stores. In several studies, the authors examined a wider range of applications and analyzed experiences related to applications that can be classified into different categories (e.g., entertainment, music, lifestyle, health and fitness, etc.). Attention has been paid to examining which functions users value the most and which factors receive the most complaints in the different app categories. Fu et al. (2013) processed and analyzed over 13 million user reviews of 171,493 Android apps in the Google Play Store by using the WisCom system. They found that in the case of health and fitness apps the top-3 complaint aspects are accuracy (38%), stability (11%) and attractiveness (10%). Not surprisingly, users also criticized the accuracy and the stability when reviewing sports and lifestyle apps. Pagano and Maalej (2013) found that shortcomings, bug reports, and feature requests had a strong influence on negative ratings, while helpfulness and feature information on positive ratings. In some studies, the authors focused on identifying spam reviews. The examination of application errors and their effects also received attention, whereby the authors analyzed the effect of application errors on user evaluations (Bavota et al., 2015). Authors analyzed 5,848 free apps from the Google Play Market, and they considered each category (e.g., lifestyle, entertainment, photography, medical, games, health and fitness, sports, etc.). Furthermore, they involved 45 professional Android developers to explore the extent of the experienced problems when using apps, and the degree of relation of these problems to the unfavorable user ratings. The results indicate that apps with high user ratings are less fault- and change-prone than the low rated ones. In addition, some researchers have examined the sampling issues of research on m-health applications. In many studies, the full collection of user reviews available in the application store was used for the analyses. However, several authors applied only the partial dataset to utilize user comments, and some of them did not use review data at all. Researchers investigated over 2,7 million user reviews and found that app metrics such as price, rating, and download rank differ significantly based on the completeness of the processed comments (Martin et al., 2015). Stoyanov et al. (2015) developed the indicators to measure the quality of applications (MARS=Mobile App Rating Scale), based on opinions and evaluations by an expert panel. There were sixty well-being and mental health apps that were randomly selected using an iTunes App Store search. Experts identified four objective quality subscales: engagement, functionality, aesthetics, and information quality and one subjective quality subscale. Researchers found that apps showed a moderate correlation between the iTunes star rating and the total MARS score.

Researchers investigating m-health applications highlighted the valuable features of apps and discovered the relationship between the user's evaluation and the elements of usability. Schumer et al. (2018) explored the assessment of the various characteristics of diet and

nutrition apps available in the Google Play Store. They chose apps with a rating of 4 or higher which are available for free or can be purchased. The authors identified a total of 86 diet and nutrition apps that were freely available in the United States. The average rating was slightly higher for dietary applications compared to nutritional applications. Diet and nutritional tracking, food database and education were the most commonly utilized features among the identified apps in their research. On the other hand, reminders and feedback were some of the least commonly applied features across the same apps. However, from the aspect of body weight management, the reminders may be an essential tool in order to sustain adherence to the use of the diet and nutrition apps. Although their paper only examined free apps, based on prior studies, the authors suggested that cost might be an important factor affecting user satisfaction with diet and nutrition apps. Previous studies have shown that more expensive apps were more likely to receive higher ratings in terms of credibility and trustworthiness than those with negligible costs (West et al., 2012). It was ascertained that there is a higher proportion of advertisements in diet and nutrition apps in comparison to prior studies assessing health and wellness apps in general (Huckvale et al., 2015; Schumer et al., 2018). They highlighted the risks of advertising within apps due to its association with compromising privacy by allowing personal data to be sent to advertisers (Huckvale et al., 2015). In another study, the main features of the most popular nutrition apps were analyzed and their technologies for dietary assessment and user feedback compared (Franco et al., 2016). Apps were selected from the two largest UK online stores (the Google Play Store for Android and the iTunes App Store for iOS) based on the number of installs and reviews. A total of 13 apps were evaluated and the results focused on the energy balance between dietary intake and physical activity. Franco et al. (2016) found that all the apps storing dietary intake used the same technologies for data input (i.e., text search and barcode scanner) and nutrition assessment method (i.e., food diary record); however, the apps did not have a decision engine capable of providing personalized diet advice. Nutrition apps for weight management were selected from the Apple App Store and Google Play Store (Briggs et al., 2021). Two important conditions were defined for the selection of the applications: they must have the ability to track calories and have at least 500,000 installations. These American researchers evaluated the features of the free and upgraded versions of nutrition apps ($n = 15$) within 4 categories: (1) dietary intake, (2) anthropometrics, (3) physical activity, and (4) behavior change strategies. They then concluded that most nutrition apps possess more features dedicated to dietary intake, anthropometric, and physical activity tracking but they lack behavior change content features. Mendiola et al. (2015) focused on understanding what a user values in a healthcare application. The aim of their research was to identify the features that patient-consumers value most and contribute positively to the evaluation of an application. These authors filtered out the apps associated with reputable health organizations which were defined as developers or evaluators with relationships with content-credible health care entities. Finally, 234 medical, health, and fitness apps were selected from the Apple iTunes Store and the Google Play Marketplace in the US. These apps were manually evaluated for the presence and characteristics of twelve app features. Using regression analysis, they came to the conclusion that five functions (plan or orders, export of data, usability, and cost) contributed significantly and positively to the evaluation of the users of the applications, while the tracking function made it worse.

When examining applications, not only usability, but also hedonistic aspects can be important. Gamification of m-health applications is considered a promising approach to

maintain long-term user motivation. Schmidt-Kraepelin et al. (2020) investigated the implementation of game mechanics in 1000 apps from the US Apple App Store and US Google Play Store and analyzed the relationship between the degree of gamification of m-health apps and user ratings. The research results point out a high degree of gamification in both app stores and indicate a positive relationship between the degree of gamification of m-health apps and user ratings in the Apple App Store. Furthermore, their study suggests that the use of gamification in the Google Play Store is substantially more common than in the Apple App Store.

Another fertile area in the research of m-health applications is the assessment of the change in user behavior and the analysis of the impact on health. The quality and effectiveness of the calorie-counting apps for weight control and behavior change among Indian youth were examined (Banerjee et al., 2020). Popular calorie-counting apps (n=20) were selected from the Google Play store and their quality was assessed on attributes like standards used, content accuracy, user interface and sources of database. The authors of this study found that over 65 per cent of apps overestimated or underestimated the calorie intake. Comparing the intervention (n = 30) and control (n = 28) groups, there was no significant difference in food consumption. Nevertheless, the physical activity in the intervention group increased during the eight weeks while using one of the top 3 apps. A recent study reviewed a large sample of healthy lifestyle apps in order to determine the apps' potential for promoting health-related behavior change (McKay et al., 2019). Five lifestyle behavior categories were identified: smoking, alcohol use, physical activity, nutrition, and mental well-being from the Australian Apple iTunes and Google Play stores. Apps with an average user rating between 3 and 5 were included, if they had been updated within the last 18 months, if the app description included two of the 4 behavior modification features (goal setting, action planning, self-monitoring, and feedback), and if they were in English. Finally, 344 apps were reviewed, which were classified as physical activity (n=275), healthy eating (n=23), mental well-being (n=27), smoking (n=14), and alcohol (n=5) category.

McKay et al. (2019) developed the App Behavior Change Scale (ABACUS) to determine behavior change potential, which contains 21 items. The selected behavior change apps were evaluated in two ways using previously developed rating scales: the Mobile App Rating Scale (MARS) for functionality and the ABACUS for potential to encourage behavior change. The average MARS score (2.93 out of 5) indicates low-to-moderate functionality and the average score for the ABACUS (7.8 out of 21) indicates a low-to-moderate number of behavior change techniques included in apps. The authors of the study determined the most common behavior change techniques included in apps: instruction, self-monitoring behavior, customizing features, reminders and prompts of activity. They then recommended developing and improving the app design to promote significant lifestyle behavior change and better health. Food consumption behavior is a significant part of health behavior. In order to explore this behavior, the authors extended the data collection to the application websites, too. Maringer et al. (2018) investigated the publicly available information from the UK app stores and app-related websites. These authors focused on the user-documented food consumption data and sought to identify the opportunities and challenges associated with using this data for nutrition research. 176 apps were selected based on user ratings and English language support. They concluded that this data offers promising opportunities for a better understanding of food

consumption behavior. However, data exchange protocols and terms of use and privacy statements limit possibilities to process and share user-documented food consumption data.

The aim of the research is to analyze the experiences of users connected to different lifestyle apps.

Q1: What criteria do users use to evaluate the different LAs apps in the Google Play store? What are the major themes that are mentioned in the negative, neutral and positive comments?

Q2: How do health aspects appear among the comments based on the different types of LAs apps? What is the ratio of comments related to perceived health improvement?

To answer the research questions, we conducted a qualitative and quantitative content analysis of the user reviews visible in the Google Play store for the 16 lifestyle apps selected for the previously conducted quasi-experiment.

METHODS

The authors of this paper were interested in the general opinion and satisfaction of users connected to the 16 different LA apps: (6) fitness, (4) diet and nutrition, (3) mindfulness, (3) other health management apps (*Appendix 2*). This research question was analyzed by content analysis. We collected the comments available in the Google Play Store and analyzed the comments of Hungarian users. The comments were collected based on the star-rating system. In the case of three apps, two sports and fitness activity tracking apps (Garmin Connect, 30 Days Fitness Challenge) and one diet and nutrition app (Yazio) the comments of 2022 were chosen for analysis due to their extremely high number.

In the case of content analysis (analysis of comments in Google Play) thematic analysis was used to identify themes in the data. The first and second authors of this paper read each comment carefully. Once reviewed, the first author labeled relevant words, expressions and sentences and created a preliminary list of codes and the second author reviewed the list. Both researchers had ongoing meetings to identify and discuss discrepancies. Differences were minimal and a tertiary researcher was not required. A codebook was developed with the identification of codes and descriptions. The codes were grouped into themes and subthemes, thus categories were created. The refining of the list was a collaborative job and redundant themes were removed (Bryman, 2016; Kvale, Brinkmann, 2009).

In this paper we highlight the main themes that were identified related to the negative (★, ★★), neutral (★★★) and positive (★★★★, ★★★★★) comments connected to the analyzed categories of LAs. Health improvement aspects and incidence rate were also identified. During the analysis qualitative data and univariate statistics are presented.

RESULTS

In this chapter, we analyze the opinions and experiences of using the apps based on the research questions and the major types of the lifestyle apps. Four major types of LA were analyzed and the results are presented related to these categories, i.e., sports and fitness, diet and nutrition, mindfulness and other health related apps.

In the sports and fitness activity apps category users expressed their satisfaction in Google Play. They were mainly satisfied with Pedometer, and 30 Days Fitness Challenge. The other apps like Garmin Connect, My Workout Plan and 'FitApp running and walking' were evaluated as really good apps. '30 Days Fitness Challenge' was mainly commented on by females, who were generally satisfied with the app. 'Garmin connect' was evaluated by many people, especially men. 'My Workout Plan' was commented on by only a small number of people, and only a few comments were analyzed. 'FitApp run and walk' was reviewed by many Google users. Generally, it is true that people expressed their satisfaction. The majority of the comments were positive, except for Pedometer; however this app received a very good overall rating (4.9 stars).

Regarding the analyzed diet and nutrition apps people are very satisfied with the apps, especially with CalorieBase and Yazio and Water Reminder. In the case of 'Water Reminder' two comments could be found in Google Play. 'Water Time' is an app that counts water from drinks and a water diary and history with a user-friendly design. Mainly women commented on each app. In the case of 'CalorieBase many comments could be read in Google Play. In the case of 'Yazio' only the comments of 2022 were analyzed.

Three different stress relief and relaxation apps were analyzed, which were evaluated as very good in Google Play. 'Forest' is an app that helps its users focus on productivity and it was the best app of the year in 2015 and 2016. Plant a seed in Forest encourages people to put down their phone and stay focused to get things done. In the case of 'Yoga Challenge' only a few people expressed their thoughts.

Two apps – the 'Flo' and 'Women's Calendar' - developed for women were analyzed. The 'Flo' was commented on by 167 people and the Women's Calendar by 171 females. It is interesting that one male commented on Flo that it is a *'Very good app. I know now what is happening with my wife and with our baby. You should maybe have some father sections.'* Only one disease management app was analyzed, namely the 'MyTherapy', which is an ad-free, award-winning pill reminder and medication tracking app. People were generally satisfied with this app and the majority of the commenters were males (*Appendix 2*).

Negative comments

People tend to express their disappointment rather than their satisfaction (Shah et al., 2021). Most of the negative comments are about unreliable tracking (inaccurate tracking of performance in the case of sport-and fitness apps). Problems with downloads and updates also occurred as well as issues with updates, or the connection with a smart watch, complaints that it was too expensive, or issues with cash refunds (if the user does not want to use anymore). The negative comments highlighted the price of the app, or incorrect deduction of fees, too many advertisements, constant breakdown of the app, problems with new versions, or with the sound, or sharing performances on social media platforms or with other members of the group to motivate each other. In the case of diet and nutrition apps people had problems with the number of ads, the app crashing after updates, registration (not accepting the email address, all the user names are already taken), unreliable tracking, loss of previously registered data, slow, problems with individual goals. Most people want to get back their money or they dislike the app pushing them to subscribe to the pro version. The users complain about the complicated settings and the language barriers. Similar problems occurred in the case of nutrition instead of

sport-and fitness apps. In the case of mindfulness apps negative comments were about dissatisfaction of the pro version of the app, problems after updates or constant crashing. Commenters complained about the price and the different features that you have to pay for it or some users found it too expensive.

Some people complained about problems with updates, or mentioned some concrete problems that would be useful for IT specialists. Other problems also occurred with Hungarian language availability and data storage or transfer of previous data. In the case of ‘Women’s Calendar’ more negative comments occurred. The most serious ones were connected to the loss of data after an update that caused inconvenience for the users or the selection of some pills. In the case of MyTherapy some users mentioned some negative experiences like language barriers, or missing functions (Table 1).

Table 1. Typical negative comments. [Source: own compilation]

Quotations	Topics
<i>‘No warm-up and stretching.’</i>	Unreliable tracking
<i>‘It does not correctly describe the muscles worked.’</i>	
<i>‘The calorie content is not the same as stated by the manufacturer.’</i>	
<i>‘No warm-up and stretching.’</i>	Unreliable function
<i>‘Adding own diet, just importing recipes.’</i>	
<i>‘Reminder function is not working well.’</i>	
<i>‘The latest update has screwed up the options of labeling photos’</i>	Problems with update
<i>‘It has not been working since the last update.’</i>	
<i>‘Statistics and tracking work only in pro version.’</i>	High prices
<i>‘Very expensive!’</i>	
<i>‘Way too loud. Volume cannot be changed only if you upgrade and pay for it’</i>	
<i>‘Constant break down of the app’</i>	Technical problems
<i>‘It does not remember the settings, so is inconvenient to use’</i>	
<i>‘Complicated settings.’</i>	
<i>‘If I don’t log in for two or more days, it doesn’t send notifications, for example: drinking water and taking pills.’</i>	Language barriers
<i>‘Not available in Hungarian.’</i>	
<i>‘The Hungarian language pack is unfortunately not understandable in some places, and I couldn’t set the language to English.’</i>	

Neutral comments

Neutral comments were related to the fact that the user has just started to use the app and will share their experiences based on the results. Some neutral comments mentioned some missing functions, sudden crash of the app or disappearing music or map. Users gave ideas on how to develop the app. Other important aspects of the neutral comments were the high number of ads in the free version. However inaccurate tracking, and technical problems with data entry also appeared among the neutral comments, just as with negative comments (Table 2).

Table 2. Typical neutral comments. [Source: own compilation]

Quotations	Topics
<i>'Other apps count the calories you've burned. If they could add this feature it would give the users motivation.'</i>	Missing functions
<i>'More specific exercise related to special body parts.'</i>	Ideas for developers
<i>'More types of liquids, like herbal teas, soups, alcoholic beverages, etc. should be included in the app.'</i>	
<i>'Can the advertising space be smaller?'</i>	Communication clutter in the free version

Positive comments

In the case of fitness apps, positive comments highlighted the health improvement (weight loss, progress in fitness), the ease of use and the willingness to recommend. Satisfied users expressed their positive emotions connected to the app and the results that they have achieved. Most people expressed their like of the exercises and the usefulness of the app and the positive word of mouth. Most of the commenters were satisfied with the app because it is simple, great, perfect, easy to use, attractive and effective.

In the case of nutrition apps pretty similar aspects were mentioned. The positive comments highlighted the usefulness of the app, weight loss, help in controlling eating, easy usage, attractive visual appeal, functions, engagement, large storage surface, and constant development of the app (from IT specialists). Most of the reviewers have positive opinions and acknowledge the reminder function of the app in case of the Water Reminder.

In the case of mindfulness apps most people were satisfied with the app because they thought that it was useful and helped them study and work better, enabled heightened concentration and helped in not losing focus or minimizing their smartphone usage and social media addiction. Some people came up with ideas on how to develop the app, and what kind of functions would help the users. Some positive comments acknowledged the gamification function of the app. Positive emotions and engagement appeared among the comments.

In the case of women cycling apps the majority of the users admitted the benefit of the app: simple usage, good functions, attractive interface, interesting content and articles and of course the usefulness and the supportive function of the app was highlighted, too. The satisfied users highlighted the usefulness (planning, tracking cycle rides, etc.), and the design of the app and they admitted that it is easy to use. In the case of other health management apps the majority of commenters expressed their general satisfaction and acknowledged the usefulness of the app (Table 3).

Table 3. Typical positive comments. [Source: own compilation]

Quotations	Topics
<i>'It is an excellent stimulant for exercise and weight loss.'</i>	Health improvement
<i>'Since I've been using this app my water intake has improved dramatically'</i>	
<i>'I don't forget to take my pills anymore.'</i>	Usefulness
<i>'I have lost 24 kg since June 2021'</i>	
<i>'Fully capable of tracking my meds.'</i>	Functions
<i>'It has good functions.'</i>	
<i>'The supportive function is very good.'</i>	
<i>'It has interesting articles and content.'</i>	
<i>'This is the best game in the world and a very good challenge.'</i>	General satisfaction
<i>'I found it has all the functionality I needed. Thanks a lot.'</i>	
<i>'I recommend it to everyone.'</i>	Willingness to recommend
<i>'The free version contains every basic function that I require, and it is easy to use.'</i>	Ease of use
<i>'I love it. Great. Super.'</i>	Positive bonds
<i>'I really like the fact it counts calories. Great app!'</i>	
<i>'Simply the best. Inspiring.'</i>	
<i>'The best app measuring running activity.'</i>	

Health aspects

Positive comments also focused on health aspects and were mainly mentioned in the case of fitness and nutrition apps. Commenters highlighted a physically active life and the benefits of regular exercises. In the case of nutrition apps, the control of a special diet for different motivations (chronic disease or weight loss) reinforced the importance of apps that help their users control their calorie intake. Many commenters admitted the facilitating role of apps in changing former lifestyles, with comments reporting amazing weight loss and improvement of wellbeing (both physical and mental). Progress in body shape (flat belly, muscular body) was also highlighted especially in the case of fitness apps. In the case of other health management apps body awareness was also mentioned by the commenters (*Table 4*).

Table 4. Typical comments related to health improvement. [Source: own compilation]

Quotations	Topics
<i>'I have become so muscular.'</i>	Physical activity
<i>'Moves all parts of the body.'</i>	
<i>'It is tiring, useful, makes me sweat.'</i>	
<i>'Good support for a successful diet.'</i>	Diet
<i>'I suffer from diabetes. I can follow my nutrition intake.'</i>	
<i>'Good help in changing my lifestyle.'</i>	Losing weight
<i>'1 month - 10kg', '1 week -2 kg'</i>	

<i>'Relaxing.'</i>	
<i>'I already feel so good after using it for the first time.'</i>	
<i>'I can practice self-control.'</i>	General wellbeing
<i>'It helps me to concentrate and I feel so much better in myself.'</i>	
<i>'Good to track my progress.'</i>	
<i>'The results are visible after one month.'</i>	Progress
<i>'I wasn't planning to lose weight, but I'm enjoying the fact I'm so much more flexible now.'</i>	
<i>'I can understand how my body works and my symptoms.'</i>	Body knowledge

DISCUSSION

Reading opinions about the use of m-health applications is not only important for consumers, but also for application developers and app stores. In the international literature, some authors used several different research approaches and research methods to explore and learn about user experiences and both negative and positive opinions. In many studies, the full collection of user reviews available in the application store was used for the analyses. However, several authors used only the partial dataset to utilize user comments. The aim of the present study was to explore the different dimensions determining satisfaction with a lifestyle app. Former study analyzed the Google Play and Apple Store comments from different perspectives and mainly fitness and (Fu et al., 2013) or nutrition apps (Schumer et al., 2015, Franco et al., 2016). Attention has been paid to examining which functions users value the most and which factors receive the most complaints in the different app categories.

First the authors of this paper raised the research question *'What criteria do users use to evaluate the different LAs apps in the Google Play store? What are the major themes that are mentioned in the negative, neutral and positive comments?'* Generally, users are satisfied with the apps. People are willing to share their negative, and positive experiences with the analyzed apps. All in all, 2,835 comments were analyzed. The negative comments were related to technical aspects, namely update problems, the price of the app (pro version), and the number of ads in the free versions. West et al. (2013) showed that the more expensive apps were more likely to receive higher ratings in terms of credibility and trustworthiness than those with negligible costs. Previous studies highlighted accuracy, stability, attractiveness (Fu et al., 2013) shortcomings, bug reports and feature requests (Pagano & Maalej, 2013) as major sources of complaints. In this empirical research we could also identify accuracy, namely unreliable tracking, stability, as in problems with updates, or technical problems as did Bavota et al. In terms of popularity, we found that reviewers had problems with unreliable functions as did Mendiola et al. (2015), stating that the tracking function in the case of healthcare apps has a negative effect on the evaluation process.

Most of the studies analyzed complaints or negative and positive ratings (Pagano & Maalej, 2013), but not the neutral ones. In the present empirical research the neutral comments expressed some missing functions, or problems with the operation of the app and communication clutter. Huckvale et al. (2015) highlighted the risks of advertising within apps due to its association with compromising privacy by allowing personal information to be sent to advertisers. In the case of all the analyzed apps, commenters came up with some ideas on

how to make a perfect app that would help develop user friendliness and the achievement of user goals.

Pagano and Maalej (2013) found that helpfulness and feature information determine positive ratings. We also found similar results. Positive reviews were related to health improvement, the achievement of goals, overall satisfaction, engagement and the willingness to recommend the app. Mendiola et al. (2015) came to the conclusion that previously defined goals, export of data, usability, and cost contributed significantly and positively to the evaluation of the users of the applications. Even though former studies emphasized the importance of gamification especially in the case of Android operating system (Schmidt-Kraepelin et al., 2020), we could not identify this element as a major theme among the positive reviews. On the other hand, we were also curious about the ratio of negative, neutral and positive comments, considering the ratio of negative comments was the highest in the case of women's cycle tracking apps and diet and nutrition apps. Users expressed their general satisfaction and positive experiences mainly in the case of stress relief, relaxation and disease management apps.

Another fertile area in the research of m-health applications is the assessment of change in user behavior and the analysis of the impact on health (Banerjee et al., 2020, McKay et al., 2018, Maringer et al., 2019). Briggs et al. (2021) highlighted that diet and nutrition apps lack behavior change content features. The second research question investigated '*How do health aspects appear among the comments based on the different types of LAs apps? What is the ratio of comments related to perceived health improvement?*' Health aspects appeared among the positive comments. Physical activity, facilitating a special diet, and weight loss were mentioned by the reviewers. Some people highlighted the improvement in wellbeing from both mental and physical aspects. As in previous studies (Pagano & Maalej, 2013) pointed out the helpfulness and usefulness of lifestyle apps. Some users reported their progress, and their knowledge about their body, and symptoms depending on the type of apps. Users mainly commented on their results and health improvement in the case of nutrition and fitness apps. All in all, we can say that people express their satisfaction based on technical information, ease of use, usefulness and functions of the apps, whereas health aspects are marginal, and mainly present in the case of nutrition and fitness apps (Table 5).

Table 5. Comments of lifestyle apps in Google Play. [Source: own compilation]

Lifestyle apps	Ratio of negative comments (★, ★★)	Ratio of neutral comments (★★★)		Ratio of positive comments (★★★★, ★★★★★)			Ratio of health-related comments	
	%	n	%	n	%	n	%	n
Sports and fitness activity tracking apps (6*, 765**)	14.1	108	6.4	49	79.5	608	2.3	18
Diet and nutrition apps (4*, 1275**)	18.8	240	8.6	109	72.6	926	4.2	54
Stress relief and relaxation apps (3*, 326**)	11.0	36	4.6	15	84.4	275	1.2	4
Other health management apps (3*, 469**)	17.7	83	6.4	30	75.9	356	1.5	7

Note. *Number of analyzed apps **number of comments

CONCLUSIONS

Results of the study showed that technical problems, features, or inaccurate tracking are the basic reasons for dissatisfaction. Negative reviews were typical in the case of diet and nutrition apps, because these types of apps require the highest level of effort from the users. Neutral reviews were related to missing functions, and also to communication clutter. Positive reviews highlighted health improvement, usefulness, functions or features, ease of use and engagement. Previous researchers placed high emphasis on behavior change (Banerjee et al., 2020) and regarding health improvement the reviewers pointed out physical activity, diet, losing weight and general wellbeing.

The results of our research will be particularly useful for consumers, app developers and service providers who focus on health awareness and health promotion. In the case of healthcare, it can contribute to reducing the burden on the health care system and to the integrated development of telemedicine and traditional healthcare. Many cardiovascular diseases can be treated with the improvement of physical and mental health. The use of LAs contribute to this improvement, since apps are good facilitators for making lifestyle changes. Technical aspects, like ease of use and aesthetics, design or user experience are more important factors for users than health aspects in the evaluation process.

The findings of this research have some limitations. First, only certain LAs were analyzed related to different fields, like physical activity, diet, relaxation and other health issues. In the case of two fitness and one nutrition app the reviews of 2022 were analyzed. As previous researchers (Schmidt-Kraepelin et. al., 2020) highlighted, gamification aspects are present in the Google Play Store rather than in the App Store. Second, all the apps received a relatively good review (above 4 stars) from users.

Future research efforts should be geared towards investigating the ratio of the identified themes. This method would enable multivariate statistical analysis (ANOVA), that is to highlight differences between different LAs (fitness, diet, mindfulness, other health management). A quantitative research should be conducted to measure the usability and user satisfaction. The previously developed and adopted scales (MAUQ - Zhou et. al., 2019, uMARS - Stoyanov et al., 2016, ABACUS - McKay, et. al., 2019) should be tested in Hungary. In our opinion the basic aspects of usability and behavior change should be extended with the identified themes due to the content analysis. Scale development (qualitative research, focus group interviewing) and validation (quantitative research) will be the future aim of the research.

IMPLICATIONS FOR APPLICATION

At population level, it has a prominent role in the field of prevention. Excess weight, obesity and cardiovascular diseases are some of today's most pressing public health issues worldwide, and Hungary is no exception. Numerous m-health apps available in app stores deal with weight-related behaviors, such as eating behavior, physical activity and mental health. Using lifestyle apps can contribute to health management, disease prevention and well-being of users.

For developers, it offers the possibility to expand the services available free of charge and to manage and analyze Big Data in compliance with GDPR regulations. They can perfect the app and learn how to meet user needs.

REFERENCES

- Banerjee, P., Mendu, V.V.R., Korrapati, D., & Gavaravarapu, S. M. (2020). Calorie counting smartphone apps: Effectiveness in nutritional awareness, lifestyle modification and weight management among young Indian adults. *Health Informatics Journal*, 26(2), 816-828. doi: 10.1177/1460458219852531
- Bavota, G., Linares-Vasquez, M., Bernal-Cardenas, C.E., Di Penta, M., Oliveto, R., & Shybyanyk, D. (2015). The Impact of Api Change-and Fault-Proneness on the User Ratings of Android Apps. *IEEE Transactions on Software Engineering*, 41(4), 384-407.
- Briggs, T., Quick, V. & Hallman, W.K. (2021). Feature Availability Comparison in Free and Paid Versions of Popular Smartphone Weight Management Applications. *Journal of Nutrition Education and Behavior*, 53(9), 732-741. <https://doi.org/10.1016/j.jneb>
- Chandy, R., & Gu, H. (2012). Identifying spam in the ios app store. In *Proceedings of the 2nd Joint WICOW/airweb Workshop on Web Quality* (56-59). ACM, 10.1145/2184305.2184317.
- Desveaux, L., Shaw, J., Saragosa, M., Soobiah, C., Marani, H., Hensel, J., Agarwal, P., Onabajo, N., Bhatia, R.S., & Jeffs, L. A. (2018). A mobile app to improve self-management of individuals with type 2 diabetes: qualitative realist evaluation. *Journal of Medical Internet Research*, 20(3), e81, doi: 10.2196/jmir.8712
- Franco, R.Z, Fallaize, R, Lovegrove, J.A., & Hwang, F. (2016). Popular Nutrition-Related Mobile Apps: A Feature Assessment. *JMIR Mhealth Uhealth*, 4(3), e85, doi: 10.2196/mhealth.5846
- Fu, B., Lin, J., Li, L., Faloutsos, C., Hong, J. & Sadeh, N. (2013, August). Why people hate your app: Making sense of user feedback in a mobile app store. In *Proceedings of the 19th ACM SIGKDD international conference on knowledge discovery and data mining* (1276-1284). KDD '13. ACM, New York, doi:10.1145/2487575.2488202
- Huckvale, K., Prieto, J.T., Tilney, M., Benghozi, P.J., & Car, J. (2015). Unaddressed privacy risks in accredited health and wellness apps: a cross-sectional systematic assessment. *BMC Med*, 13(214). <https://doi.org/10.1186/s12916-015-0444-y>
- Jaana, M., Sherrard, H., & Paré, G. (2019). A prospective evaluation of telemonitoring use by seniors with chronic heart failure: adoption, self-care, and empowerment. *Health Informatics Journal*, 25(4), 1800-1814. doi:10.1177/1460458218799458
- Maringer, M., Van't Veer, P., Klepacz, N., Verain, M.C.D., Normann, A., Ekman, S., Timotijevic, L., Raats, M.M., & Geelen, A. (2018). User-documented food consumption data from publicly available apps: an analysis of opportunities and challenges for nutrition research. *Nutrition Journal*, 17(1):59, doi: 10.1186/s12937-018-0366-6
- Martin, W., Harman, M., Jia, Y., Sarro, F., & Zhang, Y. (2015, May). The app sampling problem for app store mining. In *Proceedings of the 12th working conference on mining software repositories* (123-133). MSR '15. IEEE Press, Florence, Italy.
- McKay, F.H., Wright, A., Shill, J., Stephens, H., & Uccellini, M. (2019). Using Health and Well-Being Apps for Behavior Change: A Systematic Search and Rating of Apps. *JMIR Mhealth Uhealth*, 7(7),e11926, doi: 10.2196/11926
- Mendiola, M.F., Kalnicki, M., & Lindenauer, S. (2015). Valuable Features in Mobile Health Apps for Patients and Consumers: Content Analysis of Apps and User Ratings. *JMIR mHealth and uHealth*, 3(2),e40. doi: 10.2196/mhealth.4283
- MobileAction (2022). Top Health and Fitness Apps in Hungary of Google Play Store. Retrieved November 22, 2022, from <https://www.mobileaction.co/top-apps/health-and-fitness-7/android/hu>
- Pagano, D., & Maalej, W. (2013, July). User feedback in the app store: An empirical study. *21st IEEE International Requirements Engineering Conference (RE)*, (125-134). Rio de Janeiro, Brazil. DOI: 10.1109/RE.2013.6636712
- Pires, I.M., Marques, G., Garcia, N.M., Flórez-Revuelta, F., Ponciano, V., & Oniani, S. A. (2020). Research on the Classification and Applicability of the Mobile Health Applications. *Journal of Personalized Medicine*, 10(1), 11. doi: 10.3390/jpm10010011

- Ross, E.L., Jamison, R.N., Nicholls, L., Perry, B.M., & Nolen, K.D. (2020). Clinical integration of a smartphone app for patients with chronic pain: retrospective analysis of predictors of benefits and patient engagement between clinic visits, *Journal of Medical Internet Research*, 22(4), e16939 doi: 10.2196/16939
- Schmidt-Kraepelin, M., Toussaint, P.A., Thiebesm S., Hamari, J., & Sunyaev, A. (2020). Archetypes of Gamification: Analysis of mHealth Apps. *JMIR Mhealth Uhealth*, 8(10), e19280, doi: 10.2196/19280
- Schumer, H., Amadi, C., & Joshi, A. (2018). Evaluating the Dietary and Nutritional Apps in the Google Play Store. *Healthc Inform Res.*, 24(1), 38-45. doi: 10.4258/hir
- Shabir, H., D'Costa, M., Mohiaddin, Z., Moti, Z., Rashid, H., Sadowska, D., Alam, B., & Cox, B. (2022). The Barriers and Facilitators to the Use of Lifestyle Apps: A Systematic Review of Qualitative Studies. *Eur. J. Investig. Health Psychol. Educ.*, 12(2), 144-165. doi: 10.3390/ejihpe12020012
- Shah, A. M., Yan, X., Tariq, S., & Ali, M. (2021). What patients like or dislike in physicians: Analyzing drivers of patient satisfaction and dissatisfaction using a digital topic modeling approach. *Information Processing & Management*, 58(3), 102516, <https://doi.org/10.1016/j.ipm.2021.102516>
- Statista (2021). Smartphone users in Europe 2020, by country. Retrieved March 24, 2022, from <https://www.statista.com/forecasts/1168910/smartphone-users-in-europe-by-country>
- Statista (2022a). Digital Fitness & Well-Being Apps. Retrieved March 24, 2022, from <https://www.statista.com/outlook/dmo/digital-health/digital-fitness-well-being/digital-fitness-well-being-apps/worldwide>
- Statista (2022b). Most popular fitness and sport apps worldwide 2022, by downloads, Google Play and Apple App Store. Retrieved November 10, 2022. from <https://www.statista.com/statistics/1239771/top-fitness-and-sport-apps-downloads>
- Statista (2022c). Leading Android health apps worldwide 2022, by downloads. Retrieved November 10, 2022. from <https://www.statista.com/statistics/690887/leading-google-play-health-worldwide-downloads/>
- Stoyanov, S. R., Hides, L., Kavanagh, D. J., & Wilson, H. (2016). Development and validation of the user version of the Mobile Application Rating Scale (uMARS). *JMIR mHealth and uHealth*, 4(2),e72. doi: 10.2196/mhealth.5849
- Stoyanov, S.R., Hides, L., Kavanagh, D.J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR Mhealth Uhealth*, 3(1),e27. doi: 10.2196/mhealth.3422
- West, J.H., Hall, P.C., Hanson, C.L., Barnes, M.D., Giraud Carrier, C., & Barrett, J. (2012). There's an app for that: content analysis of paid health and fitness apps. *J. Med. Internet Res.*, 14(3),e72, doi: 10.2196/jmir.1977
- Zhou, L., Bao, J., Setiawan, I. M. A., Saptono, A., & Parmanto, B. (2019). The mHealth app usability questionnaire (MAUQ): development and validation study. *JMIR Mhealth Uhealth*, 7(4),e11500, doi: 10.2196/11500

Appendix

Appendix 1

10 most popular fitness and sports applications in Google Play and Apple App Store,
Worldwide, in March 2022, by monthly downloads (in millions)

Source: own compilation

TOP	Popular fitness and sports applications	Monthly downloads (in millions)
1.	Home Workout	3 412 517
2.	Fitpro	3 062 954
3.	Sweatcoin	2 859 793
4.	Adm At Kazan	2 836 907
5.	Six Pack in 30 Days	2 648 175
6.	Pedometer, MStep	2 477 564
7.	FitCoach	2 404 215
8.	Keep	2 327 696
9.	Da Fit	1 742 377
10.	Workouts by Muscle Booster	1 701 678

Appendix 1

Leading health and fitness apps in the Google Play Store,
Worldwide in September 2022, by number of downloads to devices (in millions)

Source: own compilation

TOP	Leading health and fitness apps	Downloads to devices in millions
1.	Samsung Health	3,15
2.	Huawei Health	3,04
3.	Home Workout - No Equipment	2,43
4.	Feelsy: Stress Anxiety Relief	2,33
5.	Aarogya Setu	2,06
6.	Blood Pressure Pro	1,45
7.	Six Pack in 30 Days	1,41
8.	Sweatcoin	1,37
9.	Lucky Step	1,35
10.	Planet Fitness Workouts	1,08

Appendix 1

10 most popular fitness and sports applications in Google Play and Apple App Store,
In Hungary, in September 2022, by monthly downloads (in millions)

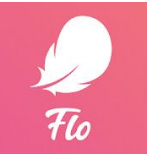
Source: own compilation

TOP	Free apps in Google Play Store	Free apps in Apple Store
1.	My Fitness	FitCoach
2.	MyStep	YAZIO
3.	Home Workout	Huawei Health
4.	FITAPP Run and Walk	Muscle Booster Workout Planner
5.	Six Pack in 30 days	Fitify: Fitness & Home Workout
6.	Yoga For Weight Loss	Sleep Cycle - Sleep Tracker
7.	YAZIO	Nike Run Club
8.	Fitify	My Fitness
9.	Mi Fit	Period Tracker Period Calendar
10.	iStep	Calorie Base - Calorie Counter

Appendix 2 The analyzed apps on Google Play Store

Sports and fitness activity tracking apps (6)	Pedometer	30 Days Fitness Challenge: Workout	Daily Workout Fitness	Garmin Connect	My Workout Plan	FitApp Run and Walk
						
number of evaluators	552,967	608,348	148,396	770,057	8,442	25,555
star rating	4.9	4.9	4.8	4.7	4.7	4.6
negative comment	Shows false values.	<i>I would use the app, but an ad pops up that cannot be removed. Annoying.</i>	<i>Does not correctly describe the muscles worked, no warm-up and stretching.</i>	<i>It has not worked for 2 days. I cannot log in. Server error.</i>	<i>Runs down the battery like a 3D game. Has a very limited set of exercises.</i>	<i>Paid but this isn't displayed correctly.</i>
neutral comment	<i>The system does not start automatically.</i>	<i>Good exercises, only short and with few tasks.</i>	<i>There could be more tasks, not just the same one, because after a while it gets boring.</i>	<i>There is no import function.</i>	<i>no reviews</i>	<i>It works fine, but unfortunately there is no audible indication of the mileage despite the setting.</i>
positive comment	<i>It's motivating to see how many calories I'm burning and the importance of increasing my speed.</i>	<i>Very easy to use, Hungarian and has everything you need. There is a pro version, but even without it you are perfectly fine.</i>	<i>Very good application. It is varied, everyone can find something to suit them.</i>	<i>The app is very fair, it does what I expect it to do.</i>	<i>Very useful app, with lots of exercises, workout plan sharing.</i>	<i>I really like it, it's a very good app, everything you need for running is there, time, mileage, calories.</i>
number of reviews	37	39	169	142	19	359
duration	30/12/2017 10/02/2022	01/01/2022 15/06/2022	01/01/2022 15/06/2022	02/01/2022 15/06/2022	06/10/2018 21/03/2022	02/01/2016 05/06/2022
male	12 (32.4%)	13 (33.3%)	27 (16.0%)	88 (62.0%)	10 (52.6%)	32 (8.9%)
female	13 (35.1%)	24 (61.5%)	108 (63.9%)	49 (34.5%)	6 (31.6%)	28 (7.8%)
not known	12 (32.5%)	2 (5.2%)	34 (20.1%)	5 (3.5%)	3 (15.8%)	299 (83.3%)
★	20 (54.0%)	0 (0.0%)	2 (1.2%)	16 (11.3%)	0 (0.0%)	30 (8.3%)
★★	0 (0.0%)	0 (0.0%)	1 (0.6%)	7 (4.9%)	2 (10.5%)	30 (8.3%)
★★★	2 (5.5%)	1 (2.5%)	6 (3.6%)	6 (4.2%)	0 (0.0%)	34 (9.4%)
★★★★	3 (8.1%)	0 (0.0%)	57 (33.7%)	13 (9.2%)	3 (15.8%)	49 (13.6%)
★★★★★	12 (32.4%)	38 (97.5%)	103 (60.9%)	100 (70.4%)	14 (73.7%)	216 (60.4%)
health aspects	3 (8.1%)	6 (15.4%)	4 (2.3%)	2 (1.4%)	2 (10.5%)	1 (0.2%)

	CalorieBase	Yazio	Water Reminder Daily Tracker	Water Time
Diet and nutrition apps (4)				
number of evaluators	4,806	455,687	395,000	147,433
star rating	4.8	4.7	4.7	4.4
negative comment	<i>Freezes and crashes after opening.</i>	<i>Very expensive. does not remember settings, so it is inconvenient to use.</i>	<i>Way too loud. Volume cannot be changed only if you upgrade and pay for it.</i>	<i>It has become a battery drainer recently.</i>
neutral comment	<i>For me, it often forgets the data entered at the end of the day, which is quite annoying</i>	<i>Morning and afternoon snacks are missed out, which would be important for insulin resistance people.</i>	<i>no reviews</i>	<i>The management of data input could be better. There is a lot of advertising.</i>
positive comment	<i>I've been using this app since March and have lost 7 kg so far. Not only does it help me see how many calories I eat a day, but it also helps me know what nutrients I need to increase or decrease to be healthier.</i>	<i>Absolutely useful application. The big advantage is that it has a lot more free features compared to other similar apps.</i>	<i>Perfect.</i>	<i>I find it very useful because it always helps me know when to have a glass of water.</i>
number of reviews	857	83	2	333
duration	20/10/2016 31/03/2022	03/01/2022 14/06/2022	03/01/2021 31/10/2021	04/05/2016 15/03/2022
male	308 (36.0%)	33 (39.7%)	1 (50.0%)	64 (19.2%)
female	475 (55.4%)	46 (55.5%)	1 (50.0%)	193 (58.0%)
not known	74 (8.6%)	4 (4.8%)	0	76 (22.8%)
★	125 (14.5%)	23 (27.7%)	1 (50.0%)	12 (3.6%)
★★	61 (7.1%)	9 (10.8%)	0 (0.0%)	9 (2.7%)
★★★	90 (10.5%)	6 (7.2%)	0 (0.0%)	13 (3.9%)
★★★★	124 (14.7%)	12 (14.5%)	0 (0.0%)	63 (18.9%)
★★★★★	457 (53.2%)	33 (39.8%)	1 (50.0%)	236 (70.9%)
health aspects	50 (5.8%)	4 (4.8%)	0 (0.0%)	0 (0.0%)

Mindfulness apps (3)	Forest	Yoga Challenge	Daily Yoga	Flo Ovulation and Period Tracker	Ladies Calendar	MyTherapy
Other health management apps (3)						
number of evaluators	491,774	2,654	143,192	2,628,383	704	134,937
star rating	4.9	4.6	4.4	4.6	4.2	4.8
negative comment	<i>I subscribed to the pro version, but it charged me without giving extra service.</i>	<i>no reviews</i>	<i>Insanely expensive</i>	<i>Advertising on the back of advertising.</i>	<i>For months I have been saving my data, which was very important, and now everything is lost, even though I exported the data to dropbox, the import back does not work at all! Everything is lost!</i>	<i>Apart from the day of the installation, I have never been told to take my medicine.</i>
neutral comment	<i>I am watching the ad, but do not get the bonus gold.</i>	<i>Moderately good.</i>	<i>In theory, the app is free, but practically everything you use within the app has to be paid for. What is available is quite sophisticated and well done (if you don't know English, you shouldn't download it, because you won't understand the instructions) The music is very good and the voice of the lady is soothing, the exercises are very well chosen, I like it very much!</i>	<i>Way too many commercial and ad breaks for an app that is one-purpose only: to quickly add a date and leave. I can tolerate ads, but not the pop-up ones.</i>	<i>Very good app, but it doesn't let you use the medicine reminder. I cannot set the pill type and it does not accept the pill name.</i>	<i>I cannot add customized times, like every 2.5 hours.</i>
positive comment	<i>This really is a great app! It helps you focus and with this app learning will be a piece of cake.</i>	<i>The best game in the world.</i>		<i>I absolutely love it.</i>	<i>Easy to use, accurate, very useful app.</i>	<i>I use it for dieting, very useful for me!</i>
number of reviews	215	5	106	167	171	128
duration	08/12/2014 27/04/2022	27/07/2016 05/07/2018	22/06/2012 25/04/2022	07/10/2017 07/06/2022	09/02/2013 03/05/2022	16/11/2018 12/05/2022
male	90 (41.8%)	1 (20.0%)	21 (19.8%)	1 (0.6%)	0 (0.0%)	69 (53.9%)
female	96 (44.7%)	2 (40.0%)	67 (63.3%)	166 (99.4%)	171 (100.0%)	48 (37.5%)
not known	29 (13.5%)	2 (40.0%)	18 (16.9%)	0 (0.0%)	0 (0.0%)	11 (8.6%)
★	18 (8.4%)	0 (0.0%)	4 (3.8%)	11 (6.6%)	36 (21.0%)	5 (3.9%)
★★	8 (3.7%)	0 (0.0%)	6 (5.7%)	5 (3.0%)	20 (11.7%)	3 (2.3%)

★★★	13 (6.1%)	1 (20.0%)	1 (0.9%)	9 (5.4%)	15 (8.8%)	6 (4.7%)
★★★★	36 (16.8%)	0 (0.0%)	3 (2.8%)	11 (6.6%)	24 (14.1%)	13 (10.2%)
★★★★★	140 (65.0%)	4 (80.0%)	92 (86.8%)	131 (78.4%)	76 (44.4%)	101 (78.9%)
health aspects	0 (0.0%)	0 (0.0%)	4 (3.7%)	5 (2.9%)	2 (1.1%)	0 (0.0%)

Source: based on Google Play data on 22 June 2022

Authors' Note

All correspondence should be addressed to
Veronika Keller
Department of Leadership and Marketing
University of Győr
Hungary
ORCID 0000-0002-7759-7613

Ida Ercsey
Department of Leadership and Marketing
University of Győr
Hungary
ORCID 0000-0002-4076-7922

Human Technology
ISSN 1795-6889
<https://ht.csr-pub.eu>