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**ARTICLE**

**Association between meeting 24-hour movement guidelines and psychological features of Chinese Emerging Adults**

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**Abstract**

**Background:** Emerging adulthood is a pivotal life stage, presenting with significant psychological and social changes, such as decreased sociability, depression, and other mental health problems. Previous studies have assoicated these changes with an unhealthy lifestyle. The 24-hour movement guidelines for healthy lifestyles have been developed to promote appropriate health behaviors and improve individual wellness. However, the relationship between adherence to the 24-hour movement guidelines and different characteristics of Chinese emerging adults is yet to be explored. This cross-sectional study aimed to investigate the association between adherence to the 24-hour movement guidelines and four characteristics (self-exploration, instability, possibilities, and responsibility) of Chinese emerging adults. **Methods:** Overall, 1,510 Chinese emerging adults aged 18-29 years were included in this study. Each participant completed a self-administered questionnaire that included questions on adherence to the 24-hour movement guidelines (physical activity, screen time, and sleep) and the inventory of dimensions of emerging adulthood. Multivariable logistic regression analysis was employed to investigate the associations between adherence to the 24-hour movement guidelines and each of the four characteristics. **Results:** The proportion of participants who adhered to the 24-hour movement guidelines was 31.72%. Multiple regression analysis revealed a significantly negative relationship between adhering to more guidelines and instability (*β* =-0.51, *p*<0.001). A statistically significant association was observed between instability and meeting only sedentary behavior (*β* =-1.27, 95% confidence interval [CI]: [-2.32, -0.24], *p*=0.02), sedentary behavior + sleep (*β* =-1.30, 95% CI: [-2.24, -0.35], p<0.01), and physical activity + sedentary behavior (*β* =-1.08, 95% CI: [1.94, -0.21], *p*=0.02) guidelines. Further, positive and significant associations were observed between possibilities and meeting the guidelines for only physical activity (*β* =0.70, 95% CI: [0.14, 1.27), *p*=0.01), only sleep (*β* =0.61, 95% CI: [0.01, 1.21], *p*=0.04), physical activity + sedentary behavior (*β* =0.56, 95% CI: [0.04, 1.07), *p*=0.01), and physical activity + sleep (*β* =0.76, 95% CI: [0.23, 1.27], *p*=0.01). **Conclusions:** These findings suggest that adherence to the 24-hour movement guidelines was associated with instability in Chinese emerging adults. Future studies are warranted to verify our findings to highlight the importance of maintaining a heath lifestyle to promote the health in emerging adulthood.

**Keywords:** 24-hour movement behavior; physical activity; sedentary behavior; sleep; psychological health; emerging adults

**Introduction**

Emerging adulthood is a special, multifcated, and dynamic period of development that spans from late adolescence to the initial stages of adulthood [1,2]. Emerging adults navigate a landscape characterized by heightened autonomy, an array of diverse opportunities, and a simultaneous grappling with uncertainties and responsibilities [3]. During the developmental process of emerging adulthood, individuals experience diverse changes in the physical, psychological, behavioral, employment, and romantic relationship domains [4,5]. This new life period often present challenges, such as decreased sociability, psychological distress, anxiety disorders, that can detrimentally affect mental health [6]. An epidemiological review found that more than 40% of individuals aged 18-29 years experienced at least one psychiatric disorder in a 12-month period. This prevalence, especially for mood and anxiety disorders, is significantly higher than that in other age groups [7]. Similarly, another study reported that approximately 30% of emerging adults had depressive symptoms, of which 13.2% had major depressive episodes [8]. Such psychopathological issues during emerging adulthood hinder adaptation and a successful transition to adulthood.

A previous study suggested that the elevated prevalence of mental problems implies a correlation between the features of emerging adulthood and an increased susceptibility to mental disorders [9]. Based on the American cultural context, Arnett [6] proposed five distinct characteristics of emerging adulthood including identity explorations, instability, self-focus, feeling in-between, and optimism/possibilities. However, cultural nuances have led to the development of different dimensions. The inventory of dimensions of emerging adulthood-Chinese version (IDEA-C) was developed previously and consists of four features including: self-exploration, instability, possibilities, and responsibility [2]. Self-exploration is an important aspect of emerging adulthood, as individuals seek to understand themselves and their place in the world. With explorations and experience of internal struggles to establish their identity, emerging adults may exhibit significant challenges that influence their psychophysiological well-being [10]. For example, in coping with identity exploration, emerging adults often report increased tendencies toward ruminative exploration and depressive symptoms [11], alongside decreased experiences of fun, satisfaction, and excitement [12]. Instability refers to the uncertainty and changes that occur during this period, such as changes in relationships, education, and employment. All these uncertain life circumstances may create challenges and instability, subsequently leading to the development of several unstable mental problems (e.g., depression and stress) [10]. Possibilities refer to the opportunities and potential, such as exploring new interests and experiences, that arise during emerging adulthood. Despite the facing difficulties, challenges, and contradictions, majority of emerging adults maintain an unwavering belief in the promising prospects of their future [13], leading to increased self-esteem and decreased levels of social anxiety levels [14]. Responsibility refers to the development of personal and social responsibilities, such as self-care and social contribution [2,6]. Accepting responsibility is associated with perceived emotional well-being and life satisfaction in emerging adults [15]. Therefore, positively improving the characteristics of these adults is very important to promote their physical and mental health.

Early adulthood serves as a crucial transition, significantly influencing the establishment and adoption of health-promoting behaviors and features of emerging adulthood that persist throughout an individual's life [16]. Previous studies have highlighted independent associations between regular physical activity (PA), sedentary behavior, sleep patterns, and psychological health [17–21]. For example, a prospective study on emerging adults show that engaging in daily PA can significantly improve an individual’s satisfaction with life [22] and reduce depressive symptoms [23]. Reduced sedentary time or sufficient sleep in emerging adults has been linked to decreased anxiety and depression levels [24,25]. To encourage healthy lifestyles in the whole population, the Chinese government developed the 24-hour movement guidelines that advocate for daily PA, balanced sedentary behavior, and adequate sleep [26]. Although several studies have investigated how adherence to these guidelines impacts physical and psychological health outcomes in children and adolescents [27–30], a knowledge gap regarding these associations among emerging adults in China still exists. Therefore, the present study aimed to understand the relationship between adherence to the 24-hour movement guidelines and four distinct psychological features—self-exploration, instability, possibilities, and responsibility—among Chinese emerging adults.

**Methods**

**Study design and participants**

This study employed a cross-sectional online design. The participants were conveniently sample and recruited through advertisement and social media. The voluntarily completed an internet-based survey on the Questionnaire Star Platform from August to September 2022. Each participant's IP address could only be used once to fill out the questionnaire. The inclusion criteria were as follows: 1) age between 18 and 29 years; 2) absence of major physical or psychological illnesses; and 3) completion of a self-administered questionnaire that included questions on adherence to the 24-hour movement guidelines (PA, sedentary behavior, and sleep) and the IDEA-C. The exclusion cirteria were: age under 18 years or over 29 years; individuals with a history of drug addiction; incompleted data. A total of 1510 Chinese emerging adults aged 18-29 years provided complete responses. All participants signed a written informed consent form before enrollment in the study. Ethics approval was obtianed from the Shenzhen Univesity Human Research Ethics Board (No. PN-2021-048). All participants provided written informed consent.

**Measures**

**Guidelines**

The Chinese version of the International Physical Activity Questionnaire-Short Form was utilized to evaluate self-reported PA levels and sedentary behavior during the past 7 days [31]. Metabolic equivalents (METs) were used to classify the PA level. The METs for each PA level were consistent with previous studies, such as light PA (walking) =3.3 METs, moderate PA=4.0 METs, and vigorous PA=8.0 METs. The total PA amount for each participant was calculated by summing up: walking minutes x walking days x 3.3 METs + moderate PA minutes x moderate PA days x 4.0 METs + vigorous PA minutes x vigorous PA days x 8.0 METs per week. The time spent engaging in moderate and vigorous PA was employed to calculate the moderate-to-vigorous PA (MVPA) level. Sedentary behavior was measured using the question: “In the past 7 days, how much time did you spend sitting on a week day?” Responses to sitting for less than 8 hours a day indicated that the adults adhered to the sedentary behavior guideline. Sleep duration was measured using the following single question from the Pittsburgh Sleep Quality Index: “In the past month, how many hours of actual sleep did you have at night?” Responses ranging from 7 to 9 hours/day indicated compliance with the sleep duration guideline.

**Dependent variables**

**Four Features**

The degree of identification with emerging adulthood features was assessed using the IDEA-C [2]. The IDEA-C has been shown to be effective in measuring the psychological characteristics of Chinese emerging adults. Compared with the original version of the IDEA developed by Reifman et al., which comprised 20 items with five features. The items in IDEA-C are narrowed down to four features (self-exploration, instability, possibilities, and responsibility). The responses to the IDEA-C items were designed on a four-point Likert scale ranging from 1 = “totally disagree” to 4 = “totally agree”. Higher scores in each subscale indicated greater agreement with feature.

**Covariates**

Participants’ demographics encompassing age, gender (men and women), ethnicity (Han and minorities), education level (no schooling, primary school, second school, high school, undergraduate/college, and postgraduate or higher), living situation (living alone, living with classmates, sharing a house with others, living with parents or partner, etc.), and body mass index (BMI). Detailed demographic data is shown in Table 1.

**Statistical analysis**

Descriptive statistics were calculated for all the variables. Continuous variables are described using means and standard deviations, and categorical variables are described using unweighted sample counts and percentages. Multiple linear regression analysis was used to estimate odds ratios with 95% confidence intervals (CIs) in the association between adherence to the 24-hour movement guidelines and the four features (self-exploration, instability, possibilities, and responsibility). Separate analyses were performed for all three components of the 24-hour movement guidelines and specific combinations (PA, sleep, sedentary, sedentary + sleep, sedentary + PA, sleep + PA, and PA+ sedentary + sleep) as independent variables in the models. Socio-demographic data (age, sex, marital status, number of children, living, income level, and highest education level of emerging adults) were included as potential confounders. Data analysis was conducted using Stata 15.0, and the statistical significance level was set at p<0.05.

**Results**

**Sample Characteristics**

Data on 1,510 Chinese emerging adults aged 18-29 years were included in this study. The mean age of the participants was 20.08±3.36 years, and the majority were single (93.51%). Approximately 96% reported having no children. Of the participants, 69.01% lived with others, 23.11% lived with their family and 7.88% lived alone. The majority (80.73%) reported an income of less than ¥2000, while only a small proportion earned ¥2000 - ¥5000(10.66%). Only a negligible percentage of emerging adults (0.20%) responded that they had not completed high school (see Table 1).

**Adherence to the 24-hour movement guidelines**

Table 2 and Figure 1 present the estimated percentages of adherence to the 24-hour movement guidelines maong Chinese emerging adults. In total, 65.36% (n = 987) of the participants met the sedentary behavior recommendation, 61.66% (n = 931) met the sleep duration recommendation, and 74.50% (n = 1,125) met the PA recommendation. A third of the participants (n = 479, 31.72%) adhered to all three guidelines, while a small proportion (n=67, 4.44%) did not adhere to any of the guidelines. Among those who followed two of the three recommendations (n=642, 42.52%), most complied with the sedentary behavior and PA recommendations.

**Table 1.** Participant characteristics

|  |  |
| --- | --- |
| **Emerging adults (*n* = 1510)** | |
| **Characteristics** | **Value1** |
| **Age (M, SD)** | 20.08 (3.36) |
| **Gender (n, %)** |  |
| Male | 700 (46.36) |
| Female | 810 (53.64) |
| **Marital status (n, %)** | |
| Single | 1412 (93.51) |
| Married | 98 (6.49) |
| **Number of children (n, %)** | |
| 0 | 1488 (95.89) |
| 1 | 40 (2.65) |
| 2 | 19 (1.26) |
| 3 | 3 (0.20) |
| **Living status (n, %)** | |
| Live alone | 119 (7.88) |
| Live with other people | 1042 (69.01) |
| Live with your family | 349 (23.11) |
| **Monthly income level (n, %)** |  |
| <2000 | 1219 (80.73) |
| 2000< - <5000 | 161 (10.66) |
| 5000≤ - <10000 | 78 (5.17) |
| 10000≤ - <50000 | 44 (2.91) |
| 50000≤ - <100000 | 3 (0.20) |
| ≥100000 | 5 (0.33) |
| **Highest education level (n, %)** | |
| Less than high school | 3 (0.20) |
| High school | 120 (7.94) |
| Some college or associated degree | 1275 (84.44) |
| College degree or higher | 112 (7.42) |
| **Four features of emerging adults** | |
| Self-exploration | 25.10 (7.28) |
| Instability | 14.03 (4.40) |
| Possibilities | 9.61 (2.85) |
| Responsibility | 9.68 (3.28) |

Note: Values are mean (SD) or n (%). N (%) represents sample counts and sample sizes.

**Table 2. Descriptive statistics of adherence to the 24-hour movement guidelines**

|  |  |
| --- | --- |
| Compliance with the 24-hour movement guidelines | (n, %) |
| Not meeting recommendations | 67 (4.44) |
| Sedentary behaviour recommendations |  |
| Meeting | 987 (65.36) |
| Not meeting | 523 (34.64) |
| Sleep recommendations |  |
| Meeting | 931 (61.66) |
| Not meeting | 579 (38.34) |
| Physical activity recommendations |  |
| Meeting | 1125 (74.50) |
| Not meeting | 385 (25.50) |
| Meeting at least one recommendations | 322 (21.32) |
| Sedentary behavior + Sleep recommendations |  |
| Meeting | 617 (40.86) |
| Not meeting | 893 (59.14) |
| Physical activity + sedentary behavior recommendations |  |
| Meeting | 765 (50.66) |
| Not meeting | 745 (49.34) |
| Physical activity + sleep recommendations |  |
| Meeting | 697 (46.16) |
| Not meeting | 813 (53.84) |
| Meeting at least two recommendations | 642 (42.52) |
| Meeting three recommendations | 479 (31.72) |