Social media (Facebook) improper use and the influence of sleeping quality in Taiwan’s university students

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Abstract
This study examines the relationship between Facebook (FB) usage and addiction level, and sleep quality of university students. A Google Forms questionnaire was prepared and disseminated via the authors’ FB profile for university students to fill out. A total of 277, including two studying overseas, took part in this research. Among the survey respondents, over 60% (n = 144) were medical students (p = 0.000); over 30% (n = 84) were always logged into FB; the average and daily usage time of most was 5 to 60 min at a time (p = 0.009), and 3 to 5 h a day (p = 0.040), respectively. The respondents’ average sleep time was 7.11 h, but over 61% categorized their sleep quality as poor. It was also found that students from financial and management school were 4.23 times more at risk of FB addiction than the medical counterparts and were likely to be already addicted to FB as well as have a sleep disorder. Based on these results, it is suggested that university students, who fall in the high-risk category, be screened early to prevent them from developing social media addiction and sleep disorders. For improving youths’ health and sleep quality, future research should attach the importance to early screening for sleep disturbances caused by the internet and social media addiction.

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Keywords
Social media, Facebook (FB), university students, addiction, sleep quality

Introduction
Modern technology has changed the way we live. Statistics released in 2020 reveal there are 5.2 billion mobile phone users, 4.66 billion internet users, and 4.14 billion social media users worldwide.\(^1\) While there are many social media platforms (e.g. Facebook (FB), WhatsApp, Instagram, and Twitter), FB is the largest globally\(^2\) with 1.82 billion daily active users as of the third quarter of 2020.\(^3\) The global FB demographic data of 2020 shows that young adults aged 18–34 account for 55% of the total users, of which 43.5% are female.\(^4\) Taiwan has over 20 million internet users, 93% of whom access it on smartphones; FB is the most popular social media platform with over 19 million users, 98.5% of whom access it on their phones.\(^5\) However, FB appears to be more popular among Taiwan’s female users of all ages—they make up 51% of the total users.\(^6\) Furthermore, studies have investigated gender differences in smartphone use habits that may lead to FB addiction.\(^7\)

FB’s fast communication and instant reply function are important to its users, and have impacted university students’ daily life. For youths, using or browsing FB is an important social communication behavior. This has had a profound effect on their social skills, thanks to rapid information delivery, opinion exchange, and sharing of research results. In other words, the inclusion of social activity, discussion on course content, multifunctionality, high usage rate, and convenience of mobility make FB popular among university students\(^8,9\); it plays a vital role in their daily life, to the extent of causing dependence or addiction.\(^10,11\) Due to the smartphone’s popularity and features, FB’s mobile app has become handier, with users spending over 15 h monthly on it. Studies show that excessive internet usage or virtual reality addiction worsens sleep quality and causes physical and mental health problems.\(^12,13\) Research also points to health issues arising from frequent FB usage, which may lead to FB addiction among university students, or negatively impact their daily life, health, and sleep quality.\(^11,14\)

In Taiwan, the average daily sleep duration of university students was 6.66 h\(^15\) lower than the recommended hours.\(^16\) Surprisingly, 86.2% of them were awake until midnight, of which 33.2% went to bed after 2:00 AM.\(^17\) This indicates that most university students have poor sleep habits, which may lead to future health issues and social problems. Students with heavy internet usage have poor sleep habits as they spend a lot of time chatting or playing games online, with an average 4 to 5 h and 5 to 10 h on weekdays and weekends respectively. In a study conducted among Taiwan’s university students, 12% of the participants said they go online no matter where they are, be it the laboratory or dormitory, mentioning being more tired the next day after browsing until late the previous night.\(^18\) University students also reported feeling angry, confused, depressed, fatigued, or nervous more easily and becoming more susceptible to get cold due to poor sleep quality; 33% admitted
to taking sleeping pills to fall asleep, as well as exhibiting a higher tendency to con-
sume alcohol.\textsuperscript{19,20}

The literature considers internet addiction (IA) as a major factor affecting uni-
versity students’ sleep quality,\textsuperscript{21} but the correlation with FB usage and addiction
level among them remains unclear. It is thus necessary to clarify the relationship
between FB addiction and sleep quality. This study investigated university stu-
dents’ FB usage and addiction level, and how FB influences their daily life and
sleep quality.

\textbf{Material and methods}

\textit{Method}

To understand the relationship between FB usage and addiction level and sleep
quality of university students, a questionnaire was distributed through an invitation
letter and a Google webpage link between June 25, 2015 and October 19, 2015. The
Google Forms questionnaire, which was open for public, was sent via FB, inviting
users to take the survey and share it with their friends who were college/university
students and still active in school settings. Hence, there was no locality limitation
in the participation criteria. Only those aged under 19 and those who rejected the
survey were excluded.

\textit{The participants}

For the effect survey values have on the accuracy of its results, the calculation tool
was applied to estimate the sample size of 267 in this study. It was based on the
population size of university students are 2 million who were active in using FB,
the limited margin of error on 6\%, and 95\% confidence level for sampling range.\textsuperscript{22}
In a total of 288 university students received the invitation letter during the survey
period, and 11 were excluded as the exclusion criteria mentioned above. The over-
all recruitment response rate was 96.2\%.

\textit{Instruments}

The self-report questionnaire included demographics, FB usage, FB addiction level,
and sleep quality. The Pittsburgh Sleeping Quality Index (PSQI)\textsuperscript{23} was used to
measure respondents’ sleep quality. It has seven components: subjective sleep qual-
ity, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use
of sleeping medication, and daytime dysfunction; the sum of the individual scores
of the seven components measures a particular aspect of sleep quality—the higher
the score, the worse the sleep quality.\textsuperscript{23,24} According to a previous meta-analysis,
PSQI provides a better understanding of sleep quality,\textsuperscript{25} has been validated in sev-
eral studies,\textsuperscript{19,26,27} and has a Chinese version with good reliability (Cronbach’s
$\alpha = 0.87$).\textsuperscript{25} The FB addiction scale was adapted from the Internet Addiction Test
(IAT) by Young and De Abreu.\textsuperscript{24} The scale has a Chinese version since 2000. It
has been adopted for university students in Taiwan with good reliability. A total of 23 questions were asked to determine the addiction level, with responses plotted on a 5-point Likert-type scale (1 = not at all, 2 = occasionally, 3 = frequently, 4 = often, and 5 = always); the total score ranged between 23 and 115. Previous research involving IAT respondents classified those scoring ≤39 as average internet users, between 40 and 69 as problematic internet users, and ≥70 as addictive internet users. Recent research, however, has pointed out that a cut-off score of 40 is too low to screen problematic internet users, considering the current popularity of the internet; accordingly, 50 has been proposed as a more appropriate cut-off score for current university students. Therefore, the present study defines respondents having a total score below 49 as not addicted to FB, while those scoring 50 and above as addicts. The test reliability was checked, and Cronbach’s α was 0.89.

**Statistical analysis**

After data collection from Google Forms, Microsoft Excel 2010 was used for the data entry process; the data was then transferred to SAS 9.3 (Copyright © SAS Institute Inc.) for analysis. Description analysis was carried out to compare the means and standard deviation for demographics, with sleep quality as the primary outcome. Linear and logistic regression model analyzed FB usage and the PSQI questionnaires to determine the relationship between usage frequency and sleep quality. The statistically significant level was set at 5%.

**Ethical considerations**

This study was reviewed and approved by the Ethics Committee and the Institutional Review Board of the university hospital (IRB number: 104-2248B and 104-3392C). An electronic consent form was used to explain the purpose of the study, and the option “I refuse to fill in this survey” was provided to close the survey form for those who did not wish to answer. Anonymous data collection was undertaken to guarantee respondents’ confidentiality.

**Results**

**Facebook usage**

From the 277 respondents, over 60% were female. The respondents were in the 18–35 age group, and the mean age was 20.81 ± 1.49. The mean age differed based on gender male respondents (21.16 ± 1.93) and female respondents (20.57 ± 1.05) (p = 0.004) here was gender difference between male (21.16 ± 1.93) and female (20.57 ± 1.05) of the mean age (p = 0.004). Most of the respondents were studying in Northern Taiwan (64.6%), followed by Southern Taiwan (20.9%), Central Taiwan (12.2%), Eastern Taiwan (0.1%), and overseas (0.1%). Over 96% of the respondents were undergraduates and only 3.97% (n = 11) were graduates. The distribution of the respondents with respect to school type was as follows: medicine
(51.9%), humanities and social sciences (12.9%), finance and management (15.5%), and technology (19.4%), with statistical significance \((p = 0.000)\) (Table 1).

With respect to FB usage frequency, over a third of the respondents \((n = 84)\) said they are always logged in, 24.1% \((n = 67)\) said they check their notifications and keep tabs on friends’ status every 1 to 3 h, and 17.3% \((n = 48)\) said they check their homepage hourly; the number of those checking their FB feedback every half hour and more than 3 h was the same percentage \((14\%, n = 39)\). The usage frequencies were similar for both genders. On average usage time, almost half \((48.7\%, n = 135)\) of the respondents said they spend up to an hour at a time after logging in, 29.2% \((n = 81)\) said they browse their FB briefly for up to 5 min, 12.6% \((n = 35)\) said they spend 1 to 3 h, and 9.4% \((n = 26)\) said they spend over 3 h, particularly the female respondents; these results showed statistical significance \((p = 0.009)\).

With respect to total time spent daily, most of the respondents \((36.1\%, n = 100)\) said they spend 3 to 5 h, 34.6% \((n = 96)\) said they spend 1 to 2 h, 11.5% \((n = 32)\) said they spend 6 to 9 h, and 6.5% \((n = 18)\) said they spend more than 9 h. It was also found that the female respondents spent more time browsing on FB than their male counterparts did \((p = 0.040)\).

The purpose of using FB was categorized based on preferences thus: the most common being for social connection (chatting, sending emotional stickers, checking-in, and following friends), followed by sharing updates (updating status, checking friends’ updates, tagging friends, validation, and seeking sympathy), seeking information (searching for resources, questioning and answering, and news or information), connection and discussion for academic purposes, and others (watching videos, and playing webpage games). The female respondents were observed to be much more interested in social connection and sharing updates, while their male counterparts focused on seeking information and connection for academic purposes.

Furthermore, over 90% of the respondents reported that they are not addicted to FB, but over half of them reported poor sleep quality.

**Facebook addiction**

Regarding FB addiction level, only a poor PQSI score was noted for both genders \((p = 0.030)\), as shown in Table 2; purpose of FB use, school location, school type, and daily login frequency were not statistically significant. Furthermore, the addictive tendency was consistent with daily usage time and addiction score—24 respondents were categorized as FB addicts based on their score \((p = 0.030)\), 62.5% of these were female, and only two of them (one male and one female) were always logged in. With respect to the average usage time, 36% of the respondents were found to use FB for up to an hour at a time \((p = 0.030)\), with significant differences observed in this variable between the male \((p = 0.019)\) and female addicts. Regarding daily usage time, the addicts reported longer average browsing time, especially over 3 h \((p = 0.009)\), with the male respondents showing a higher
| Variables                        | Total       | Male N (%) (N = 110) | Female N (%) (N = 167) | \( t/\chi^2 \) | \( p \) |
|----------------------------------|-------------|----------------------|------------------------|-----------------|--------|
| Age (mean ± SD)                  | 277         | 21.16 ± 1.93         | 20.57 ± 1.05           | -2.93           | 0.004  |
| PSQI (mean ± SD)                 | 277         | 5.43 ± 2.41          | 5.32 ± 2.50            | 0.842           | 0.732  |
| Addictive score (mean ± SD)      | 277         | 35.07 ± 9.47         | 36.07 ± 10.77          | 0.792           | 0.429  |
| Addictive status                 |             |                      |                        | 0.054           | 0.817  |
| No                               | 253         | 101 (39.9)           | 152 (60.1)             |                 |        |
| Yes                              | 24          | 9 (37.5)             | 15 (62.5)              |                 |        |
| Sleep quality status             |             |                      |                        | 0.958           | 0.328  |
| Good                             | 108         | 39 (36.1)            | 69 (63.9)              |                 |        |
| Poor                             | 169         | 71 (42.0)            | 98 (58.0)              |                 |        |
| Purpose for use Facebook         |             |                      |                        | 6.488           | 0.166  |
| Social connection                | 108         | 52 (48.1)            | 56 (51.9)              |                 |        |
| Share identification             | 53          | 17 (32.1)            | 36 (67.9)              |                 |        |
| Information seeking              | 41          | 17 (41.5)            | 24 (58.5)              |                 |        |
| Academic purpose                 | 42          | 14 (33.3)            | 28 (66.7)              |                 |        |
| Others                           | 33          | 10 (30.3)            | 23 (69.7)              |                 |        |
| School location                  |             |                      |                        | 0.465           | 0.977  |
| Northern                         | 179         | 73 (66.4)            | 106 (63.5)             |                 |        |
| Central                          | 34          | 12 (10.9)            | 22 (13.2)              |                 |        |
| Southern                         | 58          | 23 (20.9)            | 35 (20.9)              |                 |        |
| Eastern                          | 3           | 1 (0.9)              | 2 (1.2)                |                 |        |
| Overseas                         | 3           | 1 (0.9)              | 2 (1.2)                |                 |        |
| School type                      |             |                      |                        | 46.864          | 0.000  |
| Medicine                         | 144         | 43 (39.1)            | 101 (60.5)             |                 |        |
| Technology                       | 54          | 42 (38.2)            | 12 (7.2)               |                 |        |
| Finance and management           | 43          | 19 (47.3)            | 24 (14.4)              |                 |        |
| Humanities and social sciences   |             |                      |                        |                 |        |
| Day using frequency/once         |             |                      |                        | 2.708           | 0.608  |
| Always online                    | 84          | 37 (33.6)            | 47 (28.1)              |                 |        |
| Every 30 min                     | 39          | 12 (10.9)            | 27 (16.2)              |                 |        |
| Every hour                       | 48          | 20 (18.2)            | 28 (16.8)              |                 |        |
| Every 1–3 h                      | 67          | 24 (21.8)            | 43 (25.7)              |                 |        |
| Every 3 h                        | 39          | 17 (15.5)            | 22 (13.2)              |                 |        |
| Average using time/time          |             |                      |                        | 11.695          | 0.009  |
| < 5 min                          | 81          | 42 (38.2)            | 39 (23.3)              |                 |        |
| 5–60 min                         | 135         | 40 (36.4)            | 95 (56.9)              |                 |        |
| 1–3 h                            | 35          | 16 (45.4)            | 19 (55.9)              |                 |        |
| > 3 h                            | 26          | 12 (10.9)            | 14 (8.4)               |                 |        |
| Total using time/day             |             |                      |                        | 9.996           | 0.040  |
| ≤ 60 min                         | 31          | 18 (16.4)            | 13 (7.8)               |                 |        |
| 1–2 h                            | 96          | 44 (40.0)            | 52 (31.1)              |                 |        |
| 3–5 h                            | 100         | 31 (28.2)            | 69 (41.3)              |                 |        |
| 6–9 h                            | 32          | 10 (31.2)            | 22 (69.2)              |                 |        |
| > 9 h                            | 18          | 7 (6.3)              | 11 (6.6)               |                 |
Table 2. Analysis of Facebook addictive status.

| Variables                          | Total       | Male         | Female        |
|-----------------------------------|-------------|--------------|---------------|
|                                   | No N (%)    | Yes N (%)    | t/χ²          | p          | No N (%)    | Yes N (%)    | t/χ²          | p          |
|                                   | 253 (91.3)  | 24 (8.7)     | 253 (91.3)    | 24 (8.7)   | 101 (91.8)  | 9 (8.1)      | 0.202         | 0.840      |
|                                   | 20.81 ± 1.54| 20.75 ± 0.74 | 2.021         | 0.138      | 21.18 ± 2.01| 21.00 ± 0.50| 0.265         | 0.792      |
| Age (mean ± SD)                   | 5.27 ± 2.47 | 6.33 ± 2.14  | -2.287        | 0.030      | 5.33 ± 2.41| 6.56 ± 2.24 | -1.471        | 0.144      |
|                                   | 3.641       | 0.056        |               |            | 0.750       | 0.318        |               |            |
| Sleep quality status              | 103 (40.7)  | 150 (59.3)   | 3.149         | 0.076      | 37 (36.6)   | 64 (63.4)    | 0.446         | 0.979      |
| Good                              | 5 (20.8)    | 19 (79.2)    | 3.149         | 0.076      | 2 (22.2)    | 7 (77.8)     |               |            |
| Poor                              | 99 (91.7)   | 9 (8.3)      | 47 (90.8)     | 5 (9.2)    | 52 (92.9)   | 4 (7.1)      |               |            |
| Social connection                 | 48 (90.6)   | 5 (9.4)      | 16 (94.1)     | 1 (5.9)    | 32 (88.9)   | 4 (11.1)     |               |            |
| Share identification              | 38 (92.7)   | 3 (7.3)      | 16 (94.1)     | 1 (5.9)    | 22 (91.7)   | 2 (8.3)      |               |            |
| Information seeking               | 36 (85.6)   | 6 (14.3)     | 13 (92.9)     | 1 (7.1)    | 23 (82.1)   | 5 (17.9)     |               |            |
| Purpose for using FB              | 32 (97.0)   | 1 (3.0)      | 9 (90.0)      | 1 (10.0)   | 23 (100.0)  | 0            |               |            |
| School location                   |             |              |              |            |             |              | 2.298         | 0.681      |
| Northern                          | 165 (92.2)  | 14 (7.8)     | 69 (94.5)     | 4 (5.5)    | 96 (90.6)   | 11 (9.4)     |               |            |
| Central                           | 29 (85.3)   | 5 (14.7)     | 10 (83.3)     | 2 (16.7)   | 19 (86.4)   | 3 (13.6)     |               |            |
| Southern                          | 53 (91.4)   | 5 (8.6)      | 20 (87.0)     | 3 (13.0)   | 33 (94.3)   | 2 (5.7)      |               |            |
| Eastern                           | 3 (100.0)   | 0            | 1 (100.0)     | 0          | 2 (100.0)   | 0            |               |            |
| Overseas                          | 3 (100.0)   | 0            | 1 (100.0)     | 0          | 2 (100.0)   | 0            |               |            |
| School type                       |             |              |              |            |             |              | 1.290         | 0.731      |
| Medicine                          | 130 (90.3)  | 14 (11.1)    | 38 (88.4)     | 5 (11.6)   | 92 (91.1)   | 9 (8.9)      | 3.008         | 0.390      |
| Technology                        | 51 (94.4)   | 3 (5.6)      | 39 (92.9)     | 3 (7.1)    | 12 (100.0)  | 0            |               |            |
| F & M                             | 40 (93.0)   | 3 (7.0)      | 19 (100.0)    | 0          | 21 (87.5)   | 3 (12.5)     |               |            |
| HSS                               | 32 (88.9)   | 4 (11.1)     | 5 (83.3)      | 1 (16.7)   | 27 (90.0)   | 3 (10.0)     |               |            |
| Login frequency/day               |             |              |              |            |             |              | 2.477         | 0.649      |
| Always online                     | 37 (94.9)   | 2 (5.1)      | 11 (91.7)     | 1 (8.3)    | 26 (96.3)   | 1 (3.7)      | 2.858         | 0.582      |
| Every 30 min                      | 63 (94.0)   | 4 (6.0)      | 24 (100.0)    | 0          | 39 (90.7)   | 4 (9.3)      |               |            |
| Every hour                        | 44 (91.7)   | 4 (8.3)      | 18 (90.0)     | 2 (10.0)   | 26 (92.9)   | 2 (7.1)      |               |            |
| Every 1–3 h                       | 35 (89.7)   | 4 (10.3)     | 15 (88.2)     | 2 (11.8)   | 20 (90.9)   | 3 (9.1)      |               |            |
| Every 3 h                         | 74 (88.1)   | 10 (11.9)    | 33 (89.2)     | 4 (10.8)   | 41 (87.2)   | 6 (12.8)     |               |            |
| Average using time/once           |             |              |              |            |             |              | 8.949         | 0.030      |

(continued)
Table 2. Continued

| Variables                  | Total                | Male                   | Female                  |
|----------------------------|----------------------|------------------------|-------------------------|
|                            | No N (%)  | Yes N (%) | $t/\chi^2$ | $p$ | No N (%)  | Yes N (%) | $t/\chi^2$ | $p$ |
| <5 min                     | 77 (95.1) | 4 (4.9)   |              |     | 42 (100.0)| 0          |              |     |
| 5–60 min                   | 126 (93.3)| 9 (6.7)   | 4           | 0.009| 36 (90.0)| 4 (10.0)  |              |     |
| 1–3 h                      | 29 (82.9) | 6 (17.1)  |              |     | 12 (75.0)| 4 (25.0)  |              |     |
| >3 h                       | 21 (80.8) | 5 (19.2)  | 11          | 0.173| 11 (91.7)| 1 (8.3)   |              |     |
| Total using time/day       | 13.632    | 0.009     | 15.163      | 0.004| 4.331    | 0.363     |              |     |
| ≤60 min                    | 30 (96.8) | 1 (3.2)   |              |     | 17 (94.4)| 1 (5.6)   |              |     |
| 1–2 h                      | 91 (94.8) | 5 (5.2)   |              |     | 42 (95.5)| 2 (4.5)   |              |     |
| 3–5 h                      | 91 (91.0) | 9 (9.0)   |              |     | 29 (93.5)| 2 (6.5)   |              |     |
| 6–9 h                      | 24 (75.0) | 8 (25.0)  |              |     | 6 (60.0)| 4 (40.0)  |              |     |
| >9 h                       | 17 (94.4) | 1 (5.6)   |              |     | 7 (100.0)| 0          |              |     |

F & M: finance and management; HSS: humanities and social sciences.
No represents the Facebook addiction scoring <49, Yes represents scoring ≥50.
addictive tendency \( (p = 0.004) \). The group of those spending over 6 h on FB daily had the highest proportion of addicts (30.6%).

**Sleep quality**

The respondents’ sleep quality is presented. A positive correlation was found in the relationship between PSQI score and FB addiction score \( (r = .143, p = 0.017) \). In Table 3, the mean PSQI score was 5.43 ± 2.41: 61% of the respondents reported poor sleep quality—over two-thirds (63.6%) of those from Northern Taiwan and nearly 60% of those from Southern Taiwan (Table 3); while among the Northern Taiwan respondents, no significant gender difference (61.6% male and 65.0% female) was found in poor sleep quality, among those from Southern Taiwan, a higher number of male respondents (78.2%) reported poor sleep quality than their female counterparts (45.1%). Under school type, more finance and management respondents (81.4%) reported poor sleep quality than any of the others, with more than half being female (79.2%, \( n = 19 \)); meanwhile, all of the male humanities and social sciences respondents (100%, \( n = 6 \)) reported poor sleep quality. Sleep quality was found to be related to school type, especially in the case of the male respondents \( (p = 0.020) \), and the medicine respondents \( (p = 0.003) \) were found to have the poorest sleep; moreover, the male respondents’ average usage time \( (p = 0.003) \) was observed to impact their sleep quality.

With respect to login frequency, 51 (60.7%) respondents with poor sleep quality reported they are “always online” when awake; this number was followed by those logging in every 1 to 3 h; This was similar in either male or female users with sleep disorder. However, even among those who reported good sleep quality, most were “always online.” Under average usage time, a higher number of those browsing for up to an hour at a time reported poor sleep quality; among these, the number of female respondents was more as they would log in to quickly check a friend’s status and then take some time to respond to it (Table 3).

After adjusting the confounders, as presented in Table 4, the addiction score contribution raised the risk of poor sleep quality by 6% \( (\text{aOR} = 1.06, 95\% \ CI: 1.02–1.09) \) showing statistical significance. With respect to gender, the risk of poor sleep quality was found to be 22% higher for the male respondents \( (\text{aOR} = 1.22, 95\% \ CI: 0.66–2.26) \) than their female counterparts. Age was found to increase the risk of poor sleep quality by 14% \( (\text{aOR} = 1.14, 95\% \ CI: 0.93–1.41) \). Under school type, compared with the medicine respondents, the FB addicts studying finance and management \( (\text{aOR} = 4.23, 95\% \ CI: 1.76–10.18) \), humanities and social sciences \( (\text{aOR} = 2.53, 95\% \ CI: 1.02–6.27) \), and technology \( (\text{aOR} = 1.32, 95\% \ CI: 0.63–2.76) \) had a higher risk of poor sleep quality than whom studying in school of medicine. With respect to login frequency, FB addicts who were “always online” \( (\text{aOR} = 1.83, 95\% \ CI: 0.66–5.09) \) reported the poorest sleep quality. Considering average and daily usage time, more addicts browsing for short durations at a time \( (<5 \text{ min}, \text{aOR} = 1.16, 95\% \ CI: 0.48–2.81) \) and shorter daily duration \( (<2 \text{ h},
Table 3. Sleeping quality analysis by gender.

| Variables                  | Total          | Male           | Female          | Total          | Male           | Female          | Total          | Male           | Female          |
|----------------------------|----------------|----------------|-----------------|----------------|----------------|-----------------|----------------|----------------|-----------------|
|                            | Good N (%)     | Poor N (%)     | t/χ² | p      | Good N (%)     | Poor N (%)     | t/χ² | p      | Good N (%)     | Poor N (%)     | t/χ² | p      |
| Age (Mean ± SD)            | 108 (39.0)     | 169 (61.0)     |      | −1.774| 39 (35.5)      | 71 (64.5)      |      | 2.362| 69 (41.3)      | 98 (58.0)      |      | 0.960 |
| Purpose for use            |                |                |      | 0.077 |                |                |      | 0.020 |                |                |      |      |
| Social connection          | 45 (41.7)      | 63 (58.3)      |      | 0.848 | 20 (38.5)      | 32 (61.5)      |      | 1.250| 25 (44.6)      | 31 (55.4)      |      | 0.980 |
| Share identification       | 21 (39.6)      | 32 (60.4)      |      | 0.932 | 6 (35.3)       | 11 (64.7)      |      | 0.870| 15 (41.7)      | 21 (58.3)      |      | 0.913 |
| Information seeking        | 14 (34.1)      | 27 (65.9)      |      | 1.774| 6 (33.3)       | 16 (66.7)      |      | 2.362| 8 (33.3)       | 16 (66.7)      |      | 0.020 |
| Academic purpose           | 16 (38.1)      | 26 (61.9)      |      | 2.180| 11 (39.3)      | 17 (60.7)      |      | 2.362| 10 (43.5)      | 13 (56.5)      |      | 0.050 |
| Others                     | 12 (36.4)      | 21 (63.6)      |      | 0.960 | 2 (20.0)       | 8 (80.0)       |      |      |                |                |      |      |
| School location            |                |                | 5.294| 0.258 |                |                | 4.731| 0.316 |                |                | 7.283| 0.122 |
| Northern                   | 65 (36.3)      | 114 (63.7)     |      |      | 28 (38.4)      | 45 (61.6)      |      |      | 37 (34.9)      | 69 (65.1)      |      |      |
| Central                    | 17 (50.0)      | 17 (50.0)      |      |      | 5 (41.7)       | 7 (58.3)       |      |      | 12 (54.5)      | 10 (45.5)      |      |      |
| Southern                   | 24 (41.4)      | 34 (58.6)      |      |      | 5 (21.7)       | 18 (78.3)      |      |      | 19 (54.3)      | 16 (45.7)      |      |      |
| Eastern                    | 21 (66.7)      | 1 (33.3)       |      |      | 1 (100.0)      | 0              |      |      | 1 (100.0)      | 0              |      |      |
| Overseas                   | 0              | 3 (100.0)      |      |      | 0              | 1 (100.0)      |      |      | 2 (100.0)      |                |      |      |
| School type                |                |                | 14.239| 0.003 |                |                | 9.873| 0.020 |                |                | 6.920| 0.074 |
| Medicine                   | 69 (47.9)      | 75 (52.1)      |      |      | 21 (48.8)      | 22 (51.2)      |      |      | 48 (47.5)      | 53 (52.5)      |      |      |
| Technology                 | 21 (38.9)      | 33 (61.1)      |      |      | 15 (35.7)      | 27 (64.3)      |      |      | 6 (50.0)       | 6 (50.0)       |      |      |
| F & M                      | 8 (18.6)       | 35 (81.4)      |      |      | 3 (15.8)       | 26 (84.2)      |      |      | 5 (20.8)       | 19 (79.2)      |      |      |
| HSS                        | 10 (27.8)      | 26 (72.2)      |      |      | 0              | 6 (100.0)      |      |      | 10 (33.3)      | 20 (66.7)      |      |      |
| Login frequency/day        |                |                | 0.883 | 0.927 |                |                | 1.360| 0.851 |                |                | 1.490| 0.828 |
| Always online              | 33 (39.3)      | 51 (60.7)      |      |      | 15 (40.5)      | 22 (59.5)      |      |      | 18 (38.3)      | 29 (61.7)      |      |      |
| Every 30 min               | 17 (43.6)      | 22 (56.4)      |      |      | 4 (33.3)       | 8 (66.7)       |      |      | 9 (33.3)       | 18 (66.7)      |      |      |
| Every hour                 | 19 (39.6)      | 29 (60.4)      |      |      | 7 (29.2)       | 17 (70.8)      |      |      | 19 (44.2)      | 24 (55.8)      |      |      |
| Every 1–3 h                | 26 (38.8)      | 41 (61.2)      |      |      | 6 (30.0)       | 14 (70.0)      |      |      | 13 (46.4)      | 15 (53.6)      |      |      |
| Every 3 h                  | 13 (33.3)      | 26 (66.7)      |      |      | 7 (41.2)       | 10 (58.8)      |      |      | 10 (45.5)      | 12 (54.5)      |      |      |
| Average using time/once    |                |                | 4.031| 0.258 |                |                | 13.973| 0.003 |                |                | 2.190| 0.534 |
| <5 min                     | 32 (39.5)      | 49 (60.5)      |      |      | 14 (33.3)      | 28 (66.7)      |      |      | 18 (46.2)      | 21 (53.8)      |      |      |
| 5–60 min                   | 52 (38.5)      | 83 (61.5)      |      |      | 11 (27.5)      | 29 (72.5)      |      |      | 41 (43.2)      | 54 (56.8)      |      |      |
| 1–3 h                      | 10 (28.6)      | 25 (71.4)      |      |      | 4 (25.0)       | 12 (75.0)      |      |      | 6 (31.6)       | 13 (68.4)      |      |      |
| >3 h                       | 14 (53.8)      | 12 (46.2)      |      |      | 10 (83.3)      | 2 (16.7)       |      |      | 4 (28.6)       | 10 (71.4)      |      |      |

(continued)
### Table 3. Continued

| Variables                | Total          | Male            | Female           |
|--------------------------|----------------|-----------------|------------------|
|                          | Good N (%)     | Poor N (%)      | Good N (%)       | Poor N (%)      | t/\chi^2 | p    | Good N (%)     | Poor N (%)      | t/\chi^2 | p    |
|                          | t/\chi^2 | p    | t/\chi^2 | p    | t/\chi^2 | p    |
| Total using time/day     | 0.264 | 0.992 | 4.776 | 0.311 | 1.094 | 0.895 |
| ≤60 min                  | 12 (38.7) | 19 (61.3) | 7 (38.9) | 11 (61.1) | 5 (38.5) | 8 (61.5) | 0.264 | 0.992 |
| 1–2 h                    | 37 (38.5) | 59 (61.5) | 15 (34.1) | 29 (65.9) | 22 (42.3) | 30 (57.7) | 4.776 | 0.311 |
| 3–5 h                    | 39 (39.0) | 61 (61.0) | 9 (29.0) | 22 (71.0) | 30 (43.5) | 39 (56.5) | 1.094 | 0.895 |
| 6–9 h                    | 12 (37.5) | 20 (62.5) | 3 (30.0) | 7 (70.0) | 9 (40.9) | 13 (59.1) | 0.264 | 0.992 |
| >9 h                     | 8 (44.4) | 10 (55.6) | 5 (71.4) | 2 (28.6) | 3 (27.3) | 8 (72.7) | 4.776 | 0.311 |

F & M: finance and management; HSS: humanities and social sciences.

"Good" represents "Good sleeping quality", "Poor" represents "Poor sleeping quality."
aOR = 1.36, 95% CI: 0.54–3.40) reported poor sleep quality than the others, but no significant difference was observed between these two (Table 4).

Discussion

Social media dependence among university students

This study explored the uses and consequences of FB—over 30% of the university students surveyed were identified as high-frequency users displaying addictive tendency. The results indicate that social media dependence can be attributed to the fact that most students stay logged into FB for information exchange or social connection. This finding is similar to that of a study conducted among Turkey’s college students—the variables of weekly time commitment, social motives, severe depression, and anxiety and insomnia were found to be positively predictors of FB addiction among them.29 Taiwan’s university students also use FB for educational communication, sharing and exchanging academic resources on its virtual communities or social groups, besides discussing or sharing personal opinions. Similar findings have been reported from studies conducted in other countries such as the US, Indonesia, and Nepal.9,14,30,31 In the present study, a majority (36.1%) reported that they spend 2 to 6 h on FB daily, followed by the 1 to 2 h group (34.6%), which is much higher than their Indonesia and Nepal counterparts’ FB usage time. Another study has revealed that increase in FB usage time can predict loneliness and explain why youngsters log in frequently for short durations, write a post, and leave a message or comment on a friend’s homepage; it has presented a correlation with the psychological experience of loneliness.32

The present study identifies over a third of university students as heavy FB users who are always online for information exchange or social connection. As Table 2 shows, the students classified as addicts are distributed in Northern, Central, and Southern Taiwan (8%–14%), while there are none in Eastern Taiwan (0%). This reconfirms that those living in rural areas, which have poor to no wi-fi and internet connectivity, use the internet less than their urban counterparts do.33 In contrast with the Turkish study results,28 in this study, a higher number of FB addicts are female. Recruitment of different samples may explain this: in previous study, data was collected from different types of school, while in this study, the sex ratio is closer to that given in the official statistics yearly reports released on February 5, 2018 in Taiwan.34

Gender comparison for FB usage

Although FB is popular among youths overall, this study highlights some gender differences with regard to usage behavior—female students spend more time sharing updates, while their male counterparts focus on seeking information and academic purposes besides social connection. Usage frequency for both genders is similar, but time spent on FB at a time and daily is quite different—male students spend less than 5 min at a time and 1 to 2 h a day, while female students spend 5 to
60 min at a time and 2 to 6 h a day. This is similar to the finding of the study of Turkish university students,\textsuperscript{29} where female finance and management students had a high FB addiction score, up to 86 points; it was found that they stayed logged in all day. The present study found that heavy users among both genders are in the minority; the number of female heavy users (9.5\%) was more than that of their male counterparts. This may be due to gender differences prevalent in friendships—that is, communication is more central to female relationships, and men are less likely to talk about their weaknesses; in other words, women engage in self-disclosure and exchange of emotional support more than men do,\textsuperscript{35–38} as

Table 4. Regression model of Facebook addiction to sleeping quality analysis.

| Variables                  | Good          | Poor          | Univariable OR (95\% CI) | aOR (95\% CI) |
|---------------------------|---------------|---------------|--------------------------|---------------|
| Addiction score (M ± SD)  |               |               |                          |               |
| Addiction score           | 33.02 ± 8.99  | 37.37 ± 10.69 | 1.05 (1.02–1.08)\*       | 1.06 (1.02–1.09)\*       |
| Age                       | 20.61 ± 1.10  | 20.93 ± 1.68  | 1.20 (0.98–1.46)         | 1.14 (0.93–1.41)         |
| Gender                    |               |               |                          |               |
| Female                    | 69 (41.3)     | 98 (58.7)     | 1.28 (0.78–2.11)         | 1.00           |
| Male                      | 39 (35.5)     | 71 (64.6)     |                          | 1.22 (0.66–2.26)         |
| School location           |               |               |                          |               |
| Northern                  | 65 (36.3)     | 114 (63.7)    | 1.65 (0.85–3.23)         | 1.00           |
| Central                   | 17 (50.0)     | 17 (50.0)     | 1.28 (0.49–3.34)         | 1.00           |
| Others                    | 26 (40.6)     | 38 (59.4)     |                          | 1.00           |
| School type               |               |               |                          |               |
| Medicine                  | 69 (47.9)     | 75 (52.1)     | 1.00                      |               |
| Technology                | 21 (38.9)     | 33 (61.1)     | 1.45 (0.76–2.74)         | 1.32 (0.63–2.76)         |
| F & M                     | 8 (18.6)      | 35 (81.4)     | 4.03 (1.75–9.27)\***     | 4.23 (1.76–10.18)\***     |
| HSS                       | 10 (27.8)     | 26 (72.2)     | 2.39 (1.08–5.32)\***     | 2.53 (1.02–6.27)\***     |
| Login frequency/day       |               |               |                          |               |
| Every 30 min              | 17 (43.6)     | 22 (56.4)     | 1.00                      |               |
| Every hour                | 19 (39.6)     | 29 (60.4)     | 1.12 (0.43–2.90)         | 1.07 (0.50–2.31)         |
| Every 1–3 h               | 26 (38.8)     | 41 (61.2)     | 1.30 (0.54–3.14)         | 1.30 (0.55–3.04)         |
| Every 3 h                 | 13 (33.3)     | 26 (66.7)     | 1.30 (0.55–3.04)         | 1.30 (0.55–3.04)         |
| Always online             | 33 (39.3)     | 51 (60.7)     | 1.83 (0.66–5.09)         | 1.00           |
| Average using time/time   |               |               |                          |               |
| <5 min                    | 32 (39.5)     | 49 (60.5)     | 1.16 (0.48–2.81)         | 1.00           |
| 5–60 min                  | 52 (38.5)     | 83 (61.5)     | 1.07 (0.50–2.31)         | 1.00           |
| >=1 h                     | 24 (39.3)     | 37 (60.7)     | 1.00                      |               |
| Total using time/day      |               |               |                          |               |
| <2 h                      | 49 (38.6)     | 78 (61.4)     | 1.36 (0.54–3.40)         | 1.00           |
| 2–6 h                     | 39 (39.0)     | 61 (61.0)     | 1.19 (0.51–2.76)         | 1.00           |
| >6 h                      | 20 (40.0)     | 30 (60.0)     |                          | 1.00           |

F & M: finance and management; HSS: humanities and social sciences.

“Poor” represents “Poor sleeping quality”, “Good” represents “Good sleeping quality.”

Others includes Southern, Eastern Taiwan, and overseas.

\*p < 0.05. \***p < 0.001.
the latter seek practical solutions to their problems and like to meet or interact with new people through the internet. In this study, FB addicts were distributed across all school types, albeit in varying numbers. This may imply that the time spent on and frequency of accessing communication platforms differ among students in different schools as per their educational or social needs. This study also indicates that a general screening of social media addiction in universities may help decreasing on the addicts to facilitate early intervention.

Sleep quality and social media dependence

The average sleep time of university students in this study was 7.11 h—more than that recorded in a previous study in Taiwan and less than the US average (7.44 h),\(^{15}\) but still inadequate considering the recommended hours.\(^{16}\) In this study, up to 61% of the students were identified as having poor sleep quality based on the PSQI score (>5 points), which is similar to the result of a previous study in the US, but 17.7% US students having poorer sleep quality due to higher PSQI score (PSQI > 8 points).\(^{19}\) Furthermore, in this study, over half of the students reported poor sleep quality across school types, especially finance and management (81.4%) and humanities and social sciences (72.2%). Though this result is similar for both genders, all the male humanities and social sciences students were categorized as poor sleepers (100%), while more female finance and management students reported poor sleep quality (79.1%) than their male counterparts. In addition, there was no obvious trend correlation between the FB usage frequency items—average usage at a time and daily usage time.

It should thus be noted that sleep disorders are common among university students in Taiwan and other countries. Therefore, health-related policies and education should help our youths become aware of the situation and, consequently, increase their self-control for better management of health,\(^{39}\) academic performance,\(^{34}\) and psychological problems.\(^{32}\)

This study also found the correlation between addiction score and sleep quality—the risk of poor sleep quality was 6% higher for students with FB addiction than for those without it; this result is similar to that of a study conducted in Peru.\(^{40}\) Male students face a 22% higher risk of poor sleep quality compared with their female counterparts. Moreover, there is a significant difference among students of different disciplines—compared with the medical students, those of finance and management, and humanities and social sciences, respectively, were at higher risk of FB usage-related poor sleep quality. This may be related to the characteristics of different disciplines: medicine students spend more time in classroom, reading their textbooks, and performing their internship,\(^{41-43}\) while the others focus on data collection via different social media, statistical analyses and counting by computers, and interpersonal relationship development via the internet. In addition, this study found some discrepancy in usage between FB addicts and internet addicts. According to a previous study,\(^{44}\) internet addicts spend a significant amount of time daily on computer and the internet, while FB addicts log in for a
short duration multiple times a day. As per the present study, most of the heavy FB users tend to check their homepage on their smartphone, iPad, or computer frequently for short durations; this is probably related to loneliness or social compensatory needs, which lead to FB addiction with most of the time spent waiting for friends’ attention and responses. With students nowadays having their smartphones on them all the time, their need to respond immediately to notifications and messages may lead to dissociation from reality and cause social interaction problems. This is echoed by the study by Demirci et al. Therefore, it is recommended that the department of student counseling and healthcare of schools or the government routinely screen for potential addicts and risky smartphone behavior to create awareness of addiction and consequences of social media platforms like FB and their use.

Nevertheless, this study has some limitations, one being it does not examine moods related to FB addiction. Based on the concept of IA, dependent behavior such as pathological gambling, cybersex, online chatting, and mood disorders should be included in future research. Though PSQI provides substantial evidence of good validity and test-retest reliability, it is limited when it comes to predicting IA behavior and smartphone gaming addiction related sleep disturbances. Recent research also suggests that Application-Based Addiction Scale (SABAS), Bergen Social Media Addiction Scale (BSMAS), and the nine-item Internet Gaming Disorder Scale-Short Form (IGDS-SF9) provide better information to understand university students’ addiction level. Another limitation of this study is that sample bias cannot be ruled out because the invitation was sent to FB users from the school of medicine, and hence, more than half of the respondents (52%) were from that school. The fact that most of the respondents were from Northern Taiwan (65%) may also limit the sample’s universality. The linear and logistic regression model was employed, and the confounders adjusted to correct the bias. For future studies, it is recommended that the questionnaire be distributed via different regional community or student federation to increase the sample’s size and variety. FB, being the most popular social media platform, was chosen, but popularity of different platforms differs by location and age. Therefore, others such as Twitter, Weibo, Instagram, and Line may also be included in future research into addiction etiology.

**Conclusions**

This study demonstrates that improper use of social media platforms like FB increases the risk of addiction and sleep disorders, and that FB addiction is different from IA. It also shows that students from different disciplines have different risk factors according to each discipline’s characteristics and academic operation—that is, financial and management students faced the most risk of FB usage-related poor sleep quality. Based on the results, routine screening of potential internet and social media users is recommended to detect the high-risk population early. In
conclusion, we suggest further research should focus on the social independent behavior or virtual reality problem of youth health issue.

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**Ethics approval**

Ethical approval for this study was obtained from Chang Gung Foundation Institutional Review Board (ID: 201502248B0D001).

**Informed consent**

Written informed consent was obtained from all subjects before the study.

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References

1. Kemp S. Social media users pass the 4 billion mark as global adoption soars, https://wearesocial.com/blog/2020/10/social-media-users-pass-the-4-billion-mark-as-global-adoption-soars/ (2020, accessed 31 December 2020).
2. Oghazi P, Schultheiss R, Chirumalla K, et al. User self-disclosure on social network sites: a cross-cultural study on Facebook’s privacy concepts. J Bus Res 2020; 112: 531–540.
3. Clement J. Facebook: number of daily active users worldwide 2011-2020, https://www.statista.com/statistics/346167/facebook-global-dau/ (2020, accessed 30 December 2020).
4. Clement J. Facebook: distribution of global audiences 2020, by age and gender, https://www.statista.com/statistics/376128/facebook-global-user-age-distribution/ (2020, accessed 30 December 2020).
5. Kemp S. Digital 2020: Taiwan, https://datareportal.com/reports/digital-2020-taiwan/ (2020, accessed 31 December 2020).
6. Social media users in Taiwan, https://napoleoncat.com/stats/?fbclid=IwAR37YUUds_fAGa4oMnteHiSiALB4-hvp1WvCz0xtZIavXQeqwPVeT-gF5rM/ (2020, accessed 30 December 2020).
7. Yang SY, Lin CY, Huang YC, et al. Gender differences in the association of smartphone use with the vitality and mental health of adolescent students. J Am Coll Health 2018; 66: 693–701.
8. Pempek TA, Yermolayeva YA and Calvert SL. College students’ social networking experiences on Facebook. J Appl Dev Psychol 2009; 30: 227–238.
9. Roblyer M, McDaniel M, Webb M, et al. Findings on Facebook in higher education: a comparison of college faculty and student uses and perceptions of social networking sites. Internet High Educ 2010; 3: 134–140.
10. Kuss DJ and Griffiths MD. Online social networking and addiction—a review of the psychological literature. Int J Environ Res Public Health 2011; 8: 3528–3552.
11. Zaremohzzabieh Z, Samah BA, Omar SZ, et al. Addictive Facebook use among university students. Asian Soc Sci 2015; 10: 107–116.
12. Donnelly G. 75 super-useful Facebook statistics for 2018, https://www.wordstream.com/blog/ws/2017/11/07/facebook-statistics/ (2018, accessed 8 August 2018).
13. Facebook, Inc. Facebook stats, https://newsroom.fb.com/company-info/ (2018, accessed 8 August 2018).
14. Hong FY, Hunag DH, Lin HY, et al. Analysis of the psychological traits, Facebook usage, and Facebook addiction model of Taiwanese university students. Telemat Inform 2014; 31: 597–606.
15. Chen MC and Yang CL. Determinants of sleep quality and its correlation with students in a university. Chin J Sch Health 2008; 53: 35–55.
16. Hirshkowitz M, Whiton K, Albert SM, et al. National Sleep Foundation’s updated sleep duration recommendations. Sleep Health 2015; 1: 233–243.
17. Kang JH and Chen SC. Effects of an irregular bedtime schedule on sleep quality, daytime sleepiness, and fatigue among university students in Taiwan. BMC Public Health 2009; 9: 248–253.
18. Chou C. Internet heavy use and addiction among Taiwanese college students: an online interview study. Cyberpsychol Behav 2001; 4: 573–585.
19. Lund HG, Reider BD, Whiting AB, et al. Sleep patterns and predictors of disturbed sleep in a large population of college students. *J Adolesc Health* 2010; 46: 124–132.

20. Yekefallah L, Dehghanlankar L, Razaghpour A, et al. The prevalence and predictive factors of internet addiction and its relationship with emotional intelligence among medical students. *Soc Health Behav* 2019; 2: 145–150.

21. Alimoradi Z, Lin CY, Broström A, et al. Internet addiction and sleep problems: a systematic review and meta-analysis. *Sleep Med Rev* 2019; 47: 51–61.

22. Glen S. “Margin of error: definition, how to calculate in easy steps” from StatisticsHowTo.com: elementary statistics for the rest of us! https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/margin-of-error/ (2021, accessed 4 January 2021)

23. Buysse DJ, Reynolds CF III, Monk TH, et al. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989; 28: 193–213.

24. Young KS and De Abreu CN. *Internet addiction: a handbook and guide to evaluation and treatment*. 1st ed. Hoboken, NJ: John Wiley & Sons, 2011.

25. Mollayeva T, Thurairajah P, Burton K, et al. The Pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: a systematic review and meta-analysis. *Sleep Med Rev* 2016; 25: 52–73.

26. Zheng B, Li M, Wang KL, et al. Analysis of the reliability and validity of the Chinese version of Pittsburgh sleep quality index among medical college students. *J Peking Univ (Health Sci)* 2016; 48: 424–428.

27. Lai CM, Mak KK, Watanabe H, et al. Psychometric properties of the internet addiction test in Chinese adolescents. *J Pediatr Psychol* 2013; 38(7): 794–807.

28. Tateno M, Teo AR, Shiraishi M, et al. Prevalence rate of Internet addiction among Japanese college students: two cross-sectional studies and reconsideration of cut-off points of Young’s internet addiction test in Japan. *Psychiatry Clin Neurosci* 2018; 72(9): 723–730.

29. Koc M and Gulyagci S. Facebook addiction among Turkish college students: the role of psychological health, demographic, and usage characteristics. *Cyberpsychol Behav Soc Netw* 2013; 16: 279–284.

30. Jha RK, Shah DK, Basnet S, et al. Facebook use and its effects on the life of health science students in a private medical college of Nepal. *BMC Res Notes* 2016; 9: 378.

31. Erelin E, Fitri Susandri TA and Susandri. Using social networks: Facebook usage at the Riau college students. *Procedia Comput Sci* 2015; 59: 559–566.

32. Reissmann A, Reissmann A, Hauser J, et al. The role of loneliness in emerging adults’ everyday use of Facebook—an experience sampling approach. *Comput Human Behav* 2018; 88: 47–60.

33. Hale TM, Cotten SR, Drentea P, et al. Rural-urban differences in general and health-related internet use. *Am Behav Sci* 2010; 53: 1304–1325.

34. Taylor DJ, vatthauer K, Bramoweth AD, et al. The role of sleep in predicting college academic performance: Is it a unique predictor? *Behav Sleep Med* 2013; 11: 159–172.

35. Helgeson VS. *Psychology of gender*. 5th ed. New York, NY: Routledge, 2016.

36. Al-Saggaf Y and Nielsen S. Self-disclosure on Facebook among female users and its relationship to feelings of loneliness. *Comput Human Behav* 2014; 36: 460–468.

37. Hoy MG and Milne G. Gender differences in privacy-related measures for young adult Facebook users. *J Interact Advert* 2010; 10: 28–45.

38. Weiser EB. Gender differences in internet use patterns and internet application preferences: A two-sample comparison. *Cyberpsychol Behav* 2000; 3: 167–178.
39. Todd J and Mullan B. The role of self-regulation in predicting sleep hygiene in university students. *Psychol Health Med* 2013; 18: 275–288.
40. Wolniczak I, Cáceres-DelAguila JA, Palma-Ardiles G, et al. Association between Facebook dependence and poor sleep quality: a study in a sample of undergraduate students in Peru. *PLoS One* 2013; 8: e59087.
41. Huang YW, Yang CH, Ho SL, et al. The relationship between practicum-related stress and sleep quality in nursing students. *J Nurs Health Res* 2011; 7: 14–25.
42. Wu CH, Ke CC and Chen LD. Research of the clinical performance of Chinese medical interns in Taiwan. *Taiwan J Chin Med* 2010; 9: 9–18.
43. Yu C, Chen LY and Huang CK. Implementation of the simulation training during the clerkship of medical training. *J Innov Bus Manag* 2010; 1: 51–65.
44. Chen IH, Pakpour AH, Leung H, et al. Comparing generalized and specific problematic smartphone/internet use: longitudinal relationships between smartphone application-based addiction and social media addiction and psychological distress. *J Behav Addict* 2020; 9: 410–419.
45. Demirci K, Akgönül M and Akpinar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. *J Behav Addict* 2015; 4: 85–92.
46. Wong HY, Mo HY, Potenza MN, et al. Relationships between severity of internet gaming disorder, severity of problematic social media use, sleep quality and psychological distress. *Int J Environ Res Public Health* 2020; 17: 1–13.
47. Leung H, Pakpour AH, Strong C, et al. Measurement invariance across young adults from Hong Kong and Taiwan among three internet-related addiction scales: Bergen Social Media Addiction Scale (BSMAS), Smartphone Application-Based Addiction Scale (SABAS), and Internet Gaming Disorder Scale-Short Form (IGDS-SF9) (Study Part A). *Addict Behav* 2020; 101: 105969.
48. Chen IH, Strong C, Lin YC, et al. Time invariance of three ultra-brief internet-related instruments: Smartphone Application-Based Addiction Scale (SABAS), Bergen Social Media Addiction Scale (BSMAS), and the nine-item Internet Gaming Disorder Scale-Short Form (IGDS-SF9) (Study Part B). *Addict Behav* 2020; 101: 105960.
49. Chen IH, Ahorsu DK, Pakpour AH, et al. Psychometric properties of three simplified Chinese online-related addictive behavior instruments among mainland Chinese primary school students. *Front Psychiatry* 2020; 11: 875.
50. Yam CW, Pakpour AH, Griffiths MD, et al. Psychometric testing of three Chinese online-related addictive behavior instruments among Hong Kong university students. *Psychiatr Q* 2019; 90(1): 117–128.

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