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What are the long-term effects of child loss on parental health? Social integration as mediator

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ABSTRACT

Background: Some bereaved parents experience a decreasing trajectory of grief, while others fail to adapt over the long term and persistently suffer from negative health consequences. This study investigates the mediating role of social integration in the relationship between losing an only child and parental health in a family-oriented society.
Method: A sample of 1828 bereaved parents and 4739 non-bereaved parents was drawn from a 10-city survey in China. Regression methods were used to examine the impact of child loss on parental health, and Sobel test was applied to examine the mediating role of social integration.
Results: Bereaved parents who lost their only child have worse self-rated health and more negative affect than the non-bereaved parents, which lasted for years after the death of the only child. The Sobel test shows that 24.8% of the total effects on self-rated health and 6.7% of the total effects on negative affect can be explained via decreased social integration. The gender of parents and child as well as fertility intentions are important sources of heterogeneity in the Chinese culture.
Limitation: The results based on cross-sectional data may only reveal correlation rather than causality. The data was retrieved from self-reported questionnaires and there is a lack of objective measures of parental health. Moreover, the detailed mechanisms behind how child loss resulted in less social integration should be further explored.
Conclusions: Significant disparities in health outcomes and social integration were found for bereaved parents relative to the non-bereaved parents. Future work is needed to assess the health of bereaved parents, identify the vulnerable and disadvantaged groups, and design inclusive intervention programs.
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1. Introduction

Bereavement, as one of the most stressful life events, has been confirmed to adversely affect health [1]. Compared with other parents, bereaved parents are more likely to experience a series of mental disorders, including complicated grief, anger, guilt, anxiety, depression and so on. Moreover, losing a child can be traumatic and result in long-term health consequences [2]. This study especially focuses on such long-term effects of child loss. More specifically, we investigate whether some bereaved parents continue to have worse health than their peers for several years or even longer after the death of their child.

In practice, some bereaved successfully recover from the trauma in a relatively short period while others do not [3–6]. Why do some parents adapt very slowly or even show no adaptation after child loss? A branch of literature in bereavement studies especially investigates how social factors contribute to the heterogeneity of adaption process [7]. Liang et al. (2018) recently find that individual social capital, measured as one's social participation in his/her community, has a buffering effect on depressive symptoms among rural bereaved parents [8]. Their theoretical framework, in which social participation was considered as moderator only, has two potential drawbacks. First, one's social capital (or social participation) was implicitly assumed to be fixed and would not change after child loss. Second, it overlooked the fact that social participation not only moderated but also mediated the impact of child loss on health.

Raising a child is not only a long-term investment for old age but also carries social constructions of life meanings [9], and the subjective

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feelings associated with child loss can be quite different across cultures. In societies where one's social status is closely related to his/her family, parents may perceive a quick decline in social status following child loss and then are more likely to isolate themselves from others. The existence of such bereavement-induced social isolation seems to contradict the hypotheses based on the Deficit Model of bereavement [10], which suggests that bereaved parents would ask for more social integration. However, for some parents, self-imposed isolation can be regarded as a rational choice. In fact, participation in social networks can be harmful rather than helpful for individuals of relatively low status [11]. Self-imposed isolation would keep the bereaved from social activities and social interactions. Far worse, some bereaved parents might refuse to seek help from others such as friends and even medical professionals, even though such help might be useful for their trajectory of grief. For example, the bereaved reported worse health but had no more hospital visits than the non-bereaved [12].

The role of social integration is usually recognized under the following theorical frameworks in previous studies. Social integration refers to connectedness ranging from intimate to widespread [13]. As shown in existing theoretical frameworks [11], social integration has a stress-buffering effect as well as being the main effect on overall health. The stress-buffering model is based on cognitive stress theories [14], which suggest that external resources such as social supports and professional counseling can help parents cope with stressful life events, such as a child loss, and prevent harmful reactions. In contrast, the main effect model is more closely related to attachment theory [15]. Attachment theory argues that supportive friends cannot compensate for the loss of an attachment figure, and social integration cannot replace the deep emotional support provided by attachment figures. The loss of emotional support can adversely affect both physical and mental health.

Taking the mediating role of social integration into consideration, our study extends the framework of Stroebe et al. (1996) to a further triple-path model [16], by arguing that the experience of negative emotions can in turn destroy one's social resources. More specifically, the bereaved living in a family-oriented culture not only loses support from the deceased family member directly, but may also reduce social interactions with others. The conceptual framework in Fig. 1 illustrates how our hypothesis is different from main effect model and stress-buffering model. In the classic dual-path model, the stress-buffering effect (denoted with "A") moderates the impact of bereavement stress while the main effect (denoted with "B") captures the impact associated with the loss of emotional support from attachment figures. In contrast, we mainly focus on the effects mediated through the channel of decreased social integration (denoted with "C").

Chinese culture has a subtle effect on the impact of child loss on parental health. In China, a wife's status could be significantly improved if her first birth is a son [17] or if she is able to select the child's sex with ultrasound technology [18]. Besides, mothers are more vulnerable in the case of child loss than fathers because they rely more on the financial supports from children [19] or they have stronger commitments to childbearing [20]. Also, under the strict implementation of the one-child policy for the past four decades, the impact of child loss on parental health would become complicated and delicate among those with different fertility intentions. Therefore, this current study uses a unique survey sample on parents who lost their only child in 10 representative cities in China to investigate (1) the long-term effects of child loss on parental health; (2) how social integration mediates the effects of child loss on health; and (3) how the effects of child loss on health and social integration are conditional on the bereaved parent's gender and intention of fertility.

Hypothesis 1. Child loss is negatively associated with parental health in China, and such a negative association can last for several years or even longer after child loss.

Hypothesis 2. Social integration plays a mediating role between child loss and parental health.

Hypothesis 3. The effects of child loss on health differ between men and women and between high and low fertility intentions.

2. Material and methods

2.1. Sample

We analyzed data from the China Family Planning Survey on Vulnerable Households in 2017. This large-scale survey project focuses on bereaved parents who have lost their only child and is the largest survey project on bereaved parents in China. The project was conducted by the Ministry of Civil Affairs of China and collected a wide range of information about the bereaved parents, such as demographic and socioeconomic characteristics, health indicators, and information on the death of their child.

Multistage stratified random sampling was employed in this survey. At the first step, 10 cities, including Beijing, Shanghai, Shenyang, Jinan, Zhengzhou, Wuhan, Guangzhou, Nanning, Chongqing, and Xi'an, were selected as the representative cities from eastern, central and western areas in China. The parents who lost their only child, at the second step, were randomly selected as interviewees in each city according to the official record list as the sampling frame. Then some ordinary households in the same communities with the bereaved sample were randomly selected as a matching group using a quota-sampling method at 3:1 ratio. The investigation work was completed by Peking University with Computer Assisted Personal Interviewing. 1828 bereaved parents with no living child from 1152 households were surveyed, while 4739 parents from 2996 ordinary households with only one child were interviewed as matching sample. As shown in Fig. 2, for about 70% of the bereaved parents in this survey, the child had died >5 years ago at the time of interview in 2017. Therefore, the estimators of the study can largely be interpreted as long-term effects of bereavement that were not recoverable in the short term.

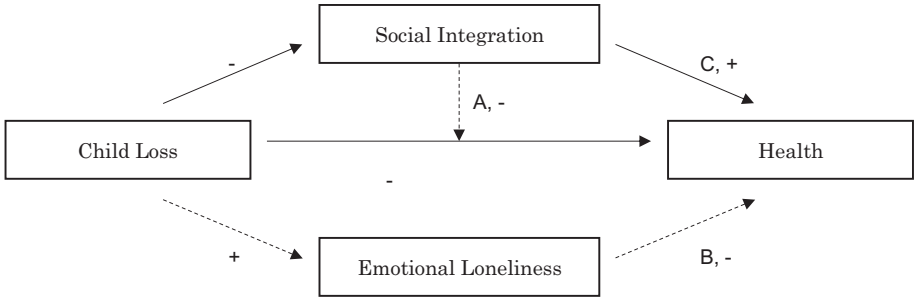

Fig. 1. Conceptual framework: The triple-path model.

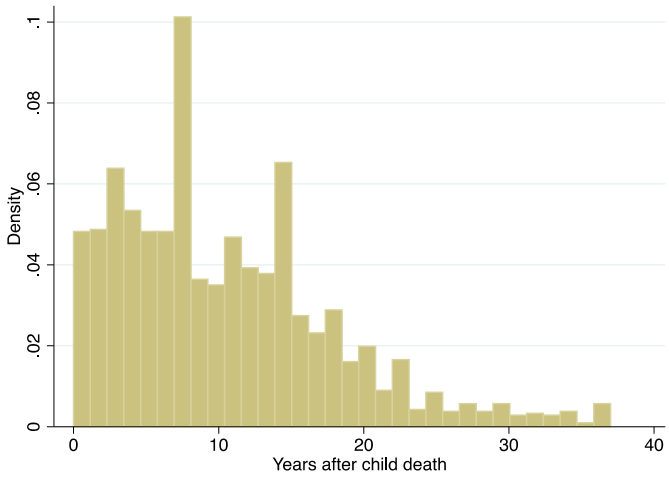

Fig. 2. The distribution of years after child death.

2.2. Self-rated health and negative affect

We used two measures to capture parental health: self-rated health (SRH) and negative affect. SRH is a comprehensive and subjective indicator for measuring health status [21]. The SRH indicator was based on answers to the question "How do you think of your health? Would you say your health is good, fair or poor?". We coded the three options into numeric scores ranging from 1 ("poor") to 3 ("good") to get the SRH indicator. Negative affect was measured using a slightly revised Kutcher Adolescent Depression Scale, which had been cross-validated among Chinese elderly [22]. Respondents were asked about whether they had any negative affect such as loneliness, anxiety, depression, inferiority, fear, nervousness, or self-accusation in the past 6 months. For each item of negative affect, a value of 1 was assigned if the respondent answered "yes". Otherwise, it would be coded as 0. We summed up the scores of all 7 items to construct our measure of negative affect. Thus, it was an indicator ranging from 0 to 7.

2.3. Social integration

The measure of an individual's social integration was an aggregated score of three questions assessing integration during the past year: (1) whether he/she participated in social activities ("yes" = 1/ "no" = 0); (2) whether he/she participated in social organizations ("yes =1"/"no" = 0); (3) and the frequency of his/her social interactions with friends or neighborhoods ("rarely" = 0, "seldom" = 0.25, "sometimes" = 0.5, "often" = 0.75, "always" = 1). Such a measurement is consistent with the conceptual model of Berkman et al. (2000), in which "social integration" is to some extent thought of as the intensity of one's social network [13]. Following the practice of previous studies [23], we used the sum of the scores of the three components to generate the measure of the respondent's overall social integration.[1]

2.4. Regression models

We conducted the following fixed-effect model regression to estimate the effects of child loss on parental health:

$$Y_{ij} = \beta_0 + \beta_1 Childloss_{ij} + \gamma X_{ij} + \varphi_j Province_j + \varepsilon_{ij}$$

where j indexes provinces and i indexes individuals within each province. Y_{ij} denotes the respondent's health status, which can be the SRH indicator or negative affect. $Childloss_{ij}$, the independent variable that we are most interested in, is a dummy variable indicating whether the respondent had experienced child loss or not ("Yes" = 1 / "No" = 0). X_{ij} are control variables such as gender, age, education, and the number of living siblings for the respondents. $Province_j$ is a bundle of dummy variables for controlling province-level fixed effects.

One potential problem was that elder parents might face greater risk of child death because of their own hereditary health problems. On one hand, whether the death was sudden or forewarned can influence the pattern of grief [24,25], among which accidental death is likely to have the most effect on vulnerable people and those who are less well-prepared [26]. On the other hand, children from families with high socio-economic status are less likely to die of natural causes, because they have better nutrition as well as better access to medical care. This indicates that there is a potential selection problem in examining the consequences of natural death if family characteristics cannot be fully observed and controlled. Estimating the effects separately with the "accidental death" subsample can partially avoid the bias caused by omitted variables. To further deal with this endogenous problem, we performed a set of additional empirical analyses based on deaths due to accidents to test the robustness of the finding.[2]

We further conducted Sobel tests to investigate the mediation role of social integration of child loss on parental health. The Sobel test is a widely used tool for investigating whether one factor among the mechanisms translates a stimulus into a response [27,28].

We then replaced the dependent variable with social integration and conducted the following regression:

$$SI_{ij} = \beta_0 + \beta_1 Childloss_{ij} + \gamma X_{ij} + \varphi_j Province_j + \varepsilon_{ij}$$

where SI_{ij} indexes individual's social integration, which is constructed based on respondents' answers to three related questions using the raw summary score, and the other variables are described above.

Based on the results of first two steps, we further added social integration as an independent variable in the first equation to estimate the effect of child loss and social integration on parental health:

$$Y_{ij} = \beta_0 + \beta_1 Childloss_{ij} + +\beta_2 SI_{ij} + \gamma X_{ij} + \varphi_j Province_j + \varepsilon_{ij}''$$

We also performed several empirical analyses to test the possible heterogeneity with the same methodology as above, including grouped regressions by years after child loss and number of living siblings. We also compared losing a son with losing a daughter between fathers and mothers.

3. Results

3.1. Descriptive statistics

Table 1 reports the descriptive statistics of all variables. Bereaved parents who lost their only child had worse SRH, more negative affect, and less social integration than non-bereaved parents. In general, non-bereaved parents are quite similar to bereaved parents in demographics and socio-economic status, indicating that the matching sample of non-bereaved parents can serve as a valid control group for our estimation. The higher likelihood of divorce in bereaved parents is consistent with previous studies [29], which found that the marital break-up rate increases for bereaved parents. The respondents were less likely to be

[1] Using the simple sum of the three scores as the measure of social integration implicitly assumes that each component carries equal weight, and such an assumption might not be valid. To examine the robustness of our results, we also used the approach of principal component analysis (PCA), in which the weight of each component is based on orthogonal transformation, to obtain an alternative measure of social integration and reconducted our analyses [26]. This produces results that are very similar to those in our main analysis.

[2] We also compared the impact on health outcomes by causes of death. The results show that health effects caused by death due to chronic diseases are smaller compared with accidental deaths. Since a child's death due to chronic diseases might overestimate the health shock to parents, this further indicates that the problem of omitting variables is negligible.

Table 1
Descriptive statistics.

Variables	Bereaved parents (n = 1650)	Nonbereaved parents (n = 4739)	P-value[a]
Self-rated health, mean (SD)	1.99 (0.62)	2.16 (0.69)	
Negative affect, mean (SD)	2.77 (2.61)	1.06 (1.77)	
Social integration, mean (SD)	0.50 (0.31)	0.60 (0.32)	
Female, %	54.6	54.3	0.121
Age, mean (SD)	62.47 (6.63)	64.85 (9.78)	<0.001
Less than primary school, %	1.6	6.9	
Primary school, %	10.7	14.9	0.081
Junior high school, %	39.0	34.6	0.106
High school or above, %	48.7	43.5	0.144
Divorced, %	10.4	4.2	0.018
Widowed, %	11.7	14.4	0.108
Disability, %	3.9	7.7	0.436
Rural, %	2.8	12.8	0.020
The number of living siblings, mean (SD)	2.92 (1.72)	2.99 (1.80)	<0.001
Log of savings, mean (SD)	4.05 (5.2)	4.24 (5.30)	0.035
Chronic disease (yes = 1), %	65.7	54.9	<0.001
Gender of the death child			
Son, %	69.9		
Daughter, %	30.1		
Cause of child death			
Illnesses, %	61.1		
Accidents, %	38.9		

[a] The difference in sample characteristics by child loss was tested by Fisher's Permutation tests.

living in rural areas because this survey was mainly conducted in cities where residents experienced more stringent fertility constrictions.

3.2. The effects of child loss on parental health

Table 2 reports the results of OLS regressions for child loss on parental health. As shown in columns (1) and (3), bereaved parents have worse SRH and more negative affect than the non-bereaved parents. The coefficients of the dummy variable indicating the experience of child loss are statistically significant. For example, the conditional mean of the SRH indicator in bereaved parents is 0.113 point lower than that in non-bereaved parents. Such a difference is as large as the gap in SRH between illiterate respondents and respondents with a high school degree or above. Consist with previous studies [30,31], the results show that more highly-educated respondents are healthier both physically and mentally.

We then repeat regression analyses with the subsample that excludes bereaved parents whose child died of natural causes to avoid the bias caused by omitted variables. The results with the subsample are reported in columns (2) and (4) of Table 2, whose coefficients are quite close to those in columns (1) and (3). In general, we don't find strong evidence supporting that the effects of child loss are significantly different between the "accidental death" subsample and "natural death" subsample.

To examine whether Chinese parents can adapt to the loss of only child in the long term, we rerun regressions with subsamples of bereaved parents whose child had been dead for >3 or 5 years. The results shown in Table 3 contradict the predictions of the set point model. Compared with non-bereaved parents, Chinese bereaved parents have been unceasingly suffering from worse SRH and more negative affect for years after the death of the only child.

3.3. Social integration as a mediator

Here we examine the mediating role of social integration in the associations between child loss and health. Columns (1) and (2) in Table 4 show the results of OLS regressions of social integration on child loss. The average score of social integration for bereaved parents is 0.10

Table 2
Results of regressions for child death on health.

	Self-rated health		Negative affect	
	(1)	(2)	(3)	(4)
	Full sample	Accidental death	Full sample	Accidental death
Child loss	−0.113***	−0.118***	1.482***	1.730***
	(0.018)	(0.028)	(0.067)	(0.111)
Female	−0.008	−0.007	0.091*	0.082*
	(0.015)	(0.017)	(0.049)	(0.050)
Age	−0.006***	−0.005***	−0.011***	−0.011***
	(0.001)	(0.001)	(0.004)	(0.004)
Age square	0.029	0.029	−0.070	−0.096
	(0.023)	(0.025)	(0.075)	(0.077)
Primary school	0.071*	0.090**	0.140	0.124
	(0.041)	(0.042)	(0.121)	(0.124)
Junior high school	0.102***	0.119***	0.130	0.139
	(0.039)	(0.041)	(0.118)	(0.121)
High school or above	0.116***	0.124***	0.072	0.016
	(0.040)	(0.041)	(0.118)	(0.121)
Divorced	−0.146***	−0.201***	0.756***	0.729***
	(0.034)	(0.040)	(0.130)	(0.144)
Widowed	−0.055**	−0.066**	0.428***	0.435***
	(0.025)	(0.029)	(0.081)	(0.086)
Disability	−0.423***	−0.405***	0.722***	0.782***
	(0.031)	(0.034)	(0.110)	(0.112)
Rural	0.072***	0.069**	−0.017	−0.005
	(0.027)	(0.028)	(0.077)	(0.078)
The number of living siblings	0.015***	0.017***	−0.027*	−0.034**
	(0.004)	(0.005)	(0.014)	(0.014)
Log of savings	0.012***	0.012***	−0.040***	−0.036***
	(0.001)	(0.002)	(0.005)	(0.005)
Chronic diseases (yes = 1)	−0.491***	−0.503***	0.692***	0.651***
	(0.016)	(0.017)	(0.048)	(0.048)
Constant	2.661***	2.589***	1.452***	1.501***
	(0.095)	(0.101)	(0.289)	(0.296)
Observations	6352	5304	6352	5304
R-squared	0.269	0.292	0.253	0.263

Note: Estimates in columns (2) and (4) are fitted on pooled sample of bereaved parents whose child had an accidental death and non-bereaved parents. Robust standard errors clustered at household level in parentheses. *, ** and *** denote significance level at the 10%, 5% and 1% levels.

points lower than for non-bereaved parents. The regression with the "accidental death" subgroup gives almost the same results and suggests that cause of death doesn't make a difference. The coefficients of control variables are consistent with the findings in previous studies [32,33]: male, poorly educated and less well-off parents tend to be less socially integrated. We also find that respondents with more living siblings are more socially integrated, which is consistent with our argument that the intensity of social integration is closely linked to family characteristics in China.

Table 3
Results of regressions for child death on parental health: by years after child loss.

	Years after child loss >3		Years after child loss >5	
	(1)	(2)	(3)	(4)
	Self-rated health	Negative affect	Self-rated health	Negative affect
Child loss	−0.125***	1.464***	−0.118***	1.424***
	(0.019)	(0.074)	(0.021)	(0.078)
Other controls	Yes	Yes	Yes	Yes
Observations	6044	6044	5848	5848
R-squared	0.273	0.246	0.277	0.239

Note: Other controls include indicators for gender, age, education, marital status, disability, rural area, number of siblings, financial savings, and chronic diseases. Robust standard errors clustered at household level are in parentheses. *, ** and *** denote significance level at the 10%, 5% and 1% levels.

Table 4
Results of regressions and Sobel tests.

	Social integration		Self-rated health		Negative affect	
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	Accidental death	Full sample	Accidental death	Full sample	Accidental death
Social integration			0.280***	0.287***	−0.978***	−0.882***
			(0.024)	(0.027)	(0.079)	(0.082)
Child loss	−0.101***	−0.093***	−0.086***	−0.091***	1.388***	1.655***
	(0.009)	(0.014)	(0.018)	(0.027)	(0.057)	(0.081)
Female	0.077***	0.084***	−0.029*	−0.030*	0.169***	0.156***
	(0.008)	(0.008)	(0.015)	(0.017)	(0.049)	(0.050)
Age	−0.002***	−0.003***	−0.006***	−0.005***	−0.013***	−0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)
Age square	0.058***	0.070***	0.013	0.009	−0.013	−0.038
	(0.012)	(0.013)	(0.023)	(0.025)	(0.074)	(0.076)
Primary school	0.105***	0.091***	0.040	0.063	0.244**	0.205*
	(0.019)	(0.020)	(0.037)	(0.039)	(0.121)	(0.117)
Junior high school	0.173***	0.166***	0.050	0.067*	0.302**	0.285**
	(0.018)	(0.019)	(0.036)	(0.038)	(0.118)	(0.115)
High school or above	0.226***	0.222***	0.050	0.058	0.295**	0.211*
	(0.018)	(0.019)	(0.037)	(0.039)	(0.119)	(0.116)
Divorced	0.001	−0.018	−0.148***	−0.200***	0.766***	0.728***
	(0.016)	(0.019)	(0.032)	(0.037)	(0.102)	(0.110)
Widowed	−0.004	0.003	−0.056**	−0.069***	0.421***	0.437***
	(0.012)	(0.013)	(0.024)	(0.027)	(0.077)	(0.080)
Disability	−0.085***	−0.082***	−0.399***	−0.382***	0.635***	0.708***
	(0.016)	(0.017)	(0.029)	(0.031)	(0.095)	(0.095)
Rural	−0.040***	−0.043***	0.083***	0.081***	−0.058	−0.046
	(0.014)	(0.014)	(0.026)	(0.027)	(0.084)	(0.081)
The number of living siblings	0.013***	0.012***	0.011***	0.013***	−0.015	−0.024*
	(0.002)	(0.002)	(0.004)	(0.005)	(0.014)	(0.014)
Log of savings	0.006***	0.005***	0.011***	0.011***	−0.035***	−0.032***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.005)	(0.005)
Chronic diseases (yes = 1)	−0.034***	−0.029***	−0.481***	−0.496***	0.658***	0.625***
	(0.008)	(0.008)	(0.015)	(0.017)	(0.049)	(0.050)
	0.440***	0.475***	2.336***	2.207***	2.078***	2.094***
Constant	(0.048)	(0.051)	(0.095)	(0.101)	(0.306)	(0.305)
Observations	6325	5282	6325	5282	6325	5282
R-squared	0.178	0.207	0.285	0.308	0.271	0.280
Percent of total effect that's mediated			24.90%	22.32%	6.56%	5.88%
Ratio of indirect to direct effect			0.3315	0.2874	0.0702	0.0625

Note: Estimates in even-number columns are fitted on pooled sample of bereaved parents whose child had an accidental death and non-bereaved parents. Robust standard errors clustered at household level are in parentheses. *, ** and *** denote significance level at the 10%, 5% and 1% levels.

Following the approach used in previous studies which also focus on the mediating role of social integration [23,34], we add the variable of social integration into our original regressions, and then perform Sobel tests to estimate how much of the effects of child loss are mediated through the channel of social integration. Consistent with previous studies [35,36], social integration is found to be an influential determinant of health. According to columns (3)–(6) in Table 4, if the social integration indicator increases by one point (about one standard deviation of its distribution), the SRH indicator will increase by 0.28 point and negative affect indicator will decrease by 0.98 point. For comparison, the urban-rural gaps in the SRH indicator and the negative affect indicator are 0.08 and − 0.06 respectively. The results of the Sobel test support our hypothesis that social integration works as an important mediator in the link between child loss and health impairment. More specifically, 24.9% of the effect on SRH and 6.6% of the effect on negative affect can be explained by lower social integration after child loss. We also performed the ordered logistic regression on SRH and negative affect in Table A1 in the Appendix, and find rather similar and significant results.

3.4. Heterogeneity effect by gender and fertility intentions

As mentioned above, the effects of child loss on parental health are heterogeneous across culture, and the effects in Chinese traditional culture would be shaped with specific features. Furthermore, the specific effects might be more intense and delicate due to the implementation of China's one-child policy. In the context of Chinese traditional culture, both the boy preference and fertility intentions are the two most significant features. In general, the death of boy would have a greater negative impact on parental health than girl, meanwhile, parents living in a clan community with higher fertility intentions may suffer more adverse effects if they lost their only child. It is noteworthy that gender difference may also exist between parents, and the impact of child death differs between father and mother; specifically, the mother suffers more negative effects when the boy dies.

Therefore, this section examines different effects of the loss of the only son or daughter on parental health, focusing on gender difference in the association between child loss and parental health. This study will also examine the difference in the association among parents with varied number of siblings, which could closely represent parents' fertility preference environment in their living communities.

3.4.1. Gender difference

Following a recent work by Lee et al. (2014), we examine the effects of son loss and daughter loss on mothers and fathers separately [37]. Panel A in Table 5 reports the regression results. All the coefficients of key independent variables are still statistically significant. On one hand, we find that the death of a son has slightly stronger effects on parental health and social integration than the death of a daughter. On the other hand, the effects are also slightly stronger for mothers than for fathers. For example, the death of a daughter would cause a drop of 0.072 point in the SRH indicator and a drop of 0.047 point in the social

Table 5
Heterogeneous effects of child loss on parental health and social integration.

Panel A: by parental gender						
	(1)	(2)	(3)	(4)	(5)	(6)
	Self-rated health	Negative affect	Social integration	Self-rated health	Negative affect	Social integration
	Fathers			Mothers		
Death of child (ref. = non-bereaved parents)						
Death of a son	−0.092***	1.402***	−0.080***	−0.133***	1.539***	−0.149***
	(0.031)	(0.117)	(0.015)	(0.028)	(0.106)	(0.014)
Death of a daughter	−0.072*	1.353***	−0.047**	−0.095**	1.449***	−0.081***
	(0.041)	(0.171)	(0.022)	(0.037)	(0.159)	(0.021)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2897	2897	2883	3455	3455	3442
R-squared	0.280	0.233	0.135	0.264	0.262	0.214

Panel B: by the number of living siblings						
	(1)	(2)	(3)	(4)	(5)	(6)
	Self-rated health	Negative affect	Social integration	Self-rated health	Negative affect	Social integration
	Siblings>2			Siblings≤2		
Child loss	−0.155***	1.561***	−0.118***	−0.069**	1.424***	−0.087***
	(0.024)	(0.087)	(0.012)	(0.027)	(0.106)	(0.014)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3839	3839	3811	2550	2550	2538
R-squared	0.251	0.256	0.166	0.289	0.255	0.173

Note: Other controls include indicators for age, education, marital status, disability, rural area, number of siblings, financial savings, and chronic diseases. Robust standard errors clustered at household level are in parentheses. *, ** and *** denote significance level at the 10%, 5% and 1% levels.

integration indicator accordingly for fathers, while the death of a son would cause a drop of 0.133 point in the SRH indicator and a drop of 0.149 point in the social integration indicator accordingly for mothers.

3.4.2. Fertility intentions difference

In this section, we investigate whether respondents with more siblings are more sensitive or less sensitive to the impact of child loss. We divided bereaved parents into two groups according to the number of living siblings, and then conducted regressions on each subsample separately. From Panel B in Table 5, we can see that bereaved parents with two or more siblings score lower on SRH, and suffer from more negative affect and less social integration. The results show that parents with more siblings experience worse health outcomes than those with smaller family size.

4. Discussion

Child loss is one of the most stressing life events an elder may face. Prior work has documented the effectiveness of social integration in improving health and reducing stress in elders whose only child died. However, these studies have seen social integration as unchanged and have not focused on its mediating role. In this study we examine the mediating role of social integration between child loss and parental health using the data from a 10-city survey in China. The results suggest that decreased social integration following child loss accounts for a part of the impact. This finding extends those of Stroebe et al. to a triple-path model, confirming that the bereavement effect may be mediated through the channel of decreased social integration. This study therefore indicates that inclusive intervention and community-level social activities may help to improve the health condition and well-being of the bereaved elders.

Moreover, we especially emphasize the importance of cultural contexts in understanding the heterogeneous consequences of bereavement. Having a child bears different anticipations and different meanings in different cultures. In family-oriented societies, such as China and Japan in East Asian countries, both quantity and quality of children can bring parents status and respect in their communities. The specific environment of Chinese culture and the unexpected policy consequence put the parents with a deceased only child in a vulnerable trap. There is an old Chinese saying, “of all who lack filial piety, the worst is who has no children”, which implies that childless parents living in traditional communities might bear moral condemnation from their relatives and neighbors. Following the Confucian patriarchal ideas, Chinese parents expect their sons to take care of them until death. The loss of anticipated support from children may result in worse SRH and more negative affect [38]. A recent qualitative study in China explicitly pointed out that older parents who lost their only child were stigmatized by their culture and experienced difficulties in identity reconstruction [39].

Specifically, we examined the heterogeneous consequences on health by genders. In China, the expectations of sons are quite different from those of daughters. Except for economic supports, children can also bring social resources and respect to their parents [34]. Some recent studies have found positive spillover effects of adult children's political status on elderly parental health in China, which is partially mediated through increased social interactions [23].

According to the stress-buffering model [14], parents with more siblings have more social supports and thus should adapt better to the event of child loss. Does this prediction also work well in China? The answer is uncertain. First, due to intergenerational transmission of fertility preference, the number of siblings is positively correlated with one's fertility intention [40]. Parents with more siblings tend to have higher expectation of their number of children but were strictly restricted by the one-child policy. Second, for people living in a clan community, the kinship network is not only the source of support but also a burden. In some communities, childless couples may bear discrimination and condemnation rather than support from their relatives. We do find evidence that family ties are a double-edged sword in China, as it could be a source of stress as well as a source of support.

There are a few limitations in this study. First, the results may only reveal correlation rather than causality as our research is based on cross-sectional data. However, the accidental death of a child could be considered as an exogenous shock in quasi-experimental setting.

Therefore, we believe that the endogeneity problem isn't a major concern because regressions with the "accidental death" subsample provide quite consistent results. Second, negative affect was based solely on a 7-item scale, which does not include consideration of multiple sources of information. Moreover, our study did not include objective indicators of physical health and other variables related to mental health such as complicated grief, on which further studies can improve. Finally, the detailed mechanisms behind how child loss results in less social integration are still not fully clear. Is it caused by voluntary isolation or by social exclusion? We may need extra data to explore the answer.

5. Conclusion

Using the data from a 10-city survey on bereaved parents in China, this study examines the mediating role of social integration on the impact of child loss on parental health. We first found that bereaved parents had worse SRH and higher negative affect. This study is in line with the literature on estimating the welfare loss caused by the one-child policy in China [41]. The one-child policy restricted parental fertility choices and increased the risk of childlessness in the case of child loss. Therefore, the adverse effects of child loss should be stronger and more persistent in such a context.

Our results showed that compared with non-bereaved parents, bereaved parents were less socially integrated. The results of Sobel tests suggested that one quarter of the lasting impact on SRH and 6.5% of that on negative affect can be mediated through the channel of decreased social integration. Our findings contribute to the literature on how bereavement may adversely affect health by extending the stress and attachment theory. We showed that the decrease in social integration was among the long-term mechanisms. Previous studies have investigated long-term mechanisms involving changes in health behaviors [42,43], but overlooked changes in social behaviors. This study extends our understanding of the adaptation to child loss in Chinese society.

This study also indicates that China's family-oriented culture, which is shaped by the long history of Chinese traditional culture combined with the impact of one-child policy, and is operated with gender preference and fertility intentions in empirical analyses, may exert heterogeneous effects between child loss and parental health. The finding to some extent contributes an in-depth understanding of the classic stress-buffering model in a Chinese context.

This study has some important policy implications for health promotion for those who are likely to suffer more from the consequences of bereavement. Given different forms of social support have both mediating and moderating effects on bereaved parents, policy makers and social workers should carefully assess the social capital of bereaved elders, identify the vulnerable and disadvantaged groups, conduct targeted intervention programs and give professional help.

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Author contributions

Xintong Zhao planned the study, conducted the statistical analyses and prepared the manuscript; Hongwei Hu conceived the study design and prepared the manuscript; Yi Zhou and Yang Bai participated in the preparation and revision of the manuscript. All authors contributed substantially to the interpretation of the data and to the revision of the manuscript for important intellectual content and have approved the final version.

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Declaration of competing interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Appendix A

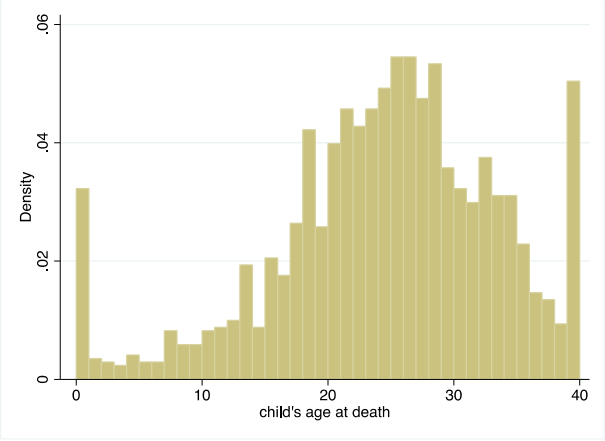

Fig. A1. Child's age at death.

Table A1
Estimates of ordered logistic regression on parental health.

	Self-rated health		Negative affect	
	(1)	(2)	(3)	(4)
	Full sample	Accidental death	Full sample	Accidental death
Social integration	0.989***	1.007***	−1.006***	−0.967***
	(0.088)	(0.098)	(0.087)	(0.099)
Child loss	−0.305***	−0.319***	1.233***	1.381***
	(0.062)	(0.097)	(0.060)	(0.096)
Other controls	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes
Observations	6325	5282	6325	5282

Note: Estimates in columns (2) and (4) are fitted on pooled sample of bereaved parents whose child had an accidental death and non-bereaved parents. Robust standard errors in parentheses. *, ** and *** denote significance level at the 10%, 5% and 1% levels.

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