

**The association between family cohesion and depression: A
systematic review and meta-analysis**

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Abstract: Background: Many studies have analyzed the relationship between family cohesion and depression, but there are different views and the results are inconsistent. It is necessary to use meta-analysis to explore the relationship between family cohesion and depression and its influencing factors.

Methods: Chinese database (China National Knowledge Infrastructure) and English databases (ERIC, MEDLINE, Web of Science Core Collection, Elsevier SD, PsycINFO, PsycArticles, and ProQuest dissertations and theses) were searched for articles published by November 2023. Family cohesion measurement tools, depression measurement tools, study design, age, gender, cultural background, and sampling year were analyzed as moderators. Meta-analysis was performed using the random effects model in CMA3.0 software.

Results: A total of 71 studies (90,023 participants) were included in this study. The meta-analysis revealed a significant negative correlation between family cohesion and depression ($r=-0.31$, 95% CI [-0.35, -0.27]). The association was moderated by family cohesion and depression measurement tools, design type, and cultural background, but not by age, gender, or sampling year.

Limitations: The sample size included in this research is relatively small in European and African cultures, making it challenging to analyze cultural differences in the study results at present comprehensively.

Conclusions: The findings contribute to the ongoing debate between Social Support Theory and The Circumplex Model, showing that individuals with lower family cohesion tend to experience higher levels of depression.

Keywords: family cohesion, family intimacy, parent-child cohesion, depression, meta-analysis

1 Introduction

With the increasingly fierce social competition and the increasing pressure of survival, depression is becoming more and more common and has become an increasingly prominent public

health problem worldwide (Shorey et al., 2022). Research shows that a certain proportion of the world's elderly (31.74%), adolescents (37%) and children (12.9%) have depression problems (Shorey et al., 2022; Zenebe et al., 2021; Zhang et al., 2022). Especially affected by the COVID-19 epidemic, the incidence of depression increased faster (Racine et al., 2021). Previous studies have also found that depression not only leads to various psychological and behavioral disorders such as anxiety, attention deficit, social avoidance, suicidal ideation, self-harm, and addictive behavior (Gámez Guadix et al., 2022; Liu et al., 2023; Zhang et al., 2023), but also causes physical injuries such as sleep disorders, eating disorders, and cardiovascular problems (Chaplin et al., 2023; Shorey et al., 2022). Therefore, the causes of depression have been continuously monitored in order to better intervene in depression. Existing studies have found that physiological factors (genetic factors, physical diseases, etc.), individual factors (negative thinking, negative coping, etc.), and environmental factors (parental neglect, deviant peer interaction, etc.) are all related to depression (Mössinger & Kostev, 2023; Li et al., 2022; Zhu et al., 2023).

Among the influencing factors of depression, family factors have always been valued by researchers, and the association between family cohesion and depression has attracted much attention. At present, the deepening of marriage freedom in China and the increasing pressure on family survival have led to an increasing divorce rate yearly (Chen et al., 2021). In addition, in the Internet era, the acceleration of work pace and the compression of leisure time have gradually reduced the interaction between family members (Zhang et al., 2022). These make it even more important to explore the relation between family cohesion and depression. Unfortunately, the results obtained by current studies are inconsistent. The Social Support Theory suggests that there may be a significant negative correlation between family cohesion and depression (Farrell & Barnes, 1993; Fredrick et al., 2022; Liu et al., 2023). The Circumplex Model suggests that there is no linear correlation between the two and may exhibit a U-shaped relationship (Copeland, 1998; Mastrotheodoros et al., 2020). In addition, in terms of correlation coefficient, there are significant differences in both results, with correlation coefficients ranging from -0.66 to 0 reported (Mastrotheodoros et al., 2020; Fang, 2023; Shi et al., 2021). Therefore, it is still unclear whether there is a correlation between family cohesion and depression and to what extent. Therefore, it is necessary to use meta-analysis to explore the overall correlation and influencing factors between family cohesion and depression in order to provide more reliable evidence for early identification

and intervention of depression.

1.1 The concept and measurement of family cohesion

Family cohesion refers to the degree of emotional bond and connection between family members (Olson et al., 1983). The family cohesion subscale in the Family Adaptability and Cohesion Evaluation Scale (FACES) is the representative tool for measuring family cohesion. The first edition (FACES) is a single dimension with 26 questions (Olson, 1986), the second (FACES II) has 16 questions, and the third (FACES III) has 10 questions. In addition, the cohesion subscale in the Family Environment Scale (FES) is also quite common, which includes four dimensions (commitment, assistance, support, and degree), with 9 questions (Moos & Moos, 1974). Finally, the family cohesion scale (Escala de Cohesión Familiar, ECF) is also commonly used, with a single dimension and 8 questions (Maya Mejía & Torres, 2000). Overall, the most widely used are FACE II and FES.

Table 1 measurements for family cohesion

Questionnaire	author	Year	Items	Dimension	Scoring method
FACES	Olson	1982	26	single	5-point scoring (0-4)
FACES II	Olson	1982	16	single	5-point scoring (0-4)
FACES III	Olson	1985	10	single	5-point scoring (0-4)
FES	Moos et al.	1974	9	commitment, support, assistance, degree	2-point scoring (0-1)
ECF	Maya et al.	2000	9	single	4-point scoring (0-3)

1.2 The concept and measurement of depression

Depression refers to a state of mind in which individuals feel frustrated and depressed, often including negative experiences such as pessimism, pain, anger, guilt, and self-blame (Radloff, 1977). There are five main tools for measuring depression. The first is the Center for Epidemiological Studies Depression (CES-D), which measures the frequency of depression within one week in a single dimension and consists of 20 questions (Radloff, 1977). The second is the SCL-90 Depression Scale, which measures the frequency of depression within one week, with a single dimension and 10 questions (Derogatis et al., 1975). The third is the Beck Depression Inventory (BDI) Second Edition, which measures the frequency of depression within two weeks in a single dimension and consists of 21 questions (Beck, 1996). The fourth is the Self-Rating

Depression Scale (SDS) measures the frequency of depression within one week with a single dimension and 20 questions (Zung, 1965). The last is the Children's Depression Inventory (CDI), which measures the frequency of depression in the past two weeks and includes five factors: negative emotions, interpersonal problems, low efficiency, lack of pleasure, and negative self-esteem, with 27 questions (Kovacs & Psychiatry, 1992). Overall, CES-D is currently the most commonly used in research.

Table 2 measurements for depression

Measurement	Lead author	Year	Items	Dimension	Measuring	Scoring method
CES-D	Radloff	1977	20	single	1 week	4-point scoring (0-3)
SCL-90	Derogatis	1975	10	single	1 week	5-point scoring (1-5)
BDI	Beck	1996	21	single	2 weeks	4-point scoring (0-3)
SDS	Zung	1965	20	single	1 week	4-point scoring (1-4)
CDI	Kovacs	1992	27	5	1 week	3-point scoring (0-2)

1.3 The association between family cohesion and depression

At present, there are two main views on the association between family cohesion and depression. The first viewpoint suggests a negative correlation between the two. According to the Social Support Theory, family-emotional closeness helps to establish a positive family relationship, provides good social support, and facilitates the good expression of emotions and behaviors between family members and mutual acceptance between members to buffer depression (Farrell & Barnes, 1993). In addition, in a high-cohesion family, family members can provide good emotional companionship, which can effectively enhance the psychological resilience and sense of security of family members to deal with difficulties and crises and reduce the risk of depression. (Cheng, 2022; Fredrick et al., 2022). Moreover, close family relationships are usually accompanied by more positive interactions, which can help members enhance their self-esteem and sense of meaning in life, thereby reducing the risk of depression (Gámez Guadix et al., 2022). Finally, family emotional support can effectively moderate the individual's neuroendocrine system or immune system so that individuals can maintain mental health (Tabet & Xaverius, 2022). Both cross-sectional and longitudinal studies have found that family cohesion can indeed negatively predict depression (Cheng, 2022; Rahman et al., 2022).

Another view is that there is no linear correlation between family cohesion and depression but a U-shaped association. According to the Circumplex Model, family cohesion can be divided into alienation, separation, connection, and entanglement from low to high (Olson, 1986), too high or too low family cohesion will increase the risk of depression (Copeland, 1998). High family cohesion will lead to family members' dependence. When individuals face difficulties, they will have the behavior of retreat and escape, which will lead to frustration and increased depression. Low family cohesion makes it difficult for individuals to obtain support from other family members, and they are more vulnerable to life events, which increases the risk of depression (Zahra & Saleem, 2021). Only a moderate degree of family cohesion can correctly connect the feelings and needs of each family member so that they can obtain support and security in the family and can also be independent in society, thus reducing the risk of depression. Although this view has not been directly verified in the association between family cohesion and depression, some studies have found that the linear correlation between family cohesion and depression is insignificant (Copeland, 1998; Mastrotheodoros et al., 2020).

In conclusion, findings from both cross-sectional and longitudinal studies affirm the validity of the Social Support Theory. This theory demonstrates broad applicability in the family environment and mental health (Fredrick et al., 2022; Zahra & Saleem, 2021). Currently, the Circumplex Model finds support solely in the correlation between family cohesion and self-control or deviant behavior (Gomes & Gouveia-Pereira, 2020), with no established verification for the link between family cohesion and depression.

1.4 Potential moderating variables

Gender. First, from the perspective of self-construal, men's independent self-construction is dominant, emphasizing that self and others are independent, separate, and pay more attention to their own thoughts and feelings. Women's interdependent self-construction is dominant, emphasizing the connection between themselves and others, and paying more attention to the thoughts and feelings of others (Cross & Madson, 1997; Farley, 2022). Therefore, poor family relationships are more likely to increase the risk of depression in women. In addition, the parasympathetic nerve function of women is more substantial, and the levels of corticosterone and adrenocorticotropin in women increase faster under intense pressure. It will lead to women being more sensitive to lousy family cohesion, which increases the risk of depression (Heck & Handa,

2019). In conclusion, this study proposes Hypothesis 2: Gender can moderate the association between family cohesion and depression.

Age. For minors, the family is their primary social support system. When facing difficulties, because the poor intimate relationship in the family cannot provide them well support, individuals easily feel the dispersion of family relations, which increases the risk of depression (Gómez-Velásquez et al., 2021). For adults, they are no longer dependent on their families and can face various pressures and challenges in life independently or partially (Rao et al., 2004). Additionally, adults develop new intimate relationships, such as romantic relationships. These make it resistant to the impact of poor family cohesion on depression (Pérez et al., 2018). Therefore, this study proposed Hypothesis 3: Age can moderate the association between family cohesion and depression.

Tools for measuring family cohesion. First of all, regarding the number of items in the scale, FACESII and III are revised on the basis of FACES. During the revision, the number of their questions was reduced, which led to the decrease of measurement information and may affect the measurement results. Secondly, in terms of questionnaire structure, FACES and ECF are single-dimensional and mainly measure the emotional connection between family members (Olson, 1986; Maya Mejía & Torres, 2000), while FES is multi-dimensional and more comprehensive (Moos & Moos, 1974), which may also affect the measurement. Therefore, this study proposed Hypothesis 4: Family cohesion measurement tools can moderate the association between family cohesion and depression.

Tools for measuring depression. Firstly, CDI measures depression from five dimensions: negative emotions, interpersonal problems, low efficiency, lack of pleasure, and negative self-esteem, which is more comprehensive and accurate than other single-dimensional scales. Secondly, the number of items and the applicable population of the four scales involved in our study are different, which may lead to the deviation of measurement information, thus affecting the measurement results. Finally, BDI and CDI measure the depressive symptoms in the last two weeks, while the other three scales measure the depressive symptoms in the last one week. Therefore, the measurement time span of BDI and CDI is wider. This may also lead to differences in research results. This study proposed Hypothesis 5: the measurement tool of depression can moderate the association between family cohesion and depression.

Cultural background. North American culture is characterized by solid individualism, emphasizing the independence of family members. Individuals are expected to face and solve difficulties independently and are not closely connected with their families' emotions. Therefore, family cohesion has little effect on depression (Ashbourne & Baobaid, 2019). The Middle East culture is conservative to a certain extent, and individuals are limited in the way they express family emotions, which makes it easier for them to experience family-scattered relationships, thus increasing the risk of depression (Muslimin, 2019). However, in East Asian culture, collectivist values are emphasized and are influenced mainly by Confucian culture. “Knowing filial piety and understanding brotherhood” is the core of family culture. Individual happiness is closely related to family cohesion, and low family cohesion is likely to increase the risk of individual depression (Hung, 2022; Shen & Zhang, 2020). Latin American culture comes from the fusion between European Civilization (Spain and Portugal) and Indian indigenous civilization. This culture emphasizes group life and points out that individual happiness is not only related to family but also related to community. It enables people to rely on community support so that they can still get enough support when family cohesion is reduced (Rojas, 2019), thereby reducing the risk of depression. Therefore, this study proposes Hypothesis 6: Cultural background can moderate the association between family cohesion and depression.

Sampling year. In recent years, rapid economic development, social transformation, and modernization have led to profound changes in marriage culture and instability of marriage relations, and the divorce rate has risen sharply worldwide (Mansour et al., 2020). In addition, with the development of the city and the implementation of the talent introduction plan, people are more willing to go to large cities with high wages and more opportunities, increasing residential mobility, and it has become a common phenomenon to gather less and leave more with their families (Oishi & Tsang, 2022). Moreover, the Internet, which tends to be personalized, creates separate social scenes for family members so that people often “keep their mobile phones in hand” during family gatherings, which significantly weakens the emotional connection between people (Arif et al., 2022; Fu et al., 2020). At the same time, the promotion of urbanization has increased the commuting distance, reduced the frequency of interaction between family members, experienced more loneliness, and increased the risk of depression (Laß & Wooden, 2023). All the above factors will enhance the influence of family cohesion on depression. Therefore, this study

proposes Hypothesis 7: sampling year can moderate the association between family cohesion and depression.

Design type. The longitudinal study reflects the lag effect of family cohesion on depression, while the cross-sectional study reflects the immediate effect. The lag effect will decay with the increase of interval time, so it is lower than that in the cross-sectional study (Zhang et al., 2022). In addition, although the lag effect size is low, the family is the most critical link in the microenvironment system and has a profound impact on individual development, so the weak influence on depression will persist (Cheng, 2022). This study proposed Hypothesis 8: design type can moderate the association between family cohesion and depression.

2 Methods

2.1 Literature search and screening

Firstly, the Chinese database (CNKI master thesis and journal database) was queried for literature containing keywords such as "家庭亲密度" OR "家庭凝聚力" OR "亲子亲密度" AND "抑郁" within abstracts. Secondly, English-language databases (EBSCO-Eric, MEDLINE, Web of Science Core Collection, Elsevier SD, PsycINFO, PsychArticles, and ProQuest dissertations and theses) were searched for literature with keywords like "family cohesion" OR "family intimacy" OR "parent-child intimacy" OR "parent-child closeness" OR "parent-child cohesion" AND "depress*" within abstracts. Finally, the search was complemented and updated by retrieving relevant articles from the Google Scholar website and conducting a thorough literature review. A total of 2901 articles were retrieved, and the last literature update was conducted in November 2023.

Utilize EndNote X9 for literature import and screening based on the following criteria: (1) Exclude nonempirical studies; (2) Include studies where both family closeness and depression were measured, with reported data suitable for effect size extraction; (3) Prioritize studies providing comprehensive data if there is data reuse; (4) Exclude studies with specific participant groups, such as left-behind children or pregnant women. Refer to Figure 1 for an overview of the literature screening process.

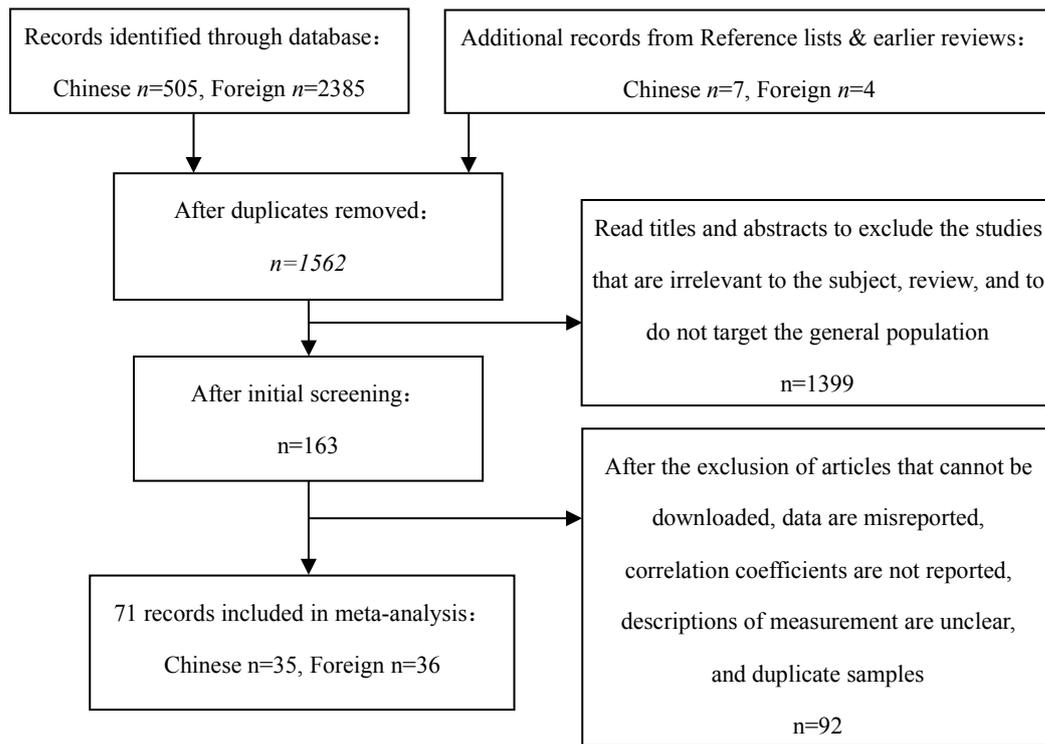


Figure 1 Flow diagram of the search results

2.2 Coding and quality assessment

Each study was coded according to the following characteristics: first author, sampling year, correlation coefficient, sample size, publication type, cultural background, male ratio, age, family cohesion measurement tool, depression measurement tool, research design type, and literature quality (Table 3). The following principles should be followed in coding: (1) if there are multiple independent samples in the same document, they should be coded separately; (2) The longitudinal study with multiple tests included the correlation between the first data of family cohesion and the last data of depression.

If the study does not report the correlation coefficient, the F value, t value, and β Value are transformed into the r value using the formula $[r = \beta \times 0.98 - 0.05 (\beta < 0) (\beta \in (-0.5, 0.5))]$ (Card, 2015; Peterson & Brown, 2005). Two independent evaluators coded the data, achieving a coding consistency of 95%. In cases of inconsistency, corrections were made after reviewing and discussing the original literature. All information in the literature is openly accessible (https://osf.io/9vnw4/?view_only=b4b3eadb028d44e99881a6294e4956e1).

The Joanna Briggs Institute Critical Appraisal Checklist for Analytical Cross-sectional Studies, as employed in the original study (Stern et al., 2020), consists of 8 items, with response options 'Yes,' 'No,' 'Unclear,' or 'Not applicable.' Each affirmative response received 1 point, while

other responses were unscored. Scores for each original study ranged from 0 to 8 points. Research quality was assessed based on the total score, categorizing scores of <50%, 50~80%, and >80% as low, medium, and high quality, respectively (Zhang et al., 2023).

Table 3 Basic information of studies included in the meta-analysis

Author	Year	r	Sample size	Country	Culture	Male ratio	Age	Measurement		Design	Quality	Publication
								Family cohesion	Depress			
Anyan	2015	-0.28	285	Ghana	Other	0	minor	Other	Other	C	M	Y
	2015	-0.13	244	Ghana	Other	1	minor	Other	Other	C	M	Y
Au	2007	-0.51	6340	China	EA	0.49	minor	FES	CDI	C	M	Y
Aydin	1999	-0.23	311	Turkey	ME	0.43	minor	FES	BDI	C	M	Y
Bhawanie	2015	-0.1	690	America	NA	0.48	minor	Other	Other	L	H	N
Buitrago Matamoros	2016	-0.16	244	Columbia	LA	0.52	minor	ECF	CES-D	C	M	Y
Cano	2018	-0.21	200	America	NA	0.49	adult	Other	CES-D	C	H	Y
Cheng	2020	-0.23	173	America	NA	0.25	adult	FACES III	Other	L	H	Y
Cheung	2017	-0.27	167	China	EA	0.33	adult	FES	Other	C	H	Y
Choi	2020	-0.34	399	Korea	EA	0.49	minor	FACES	Other	C	M	Y
Chung	2014	-0.43	326	Korea	EA	0.41	adult	Other	SCL-90	C	M	Y
Cole	1991	-0.53	107	America	NA	0.54	minor	FES	CDI	C	H	Y
Copeland	1989	-0.05	767	America	NA	0.43	minor	FACES III	CES-D	C	H	N
Elizabeth	2010	-0.19	3690	Columbia	LA	0.43	minor	ECF	Other	C	H	Y
Farley	1994	-0.26	6504	America	NA	0.48	minor	Other	CES-D	L	H	N
Fredrick	2015	-0.32	801	America	NA	0.43	minor	FACES III	CES-D	L	H	Y
Gómez Guadix	2020	-0.3	1877	Spain	Other	0.5	minor	Other	Other	C	M	Y
Garrison	1980	-0.4	766	America	NA	0.46	minor	FACES	CES-D	C	H	N
Gençöz	2004	-0.31	226	Turkey	ME	0.21	adult	FES	BDI	C	M	Y
Gómez	2019	-0.24	1008	Columbia	LA	0.6	minor	ECF	CES-D	C	H	Y
Guassi	2013	-0.29	338	America	NA	0.36	adult	Other	CES-D	L	H	Y
Han	2014	-0.38	211	Korea	EA	0	adult	FACES	Other	C	M	Y
Harris	1998	-0.27	188	America	NA	0.32	adult	FES	BDI	C	H	Y
Lee	2016	-0.35	430	Korea	EA	0	adult	FACES III	SDS	C	H	Y
Lorenzo-Blanco	2005	-0.17	1922	America	NA	0.47	minor	FACES II	CES-D	L	H	Y
McKeown	1986	-0.26	3191	Columbia	LA	0.49	minor	FACES II	CES-D	L	M	Y
Panda	2014	-0.63	100	India	Other	0.5	adult	FES	BDI	C	M	Y
Park-A	2003	-0.11	395	America	NA	0.43	adult	Other	Other	C	M	N
Park-B	2021	-0.44	544	Korea	EA	0.61	adult	FACES III	BDI	C	H	Y

Pérez	2016	-0.14	943	Chile	LA	0.31	minor	FACES III	BDI	C	H	Y
	2016	-0.22	943	Chile	LA	0	adult	FACES III	BDI	C	H	Y
Rahman	2018	-0.21	200	America	NA	0.49	adult	Other	CES-D	C	M	Y
Rudd	1991	-0.23	108	America	NA	0.34	minor	FACES III	CES-D	C	M	Y
Sze	2000	-0.04	2690	China	EA	0.51	minor	Other	Other	L	H	Y
Williams	2006	-0.33	695	America	NA	0.46	minor	FES	CES-D	C	M	N
Yu	2013	-0.33	5329	China	EA	0.5	adult	FES	BDI	C	M	Y
Zahra	2019	-0.22	394	Pakistan	ME	0.54	minor	Other	Other	C	M	Y
Zúñiga	2007	-0.31	342	Mexico	LA	0.53	minor	FES	BDI	C	H	Y
Chen ^a	2011	-0.18	4601	China	EA	0.51	minor	FES	Other	C	M	Y
Chen ^b	2020	-0.43	539	China	EA	0.41	minor	Other	Other	C	M	Y
Cheng ^b	2017	-0.27	635	China	EA	0.52	adult	FES	SCL-90	C	M	N
Cong	2015	-0.18	2906	China	EA	0.38	minor	FES	Other	C	H	Y
Fang	2021	-0.66	2551	China	EA	0.55	minor	FACES II	SDS	C	M	N
Hu	2010	-0.27	307	China	EA	0.48	adult	FACES II	SDS	C	M	Y
Li	2019	-0.55	278	China	EA	0.26	adult	FACES II	SCL-90	C	H	N
Liu ^a	2021	-0.46	1027	China	EA	0.33	adult	FACES II	CES-D	C	H	Y
Liu ^b	2017	-0.31	285	China	EA	0.29	adult	FES	CES-D	C	H	Y
Liu ^c	2021	-0.42	3713	China	EA	0.49	minor	FACES II	Other	C	H	Y
Luo	2011	-0.5	1535	China	EA	0.51	minor	FES	Other	C	M	Y
Ou	2021	-0.33	667	China	EA	0.3	adult	FES	CES-D	C	H	Y
Rao	2002	-0.21	1842	China	EA	0.56	adult	FES	CES-D	C	M	Y
Ren	2021	-0.05	515	China	EA	unknown	minor	FACES II	Other	L	M	N
Shen	2018	-0.51	663	China	EA	0.53	adult	FES	CES-D	C	H	Y
Shi	2016	-0.23	932	China	EA	0.46	minor	FES	Other	L	H	Y
Wang ^a	2014	-0.43	443	China	EA	0.45	adult	FES	CES-D	C	M	N
Wang ^b	2015	-0.46	4866	China	EA	0.52	minor	FACES II	CDI	C	H	Y
Wei	2001	-0.27	1240	China	EA	0.45	minor	FACES II	SDS	C	M	Y
Wu	2011	-0.24	840	China	EA	0.44	minor	FES	SDS	C	H	Y
Xiong	2011	-0.33	400	China	EA	0.76	adult	FACES II	SDS	C	M	Y
Xu	2022	-0.35	1152	China	EA	0.5	minor	FACES II	CES-D	C	M	Y
Yan	2021	-0.46	1773	China	EA	0.54	minor	FACES II	CES-D	C	H	Y
Yan2	2022	-0.41	842	China	EA	0.49	minor	FACES II	CES-D	C	H	N
Yang ^a	1999	-0.36	500	China	EA	0.55	minor	FACES II	CES-D	C	M	Y
Yang ^b	2008	-0.28	296	China	EA	0.44	minor	FES	Other	C	H	Y
Yang ^c	2021	-0.46	2163	China	EA	0.45	minor	FACES II	CES-D	C	M	N
Yang ^d	2005	-0.27	550	China	EA	0.28	adult	FES	SCL-90	C	H	N

Yi	2011	-0.08	2208	China	EA	0.46	minor	FES	CES-D	C	M	Y
Yun	2004	-0.34	156	China	EA	0.56	minor	FES	SDS	C	M	Y
Zhang ^a	2013	-0.34	664	China	EA	0.3	adult	FES	CES-D	C	H	Y
Zhang ^b	2013	-0.37	958	China	EA	0.46	minor	FACES II	SCL-90	C	M	N
Zhang ^c	2015	-0.16	76	China	EA	0.47	adult	FACES II	CES-D	C	H	Y
Zheng	2010	-0.33	3040	China	EA	0.48	minor	FACES II	SDS	C	H	Y
Zhuang	2020	-0.22	772	China	EA	0.52	minor	FACES II	CES-D	C	M	Y

Note: Since some documents do not provide a clear sampling year, publication year of the document minus two years is used as the sampling year. EA stands for East Asian culture, Na for North American culture, LA for Latin American culture, and ME for Middle East culture; Y means published, N means unpublished; C stands for cross-sectional study, L stands for longitudinal study; H stands for high quality and M stands for medium quality.

2.3 Model selection

The fixed effect model assumes that the actual effects of each study are the same and only random errors lead to differences. The random effect model assumes that each study's actual effects may differ, and random errors and sample characteristics jointly lead to differences (Schmidt et al., 2009). This study believes that gender, culture, and other factors may affect the association between family cohesion and depression, so the random effect model is used to estimate. The appropriateness of model selection can be verified by heterogeneity test. The random effect model should be used if the Q test is significant or the I^2 value exceeds 75%. On the contrary, the fixed effect model should be used (Huedo-Medina et al., 2006).

2.4 Data processing

This study employed the correlation coefficient (r) as the effect index. Comprehensive Meta-Analysis Version 3.3 was utilized to examine both the main and moderating effects. Two moderating effect analyses were conducted: (1) Meta-regression analysis for continuous variables, including male ratio and sampling year. (2) Subgroup analysis for categorical variables, including age, family cohesion measurement tools, depression measurement tools, cultural background, and design type. Additionally, to ensure the representativeness of effect size under different subgroup variables, each subgroup comprised at least 3 effect sizes. (Zhang et al., 2023).

2.5 Publication bias control and test

In order to ensure the representativeness of literature, this study incorporated gray literature whenever feasible. Various methods were employed to assess publication bias, including the

Funnel plot, Egger's regression method, and trim-and-fill method. The symmetrical inverted funnel shape in the funnel plot and non-significant results from Egger's regression suggested minimal publication bias. The trim-and-fill method was employed for further publication bias testing in cases of asymmetry in the funnel plot. If no significant changes occurred before and after adjustment, the likelihood of publication bias was deemed minimal (Egger et al., 1997; Richard et al., 2009; Rothstein et al., 2005).

3 Results

3.1 Sample descriptions

This study incorporated 71 articles, comprising 73 Independent Effect Sizes and involving 90,023 participants. Among them, 15 were theses, and 56 were journal articles. The articles were distributed across different languages: 4 in Spanish, 5 in Korean, 27 in English, and 35 in Chinese. All the literature assessed demonstrated quality above the medium level, with 35 classified as medium quality and 36 as high quality. The selected articles span the years 1982 to 2023.

3.2 Heterogeneity test

The results showed that the Q value was 2413.62 ($P < 0.001$), and the I^2 value reached 97.02%, which exceeded the 75% rule proposed by Huedo Medina (Huedo-Medina et al., 2006). It shows that 97.02% of the variation in the effect quantity comes from the absolute difference in the effect size, and the results are heterogeneous. Therefore, the random effect model is selected to estimate the main effect and analyze the regulatory effect.

3.3 Main effect test

The results showed that the correlation between family cohesion and depression was -0.31, 95% CI [-0.35, -0.27] (Table 4, Figure 2). Following the proposed standard, the correlation surpasses 0.3, signifying a high correlation between family cohesion and depression (Gignac & Szodorai, 2016). Considering the literature quality score, only 37 high-quality effect size were analyzed, resulting in a correlation coefficient of $r = -0.30$, $P < 0.001$. Sensitivity analysis demonstrated stability, with the effect size fluctuating between -0.30 and -0.31 after eliminating any sample. In conclusion, the meta-analysis results exhibit high stability.

Table 4 Correlation between family cohesion and depression

Model	k	r	95% CI		z	p	Heterogeneity test				τ^2
			LL	UL			$Q(T)$	df	p	I^2	
Random	73	-0.31	-0.35	-0.27	-15.99	<0.001	2413.62	72	<0.001	97.02	0.03

Note: k is the number of independent samples.

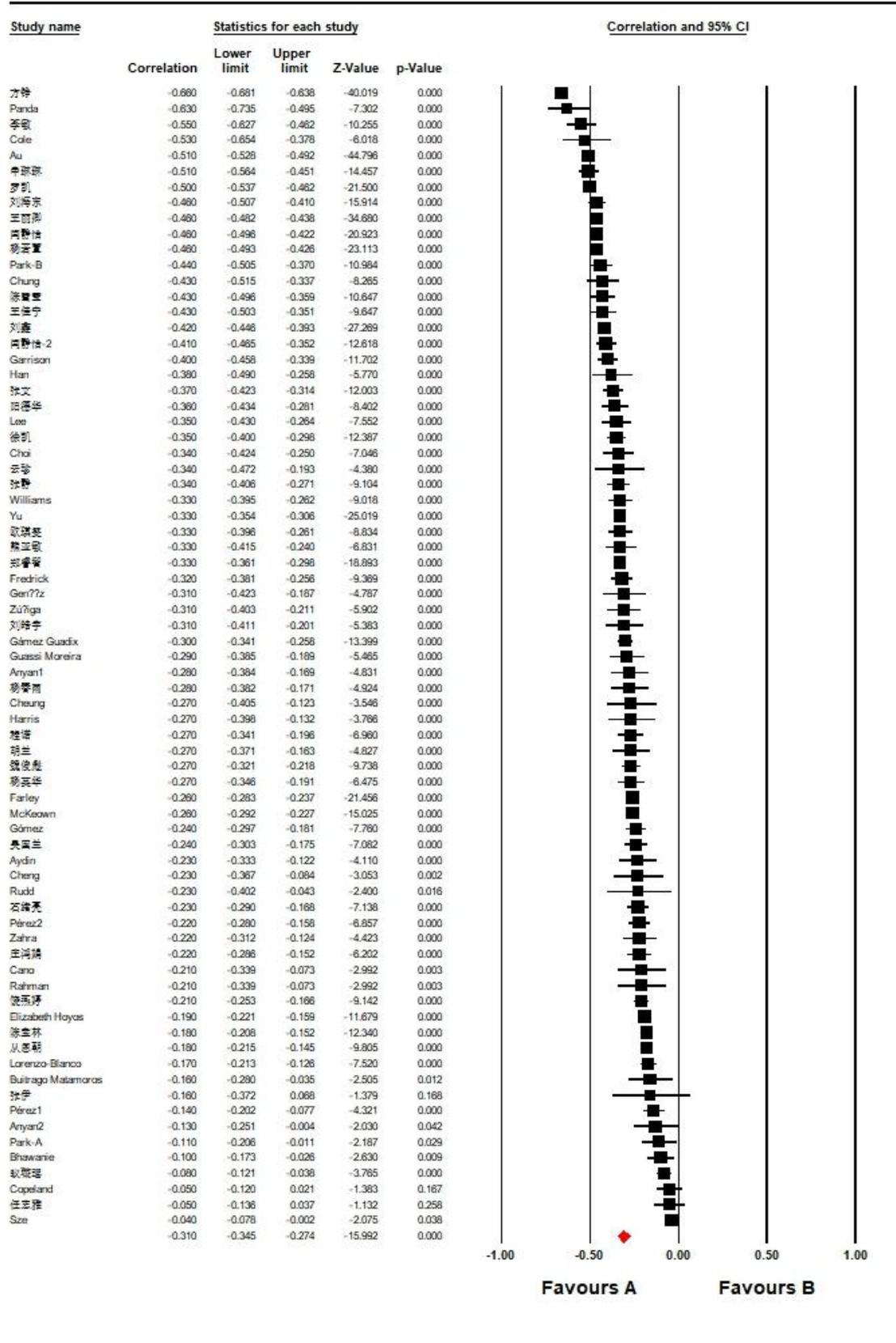


Figure 2 Meta-analysis of family cohesion and depress

3.4 Moderating effect test

The subgroup analysis results indicated that (1) Age did not significantly moderate the association between family cohesion and depression. (2) Family cohesion measurement tools significantly moderated the association, with FACES showing the highest correlation and ECF the lowest. (3) Depression measurement tools also significantly moderated the association, with CDI showing the strongest correlation and CES-D the weakest. (4) Design type significantly moderated the association, with cross-sectional design showing a higher correlation than longitudinal design. (5) Cultural background significantly moderated the association, with East Asian culture having the highest correlation and Latin American culture being the lowest (Table 5). Meta-regression analysis indicated that gender ($b=-0.01$, 95% CI [-0.27, 0.25]) and sampling year ($b=-0.004$, 95% CI [-0.008, 0.0002]) did not significantly moderate the association between family cohesion and depression.

Table 5 Results of subgroup analysis of categorical variables

Moderate variables	Heterogeneity test			<i>k</i>	<i>r</i>	95%CI		Two-sided test		
	<i>Q_B</i>	<i>df</i>	<i>p</i>			<i>LL</i>	<i>UL</i>	<i>z</i>	<i>P</i>	
Age	1.25	1	0.263	adult	28	-0.33	-0.37	-0.29	-15.29	<0.001
				minor	45	-0.30	-0.34	-0.25	-11.27	<0.001
Family cohesion measurement tools	44.92	4	<0.001	ECF	3	-0.20	-0.24	-0.17	-10.75	<0.001
				FACES	3	-0.38	-0.42	-0.33	-14.79	<0.001
				FACES II	20	-0.36	-0.43	-0.30	-10.12	<0.001
				FACESIII	8	-0.25	-0.34	-0.15	-4.98	<0.001
				FES	26	-0.33	-0.38	-0.27	-9.96	<0.001
				BDI	9	-0.31	-0.38	-0.24	-7.95	<0.001
Depression measurement tools	35.02	4	<0.001	CDI	3	-0.49	-0.53	-0.44	-17.79	<0.001
				CES-D	28	-0.30	-0.35	-0.26	-12.01	<0.001
				SCL-90	5	-0.38	-0.47	-0.28	-7.32	<0.001
				SDS	8	-0.36	-0.50	-0.20	-4.24	<0.001
Design	12.68	1	<0.001	cross-sectional	63	-0.33	-0.37	-0.29	-15.74	<0.001
				longitudinal	10	-0.20	-0.26	-0.13	-5.89	<0.001

				NA	15	-0.24	-0.30	-0.19	-8.52	<0.001
				EA	44	-0.34	-0.39	-0.30	-13.04	<0.001
Culture	16.70	3	0.001	LA	7	-0.22	-0.26	-0.18	-10.71	<0.001
				ME	3	-0.25	-0.31	-0.18	-7.61	<0.001

3.5 Publication bias test

According to the Funnel plots (Figure. 3), the effect size of the association between family cohesion and depression is centralized at the top of the graph and evenly distributed on both sides of the midline. It was found that the result of Egger linear regression was not significant, and the intercept was -1.02, 95% CI [-1.69, 3.73]. There was a high correlation before and after the trim-and-fill method. In conclusion, the results of this meta-analysis are reliable.

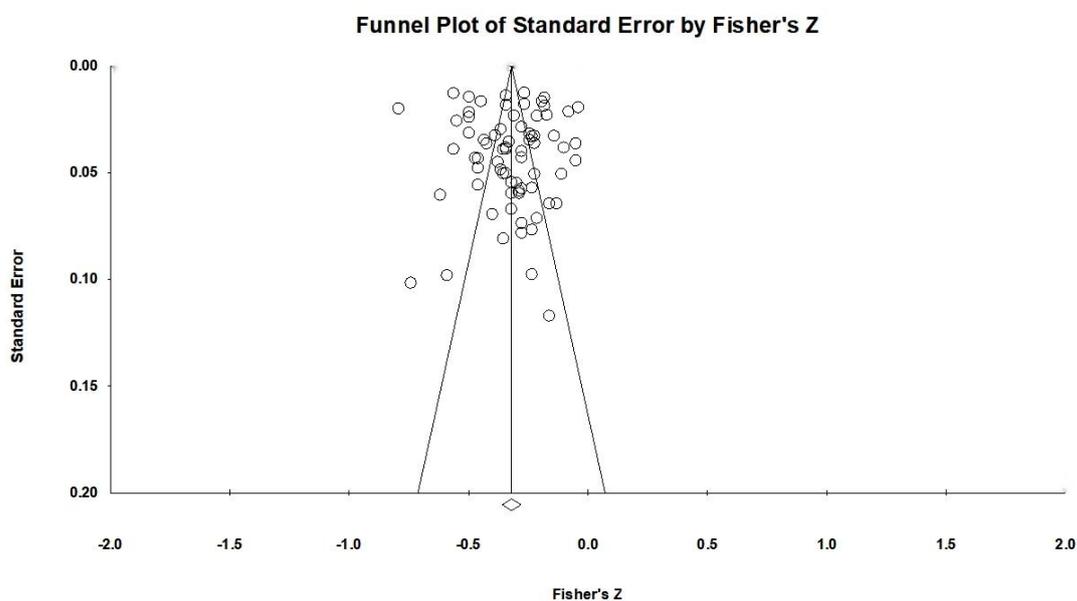


Figure 3 Funnel plot for publication bias.

4 Discussion

4.1 Association between family cohesion and depression

There are different views on the association between the two, and the results are also very different (Cheng, 2022; Mastrotheodoros et al., 2020; Panda, 2016). This study used meta-analysis to estimate the correlation of the two for the first time. The results showed that there was a high correlation between the two, indicating that the association between family cohesion and depression was very close. This result verifies Hypothesis 1 and supports the Social Support Theory (Farrell & Barnes, 1993; Fredrick et al., 2022), indicating that there is a linear correlation

between family cohesion and depression, while the U-shaped relationship (Copeland, 1998; Mastrotheodoros et al., 2020) needs to be further tested.

This result somewhat supports the Social Support Theory (Farrell & Barnes, 1993; Fredrick et al., 2022). Family cohesion is a protective factor for depression. The saying goes, “Harmony in a family makes everything successful” When family members perceive support from their families, they will have more courage to face various challenges in life, and the risk of depression will be significantly reduced (Rahman et al., 2022). In addition, the correct expression of care among family members helps to strengthen emotional connection, help individuals improve self-esteem, reduce depression, and promote mental health (Fredrick et al., 2022). Finally, family cohesion is a positive resource to help family members overcome difficulties, help individuals obtain positive self-identity, avoid social isolation, and reduce the risk of depression (Farley, 2022).

4.2 Analysis of moderating effects

Family cohesion measurement tools significantly moderate the association between family cohesion and depression, confirming Hypothesis 4. Specifically, the effect size measured by FACES is higher, and measured by ECF is lower. Firstly, it might be attributed to the varying comprehensiveness of the measurement tools. Although FACES is unidimensional, it contains the most items and covers a wide range of content, resulting in a higher measured correlation. ECF is not only unidimensional but also has the less items, leading to a lower measured correlation. Secondly, the differences may stem from distinct research theoretical frameworks and focus. Based on the family system theory, FACES measures the interaction, cooperative behavior, and interaction quality among family members, including conflict resolution and supportive behavior, and emphasizes family interaction and emotional connection. On the other hand, ECF measures family cohesion through aspects like family satisfaction and problem-solving, lacking observation of family interaction, resulting in a lower correlation.

Depression measurement tools significantly moderate the association between family cohesion and depression, confirming Hypothesis 5. Specifically, the effect size measured by CDI is higher, while CES-D is lower. Firstly, it could stem from the differential comprehensiveness of the measurement tools. CDI, a multidimensional measurement tool with the most items, captures depressive symptoms over a broader time span of 2 weeks. Its extensive coverage and detailed content render the measurement results more comprehensive and accurate. On the other hand,

CES-D, being both single-dimensional and having a shorter measurement time range, results in a lower measured correlation. Secondly, variations in research theoretical frameworks and focus may impact the measurement outcomes. Based on the cognitive-affective theory (Beck, 1996), CDI emphasizes the relationship between individual depressive symptoms and life events. Adapted for children's understanding abilities, it proves more convenient for participants, yielding a higher correlation. Meanwhile, CES-D, grounded in social psychology, not only overly focuses on the relationship between social aspects and emotional state but also includes topics unrelated to depressive symptoms, contributing to a lower correlation (Fried, 2017).

Cultural background significantly moderates the association between family cohesion and depression, confirming Hypothesis 6. Specifically, in East Asian culture, the correlation between the two is strong, whereas in Latin American culture, the correlation is weak. In East Asian culture, deeply influenced by Confucianism, the family concept emphasizes the "Loving Father, Faithful Son" ethic, requiring mutual respect and love among family members. Within this familial environment, individuals depend on the emotional support provided by the family, heightening the risk of negative emotions with a decrease in family cohesion (Hung, 2022; Yu & Xie, 2021). Conversely, Latin American culture emphasizes social contact and community cooperation, allowing individuals to find emotional support in diverse social networks beyond the family. This support network can mitigate the risk of depression when family cohesion diminishes. Additionally, expressing emotions through distinctive cultural outlets, such as dance music (such as samba and tango) and social activities (such as carnival), provides avenues for individuals to address negative emotions without relying solely on familial emotional expression. These cultural practices reduce the association between family cohesion and depression (Blanco Castro et al., 2022; Rojas, 2019).

Design type significantly moderates the relationship between family cohesion and depression, with a higher effect size observed in cross-sectional studies, confirming Hypothesis 8. Cross-sectional studies collected data at the same time point, making it easier to capture the immediate relationship between family cohesion and depression. In contrast, longitudinal studies collected data at different time points. Over time, individuals' positive psychological qualities gradually increased, and mental health services in schools and society improved. These factors better-equipped individuals to resist crises caused by a lack of cohesion, leading to a decline in the

impact of family cohesion on depression. (Cheng, 2022; Zhang et al., 2022).

Gender, age, and sampling year did not significantly moderate the association between family cohesion and depression, thus not supporting Hypothesis 2, Hypothesis 3, and Hypothesis 7. Regarding gender, despite women's emotions being more susceptible to family relations, societal sympathy and legal documents like the Committee on the Elimination of Discrimination Against Women (CEDAW) adopted by the United Nations provide protection and promote gender equality (Reddock, 2022). Hence, even if familial support is lacking, women have the right to protect their interests against the impact of low family cohesion. Regarding age, although minors are more closely connected with their families, they are also willing to establish intimate relationships with their peers and classmates outside the family relationship. The support brought by peer interaction can offset the impact of low family cohesion on depression (Gómez-Velásquez et al., 2021). In terms of the era, despite global disparities, increasing societal attention to mental health and the growing popularity of global psychological services contribute to a mature psychological support system. This system, including professional services and a social support network, helps alleviate depression risk. Consequently, individuals can still access adequate psychological support within families with weak cohesion, reducing the negative impact of low cohesion on depression.

4.3 Implication and limitations

Firstly, this study explored the correlation between family cohesion and depression, preliminarily elucidating the current debate between Social Support Theory and the Circumplex Model (Farrell & Barnes, 1993; Fredrick et al., 2022). The findings underscore that low family cohesion can be a risk factor for depression. Thus, promoting close relationships within families, fostering positive family dynamics, building a civilized society, and preventing collective depression becomes imperative.

Secondly, this study found that the measurement tools of family cohesion and depression can affect the association between family cohesion and depression. Consequently, future researchers should attentively select appropriate tools and indicators to ensure accurate data and information when investigating the interplay between the two.

Finally, this study also found that research design and cultural background had an impact on the association between family cohesion and depression. It shows that mental health professionals and decision-makers should consider the needs of different cultural groups when making social

policies and providing mental health support services, helping family members establish healthier intimate relationships, and developing more culturally adaptive and long-term intervention measures to help better patients and family members cope with depression.

This study also has limitations. Firstly, the sample size included in this research is relatively small in European and African cultures, making it challenging to analyze cultural differences in the study results at present comprehensively. Future research, with a more extensive sample, can facilitate more cross-cultural comparisons to understand the cultural variations in the relationship between family cohesion and depression across different cultural backgrounds. Additionally, the number of longitudinal studies included in this research is limited, preventing comparing the impact of family cohesion on depression at different intervals. Further analysis of such differences in longitudinal studies can be conducted in the future as more longitudinal research becomes available.

5 Conclusion

(1) Individuals with higher levels of family cohesion have lower levels of depression. (2) Measuring family cohesion with FACES resulted in a stronger correlation with depression, whereas ECF led to a weaker correlation. (3) Measuring depression with CDI resulted in a stronger correlation with family cohesion, while CES-D led to a weaker correlation. (4) The correlation between family cohesion and depression was stronger in East Asian culture and weaker in Latin American culture. (5) In cross-sectional design, the correlation between family cohesion and depression exceeded that in longitudinal design. (6) The correlation between family cohesion and depression was not adjusted for gender, age, and sampling year.

Declaration of competing interest

All authors declare that they have no conflicts of interest.

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