

## **Factors affecting the adoption of personal safety apps among Millennials in Johannesburg, South Africa**

Anna Oksiutycz (corresponding author)

Department of Strategic Communication at the University of Johannesburg

[aoksiutycz@uj.ac.za](mailto:aoksiutycz@uj.ac.za)

Elizabeth Lubinga

Department of Strategic Communication at the University of Johannesburg

[elizabethl@uj.ac.za](mailto:elizabethl@uj.ac.za)

## **ABSTRACT**

### **Background**

Numerous studies around the world have examined how young people use digital technology mostly for social interaction, but also for marketing related purposes. However, few studies have addressed how mobile applications have been adopted in developing economies such as South Africa. Specifically, given that issues of personal safety are paramount in South Africa, which grapples with high levels of crime, it is necessary to explore factors that could affect the adoption of mobile safety applications. Theoretically, the study relies on the Generational Cohort Theory and the Technology Acceptance Model to provide insight into patterns of behaviour regarding the use of personal safety apps by college students.

### **Objectives**

This study identifies the factors affecting the adoption and use of mobile safety applications by the young generation in South Africa.

### **Method**

A quantitative study using a multiscale questionnaire was conducted among 203 tertiary students in Johannesburg. Purposive, heterogeneous sampling was used in the study. An exploratory factor analysis was conducted to identify latent factors within the data.

### **Results**

Results reveal that the majority of the respondents are not aware of any safety apps, but that they would use personal safety apps that are free, meet their daily needs and are recommended by peers. The key factors influencing the adoption of safety apps by college students in Johannesburg are credibility of the app, perceived utility of the app and safety experience.

### **Conclusion**

Despite high penetration of the South African Market by smart devices, the propensity of Millennials to use technology in everyday life and high concern for personal safety only 15 % of respondents have adopted personal safety apps.

**Keywords:** *Millennials, Generation Y, smartphones, apps, personal safety applications, crime, South Africa*

## INTRODUCTION

Available research on young people globally focuses on their use of social media mostly for social interaction and increasingly marketing. Fewer studies conducted on Millennials, address their use of other aspects of technology such as mobile applications (also called apps), which are software programmes designed to perform a specific function directly for the user or, in some cases, for another application programme (Tech Target 2018).

South Africa is one of the countries that experience high crime rates. Statistics show that many tertiary institutions are situated in the country's crime hotspots (Crime Stats SA 2019). The adoption of personal safety apps could be useful in an environment where people live in fear of, or experience a lot of crime. Personal safety apps could also give consumers confidence when faced with situations in which they are required. Safety apps may prove to be easy to use, because they administer monitoring that allows users to get assistance in an emergency through the usage of a number of keystrokes of their device.

Industrial marketing managers and designers are required to understand how online consumers make sense of the value of unfamiliar technology-driven products in order to make use of them. When features of technologies match particular characteristics of targeted markets, marketers and designers can decide the suitable investments in design and the best level of consumer engagement in design development (Park, Gunn, Lee, & Shim 2015).

Research into the use of interactive media offers insight into the motivations of tertiary level or university students for adopting personal safety apps. Although researchers or marketers may assume that young people automatically integrate technology into their lives, the factors that motivate such use, especially in developing countries such as South Africa are still understudied. While research has been conducted on the adoption and use of apps for banking, social interaction, music among others, factors influencing possible use of personal safety apps by tertiary students specifically face a paucity of literature. This article therefore aims to identify factors influencing the adoption of personal safety apps by college students in Johannesburg, South Africa.

In order to provide insight into these factors, the following questions were asked:

1. Do selected University students studying in Johannesburg use personal safety applications?
2. What factors influence students' decision to install a safety application?
3. What are the perceived barriers to adopting safety apps by university students?

## USE OF DIGITAL TECHNOLOGY BY MILLENNIALS

South Africa boasts of a population of almost 57 million people. Mid-year population estimates show that over 20 million South Africans are aged 15-34 years old (Stats SA 2017). Given that it is a significant number of people who are increasingly growing in terms of their purchasing power, they are often a primary target for various commercial products including mobile applications.

The vast majority of South African students attending post-secondary education fall between the ages of 18-35 (DHET 2018), which means that they largely overlap with the Generation Y category - Millennials. The definitions of Millennials vary but generally, Millennials are described as the individuals who were born between 1981 and 1999 (Bolton et al 2013). Among key characteristics of this generation is their search for personal rewards, an affinity for flexibility, the need for participation without paying attention to outcomes and absence of brand loyalty (McCormick 2015; Ogbeide, Fenich, Scott-Halsell & Kesterson, 2013). Millennials are different from other generations in that they adapt quickly to innovative changes in technology (Purani, Kumar, & Sahadev, 2019) therefore being the most technologically savvy.

Millennials are immersed in technology and use it not only for personal reasons but also to engage with organisations and brands (McCorkindale, DiStaso & Sisco, 2013; Moore 2012). South African Millennials too have an inclination to engage with brands online (Azionya 2015; Oksiutycz & Kunene 2017). This age group is technology dependent and they are likely to adopt technology in their lives for a variety of purposes: from accessing the health services (Petaschnick, 2017) and banking (McCormick 2015) to getting news (Ferguson & Greer, 2016). Millennials have shown the propensity to use technology to communicate, connect with others and to share content (Bolton et al 2013). Mobile apps usage is to a large extent driven by utilitarian motivations (Verkasalo et al 2010).

For Millennials, technology is a necessity, not a luxury (Ogbeide 2013), hence they embrace the technological capabilities of smartphones. The majority of Millennials own a smartphone (Petaschnick, 2017). Smartphone subscriptions in South Africa increased by 72.9% from 2016 to 2017 (ICASA 2018). About 20 to 22 million people in South Africa use a smartphone, which accounts for about one third of the country's population (Statista 2020). According to Verkasalo, Lopez, Molina-Castello and Bouwman (2010) smartphones, facilitate the potential adoption of new mobile applications. Parallel to the spread of the adoption of mobile devices, apps have accomplished great growth over the years (Kim, Kim & Rogol, 2017). Voigt (2013) states that global revenue from mobile apps was anticipated to grow more in 2015. Some researchers argue that there is still a need to study the adoption of technological innovations

among various age cohorts (Kwateng, Atiemo & Appiah 2018; Mari 2018; Thusi & Maduku 2020). This is because research has proved that behavioural intention is the best predictor of actual use, with behavioural intention being the main factor indicating individual mobile services usage (MafeRuiz, Sanz Blas, & Fernando Tavera-Mesías, 2010).

However, Alam et al. 2020 argue that whereas Generation Y individuals are more likely to use applications, they take into consideration the price value, defined as “consumers’ cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them” (Venkatesh et al. 2012:161). Even when Generation Y individuals use applications, the use is not sustained if they do not accrue any discounts from the continuous use of technology (Baabdullah 2018). As an age cohort, regarding the use of mobile apps they are viewed as the most difficult both to attract and retain (Moreno, Lafuente, Carreón, & Moreno, 2017; Tan & Lau, 2016). Steele et al. (2009) posit that cost may be the most important determinant influencing the adoption of technology. For gender use of technology Tarhini, Hone, and Liu (2014) suggest that in general women were more likely to have a higher technology anxiety and lower self-efficacy when dealing with technology than men. Self efficacy with regards to technology is the perception by which a person regards that they will be able to utilise a given technology without exerting a lot of effort (Cho, Quinlan, Park & Noh 2014). Furthermore, Ghalandari (2012) argues that gender may mediate the effects of facilitating conditions on the users’ behaviour associated with the adoption of new technology. Females are more likely to be more cautious, rational and sensitive to risks of using technologies (Alam et al. 2020).

## **PERSONAL SAFETY AND PERSONAL SAFETY APPS**

Arguably, the use of safety apps is closely related to the perceptions of safety. Safety perceptions are influenced by individual, social and environmental factors. Among factors affecting individual safety perceptions are demographic characteristics, culture, level of urbanisation, and the type of neighbourhood. For example, people with disabilities and women are more concerned about safety in public places (Delbosc & Currie 2012). Previous studies (Batra, 2008; Jansson, Fors, Lindgren & Wistrom 2013) highlight that feeling unsafe outdoors, or when using public transport is often linked to the fear of crime. Stats SA’s (2017a) Victims of Crime Survey (VOCS), shows that due to fear of crime, one in three households in South Africa do not go to open spaces or walk alone in parks, and one in five households do not allow their children to play on their own in the area they live. Provincially, the majority (52%) of households in the province of Northern Cape indicated that they do not go to open spaces or walk alone in parks in the area they live due to fear of crime, although only 13% of households in Limpopo province said the same. In another study, McCarthy, Culfield and O’Mahony (2016) concluded that travel safety associated with the use of public transport

influences people's perceptions of individual safety. People who use public transport have increased sense of crime risks.

Safety-related applications are said to be becoming the fastest growing segment of the industry (Statista 2015). Mobile safety apps have the capability to serve as a powerful medium that communicates the details and experiences of consumers in possession of personal safety apps (Kim et al 2017). Smartphone personal safety applications (apps) are tools that can make a person's personal life better (Dube 2013). These apps are not discriminatory in terms of whether they are used by a man or woman, a person going to new places or travelling alone. This is because being isolated from other people has the potential to create dangerous situations. Research revealed that carrying a mobile phone increases the sense of safety outdoors at the same time although downloading safety apps is considered a supplementary safety technology while travelling (McCarthy et al 2016).

In terms of adoption, it is paramount to know the circumstances influencing the consumers' adoption of safety apps to be able to figure out if consumers are making rational choices to maximise their safety. Previous mobile device studies show that consumers usually refer to reviews of an app and examine the star rating before installing it (Harris, Brookshire & Chin, (2016). Advertising, word of mouth, expertise, categorisation and product characteristics fully influence adoption rates and patterns. Studies show too that university students adopt smartphone technology faster than any other group (Lepp, Barkley & Karpinski 2014). Mobile marketers are looking for ways to provide value through mobile apps. As the app market is expected to continue evolving, the goal of designers and marketers should be to design apps for the world as it stands, rather than the world as one envisions it to be (Barkhuus & Polichar 2011).

Thus, a lot of research has been dedicated to the development, accessibility and patterns of use of apps in general by millennials. However, there is a paucity of studies about the use of personal safety apps and specifically the challenges posed in developing societies such as South Africa, regarding adoption by millennials. Thus, the present article attempts to understand challenges faced by students at tertiary institutions affecting their adoption of existing personal safety apps such as Cell 411, FindU, Namola and Shake2Alert

Potter et al (2020) point out that the unique experiences of tertiary students present a challenge to the use of personal safety apps. One of the challenges of using personal safety apps by tertiary students is that many of them lack the necessary resources, which affects prioritisation of and affordability to use personal safety apps. In addition, tertiary institutions are unable to secure funding dedicated to implementing prevention and response strategies

such as providing and running personal safety apps, as well as creating buy-in from students (Potter et al. 2020:46S). In terms of gender, studies have found that females are more likely to be concerned by security issues than males, yet males pay more attention to the effectiveness of the technology that they use (Tarhini, Hone, and Liu 2014).

Some researchers have suggested interventions to mitigate the challenges of adopting use. Thusi & Maduku (2020) argue that millennials will adopt mobile banking apps if they trust the app's systems and the institutions offering the service. Maduku (2016) stressed that customers who perceive electronic channels (such as mobile apps) as easy to use are likely to report high levels of trust in the institutions which offer them. They argue that institutions, which offer apps, need to increase publicity about the products available, by using promotional messages that increase awareness and emphasise the benefits of mobile apps, thus appealing to millennials' performance expectancy motivations. Alam et al. (2020) suggest that decision makers should focus on word-of-mouth communication as a tool for promoting services via smartphones. Thusi and Maduku (2020:8) argue "most studies addressing mobile apps acceptance and use have focused on Western and Asian countries. Less attention has been paid to other regional contexts such as Africa." This article explores, specifically for students in tertiary institutions in the South African context, how factors such as costs, trust, expectations and other perceptions could affect the adoption of personal safety apps.

## **THEORETICAL FOUNDATION**

Theoretically, the Technology Acceptance Model (TAM) originally developed by Davis (1998) is one of the theories that attempts to explain why individuals adopt technology such as apps. Technology acceptance begins with external variables, often cognitive in nature, which influence perceived usefulness (PU) and the perceived ease of use (PEOU) which in this case would relate to the adoption of safety apps. PU refers to the degree in which an individual believes that using technology will assist in improving their performance, while PEOU is explained as the extent to which a person regards that they will be able to utilise a given technology without exerting much effort- also termed as self-efficacy (Cho, Quinlan, Park & Noh 2014). The TAM depends on the main hypothesis of the Theory of Reasoned Action (TRA), which discusses how a person intends to be engaged in a particular behaviour that is determined by cognitive factors. Komiak and Benbasat (2006) point out that cognition has an impact on a wide range of safety information systems platforms usage, acceptance, and adoption.

A study done by Kim & Yoon (2014), made use of TAM to research antecedents affecting app use. The variables researched included perceived informative usefulness, perceived

entertaining usefulness, user review and perceived social usefulness, perceived ease of use, attitude towards app usage, and perceived cost effectiveness. Verkasolo et al. (2010) found that enjoyment and efficiency could be used to explain users' and non-users' intentions to make use of smartphone apps. The Generational Cohort Theory (GCT) posits that groups of people can be clustered based on placement in the historical cycle which includes specific events that shape the attitudes and behaviour of each cohort. In this case, the Millennials as compared to, for instance, the previous Generation X. The GCT previously formulated by Schewe and Meredith (2004), is now commonly applied to market analysis to define and describe generational cohorts. Given that the Millennial Generation is at present the primary focus of popular media and markets, this theory becomes applicable to the study.

## **METHODOLOGY**

A cross-sectional descriptive study using a survey research design was conducted. Saunders, Lewis and Thornhill (2003) describe surveys as structured collection of data from sizable populations. The researchers used a descriptive survey with the aim "of providing an accurate representation of phenomenon at one point in time" (Collis & Hussey 2009:77).

The population of the study were students who attend post-school (tertiary) educational institutions in Johannesburg. The South African post-school education system consists of Higher Education Institutions which comprise public and private universities, Technical and Vocational Education and Training (TVET) colleges, Community Education and Training Colleges (CET), and Private Colleges.

Although there is no data on the number of tertiary students in Johannesburg, based on the data provided by the DHET (2018) on the numbers of post-school students in Gauteng province where Johannesburg is situated, it can be estimated that the population of students attending colleges is well over 100 000. Multistage sampling was used in the study. Initially, 10 colleges and universities in Johannesburg were selected, using purposive heterogeneous sampling approach. The sample comprised of large and small universities and colleges including three public universities (HEIs), four private HEIs, one TVET college and two private colleges. The University of Johannesburg is one of the largest HEI in Johannesburg with nearly 50 000 students studying on four campuses situated in various suburbs of the city. It was decided that each of the campuses will be treated as a separate sampling site. Johannesburg was relevant for the study of personal safety apps, because the 2018/2019 South African Police Crime Statistics revealed that Johannesburg Central is the second worst crime-ridden region in the country after Cape Town Central with 14 058 cases (Crime Stats SA 2019). Tertiary institutions were studied because in addition to tertiary institutions being



situated around crime hotspots, students adopt apps faster than other groups (Lepp et al. 2014).

During the second stage of sampling, purposive sampling was employed again. Saunders, et al (2003:175) explain that heterogeneous sample “enables a researcher to collect data and explain key themes that can be observed”. Six field workers went to the selected campuses intending to obtain at random around 20 responses from students at each site. The field workers were asked to approach students of different gender, age and race. In-person data collection resulted in a high response rate; 203 valid responses were obtained.

A multi-scale, structured, self-administered questionnaire, was used to collect the data. The questionnaire had four sections. Section A solicited biographical information such as gender, age, college attended, residence and the primary mode of transport used. Section B comprised of questions on safety perceptions, Section C asked about attitudes about the adoption of technology and Section D consisted of questions about intentions to use personal safety apps. The Likert scale was used in sections B, C and D. In addition, the questionnaire had questions about the actual use of personal safety apps and familiarity with specific safety apps. The questionnaire also had an open question requesting to indicate three barriers to downloading safety apps.

Data were analysed with IBM/SPSS Version 26 using descriptive statistics. An exploratory factor analysis (EFA) was used to identify a smaller set of latent factors, which represent the larger set of variables (Williams, Onsman & Brown 2010). According to Henson and Roberts (2006:395) “Although the researcher may have some conceptualization of what factors may be present in the data, such as when items are developed to measure expected constructs, EFA generally does not consider a strong a priori theory”. Independent T-Tests were conducted to identify possible gender differences between responses. In addition, a One-Way- Analysis of Variance (ANOVA) was conducted to ascertain whether factors such as age, place of residence and the primary mode of transport used influenced the responses. Reliability was tested by means of Cronbach Alpha.

## **RESULTS**

### **Sample characteristic**

Descriptive statistics used to provide sample characteristics show that almost half of the participants 50% were aged between 18-22 years, 33% ranging from 23-27 years, 11% from 28-31 and 6% from 31-35 years. Most of the participants live in suburbs (27%) and townships (29%) surrounding Johannesburg with a large number of 26% hailing from the city centre. Of

the participants, 12% were residents of University or college residences (12%) while others travelled from informal settlements (6%). This means that the majority of the participants, over 60% commute between their places of residence to their institutions of study, therefore may find the need for using personal safety apps. In terms of their experiences and perceptions towards personal safety. Most of the participants indicated that they had personally experienced a threat to their personal safety (78%) and that their peers had experienced threats too (89%), as well as their family members (76%). In terms of gender-related views, they thought that women encountered a higher risk of facing crime in Johannesburg (97%) than men (78%).

### Intention to download personal safety apps

The responses summarising the intentions to download personal safety apps are presented in Table 1.

Table 1. Customs table representing the responses on intentions to download personal safety apps (n 203)

		Strongly disagree	Disagree	Agree	Strongly Agree	Total
D1_1 I would download a personal safety app if meets my expectations	Count	4	17	93	89	203
	Row N %	2.0%	8.4%	45.8%	43.8%	100.0%
D1_2 I would download a personal safety app because I used a similar app before	Count	6	84	83	30	203
	Row N %	3.0%	41.4%	40.9%	14.8%	100.0%
D1_3 I would download a personal safety app because I believe in using any tools that increase my personal safety	Count	2	30	81	90	203
	Row N %	1.0%	14.8%	39.9%	44.3%	100.0%
D1_6 I would download a personal safety app recommended by my friends	Count	4	31	94	74	203
	Row N %	2.0%	15.3%	46.3%	36.5%	100.0%
D1_7 I would download a personal safety app that good online reviews	Count	5	31	85	82	203
	Row N %	2.5%	15.3%	41.9%	40.4%	100.0%
D1_8 I would download a personal safety app that linked to my medical aid	Count	4	38	82	79	203
	Row N %	2.0%	18.7%	40.4%	38.9%	100.0%
D1_9 I would download a personal safety app if it is linked to the government medical emergency services	Count	4	39	84	76	203
	Row N %	2.0%	19.2%	41.4%	37.4%	100.0%

D1_10 I would download a personal safety app that is linked to reputable brand/organisation	Count	5	30	76	92	203
	Row N %	2.5%	14.8%	37.4%	45.3%	100.0%
D1_11 I would download a personal safety app if it ensures an easy access to emergency service (police, fire service)	Count	3	16	62	122	203
	Row N %	1.5%	7.9%	30.5%	60.1%	100.0%

The majority of participants (89.6 %) agreed that they would download a safety app if it would meet their expectations. Most of the participants (91%), indicated that they would pay for a personal safety app that ensures easy access to emergency services including police, fire department among others. A large number of the participants (83%) indicated that they would be ready to download an app that is recommended by their friends. They would also be willing to download an app if it would ensure their personal safety (84%), they have used a similar one before (56%), if it is free (88%), had good online reviews (82%), linked to personal medical aid (79%), linked to a reputable organisation (83%) or is linked to government emergency services (79%).

### Use of personal safety apps

Most of the participants indicated that they have never downloaded or used a personal safety app (85%) while the remaining 15% stated that they have. Although only 3% of all participants do not own smart devices, with 80% indicating that they use smartphones for accessing the internet and social media, 8% use mini tablets, 6% tablets and 3% using laptops. Most of the participants 89% have never used a personal safety app, only 11% have. This is reflected in their responses to a question asking them which personal safety apps they know. More than half of the participants, 65% were not familiar with any personal safety apps. The better known app, out of My SOS, Cell 411, FindU, Namola, Shake2Alert, was My SOS with 21% participants acknowledging knowledge and the rest distributed across the others.

### Factors influencing the use of apps

To measure the adequacy of the sampling for Factor Analysis in SPSS, the Kaiser-Meyer Olkin (KMO) and Bartlett's Test were performed (Table 2) The sampling is adequate if the value of Kaiser Meyer Olkin (KMO) is > 0.6 (Pallant 2013). The Kaiser- Meyer- Olkin Measure (KMO) of Sampling Adequacy Value was 0.877 indicating that the sample size was adequate. Bartlett's test of sphericity was significant ( $\chi^2$ ) = 1652.181,  $p < .001$ ).

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.877
Bartlett's Test of Sphericity	Approx. Chi-Square	1652.181
	df	190
	Sig.	.000

Eigenvalues > 1 were used to determine the underlying component. The analysis yielded three factors with eigenvalues > 1, explaining the total 53.056 percent of the variance in the data. According to Willimas et.al (2010) there are no fixed thresholds for cumulative percentage of variance but 50-60% is commonly accepted.

Factorial validity, assessed through factor analysis (Geffen & Straub 2005) was used to determine construct validity. Seven questions related to safety perceptions, 12 question on the use of apps and 11 questions about intentions to use safety apps were analysed using Principal Component Analysis (PCA) and Varimax with Kaiser Normalization rotation. PCA is recommended if studies are not based on existing models (Williams et al. 2010). The three extracted factors were labeled as follows: Factor 1 was labelled *Credibility of the app*, the factor contributed to 31.6% of the variance. Factor 2 was labelled *Perceived utility of the app* and explained 13.8% of the variance; factor 3 was named *Safety experience* and accounted for 7.5 % of the variance.

A commonly used rule states that only variables with loadings greater than 0.4 on a factor should be considered "significant" and used in defining that factor (Ford, MacCallum & Tait 1986)., to yield a valid factor analysis. Ten questions were removed due to factor loading below 0.4. The factor *Credibility of the app* had nine items loading above 0.4, the factor *Perceived utility of the app* had eight items loading above 0.4 and *Safety experience* factor had three valid items (Table 3). No cross-loading items were present.

Table 3. Rotated Component Matrix for the three factors (Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization)

	Component		
	1	2	3
D1_11 I would download a personal safety app if it ensures an easy access to emergency service (police, fire service)	.792	.031	.119
D1_7 I would download a personal safety app that good online reviews	.792	.191	-.047
D1_1 I would download a personal safety app if meets my expectations	.780	.017	-.021
D1_3 I would download a personal safety app because I believe in using any tools that increase my personal safety	.774	.070	-.007
D1_10 I would download a personal safety app that is linked to reputable brand/organisation	.761	.229	.183
D1_8 I would download a personal safety app that linked to my medical aid	.759	.171	.062
D1_6 I would download a personal safety app recommended by my friends	.752	.166	.061
D1_9 I would download a personal safety app if it is linked to the government medical emergency services	.725	.222	.080
D1_2 I would download a personal safety app because I used a similar app before	.487	.191	-.226
C1_8 I use apps that don't take a lot of memory on my gadget	-.099	.709	.020
C1_9 I use apps that make my life easier	.265	.704	.156
C1_10 I use apps so I can talk about them with my friends	.187	.675	.099
C1_6 I try new apps because I know they can be easily deleted if they do not fulfil my expectations	.168	.632	.101
C1_7 I use apps that are easy to use	.168	.628	.043
C1_11 I like experimenting with apps	.102	.626	.118
C1_5 I use apps when I have clear understanding of their benefits	.194	.621	.227
C1_4 I only use apps when most of my friends have it	.077	.528	-.037
B1_1 My university friends have experienced a threat to their personal safety	-.036	.114	.757
B1_3 I have personally experienced a threat to my personal safety	.054	.114	.723
B1_2 My family members have experienced a threat to their personal safety	.072	.159	.716

### Construct reliability

Cronbach Alpha was used to establish reliability. Cronbach Alpha of the factors extracted using an EFA, ranged from 0.633 to 0.904 (Table 4). Churchill (1979) suggests that a

Cronbach's alpha value of 0.6 is acceptable. The lower level of Cronbach alpha for the construct *Safety experience* can be attributed to a small number of items (3).

Table 4. Cronbach alpha for the three constructs

Construct	Cronbach Alpha	Number of items
Credibility of the app	.904	9
Utility of the app	.809	8
Safety experience	.630	3

The independent T-Test did not identify statistically significant differences in responses between genders. Similarly, the one-way Anova did not point to significant differences between respondents of different ages or those using different modes of transport.

### Barriers to adoption of personal safety apps

The respondents were asked an open question to list three key reasons preventing them from downloading and using a personal safety app. The summary of the responses are presented in Table 5 below. Although not tested statistically, the thematic grouping of the open responses is in line with the factors *Perceived utility of the app* and *Credibility of the app* identified through factor analysis. Few respondents pointed to the ease of use as one of the reason for downloading new apps. Other aspects named by respondents as preventing them from using safety apps are cost/expense, memory usage and privacy concerns. The latter three factors have not been cited in previous studies on adoption technology as factors influencing the adoption of apps.

Table 5. Reasons preventing participants from using personal safety apps.

Theme	Reasons
Expense/cost	<ul style="list-style-type: none"> <li>• cost of data</li> <li>• data expense</li> <li>• data usage too high</li> <li>• how much it cost to get the app</li> </ul>
Memory Usage	<ul style="list-style-type: none"> <li>• phone space</li> <li>• takes a lot of space</li> <li>• app is too big</li> </ul>
Ease of use	<ul style="list-style-type: none"> <li>• complicated to use</li> <li>• not responsive</li> <li>• difficult to understand</li> </ul>
Utility (meets expectations and needs)	<ul style="list-style-type: none"> <li>• if the app is not linked to emergency services</li> <li>• if there isn't a toll-free number</li> <li>• no instant response</li> <li>• one that fails to meet my expectations</li> <li>• if it doesn't provide the service it is supposed to</li> </ul>

	<ul style="list-style-type: none"> <li>• if it does not meet my needs and expectations</li> </ul>
Privacy Concerns	<ul style="list-style-type: none"> <li>• safety of my information</li> <li>• fear of being hacked</li> <li>• not personalised</li> <li>• fear of getting viruses</li> </ul>
Credibility	<ul style="list-style-type: none"> <li>• if the app does not have good reviews</li> <li>• if it is not proven to be effective</li> <li>• an app that is unknown</li> <li>• no online reviews</li> </ul>

## DISCUSSION

The first research question aimed to ascertain which safety apps are used by students in Johannesburg. The findings of this study indicate that few students (15%) downloaded or used safety apps, despite many of them reporting that they experienced threats to their personal safety. Furthermore, the vast majority of the respondents indicated that they have access to suitable devices, are comfortable with using new technology and consider themselves early adopters. In addition, nearly 80% of respondents indicated that they use a variety of apps in everyday life. Not having a safety app, may be partially explained by the lack of awareness of safety apps as nearly three quarters of respondents were not familiar with any safety apps, but it is also evident from the study that other factors play the role in a low level of adoption of safety apps among the university students.

The exploratory factor analysis identified three factors affecting the adoption of safety apps by university students in Johannesburg. Factor 1 named *Credibility of the app* indicates that the credibility of the app is the one of the most important factors in students' decision to adopt a safety app. The credibility comes from different sources such as peer reviews, online reviews, association with reputable brands and even personal experience with similar apps. The respondents indicated that if the app does not have online reviews or has poor online reviews they are not willing to download the app. Similarly, peer and word of mouth reference play an important role in apps' adoption by Millennials. Over 80% of respondents stated that they would adopt the app that is recommended by their friends. In addition, the respondents indicated willingness to use the apps associated with a reputable brand such as a scrutiny company, car insurance or a medical aid/insurance company. This finding is in line with previous research by Thusi and Maduku (2020) and Alam et al. (2020) who identified trust in the institutions linked to the apps and the word of mouth respectively as key factors in apps adoption.

Factor 2 *Perceived utility of the app* supports the notion that utilitarian motivations are key reasons for technology adoption, as stated by Verkasalo et al (2010). This factor also corresponds loosely with the PU factor of the Technology Acceptance Model. The respondents indicated that they are more likely to upload the apps that meet their expectations, deliver on the customer promise and fulfil the value proposition. The utility value of the app is understood by Millennials broadly and includes elements such as experimenting with the apps and talking to peers about apps. Developers responsible for designing mobile apps may need to invest resources in creating apps that improve Millennials' experience. In addition, Millennials will have a positive intention to adopt mobile apps in this case personal safety apps, if they believe that the technology benefits their activities (Thusi & Maduku 2020).

Factor 3 *Safety experience* is another latent factor identified in this study and not present in other studies on adoption of apps. This factor can be explained by the specific focus of the app (personal safety) and the societal context of South Africa, where there is a high prevalence of crime.

While answering the open question about the key barriers to adopting safety apps, the respondents expressed concerns about issues such as safety of the apps, including the integrity of personal information and the risks of malware associated with downloading apps. Some were reluctant to download apps because of spam associated with some apps. Other factors related to intrinsic qualities of apps are worries about an app using too much memory of the device. This kind of concerns is inherently associated with digital and web-based technologies. The responses to the open question indicate that for many students, the cost of using apps is an important concern. Cost of data is a considerable constraint, therefore there was high concern about downloading apps that use a lot of data, even if the apps were free. Cost of use of technology was a factor in adoption of new technology identified in prior research by Steel (2009) and may be even more deciding factor in case of users in the developing markets.

## **CONCLUSION**

Despite high penetration of the South African Market by smart devices, and high concern for personal safety only 15 % of respondents have adopted personal safety apps. This study highlighted that the original dimensions of the TAM model are not sufficient to explain the adoption of safety apps by college students in South Africa. Although *the perceived usefulness* (PU) of technology relates to the factor *Perceived utility of the app* identified through the exploratory factor analysis applied in this study, other factors were identified, namely the *Credibility of the app* and the *Safety experience*. It is recommended for future research that a confirmatory factor analysis be conducted regarding these factors. In addition, a possible



further exploration of dimensions associated with the use of mobile digital technology such as *app cost, memory usage, and privacy concerns*, which were not included in the questionnaire, but emerged as a result of an open question about barriers to the adoption of safety apps by the college and university students in Johannesburg, should be conducted.

## **ACKNOWLEDGEMENTS**

### Competing interests

The author(s) declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

### Authorship

Both authors contributed to the writing of the article.

### Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### Data availability

The data that support the findings of this study are available from the corresponding author, [AO], upon reasonable request.

### Disclaimer

The views expressed in the submitted article are the authors' own and do not represent any institution.

## List of sources

- Alam, M.Z., Hoque, Md.R., Hu, W., & Barua, Z., 2020, 'Factors influencing the adoption of mHealth services in a developing country: A patient-centric study'. *International Journal of Information Management*, 50, 128-143.
- Aziona, C.M., 2015, 'University of Johannesburg Millennials' communication of brand perception on Facebook: Implications for reputation management.' Master's dissertation, the University of Johannesburg. Accessed from: <http://hdl.handle.net/10210/85184>
- Baabdullah, A. M., 2018, 'Factors influencing adoption of mobile social network games (M-SNGs):The role of awareness'. *Information Systems Frontiers*, 1–17. <https://doi.org/10.1007/s10796-018-9868-1>.
- Barkhuus, L., & Polichar, V., 2011, 'Empowerment through seamfulness: Smart phones in everyday life'. *Personal and Ubiquitous Computing*, 15, 629–639.
- Batra, A., 2008, 'Foreign tourist's perceptions towards personal safety and potential crime while visiting Bangkok'. *Anatolia: An International Journal of Tourism and Hospitality Research*, 19(1), 89-101.
- Bolton, N. R., Parasurman, A., Hoefnagels, N., Migchels, S., Kabadayi, T., Gruber, Y., Loureiro, Y.K. & Solnet. D., 2013, 'Understanding Generation Y and Their Use of Social Media: A Review and Research Agenda.' *Journal of Service Management*, 24 (3), 245–257.
- Cho, J., Quinlan, M.M., Park, D. & Noh, G., 2014, 'Determinants of adoption of smartphone health apps among college students'. *American Journal of Health Behaviour*, 36(6), 860-870.
- Churchill, G. 1979, 'A paradigm for developing better measures for marketing contrasts' *Journal of Marketing Research*, 16, 64–73.
- Collis, J., & Hussey, R., 2009, '*Business research; a practical guide for undergraduate and postgraduate students*'. London: Palgrave MacMillan.
- Crime Stats SA., 2019, 'The 10 worst areas for crime in every province in South Africa'. Accessed from <https://www.crimestatssa.com/>.
- Davis, F.D., 1998, 'Perceived usefulness, perceived ease of use and user acceptance of information technology'. *MIS Quarterly*, 13(3), 319-339.
- Delbosc, A. & Currie, G., 2012, 'Modelling the causes and impact of personal safety perceptions on public transport ridership'. *Transport Policy*, 24, 302-209.

- DHET (Department of Higher Education and Training), 2018, 'Statistics on post-school education and training in South Africa 2016'. Accessed from:  
[http://www.dhet.gov.za/Research%20Coordination%20Monitoring%20and%20Evaluation/6\\_DHET%20Stats%20Report\\_04%20April%202018.pdf](http://www.dhet.gov.za/Research%20Coordination%20Monitoring%20and%20Evaluation/6_DHET%20Stats%20Report_04%20April%202018.pdf)
- Dube, R., 2013, 'Don't be a victim-your smartphone as a personal safety device'. Accessed from: <http://www.makeuseof.com/tag/dont-be-a-victim-your-smartphone-as-a-personal-safety-device/>
- Ferguson, D.A., & Greer, C.F., 2016, 'Reaching moving target; how local TV stations are using digital tools to connect with Generation C'. *International Journal on Media Management*, 18(3-4), 141-161.
- Ford, J.K, Mac Callum, R.C., & Tait, M, 1986, 'The application of exploratory factor analysis in applied psychology: a critical review and analysis', *Personnel. Psychology*, 39, 291-314.
- Geffen, D. & Straub, D.,2005, 'A practical guide to factorial validity using pls-graph: tutorial and annotated example', *Communications of the Association for Information Systems*, 16, 91-109.
- Ghalandari, K., 2012, 'The effect of performance expectancy, effort expectancy, social influence and facilitating conditions on acceptance of e-banking services in Iran: The moderating role of age and gender'. *Middle-East Journal of Scientific Research*, 12(6), 801–807.
- Harris, M.A., Brookshire, R., & Chin, A.G., 2016, 'Identifying factors influencing consumers' intent to install mobile applications'. *International Journal of Information Management*, 36, 441-450.
- Henson, R.K. & Roberts, J.K., 2006, 'Use of exploratory factor analysis in published research common errors and some comment on improved practice', *Educational and Psychological Measurement*, 66 (3), 393-416.
- ICASA (Independent Communications Authority of South Africa), 2018, '3rd Report on the state of ITC sector in South Africa'. Accessed from:  
<https://www.icasa.org.za/uploads/files/State-of-ICT-Sector-Report-March-2018.pdf>
- Jansson, M., Fors, H., Lindgren, T. & Wistrom, B., 2013, 'Perceived personal safety in relation to urban woodland vegetation- a review'. *Urban Forestry & Urban Greening*, 12, 127-133.

- Kim, H.J., & Yoon, M.N., 2014, 'Adopting smartphone-based blended learning: An experimental study of the implementation of Kakao-Talk and Mocafe.' *Multimedia assisted Language Learning*, 17(2), 86-111.
- Kim, J., Kim, S., & Rogol, E., 2017, 'The effects of consumer innovativeness on sport team applications acceptance and usage'. *Journal of Sport Management*, 31, 241-255.
- Komiak, S.Y.X., & Benbasat, I., 2006, 'The effects of personalization and familiarity on trust and adoption of recommendation agents'. *MIS Quarterly*, 30(4), 941-960.
- Kwateng, O. M., Atiemo, K., & Appiah, C., 2018, 'Acceptance and use of mobile banking: An application of UTAUT2'. *Journal of Enterprise Information Management*, 32(1), 118–151.
- Lepp, A., Barkley, J. E., & Karpinski, A.C., 2014, 'The relationship between cell phone use, academic performance, anxiety, and satisfaction with life in college students'. *Computers in Human Behavior*, 31, 343–350.
- Maduku, D. K., 2016. 'The effect of institutional trust on internet banking acceptance: Perspectives of South African banking retail customers'. *South African Journal of Economic and Management Sciences*, 19(4), 533–548.
- Mafe Ruiz, C., Sanz Blas, S., & Fernando Tavera-Mesías, J., 2010, 'A comparative study of mobile messaging services acceptance to participate in television programmes'. *Journal of Service Management*, 21(1), 69–102.
- Mari, V, 2018, 'Predictors of online insurance service use intentions among young consumers'. Master's thesis <http://urn.fi/URN:NBN:fi:aalto-201806273635>.
- McCarthy, O.T., Caulfield, B. & O'Mahony, M., 2016, 'How transport users perceive personal safety apps'. *Transport Research Part F*, 43, 166-182.
- McCorkindale, T., DiStaso, M.W. & Sisco, H.F., 2013, 'How Millennials are engaging and building relationships with organizations on Facebook.' *Journal of Social Media in Society*, 2 (1), 66–87.
- McCormick, E., 2015, 'Invasion of the Millennials'. Bank Director.Com, *4th Quarter*, 28-34.
- Moore, M., 2012, 'Interactive media usage among Millennial consumers'. *Journal of Consumer Marketing*, 29(6), 436–444.
- Moreno, F. M., Lafuente, J. G., Carreón, F.Á, & Moreno, S. M., 2017, 'The characterization of the millennials and their buying behavior'. *International Journal of Marketing Studies*, 9(5), 135–144.

- Ogbeide, G., Fenich, G.G., Scott-Halsell, S. & Kesterson, K., 2013, 'Communication preferences for attracting the Millennial generation to attend meetings and events'. *Journal of Convention and Event Tourism*, 14, 331-344.
- Oksiutycz, A. & Kunene, S., 2017, 'Contribution of online corporate communication to brand reputation among Millennials in the Vaal Region'. *Communicatio*, 43(3-4), 74–94.
- Pallant, J., 2013, '*SPSS Survival Manual: A step by step guide to data analysis using SPSS*' 5th edition. Crows Nest, N.S.W.: Allen & Unwin.
- Park, J., Gunn, F., Lee, Y., & Shim, S., 2015, 'Consumer acceptance of a revolutionary technology-driven product: The role of adoption in the industrial design development'. *Journal of Retailing and Consumer Services*, 26,115-124.
- Petaschnick, J., 2017, 'Communicating across generations'. *The Receivables Report for America's Healthcare Financial Managers*, 32(1), 8-11.
- Potter, S.J., Moschella, E.A., Smith, D., & Draper, N., 2020, 'Exploring the Usage of a Violence Prevention and Response App Among Community College Students'. *Health Education & Behavior*, 47(1S): 44 S–53S.
- Purani, K., Kumar, D. S., & Sahadev. S., 2019, 'E-loyalty among millennials: Personal characteristics and social influences'. *Journal of Retailing and Consumer Services*, 48, 215–223.
- Schewe, C.D. & Meredith, G., 2004, 'Segmenting global markets by generational cohorts: determining motivations by age'. *Journal of Consumer Behaviour*, 4,51-63.
- Statista, 2015, 'Most popular Apple App Store categories in March 2015, by share of available apps'. Accessed from: <http://www.statista.com/statistics/270291/popularcategories-in-the-app-store/>
- Statista, 2020, 'Number of smartphone users in South Africa from 2014 to 2023'. Accessed from <https://www.statista.com/statistics/488376/forecast-of-smartphone-users-in-south-africa/>
- Stats SA (Statistics South Africa), 2017, 'Mid-year population estimates 2017'. Accessed from: <http://www.statssa.gov.za/publications/P0302/P03022017.pdf>
- Stats SA (Statistics South Africa), 2017a, 'And the streets fell silent: how crime impacts the everyday'. Accessed from: <http://www.statssa.gov.za/?p=9553>
- Steele, R., Lo, A., Secombe, C., & Wong, Y. K., 2009, 'Elderly persons' perception and acceptance of using wireless sensor networks to assist healthcare'. *International Journal of Medical Informatics*, 78(12), 788–801.

Sunders, M. Lewis, P. & Thornhill, A., 2003, '*Research methods for business students.*' Harlow, England: Prentice-Hall.

Tan, E., & Lau, J., 2016, 'Behavioural intention to adopt mobile banking among the millennial generation'. *Young Consumers*, 17(1), 18–31.

Tarhini, K., Hone, X., & Liu., 2014, 'Measuring the moderating effect of gender and age on e-learning acceptance in England: A structural equation modeling approach for an extended technology acceptance model'. *Journal of Educational Computing Research*, 51(2), 163–184.

TechTarget., 2018, Definition: app. Accessed from:  
<https://searchmobilecomputing.techtarget.com/definition/app>

Thusi, P., & Maduku, D.K., 2020, 'South African millennials' acceptance and use of retail mobile banking apps: An integrated perspective'. *Computers in Human Behaviour*, 111: 106405. <https://doi.org/10.1016/j.chb.2020.106405>.

Venkatesh, V.,Thong,J.Y., & Xu. X., 2012, 'Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology'. *MIS Quarterly*, 36(1), 157–178.

Verkasalo, H., Lopez, N.C., Molina-Castello, F.J. & Bouwman, H., 2010, 'Analysis of users and non-users of smartphone applications'. *Telematics and Informatics*, 27(3), 242-255.

Voigt, K., 2013, 'Report: Apps industry surging to \$25 billion'. Accessed from  
<https://edition.cnn.com/2013/03/05/business/global-apps-industry/index.html>

Williams, B., Onsman, A. & Brown, T., 2010, 'Exploratory factor analysis: A five-step guide for novices' *Journal of Emergency Primary Health Care*, 8( 3), article 990399