

# The Impact of mHealth Apps on Student Success in Professional Activity and Economic Effect Assessment

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**Abstract.** This article examines the current problem of using and selecting of mHealth apps for organizing life routines online. mHealth apps are considered as tools for motivating sports and an alternative for training in the gym. The main advantages and disadvantages of using mHealth apps as main tools for tracking physical and sports motivation are considered. Regardless of the goals that the user of mHealth apps sets in the process of using these applications, the correct use of the functionality of mHealth apps is the key issue. The availability of several thousand mHealth apps complicates the process of successful choosing of personal mHealth apps that will meet all the requirements and needs of the user. The analysis of the functionality of mHealth apps available in Google Play and App Store, divided into categories and taking into account the recommendations of doctors of the HealthTap network, will help the user to choose a personal application, in particular for an active student's lifestyle. The important issue of forming a psychological portrait of the user and its impact on health in achieving success in professional activities is also explored. The economic effect assessment is evaluated.

**Keywords:** Mobile Apps, Fitness, Health, Sports, Mobile Applications.

## 1 Introduction

The appearance of smartphones has greatly expanded both the achievements and opportunities for the development of fitness and health. In particular, it has provided a platform for developing third-party applications that extend the functionality and usefulness of these mobile devices. The use of mobile devices for maintaining a healthy lifestyle is promising. In addition to enhanced user access to health information, diet, exercises, mobile devices are becoming useful in facilitating the ongoing collection of personal data and change habits in the shortest possible time.

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The clients of fitness clubs are 1.02 million Ukrainians, which is 2.4% of the population of our country. This conclusion was reached by experts as a result of a study of the fitness services market in Ukraine, conducted by the team of the FitnessConnectUA project [2]. Analyzing market indicators, experts found that there are 1,419 clubs in Ukraine today. At the same time, 75% of the area of all fitness clubs is concentrated in large cities, where only 18% of Ukrainians live. In smaller cities, there is a significant shortage of fitness facilities [2]. Mobile fitness applications – mHealth apps – can solve this problem. Many of these programs are completely free, while the average price of an annual visit to a fitness club in Ukraine is 5 thousand 429 UAH, in Kiev - 7 thousand 580 UAH [2]. In view of this, the problem of choosing hundreds of thousands of user-relevant applications becomes relevant. This problem needs to be addressed through a comprehensive interdisciplinary approach based on expert opinion, such as the recommendations of the HealthTap network [1], which includes more than 62,000 leading physicians.

## 2 Analysis of popular mobile applications (mHealth apps) for leading a healthy lifestyle

Mobile applications are softwares designed specifically to work on mobile devices. In the "health and fitness" category in the Apple App Store, the developers have created thousands of downloaded applications for Apple mobile devices. Since the launch of the Apple App Store in the United States in July 2008, more than 1.5 million applications have become available for the iPhone and iPod Touch, with more than 100 billion downloads and user base contains 575 million people. For example, in 2016, the number of downloads of the Fitbit mobile application amounted to more than 450 thousand during the Christmas holidays [2].

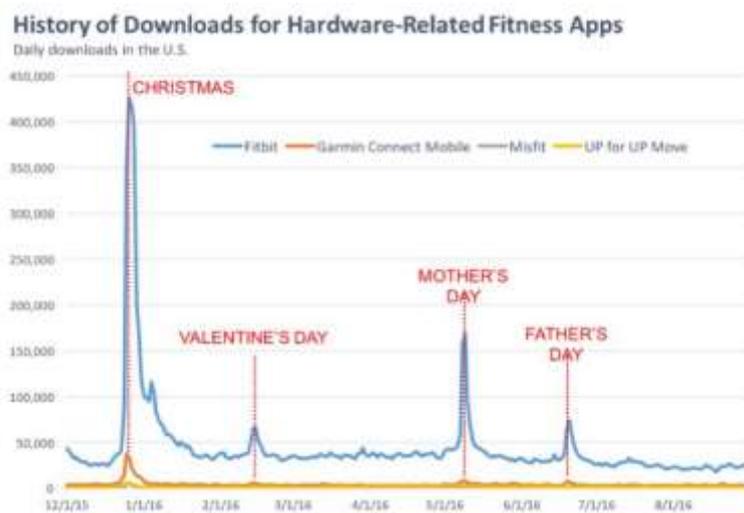
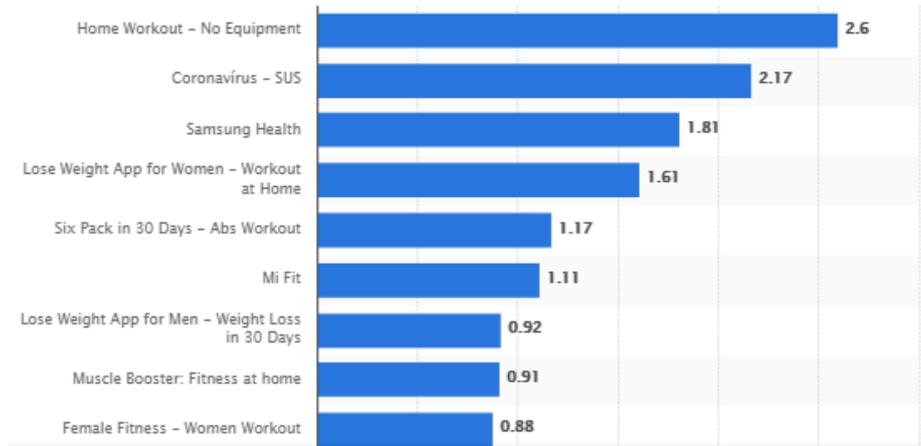


Fig. 1. Statistics of downloading the Fitbit mobile application in 2016

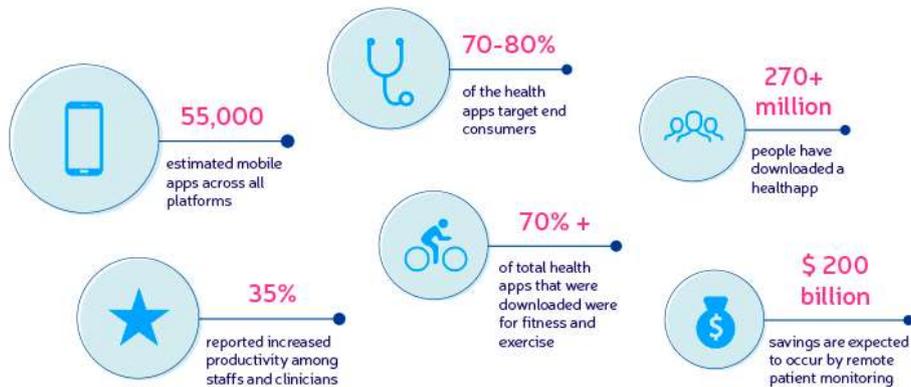
Clement J. [4] investigated the popularity of mHealth apps. The figure shows the statistics of the most popular mHealth apps.

Thus, in March 2020, mobile phone users most often downloaded the mobile application "Home Workout – No Equipment" in the Google Play Store – approximately 2.6 million times to mobile devices worldwide.



**Fig. 2.** Leading mHealth apps in the Google Play Store worldwide in March 2020, by number of downloads (in millions)

According to the authoritative service Statista [5], 41% of users consider mHealth (Mobile Health) to be the most popular area of the digital healthcare industry.



**Fig. 3.** Statistics of healthcare market trends

Despite of their wild popularity, the use of public health supplements has both advantages and disadvantages. On the plus side, the mHealth apps user has the ability to monitor his physical condition: monitor heart rate, blood pressure, caloric intake,

sleep, weight and other personal data. For example, monitoring can help a person lose weight by calculating the number of calories that person needs during the day and choosing a set of exercises. Also, if you exercise regularly, you can achieve the desired heart rate and explore your changes with the help of personal statistics available in the application.

Applications can also help people to work with health professionals, set safe and adequate goals, which will increase people's confidence in achieving the desired result. The user functionality also allows users to share their personal results with family and friends within the application or through social networks, which will promote the mHealth app among the client's immediate environment.

The big danger for the users of mHealth apps is the incorrect functionality of the application, its erroneous activity, incorrect choice of a set of exercises and diet plans by the users, which can seriously harm the user's health. If the application does not measure a certain aspect of health correctly while setting for an overly ambitious goal, it will harm the user's health, for example, losing too much weight too quickly. It is worth noting that potential users of mHealth apps with serious health problems should choose specialized applications or consult a specialist before using the application.

**Table 1.** Functional analysis of popular mHealth apps

<b>Category mHealth apps</b>	<b>The name of the application</b>	<b>Main characteristics</b>	<b>HealthTapps Recommendation</b>
Fitness supplements	Google Fit	<ul style="list-style-type: none"> <li>– monitors user activity during the day,</li> <li>– distinguishes between steps, running and cycling,</li> <li>– calculates the distance covered in steps,</li> <li>– counts the number of calories burned,</li> <li>– gives recommendations depending on the achieved results.</li> </ul>	1st place
	Runtastic	<ul style="list-style-type: none"> <li>– uses GPS to track and analyze sports activity,</li> <li>– tracks time, distance, height differences, calories burned,</li> <li>– available weather information and offline maps.</li> </ul>	2nd place
	8minutes ABC	<ul style="list-style-type: none"> <li>– contains exercises of different levels for training the press,</li> <li>– contains pictures, videos and recommendations for training.</li> </ul>	3rd place
	Fitness Coach	<ul style="list-style-type: none"> <li>– contains a collection of ready-made training programs,</li> </ul>	4th place

Category mHealth apps	The name of the application	Main characteristics	HealthTapps Recommendation
		<ul style="list-style-type: none"> <li>– exercises contain animations with descriptions,</li> <li>– contains a training log, body atlas,</li> <li>– various articles on fitness, calculator,</li> <li>– you can create your own training regime based on ready-made plans or personal preferences.</li> </ul>	
Supplements for proper nutrition	Waterbalance	<ul style="list-style-type: none"> <li>– calculates the amount of water you need,</li> <li>– controls how much fluid you drink.</li> </ul>	1st place
	Eat This Not That	<ul style="list-style-type: none"> <li>– offers recipes with a good alternative to junk food,</li> <li>– allows you to count the calories that were consumed and those that the body managed to burn.</li> </ul>	2nd place
	Eat Slower	<ul style="list-style-type: none"> <li>– watch how you eat,</li> <li>– allows you to set intervals between each spoonful of food you eat.</li> </ul>	3rd place
	Chemical Cuisine	<ul style="list-style-type: none"> <li>– gives information about what a certain product consists of,</li> <li>– contains information on more than 130 food additives, each of which is marked with a corresponding color.</li> </ul>	4th place
Health monitorig supplemns	My Heart	<ul style="list-style-type: none"> <li>– generates statistics: pulse pressure, MAP - mean blood pressure, blood pressure indicator, mean blood pressure,</li> <li>– reminds you every day at a certain time that you need to measure your blood pressure.</li> </ul>	1st place
	MotionX	<ul style="list-style-type: none"> <li>– facilitates the monitoring of heart rate,</li> <li>– tracks your sleep cycle</li> <li>– monitors heart rate,</li> <li>– monitors activity to help you achieve your fitness goals.</li> </ul>	2nd place
	Instant Heart Rate	<ul style="list-style-type: none"> <li>– Facilitates the monitoring of heart rate,</li> <li>– measures your momentum,</li> <li>– contains export data, tags and scope calculator.</li> </ul>	3rd place

Advantages of using mHealth apps in everyday life:

- **Allows you to monitor progress in training.** Using the smartphone app, you can easily track your personal trainings. Apps like Google Fit and Runtastic make good use of the phone's GPS to track speed in any physical condition, while jogging or walking. As a result of use mHealth apps users receive an automatic progress report, which can be shared with social media users and friends. This promotes self-motivation in using the application.
- **Helps to get free ideas for training.** In case of lack of resources or time for training with a trainer or in the gym, a smartphone is a good solution in this situation. mHealth apps give a variety of training tips depending on the user's physical condition and the desired training dynamics.
- **Helps to monitor the diet daily.** Using mHealth apps allows you to follow your diet.
- **Helps to set and achieve goals to maintain a healthy lifestyle.** It is very important to set reasonable and adequate goals for the beginning of physical training and diet. Fitness programs allow you to set realistic goals that can be achieved over a period of time.

The analyzed mHealth apps in Table 1 take first places in the ranking of mHealth apps recommended by the HealthTap network [6], which includes more than 62,000 leading physicians. This information is useful for beginners and experienced users who are active in sports and lead a healthy lifestyle.

### **3 Psychological portrait of the student and his influence on health in achieving success in professional activities**

Focusing on a healthy lifestyle is a complex and multifaceted process. This is especially true of the most vulnerable group of students – student youth, whose health problems are more relevant today than ever, and the way to solve them lies not only in the medical but also in educational sphere. Undoubtedly, the formation of the readiness of university students for health activities is one of the results of higher education.

The analysis of scientific sources showed that scientists prefer to consider the processes of health preservation of young people, because at a young age there is a formation of behavior patterns, formation of a hierarchy of values and worldviews, accumulation of relevant knowledge and skills, awareness of personal needs and motives. Prominent philosophers, educators, psychologists, and doctors throughout human history have focused on the health of the younger generation.

Various aspects of preserving and strengthening the health student youth are the subject of scientific research of the following domestic and foreign scientists: G. Apanasenko, V. Bobrytska, Y. Boychuk, L. Goryana, O. Dubogai, N. Zavydivska, V. Zdanyuk, S. Lapaenko, L. Mikheeva, Y. Palichuk, L. Popova, E. Syvokhop and others. The need to introduce health-preserving youth education, the formation of values to health and health culture are highlighted in the works of modern researchers:

O. Bezpalko, T. Berezhna, O. Vakulenko, O. Voloshin, G. Vlasyuk, V. Kuzmenko, N. Kovalchuk, O. Logvinenko, M. Lukyanchenko, L. Mokrynska, V. Orzhekhovska, L. Sushchenko.

Many scientists consider the formed readiness for health-oriented activities as a result of health-forming function of education: J. Herchak (readiness of students for health preservation), V. Bobrytska (readiness for realization of healthy life activity of their own and others), which emphasize that the value system is the basic of the individual and forms a model of its health-preserving behavior. Some aspects of this problem were the subject of scientific research by V. Babych, V. Horashchuk, G. Kryvosheeva (formation of health culture), M. Hrynyova, O. Yezhova (formation of values to health).

Issues of forming the value attitude of student youth to their health are reflected in dissertations, in particular T. Belinska, T. Vershinina, N. Bashavets in their research qualify the value orientations of students for their own health as an inner belief in the importance of health associated with the emotional and volitional sphere of personality and activity in educational and cognitive activities.

Despite of the large number of studies on healthy behavior of young people, the issue of developing readiness for healthy activities is insufficiently studied.

The health of an individual depends on many factors, first of all on the attitude of a person to his own health and to life in general. It has been proven that the formation of health depends on 50% of a person's lifestyle, 20% - on hereditary information, 10% - on medical care and 20% - on the total effect of environmental factors. Thus, the determining factor of health is a way of life, in the definition of which the term "healthy way of life" is often used.

A healthy lifestyle is an individual system of human behavior, which is aimed at the rational satisfaction of biological and social needs, positive emotions, and prevention of diseases and accidents, which leads to complete physical, psychological, spiritual and social well-being [7].

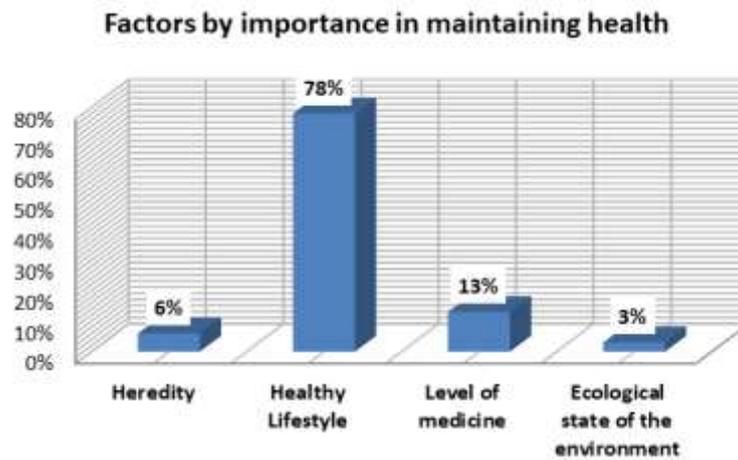
The key factor in the formation of readiness to maintain health is the motivation of health-preserving activity.

O. Martyniv considers the criteria of formation of positive motivation for a youth healthy lifestyle [7]:

- at the level of physical health;
- at the level of mental health (psychological comfort);
- at the level of spiritual health;
- at the level of social health (social well-being).

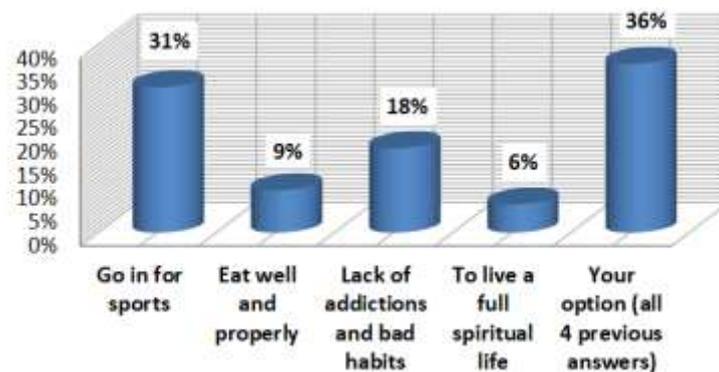
In order to diagnose the state of readiness to maintain own health, we conducted a survey among student youth. 32 students of technical specialties of the Lviv Polytechnic National University were involved in the survey. The results of the survey show that most students prefer personal values: health, family happiness and their own freedom. The value of "health" in the first place in 54% of students, in the second – in 18% and in the third in 9% of students, but 3% of young people took the values of health last place. In the last places in the hierarchy of values, student youth placed "public recognition", "friends and acquaintances" and "entertainment".

Analyzing the answers to the question "Which of the following factors is the most important in maintaining health?" we obtained the following data: 78% consider a healthy lifestyle to be the most important in health, 13% - the level of medicine, 6% - heredity and 3% of students consider the most important factor the ecological state of the environment (Fig. 1).



**Fig. 4.** Distribution of answers to factors by importance in maintaining health

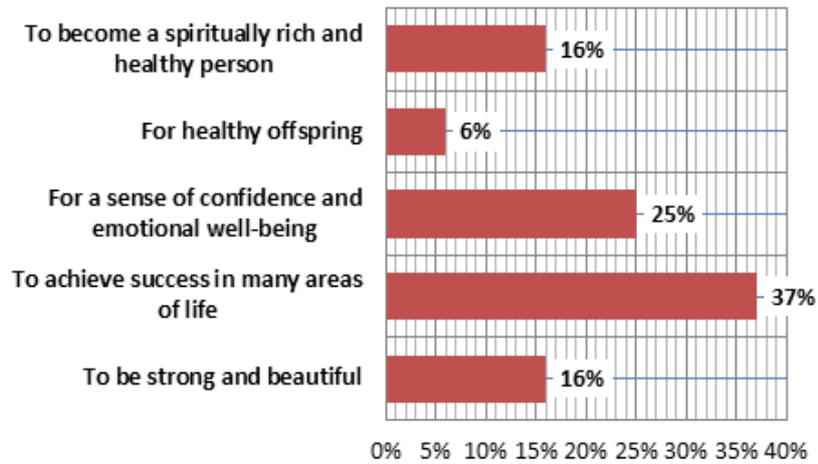
The vast majority of respondents have a holistic view of a healthy lifestyle - 36% consider this concept as a set of factors (sports, proper nutrition, lack of bad habits and a full spiritual life); 31% of students understand sports as the basis of a healthy lifestyle, 18% - the absence of addictions and bad habits, 9% - consider sufficient and complete nutrition, and 6% - a full spiritual life (Fig. 2).



**Fig. 5.** Distribution of answers on the importance of the criteria that define the concept of "healthy lifestyle"

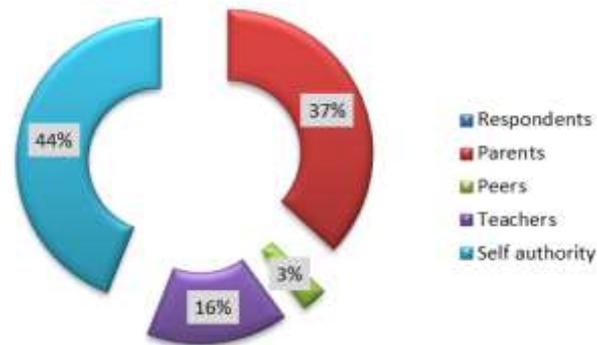
To find out the motivation for a healthy lifestyle, students were asked to answer the question: Why follow a healthy lifestyle? Thus, the leading motive for students is to

succeed in many areas of life (37%), a quarter of respondents have a motive for confidence and emotional well-being (25%), 16% of students believe that health is a factor that will help them become strong and beautiful and the same percentage of students (16%) - to become a spiritually rich and healthy person, and for 6% of respondents health is important for the sake of healthy offspring (Fig. 3).



**Fig. 6.** Diagram of data on motivational criteria for a healthy lifestyle.

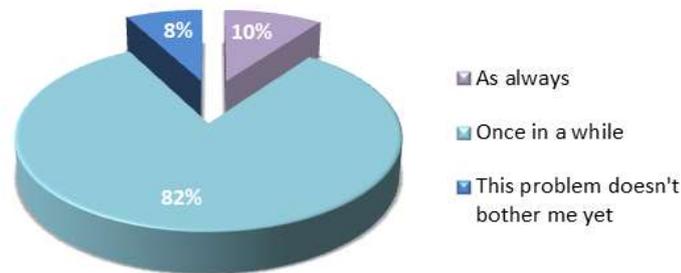
In the course of the research, the students were given the task to determine whose opinion is authoritative regarding the value of their own health. Analysis of the data showed that the largest percentage of young people rely on themselves, thus stating: "I already know everything", such - 44%, consider the opinion of parents - 37%, a significant impact on the formation of values to health have teachers - 16%, the least students listen to peers -1% (Fig. 4).



**Fig. 7.** Distribution of answers regarding to the authorities on the formation of values about health

Self-assessment of awareness of healthy living indicates that 41% of respondents consider themselves aware, the same percentage are partially aware - 41%, unfortunately, 18% do not have the knowledge and skills of leading healthy lifestyle. Among the informed share of students, they are most influenced by the media in forming an idea of health measures - 65%, parental experience and special educational activities as a source of information are perceived by 16% of respondents, the least influence on the formation of health worldview have friends - 3%.

When asked about the questionnaire on the principles of a healthy lifestyle, the vast majority of young people (74%) said that they follow from time to time, always follow only 9% and, unfortunately, 17% of respondents do not care about health problems (Fig. 5).



**Fig. 8.** Diagram of data on maintaining a healthy lifestyle.

To the question "Please mark with a number from 1 to 5 (1- min, 5 - max) your level of responsibility for the state of your health, we received the following results: the highest score (5) marked their level of responsibility 9% of respondents students, high (4) -55%, 28% - medium, 8% - low, no one considers himself irresponsible.

When asked about the presence of bad habits, 31% of students answered in the affirmative, half of the respondents from time to time resort to the misuse of bad habits - 50%, 19% of students do not have a bad addiction. According to students' opinion, young people most often resort to bad habits under the influence of friends and acquaintances (32%) and because of personal problems (31%). Some young people believe that indifference to their own lives creates harmful addictions (19%), ignorance of the harmfulness of seemingly innocent hobbies (9%), weakness of spirit (2%) and the desire to be "cool" (3%) negative habits.

Noteworthy students position is: to overcome the negative phenomena among student youth 38% of surveyed students believe that it is necessary to conduct conversations, lectures, screenings of thematic films, as well as organizing socio-pedagogical and educational trainings, conversations - 37%. Some students (18%) are inclined to more radical measures - strict control of student behavior (especially in student dormitories). However, 7% of respondents are of the opinion that everyone is responsible for them and decides how to act.

The main source of knowledge about a healthy lifestyle is the media (in particular, the Internet). Most students have bad habits as a result of the influence of friends, personal problems. The opinion of the respondents on the ways to overcome the

negative phenomena that prevails among students deserves special attention. Young people believe that it is necessary to form a healthy worldview through pedagogical methods, lectures, talks, educational trainings, etc.

An effective mechanism for the successful solution of this problem is the inclusion in the educational process of the concept of forming a healthy worldview. At the same time, the importance of forming a healthy lifestyle in student youth as a condition for successful self-realization in future professional activities, the development of a physically healthy and spiritually rich personality is actualized.

Further researches are expected to be conducted in the direction of studying and finding pedagogical conditions aimed at forming the value attitude of students to their own health.

#### 4 The Economic Effect Assessment

The economic effect analysis estimates the change in economic activity of market of mobile health apps in Ukraine and abroad.

The proper analysis of the effectiveness apps, resulting in intermediate effects should be considered a continuous chain that combines field-class applications of mHealth apps outcomes of apps. The purely arithmetic economic effect of the use of mHealth apps could be estimated by the formula:

$$E = S + R_f + r \times F - A - p \times (L - D) \quad (1)$$

where E is the estimated economic effect;

S is the maintenance cost of apps;

R<sub>f</sub> is a related funds of normalizing the user's condition of a possible negative impact on the user's health;

F is the funds that are frozen in the balances;

r is the average rate of return of actively used working capital;

A is an additional payment to users for special conditions of use of apps;

L is the losses that will occur in case of possible malfunctions of apps;

D is discounts and promotions introduced by apps owner;

p is the probability of apps failure.

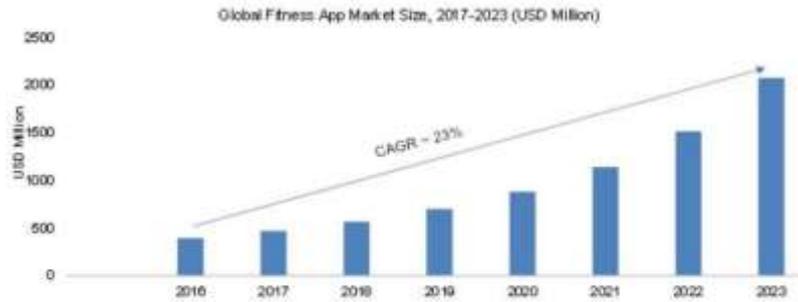
This formula expresses evaluative economic efficiency apps.

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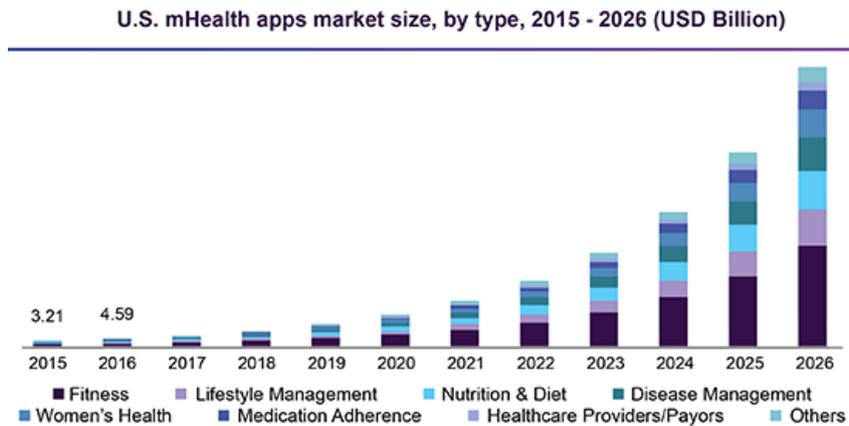
Fig. 9. Scheme of using mHealth apps

According to Marketwatch [3], in the period 2016-2023, the Compound Annual Growth Rate (CAGR) is projected to increase by 23% in the mHealth Apps market segment.



**Fig. 10.** Statistics of the market segment of mHealth Apps in the period 2016-2023.

According to Grandviewresearch [3], in the United States in the period 2020-2026, the mHealth Apps market is expected to increase tenfold.



**Fig. 11.** Statistics of the market segment of mHealth Apps in the United States in the period 2016-2026

## 5 Conclusions

Mobile applications for sports and health (mHealth apps) are becoming key tools for people who want to monitor their own health almost every day. They are firmly established as the main tool for tracking physical indicators and sports motivation. mHealth apps are easy to use and most of them are completely free. Healthcare professionals need to recognize this trend, encourage patients to monitor their health,

and provide information online to their physicians. By partnering with healthcare professionals and smartphone users, you can optimize the use of mHealth apps, as well as the collection of user health statistics. Regardless of the goals that the user of mHealth apps sets in the process of using these applications (adjusting and improving the diet, weight loss, daily routine, regular exercise), the correct use of the functionality of mHealth apps is a key solution. The availability of several thousand mHealth apps complicates the process of successfully choosing a personal mHealth app that will meet your needs. The analysis of the functionality of mHealth apps available in Google Play and App Store, divided into categories and taking into account the recommendations of doctors of the HealthTap network, will help the user in choosing a personal application with the requirements, in particular for an active students' lifestyle. It is also important to consider the psychological portrait of the user and his impact on health to succeed in professional activities.

## References

1. <https://www.healthtap.com/>
2. [https://medium.com/@sm\\_app\\_intel/these-fitness-app-statistics-show-whats-going-right-and-wrong-for-fitbit-da2c4c3be142](https://medium.com/@sm_app_intel/these-fitness-app-statistics-show-whats-going-right-and-wrong-for-fitbit-da2c4c3be142)
3. <https://theappsolutions.com/blog/development/fit-app-development/>
4. <https://www.statista.com/statistics/690887/>
5. <https://www.statista.com/statistics/387875/>
6. <https://www.healthtap.com/>
7. Martyniv O. Analysis of the state of readiness of students for a healthy lifestyle as an indicator of a culture of health. *Scientific Bulletin of Uzhhorod National University. Series: Pedagogy. Social work*, 2013. Issue. 28. Pp. 100-103.
8. Avdeenko I.M. Scientific and methodological approaches to the development of student health culture in higher education *Health pedagogy: a collection of scientific papers of the VII All-Ukrainian scientific-practical conference*. Chernihiv, 2017. Vol.1. Pp. 15-16.
9. Glebova E.I. Health as a means of improving the efficiency of education of university students. *Russian State Professional and Pedagogical University*. 2005. 182 p.
10. Mikheeva L.P. Features of the formation of a healthy lifestyle in the younger generation. *Ukrainian scientific journal "Education of the region"*. Kyiv, 2011. №3. p. 318-322.
11. Orzhekhovskaya V. *Pedagogy of healthy lifestyle. The path of education*. 2006. 4. p.29-32.
12. Palichuk Y.I. Structure, content and functions of health care in the educational process of economic higher education. *Scientific notes of Ternopil National Pedagogical University. Pedagogy series*. Ternopil, 2011. № 4. Pp. 56-62.
13. Pokroeva L.D. *Socio-humanitarian aspects of the development of society and education of the XXI century: teaching method. manual*. Kharkiv: HANO, 2014. 172 p.
14. Yaremenko O., Balakireva O., Vakulenko O. *Formation of a healthy way of life of youth: problems and prospects: monograph*. Ukrainian Institute for Social Research, 2000. 207 p.
15. Izonin I., Tkachenko R., Kryvinska N., Tkachenko P., Greguš M. Multiple Linear Regression based on Coefficients Identification using Non-Iterative SGTM Neural-Like Structure. *Advances in Computational Intelligence. IWANN 2019. Lecture Notes in Computer Science*, vol 11506, 2019, Springer, pp 467-479.
16. Fedushko S., Michal Gregus ml., Ustyianovych T. Medical card data imputation and patient psychological and behavioral profile construction. *Procedia Computer Science*. Volume 160, 2019, Pages 354-361. <https://doi.org/10.1016/j.procs.2019.11.080>