

## Association between Problematic Cellular Phone Use and Suicide: The Moderating Effect of Family Function and Depression

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### Abstract

**Background:** Suicidal ideation and attempt among adolescents are risk factors for eventual completed suicide. Cellular phone use (CPU) has markedly changed the everyday lives of adolescents. Issues about how cellular phone use relates to adolescent mental health, such as suicidal ideation and attempts, are important because of the high rate of cellular phone usage among children in that age group. This study explored the association between problematic CPU and suicidal ideation and attempts among adolescents and investigated how family function and depression influence the association between problematic CPU and suicidal ideation and attempts.

**Methods:** A total of 5051 (2872 girls and 2179 boys) adolescents who owned at least one cellular phone completed the research questionnaires. We collected data on participants' CPU and suicidal behavior (ideation and attempts) during the past month as well as information on family function and history of depression.

**Results:** Five hundred thirty-two adolescents (10.54%) had problematic CPU. The rates of suicidal ideation were 23.50% and 11.76% in adolescents with problematic CPU and without problematic CPU, respectively. The rates of suicidal attempts in both groups were 13.70% and 5.45%, respectively. Family function, but not depression, had a moderating effect on the association between problematic CPU and suicidal ideation and attempt.

**Conclusion:** This study highlights the association between problematic CPU and suicidal ideation as well as attempts and indicates that good family function may have a more significant role on reducing the risks of suicidal ideation and attempts in adolescents with problematic CPU than in those without problematic CPU.

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### 1. Introduction

Suicide is the second leading cause of adolescent death worldwide [1,2]. Suicidal ideation and attempt are often repetitive behaviors, and previous studies have shown that those behaviors among children are risk factors for eventual completed suicides in the adolescent age group [3]. By identifying adolescents who are most at risk of suicide,

mental healthcare professionals can focus their efforts on prevention and intervention.

Substance abuse is associated with an increased frequency of suicide attempts, medically lethal attempts, and severe suicidal ideation [4]. In addition, active substance use has been shown to be a significant risk factor for suicidal ideation and attempts [5]. Cellular phone use is very common now but the study showed that higher frequency of cellular phone use (CPU) may predict mental disorders [6]. Furthermore, problematic CPU may associate with depression which is a risk factor of suicidal behavior [7]. Based on the above-mentioned findings, problematic CPU may play a role in adolescent suicidal ideation and attempts.

The number of cellular phone users has increased dramatically since the late 1990s [8]. In Germany, for

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example, the rate of CPU among adolescents increased from 16% in 1998 to 91% in 2002 [9]. A similar trend was also observed in Japan [10]. Issues about how CPU relates to adolescent mental health are important because of the high rate of CPU in that age group. Previous studies have shown that problematic CPU is prevalent among adolescents [9,11] and that problematic CPU is significantly associated with suicidal tendencies in that age group [12]. However, whether there are factors that moderate the association between problematic CPU and adolescent suicide has not been well examined. Recent studies have found that depression is a major risk factor for adolescent suicide [13] and a factor influencing the association between addictive behaviors and suicidal ideation [14]. Meanwhile, good family function which is defined as having good family adaptation, mutuality and communication, is important in reducing and preventing suicidal behaviors in adolescents [15,16]. Kwok and colleagues have found that family function is a moderator between adolescent suicidal ideation and social problem solving [17]. Whether depression and family function moderate the association between problematic CPU and suicidal ideation and attempts needs further study.

Problematic CPU is defined as an inability to regulate one's use of the mobile phone, which eventually involves negative consequences in daily life [18]. The aims of this study were to explore the association between problematic CPU and adolescent suicidal ideation and attempts and the moderating effects of family function and depression on the association. We hypothesized that: (1) the rates of suicidal ideation and attempts are higher in the adolescents with problematic CPU than in those without problematic CPU before and after controlling for the effects of depression and family function, (2) the association between problematic CPU and suicidal attempt was lower in adolescents who had a higher level of family function than in those who had a lower level of family function, and (3) the association between problematic CPU and suicidal attempt was higher in adolescents who had a higher level of depression than in those who had a lower level of depression.

## 2. Methods

### 2.1. Participants

The current study is a secondary data analysis of the data from the 2004 Project for the Health of Adolescents in Southern Taiwan, which is a research program studying the mental health status of adolescents living in four counties and three metropolitan areas. There were 460,390 adolescent students in these areas. Of them, 257,873 (56%) were enrolled in 209 junior high schools and 202,517 were enrolled in 140 senior high/vocational schools. The schools were stratified into rural and urban districts based on the definitions of rural and urban districts in the Taiwan-Fukien Demographic Fact Book [19]. A stratified random sampling strategy was used with the final goal of ensuring that subjects

from each subgroup are included in the final sample [20,21]. The sample size of each stratum is proportionate to the population size of the strata based on districts, schools and grades. A total of 10 senior high/vocational schools and 11 junior high schools were randomly selected from non-urban areas and 19 senior high/vocational schools and 12 junior high schools were randomly selected from urban areas. Then, 207 classes that contained a total of 12,210 adolescent students were randomly selected based on the ratio of students in each grade. The protocol was approved by the Institutional Review Board of the Kaohsiung Medical University.

### 2.2. Assessment

#### 2.2.1. Problematic Cellular Phone Use Questionnaire (PCPU-Q)

We used the Problematic Cellular Phone Use Questionnaire (PCPU-Q), a self-administered, 12-item measure developed according to the *DSM-IV-TR* taxonomies of substance use/dependence [22], to determine the presence of symptoms of problematic CPU [11]. The first seven questions inquired whether in the preceding year participants had symptoms of problematic CPU. The last five questions ascertained participants' subjective functional impairment in the preceding year caused by CPU, including compromised academic performance, relationships with classmates and friends, relationships with parents and siblings, physical or psychological health, and legal problems. The two-week test-retest reliability ( $\kappa$ ) of the items on the PCPU-Q ranged from 0.410 to 0.778 ( $p < 0.001$ ), and the  $\kappa$  between participants' self-reports and their parents' reports ranged from 0.258 ( $p < 0.05$ ) to 0.441 ( $p < 0.001$ ) [11]. The Cronbach's alpha was 0.852. Participants who had positive responses to four or more of the first seven questions and those who had positive responses to any of the last five questions were classified as having problematic CPU.

#### 2.2.2. Suicidal ideation and attempts

The 5-item questionnaire from the epidemiological version of the Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS-E) [23] was used to assess the occurrence of four forms of suicidal ideation (items 1 to 4) and suicide attempt (item 5) in the preceding month [24]. Each question elicited a "yes" or "no" answer. The Cohen's kappa coefficient of agreement ( $\kappa$ ) between participants' self-reported suicide attempts and their parents' reports was 0.541 ( $p < 0.001$ ) [24]. In this study, those who had a "yes" answer to any of the first four items were classified as having suicidal ideation and those with a "yes" answer to the last item were classified as having attempted suicide.

#### 2.2.3. Family APGAR Index (APGAR)

The Taiwanese version [25] of the Family APGAR Index (APGAR) [26] consists of five parameters of family functioning: Adaptability, Partnership, Growth, Affection, and Resolve. The 4-point response scales reflect frequency,

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