



Can health information acquisition on mobile app influence psychological and physical well-being? Examining mediating role of bonding and bridging capital

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ABSTRACT

Mobile application (app), with its expansive reservoir of data and content, harbors considerable promise in advancing health outcomes at both the individual and population levels. Nevertheless, there is a paucity of scholars that concretely examine the dynamics of health information acquisition within mobile app. This research presents a conceptual model aimed at investigating the potential ramifications of health information acquisition on both individuals' psychological and physical well-being. Concurrently, this research attempts to illuminate the underlying mechanisms behind these correlations through evaluating the mediating role of bonding and bridging social capital. The obtained results of a web-based survey conducted among 656 college students in mainland China suggest a positive association between health information acquisition and bonding and bridging social capital. Moreover, the study reveals that the impact of health information acquisition via mobile applications on psychological and physical well-being is significantly mediated by college students' bonding and bridging social capital. The cultivation of bonding social capital could exert a direct and positive influence on college students' physical well-being. However, there appears to be no discernible correlation between bridging social capital and physical well-being. Taken collectively, these findings not only complement extant theoretical perspectives within the scholarship concerning mobile app usage for health improvement, but also furnish several pragmatic guidelines for healthcare professionals and mobile app designers.

1. Introduction

Owing to the exponential advancement of sophisticated digital technologies, mobile application (app) has emerged as the preferred vehicle to disseminate health information and manage diseases (Blebil et al., 2023; Yeoh et al., 2024). With the prolonged duration of the pandemic, the general public inevitably suffers from a deterioration in mental and physical well-being in recent years (Sacre et al., 2024; Wah, 2022). Recognizing the paramount importance of health, a tremendous amount of people have grown more reliant on the internet and mobile media for beneficial information to effectively prevent disease or manage health (Soroya et al., 2021; Yeoh et al., 2024). Functioning as an innovative avenue with a vast spectrum of available health-related content, mobile app has witnessed a surge in popularity following the onset of the COVID-19 outbreak (Thapliyal et al., 2024; Yang et al., 2023). More specifically, mobile app could potentially alleviate undue

stress on the hospitals and clinics in mainland China, in which people run into formidable barriers in reaching health services (e.g., high financial costs, inequitable health resource distribution, deficient health information services) (Yang et al., 2023; Zhang & Jung, 2022). According to the latest statistics, mobile applications in the rehabilitation medical support category attained the highest rankings, with an average of 2.74 million downloads (Yang et al., 2023).

Mobile app not only encapsulates a wide range of health-related resources, but also introduces a novel approach to disseminating information (Blebil et al., 2023; Thapliyal et al., 2024). A multitude of health information can be constantly generated and conveyed among immense amounts of users through distinct and diverse functionalities (Yang et al., 2023; Yeoh et al., 2024). Furthermore, health information acquisition through mobile app is markedly distinct from that through traditional online websites (Blebil et al., 2023; Oakley-Girvan et al., 2022; Thapliyal et al., 2024). The utilization of mobile applications as a

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web-based service is characterized by an elevated sense of personalization, thereby rendering it a more secure avenue for individuals to collect and store private health-related information (Yeoh et al., 2024; Zhu et al., 2019). Moreover, the widespread adoption of advanced media technologies and relational assets integrated into social networks augment the accessibility and effectiveness of mobile app for acquiring dependable guidance (Yeoh et al., 2024; Zhang et al., 2020). Mobile app has become indispensable in satisfying diverse demands and an optimal platform to facilitate healthy behavior adoption (Wang et al., 2019; Yang et al., 2023). Notwithstanding mobile app achieving increased consequences in diffusing wholesomeness, the key psychological and physical implications that individuals adopt mobile applications for seeking health information remain ambiguous (Chen & Li, 2017; Fornell & Larcker, 1981; Zhang & Jung, 2022).

A plethora of studies have elucidated information seeking, whereas a comparatively scant corpus has explicitly concentrated on health information acquisition behavior in the Asian context (Conrad, 2024; Zhang et al., 2017; Zhang & Jung, 2022). This implies that insufficient scholarly investigation exists concerning the ramifications of health information acquisition in the Chinese context. Furthermore, the potential outcomes of health information acquisition have not achieved concurrence in previous studies (Blebil et al., 2023; Conrad, 2024; Wah, 2022). Some empirically documented positive implications of searching for health information, such as perceived social support and increased health literacy (Blebil et al., 2023; Conrad, 2024; Wang et al., 2019). However, adverse repercussions were reported in other research (e.g., amplifying risk perception and exacerbation of depressive symptoms) (Wah, 2022; Zhong et al., 2021). Considering the divergent conclusions from existing studies, there is a pressing need for further research to precisely elucidate the underlying mechanism of mobile health information acquisition behavior and its implications for health outcomes. Accordingly, it is paramount to methodically determine the applicability of previously documented correlations between health information acquisition and health ramifications within the mobile app environment, as well as their generalizability in another setting.

Building on social capital theory and related literature, the present study endeavors to unravel the underlying pathways from mobile app health use to psychological and physical well-being through two dual facets of social capital (e.g., bonding and bridging). Specifically, this study intends to statistically explore the following questions: (1) How might health information acquisition correlate with bonding and bridging social capital in the context of mobile app? (2) How do bonding and bridging social capital correlate with well-being, encompassing psychological and physical dimensions? (3) How can two dimensions of social capital serve as mediators in the impacts of health information acquisition on psychological and physical well-being? By addressing these questions, this research provides a theoretical extension by giving a more nuanced view of comprehending mobile-based health information acquisition in the mobile app context. Concretely, this examination extends beyond previous explorations through delineating differential dimensions of social capital reinforced through mobile app. Furthermore, this article proffers some concrete suggestions for harnessing emergent mobile technologies within a healthcare setting to promote individuals' well-being in a modern media-inundated society.

2. Theoretical framework and hypotheses development

2.1. Linking health information acquisition to psychological and physical well-being

In general, health information acquisition is portrayed as the proactive and conscious endeavor embarked upon by individuals to seek health information from diverse accessible sources to improve health (Conrad, 2024; Zhang et al., 2020). This quest primarily aims to procure appropriate instructions and recommendations for managing their own health or that of their families (Bigsby & Hovick, 2018; Yeoh et al.,

2024). Within the mobile context, the definition reflects that users can conveniently acquire valuable information, opinions, or advice from social media or mobile devices, which serve as novel channels for disseminating significant information related to health topics (Junaidi et al., 2020; Yang et al., 2023). Especially amid the global epidemic, mobile app has appeared as a naturally appealing conduit to spread accurate healthy content to a broad audience in a prompt and effective manner, which also expeditiously connects users for seeking health information (Conrad, 2024; Junaidi et al., 2020; Pang & Liu, 2023). Hence, health information acquisition can principally benefit from mobile app's unique features as a crucial venue for health information dissemination and an interactive platform for users to exchange, produce and discuss healthcare content (Lama et al., 2022; Yeoh et al., 2024).

This current study adopts a remarkably holistic approach to well-being, meticulously taking into account two discrete perspectives: the psychological and physical dimensions. Psychological well-being, as a fundamental gauge of health status, is commonly construed as personal perceptions and appraisals pertaining to the significance of individual existence (Erfani & Abedin, 2018; Lee & Hancock, 2024; Zhang & Jung, 2022). It has also been deciphered and characterized as intricate and hybrid feelings, encapsulating people's evaluations of the value of survival and social operation, as well as personal assessments of their overall life quality (Erfani & Abedin, 2018; Lee & Hancock, 2024). This multidimensional concept is broadly exemplified by self-acceptance, autonomy, individual development, purposeful life, positive relationships with others, and environmental mastery (Chan, 2023; Chen & Li, 2017; Simons et al., 2020). Typically, physical well-being is elucidated as one's self-appraised bodily health and vigor combined with sensed lack of physical suffering (Imbulana Arachchi & Managi, 2023; Liu & Kashian, 2021). It embodies the personal ability to perform activities of daily living, ranging from basic self-care to more demanding physical tasks (Jim et al., 2015; Liu & Kashian, 2021). Currently, mobile app has been extensively leveraged to enhance physical well-being, such as facilitating weight loss, smoking cessation, and combating obesity (Lee et al., 2018; Thapliyal et al., 2024).

Previous outcomes from studies investigating the impact of mobile app usage on well-being are unequivocally mixed (Chan, 2023; Lee & Hancock, 2024). Mobile app has been deemed advantageous, empowering users to proactively seek health information and nurture social ties (Conrad, 2024; Yang et al., 2023), while it can come with potential downsides, such as heightened anxiety and compromised physical well-being (Lee & Hancock, 2024; Wah, 2022; Zhong et al., 2021). In an era marked by the burgeoning dominance of mobile app in society, particularly within the healthcare contexts, it is essential to persist in scrutinizing the relationship between mobile app usage and well-being (Yang et al., 2023; Yeoh et al., 2024). Besides, a plethora of research revealed that mobile app usage for health purposes failed to exert direct impacts on people's health conditions (Jiang & Street, 2017; Thapliyal et al., 2024; Zhang & Jung, 2022). For example, Zhang and Jung (2022) unveiled that technology use might influence health outcomes indirectly by virtue of the mediating role of bonding and bridging social capital. That underscored that engagement actively with health content on digital platforms may not only facilitate knowledge acquisition but also foster robust social networks, thereby culminating in enhanced well-being (Zhang & Jung, 2022). In a similar vein, a recent meta-analysis emphasized that mobile app utilization could bolster well-being by fortifying relationships and connections among individuals and communities sharing similar interests (Minihan et al., 2023). Considering the insights gleaned from the aforementioned studies, there is an urgent imperative to delve into not just the direct impacts but also the underlying mechanisms that mediate these effects on individuals' psychological and physical well-being.

2.2. Linking health information acquisition to bonding and bridging capital

Social capital can be succinctly characterized as the deliberate cultivation of relational networks, underscoring the profound impact of intentional investment in fostering interconnectedness among individuals (Imbulana Arachchi & Managi, 2023; Riva et al., 2024; Zhang & Jung, 2022). Some scholars have additionally delineated social capital as the social investments made by individuals within society, encompassing their affiliations with both formal and informal groups and institutions (Dong et al., 2023; Turner, 2003). In the study of communication, social capital is typically articulated as benefits people accrue from social interactions (Chen & Li, 2017; Guo & Chen, 2022; Putnam, 2001), which may include the sustenance of their health, and access to resources for recovery from illness (Turner, 2003; Zhang & Jung, 2022). According to Putnam (2001), social capital could be classified into two discrete forms: bonding and bridging. Bonding social capital broadly denotes close and tight-knit links among people, while bridging social capital relates to weaker and more loosely ties of acquaintances or even strangers with diversified socioeconomic backgrounds and multiple perspectives (Arriola et al., 2024; Guo & Chen, 2022; Putnam, 2001). Furthermore, the essence of bonding social capital lies in the establishment of social cohesion: a profound sense of camaraderie, affection, or shared values and collective experiences that unite people of a community together (Imbulana Arachchi & Managi, 2023; Jiang & Song, 2022; Riva et al., 2024). To cultivate bonding social capital, it is imperative to enhance ingroup mutual trust and provide substantive emotional and psychological sustenance (Guo & Chen, 2022; Riva et al., 2024). Conversely, bridging social capital is nurtured through the cultivation of respectful and reciprocal connections among individuals in a community, transcending sociodemographic disparities (Dong et al., 2023; Riva et al., 2024). It highlights the significance of nurturing an outward-facing perspective, engaging with a multifaceted array of individuals and viewpoints, and advocating diffuse or generalized reciprocity within a broader community (Dong et al., 2023; Putnam, 2001). In recent times, social capital has expanded its domain into the digital sphere, elucidating the advantageous outcomes facilitated by diverse online mobile applications (Bano et al., 2019). As mobile app continue to advance in functionality, it can offer additional avenues for strengthening family ties, as well as widening corresponding social networks by bridging loose and frail ties (Chen & Li, 2017; Zhang et al., 2020). Moreover, users are likely to fortify strong connections and forge new ones by engaging in mutual interactions facilitated by a diverse array of communicative features on mobile platforms (Zhang & Jung, 2022).

Recently, the potential implications of health information acquisition for social capital have attracted extensive research attention, with a series of empirical studies substantiating the existence of a positive and statistically significant correlation between them (Jiang & Street, 2017; Zhang & Jung, 2022; Zhu et al., 2019). For instance, Zhang et al. (2013) showcased how diabetes patients across various countries utilize Facebook's social clusters to gather and exchange health-related opinions and experiences. This activity significantly contributes to enhancing their companionship and social capital. In a similar vein, Jiang and Street (2017) illuminated that internet use might provide incredible probabilities to establish and sustain more extensive interpersonal networks, through which individuals could directly or indirectly access social resources. Furthermore, a qualitative study by Zhu et al. (2019) concentrated on pregnancy-related applications. The investigation revealed that pregnant women with specific health information requirements would employ mobile applications to search for pertinent information and obtain timely assistance from other pregnant women (Zhu et al., 2019). More recently, Zhang and Jung (2022) uncovered that information engagement on mobile app is associated with two types of social capital in distinct manners, which is mainly contingent upon various features embedded within the mobile app. In contrast to

alternative communication techniques, health-related information acquisition via mobile app is deemed much more convenient, comprehensive, informative, and tailored (Conrad, 2024; Zhu et al., 2019). As such, it also presents unparalleled prospects to foster increased interaction and accrue a greater reservoir of social capital (Dong et al., 2023; Guo & Chen, 2022; Zhang et al., 2020). Therefore, it is plausible that health information acquisition on mobile app will induce elevated degrees of bonding and bridging social capital; thus, the below hypotheses are proffered:

H1. Health information acquisition is positively associated with bonding capital.

H2. Health information acquisition is positively associated with bridging capital.

2.3. Linking perceived social capital to psychological well-being

As evolving communication technologies become intertwined with daily routines, psychological well-being has always been linked with social capital obtained from mobile platforms (Bano et al., 2019; Erfani & Abedin, 2018; Lee & Hancock, 2024). Actually, the attainment of social capital is facilitated by long-term engagement with the internet and mobile platforms, and contributes to greater psychological well-being (Dong et al., 2023; Erfani & Abedin, 2018). Collectively, amassed social capital has the potential to enhance individuals' psychological well-being by nurturing positive connections with others and providing resources for self-governance and environmental control (Pang & Qiao, 2022; Simons et al., 2020; Zhang & Jung, 2022). Over the course of recent decades, a multitude of scholars have affirmed that social capital and psychological well-being are positively and significantly correlated (Bano et al., 2019; Guo & Chen, 2022; Imbulana Arachchi & Managi, 2023). For instance, through the utilization of a two-panel survey, Chen and Li (2017) provided evidence of a significant association between perceived social capital and psychological well-being. Likewise, Bano et al. (2019) also documented that Pakistani students' mobile app use would directly influence kinship and bonding social capital, thus eventually improving individuals' psychological well-being. Within the setting of a global pandemic, Sigurvinsdottir et al. (2020) postulated that social capital may exhibit a positive and statistically significant correlation with a reduction in psychological distress. Moreover, Zhang and Jung (2022) also proposed that perceived social capital can directly predict mobile app users' individuals' psychological well-being. In a recent report, The empirical evidence suggested that augmenting social capital could potentially yield ameliorated life satisfaction, particularly prevalent in numerous low-income nations (Imbulana Arachchi & Managi, 2023).

In synthesis, there exists a discernible correlation between the substantial accumulation of social capital and a wide range of advantageous psychological outcomes, foremost among them being enhanced psychological well-being (Bano et al., 2019; Guo & Chen, 2022; Imbulana Arachchi & Managi, 2023; Kaye et al., 2017). Moreover, the swift advancement of nascent technologies assists people in cultivating interpersonal relationships and establishing mutual reliance, which finally promotes psychological well-being (Bano et al., 2019; Chan, 2023). In particular, mobile app usage has the potential to amplify active engagement with both robust and weak social connections, thereby fostering a heightened sense of appreciation, value, and expanded access to resources and opportunities for individuals (Chen & Li, 2017; Conrad, 2024). For fostering strong relationships with families or friends, mobile app equipped with multiple sensory cues capable of conveying various forms of affectionate and heartfelt communication, has been proven to be more advantageous in enhancing psychological well-being (Chan & Li, 2020; Zhang & Jung, 2022). Relatively, the essential elements of bridging social capital, especially access to multifarious choices and opinions, appear to hold greater relevance for individual development, thereby promoting psychological well-being

(Conrad, 2024; Zhang & Jung, 2022). Furthermore, bridging social capital can enhance personal psychological well-being by providing valuable information and assistance for individuals' upward mobility and improved quality of life (Gong et al., 2021; Imbulana Arachchi & Managi, 2023; Pang et al., 2024). Drawing from the above-mentioned academic demonstration, it is plausible to posit that both bonding and bridging social capital can contribute to numerous positive psychological outcomes. Consequently, the subsequent hypotheses are presented:

H3. Bonding capital is positively associated with psychological well-being.

H4. Bridging capital is positively associated with psychological well-being.

2.4. Linking perceived social capital to physical well-being

Apart from delving into the potential linkage between psychological well-being and social capital, preceding scholarly studies have exhibited a positive correlation between social capital and physical well-being (Arriola et al., 2024; Jiang & Song, 2022; Xue et al., 2020). Improved physical well-being can be accomplished through heightened social support and sustained interpersonal relationships (Imbulana Arachchi & Managi, 2023; Jiang & Song, 2022). Indeed, social networks could play the part of constructive environments where individuals may receive practical suggestions, refine self-preservation capabilities, and acquire self-assurance in sustaining wellness, ultimately contributing to heightened physical well-being (Conrad, 2024; Jiang & Street, 2017). Hence, social capital has frequently been indicated as a critical driver of physical well-being (Jiang & Song, 2022; Rodgers et al., 2019). A plethora of research has presented compelling corroboration that social capital is positively related to physical well-being (Arriola et al., 2024; Jiang & Song, 2022; Rodgers et al., 2019). For example, Jiang and Street (2017) emphasized that health information acquisition impacts physical well-being indirectly by facilitating perceived social support. Through a meta-analysis, Xue et al. (2020) discerned that social capital may serve as a significant predictor of positive physical health outcomes. Jiang and Song (2022) also uncovered that for middle-aged and older persons, bridging social capital incorporated into assorted social ties could present additional physical well-being advantages versus bonding social capital. More recently, Arriola et al. (2024) unearthed that social capital may be correlated with positive health outcomes and well-being among inhabitants of rural locales.

Overall, academic research widely concurs that social capital can be a pivotal determinant of individuals' physical well-being (Arriola et al., 2024; Farrell et al., 2022; Zhang & Jiang, 2019). Moreover, mobile app has been identified as an enticing tool for enhancing physical well-being, as people can readily access social capital via this platform (Conrad, 2024; Lee et al., 2018). Further, individuals can also develop a sense of social identity through social networks, which ultimately bolsters their capacity to navigate health challenges (Ihm & Lee, 2021; Yeoh et al., 2024). For strong social ties, there exists a greater pool of shared resources among participants, which can facilitate the exchange of information and provision of essentials crucial for maintaining health and safety, particularly during the pandemic (Ihm & Lee, 2021; Thapliyal et al., 2024). Strong social ties can potentially motivate individuals to make conscientious choices, as their physical and emotional welfare holds profound significance for those whom they cherish (Xue et al., 2020). In contrast, interacting with peripheral ties in diverse networks is more likely to catalyze people to participate in a broad spectrum of health promotion activities (Farrell et al., 2022; Yeoh et al., 2024). Accordingly, bridging social capital can also dissuade hazardous behaviors like smoking and alcohol abuse, and facilitate improvements in physical well-being (Zhang & Jiang, 2019; Zhu et al., 2019). Based on these arguments, this investigation puts forward the following hypotheses:

H5. Bonding capital is positively associated with physical well-being.

H6. Bridging capital is positively associated with physical well-being.

Given the established positive nexus between social capital and well-being in antecedent scholarship, it appears possible that social capital could serve as a mediator in the correlation between mobile application utilization and well-being (Arriola et al., 2024; Bano et al., 2019; Zhang & Jung, 2022). One plausible avenue through which mobile app usage for health information acquisition may enhance well-being is via the intermediary path of perceived bonding and bridging social capital (Chan, 2018; Guo & Chen, 2022). This proposition aligns with the conclusion drawn from Chen and Li (2017)'s study, which delved into the mediating role of bonding social capital in the linkage between mobile media utilization and psychological well-being within a general populace. Similarly, Chan (2018) posited that social capital assumes a mediating function in the relationship between digital communication activities and well-being. Guo and Chen (2022) also underscored that media platform usage exerts an indirect influence on health outcomes, further revealing the mediating function of both bonding and bridging social capital. Additionally, this study also emphasized the positive correlation between media utilization and the cultivation of social capital, as well as the significant association between both forms of social capital accumulation and psychological well-being (Guo & Chen, 2022). More recently, Conrad (2024) uncovered that mobile platforms empower pregnant women to access social capital from fellow expectant mothers, thus reducing feelings of anxiety and enhancing their well-being during pregnancy.

Collectively, bonding and bridging social capital assume pivotal mediating roles in navigating the complex interrelationship between mobile application utilization and overall well-being (Bano et al., 2019; Conrad, 2024). More precisely, bonding, indicative of close-knit social ties, and bridging, emblematic of connections across diverse social strata, serve as indispensable conduits in explicating the nuanced dynamics between mobile app usage and the well-being of individuals (Bano et al., 2019; Riva et al., 2024). Proactive seeking of health-related information on mobile platforms may empower individuals to fortify intimate connections while also fostering weak connections, thereby engendering an augmented health level (Chan, 2023; Zhang & Jung, 2022). Hence, the research poses the following question and examines this conceptual research based on the above hypotheses:

RQ1. How do bonding and bridging social capital mediate the association between mobile app usage for health information acquisition and well-being (i.e. psychological well-being and physical well-being)?

3. Research methodology

3.1. Research model

Grounded on the preceding six hypotheses, as depicted in Fig. 1, the paper constructs a conceptual model to systematically investigate the potential determinants that may influence individuals' psychological well-being and physical well-being. The research scrutinizes whether and how health information acquisition through mobile app can exert direct effects on two disparate manifestations of social capital. In addition, the research model elucidates a pathway linking health information acquisition to individuals' well-being through the underlying mechanisms of bonding and bridging social capital.

3.2. Sample and data collection

The quantitative data was gathered from 2022/12/20 to 2023/1/12 through an online survey. Given the salience of mobile app among younger cohorts (Lama et al., 2022; Mackson et al., 2019), the target population was Chinese college students. Focusing on college students is primarily due to their unique challenges, such as academic pressures and

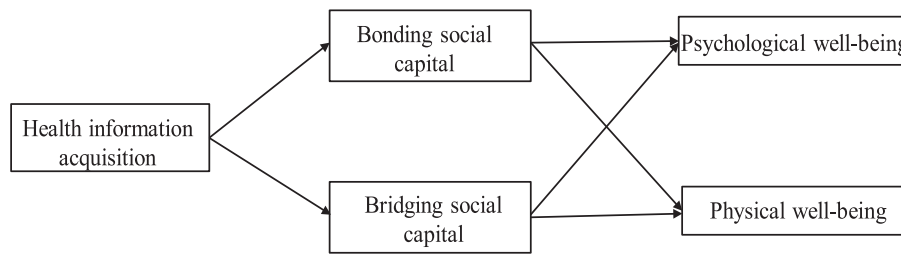


Fig. 1. The conceptual research model.

social relationships, which may impact their use of mobile devices to acquire health information differently compared to other young adults (Blebil et al., 2023; Erfani & Abedin, 2018). The dataset under scrutiny was sourced from a nationwide sample survey, encompassing Chinese college students from Beijing, Shanghai, Guangzhou, and Shenzhen. These four cities were singled out because of their formidable technological infrastructures and elevated levels of digital interconnectedness. Consequently, a higher percentage of college students residing in these cities use mobile app compared to other cities in mainland China. Besides, these cities host massive colleges that draw students from diverse geographical origins across China. Surveying college students in these cities can offer insights into trends and behaviors that may reflect broader patterns among Chinese college students. Samples were randomly selected according to the proportion of college students in four cities. They were requested to complete an online survey on www.sojump.com. It is a specialized online questionnaire system with a substantial quantity of registered respondents in China. The principal benefit of utilizing online survey technology lies in the superior quality of the data collected online compared to that gathered through more conventional research instruments (Kaye et al., 2017). This questionnaire was originally composed in English, thence rendered into Mandarin Chinese to facilitate respondents' comprehension, and afterwards back-translated into English to guarantee that the interpretation accurately captured all aspects of the original. Overall, the web-based survey received 712 replies in total. After eliminating invalid questionnaires, the final sample for data analysis was 656 with a completion rate of 92.4%. Students were asked about their gender, age, education background, expenditure per month, experience using mobile app and daily mobile app use time. Regarding the demographic information, 296 were male (45.10%), and 360 were female (54.90%). The majority of students ranged from 18 to 25, and more than half of people (62.80%) have used mobile app for over six years. Table 1 reveals the specific statistics on demographics for the research sample.

3.3. Measurement

3.3.1. Health information acquisition

Health information acquisition via mobile app was scaled by three questions, sourced from prior scholarly works (Ahadzadeh et al., 2015; Zhang et al., 2020). Respondents were inquired to estimate how often they utilize mobile app for three forms of health information-acquiring practices, such as "I utilize mobile app for obtaining comprehensive description pertaining to the diagnosis and treatment of several disorders" and "I utilize mobile app as a way of accessing information regarding pharmaceuticals or medications". Three items in total were evaluated utilizing a 5-point Likert scale, encompassing responses ranging from 1 (never) to 5 (always). The answers were aggregated and computed as a mean to form a quantifiable representation of this construct (Cronbach's alpha = 0.762, M = 3.23, SD = 0.79).

3.3.2. Bonding social capital

Derived from previously validated scales (Guo & Chen, 2022; Williams, 2006), bonding social capital was evaluated with five statements like "When experiencing feelings of loneliness, I can reach out to a range

Table 1 Demographic characteristics of respondents (N = 656).

	Frequency	%
Gender		
Males	296	45.12
Females	360	54.88
Age		
<18	6	0.91
18–21	270	41.16
22–25	316	48.17
26–29	48	7.32
≥30	16	2.44
Education background		
Undergraduate students	458	69.82
Graduate students	188	28.66
Doctoral students	10	1.52
Expenditure/month		
≤RMB 1000	52	7.93
RMB 1001–2000	343	52.13
RMB 2001–3000	158	24.09
RMB 3001–4000	54	8.23
>RMB 4000	50	7.62
Experience using mobile app		
<2 years	10	1.52
2–4 years	102	15.55
4–6 years	132	20.12
>6 years	412	62.80
Daily mobile use time		
<2 h	12	1.83
2–4 h	158	24.09
4–6 h	224	34.15
>6 h	262	39.94

of people via mobile app", and "There exist some individuals within the mobile app whom I have confidence in to effectively address and resolve the issues I encounter". The scale consists of five items evaluated using a 5-point rating scale, with responses ranging from 1, indicating "strongly disagree", to 5, representing "strongly agree". Respondents were prompted to articulate the extent how much they agreed or disagreed with the five questions. A measure of bonding social capital was derived by calculating the average scores (Cronbach's alpha = 0.843, M = 3.93, SD = 0.70).

3.3.3. Bridging social capital

To gauge the extent to which respondents discerned they could gain bridging social capital on mobile app, a total of four items were adapted from prior research (Guo & Chen, 2022; Williams, 2006). Participants were requested to disclose their level of agreement with these statements on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). These items mainly include, for example, "Engaging in interpersonal interactions through mobile app elicits a desire within me to explore novel experiences", and "I engage in social interactions with individuals on mobile app who possess distinct characteristics and qualities that differ from my own". The scores were averaged to establish a metric for bridging social capital (Cronbach's alpha = 0.722, M = 3.93, SD = 0.63).

3.3.4. Psychological well-being

The variable was formulated by revising the five questions from prior evaluation scales (Bano et al., 2019) that require participants to report their degree of approval (from 1 = strongly disagree to 5 = strongly agree). These statements include “I am actively engaged and enthusiastic about my lives”, “I am fully involved in fostering the happiness and well-being of individuals in my community”, and “I pursue a life characterized by purpose and significance”. The scores were subsequently computed as an average to create a metric for assessing psychological well-being (Cronbach’s alpha = 0.857, M = 3.99, SD =0.67).

3.3.5. Physical well-being

Drawing upon previous studies (Liu & Kashian, 2021), the evaluation of physical well-being comprised four items such as “Based on self-perception, it is believed that my state of health is satisfactory”, and “I do not have significant fatigue”. Participants were required to rate the degree to which they approve of these items according to a 5-point scale from 1 (strongly disagree) to 5 (strongly agree). The responses were averaged to establish a measure of physical well-being (Cronbach’s alpha = 0.836, M = 3.80, SD =0.73).

4. Data analysis strategy

To scrutinize the proposed model comprising various interconnections between variables, structural equation modeling (SEM) was undertaken using AMOS 26.0 in two sequential steps. SEM serves as a primary analytical tool for empirically assessing the theoretical model of this research, enabling scholars to discern the relationships among concepts based on data (Dong et al., 2023; Ong & Puteh, 2017). The measurement model was initially investigated using a confirmatory factor analysis (CFA) to establish if the concepts fit the data well. Subsequently, the hypothesized relationships among research constructs were tested.

5. Results

5.1. Assessment of the measurement model

The measurement model indicates a great model fitting, as evidenced by the absolute fit indices ($\chi^2/d.f. = 1.698$; RMSEA = 0.046; SRMR = 0.054) and the incremental fit indices (CFI = 0.954; AGFI = 0.894; IFI = 0.955; TLI = 0.947). The commonly used combinational criteria are employed to estimate the goodness of fit of the measurement model: the Chi-square to the degrees of freedom ratio ($\chi^2/d.f.$) < 3, RMSEA < 0.05, and SRMR < 0.06; CFI > 0.95, TLI > 0.90 (Zhang et al., 2020). Therefore, the measurement model yields a great model fitting, and the findings are illustrated in Table 2. Cronbach’s alpha and composite reliability (CR) are statistical indices utilized to assess the internal consistency of the constructs, offering valuable insights into the reliability of the measurements. All Cronbach’s alpha and CR values exceed the recommended values (Cronbach’s alpha > 0.7, CR > 0.7), indicating

Table 2
Fit indices for the measurement model.

Model fit measures	Model fit criterion	Index value	Good model fit (Y/N)
Absolute fit indices			
RMSEA	<0.08	0.046	Y
SRMR	<0.06	0.054	Y
$\chi^2/d.f.$ ($\chi^2 = 303.939$, d.f. = 179)	<3	1.698	Y
Incremental fit indices			
CFI	>0.9	0.954	Y
AGFI	>0.8	0.894	Y
IFI	>0.9	0.955	Y
TLI	>0.9	0.947	Y

commendable reliability. Similarly, factor loadings, average variance extracted (AVE), and squared multiple correlations (SMC) serve as metrics to evaluate convergent validity (Bano et al., 2019; Guo & Chen, 2022). Most of the results are higher than the suggested thresholds, thus signaling acceptable convergent validity (Fornell & Larcker, 1981; Guo & Chen, 2022). Some statistical findings regarding the confirmatory factor analysis are presented in Table 3. The examination of discriminant validity in the measurement model entails comparing the square root of the average variance extracted (AVE) for each construct with the observed correlations between the constructs (Fornell & Larcker, 1981). In Table 4, the square root of the AVE for each construct exhibits larger values compared to its correlations with all other constructs, hence demonstrating great discriminant validity. Considering the measurement model in this study with a satisfactory model fit, great reliability, sufficient convergent and discriminate validity, the current measurement model is accepted.

5.2. Assessment of the structural model

The structural model demonstrates an acceptable model fitting: $\chi^2/d.f. = 2.222 < 3$, RMSEA = 0.061 < 0.08, CFI = 0.918 > 0.9, AGFI = 0.868 > 0.8, IFI = 0.919 > 0.9, TLI = 0.906 > 0.9 (Bano et al., 2019). Afterwards, this research evaluates the structural model to discern the correlations posited by the hypotheses. The empirical results indicate that standardized path coefficients significantly support five assumed hypotheses, while one hypothesis is statistically rejected. As predicted, health information acquisition correlates positively and significantly with bonding social capital ($\beta = 0.446$, $p < 0.001$) and bridging social capital ($\beta = 0.456$, $p < 0.001$). Thus, Hypothesis 1 and Hypothesis 2 are verified by the evidence. Similarly, bonding social capital ($\beta = 0.360$, $p < 0.001$) and bridging social capital ($\beta = 0.340$, $p < 0.001$) are significantly and positively correlated with psychological well-being. Hypothesis 3 and Hypothesis 4 are corroborated empirically. In addition,

Table 3
Statistical results of confirmatory factor analysis.

Constructs and items	Loading (>0.7)	T-value	SMC (>0.5)	CR (>0.7)	AVE (>0.5)
Health information acquisition (HIA)					
HIA1	0.817		0.667	0.798	0.569
HIA2	0.731	10.569	0.534		
HIA3	0.712	9.667	0.597		
Bonding social capital (BOC)					
BOC1	0.773	11.921	0.598	0.825	0.541
BOC2	0.709	10.951	0.503		
BOC3	0.744	11.568	0.554		
BOC4	0.714	11.182	0.510		
Bridging social capital (BRC)					
BRC1	0.726		0.527	0.819	0.530
BRC2	0.738	8.707	0.545		
BRC3	0.717	8.538	0.514		
BRC4	0.732	8.226	0.536		
Psychological well-being (PSW)					
PSW1	0.718		0.516	0.870	0.573
PSW2	0.724	10.817	0.524		
PSW3	0.751	12.577	0.564		
PSW4	0.807	13.431	0.651		
PSW5	0.782	13.07	0.612		
Physical well-being (PHW)					
PHW1	0.737		0.543	0.859	0.604
PHW2	0.832	14.076	0.692		
PHW3	0.825	13.994	0.681		
PHW4	0.708	11.053	0.501		

Notes: SMC, squared multiple correlations; CR, construct reliability; AVE, average variance extracted.

Table 4
Discriminant validity.

	HIA	BOC	BRC	PSW	PHW
HIA	0.754				
BOC	0.412	0.736			
BRC	0.421	0.580	0.728		
PSW	0.210	0.476	0.504	0.757	
PHW	0.204	0.440	0.287	0.599	0.778

Notes: HIA, health information acquisition; BOC, bonding social capital; BRC, bridging social capital; PSW, psychological well-being; PHW, physical well-being.

bonding social capital significantly and positively predicts physical well-being ($\beta = 0.416, p < 0.001$), supporting Hypothesis 5. However, there is no significant association between bridging social capital and physical well-being ($\beta = 0.124, p = 0.062 > 0.05$). Hypothesis 6 is rejected empirically. The outcomes of the hypotheses testing are depicted in Fig. 2. In evaluating the mediating effects, bootstrapping estimation is employed. As a method for testing mediation, bootstrapping is widely regarded as superior to alternative approaches like the Sobel test (Hayes, 2018; Jiang & Street, 2017; Zhang & Jung, 2022). This research generates a bootstrap of 95 % confidence intervals (CIs), utilizing a dataset comprising 5000 bootstrapping samples. The data indicates that health information acquisition fails to directly influence psychological well-being ($\beta = 0.017, SE = 0.064, 95 \% CI [-0.101, 0.149]$) and physical well-being ($\beta = 0.027, SE = 0.070, 95 \% CI [-0.106, 0.175]$). However, bonding social capital ($\beta = 0.175, SE = 0.044, 95 \% CI [0.105, 0.277]$) may significantly and completely serve as a mediator linking health information acquisition to psychological well-being, as well as bridging social capital ($\beta = 0.188, SE = 0.056, 95 \% CI [0.108, 0.338]$). The correlation between health information acquisition and physical well-being is significantly and completely mediated by bonding social capital ($\beta = 0.166, SE = 0.054, 95 \% CI [0.090, 0.317]$) and bridging social capital ($\beta = 0.090, SE = 0.043, 95 \% CI [0.022, 0.194]$). These results are illustrated in Table 5.

5.3. Multi-group invariance testing

Multi-group invariance (MGI) testing is a methodological approach facilitating researchers in ascertaining the equivalence (e.g., invariance) of parameters within a measurement model or structural model across two or diverse groups (Adeel et al., 2023; Byrne et al., 1989). Byrne et al. (1989) proposed an invariance procedure that circumscribed the measurement model to factor loading, factor correlation, and structural parameter explicating postulated structural correlations. Due to relatively small sample sizes in certain groups, the similar groups with limited samples were merged together prior to the multi-group invariance analysis. To investigate the invariance, it was assumed that the factor loading, factor correlation, and structural parameter for each group were identical. If the chi-square difference test between the baseline model and the constraint model is not statistically significant ($p > 0.05$), it indicates that these groups exhibited invariance with respect to those constraints (Adeel et al., 2023; Chin et al., 2016). Besides, even if the chi-square difference test between the baseline model and the

Table 5
Analysis of the mediation effect.

Path	Effect	β	Lower	Upper	Test result
Health information acquisition \rightarrow Psychological well-being	Direct Effect	0.017	-0.101	0.149	/
Health information acquisition \rightarrow Bonding social capital \rightarrow Psychological well-being	Indirect Effect	0.175	0.105	0.277	Complete mediation
Health information acquisition \rightarrow Bridging social capital \rightarrow Psychological well-being	Indirect Effect	0.188	0.108	0.338	Complete mediation
Health information acquisition \rightarrow physical well-being	Direct Effect	0.027	-0.106	0.175	/
Health information acquisition \rightarrow Bonding social capital \rightarrow Physical well-being	Indirect Effect	0.166	0.090	0.317	Complete mediation
Health information acquisition \rightarrow Bridging social capital \rightarrow Physical well-being	Indirect Effect	0.090	0.022	0.194	Complete mediation

constraint model is significant, the measurement invariance assumption can still be accepted if the change in the values of these fit indices (e.g., NFI, IFI, RFI, TLI) is relatively small (commonly used criterion < 0.05) (Li et al., 2020; Little, 1997). Based on these recommended values, this research model demonstrates acceptable invariance regarding factor loading, factor correlation, and structural parameter across multiple groups categorized by gender, age, educational background, expenditure, mobile app experience, and daily mobile usage time. Thus, this underscores the robustness of the research conclusions. The detailed outcomes of the invariance model are outlined in Table 6.

6. Discussion

6.1. Summary of the key results

The present study underscores the paramount significance of health information acquisition behavior on mobile app and struggles to statistically elucidate the prospective mechanistic association between health information acquisition and individuals' health status. Furthermore, this study systematically investigates a theoretical model that pinpoints the crucial mediating roles of bonding and bridging social capital, relating health information acquisition to well-being outcomes. More specifically, this investigation delves deeply into the mechanisms through which health information acquisition influences two facets of social capital, namely bonding and bridging. Furthermore, it aims to explore the ramifications of diverse forms of social capital on both psychological well-being and physical well-being.

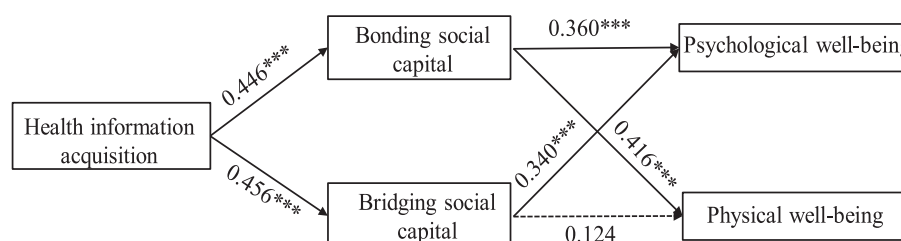


Fig. 2. Outcomes for the structural equation model.

Table 6
Multi-group invariance testing.

	Model Comparison	Df diff	CMIN diff	p-values	NFI diff	IFI diff	RFI diff	TLI diff
Gneder	Unconstrained vs Measurement weights	16	26.402	0.049	0.008	0.009	-0.002	-0.002
	Measurement weights vs Structural weights	6	31.952	0.000	0.01	0.011	0.007	0.008
	Structural weights vs Structural covariance's	1	8.463	0.004	0.003	0.003	0.002	0.002
Age	Unconstrained vs Measurement weights	32	54.177	0.008	0.015	0.018	0.001	0.001
	Measurement weights vs Structural weights	12	39.938	0.000	0.011	0.014	0.006	0.007
	Structural weights vs Structural covariance's	2	2.263	0.323	0.001	0.001	0.000	0.000
Educational background	Unconstrained vs Measurement weights	16	22.813	0.119	0.007	0.008	-0.002	-0.002
	Measurement weights vs Structural weights	6	19.196	0.004	0.006	0.007	0.003	0.003
	Structural weights vs Structural covariance's	1	0.359	0.549	0.000	0.000	0.000	-0.001
Expenditure	Unconstrained vs Measurement weights	32	39.035	0.183	0.011	0.014	-0.005	-0.006
	Measurement weights vs Structural weights	2	22.745	0.03	0.007	0.008	0.001	0.001
	Structural weights vs Structural covariance's	8	1.125	0.57	0.000	0.000	-0.001	-0.001
Experience using mobile app	Unconstrained vs Measurement weights	32	62.58	0.001	0.018	0.021	0.003	0.003
	Measurement weights vs Structural weights	12	12.264	0.425	0.004	0.004	-0.003	-0.003
	Structural weights vs Structural covariance's	2	11.112	0.004	0.003	0.004	0.002	0.003
Daily mobile use time	Unconstrained vs Measurement weights	32	45.641	0.056	0.013	0.016	-0.002	-0.003
	Measurement weights vs Structural weights	12	35.553	0.000	0.010	0.012	0.005	0.006
	Structural weights vs Structural covariance's	2	16.096	0.000	0.005	0.006	0.004	0.005

Firstly, these results uncover that health information acquisition significantly exhibits a positive influence on cultivating two distinct forms of social capital (e.g., bonding and bridging), as the first two hypotheses predicted. The positive connections provide consistent evidence with existing literature, affirming that social media usage exhibits a positive association with the production of social capital (Bano et al., 2019; Chen & Li, 2017; Dong et al., 2023). This paper echoes and expands upon the strongly positive correlation between mobile app usage and social capital. College students who gravitate toward acquiring health information via mobile app could have a greater propensity to accrue social capital advantages. Moreover, health information acquisition has a relatively higher degree of predictability in fostering bridging social capital as opposed to bonding social capital. One potential explanation could be that tech-savvy college students, possessing higher eHealth literacy, can readily access more health-related information and diverse perspectives from others. These factors constitute core elements of bridging social capital (Blebil et al., 2023).

Secondly, these two forms of social capital (e.g., bonding and bridging) are revealed as key facilitators for improving psychological well-being, thereby corroborating the third and fourth hypotheses. These results are congruent with several earlier investigations (Arriola et al., 2024; Bano et al., 2019; Simons et al., 2020), which demonstrates that the high degrees of bonding and bridging social capital are favorable for individuals' psychological well-being. Social capital has the potential to alleviate stress through rewarding connections, trust, and the advantages of social interaction, which in turn may positively influence well-being (Xue et al., 2020). Additionally, although the research pathways discover no direct relationship between health information acquisition and psychological well-being, two forms of social capital significantly and completely mediate the association. This implies that subsequent digital media academics need to refrain from overstating the direct linkage between mobile app usage and psychological well-being (Chan, 2023; Guo & Chen, 2022). Concurrently, the indirect ramifications of mobile app usage on psychological outcomes suggest that obtaining health information online fosters the cultivation of both bonding and bridging social capital, sequentially empowering mobile app to bolster psychological well-being.

Thirdly, this research corroborates that bonding social capital significantly and positively influences physical well-being, which is in accordance with previous studies (Ihm & Lee, 2021; Xue et al., 2020; Zhang & Jiang, 2019). Moreover, the linkage between health information acquisition and physical well-being is significantly and completely mediated by bonding and bridging social capital. Contrary to initial expectations, empirical findings reveal that bridging social capital does not directly emerge as a prominent predictor of physical well-being among college students. The insignificant correlation could be

attributable to the fact that despite the abundance of information and resources available from broad social networks, they cannot easily and directly substitute exercise at the gym or health services from hospitals (Ihm & Lee, 2021). Therefore, the association between bridging social capital and physical well-being remains still unclear. Nonetheless, the absence of a significant direct impact does not preclude a connection between bridging social capital and physical well-being. Alternatively, it necessitates a more thorough demonstration of the indirect mechanisms that can potentially link bridging social capital to physical well-being.

6.2. Theoretical and practical implications

The investigation augments the existing scholarship across diverse facets. Firstly, the present study statistically establishes and validates a research model of mobile app usage for health information acquisition by systematically elucidating health benefits among college students in mainland China. These findings elucidate that the endeavor of seeking health information can enhance college students' well-being by amplifying two forms of social capital. Consequently, the study offers a valuable expansion to scholarly comprehension of individuals' health information acquisition behavior through mobile app. Secondly, this research model accurately identified social capital, particularly bonding and bridging social capital, as a vital mediator in the relationship between mobile app usage and health consequences. By taking into account these two discrete dimensions of social capital, this study reconciles highly divergent and inconclusive findings pertaining to the correlation between media usage and health outcomes in the earlier research literature. Thirdly, this study considers the impact of mobile app usage from physical aspects by examining physical well-being outcomes of seeking health information. The findings identify specifically bonding social capital accumulated from mobile app can have a positive effect on individuals' physical well-being. Accordingly, the examination enriches the current academic discourse surrounding mobile app and broadens academics' theoretical comprehension of how mobile app use benefits individuals' physical well-being.

These obtained conclusions offer evidence-based guidelines to guide healthcare professionals and mobile app developers in promoting certain products and services. Firstly, acknowledging the pivotal role of health information acquisition behavior in social capital and well-being, health practitioners are supposed to proactively harness mobile app to convey professional medical knowledge. Moreover, it is highly advisable for them to create digital information spaces that make it easier to obtain health-related content. This implies that health communicators must prioritize generating valuable content that is accurate, concise, and easily understandable, thus enabling users to efficiently access the necessary information. Furthermore, mobile app designers should

contemplate incentivizing the broad populace to participate in health-related activities through interactive communication components (e.g., reminders, push notifications and personalized feedback) (Oakley-Girvan et al., 2022). Future interface designs should also be oriented toward facilitating the acquisition of additional relational resources through the process of seeking health information. For instance, while individuals utilize mobile app for health information acquisition, distinct communication attributes such as tagging could be linked to the content retrieval and discussion, thus building and strengthening relational interactions among users.

6.3. Limitations and implications for future research

Notwithstanding the salient effects observed, there exist a few limitations that warrant careful consideration and appropriate addressing in future research. Firstly, due to the inherent limitations of cross-sectional statistics, it is inherently difficult to determine causality between mobile app usage, heightened social capital, and well-being. Individuals with higher levels of well-being may demonstrate an increased inclination to seek health information to maintain their state, while those with elevated levels of social capital may be more prone to accessing health information through interpersonal networks. Consequently, researchers should consider conducting longitudinal investigations to monitor long-term changes and outcomes, thus shedding light on the directionality of these relationships. Secondly, as the sample is limited to college students in mainland China, the outcomes might not be universally applicable to the entire spectrum of Chinese youth. Thus, it is crucial for forthcoming studies to explore other segments of young populations, such as young professionals in the workforce, to broaden the scope of these findings. Besides, while efforts were made to improve representativeness within the sample, the proportions may not align perfectly with the overall population distribution in terms of generalizing findings to the broader population of Chinese college students. Subsequent research endeavors should ensure a more balanced representation of students across various academic stages (undergraduate, master, doctor) or disciplines to capture a comprehensive perspective of the college students. This may entail the implementation of targeted sampling strategies or fostering collaborations with an array of educational institutions. Thirdly, the evaluation of well-being outcomes relies on college students' subjective perceptions of their psychological and physical well-being states. While this measurement is convenient and frequently utilized, it may introduce bias as individuals exclusively rely on their cognitions when responding to related questions. This calls for future scholars to explore more objective methodologies to appraise well-being outcomes.

7. Conclusion

The empirical model outlined in this paper seeks to substantially deepen a nuanced understanding of the intricate association between health information acquisition and advancements in well-being outcomes. Moreover, this research further expounds upon the mediating roles of two distinct forms of social capital (e.g., bonding and bridging). The results present a solid body of evidence elucidating the mechanism by which health information acquisition on mobile app indirectly spawns favorable well-being consequences. The hypothesized research model affirms that health information acquisition is correlated positively with bonding and bridging social capital, subsequently predicting heightened psychological well-being. The positive influence of bonding social capital on physical well-being has been observed, however the relationship between bridging social capital and physical well-being remains inconclusive. At the same time, this study underlines the significance of mobile app as an indispensable component of driving advances in social relationships and health care. Recognizing its extensive potential, forthcoming scholars may prioritize the investigation of how to exploit mobile app and digital technologies in population health promotion.

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CRediT authorship contribution statement

Hua Pang: Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Data curation, Conceptualization. **Yi Wang:** Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation. **Wanting Zhang:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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