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Original Research Article

ASSESSMENT OF KNOWLEDGE, ATTITUDE, PRACTICES OF COLLEGE STUDENTS OF INDORE CITY TOWARDS HEALTHCARE GAMIFICATION APPLICATIONS AND TO KNOW THE BEHAVIOURAL CHANGES BROUGHT ABOUT BY THESE APPLICATIONS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: There is little research on the application of gamification. Gamification is a strategy that aims to have a beneficial influence on a variety of wellness and health-related situations, not only because it can increase people's engagement and responsibility for their health-related decisions, but also because it can improve healthcare personnel' performance. **Objectives:** To assess the knowledge, attitude, practices of college students of Indore city towards healthcare gamification apps and to know the behavioural changes brought about by these apps.

Materials and Methods: A cross-sectional study of 4 months duration (Oct 2022 – Jan 2023) was conducted among 250 randomly selected students from various colleges of Indore, by using pre-designed pre-tested semi-structured questionnaire. Data entered in MS Excel and analysed by SPSS Software 25.0 (trial version).

Results: Mean age of participants was 20 ± 1.35 years. Use of fitness devices were significantly higher in upper and upper-middle socio-economic class (p value 0.007). Daily steps counting (66%), sleep tracking (32%) and calorie burn monitoring (31%) were the most common activities monitored.

The following results were statistically significant:

Majority, 39.7% female and 47.4% male students used fitness device/ app every day. 72.8% females and 70.2% males were not willing to spend on gamified health tracking. Health benefit was found to be the major factor (86.0% females and 72.8% males) promoting the use of healthcare gamification applications over rewards and competition. 44.9% females and 56.1% males perceived physical health improvement.

Conclusion: Healthcare gamification applications for the promotion of digital wellbeing is a breakthrough approach. This study has allowed us to learn more about the various deeper aspects of this process.

Keywords: Gamification, Fitness-bands, Mobile Health application.

INTRODUCTION

Gamification refers to the "use of game design elements within non-game contexts".[1] The main aim of gamification, i.e., the implementation of game design elements in real-world contexts for non-gaming purposes, is to promote human motivation

and performance in regard to a particular activity. The contexts in which gamification has previously been implemented include the following: work, education, crowdsourcing, data-collection, health, marketing, social networks and environmental protection.[2] Gamification has been identified as an effective approach in attracting the user's attention and further leading behavioural change. This process has mitigated various corporations into bringing about compliance for specified rather non-friendly tasks in a non-compliant space.[3]

However, its application in healthcare has been associated with different challenges. As different conditions need different behavioural therapies, so do the elements and features of the games, targeting the different conditions.[2] More recently, with rise in smartphone users and digital literacy globally, there has been rapid surge by the public and private health sectors to take advantage of mobile apps to address public health concerns.[4] Use of mobile health (mHealth) apps has predominantly emphasized on physical activity and health tracking as companies such as Fitbit and Niantic can profit from commercializing wearables that integrate with the app or in-app currency.[5] In addition to generating considerable profits for the company, evaluations of these products denotes that their use leads to significant improvement in physical activity.[6] Recently, a systematic review on the general use of mobile apps for medication adherence reported that mobile apps may improve medication adherence, it is ultimately unclear whether they are effective or what makes them effective because of heterogeneity in study design and features of various apps identified in included studies.[7] With this background the present study was conducted to assess the knowledge, attitude, practices of college students of Indore city towards healthcare gamification applications and to know the behavioural changes brought about by these applications.

Objectives

1. To assess the knowledge, attitude, practices of college students of Indore city towards healthcare gamification applications.
2. To know the behavioural changes brought about by these applications.

MATERIAL AND METHODS

Study population

A cross-sectional study of 4 months duration (Oct 2022 – Jan 2023) was conducted among 250 randomly selected college going students from 5 randomly selected colleges of Indore city. College students >18 years of age, who were users of smartphone, fitness bands or smart watches, willing to participate in the study were included. Students with known physical or mental impairment were excluded from the study.

Sample Size Calculation

Sample size was calculated using Cochran's formula i.e. $4pq/d^2$, [where p = expected prevalence or proportion, q = (100 – p) and d = precision], assuming p=50% and d=7%, and considering a non-response rate of 20%, sample size came out to be 240.8 (rounded to 250). A predesigned pretested semi-structured questionnaire comprising of 5 sections, covering demographic profile, knowledge, attitude, practice and behaviour changes towards health gamification was used to collect data.

Study instruments and data processing

Data was collected after taking written informed consent and confidentiality was maintained throughout the study. The data was entered in MS Excel and analysed by SPSS 25.0 (trial version). Descriptive statistics were applied to establish sociodemographic characteristics. Continuous data was expressed in terms of mean and standard deviation. Categorical data was expressed in terms of frequency and percentages. Chi-square test was applied to compare categorical data and p-value < 0.05 was considered statistically significant.

RESULTS

The mean age of participants was 20 ± 1.35 years. Table 1 depicts Demographic profile of students; use of fitness devices were significantly higher in upper (37.2% mobile and 47.9% band/watches) and upper-middle (28.8% mobile and 36.1% band/watches) socio-economic class with p value 0.007. However, the age, gender and field of study were not significantly related to device used for healthcare gamification among students. [Table 1]

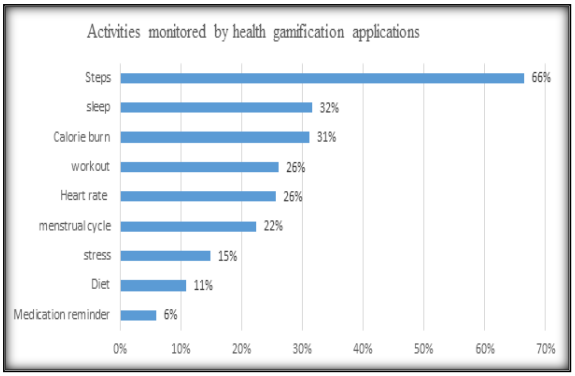

Figure 1: Profile of activities monitored by healthcare gamification applications among study participants (N=250)

Table 2 depicts the association between gender of participants and their practices towards healthcare gamification applications. Average time spent on mobile phone was found to be statistically significant with p-value 0.003. Majority 38.2% female and 43.9 % male students spent average time of 3-5 hours on mobile phone, whereas only 2.2% females and 11.4% males spent more than 8 hours. Majority 39.7% females and 47.4% males used fitness device/ app

every day (p-value 0.017, statistically significant). 52.9% female and 64.9% male students never correlated their data with any medical grade equipment (p- value 0.036, statistically significant). Variables like fitness device used, screen time monitoring frequency and amount paid for subscription showed statistically non-significant results. [Table 2]

Table 3 depicts the association between gender of participants and their knowledge & attitude towards healthcare gamification applications. Majority 72.8% female and 70.2% male students were not willing to spend on gamified health tracking, whereas only 4.4% females and 3.5% males were willing to spend INR 100 per month on gamified health tracking (p-value 0.011, statistically significant). Health benefit was found to be the major factor (86.0% females and 72.8% males) promoting the use of healthcare gamification applications, while rewards and competition being the other two factors (p-value 0.033, statistically significant). Device accuracy in terms of health measurements showed statistically non-significant results. [Table 3]

Table 4 depicts association between gender of participants and their behavioural changes due to healthcare gamification applications. 44.9% female and 56.1% male students perceived physical health improvement owing to healthcare gamification applications (p-value 0.036, statistically significant). Perceived mental health improvement showed statistically non-significant results. [Table 4]

Table 1: Association of Demographic Profile of Participants with Fitness device used (N=250)

Characteristics	Fitness device used				P- value (Chi-square)
	Mobile (156)		Band/Watches (94)		
	Frequency	(%)	Frequency	(%)	
Age (years)					
18-20 (n=172)	105	67.3	67	71.3	0.35
21-23 (n=71)	48	30.8	23	24.5	
24-26 (n=7)	3	1.9	4	4.2	
Sex					
Male (n=114)	66	42.3	48	51.1	0.178
Female (n=136)	90	57.7	46	48.9	
Socioeconomic Status (Modified BG Prasad scale)					
Upper (n=103)	58	37.2	45	47.9	**0.007 (s)**
Upper Middle (n=79)	45	28.8	34	36.1	
Middle (n=41)	28	18	13	13.8	
Lower Middle (n=19)	18	11.5	1	1.1	
Lower (n=8)	7	4.5	1	1.1	
Field of Study					
Health and allied sciences (n=106)	73	46.8	33	35.1	0.285
Engineering (n=75)	42	26.9	33	35.1	
Management (n=47)	29	18.6	18	19.1	
Arts (n=22)	12	7.7	10	10.7	

Table 2: Association between Gender of participants and their Practices towards Healthcare Gamification Applications (N=250)

Variables	Gender				P- value (Chi-square)
	Female (n=136)		Male (n=114)		
	Frequency	(%)	Frequency	(%)	
Fitness device used					
Fitness bands/ watches (n=94)	46	33.8	48	42.1	0.178
Mobile Apps (n=156)	90	66.2	66	57.9	
Average time spent on mobile phone					
Less than 3 (n=58)	40	29.4	18	15.8	**0.003 (s)**
3-5 (n=102)	52	38.2	50	43.9	
5-8 (n=74)	41	30.2	33	28.9	
More than 8 (n=16)	3	2.2	13	11.4	
Screen time monitoring frequency					
Every day (n=101)	50	36.8	51	44.7	0.53
Once a Week (n=63)	37	27.2	26	22.8	
Once a month (n=34)	21	15.4	13	11.4	
Never (n=52)	28	20.6	24	21.1	
Fitness device/ app use frequency					
Every day (n=108)	54	39.7	54	47.4	**0.017 (s)**
Once a Week (n=77)	53	39	24	21.1	
Once a month (n=31)	15	11	16	14.0	
Never (n=34)	14	10.3	20	17.5	
Participant correlating their data with medical grade equipment					
Yes (n=51)	27	19.9	24	21.1	**0.036 (s)**

No (n=144)	72	52.9	74	64.9	
Sometime (n=55)	37	27.2	16	14.0	
Amount paid for the subscription of healthcare applications					
Yes (n=23)	16	11.8	7	6.1	0.12
No (n=227)	120	88.2	107	93.9	

Table 3: Association between Gender of participants and their Knowledge & Attitude towards Healthcare Gamification applications (N=250)

Variables	Gender				P- value (Chi-square)
	Female (n=136)		Male (n=114)		
	Frequency	(%)	Frequency	(%)	
Device accuracy in terms of health measurements					
Yes (n=53)	31	22.8	22	19.3	
No(n=65)	32	23.5	33	28.9	0.57
Not sure (n=132)	73	53.7	59	51.8	
Amount willing to spend on gamified health tracking					
INR 100 per month (n=10)	6	4.4	4	3.5	
INR 50-100 per month (n=34)	11	8.1	23	20.2	**0.011 (s)**
Less than INR 50 per month (n=27)	20	14.7	7	6.1	
No amount (n=179)	99	72.8	80	70.2	
Factors promoting the use of the app					
Health benefit (n=197)	117	86.0	83	72.8	
Competition (n=14)	4	2.9	7	6.1	**0.033 (s)**
Rewards (n=39)	15	11	24	21.1	

Table 4: Association between Gender of participants and their Behavioural changes due to Healthcare Gamification Applications (N=250)

Variables	Gender				P- value (Chi-square)
	Female (n=136)		Male (n=114)		
	Frequency	(%)	Frequency	(%)	
Physical health improvement (perceived)					
Yes (n=125)	61	44.9	64	56.1	**0.036 (s)**
No (n=37)	18	13.2	20	17.6	
Not sure (n=88)	57	41.9	30	26.3	
Mental health improvement (perceived)					
Yes (n=105)	54	39.7	51	44.7	
No (n=78)	42	30.9	36	31.6	0.56
Not sure (n=67)	40	29.4	27	23.7	

DISCUSSION

The present study was done to assess the knowledge, attitude, practices of college students of Indore city towards healthcare gamification applications and to know the behavioural changes brought about by these applications. 250 students, aged >18 years who were users of smartphone, fitness bands or smart watches were selected from various colleges in Indore city. 45.6% of respondents were male and 54.4% were females. The mean age of participants was 20 ± 1.35 years. A study done by Shrivastava et al. (2023) on mobile app interventions to improve medication adherence among type 2 diabetes mellitus patients included 7 clinical studies having 649 participants; where median sample size was 58 (range = 41-247) and the median age of participants was 53.2 (range = 48-69.4) years.[9] Also a cross-sectional study done by Patil V et al (2022) on factors affecting the usage of wearable device technology for healthcare among 495 Indian adults, aged >16 years, 65.5% of respondents were male and 34.5% females; where 50.3% participants were between 25-50 years of age.[11] A systematic review and meta-analysis by Khamzina M et al. (2020), included 17 studies (16 observational and 1 pre–post) with a total of 33,108 participants.[6]

In our study, use of fitness devices were significantly higher in upper (37.2% mobile and 47.9% band/watches) and upper-middle (28.8% mobile and 36.1% band/watches) socio-economic class with p value 0.007. Daily Steps counting (66%), sleep tracking (32%) and calorie burn monitoring (31%) were the most common activities monitored by study participants, while medication reminder being the least.

The present study revealed that average time spent on mobile phone was found to be statistically significant with p-value 0.003. Majority 38.2% female and 43.9 % male students spent average time of 3-5 hours on mobile phone, whereas only 2.2% females and 11.4% males spent more than 8 hours. Majority 39.7% females and 47.4% males used fitness device/ app every day (p-value 0.017, statistically significant); whereas in study done by Patil V et al. only 29.3% respondents reported using wearable devices

daily.[11] In our study, 52.9% female and 64.9% male students never correlated their data with any medical grade equipment (p- value 0.036, statistically significant).

The present study revealed, majority 72.8% female and 70.2% male students were not willing to spend on gamified health tracking, whereas only 4.4% females and 3.5% males were willing to spend INR 100 per month on gamified health tracking (p-value 0.011, statistically significant). Health benefit was found to be the major factor (86.0% females and 72.8% males) promoting the use of healthcare gamification applications, while rewards and competition being the other two factors (p-value 0.033, statistically significant). Also, study done by Patil V et al showed that use of wearable devices was highly correlated with perceived usefulness(r=0.711).[11]

Leading behavioural change is one of the main aims of health gamification applications. In the present study, 44.9% female and 56.1% male students perceived physical health improvement owing to healthcare gamification applications (p-value 0.036, statistically significant). Similar result was shown in study done by Flores Mateo G et al. (2015) that compared with the control group, use of a mobile phone app was associated with significant changes in body weight (kg) and body mass index (kg/m2) of -1.04 kg (95% CI -1.75 to -0.34; I2 = 41%) and -0.43 kg/m2 (95% CI -0.74 to -0.13; I2 = 50%), respectively; a nonsignificant difference in physical activity was observed between the two groups (standardized mean difference 0.40, 95% CI -0.07 to 0.87; I2 = 93%).[8] Another study done by Althoff T et al. (2016) showed similar results with our study, that Pokémon Go game lead to significant increase in physical activity over a period of 30 days, with particularly engaged users increasing their activity by 1473 steps a day on average, a more than 25% increase compared with their prior activity level (P<.001).[5] Also a study by Khamzina M et al. (2020) showed that a comparison between Pokemon Go players and non-players and between pre- and post-play time points revealed an increase in walking duration, distance walked, and number of steps/day; Pokemon Go players were also found to engage in less sedentary behaviour; playing Pokemon Go was associated with an increase in the number of steps per day by 1,446 steps (95% CI=953, 1,939; I2=81%).[6]

A systematic review of clinical trials done by Shrivastava et al. (2023) reported that all studies showed improvements in medication adherence among type 2 diabetes mellitus patients due to mobile app interventions; however, only three studies reported statistically significant improvements in adherence measures.[9] A randomised trial by Lester RT et al. (2010), effects of a mobile phone short message service on antiretroviral treatment (ART) adherence in Kenya randomly assigned 538 participants to the SMS intervention (n=273) or to standard care (n=265); adherence to ART was reported in 168 of 273 patients receiving the SMS intervention compared with 132 of 265 in the control group (relative risk [RR] for non-adherence 0·81, 95% CI 0·69–0·94; p=0·006); suppressed viral loads were reported in 156 of 273 patients in the SMS group and 128 of 265 in the control group, (RR for virologic failure 0·84, 95% CI 0·71–0·99; p=0·04); hence patients who received SMS support had significantly improved ART adherence and rates of viral suppression compared with the control individuals.[10]

In our study, perceived mental health improvement showed statistically non-significant results; which differed from results of a systematic review and meta-analysis done by Six SG et al. concluding that both mental health apps with and without gamification elements were effective in reducing depressive symptoms and there was no significant difference in the effectiveness of mental health apps with gamification elements on depressive symptoms or adherence.[12]

CONCLUSION

Gamification of healthcare is a breakthrough approach. This study has allowed us to learn more about the various deeper aspects of this process. The group under study was digitally literate and had a considerable knowledge about healthcare gamification applications that they used to monitor various health activities. Use of health gamification applications was more for health benefits over the physical rewards or peer competition that showed participants awareness and active deviation from addictive aspects of these applications. Decreased belief of subjects on the device accuracy for health measurements was seen. The study clearly describes the preference of subjects for free gamification providers, this leads to the revenue model of day-to-day activity. Therefore, these applications stick to advertisements as their primary source of revenue. To improve advertising revenue, targeted-ads are used which raise the ever-scarier issue of data-theft. Only way to provide free applications without the data-theft scare is, when the application is attached to some other technology like their respective wearable devices etc.; for example, Apple health application with iPhone. Systemic behavioural change i.e., perceived physical health improvement was brought about by these applications towards better healthcare practices. Increased use of health gamification applications ultimately leads to more profits to these companies.

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