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Adults' perspectives on smartphone usage and dependency in Australia

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ABSTRACT

This study investigated the smartphone usage and dependency problem based on demographics among the adult population of Australia. A novel aspect of this study is that it specifically examines how people rate their perceived dependency levels compared with their perceived usage, which participants are asked to measure in comparison to their peers. Other novel aspects of this study include assessing the impact of parental status and occupational status on smartphone use and dependency, as well as addressing previous research gap in studying balanced population across genders and wide age range. This study also identifies activities associated with low usage and low dependency as opposed to activities linked to high smartphone usage and dependency. By comparing our findings to those obtained from similar studies in other countries and cultures, this study finds where problems are being detected consistently across multiple studies and where there are ambiguities. Where inconsistencies were identified, the question arises whether this is due to differences between measured populations (i.e. the Australian context of our research) or smartphones becoming more powerful and more affordable between research studies. Finally, this study explores possible avenues for future research into the usage patterns and smartphone dependency to support achieving balanced lifestyles of concerned individuals.

1. Introduction

This study investigates peoples' use and dependence on smartphones. This topic is of interest as smartphones are associated with both significant benefits and significant drawbacks (at least for some people). Both the benefits and drawbacks arise from the smartphone's combination of portability and functionality. Portability arises from the small size of the device and ubiquitous network availability allowing users to access smartphone features almost anytime and anywhere. The functionality includes a wide range of applications useful for work, entertainment and socialising (Mitchell & Hussain, 2018). The benefits of smartphones arise from allowing individuals to perform their daily tasks and achieve their goals effectively and efficiently. This includes access to social support and to family and friends, thus creating feelings of belonging (Chan & Li, 2020; Kim, Wang, & Oh, 2016). A drawback of smartphones is the potential for high levels of dependency and use, which could interfere with the otherwise healthy lifestyle of some users (Vally & El Hichami, 2019). Some researchers consider long hours of smartphone usage as a potential indication of addictive behaviour (Mlilel & Larouz, 2018).

Mobile phones, of which most are smartphones, are used globally by around 2.5 billion people (Oviedo-Trespalacios, Nandavar, Newton,

Demant, & Phillips, 2019). However, some countries have higher levels of adoption. Australia is one of those countries. Approximately 88% of the Australian population own a mobile phone, so Australia has a culture of mobile phone use that likely reflects patterns of behaviour that are growing globally. And smartphone usage is increasing globally, along with concerns that individuals are suffering from problems resulting from lengthy smartphone use. However, judging problematic use simply by duration is too simplistic. It is important to investigate reasons for smartphone use and distinguish between purposeful, productive, goal-related use (effectual use) vs compulsive and unnecessary use (i.e. performing tasks which could be delayed to more appropriate times or be conducted using other media, such as face-to-face).

Both Apple and Google have attempted to address concerns regarding high levels of smartphone use by creating phone apps (Screen Time for iOS and Digital Wellbeing for Android) which measure how much time users spend using particular categories of applications. For example, some applications are categorised as entertainment (e.g. YouTube and Facebook) and their use is recorded under that category. Users can track the amount of time they spend on these apps in these categories and then attempt to modify their behaviour by adjusting their use so as to avoid interfering with other lifestyle activities.

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Nevertheless, the categorisations of use as recorded by Screen Time and Digital Wellbeing are rather crude. There are no means to distinguish effectual and goal-oriented use from ineffectual use. For example, these tools may register that a user spent several hours on YouTube, but they cannot distinguish whether the user was watching videos for entertainment or videos that supported their studies or otherwise helped with useful problem-solving. That is not to say that there is necessarily a problem with using smartphones for entertainment, it is one of the potentially useful features. However, without the ability to evaluate user activities on the smartphone versus user's goals and priorities it is difficult to determine what usage is effectual. If usage is not effectual (i.e. not serving some purpose that is important and useful to the user) then it is likely unnecessary use. High levels of ineffectual use are likely to be impacting on the broader lifestyle of the user by detracting from the time and attention for goal-oriented activities (whether those goals be work, socialising or entertainment). There has been much research on the issues of heavy problematic use and its relationship with possible dependency issues, however, there is little discussion in the literature on how to distinguish time spent on effectual goal-oriented use from compulsive or ineffectual use.

This study is the foundational component of a research project investigating identification and prevention of ineffectual smartphone use. In this study we are exploring what self-reported data could be used as indicators of ineffectual use. One potential candidate situation is when users identify they are dependent on their phones when they would prefer not to be. Note, this information is likely to be insufficient on its own, as users might have other pressures to use their phone when they would prefer not to (e.g. professional/work demands). Being able to distinguish these situations is one of the goals of the overall research project. At this stage we are interested in what we can learn from the self-reported data, in particular whether people do in fact report high unwanted dependency and if so, in what demographic groups that occurs.

Hence, the goal of this study is:

To investigate the relationship between smartphone usage and dependency based on demographics and explore categories of activities contributing to smartphone usage and dependency.

To help achieve this goal, the following objectives have been set:

- To identify whether there are differences in self-reported smartphone dependency between demographic groups;
- To investigate the relationship between self-reported dependency and usage as compared to peers;
- To evaluate the participants' preferred smartphone activities and their impact on smartphone usage and dependency; and
- To identify the inconsistencies between findings of this study and results of previously conducted studies in a similar context.

2. Background

Excessive smartphone use is connected with a number of social, mental, and other health-related problems (Bozoglan, 2018; Enez Darcin et al., 2016; Stephan, Michael, Michael, Jacob, & Anesta, 2012). Excessive smartphone use is also connected to certain types of negative mobile phone dependency (King et al., 2013). For example, nomophobia (derived from "no-mobile phobia") is described as the dread of losing access to the one's mobile phone (Bivin, Mathew, Thulasi, & Philip, 2013). Users who suffer from such negative dependencies reportedly become anxious if they experience a loss of network connectivity, phone separation or a flat battery (Cheever, Rosen, Carrier, & Chavez, 2014). Such problems do not appear to be limited to particular continents or cultures. Recent research shows that 53% of studied participants from the UK and 58% of studied participants in Mumbai experienced nomophobia (George, Saif, & Joseph, 2017).

It is important for researchers to understand the factors leading to excessive use of smartphones because, as the research literature we are presenting indicates, such use is associated with many health, lifestyle

and wellbeing problems (Cheever et al., 2014; Hawi & Samaha, 2017). Felisoni and Godoi (2018) conducted a study on smartphone usage and its impact on students' academic performance in Brazil and found that students spending less time on smartphones achieved higher grades compared to those who had excessive smartphone usage. Munderia and Singh (2018) examined smartphone dependency and mental well-being in young Indian adults and found that higher smartphone dependency adversely influenced mental health. Bian and Leung (2015) conducted research involving 414 university students in Hong Kong investigating the roles of psychological factors (such as loneliness and shyness) and patterns of smartphone use in predicting smartphone dependency and people relationships. This investigation found that the utilisation of smartphones for various purposes (particularly for information searching and social media) caused undesirable side effects such as distraction, feeling lost and anxiety. Problematic use associated with reservedness and loneliness has had ramifications sufficient to require interventions and help from family members, teachers, and policymakers (Škarupová, Ólafsson, & Blinka, 2016). Researchers further recommended investigating the consequences of smartphone usage patterns and behavioural dependency on various age groups and widening the geographical background (Abbasi, 2019; Choudhury et al., 2019; Fischer-Grote, Kothgassner, & Felnhofner, 2019; Um, Choi, & Yoo, 2019). Sciandra, Inman, and Stephen (2019) investigated how smartphone use and dependency cause a distraction while shopping in the United Kingdom. They found smartphone use and dependency influences customers' capacity to precisely complete in-store shopping plans and linked the problem to an expansion in unplanned shopping.

Researchers raised some important questions, such as how prevalent excessive phone use and negative dependency are; and, which demographic factors have significant association with dependent smartphone behaviour. There are studies that provide insights into these questions. For example, Vally and El Hichami (2019) examined smartphone usage habits of 350 college-age young adults in the United Arab Emirates. According to the results of this study, one-third of the participants reported problematic smartphone use, with females spending most of their daily time on their smartphones and exhibiting higher usage than males. The widespread presence of problematic smartphone use in UAE was considerably higher in comparison to previous reports from America, Europe, and the Far East. Vally & El Hichami (ibid) recommended further investigations of smartphone usage by young adults through insights into specific aspects of the usage, such as which features are being used and which activities are being performed using smartphones (e.g. emails, messaging, playing games or browsing the Internet). Oviedo-Trespalacios et al. (2019) conducted a research study on problematic use of smartphones in Australia that compared the data gathered in 2005 with data gathered in 2018. The study examined advancements in mobile technology and connections between compulsive smartphone use and road safety. They found that excessive smartphone use had increased over time and that there were clear differences in usage patterns based on age and gender. Participants in the 18–25 age group recorded higher smartphone usage, particularly females.

Lopez-Fernandez et al. (2017) studied the influence of self-reported smartphone dependency in young adults using a cross-cultural empirical survey in Europe. They discovered that frequency of smartphone usage and a specific application usage played an essential role in the smartphone dependency. Park, Kim, Shon, and Shim (2013) examined the factors influencing smartphone use and dependency in the context of South Korea, and they found that smartphone use and dependency were affected by specific personality traits.

Similarly, socio-demographic and psychological issues have been known to cause smartphone dependency (Billieux, 2012). Numerous studies have examined this phenomenon from different perspectives in various parts of the world. These studies, primarily conducted in America, Europe and Asia, have reported alarming rates of problematic smartphone use. While there has been a significant increase in research about excessive smartphone usage and dependency in many countries,

there appears to be a lack of research in this area conducted within Australia (Oviedo-Trespalacios et al., 2019). However, in general, excessive smartphone use has been found to cause problematic or anti-social practices across the board (Mei et al., 2018). Hence, there is still a need for researchers and clinicians to develop and have access to instruments that can determine and measure problematic usage of smartphones.

3. Methodology

This study explores smartphone usage by the adult population in Australia using a quantitative research method. Data was collected through a questionnaire (using Qualtrics) and was analysed using statistical methods (see the next section 'Data Analysis' for details), specifically using MS Excel and SPSS.

Similar studies in this research area, involving data collection from a large number of participants, also used questionnaires (Lopez-Fernandez et al., 2017; Stead & Bibby, 2017; Vally & El Hichami, 2019). Our study used an online questionnaire as it allowed collecting data from a large number of people without geographical barriers and within a relatively short period of time (Lefever, Dal, & Matthíasdóttir, 2007). Previous studies into mobile phone usage and dependency designed questionnaires based on their study goals, for example, Mobile Phone Problem Usage Scale - MPPUS (Bianchi & Phillips, 2005), Mobile Phone Dependency Questionnaire - MPDQ (Toda, Monden, Kubo, & Morimoto, 2004), Test of Mobile Phone Dependency - TMD (Chóliz, 2012), Assessment of Internet and Computer game Addiction - AICA-S (Müller, Glaesmer, Brähler, Woelfling, & Beutel, 2014), TMDbrief (Chóliz et al., 2016), Smartphone Addiction Scale based on the Human Evaluation Model - HEM (Moon, 2019) and Problematic Media Use Measure - PMUM (Domoff et al., 2019). Our study has drawn on these questionnaires used in past research; however, since we were examining variables that have not been thoroughly studied to date, additional questions were designed to investigate how people perceive their smartphone usage habits compared to their peers and whether they assessed themselves as suffering from an adverse or problematic smartphone dependency. To understand factors affecting this dependency behaviour and in line with previous studies, our questionnaire included a set of demographic questions as well as questions on usage patterns and preferred activities when using smartphones. Thus, our questionnaire was designed for our specific purposes, and while our results can be compared to the findings from other surveys, the survey instruments are not directly compatible.

Our Internet-based questionnaire was conducted in Australia during September and October 2019. In total, 607 participants from across Australia responded to the survey. However, with removal of incomplete entries we worked with a total of 523 responses.

To improve the mixed representativeness of the sample (in relation to our desired demographic data) participants were recruited not only at universities but also by advertising on Gumtree, Facebook and LinkedIn. This broad recruitment strategy was targeting some limitations of the previous research studies which investigated dependency only within younger generations, and these were mainly students. Respondents were required to be at least 18 years old; regular users of a smartphone; competent in English; and currently residing in Australia. Australia as a country and a continent is also under-represented in such studies (Nyamadi, Boateng, & Asamenu, 2020)

It is possible that the sample is biased towards people who use the forums where we promoted the survey, however, we believe that the use of multiple forums attracted a reasonably representative sample of the general population, and although these were self-selected, there was an incentive for people to participate which should have broadened the participants beyond simply those with a particular concern about their smartphone use.

The final sample consisted of 523 adults, aged 18 years old and above. The sample included 258 women and 252 men (12 participants preferred not to identify their gender and one identified as intersex/

indeterminate). This distribution addressed the imbalance reported in previous studies.

4. Data analysis

In our analysis we investigate three aspects of smartphone usage and dependence. Firstly, we systematically look at the relationship between each demographic variable (age, gender, parental status, and occupational status) and smartphone dependence. Secondly, we look at the relationship between reported smartphone usage (as perceived compared to their peers) and dependence, irrespective of the demographic group. We would expect that participants reporting high smartphone dependence would also report perceived high usage (compared to their peers). Finally, we examine which activities on the smartphone are associated with lower usage and dependence and which are associated with higher usage and dependency level.

For the first aspect, we need to perform association analysis between each demographic variable and self-reported smartphone dependence. For each pair of categorical variables (i.e. each demographic attribute vs. dependency) we applied a commonly used data analysis approach – Pearson Chi-square test of independence. This statistical technique is appropriate for parts of our data that meet the following criteria of the Chi-square test (McHugh, 2013):

- the sampling method was simple random sampling;
- all responses come from the same sample;
- the expected frequency count for all category variables was 5 or higher;
- all studied variables are categorical; and
- the categories are mutually exclusive.

The data for this analysis was prepared in cross-tabular format and classified into sets according to two categorical variables (one of which one was always dependence). In tables where an expected count was below 5 the Fisher-Freeman-Halton Exact Test was used for analysis, and this test was applicable since all our tables > 2x2 (Freeman & Halton, 1951).

The Chi-Square Test allows determining the difference between our data (observed count) and the expected value. In this study, statistical significance was defined as $p < 0.05$ which is an accepted convention in academic publications (Dahiru, 2008). In cases where we identify a significant association, we assess the strength of the association using Cramer's V test.

In the first dependency evaluation we test the null hypothesis H1-0 and the alternative hypothesis H1-1 on the association between gender and self-reported mobile phone dependency:

Null Hypothesis (H1-0): There is no significant association between the two categorical variables – gender and mobile phone dependence.

Alternate Hypothesis (H1-1): There is a significant association between the two categorical variables – gender and mobile phone dependence.

Table 1 summarises data on gender versus self-reported phone dependency levels. When comparing gender vs dependency variables, 50% of expected count produced values below 5, therefore the Chi-square test was not applicable, and the Fisher-Freeman-Halton Exact Test was computed instead. The test produced the p-value of 0.605, i.e. $p > 0.05$. Therefore, we conclude that there is no significant association between gender and smartphone dependency, i.e. the null hypothesis is supported.

The next pair of hypotheses considered the parental status:

Null Hypothesis (H2-0): There is no significant association between the two categorical variables – parental status and smartphone dependency.

Alternate Hypothesis (H2-1): There is a significant association between the two categorical variables – parental status and smartphone dependency.

Table 1
Participants' self-reported smartphone dependency based on gender.

			Which of the following best describes how dependent you are on your phone				Total
			Not dependent	Slightly Dependent	Moderately dependent	Heavily dependent	
What is your gender?	Male	Count	15	51	85	99	250
		Expected Count	15.7	56.1	87.1	91.0	250.0
		% within What is your gender?	6.0%	20.4%	34.0%	39.6%	100.0%
		% of Total	3.0%	10.0%	16.7%	19.5%	49.2%
		Count	17	62	90	85	254
	Female	Expected Count	16.0	57.0	88.5	92.5	254.0
		% within What is your gender?	6.7%	24.4%	35.4%	33.5%	100.0%
		% of Total	3.3%	12.2%	17.7%	16.7%	50.0%
		Count	0	0	0	1	1
		Expected Count	.1	.2	.3	.4	1.0
	Intersex/Indeterminate/Unspecified	% within What is your gender?	0.0%	0.0%	0.0%	100.0%	100.0%
		% of Total	0.0%	0.0%	0.0%	0.2%	0.2%
		Count	0	1	2	0	3
		Expected Count	.2	.7	1.0	1.1	3.0
		% within What is your gender?	0.0%	33.3%	66.7%	0.0%	100.0%
Prefer not to say	% of Total	0.0%	0.2%	0.4%	0.0%	0.6%	
	Count	32	114	177	185	508	
	Expected Count	32.0	114.0	177.0	185.0	508.0	
	% within What is your gender?	6.3%	22.4%	34.8%	36.4%	100.0%	
	% of Total	6.3%	22.4%	34.8%	36.4%	100.0%	
Total	Count	32	114	177	185	508	
	Expected Count	32.0	114.0	177.0	185.0	508.0	
	% within What is your gender?	6.3%	22.4%	34.8%	36.4%	100.0%	
		% of Total	6.3%	22.4%	34.8%	36.4%	100.0%

For Table 2 which presents cross-tabulated data detailing self-reported dependency levels by parental status, the chi-square statistic value is 1.840 and the p-value is 0.055, which is statistically insignificant as p is greater than 0.05. Therefore, the collected data shows no significant association between parental status and smartphone dependence.

Next, we examine the association between age groups and self-reported smartphone dependency.

Null Hypothesis (H3-0): There is no significant association between the two categorical variables – age group and smartphone dependency.

Alternate Hypothesis (H3-1): There is a significant association between the two categorical variables – age group and smartphone dependency.

Table 3 depicts cross-tabulated data on self-reported smartphone dependency grouped by age. The Chi-square statistic value is 24.185. The p-value is 0.019 which is less than the significance level of 0.05. Our data supports the alternate hypothesis that there is significant association between the age group and smartphone dependency levels. To determine the strength of this association we computed the Cramer's V value. The value is 0.125, i.e. closer to 0, therefore the association is deemed relatively weak.

To find additional insights into statistical significance between age groups and smartphone dependency, we conducted one more test - a

Comparison of Column Proportions Test with Bonferroni correction. The results show that there are no discernible differences in the proportions of age groups within 18–50 age range. It is 51+ group that makes the age vs dependency association significant. There are significant proportional differences between individuals in the 51+ group who 1) reported slight dependency and heavy dependency; 2) reported as not dependent and heavy dependency; and 3) reported slight dependency and moderate dependency.

The final test examines occupational status and smartphone dependency. Since the question on occupational status allowed multiple responses, Chi-square tests are not suitable, and a Comparison of Column Proportions Test with Bonferroni correction was computed instead. The results of the test are presented in Table 4.

The following conclusions can be drawn from the results. The retired group drives the association. The proportion of participants identifying as retired and self-reported as not dependent on their phone is greater than the proportion of retired participants who self-reported that they are moderately dependent on their phone ($p < 0.001$) or are heavily dependent on their phone ($p < 0.001$). The proportion of participants identifying as retired and self-reported as slightly dependent on their phone is greater than the proportion of retired participants which self-

Table 2
Participants self-reported smartphone dependency based on parental status.

			Which of the following best describes how dependent you are on your smartphone:				Total
			Not dependent	Slightly Dependent	Moderately dependent	Heavily dependent	
Are you a parent?	Yes	Count	11	49	50	56	166
		Expected Count	10.3	37.2	57.8	60.7	166.0
		% within Are you a parent?	6.6%	29.5%	30.1%	33.7%	100.0%
		% of Total	2.1%	9.5%	9.7%	10.8%	32.1%
		Count	21	67	130	133	351
	No	Expected Count	21.7	78.8	122.2	128.3	351.0
		% within Are you a parent?	6.0%	19.1%	37.0%	37.9%	100.0%
		% of Total	4.1%	13.0%	25.1%	25.7%	67.9%
		Count	32	116	180	189	517
		Expected Count	32.0	116.0	180.0	189.0	517.0
Total	% within Are you a parent?	6.2%	22.4%	34.8%	36.6%	100.0%	
	% of Total	6.2%	22.4%	34.8%	36.6%	100.0%	

Table 3
Participants' self-reported smartphone dependency based on age.

			Which of the following best describes how dependent you are on your smartphone:				Total
			Not dependent	Slightly Dependent	Moderately dependent	Heavily dependent	
What is your age group?	18–25	Count	11 _a	37 _a	75 _a	82 _a	205
		Expected Count	12.7	46.0	71.4	74.9	205.0
		% within What is your age group?	5.4%	18.0%	36.6%	40.0%	100.0%
		% of Total	2.1%	7.2%	14.5%	15.9%	39.7%
	26–32	Count	5 _a	26 _a	35 _a	41 _a	107
		Expected Count	6.6	24.0	37.3	39.1	107.0
		% within What is your age group?	4.7%	24.3%	32.7%	38.3%	100.0%
		% of Total	1.0%	5.0%	6.8%	7.9%	20.7%
	33–40	Count	4 _a	14 _a	29 _a	34 _a	81
		Expected Count	5.0	18.2	28.2	29.6	81.0
		% within What is your age group?	4.9%	17.3%	35.8%	42.0%	100.0%
		% of Total	0.8%	2.7%	5.6%	6.6%	15.7%
	41–50	Count	3 _a	6 _a	15 _a	13 _a	37
		Expected Count	2.3	8.3	12.9	13.5	37.0
		% within What is your age group?	8.1%	16.2%	40.5%	35.1%	100.0%
		% of Total	0.6%	1.2%	2.9%	2.5%	7.2%
	51+	Count	9 _{a, b}	33 _b	26 _{a, c}	19 _c	87
		Expected Count	5.4	19.5	30.3	31.8	87.0
		% within What is your age group?	10.3%	37.9%	29.9%	21.8%	100.0%
		% of Total	1.7%	6.4%	5.0%	3.7%	16.8%
Total	Count	32	116	180	189	517	
	Expected Count	32.0	116.0	180.0	189.0	517.0	
	% within What is your age group?	6.2%	22.4%	34.8%	36.6%	100.0%	
	% of Total	6.2%	22.4%	34.8%	36.6%	100.0%	

Table 4
Participants self-reported smartphone dependency based on occupational status.

		Which of the following best describes how dependent you are on your smartphone:			
		Not dependent	Slightly Dependent	Moderately dependent	Heavily dependent
		(A)	(B)	(C)	(D)
Occupation	Student				
	Employed				
	Unemployed				
	Self-Employed				
	Retired	C (.000)	D (.005)		
	Other	D (.000)			

reported that they are heavily dependent on their phone ($p = 0.005$). Significant differences in smartphone dependency in other than retired occupations were not determined.

Next, we investigated the association between self-reported usage compared to peers and smartphone dependency. Again, a Comparison of Column Proportions Test with Bonferroni correction was used to determine whether there were any significant differences between usage levels and self-reported mobile phone dependency. As depicted in Table 5, higher users are significantly different in their dependency levels, i.e. between heavily dependent, moderately dependent and slightly dependent groups. The same can be observed for users assessing themselves as lower than peers users – there are significant differences between heavily dependent, moderately dependent and slightly dependent groups and no significant differences between not dependent and slightly dependent groups. However, participants who assessed their usage as the same as their peers did not show any significant difference in dependency levels.

While analysing participants preferred activities on a smartphone, we investigated the association between such groups of activities and levels of self-reported usage as compared to peers and smartphone dependence by running the Column Proportions Test with Bonferroni correction (see Table 6 and Table 7). The greater proportion of participants who use their mobile mainly for phone calls reported lower usage than their peers and also assessed themselves as non-dependent on their mobile phone. The proportion of text messaging users who identified themselves as slightly

dependent on their phone is greater than the proportion of those who identified themselves as heavily dependent. These proportions are statistically significant at the 0.05 significance level.

High smartphone usage and stronger dependency was associated with social media use. The higher proportion of participants who assessed their smartphone usage at the same level or higher than their peers reported spending most of their time on social media apps. The larger proportion of such individuals also identified themselves as heavily dependent on their smartphones (as compared to non-dependent and slightly dependent groups). The proportions are statistically significant with $p = 0.006$ and $p = 0.007$ respectively (i.e. below 0.05).

5. Discussion

The purpose of this study was to investigate the relationship between smartphone usage and dependency based on demographics and explore categories of activities contributing to smartphone usage and dependency. As there is no uniform definition of the term dependency and previous studies typically do not make a distinction between effectual and ineffectual use, so caution should be applied when comparing results from various studies. Considering this, our study asked participants to self-report their smartphone dependency based on their preference to keep their smartphone handy and usage patterns as compared to their peers. To avoid ambiguity in dependency interpretation, we identified different levels of dependency as:

Table 5
Self-reported levels of mobile phone usage compared to peers versus phone dependency.

			Which of the following best describes how dependent you are on your smartphone:				Total
			Not dependent	Slightly Dependent	Moderately dependent	Heavily dependent	
Compared to your friends and family, do you feel that your phone usage is:	Higher	Count	7 _{a, b, c}	14 _c	51 _b	86 _a	158
		Expected Count	9.8	35.5	54.8	57.9	158.0
		% within Compared to your friends and family, do you feel that your phone usage is:	4.4%	8.9%	32.3%	54.4%	100.0%
		% of Total	1.4%	2.7%	9.9%	16.7%	30.6%
	About the same	Count	6 _a	59 _b	89 _b	95 _b	249
		Expected Count	15.4	56.0	86.4	91.2	249.0
		% within Compared to your friends and family, do you feel that your phone usage is:	2.4%	23.7%	35.7%	38.2%	100.0%
		% of Total	1.2%	11.4%	17.2%	18.4%	48.3%
	Lower	Count	19 _a	43 _a	39 _b	8 _c	109
		Expected Count	6.8	24.5	37.8	39.9	109.0
		% within Compared to your friends and family, do you feel that your phone usage is:	17.4%	39.4%	35.8%	7.3%	100.0%
		% of Total	3.7%	8.3%	7.6%	1.6%	21.1%
Total	Count	32	116	179	189	516	
	Expected Count	32.0	116.0	179.0	189.0	516.0	
	% within Compared to your friends and family, do you feel that your phone usage is:	6.2%	22.5%	34.7%	36.6%	100.0%	
	% of Total	6.2%	22.5%	34.7%	36.6%	100.0%	

Table 6
Activities on smartphones vs self-reported usage levels compared to peers.

		Compared to your friends and family, do you feel that your smartphone usage is:		
		Higher	About the same	Lower
		(A)	(B)	(C)
Activities From the list below select the two smart phone activities you spend most of your time on:	Phone Calls			B (.001)
	Text Messaging (e.g. WhatsApp, Messenger, WeChat, Vibre)			
	Social Media (e.g. Twitter, Instagram, Facebook)	C (.000)	C (.000)	
	Video Games			
	Audio/Video and Podcasts (e.g. YouTube, listening to music, watching movies)			

- Not dependent (i.e. you could leave it at home and not miss it)
- Slightly dependent (i.e. you may not use it but like to have it with you)
- Moderately dependent (i.e. you use it occasionally and like to have it with you)
- Heavily dependent (i.e. you use it often, and would feel very uncomfortable without it)

Where previous studies investigating similar parameters existed, this study compared results with their findings (see Table 8). Since previous studies did not examine association between parental status and smartphone dependency, nor did they examine occupational status association with smartphone dependency, these parameters are not summarised in the table.

5.1. Smartphone usage and dependency based on demographics differences

The demographic attributes of participants have been used as the directing factors for this study in order to identify an association between each attribute and smartphone dependency (Maqableh et al., 2015). In addition to investigating age and gender association with dependency (as done by many previous research studies in other countries and continents) we also examined how parental status and occupational status affect smartphone dependency. Our data analysis suggests that there is no significant association between each of the two demographic parameters – gender and parental status, and smartphone dependency.

5.1.1. Gender and smartphone dependency

Previous studies showed some contradictory results. Several studies conducted in India regarding usage (Choudhury et al., 2019), and dependency (George et al., 2017; Myakal & Vedpathak, 2019; Nayak, 2018), found the male population to be more dependent on their smartphones compared to females. On the contrary, studies into smartphone dependency in Taiwan (Lee et al., 2014), and in China (Mei et al., 2018) found that females are more dependent on their smartphones as compared to males. However, the sample population in our study did not demonstrate any significant association between gender and smartphone dependency. This might be explained by a more balanced distribution of respondents between male and female genders than in previously reported studies. Another possibility is that the dissimilarity is due to cultural differences. A further possible explanation is that due to technology becoming more powerful and more affordable, the context of previous studies (especially the ones that are 5 or more years old) is significantly different from the modern-day context. With every passing year our dependence on technology is accepted as natural component of our lives adding quality to the lifestyle. As a result, individuals of all genders may be equally reliant on smartphones.

5.1.2. Age and smartphone dependency

Our data analysis of the demographic parameters of age versus smartphone dependency found a significant association between these two categorical variables. We also examined groups within categorical variables to determine which of them are driving the association. We

Table 7
Activities on smartphones vs self-reported smartphone dependency levels.

		Which of the following best describes how dependent are you on your smartphone?			
		Not dependent	Slightly Dependent	Moderately dependent	Heavily dependent
		(A)	(B)	(C)	(D)
Activities From the list below select the two smart phone activities you spend most of your time on:	Phone Calls	D (.010)			
	Text Messaging (e.g. WhatsApp, Messenger, WeChat, Vibre)	D (.015)			
	Social Media (e.g. Twitter, Instagram, Facebook)			A (.006) B (.007)	
	Video Games				
	Audio/Video and Podcasts (e.g. YouTube, listening to music, watching movies)		B (.014)		

identified that participants in the 51+ age range showed major proportional differences within the groups of dependency levels. Our study is different from the previous studies because the majority either focused their research on a narrow age group such as adolescents (Chóliz, 2012; Lee & Lee, 2017; Randler et al., 2016), secondary school students (Warzecha & Pawlak, 2017) or young adults (Hoffner & Lee, 2015; Munderia & Singh, 2018) or referred to the participants as adults without insights into the actual age range (Lee et al., 2014).

5.1.3. Occupational status and smartphone dependency

The previous studies cited did not examine occupational status versus smartphone dependency, however, multiple previous studies focused on smartphone usage by one occupational group – students, e.g. in China (Zhang, Yang, Tu, Ding, & Lau, 2019); in South Korea (Han & Yi, 2019); in India (Choudhury et al., 2019; Myakal & Vedpathak, 2019) and in Morocco (Mliless & Larouz, 2018). Our data analysis showed a significant association between occupational status and smartphone dependency. To understand which occupational group is driving the association, we examined it further. Interestingly the only occupational status groups that showed a significant association with dependency levels is the Retired group (which is consistent with the 51+ age group, the age group most likely to have people in the Retired occupational status). So, this study addressed the gap of investigating the association between occupational status (student, employed, unemployed or retired) and mobile phone dependency with the Retired group driving the association.

5.2. Association between smartphone usage and dependency

Previous studies conducted in different countries (for example, Munderia & Singh, 2018 in India; Hoffner & Lee, 2015 in Georgia; Mei et al., 2018 in China; Smetaniuk, 2014 in USA) found that higher utilisation of smartphones was positively connected to smartphone dependency. Our study findings are similar to that. In addition, participants who reported higher than peers’ smartphone usage are significantly different in their dependency levels. However, no significant differences in smartphone dependency levels were determined for participants who assessed their usage as the same as their peers.

5.3. User-preferred activities on smartphones

Finally, we examined activities on smartphones to identify the ones that could be associated with higher than peers usage and stronger dependency and the ones that could be associated with lower than peers usage levels and lower or no smartphone dependency. It was observed that nearly 73% of the participants specified social media (e.g. Twitter, Instagram, Facebook) as their preferred activity on the smartphone. This result is similar to the findings of the study conducted in Switzerland, where 67% of participants admitted to spending most of their smartphone time engaging in social networking (Haug et al., 2015). Both this study and the study conducted in the USA claim that respondents

spending more time on social media apps also exhibited heavier smartphone usage and dependency (Salehan & Negahban, 2013). So, our findings that social media appeared to have a significant association with higher smartphone dependency, are similar to previous research claims.

On the opposite end, phone calls have a significant association with lower usage and no-dependency on smartphones. Also, there is a significant association between text messaging activities and low usage of smartphones as compared to peers. However, the previous studies cited do not discuss which activities may be associated with the low usage and low or no smartphone dependency.

6. Conclusion

Researchers all over the world have investigated various characteristics of smartphone usage in an attempt to identify at what stage high usage becomes problematic. The research studies recognise that high phone use may be stemming from purely practical reasons such as work commitments. Still, it could be coming from some strongly exhibited psychological and behavioural problems. Previous research discovered a significant association between high smartphone use and adverse dependency, determining that with usage increase dependency is also likely to increase. This study had similar findings. In addition to commonly studied demographics attributes of age and gender, this research also examined parental status and occupational status as potentially associated with smartphone dependency, however only the second association was determined. Our investigation is among the first ones to study the adult population of Australia without age limitations and with a balanced representation of genders, studying self-reported usage as compared to peers and smartphone dependency levels.

Since we identified some inconsistencies among findings of previous studies as well as inconsistencies between previous findings and the findings of this study, we recommend further investigation into cultural differences of the studied population and their impact on smartphones usage patterns and usage context. The majority of studies are limited to a specific country, which leads us to suggest that cultural differences could explain some differences in behaviour related to smartphone use. Also comparing findings between studies could be difficult due to some studies having a rather narrow focus on a specific age group or only on students (whether secondary school, or college, or university). As recommended by Nyamadi et al. (2020), future research needs to target a wider population with diverse demographics.

Given the fact that the main instrument of data collection was a self-reported survey, it is possible some participants overestimated or underestimated their mobile phone usage as compared to their peers (Boase & Ling, 2013; Hawi & Samaha, 2017). To address this limitation, future research should collect more objective data by utilising applications which monitor the overall time spent on the smartphones as well as on individual apps. Apps collecting such objective data (e.g. Screen Time and Digital Wellbeing) need additional functionality that would allow distinguishing between effectual use and compulsive unnecessary use

Table 8

Comparison of this study findings with previous research.

Findings identified in this study	Previous studies that produced similar results	Previous studies which contradict the results
There is no significant association between gender and smartphone dependency.	Mitchell and Hussain (2018), the adult population in the UK Basu, Garg, Singh, and Kohli (2018), medical students in India Naser Abed, Kamel Abd, Dawood Salim, and Razzaq Jamal (2017), college students in Iraq Gurbuz and Ozkan (2020), young people in Turkey Hawi and Samaha (2016), university students in Lebanon Kwon, Kim, Cho, and Yang (2013), the adult population in South Korea	These studies found that males exhibited heavier dependence on their smartphones compared to females. Nayak (2018), university students in India Ayar et al. (2017), college students in Turkey Myakal and Vedpathak (2019), medical college students in India Mazaheri and Najarkolaei (2014), students in Isfahan University of Medical Sciences in Iran These studies found that females exhibited heavier dependence on their smartphones compared to males. Lee, Chang, Lin, and Cheng (2014), the adult population in Taiwan Mei et al. (2018), university students in China None identified.
Age groups are significantly associated with smartphone dependency.	These studies partially support our findings on the significant association between age and smartphone dependency. However, some of these studies focused on the limited age range Oviedo-Trespalacios et al. (2019), a study in Australia particularly young people while driving De-Sola, Talledo, Rodríguez de Fonseca, and Rubio (2017), the adult population in Spain Mazaheri and Najarkolaei (2014), students in Isfahan University of Medical Sciences in Iran Lopez-Fernandez, Honrubia-Serrano, Freixa-Blanxart, and Gibson (2014), secondary school students in the UK	None identified.
Higher mobile phone usage is significantly associated with mobile phone dependency.	These studies partially support our findings; they found that higher smartphone usage is significantly associated with smartphone dependency. Munderia and Singh (2018), young adults in India Hoffner and Lee (2015), young adults in Georgia Mei et al. (2018), university students in China Smetaniuk (2014), university students in the USA	None identified.

(ineffectual use). Previous research also recommended studying what we have termed effectual versus ineffectual smartphone use to understand characteristics of smartphone dependency (Merlo, Stone, & Bibbey, 2013).

For people who reported heavy dependency on their phone, it would be beneficial to investigate the reasons behind this dependency as this understanding could help in finding ways to overcome the dependency. Studying which lifestyle activities help people to put their smartphone away could help medical professionals and educators to guide dependent individuals in their struggles with smartphone dependency. This study emphasises the need for a multidisciplinary approach to tackle this issue involving professionals from a wide variety of disciplines, including researchers, medical professionals, and educators.

Declaration of competing interest

The authors declare that they have no conflict of interest associated with this paper. We affirm that this manuscript is not under review anywhere else, involves data that were collected ethically and involves no prior or duplicate publication.

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