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**Articles**

# Mobile Phone Addiction and Mobile Phone Use in Dangerous Circumstances: Prevalence and Correlates in a Sample of Italian University Students

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## Abstract

*Background:* Beyond unambiguous advantages of mobile phones (MP), growing evidences document its problematic use and association with mental health issues. Unintentional injuries, such as road traffic or pedestrian accidents, result from dangerous use of the MP (DUMP).

The aim of our study was to estimate the prevalence of DUMP and the addiction to MP in young while driving, cycling or walking (defined as DUMP) relating to some demographic and psychological factors.

*Methods:* A cross-sectional prevalence study was carried out on a sample of 1130 Italian university students. The use and addiction to MP were studied with Italian version of the Mobile Phone Use Questionnaire (MPUQ) and Dependence test of MP (DTMP). The Cognitive Behavioral Assessment 2.0 (CBA 2.0) was used to investigate anxiety and obsessive-compulsive disorder.

*Results:* Result statistics showed a continuous use of MP. One third of subjects showed MP addiction, associated to female and younger students. Two thirds showed risk of DUMP, associated to male and older. The obsessive-compulsive disorder was estimated only in a small fraction and significantly correlated with DTMP.

*Conclusions:* Our study points out the importance that information and prevention campaigns targeting specific demographic subpopulations should be sought to raise young awareness for a safe use of MP.

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## 1. Introduction

Modern technologies generate in the same measure comfort and disaster and cause psychological ambivalence. Mobile phone (MP) has become an essential part of daily life and many researches has shown its problematic use like internet use, video games and online

gambling and role-playing games (Bianchini et al., 2017; Griffiths, 1995; Joël Billieux et al., 2015; Mariano Chóliz, 2010; Panova & Carbonell, 2018). Despite its unambiguous advantages, MP use has been associated with harmful or disturbing behaviors. Internet and social networking sites are even thought to psychologically bind users with big interest for businesses to market their products (Can & Caia, 2016). Moreover, MP and internet technology blew up the number of gambling platforms escaping law regulations, with potential organized crime involvement in internet gambling as an urgent matter, one that the research community should target soon (Ferentzy & Turner, 2009). Problematic MP use shares a lot of characteristics with behavioral addictions like internet addiction and compulsive gambling, for instance problem gambling grows in periods of stress and isolation similarly to mobile phone use, with personality and sociodemographic characteristics as predictors (Frisone et al., 2020a). Specifically, impulsivity in adolescents is the neurodevelopmental correlate of pathological gambling with circuitry modifications in brain regions associated with motivation and impulsive behavior (Chambers & Potenza, 2003; Frisone et al., 2020b). As internet on MP is staple of everyday life being constantly available and within reach of every user in the world, the potential for overuse is introduced, which may lead to addiction (Ng & Wiemer-Hastings, 2005), sharing some of the negative aspects of substance addiction (Shaw & Black, 2008; Vitaro et al., 1998), and lead to consequences such as failing school, family, and relationship problems, beyond the continuous exposure to the risk of accidents and public health risks. This is on the same line of studies showing how technological devices induce addiction and problematic use especially among the youngest on one side, or a rejection especially in the elderly on the other (De-Sola Gutiérrez et al., 2016; Di Giacomo et al., 2020; Osiceanu, 2015).

Joel Billieux has revised negative consequences associated with problematic use of MP, defined as "an inability to regulate one's use of the MP, which eventually involves negative consequences in daily life"(Joel Billieux, 2012). A solid body of literature reporting the association between problematic MP use and various mental health issues such as anxiety, depression, post-traumatic stress disorder (PTSD), attention deficit hyperactivity disorder (ADHD), as well as problems with self-esteem, interpersonal sensitivity, and impulsivity (Grant et al., 2019; Kim et al., 2015; Kuss et al., 2018; Pundir et al., 2016; Rosen et al., 2014; Toda et al., 2015; Zhang et al., 2014). The negative consequences of this problem include the possible increase of behavioral addiction and/or the "paradox" of a lack of communication, despite being more connected, especially among young people and adolescents (Parisi & Cantelmi, 2009). The risk of distraction from MPs has grown dramatically over recent years, and this distraction connected to unintentional injuries, such as involvement in road traffic accidents or pedestrian injuries (Huemer et al., 2018; Lamberg & Muratori, 2012; Olsson et al., 2020; Simmons et al., 2020; Stavrinos et al., 2011; Tao et al., 2016). Indeed, driving behaviour is a complex activity that involves several mental

cognitive processes requiring the coordination of different abilities (i.e., visuo-spatial attention and auditory skills: Graydon et al., 2004). It requires reallocation of attention, that can be affected by different sources of distraction. A secondary task, as MP use may represent, produces that the neural system involved during driving redirects attention resources away from visual processing, increasing the possibility of incorrect, dangerous or risky behavioral responses (Palmiero et al., 2019).

MP driving or MP walking, or MP cycling are risk factors of unintentional injuries, representing an emerging problem for public health and researchers are investigating about the relation between problematic use of MP and accidents. Recent literature showed that rates of unintentional injuries were significantly higher for young and students with Problematic MP use (Cazzulino et al., 2014; Klauer et al., 2015; Li et al., 2018; Quon et al., 2019; Tao et al., 2016). MP addiction is an emerging social issue particularly among young and students (Choi et al., 2015; Haug et al., 2015; Liu et al., 2016). Compared with adults, adolescents were reported to be at greater risks of dangerous consequences because they are yet to develop self-control in MP use (Choi et al., 2015; Guo et al., 2016). MP addicted university students were more likely to have experienced accidents and unintentional injuries are becoming a public health challenge in many countries (Crowley et al., 2019; Fernández et al., 2020; Kim et al., 2017; Souza Silva et al., 2019; Truong et al., 2019).

In Italy, National Institution of Statistics reported that during 2017, 174933 road accidents occurred due to excess speed, failures to use safety devices and the use of MPs while driving, but according to our knowledge, there are no studies on the prevalence of mobile use in driving or other dangerous situations (ISTAT, 2018; Valent et al., 2020).

### 1.1 Study aims

The aim of the present study was to examine the prevalence of the problematic use of mobile phone (MP) and its use in dangerous situations, while driving, cycling, or walking, investigating their association with high risk demographics and psychological factors. We hypothesized that problematic MP use could be related to addiction behaviors and specific psychological discomforts associated to young, and predicted by demographic and psychosocial factors as observed for internet addiction and gambling. Since problematic MP use is a risk factor for unintentional road accidents and a public health challenge, we wanted to investigate specific problematic MP use and psychopathological predictors in students.

## 2. Methods

The present study was a cross-sectional prevalence study on the use of MP among students from University of L'Aquila, Italy. The study was carried out on March 2016, study participation

was voluntary, and subjects were enrolled after a complete presentation of the research and providing informed verbal consent. Signature of an informed consent to the research materials and methods was collected from each subject at the time of enrolment. Inclusion criteria were: having a mobile-phone and having provided informed consent. The project was carried out in compliance with the Helsinki Declaration. The privacy rights of human subjects were always observed. The exclusion criteria were: psychotherapeutic treatment at the time of interview and inadequate knowledge of the Italian language.

**2.1 Instruments**

A questionnaire test battery was self-administered by the students after giving them instructions. Test battery was composed by the following.

- *Mobile Phone Use Questionnaire (MPUQ):* one step beyond general evaluation of internet behaviors as in the literature (Ranaiey et al., 2016; Sicari et al., 2021), we used the Italian version of Mobile Phone Use Questionnaire (MPUQ; Pastore & Chóliz, 2011), which is a questionnaire for the assessment of MP use or abuse in young. The questionnaire consists in the following sections: Social and demographic characteristics; Basic MP usage parameters; Scale on cell phone functions; Attitudes towards the MP.

- *Mobile Phone Dependence Test (DTMP):* this test consists in 17 items based on a 5-point Likert scale scoring from 0 to 4 (M. Chóliz, 2012). The use of MP in dangerous situations was investigated with the dichotomous variable (yes/no) on dangerous use of MP (DUMP), that was the item "Do you use MP in dangerous situations (e.g., driving, cycling, walking)?" from DTMP.

- *Cognitive Behavioral Assessment (CBA) 2.0*: in the Italian version, this battery test includes a series of questionnaires that investigate broad issues of potential clinical interest and identify areas of current dysfunction (Bertolotti et al., 1997). For this study, we specifically used the following scales of the battery: State-Trait Anxiety Inventory scale (2 STAI X-1) to investigate status anxiety and Maudsley Obsessional-Compulsive Questionnaire (MOCQ/R) for assessing the obsessive and compulsive symptoms in psychiatric patients as used as a screening tool in nonclinical population. The Italian version, which includes 21 dichotomous items, provides an overall score, for the subjective evaluation of obsessive-compulsive symptoms. The MOCQ-R consists of 3 indices that study thought patterns and compulsive behaviors: the MOCQ-R1 (Checking Subscale), the MOCQ-R2 (Cleaning Subscale) and the MOCQ-R3 (Doubting-Ruminating Subscale). Scales scores at or above the 95th percentile is in the severe problem range (Sanavio et al., 1998).

### 2.2 Statistical Analysis

Raosoft® software was used to assess 582 as minimum recommended size of our survey, based on: 5% margin of error, 95% confidence level, 50% response distribution and population of 19470 students.

For all variables, descriptive statistics (proportions, means and standard deviations) were elaborated. Categorical data were compared using Chi square test or Fisher exact test, continuous variables were compared with one-way ANOVA test. Spearman coefficient (r) was used to analyze correlation. Confidence Interval at 95% (95% CI) was computed for prevalence data and a logistic regression model was used to estimate the odds ratio (OR) with 95% CI. The prevalence of addiction to MP (DTMP) was investigated as dichotomous variable (yes/no), setting the cut off point for DTMP scores at 75th percentile. The factors associated with DUMP from univariate analysis were used as independent variables of a multivariate regression model to calculate adjusted Odds Ratio (ORadj). An alpha level of .05 was used for all statistical tests and STATA MP/14 was used to data analysis.

## 3. Results

The sample consisted of 1130 subjects: 226 men and 904 women, with a mean age of 23±3.2 years, 90% of them reporting they never turned off their MP during the night, and other characteristics are reported in table 1.

**Table 1.** Participants' characteristics and MP use (*n=1130*)

| Variables | n (%) or mean ± sd |
|---|---|
| Sex | |
| F | 904 (80%) |
| M | 226 (20%) |
| Age (years) | 23±3.2. |
| How long have you had a cell phone? (years) | 10±2.6 |
| How many cell phones have you had in the past? | 5±2.3 |
| How much money do you spend per month on your MP? (EUR) | 13±8.2 |
| During the week: how many calls do you make per day from your MP? | 5±8.4 |
| During the weekends: how many calls do you make per day from your MP? | 5±6.7 |
| During the week: how many text messages do you send per day from your MP? | 77±188.7 |
| During the weekends: how many text messages do you send per day from your MP? | 73±189.4 |
| During the week: how many missed or ringing calls do you make per day from your MP? | 4±23.5 |
| On weekends: how many missed or ringing calls do you make per day from your MP? | 2.8±5.2 |
| During the week: how much time do you spend on calls and text messages per day? (Minutes) | 170±221.9 |
| During the weekends: how much time do you spend on calls and text messages per day? (Minutes) | 157±190.7 |

The addiction to MP was reported by one out of three students (31%), while the prevalence of the MP use in dangerous situations (DUMP) was 62% (95%CI: 59%-65%).

The prevalence of anxious students was 11% and 3% of them had obsessive/compulsive behavior (table 2)

**Table 2.** Prevalence of addiction of MP, DUMP and psychological distress (*n=1130*)

| Variables | Prevalence | 95%CI |
|---|---|---|
| Dependence of MP (DTMP) | 31% | 28%-34% |
| Dangerous use of MP (DUMP) | 62% | 59%-65% |
| Anxiety (trait) | 11% | 9%-13% |
| Obsessive/compulsive behaviour | 3% | 2%-4% |
| Cecking Subscale | 6% | 5%-8% |
| Cleaning Subscale | 4% | 3%-5% |
| Doubting-Ruminating Subscale | 7% | 6%-9% |

The mean score of DTMP was 26±10, and the auto-perceived addiction of MP mean score was 60±22. The DTMP score was highly correlated with the auto-perceived addiction of MP (r=0.48; p<0.001).

The analysis of DTMP showed that it was more prevalent among females and younger students. Students classified with Obsessive/compulsive and Doubting-Ruminating disorders were at risk for DTMP as reported in Table 3.

**Table 3.** Univariate analysis of DTMP by demographics and psychological factors

| | | *DTMP (n=1130)** | | | | | |
|---|---|---|---|---|---|---|---|
| Sex | | No | Yes | Test ** | p | OR | 95%CI |
| | Female | 629 (73%) | 237 (27%) | **6.12** | **0.013** | **1** | |
| | Male | 170 (81%) | 40 (19%) | | | **0.62** | **0.4-0.9** |
| Age | 18-21 | 337 (69%) | 154 (31%) | 15.6 | **<0.00** | **1** | |
| | 22-25 | 308 (78%) | 87 (22%) | | | **0.62** | **0.4-0.8** |
| | ≥26 | 154 (81%) | 36 (19%) | | | **0.51** | **0.4-0.5** |
| Anxiety | no | 708 (74%) | 249 (26%) | 0.34 | 0.56 | 1 | |
| | yes | 9 (77%) | 28 (23%) | | | 0.87 | 0.6-1.4 |
| Obsessive/compulsive disorder | No | 782 (75%) | 264 (25%) | **4.99** | **0.03** | **1** | |
| | yes | 17 (57%) | 13 (43%) | | | **2.65** | **1.1-4.7** |
| Checking Subscale | no | 750 (75%) | 256 (25%) | 0.71 | 0.40 | 1 | |
| | yes | 49 (70%) | 21 (30%) | | | 1.26 | 0.7-2.1 |
| Cleaning Subscale | no | 772 (75%) | 261 (25%) | 3.08 | 0.08 | 1 | |
| | yes | 27 (63%) | 16 (37%) | | | 1.75 | 0.9-3.3 |
| Doubting-Ruminating Subscale | No | 750 (75%) | 250 (25%) | **4.09** | **0.04** | **1** | |
| | yes | 49 (65%) | 27 (35%) | | | **1.6** | **0.3-0.4** |

*total could be not 1130 because of missing data; **Chi-square test.

The multivariate logistic model confirmed that gender, age and MP addiction were factor risk for DUMP. The presence of checking disorder seemed to protect subjects to use MP in the investigated risky situations (table 5).

**Table 5.** Multivariate logistic model of DUMP

| Factors | | OR | p | 95%CI |
|---|---|---|---|---|
| Sex | Female | 1 | | |
| | Male | 1.8 | **<0.001** | **1.3-2.6** |
| Age | 18-21 | 1 | | |
| | 22-25 | 1.2 | 0.196 | 0.9-1.6 |
| | ≥26 | 1.8 | **<0.001** | **1.3-2.7** |
| Anxiety | no | 1 | 0.620 | |
| | yes | 1.16 | | 0.7-1.7 |
| Obsessive/compulsive behaviour | No | 1 | 0.467 | |
| | yes | 1.4 | | 0.6-3.6 |
| Checking Subscale | no | 1 | **0.016** | 0.3-0.9 |
| | yes | 0.5 | | |
| Cleaning Subscale | no | 1 | 0.135 | |
| | yes | 0.6 | | 0.3-1.2 |
| Dependence of MP (DMP) | no | 1 | **<0.001** | |
| | yes | 1.9 | | 1.4-2.6 |

## 4. Discussion

The primary objective of the present study was to investigate the prevalence of MP use in dangerous situations (DUMP) and the associated risk factors in Italian university students (Tao et al., 2016). Evidence has accumulated showing that technology and virtual navigation devices can be both beneficial or harmful on social, mental health, cognitive and academic performance, and we previously found that their use is decisive when these devices are used for teaching or to simulate specific work tasks (Bianchi et al., 2020; Harris et al., 2020; Joel Billieux, 2012). In this study we focused on problematic attachment to technology such as smartphone devices and dangerous use of mobile phone (DUMP) associated to psychological parameters. Literature reported that the more prevalent dangerous behavior is the MP use while driving, and prevalence among young and students has been reported (Cazzulino et al., 2014; Klauer et al., 2015; Li et al., 2018; Quon et al., 2019). Among these, one study indicated 66% prevalence of college students using MP while driving (Al-Jasser et al., 2018). MP use has high prevalence also while cycling and walking (Chen & Pai, 2018; Crowley et al., 2019; Quon et al., 2019; Simmons et al., 2020; Souza Silva et al., 2019; Truong et al., 2019). We then considered either driving or

cycling or walking as risky circumstances, and we showed that 62% of university students use the MP during these behaviors. This result is similar or even higher than reported from other studies (Joël Billieux et al., 2015; Sohn et al., 2019). Interestingly, we found that 1 out of 3 students present addiction to MP (31%; 95%CI: 28%-34%).

Even though the disorder is not recognized in psychiatry manuals, screening studies estimate that MP addiction ranges from anywhere between just above 0% and 38% (Carbonell et al., 2012; Pedrero Pérez et al., 2012), with a study reporting that 48% of undergraduate university students were addicted to MP (Aljomaa et al., 2016).

We also showed that MP addiction is associated with DUMP: among 307 students who reported DUMP, 216 used MP in unhealthy situation (71%). Several studies have showed evidence that psychological factors such as anxiety could be associated with problematic MP use, especially in populations of adolescents and young adults (De-Sola et al., 2017; Elhai et al., 2016; Matar Boumosleh & Jaalouk, 2017).

Studies on MP use have shown that the touch of the phone screen could occur over 100 times a day, often not to answer a call or reply a message but simply to check (Lepp et al., 2015). In this perspective, obsessive-compulsive disorders or anxiety attitudes find a perfect link in the functioning of the man/machine relationship. The anxiety linked to the communications passing through the cell phone can be transferred to the object itself, transforming it into an object/fetish whose absence raises real crises (Mariano Chóliz, 2010; Pastore & Chóliz, 2011).

Meta-analyses of risk and protective factors for mental disorders with onset in adolescence found that no risk factor is supported by convincing evidence nor by highly suggestive evidence, and no protective factor has been identified, neither convincing biomarkers with diagnostic specificity (Fullana et al., 2020; Solmi et al., 2020). In our study, 11% of the students (95%CI: 9%-13%) reported symptoms of anxiety lower than reported in other studies (Elhai et al., 2016). The anxiety, the Obsessive/compulsive behavior, the Cleaning Subscale and the Doubting-Ruminating Subscale investigated were not associated with DUMP. Therefore, we assume that other factors of mental health and personality which could be considered as predictors of risk in DUMP might be involved and need for further investigation. Recent studies revealed for specific patterns of behaviors in the domains of communication and social behavior, music consumption, smartphone and app usage, mobility and day-/night-time activity as distinctively predictive of personality traits (Stachl et al., 2020).

According to our study, the multivariate model confirmed that age, gender and MP addiction were risk factors for DUMP: males are exposed to a higher risk for a dangerous use of MP than female students. Previous studies reported that women tend to be more prone to problematic

MP use than men (Van Deursen et al., 2015); however, we showed that the MP use in dangerous situations is more frequent in male students, as even reported in other studies (Vollrath et al., 2016), suggesting that age and gender distribution can be specifically studied in subpopulations such as in our, and more accurate studies need to be performed. In fact even if addiction to MP seems to be higher in females compared to males (Beranuy et al., 2009; Kim et al., 2019), this seems to be related to the more relationship-oriented nature of females and higher social interaction through instant messaging and calls is taken from females by using MP. Despite of women spending more time using social networks and resulting in a more frequent use of MP, men could primarily use the MP for work-related purposes and internet navigation beyond entertainment, thus during work and study-related activities (Bianchi & Phillips, 2005). A further explanation of gender differences in risky behaviors as assessed in this work comes from our previous experience in studies on gender differences in risk perception. An international comparative study was carried out in collaboration with our university department (Cordellieri et al., 2016), which results indicated that the level of risk perception during driving is the same for males and females, but significant sex differences were represented in the level of concern about this risk. Particularly, males being less concerned about the risk of a road accident. This study yielded proof for the development of gender-based prevention programs. Sex difference in the level of concern about the consequences of MP dangerous use while driving could affect also the evaluation of DUMP as assessed in this research, considering the relative vulnerability of females to MP addiction, further investigation into patterns of MP use and related risk factors among sex, age and occupation beyond psychological diseases is suggested.

The contribution of present study should be considered with these limitations but shed new light on demographic and psychosocial predictors of accidents caused by MP use. The analysis depends on reported data on MP use during different risky circumstances. The cut off for MP addiction was set without a specific method, but an interesting result was that problematic MP use tested and auto-perceived MP addiction were highly correlated ($r=0.61$; $p<0.001$) as reported in other studies (Lopez-Fernandez et al., 2017).

The dependence test used does not indicate cut-offs for diagnosis, on the other hand there is vagueness of the concept of addiction to MP without unambiguous criteria (Panova & Carbonell, 2018; Pedrero Pérez et al., 2012).

One of the essential features of a behavioral addiction should be the functional impairment in clinical settings. If the harm is not significantly severe, the disorder would be better classified as problematic or maladaptive use or else considered as a side effect/manifestation of another primary disorder (Kardefelt-Winther et al., 2017). Our results can be considered as between

starting points for further development of diagnostic criteria for defining the problematic use of MP and MP addiction, as well as for prevention campaigns and tentative treatment protocols.

## 5. Conclusion

The present study unravels the high prevalence of Italian students' mobile phone (MP) use while driving, walking or cycling, and dangerous use of MP (DUMP) is an increasing public health problem related to unintentional accidents, injuries and death. We found that DUMP is correlated to demographic and psychosocial factors such as male gender, age and presence of problematic MP use. The psychological diseases investigated were not factors associated with DUMP except for the MP checking as obsessive-compulsive disorder behavior, which was a protective factor. DUMP is regardless of psychological disorders since affects healthy behavior of wide population. Educative and preventive campaigns and protocols are needed such as accurate diagnostic criteria for DUMP and defining MP addiction. In this perspective, our findings contribute to understanding of these phenomena; further studies are needed in order to define the impact of DUMP on people's health and safety.

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## Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

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