

Emotion Regulation as a Mediator in the Relationship between Social Isolation and Psychological Distress among Students with Mobile Phone Addiction

Abstract

Introduction: Smartphone addiction, emotional regulation, and social isolation (SI) are highlighted as key contributing factors to psychological distress (PD). The study investigates whether emotion regulation mediates the link between SI and PD among Chinese university students, and examines potential differences between family and friend isolation, considering cultural context. **Methods:** A cross-sectional survey was conducted in May 2024 and June 2024 with 1276 undergraduates (mean age = 19.94 years) in Henan Province, China, using purposive sampling. Participants completed validated measures of SI (family and friends), PD, smartphone addiction, and emotion regulation strategies. Partial Least Squares Structural Equation Modeling was used for analyzing the data. **Results:** Both family SI ($\beta = -0.056$, $P < 0.05$) and friend SI ($\beta = -0.191$, $P < 0.05$) were significantly associated with PD. Friend SI significantly influenced PD through inhibition ($\beta = -0.081$, $P < 0.05$), and a similar pattern was found for family SI ($\beta = -0.043$, $P < 0.05$). Inhibition significantly mediated these relationships, suggesting that students who suppress emotional expression may experience greater PD when socially isolated. Cognitive reappraisal showed no significant mediating effect ($\beta = 0.002$, $P > 0.05$; $\beta = -0.001$, $P > 0.05$). **Conclusions:** Inhibition, as a maladaptive strategy, may heighten PD among socially isolated students with smartphone addiction. Improving adaptive regulation techniques may provide some protection. The findings support the development of targeted interventions to improve students' emotion regulation skills and reduce psychological risks in excessive smartphone use and socially disconnected contexts.

Keywords: Emotion regulation, psychological distress, smartphone addiction, social isolation

Introduction

Psychological distress (PD) is increasingly common among university students, largely due to academic demands, social adjustment, and developmental changes.^[1,2] A study in Portugal found that 75% of students reported mild-to-severe anxiety and 61.2% experienced depressive symptoms.^[3] Similar global findings indicate that over 70% of students suffer from moderate distress, a prevalence heightened during and after the COVID-19 pandemic.^[4] Such distress manifests in fatigue, irritability, and emotional dysregulation, impairing daily functioning. Smartphone addiction has emerged as a major contributor, with excessive use linked to depression, anxiety, and other mental health problems.^[5] China reports the world's highest prevalence of smartphone addiction among university students, underscoring

their vulnerability.^[6,7] Evidence also suggests that social isolation (SI) and maladaptive emotion regulation amplify distress, warranting closer examination.

The biopsychosocial model conceptualizes PD as shaped by biological, psychological, and social factors.^[8] Biologically, smartphone addiction weakens self-regulation and resilience.^[9] Psychologically, reliance on inhibition rather than cognitive reappraisal worsens outcomes.^[10] Socially, isolation reduces support and fosters greater smartphone dependence.^[11]

SI, characterized by diminished interaction and weak support networks,^[12] has become a critical risk factor for anxiety, depression, and emotional dysregulation among students. Research consistently shows that isolation intensifies distress, and the relationship is often bidirectional. Emotion regulation plays a central role in this process. Isolated individuals typically

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rely on inhibition, a maladaptive strategy that temporarily suppresses discomfort but increases distress over time, whereas reappraisal is more adaptive.^[13-15] Studies confirm that emotion regulation mediates the link between isolation and distress, with reappraisal linked to fewer negative outcomes and inhibition to worse ones, particularly under severe isolation.^[16,17] This mediating role of emotion regulation provides valuable insights for psychological interventions.

This differential impact highlights the importance of distinguishing between regulation strategies. SI appears to undermine adaptive regulation and reinforce maladaptive responses. Empirical findings across depression, anxiety, and social contexts support this mediating role.^[18]

Cultural factors further shape this dynamic. In China, collectivist values emphasize harmony and discourage open expression of negative emotions, reinforcing the use of inhibition over reappraisal.^[19] At the same time, smartphones have become the primary means of communication for undergraduates, often substituting for in-person social support and reinforcing addictive usage patterns.^[20] Research indicates that expressive inhibition frequently mediates the effects of isolation on resilience, revealing culturally specific tendencies.^[21] Overall, emotion regulation is pivotal in shaping responses to social stress, with inhibition consistently linked to heightened distress in adverse contexts.^[22]

Building on these insights, the present study investigates the relationship between SI and PD among Chinese university students with smartphone addiction. It further examines whether difficulties in emotion regulation mediate this relationship and whether isolation originating from family or peers exerts differential effects. By incorporating cultural and environmental considerations, the study seeks to strengthen ecological validity and contribute to the theoretical understanding of emotion regulation in the context of digital mental health challenges. Figure 1 illustrates the conceptual framework of the study variables.

Methods

Study design

This quantitative cross-sectional study examined the association between perceived SI and PD and, in parallel, tested whether emotion regulation functioned as a mediator. Data were collected between March 2024 and June 2024, which fell within the 2023–2024 academic year.

Setting

The study was conducted in Henan Province, China. To enhance diversity and contextual representativeness, participants were recruited from two universities that differed in both institutional type and location. Specifically, one institution was public and the other private, and the campuses were situated in urban and suburban areas,

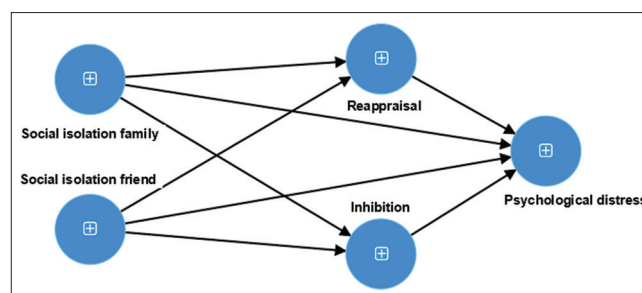


Figure 1: Conceptual map of study variables

respectively. This purposive selection allowed coverage of varied educational and social contexts within the province. Paper-based questionnaires were administered during scheduled on-campus sessions under supervised conditions. Supervision ensured standardized instructions, minimized disruption, and supported data quality throughout the administration process.

Participants

1276 Chinese university students who exhibited smartphone addiction were involved in this study. Three criteria were used to determine eligibility. Initially, individuals needed to score at least 31 (for men) and 33 (for women) to reach the established criterion for smartphone addiction.^[23] Second, they were required to be Chinese nationals. Third, all participants had to be enrolled in a university program and aged 18 or older. Individuals who failed to meet any of these criteria were excluded from the study. With an average age of 19.94, the participants' ages varied from 18 to 24. This study involved 1st-year to 4th-year university students. The largest proportion was sophomores (35.7%), followed by juniors (25.9%) and freshmen (25.3%). Seniors represented the smallest group (13.1%).

Sampling procedure

Purposive sampling was used to enroll students who met the screening threshold for smartphone addiction on the Smartphone Addiction Scale–Short Version (SAS-SV). This strategy aligned with the study objective of testing psychological mechanisms within a high-risk subgroup rather than the general student population, thereby increasing the relevance of inferences to the research question.^[24] However, purposive sampling can introduce selection bias and may constrain generalizability beyond comparable contexts. To mitigate these risks, recruitment was conducted across two campuses in Henan Province, and all prospective participants underwent the same SAS-SV screening administered under uniform procedures before inclusion.

Variables

The independent variables were SI from family and SI from friends. The mediating variables were emotion regulation strategies of reappraisal and inhibition. The dependent variable was PD. Smartphone addiction functioned as a screening variable to define the target population.

Data measurement

This verification process confirmed that the existing Chinese versions accurately reflected the original content and intent of the scales, and no modifications were required. To further ensure semantic accuracy, a bilingual language expert independently translated the Chinese versions of the SAS-SV, K10, Lubben Social Network Scale (LSNS), and Emotion Regulation Questionnaire (ERQ) back into English without consulting the original items. The back-translated items were then reviewed against the original English versions by a psychology researcher. Any potential discrepancies in meaning or cultural nuance were discussed until consensus was reached, thereby affirming the validity of the Chinese versions used in this study. To evaluate content validity, a developmental psychology expert independently assessed the cultural and linguistic appropriateness of the scale items. Based on his qualitative review, the items were deemed clear and contextually appropriate for use with Chinese university students. No modifications were made to the conceptual content of any item. Although a formal content validity index was not calculated, the expert concluded that the items adequately captured the constructs of the original scales and were suitable for the target population.

Smartphone Addiction Scale

Using a 6-point Likert scale (1 being strongly disagree and 6 being strongly agree), the 10-item SAS-SV, developed by Kwon *et al.* (2013),^[24] was used to assess smartphone addiction. With thresholds set at ≥ 31 for men and ≥ 33 for women, elevated scores indicate greater addiction.^[23] This study's internal consistency was $\alpha = 0.896$.

Psychological Distress Scale

PD was assessed utilizing the Kessler PD Scale (K10),^[25] consisting of 10 items evaluated on a 5-point scale (1 = Never to 5 = Always). Total scores vary from 10 to 50, with elevated numbers indicating greater distress. The scale exhibited substantial dependability ($\alpha = 0.935$).

Social Isolation Scale

SI was assessed utilizing the 12-item LSNS,^[26] comprising two subscales for family and friends. Family isolation reflected fewer relatives in regular contact and lower perceived availability of familial support.^[26] Friend isolation reflected fewer close friends, reduced frequency of interaction, and lower perceived availability of peer support.^[26] Responses are evaluated on a 6-point scale (0 = None/never to 5 = Nine or more/daily), with lower scores signifying increased isolation. Cronbach's alpha measured 0.912.

Emotion Regulation Questionnaire

The ERQ, developed by Gross and John, was utilized to evaluate emotion regulation, specifically focusing on

reappraisal and inhibition tactics.^[27] Using a 7-point scale, where 1 represents strong disagreement and 7 indicates strong agreement, the ten items are assessed. The internal consistency was $\alpha = 0.842$ for inhibition and $\alpha = 0.878$ for reappraisal.

Study size

The final sample of 1276 cases exceeded common minimum guidelines for partial least squares modeling, including the ten cases per indicator rule of thumb, and provided adequate power for model estimation.

Ethical consideration

The Universiti Putra Malaysia Ethics Committee approved the study with reference JKEUPM-2023-1426. Permissions were obtained from participating universities. Participation was voluntary, anonymity was assured, and all students provided written informed consent before completing the survey.

Statistical methods

Before analysis, the dataset was screened for missing responses. The proportion of missing values was below 5% and was addressed using mean replacement, an approach commonly considered appropriate in Partial Least Squares Structural Equation Modeling (PLS-SEM) to maintain statistical power and minimize bias.^[28]

PLS-SEM was conducted using SmartPLS version 4 (SmartPLS GmbH, Bönningstedt, Schleswig-Holstein, Germany).^[29] This approach was preferred over covariance-based SEM for several reasons. First, PLS is robust to violations of multivariate normality, which is common in self-report survey data.^[30] Second, it performs well with small to medium effective sample sizes relative to model complexity.^[30] Third, it emphasizes variance explanation and prediction, which aligns with the present focus on estimating direct and indirect effects and detecting group differences.^[28] Fourth, it accommodates complex models with multiple mediators and a categorical moderator.^[31] Model evaluation followed a two-step procedure.^[30] The measurement model was assessed using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) to establish internal consistency and convergent validity, and the Fornell–Larcker and heterotrait–monotrait (HTMT) criteria to establish discriminant validity.^[30,32] The structural model was then evaluated using path coefficients, coefficient of determination, and predictive relevance.^[30] Significance testing used bootstrapping with five thousand resamples. Harman's single-factor test was used as a procedural diagnostic for common method bias.^[30]

Results

Missing data handling

Prior to analysis, the dataset was examined for missing values. The proportion of missing responses was minimal (<5%) and handled using mean replacement, as recommended for PLS-SEM applications. This ensured that the effective sample size was preserved for subsequent analyses.

Common method variance

Harman's single-factor test detected cytomegalovirus before further study. The first component accounted for 25.39% of the variation, much below the 50% threshold, indicating that common technique bias was low and that the data were suitable for analysis.

Measurement model assessment

In SmartPLS, PLS-SEM was used to assess the measurement model. In keeping with the theoretical paradigm, all constructions were considered reflecting indicators. A total of thirty-two items, representing five latent variables, were used in the model. Table 1 shows that all constructions had internal consistency values higher than the 0.60 criterion, as measured by Cronbach's alpha. Factor loadings, AVE, and CR values that were over the 0.50 threshold provided evidence of convergent validity.

The HTMT ratio and Fornell–Larcker criterion assessed discriminant validity. All HTMT values were below 0.90, and each construct's AVE square root exceeded its inter-construct correlations [Table 2]. PD (PD1–PD10), SI (SI1–SI6, SI7–I 12), and Reappraisal (RE1–RE6) and inhibition (IE1–IE4) were all variables categorized. In general, the measurement model proved to be reliable enough, and it also showed signs of convergent and discriminant validity, which provides a strong basis for structural analysis.

Structural model assessment

Following the confirmation of construct validity and reliability, the structural model was subsequently assessed.

Grounded in the Biopsychosocial Model, this study proposed a dual-path mediation framework in which SI from family and SI from friends were modeled as independent variables. Inhibition and reappraisal functioned as mediators, while PD served as the outcome variable. This design resulted in two parallel mediation pathways, as illustrated in Figure 2.

Structural model analysis was conducted using PLS-SEM. The results revealed significant direct effects among the variables, offering empirical support for the hypothesized relationships. Key model estimates, including R^2 values, path coefficients (β), t -values, and P values, were examined at a 95% confidence level. Furthermore, all inner Variance Inflation Factor values were below 1.314, suggesting that multicollinearity was not a concern in this model. The detailed evaluation results are summarized in Table 3.

Verification of direct effects

To validate the structural model and establish path coefficients, the research used bootstrapping with 5000 resamples. The $r^2 = 0.231$ shows that SI and inhibition jointly explained 23.1% of the variance in PD, as illustrated in Figure 2. In this context, higher SI scores reflect better social connectivity, whereas lower scores indicate greater isolation. Elevated PD scores represent more severe symptoms, whereas higher inhibition and reappraisal scores denote more frequent use of these emotional regulation strategies.

As shown in Table 3 and Figure 1, the results reveal a positive association between family SI and PD. ($\beta = -0.056$, $P < 0.05$, 95% bias corrected confidence interval [BC CI] [- 0.106–0.002]); SI friend and PD were positively correlated ($\beta = -0.191$, $P < 0.05$, 95% BC CI [–0.248–0.133]); Inhibition and PD were positively correlated ($\beta = 0.382$, $P < 0.05$, 95% BC CI [0.326–0.438]); Inhibition and SI family were positively correlated ($\beta = -0.112$, $P < 0.05$, 95% BC CI [–0.168–0.050]); Inhibition and SI friend were positively correlated ($\beta = -0.212$, $P < 0.05$, 95% BC CI [–0.277–

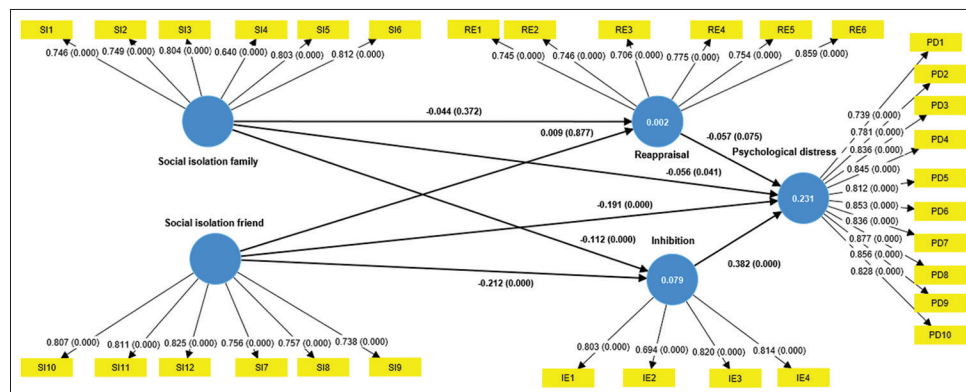


Figure 2: Results of the structural model. Path coefficients directly affect independent variables (social isolation family and social isolation friend), mediating variables (inhibition and reappraisal), and dependent variables (psychological distress). SI: Social isolation, PD: Psychological distress, RE: Reappraisal, IE: Inhibition

Table 1: Loadings, composite reliability, and average variance extracted values for low-order components

	Loading	CR	AVE
Psychological distress			
PD1	0.739	0.956	0.684
PD2	0.781		
PD3	0.836		
PD4	0.845		
PD5	0.812		
PD6	0.853		
PD7	0.836		
PD8	0.877		
PD9	0.856		
PD10	0.828		
SI			
Family		0.891	0.579
SI1	0.746		
SI2	0.749		
SI3	0.804		
SI4	0.640		
SI5	0.803		
SI6	0.812		
Friend		0.905	0.613
SI7	0.756		
SI8	0.757		
SI9	0.738		
SI10	0.807		
SI11	0.811		
SI12	0.825		
RE			
Reappraisal		0.894	0.586
RE1	0.745		
RE2	0.746		
RE3	0.706		
RE4	0.775		
RE5	0.754		
RE6	0.859		
Inhibition		0.864	0.615
IE1	0.803		
IE2	0.694		
IE3	0.820		
IE4	0.814		

CR: Composite reliability, AVE: Average variance extracted, PD: Psychological distress, SI: Social isolation, RE: Reappraisal, IE: Inhibition

−0.146]). However, the findings showed no significant relationship between reappraisal and PD ($\beta = -0.057$, $P > 0.05$, 95% BC CI [−0.139–0.009]), SI family and reappraisal ($\beta = -0.044$, $P > 0.05$, 95% BC CI [−0.114–0.101]), as well as SI friend and reappraisal ($\beta = 0.009$, $P > 0.05$, 95% BC CI [−0.096–0.126]).

Assessment of indirect effects

As presented in Table 4, the findings demonstrate that SI from friends exerts a significant indirect effect on PD via

Table 2: Discriminant validity of lower-order components

	1	2	3	4
SI family				
SI friend	0.503			
IE	0.226	0.308		
Reappraisal	0.058	0.037	0.400	
PD	0.209	0.338	0.484	0.076

Discriminant validity approved when HTMT < 0.90. SI: Social isolation, IE: Inhibition, PD: Psychological distress

inhibition ($\beta = -0.081$, $P < 0.05$, 95% BC CI [−0.112–0.055]). Likewise, the SI family also showed a significant effect on PD through inhibition ($\beta = -0.043$, $P < 0.05$, 95% BC CI [−0.068–0.019]). However, reappraisal neither mediated the impact of family social isolation on psychological distress ($\beta = 0.002$, $P > 0.05$, 95% BC CI [−0.003, 0.011]) nor significantly mediated the effect of friend social isolation on psychological distress ($\beta = -0.001$, $P > 0.05$, 95% BC CI [−0.012, 0.005]).

Discussion

This research examined how SI influences PD in university students exhibiting signs of smartphone addiction, with particular attention to the potential mediating role of emotion regulation in this association. Higher SI was linked to greater PD, emphasizing the protective role of social connectedness and confirming earlier research on the detrimental consequences of SI on mental health.^[33,34]

Inhibition emerged as a maladaptive mediator between SI and PD, as it suppresses emotions without resolving underlying causes.^[10,35] Unlike reappraisal, it increases emotional burden and may elevate risks of mental and physical health issues, particularly in cultures that promote emotional restraint.^[36]

This study advances the biopsychosocial model by positioning emotion regulation as a mediator and incorporating smartphone addiction as a biological component, thus extending the model to digital contexts. It underscores emotion regulation as a crucial mechanism connecting individual and environmental factors, offering insights for interventions that promote adaptive strategies to reduce distress.

This study makes three key contributions. First, it offers localized insights into the PD experienced by Chinese university students. Second, it clarifies the distinct functions of different emotion regulation strategies within this population. Third, these results offer empirical support for the mediating effect of emotion regulation in the relationship between SI and PD. By bridging developmental psychology with research on digital addiction, the study presents a novel perspective on how social dynamics contribute to PD in the digital age.

Table 3: Hypotheses verification (direct relationship)

Relationship	Coefficient	<i>t</i>	<i>P</i>	95% BC CI	VIF
SI family → PD	−0.056	2.045*	0.041**	−0.106 to 0.002	1.271
SI friend → PD	−0.191	6.528*	<0.001**	−0.248 to −0.133	1.314
Inhibition → PD	0.382	13.248*	<0.001**	0.326 to 0.438	1.229
Reappraisal → PD	−0.057	1.783	0.075	−0.139 to −0.009	1.134
SI family → IE	−0.112	3.687*	<0.001**	−0.168 to −0.050	1.257
SI family → reappraisal	−0.044	0.893	0.372	−0.114 to 0.101	1.257
SI friend → IE	−0.212	6.339*	<0.001**	−0.277 to −0.146	1.257
SI friend → reappraisal	0.009	0.154	0.877	−0.096 to 0.126	1.257

t* > 1.96, *P* < 0.05. BC CI: Bias corrected confidence interval, VIF: Variance inflation factor, SI: Social isolation, PD: Psychological distress, IE: Inhibition

Table 4: Hypotheses verification (indirect relationship)

Paths	Indirect effect	<i>t</i>	<i>P</i>	95% BC CI
SI friend → IE → PD	−0.081	5.666*	<0.001**	−0.112 to −0.055
SI family → IE → PD	−0.043	3.463*	0.001**	−0.068 to −0.019
SI family → reappraisal → PD	0.002	0.686	0.492	−0.003 to 0.011
SI friend → reappraisal → PD	−0.001	0.13	0.897	−0.012 to 0.005

t* > 1.96, *P* < 0.05. IE: Inhibition, PD: Psychological distress, SI: Social isolation, BC CI: Bias-corrected confidence interval

In terms of practical applications, results indicate that treatments should target improving adaptive regulation methods, especially cognitive reappraisal, and decreasing dependence on maladaptive mechanisms, including inhibition.^[37] Programs offered at universities could include counseling and structured workshops that teach students to recognize stressful situations, find positive meaning in them, and reframe them in a healthier light.^[38] To encourage the everyday use of reappraisal techniques, digital well-being initiatives may also incorporate short app-based courses or social activities.^[39] Furthermore, teamwork among educators, counselors, and families can foster a supportive atmosphere that promotes open emotional expression and effective coping strategies, thereby mitigating the likelihood of enduring PD.^[40]

Despite the model's limited explanatory power ($r^2 = 0.231$), the results possess significant practical implications. Even a moderate degree of explained variance is significant in the context of PD among university students with mobile phone addiction, given the multifaceted nature of mental health outcomes.^[28] The findings indicate that SI has both direct and indirect impacts via emotion regulation, emphasizing the importance of addressing social and students' regulatory skills in intervention programs. The evidence indicates that initiatives aimed at diminishing SI and enhancing students' capacity to reappraise difficult circumstances may produce quantifiable advantages for their psychological well-being, despite the influence of other unmeasured determinants on distress.

Limitations

This study has some limitations. Since all data were collected through self-report questionnaires, the accuracy of responses might be influenced by personal bias or

misunderstanding. Furthermore, because the study used a cross-sectional design, it cannot confirm cause-and-effect relationships between the variables. The purposive sampling strategy limits the generalizability of the findings to broader populations, as the sample may not fully represent university students in other contexts. Uncontrolled variables might also affect outcomes. Future research should use behavioral and physiological assessments to improve validity and longitudinal designs to clarify causality and developmental patterns.

Conclusions

The structural model demonstrated that SI and emotion inhibition were significant predictors of PD, collectively explaining 23.1% of its variance. The association between PD and SI linked to family and friends was significantly mediated by inhibition. Conversely, there was no significant mediation effect of reappraisal. These results underscore the central role of maladaptive emotion regulation, particularly inhibition, in translating social disconnection into psychological symptoms. Interventions targeting emotion regulation strategies may therefore be crucial in mitigating PD among university students experiencing smartphone addiction.

Authors' contributions

Liu Xu was responsible for developing the study concepts, designing the research framework, defining the intellectual content, conducting experimental studies, acquiring and analyzing data, performing statistical analyses, preparing the manuscript draft, editing the manuscript, and conducting the final manuscript review.

Zarinah Arshat contributed to the study's conceptualization, design, definition of intellectual content, literature

search, experimental studies, data acquisition, manuscript preparation, manuscript editing, and manuscript review.

Nellie Ismail participated in the study design, definition of intellectual content, literature search, data acquisition, data analysis, statistical analysis, manuscript preparation, and manuscript editing.

Shi Lulu assisted in data analysis, statistical analysis, and manuscript editing.

Data availability statement

The corresponding author can supply the data that backs up the study's conclusions if asked reasonably.

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Conflicts of interest

There are no conflicts of interest.

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