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International students' psychosocial well-being and social media use at the onset of the COVID-19 pandemic: A latent profile analysis

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ABSTRACT

This study examined the link between the psychosocial well-being and social media use of international students in the US at the onset of the COVID-19 pandemic, when social isolation was mandated. Unlike prior research, which has typically focused on a single aspect of psychosocial well-being, we conceptualized international students' well-being as a multidimensional construct including internalizing symptoms (i.e., depression, anxiety, loneliness) as well as markers of intercultural difficulties. We then investigated social media use as a function of international students' idiosyncratic well-being vulnerabilities. A latent profile analysis revealed four groups with distinctive psychosocial profiles: well-adjusted students, interculturally adjusted students with internalizing symptoms, students with low internalizing symptoms but high intercultural difficulties, and maladjusted students with high internalizing symptoms and high intercultural difficulties. Supporting the social compensation perspective, maladjusted international students reported the highest engagement with social media compared to the other groups. These findings shed light on the unique and heterogenous experiences of international students at the onset of the pandemic. They also add nuance to the social compensation hypothesis by delineating person-specific associations between psychosocial well-being and social media use.

The COVID-19 pandemic has brought questions about individuals' psychosocial well-being into focus. Studies have documented increases in depression (Wang et al., 2021), anxiety (Kibbey et al., 2021), and loneliness (Bonsaksen et al., 2021) among both the general population (Xiong et al., 2020) and vulnerable populations such as children (Liu et al., 2020) and older adults (Vahia et al., 2020). This research has revealed important insights into individuals' struggles during the pandemic, but it has tended to look at well-being indicators one at a time rather than capture how these well-being struggles *co-occur* within individuals. International students studying abroad comprise one group who is susceptible to multiple and simultaneous well-being struggles. At the onset of the pandemic, these young adults were subject to both chronic psychopathological issues, such as anxiety and depression, and situational adversities, presenting a unique opportunity to capture their idiosyncratic vulnerabilities based on a variety of well-being indicators.

While facing these challenges, international students were forced to cut back their social ties and face-to-face interactions due to social isolation polices at the beginning of the pandemic. Thus, mediated communication for interpersonal functions, colloquially known as social media, became a critical means of satisfying their social needs, thereby raising questions about how international students with distinctive psychosocial vulnerabilities use social media. Drawing on the social compensation perspective (Valkenburg & Peter, 2009), we conceptualize psychosocial well-being as a precursor to social media use. In particular, research in this paradigm has argued that psychosocial vulnerabilities, such as depression or loneliness, predict a higher likelihood of social media use, because individuals with such psychosocial problems perceive mediated environments as more comfortable than face-to-face interaction (High & Caplan, 2009; Valkenburg & Peter, 2007). However, most of these empirical findings have focused on only one aspect of psychosocial well-being or between-group effects (e.g., individuals with high depression engage in more social media use than those with low depression), precluding more detailed investigations into interindividual variations (Jung & Wickrama, 2008). In contrast,

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communication scholars are calling for a person-centered approach to illustrate distinctive personal experiences in relation to social media use (see Valkenburg et al., 2021).

In response to this call, we surveyed international students' experiences at the onset of the COVID-19 pandemic and used a latent profile analysis (LPA) to identify various psychosocial profiles, delineating groups of international students according to the extent to which they experienced different well-being issues. We then investigated a link between the emergent psychosocial profiles and social media use. To provide a granular examination of international students' social media use in relation to their well-being, we differentiated passive versus interactive forms of social media use in combination with the different social networks that international students used for socializing. In this study, social media was defined broadly to include both social network sites (SNSs) and dyadic/small group communication channels (e.g., texting, phone calling).

1. Psychosocial well-being: International students at the onset of the pandemic

At the onset of the pandemic, international students were particularly prone to various psychosocial challenges. Restricted travel opportunities made it unfeasible for many of them to return home. Thus, while adjusting to life overseas, these young adults had to face the possibility of becoming seriously ill and the demands of self-isolation in a foreign country—all without immediate access to traditional sources of support. In addition to pandemic-related challenges, some international students might have had chronic psychosocial concerns prior to the pandemic, such as anxiety and depression (e.g., Han et al., 2013; Shadowen et al., 2019). According to Lahey et al. (2017), one way to understand well-being is to capture individuals' psychosocial vulnerabilities from various perspectives, including chronic psychopathological disorders or dysfunctions *and* situational factors inhibiting optimal psychological functioning. Considering this line of thinking, and based on international students' experiences, we specify two domains that are most related to international students' psychosocial well-being during the pandemic: *internalizing symptoms* and *intercultural difficulties*.

1.1. Internalizing symptoms

These are psychopathological disorders characterized by suppressed emotions, inflexible cognition, and overcontrolled behaviors (Wang et al., 2021). Depression, anxiety, and loneliness are three main manifestations of internalizing symptoms that are highly prevalent among young adults (Sarmiento et al., 2020; Wang et al., 2021). Depressive symptoms are characterized by feelings of sadness, frustration, and hopelessness, as well as loss of pleasure in most normal activities (Gross & Jazaieri, 2014). Anxiety symptoms are characterized by frequent feelings of nervousness or unease and having a sense of impending danger (Pilkonis et al., 2011). During the COVID-19 pandemic, the occurrence of depression and anxiety registered an uptick among college students (Kibbey et al., 2021).

Loneliness refers to the feeling of being apart or left out from one's desired social networks (Beutel et al., 2017). Based on Weiss's (1973) conceptualization, we specify two types of loneliness: dispositional loneliness and situational loneliness. Dispositional loneliness indicates a generalized tendency to think that relationships with others are missing or inadequate because of estrangement and rejection, leading to prolonged and persistent feelings of isolation (Dahlberg & McKee, 2014). Prior research has found that 10–20% of young adults experienced some degree of chronic loneliness, which has in turn been linked to alcoholism, suicide, and other psychopathological symptoms (Beutel et al., 2017). Situational loneliness refers to feelings of isolation that arise in or are heightened by certain circumstances, such as job or relationship changes, or separation from family and/or friends. In the early days of the pandemic, people were instructed to practice social isolation (World Health Organization, 2020). This implies maintaining physical distance from people outside the household, thereby likely elevating situational loneliness (Bonsaksen et al., 2021). Considering both dispositional and situational loneliness provides a nuanced conceptualization of this well-being indicator.

1.2. Intercultural difficulties

These refer to psychosocial challenges associated with adapting to a new cultural setting (Berry, 2005). While studying abroad, international students need to adapt to an unfamiliar cultural context with language, norms, and values that might be quite different from their own. This process can take a significant amount of time and effort and tends to be accompanied by feelings of homesickness due to missing family, friends, and the comfort and familiarity of home (Kim, 2017; Rathakrishnan et al., 2021). Sometimes international students experience feelings of alienation and social rejection due to their foreign or immigrant status (i.e., perceived hate), and in more extreme cases they even experience discrimination, ostracism, or derogatory behavior due to their racial or cultural background (Berry, 2005). These feelings of homesickness, hatred, and discrimination have been shown to be common experiences during all stages of international students' stay abroad (Jackson et al., 2019). Moreover, the pandemic might have placed extraneous burdens upon these students due to disruption in their pursuit of educational degrees and unpredictability regarding their travel plans. A recent survey of international students in the US documented surging concerns over their own health and foreign status (Chirikov & Soria, 2020). Plus, due to the origin of the coronavirus, international students, especially those of Asian descent, reported increasing incidents of perceived hate and discrimination (Lee & Waters, 2021;Yang et al., 2020).

In summary, international students faced a wide range of psychosocial challenges at the onset of the pandemic, ranging from internalizing concerns (i.e., depression, anxiety, dispositional and situational loneliness) to intercultural difficulties (i.e., homesickness, hate, discrimination). These factors could impact these students' overall psychosocial well-being *simultaneously*; however, their experiences should be idiosyncratic. For instance, some international students might have struggled with heightened intercultural difficulties without displaying any internalizing symptoms, while others faced both challenges at the same time. Until now, little research has taken the co-occurrence of these psychosocial challenges into account. Thus, the first aim of this study is to identify international students' psychosocial profiles based on a combination of psychological well-being markers. While dealing with these difficulties, international students were put under social isolation at the beginning of the pandemic, leaving them little opportunity to meet their social needs. This restriction raises another critical question: To what extent did international students use social media for tackling various well-being vulnerabilities?

2. The social compensation perspective: Well-being as a precursor of social media use

Several theoretical frameworks have considered psychosocial well-being as a precursor of social media use, meaning that individuals' well-being can be expected to influence how they use technology for social interactions (see Valkenburg & Peter, 2009). One prominent such framework is the social compensation hypothesis (e.g., Toma, 2022; Valkenburg & Peter, 2007), according to which social media provide needed resources for socially disadvantaged individuals (e.g., those who are lonely or have low social competence). These individuals often have difficulties in maintaining rich and strong social ties in face-to-face environments due to their fear of negative evaluation or their relatively low social competence. They tend to find social media more comfortable, controllable, and able to help them augment their limited social networks.

In support of this claim, research has shown that lonely adolescents

perceive online communication as a more comfortable environment for self-disclosure than face-to-face contact, resulting in higher level of social media use (Cauberghe et al., 2021; Valkenburg & Peter, 2007). Following the social compensation logic, researchers argue that individuals struggling with chronic psychopathological issues (e.g., depression, anxiety) may attempt to compensate for their regular psychosocial challenges over social media as well (Caplan, 2010; O'Day & Heimberg, 2021). Consistent with this theoretical account, a higher frequency of social media usage has been associated with lower life satisfaction (Ellison et al., 2007; Ponnusamy et al., 2020), heightened stress (Apaolaza et al., 2019; Frison & Eggermont, 2015), and higher social anxiety (Jelenchick et al., 2013; Valkenburg & Peter, 2007).

Other than these chronic psychosocial issues, increased social media use has been documented among individuals going through life transitions, such as incoming college students (Ruppel et al., 2018), immigrants (Chen & Choi, 2011) and international students (Mikal & Grace, 2012). These findings largely align with the social compensation perspective. Convenient access to social networks online enables individuals in transition to maintain their social needs. This is of great significance to international students, as they have limited social ties while transitioning to a new cultural setting. Those with fewer social connections are likely to gather information about their new surroundings, from culture to language, through social media (e.g., Mikal & Grace, 2012). Although international students may encounter xenophobic or hateful speech on social media (Allen & Ye, 2021), research shows they heavily rely on social media to elicit social support and cope with these intercultural adversities (e.g., Li & Peng, 2019; Saud et al., 2020).

3. Social media use among international students

In the present study, we conceptualize social media use in a granular way. While early research has focused on individuals' frequency of media use (e.g., screen time), an increasing number of studies have been advocating for an activity-based approach, as different activities on social media bear different psychological implications (e.g., Burke et al., 2011; Yang, 2016). One way to group these social media activities is by distinguishing passive versus interactive uses(Yang et al., 2021). Passive use refers to browsing through social network messages or postings without directly interacting with anyone. This is prevalent on SNSs, where users can engage in surveillance of individuals from their social networks (Burke et al., 2020). In contrast, interactive use refers to engaging in direct interaction with a communication partner via social media, whether through lightweight engagement (e.g., likes, comments) or reciprocal conversations (e.g., texts, phone conversations, video chatting) (Ellison et al., 2014). Current research has found positive effects of interactive usage on well-being, while negative outcomes are associated with passive usage (Verduyn et al., 2015; Yang et al., 2021). However, limited research has considered how psychosocial well-being could shape individuals' liklihood of engaging in passive versus interactive forms of social media use.

In addition to social media activities, one essential yet often understudied dimension of social media use is the communication partner: the person with whom users talk to or whose posts they browse online (see Yang et al., 2021). Here, we approach this issue by focusing on the homophily between international students and their social networks. Social networks with high homophily are made up of friends, family members, or social contacts, who share similar characteristics and serve significant social functions (i.e., see McPherson et al., 2001). This characteristic is particularly critical to our population of interest because prior research has found that international students prefer online interaction with networks with high homophily (e.g., individuals from their home country), which in turn benefited their well-being (e.g., Li & Peng, 2019; Park & Noh, 2018).

Based on geographic location and cultural homophily, we categorize international students' social networks into three groups. First, the *home network* refers to individuals who share the cultural backgrounds of international students and live in their home country (e.g., friends/family who live in international students' home country). Second, the *home network in the host country*(here, the US) consists of friends or acquaintances who have relocated to the US from the same country (e.g., friends/family who currently reside in the U.S. but originate from the same home country). Members in this network also share the same cultural background and similar migrant experiences. Finally, the *host network*, (here, a US network), refers to individuals who are US natives and do not share international students' cultural backgrounds. This network tends to have the lowest cultural homophily.

4. Current study: A person-centered approach

The current study uses LPA, a person-centered statistical method, to identify a typology of international students' psychosocial well-being at the onset of the pandemic based on their internalizing symptoms and intercultural difficulties. We examine if the emergent groups engaged in interactive and passive uses of social media with their various social networks differently. Unlike traditional cluster analysis, class membership identified through LPA is not determined by arbitrary cut-off points but by using different estimators (e.g., maximum likelihood estimation) to combine multiple indicators of the target construct (Eshghi et al., 2011; Muthén & Muthén, 2000). In the present study, this means that LPA would help uncover how international students can be grouped based on a comprehensive combination of well-being markers (e.g., depression, anxiety, loneliness, homesickness, perceived hate, etc.). Groupings derived from LPA provide the following key information regarding profile characteristics (Nylund et al., 2007): (a) the extent to which international students' well-being is heterogeneous (e.g., more vs. fewer identified profiles) and (b) differences between groups delineated in terms of how each well-being indicator is associated with a given profile (e.g., international students with high internalizing symptoms but low intercultural difficulties). Considering the need to illustrate idiosyncratic psychosocial experiences, our first aim was to use LPA to uncover international students' well-being make-up using a mix of indicators. Thus, we sought to answer the following:

RQ1. What psychosocial well-being profiles can be identified for international students at the onset of the pandemic, based on internalizing symptoms and intercultural difficulties?

Another advantage of LPA suits our second study aim, which was to investigate international students' social media use as a function of their distinctive well-being vulnerabilities. Oftentimes, empirical investigations of psychosocial well-being and social media rely heavily on one aspect of well-being vulnerabilities (e.g., lonelier adolescents prefer social media in comparison to less lonely adolescents; Valkenburg & Peter, 2007). However, an incipient literature has pointed out that individuals' experiences on social media are *not* monolithic but rather person-specific (e.g., Scott et al., 2017; Valkenburg et al., 2021). Via LPA, Scott et al. (2017) categorized young adults' social media use into three groups and illustrated the demographic differences and individual traits associated within the identified groups. Moreover, Valkenburg et al. (2021) found that the influence of social media on adolescents' well-being can vary from small negative and small positive to null effects at the individual level. A related question, mirroring these person-specific effects, is whether the tendency to use social media can also differ from individual to individual based on their idiosyncratic well-being vulnerabilities. LPA permits this test for differences in other variables of interests (e.g., international students' social media use) among identified profiles (Nylund-Gibson et al., 2019).

Guided by the social compensation perspective, we argue that an individual's psychosocial problems and social difficulties may serve as the precursor to frequent social media use. This perspective would suggest that international students with *both* internalizing symptoms and intercultural difficulties frequently engage in social media use. Yet,

current research has not specified to what extent individuals with a relatively complex psychosocial makeup (e.g., those who might experience certain internalizing symptoms but not intercultural difficulties) like to use social media, especially during a time of limited face-to-face opportunities. Thus, utilizing the profiles from RQ1, the current study makes an important contribution to past theorizing on social compensation by exploring social media use as a function of idiosyncratic well-being vulnerabilities. Considering all types of social media use as specified above (i.e., passive and interactive use with three different networks), we ask the following:

RQ2. In what ways are international students' psychosocial profiles associated with different types of social media use?

5. Method

5.1. Participants and procedure

A total of 441 international students (57.8% females, $M_{age} = 24.41$) attending the University of Wisconsin-Madison took part in the study. They came from 62 countries, with the largest groups originating from mainland China (38.1%), India (13.9%), and South Korea (7.0%). An additional 23.1% came from other Asian countries, 7.5% from Latin America, 5.9% from Europe, 2.5% from Africa, and the rest (2%) from Australia, Canada, and New Zealand. Undergraduate students constituted 45.8% of the participants (compared to 50.0% at the university), followed by doctoral students (33.3%) and master's students (20.9%).

The registrar's publicly available email directory was used to contact all international students attending the university during the spring semester of 2020. By participating, students could either earn 25 dollars through a random draw or extra credit in their classes. To keep geographic location constant, we only included international students who were living in the US during the study. The survey was administered on Qualtrics from mid-March to mid-April 2020, when a state-wide mandate of social isolation was in place (e.g., residents were forced to stay at home except for essential activities, businesses were closed, and schools moved to online instruction). All study procedures were approved by the review board of the researchers' institution.

5.2. Measures

Participants self-reported their psychosocial well-being, social media use, and demographics. The answer options for all measures of psychosocial well-being and social media use ranged from 1 (*not at all*) to 7 (*very much*). When responding to these items, participants were instructed to reflect on their experiences only within during the time that they had experienced social isolation due to the COVID-19 pandemic. We described these measurements in two subsections based on our LPA model: (a) measurement of the unconditional LPA model that created international students' psychosocial well-being profiles (i.e., situational loneliness, dispositional loneliness, anxiety, depression, perceived hate, discrimination, homesickness) and (b) measurements of social media use, which were added to the conditional LPA model as outcome variables (typically called "distal variables" in conditional LPA models) (e.g., Nylund-Gibson et al., 2019).

5.2.1. Psychosocial well-being

We measured psychosocial well-being using two main constructs: internalizing symptoms and intercultural difficulties. Internalizing symptoms include depression, anxiety, and situational and dispositional loneliness. *Anxiety* was measured using the NIH Patient-Reported Outcomes Measurement Information System (PROMISE) (Pilkonis et al., 2011), including six items such as "My worries overwhelmed me" and "I felt I need help for my anxiety" ($M = 3.24$, $SD = 1.82$, $\alpha = 0.95$). *Depression* was also measured with the NIH PROMISE scale (six items such as "I felt depressed" and "I felt hopeless"; $M = 3.14$, $SD = 1.72$, $\alpha = 0.93$). Next, participants were asked to reflect on their general experiences regarding loneliness (i.e., *dispositional loneliness*) based on the NIH Toolbox Adult Social Relationship Scales (Cyranowski et al., 2013), including five items such as "I feel alone and apart from others" and "I feel left out" ($M = 3.25$, $SD = 1.80$, $\alpha = 0.92$). Finally, *situational loneliness*, referring to loneliness resulting from pandemic-related social isolation, was measured with three questions developed for this study, including "To what extent do you feel apart from others due to being quarantined at home?" and "To what extent do you feel that you are no longer close to anyone due to being quarantined at home?" ($M = 4.11$, $SD = 1.80$, $\alpha = 0.86$).

Intercultural difficulties were assessed with subscales from the well-validated scale of internationals students' acculturative stress (Sandhu & Asrabadi, 1994). These included *homesickness* (three items such as "I feel sad leaving my relatives behind"; $M = 3.80$, $SD = 1.83$, $\alpha = 0.84$), *perceived hate* (three items such as "People show hatred toward me verbally"; $M = 1.95$, $SD = 1.37$, $\alpha = 0.89$), and *perceived discrimination* (four items such as "I feel that I receive unequal treatment"; $M = 3.00$, $SD = 1.64$, $\alpha = 0.84$).

5.2.2. Distal variable: Social media use

One of the benefits of LPA is that distal outcomes can be added in the conditional model enumeration, meaning that it is possible to examine how the profiles that emerge from the data relate to the outcome variables of interest. Statisticians term these outcome variables as distal variables in LPA, and we adopted this language here (see Nylund-Gibson et al., 2019). Thus, we added measures of social media use as distal outcomes in the conditional LPA model to estimate the distal means for each psychosocial profile.

We assessed international students' social media use with three social networks, including *home network* (i.e., members of the participants' social network who simultaneously resided in their home countries), *US network* (i.e., members of the participants' social network who simultaneously resided in the US and did not share the participants' cultural background and/or nationality), and *home network in the US* (i.e., members of the participants' social network who shared their cultural background and/or nationality and also simultaneously resided in the US). These three networks were carefully defined for the participants, who were asked to report their passive and interactive media use separately for each of these networks during the two-week period prior to the survey.

Given the dearth of appropriate measures in the literature, we developed our own scales for the social media usage of interest (i.e., passive use and interactive use). Items were developed iteratively through consultations with prior scales (e.g., Ellison et al., 2014), interviews with international students, and multiple revisions by the authors. A total of 11 items were created (see Appendix for verbatim items). Passive media use was assessed with five items asking participants to indicate to what extent they browsed online posts by the corresponding network (e.g., "Browse information about [network members'] lives that they shared on SNSs," "Browse entertainment news articles that [network members] shared on SNSs"). Interactive media use was assessed with six items asking participants to indicate to what extent they interacted online with the corresponding network (e.g., "Video chat with [network members]," "Send private messages (e.g., texts, instant messages) to [network members]"). We validated our measures through a confirmatory factor analysis that showed an excellent fit for the data to our model for all three networks (US network: $\chi^2/df = 2.59$, $p < .001$; RMSEA = 0.07; CFI = 0.98; SRMR = 0.04; home network: $\chi^2/df = 2.24$, $p < .001$; RMSEA = 0.06; CFI = 0.98; SRMR = 0.04; home network in the US: $\chi^2/df = 2.71$, $p < .001$; RMSEA = 0.08; CFI = 0.98; SRMR = 0.04).

In summary, six composite variables assessed various aspects of media use: interactive media use with the US network ($M = 3.46$, $SD = 1.52$, $\alpha = 0.88$), passive media use with the US network ($M = 3.62$, $SD = 1.69$, $\alpha = 0.91$), interactive media use with the home network ($M = 4.45$,

SD = 1.46, α = 0.83), passive media use with the home network (*M* = 4.40, *SD* = 1.55, α = 0.88), interactive media use with the home network in the US (*M* = 4.05, *SD* = 1.56, α = 0.87), and passive media use with the home network in the US (*M* = 4.14, *SD* = 1.72, α = 0.91). The mean of each of these types of interactive and passive use were used as distal variables in the conditional LPA model.

6. Results

6.1. Detecting latent profiles

Table 1 shows the bivariate correlations among the key variables in the present study. All indicators of psychosocial well-being were moderately correlated; however, LPA provides a much more granular depiction of individuals' psychosocial well-being profiles than a correlation analysis. Therefore, we used LPA first to identify latent psychosocial profiles among international students. This procedure included all the psychosocial variables (i.e., depression, anxiety, situational loneliness, dispositional loneliness, perceived hate, perceived discrimination, homesickness) and was performed using the *MplusAutomation* R package for LPA (Hallquist & Wiley, 2018) with full information maximum likelihood estimators and randomly chosen starting points. In a stepwise approach, we started with an unconditional model with one latent profile, followed by models with two to five profiles.

We used a suggested set of fit indices to assess model fit (see Nylund-Gibson et al., 2019), including Akaike information criterion (AIC), Bayesian information criteria (BIC), adjusted Bayesian information criteria (aBIC), entropy, Lo–Mendell–Rubin likelihood ratio test (LMR), and bootstrap likelihood ratio test (BLRT). We used lower AIC, BIC, and aBIC as overall indicators of model fit; these were the *p*-value for LMR and BLRT as incremental fit indices to assess if the addition of a latent profile improved model fit (i.e., a *p*-value less than .05 indicates statistically significant improvement) and entropy values ranging from 0 to 1 as indicators for the accuracy of the model classification, with higher values being indicative of higher classification accuracy.

Table 2 shows the model fit for one to five-profile models. Although the five-profile model had the lowest values of AIC, BIC, and aBIC with significant LMR and BLRT, it is challenging to interpret its classifications based on well-being indicators. In contrast, the four-profile model had the second-lowest scores on AIC, BIC, and aBIC as well as significant LMR and BLRT. It also had the highest entropy score, indicating the best classification accuracy among other models, as well as relatively high posterior probabilities, indicating that participants were classified into four mutually exclusive profiles. More importantly, the four-profile model, as discussed later, had the most meaningful classifications with well-being indicators. Therefore, the four-profile model was selected as the final solution in the present study.

6.2. RQ1: Latent profile descriptions

RQ1 asked what types of psychosocial profiles could be identified based on intercultural difficulties and internalizing symptoms experienced by international students in the US. Below, each profile is labeled based on the observed mean values of each well-being indicator for the four-profile model, as reported in Fig. 1.

The largest profile of international students (*n* = 189, 42.86%) reported the lowest level of all the internalizing variables along with the lowest level of intercultural difficulties. Thus, we labeled these international students as the *well-adjusted* group. The second largest profile of international students (*n* = 142, 32.2%) showed a relatively low level of intercultural difficulties but a much higher level of internalizing symptoms. We labeled these international students as *interculturally adjusted with internalizing symptoms*. In contrast, the third profile comprised international students who reported relatively low levels of internalizing symptoms but high intercultural difficulties. We labeled this group as *low internalizing symptomsbut high intercultural difficulties* (*n* = 55, 12.47%). The last profile of international students (*n* = 55, 12.47%) reported high levels of internalizing symptoms as well as high intercultural difficulties. We labeled them as the *maladjusted* group.

In summary, it appears that international students in the US had different experiences in relation to their psychosocial well-being at the onset of the pandemic. While we found most of this population to be well-adjusted, three distinctive groups facing various sets of challenges emerged. Internalizing symptoms tended to be quite potent within many international students; specifically, both students in maladjusted and interculturally adjusted with internalizing symptoms profiles had mean scores higher than the mid-point of the scale for all variables of internalizing symptoms. When comparing maladjusted international students with those interculturally adjusted with internalizing symptoms, the mean values for their internalizing symptoms (i.e., dispositional and situational loneliness, anxiety, depression) were relatively similar. What distinguished them were their intercultural experiences. Heightened hate, discrimination, and homesickness comprised an additional challenge for the maladjusted international students.

6.3. RQ2: Social media use and psychosocial profiles

Having identified the four psychosocial well-being profiles described

Table 1
Bivariate Correlations between Indicators of Psychosocial Well-being and Social Media Use by Networks.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Intercultural difficulties													
1. Perceived hate	–												
2. Perceived discrimination	.66***	–											
3. Homesickness	.24***	.27***	–										
Internalizing symptoms													
4. Situational loneliness	.22***	.24***	.45***	–									
5. Dispositional loneliness	.23***	.27***	.38***	.76***	–								
6. Depression	.24***	.31***	.38***	.57***	.74***	–							
7. Anxiety	.19***	.24***	.39***	.60***	.70***	.78***	–						
Media use with various networks													
8. Passive use - US	.13**	.09	.13**	.14**	.08	.14**	.19***	–					
9. Interactive use - US	.10*	.04	.07	.08	.04	.10*	.15**	.73***	–				
10. Passive use - Home	.07	.11*	.31***	.12*	.06	.10*	.10*	.36***	.18***	–			
11. Interactive use - Home	−.01	.02	.35***	.13**	.04	.06	.09*	.26***	.23***	.72***	–		
12. Passive use - Home US	.16***	.23***	.27***	.11*	.03	.04	.05	.27***	.13**	.60***	.45***	–	
13. Interactive use - Home US	.15**	.17***	.30***	.13**	.04	.04	.03	.21***	.21***	.43***	.51***	.75***	–
M	1.95	3.00	3.80	4.11	3.25	3.14	3.24	3.62	3.46	4.40	4.45	4.14	4.05
SD	1.37	1.64	1.83	1.80	1.80	1.72	1.82	1.69	1.52	1.55	1.46	1.72	1.56

Note. *$p < .05$; **$p < .01$, ***$p < .001$. All variables here were measured with 7-point Likert scales. US = US network, Home = home network, Home US = home network in the US.

Table 2
Fit Indices for Five Models using Latent Profile Analysis (N = 441).

Profile	AIC	BIC	aBIC	*p*LMR	*p*BLRT	Entropy	Group size for each profile				
							1	2	3	4	5
1-profile	12075.7	12133.0	12088.5	–	–	–	441				
2-profile	11085.2	11175.1	1105.3	0.000	0.000	0.889	263	178			
3-profile	10851.2	10973.8	10878.6	0.000	0.000	0.862	204	150	87		
4-profile	10664.4	10819.8	10699.2	0.009	0.000	**0.919**	189	142	55	55	
5-profile	**10504.0**	**10692.1**	**10546.1**	0.005	0.000	0.896	160	121	54	51	55

Note. Numbers in bold indicate "best" fit. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = adjusted BIC; *p*LMR = *p*-value for Lo-Mendell-Rubin adjusted likelihood ratio test for K vs. K-1 profiles; *p*BLRT = *p*-value for Bootstrapped Likelihood Ratio Test.

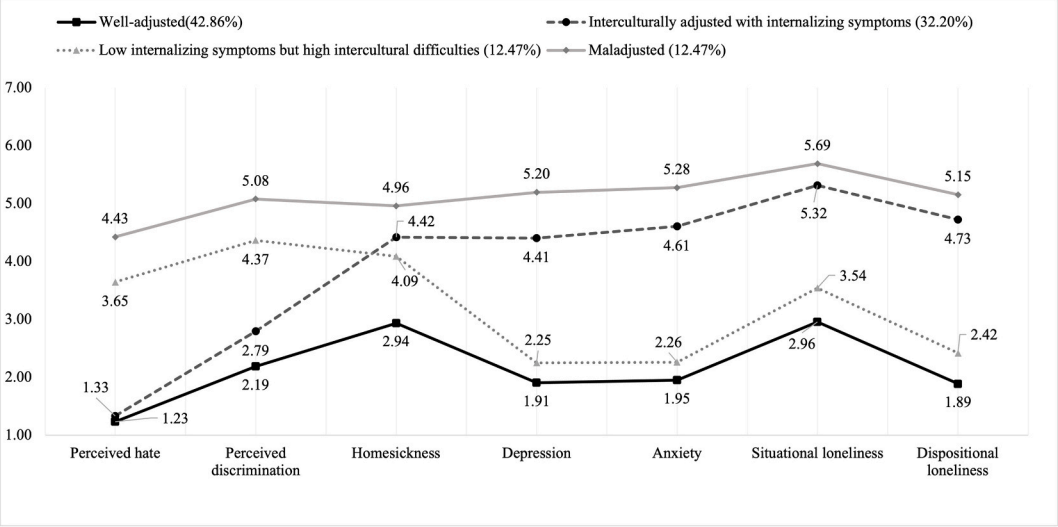

Fig. 1. Four-Profile Model in the Present Study.

above, RQ2 asked whether there were differences in terms of social media use across these profiles of international students. We included a total of six distal variables for this examination, including interactive and passive use with the three social networks (i.e., US network, home network, home network in the US). These variables were entered in the four-profile model to estimate a distal outcome mean for each psychosocial profile. Guided by Nylund-Gibson et al. (2019), a series of pairwise tests using chi-square were run via the BCH method (Bolck et al., 2004) in *MplusAutomation*. This method relied on the probabilities of profile membership for everyone derived from the four-profile model and then examined how the mean of the six distal variables differed across these profiles (see Nylund-Gibson et al., 2019).

Table 3 and Fig. 2 present the mean differences in social media use across the four profiles. First, we analyzed the differences among the four groups in their *passive use* of media with each network. Maladjusted international students reported significantly more passive use with the US network than well-adjusted international students (χ^2 (2) = 12.21, $p < .001$) and those interculturally adjusted with internalizing symptoms (χ^2 (2) = 5.67, $p = .017$). As for passive media use with the home network in the US, a similar pattern emerged. Maladjusted international students reported higher passive media use with this network than the well-adjusted international students (χ^2(2) = 5.69, $p = .017$) and those who were interculturally adjusted with internalizing symptoms (χ^2 (2) = 5.68, p = .017). Considering passive use with both the US network and the home network in the US, those students with low internalizing symptoms *but* high intercultural difficulties did not differ from the other three groups. In terms of passive media use with the home network, maladjusted international students again differed from well-adjusted international students (χ^2 (2) = 5.41, $p = .020$). The maladjusted international students tended to browse posts by their home network more than those who were well-adjusted. However, in terms of passive use

Table 3
Mean Differences across International Students' Psychosocial Profiles in terms of Media Use.

	(a) Well-Adjusted	(b) Internalizing Symptoms Only	(c) Intercultural Difficulties Only	(d) Maladjusted
1. Passive use - US network	3.39^{a***}	3.65^{b*}	3.69	4.32^{a***b*}
2. Passive use - Home network	4.28^{a*}	4.44	4.33	4.81^{a*}
3. Passive use - Home network in the US	4.04^{a*}	3.99^{b*}	4.43	4.61^{a*b*}
4. Interactive use - US network	3.34^{a**}	3.45^{b*}	3.31^{c*}	$4.03^{a**b*c*}$
5. Interactive use - Home network	4.40	4.60	4.13	4.59
6. Interactive use - Home network in the US	3.99^{a*}	3.91^{b*}	4.17	4.47^{a*b*}

Note. Mean values with the same letter are significantly different from each other. $*p < .05$; $**p < .01$; $***p < .001$. Columns represent each profile identified via LPA: (a) Well-adjusted international students, (b) International students who are interculturally adjusted with internalizing symptoms; (c) International students withlow internalizing symptoms but high intercultural difficulties, (d) Maladjusted international students.

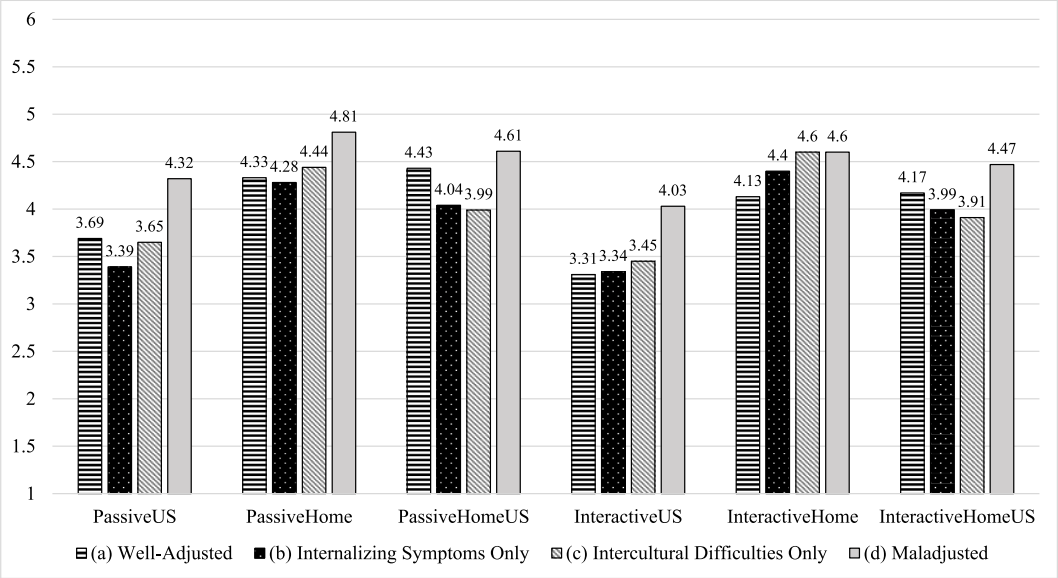

Fig. 2. *Bart Charts for Mean Differences across International Students' Psychosocial Profiles in terms of theirSocialMedia Use. Note*. (a) Well-adjusted international students, (b) International students who are interculturally adjusted with internalizing symptoms; (c) International students with low internalizing symptoms but high intercultural difficulties, (d) Maladjusted international students. Passive = passive media use; Interactive = Interactive media use; US = US network; Home = home network; HomeUS = home network in the US.

with their home network, neither interculturally adjusted students with internalizing symptoms nor those with low internalizing symptoms and intercultural difficulties differed from the maladjusted or well-adjusted groups.

Second, we analyzed the differences among the four groups in their *interactive use* of media with their networks. Maladjusted individuals again reported a significantly higher level of use with the US network than all the other groups (for the well-adjusted international students, $\chi^2(2) = 6.66$, $p = .010$; for those interculturally adjusted with internalizing symptoms, $\chi^2(2) = 4.24$, $p = .039$; for those with low internalizing symptoms but high intercultural difficulties, $\chi^2(2) = 4.32$, $p = .038$). For interactive use with the home network in the US, the maladjusted group reported a significantly higher level of use than the well-adjusted group ($\chi^2(2) = 3.93$, $p = .047$) and those with internalizing symptoms but interculturally adjusted ($\chi^2(2) = 5.15$, $p = .023$). However, no significant differences across groups were found in terms of interactive media use with the home network, indicating that all international students engaged in a similar level of conversations online with their social networks in their home country regardless of their psychosocial profiles.

Taken together, these results show that international students' social media use with their networks differed according to their psychosocial profiles. Overall, maladjusted students engaged in a higher amount of social media use (both interactive and passive) than all the other types of international students. Maladjusted international students were more likely to actively interact with their US networks than the other three groups; they also interacted with their home networks in the US more than those who were well-adjusted and interculturally adjusted with internalizing symptoms. In contrast, international students in all four profiles actively engaged with their home networks online on a relatively similar level. Another noteworthy finding was regarding social media use with the home network in the US. While maladjusted individuals socialized with this network online more than those who were well-adjusted or interculturally adjusted with internalizing symptoms, students with low internalizing symptoms and intercultural difficulties did not differ from others in terms of social media use with the home network in the US.

7. Discussion

Although numerous studies have investigated the relationship between social media use and psychosocial well-being using traditional statistical techniques based on group differences, scholars have recently advocated for a person-centered approach (e.g., Scott et al., 2017; Valkenburg et al., 2021). This approach posits that individuals' engagement with social media and its implications for psychosocial well-being depend on individual-level factors. Some individuals are likely to use social media in ways that relate to their well-being, while others are less so. We adopted this approach, focusing on individual-level factors related to internalizing symptoms and intercultural difficulties. Our overall argument is grounded in the social compensation perspective, treating psychosocial well-being as a precursor of social media use (e.g., Valkenburg & Peter, 2007). This line of research theorizes that individuals who struggle with psychosocial problems and social deficits engage in more social media use because the mediated environment affords more controllability and opportunities to meet social needs than face-to-face interaction.

We examined these research questions through the experiences of international students at the onset of the COVID-19 pandemic. Not only were they prone to multiple psychosocial issues, but also each international student could have idiosyncratic vulnerabilities, ranging from internalizing symptoms (i.e., depression, anxiety, loneliness) to intercultural difficulties (i.e., hate, discrimination, homesickness). Using LPA, our results identified four distinctive profiles of international students based on a combination of psychosocial markers. Maladjusted international students, or those who struggled with both internalizing symptoms and intercultural difficulties, engaged in the highest level of social media use, including passive use and interactive use with their US network and home network in the US. These findings have both theoretical and societal significance, as detailed below.

7.1. International students' psychosocial well-being profiles

LPA reveals how international students can be grouped based on a combination of psychosocial well-being indicators, identifying four distinguishable psychosocial profiles among the international students in our sample. Although increasing research has found prevalent

psychopathological disorders among young adults since the onset of the pandemic (e.g., Wang et al., 2021), this study finds that a substantial portion of our international student sample were well-adjusted (approximately 43% of our sample are grouped into this profile). Nevertheless, more than half of our sample (57%) experienced undesirable psychological conditions, yet their experiences were different from each other.

Within this majority, we identified students who were struggling with internalizing symptoms and intercultural difficulties simultaneously, students who were facing internalizing symptoms but were well adapted to the US, and students whose life was filled with certain intercultural challenges but not internalizing symptoms. It appears that internalizing symptoms are among the salient psychosocial issues experienced by these international students. Combining maladjusted international students with those who were interculturally well-adjusted but with internalizing symptoms, approximately 45% of our sample reported internalizing issues. This is consistent with pre-pandemic research, which found the prevalence of depressive and anxiety symptoms among international students in the US to be around 25–45% (e.g., Han et al., 2013; Shadowen et al., 2019). Together, these studies highlight the vulnerable position in which some international students find themselves, from a psychological standpoint.

At the same time, about 12% of our sample reported facing intercultural difficulties, but not necessarily internalizing symptoms. In combination with the maladjusted group, the percentage of individuals facing intercultural difficulties is largely consistent with research prior to the pandemic, which found that over half of international students experienced at least mild level of intercultural difficulties (e.g., Koo et al., 2021; Poyrazli & Lopez, 2007). This highlights the need for customized support for young adults, especially those who are marginalized and vulnerable. Recent research also suggests that the occurrence of the pandemic may have long-lasting detrimental effects on individuals' well-being worldwide (e.g., Stamatis et al., 2022). The magnitude of this negative impact on international students in comparison to other populations remains unknown. Future research will benefit from including a reference group and illustrating these differences.

7.2. Revisiting the social compensation perspective using LPA

LPA as a person-centered approach enables us to delineate the extent to which international students' social media use differs across various psychosocial makeups, advancing current theorizing on the social compensation perspective. Moreover, this survey was conducted during a state-wide lockdown, when face-to-face interaction was strictly limited. Although results here cannot discern absolute preferences for social media use over face-to-face communication, our findings indicate to what extent certain psychosocial profiles consistently use social media more than others in this unique environment. Robust empirical evidence for the social compensation perspective emerged. Overall, it appears that maladjusted international students tend to use social media more frequently than students belonging to the other three psychosocial profiles. This suggests that, in support of the social compensation perspective, international students facing both psychosocial vulnerabilities and situational risks were more likely to use social media than their peers at the onset of the pandemic.

7.2.1. Social media activities

We also considered different types of social media use (i.e., passive and interactive use). Compared to the other three psychosocial profiles, maladjusted international students tended to engage in a higher level of passive use across all social networks *and* interactive use with the US network and home network in the US. In other words, browsing social media content and interacting with others over social media were highly salient for international students facing both internalizing symptoms and intercultural difficulties. These findings are consistent with the social compensation perspective. However, what might be the psychological outcomes of social media use? According to the social compensation perspective, individuals with psychological vulnerabilities not only gravitate towards mediated communication, but also benefit from it, although these benefits are not as frequently studied (cf. Her & Timmermans, 2021; also see Toma, 2022). While the current dataset cannot address this important question, we urge future research to do so. We offer several possibilities.

In terms of passive use, it could be that maladjusted international students turn to social media use to gather useful information about how to manage their difficult circumstances. Consuming online messages by others with similar experiences provides individuals with new perspectives on a given problem, helps them reduce distress, and makes them feel less isolated (e.g., Han et al., 2014; Park & Baek, 2018). Maladjusted international students could be motivated to seek information and clarity over social media, which could help them navigate this time of crisis. However, research on social comparison suggests a different, more troublesome outcome. Since SNS users tend to post embellished representations of their lives, passive users are likely to experience envy and jealousy, resulting in poor psychosocial well-being (e.g., Frison & Eggermont, 2017; Verduyn et al., 2015). It is also possible that mindless browsing online could exacerbate existing internalizing symptoms among these maladjusted international students. These possibilities merit future investigation.

Regarding interactive use, our findings indicate that maladjusted international students were the most in need of social contact at the onset of the pandemic, especially with their peers from the US or home country living in the US. Growing evidence suggests that direct communication over social media helps users garner social support and cultivate personal relationships, which often lead to positive outcomes on psychosocial well-being (e.g., Li & Peng, 2019; Manago & Melton, 2020). Therefore, it is possible that active interaction over social media could help maladjusted international students locate and access needed resources to tackle their psychosocial vulnerabilities. We encourage future research to pursue the possibility that the increased amount of interactive use may benefit international students in the long run.

7.2.2. Communication partners

Another critical aspect of social media use is users' communication partners. While prior research mainly focused on the role of tie strength in relation to well-being (e.g., Burke & Kraut, 2016), we differentiate international students' communication partners based on homophily. The similar experiences shared between communicators (i.e., homophily) is a key factor shaping international students' communication preferences, but also their psychosocial well-being (e.g., Li & Peng, 2019; Park & Noh, 2018). When examining correlations between passive and interactive use within each type of social network, it appears that international students engaged in similar levels of social media use within each network, indicating a habitual pattern of usage. However, nuances emerge when considering social media use with networks across psychosocial profiles. International students, regardless of their psychosocial well-being profiles, engaged in a similar level of interactive use with their home network. Since this study was conducted at the onset of the pandemic during a state-wide lockdown, these international students had to restrict their interactions to mediated channels only. All international students actively interacted with their home network online, suggesting that social media provide a critical avenue for staying connected with those back home. In terms of browsing online posts by members of the home network, only well-adjusted international students significantly differed from the maladjusted group. In other words, international students with a mix of intercultural difficulties, internalizing symptoms, or both engaged in a similar level of passive use with the home network. This again indicates heighted need for information and clarity, especially from their home country, among students with vulnerabilities.

Regarding homophily, international students' home network in the

US, or individuals from international students' home country currently living or studying in the US, has the highest homophily. For international students' social media use with this network, it is worth pointing out a null effect. That is, international students with low internalizing symptoms and intercultural difficulties did not differ from maladjusted students in terms of their social media use with this network. A closer examination of the correlations reported in Table 1 revealed that indicators of intercultural difficulties were all highly correlated with social media use with the home network in the US, whereas internalizing symptoms only had somewhat small associations with this type of use. This suggests that, rather than chronic psychological issues, situational factors (i.e., being away from home during a time of crisis) may lead international students to reach out to their friends with similar experiences.

Moreover, considering the positive outcomes from interactive use through social support (Li & Peng, 2019; Manago & Melton, 2020), social media might provide a critical means for these vulnerable international students to exchange collective experiences with networks of high homophily and locate needed resources to combat psychosocial issues and adjust interculturally. Our examination of social networks in combination with different social media activities provides a granular look into international students' social media use in association with their psychosocial well-being. We encourage future research to consider both dimensions (activities and communication partners) together while examining the implications of social media use.

7.3. Limitations and future research directions

This study has limitations as well as some unresolved questions for the future. First, our cross-sectional design impedes our ability to establish temporality and causality. Although many selected psychosocial well-being markers here comprise dispositional traits or chronic symptoms, future studies should examine how psychosocial profiles with social media change over time and draw directional or causal conclusions. Relatedly, we have only captured international students' experiences at the onset of the pandemic in the US. More developmental insights would be provided by comparing social media use between international students and other similar-age groups, or considering the changes in international students' psychosocial well-being as the pandemic continued (e.g., growing resilience vs. enduring dysfunction). Second, social media use comes with its own benefits and drawbacks (e.g., Yang et al., 2021). As previously mentioned, much research investigated the impact of social media on psychosocial well-being. Thus, there is a possible reciprocal relationship that could be drawn here. Future studies should explore how international students' social media use could influence their psychosocial functioning and how changes in psychosocial well-being could again shape their communication online. Last but not the least, we encourage future research to take this approach and investigate experiences of other subgroups of the population (e.g., adolescents, older adults, LGBTQ). The present study focuses on international students, given their vulnerable position during the pandemic. This person-centered approach could be fruitful in investigating those who have unique individual experiences and how their distinctive psychosocial makeups can be associated with social media use.

8. Conclusion

Responding to a recent call for a person-centered approach in investigating social media use and well-being, this study established four unique psychosocial profiles within international students using LPA and explored the relationship between these profiles and international students' social media use at the onset of the COVID-19 pandemic. Although international students have different psychosocial makeups, those facing serious psychological challenges engaged in more communication online than others, supporting the theoretical account of the social compensation perspective. These findings also enrich our understanding of international students' idiosyncratic well-being issues at the onset of the pandemic and shed light on how individuals' use of social media can differ based on their distinctive well-being makeups.

Credit Author Statement

Y. Anthony Chen and Tingting Fan: Conceptualization, Methodology, Data curation, Formal analysis, writing (Writing – original draft preparation), Visualization. Catalina L. Toma and Sebastian Scherr: Conceptualization, Methodology, writing (reviewing and editing), Funding acquisition.

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Declarations of competing interest

None.

Data availability

Data will be made available on request.

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Appendix

Social Media Use Measurement (11 items).

Thinking about your interactions with [social network type] during the COVID-19 quarantine, how much do you ...? (Please respond on a scale from *1 = Not at all* to *7 = Very much*).

Passive Use.

1. Browse information about [network members'] lives that they shared on SNSs
2. Browse serious news articles that [network members] shared on SNSs
3. Browse entertainment news articles that [network members] shared on SNSs
4. Browse humorous material that [network members] shared on SNSs
5. Browse inspiring or encouraging information that [network members] shared on SNSs

Interactive Use.

6. Comment on or like posts made by [network members] on SNSs
7. Receive comments or likes from [network members] on SNSs
8. Video chat with [network members]
9. Call [network members] on the phone (i.e., voice chat)
10. Send private messages (e.g., texts, instant messages) to [network members]
11. Receive private messages (e.g., texts, instant messages) from [network members]

Note. [network members] were the three different types of social networks of international students examined in the present study (i.e., the US network, the home network, and the home network in the US).

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