



Original Article

Effort–reward Imbalance at Work, Parental Support, and Suicidal Ideation in Adolescents: A Cross-sectional Study from Chinese Dual-earner Families



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ARTICLE INFO

Article history:

Received 17 December 2015

Received in revised form

27 July 2016

Accepted 8 September 2016

Available online 30 September 2016

Keywords:

adolescent

China

effort–reward imbalance

parents

suicidal ideation

ABSTRACT

Background: In contemporary China, most parents are dual-earner couples and there is only one child in the family. We aimed to examine the associations of parents' work stress with suicidal ideation among the corresponding adolescent. We further hypothesized that low parental support experienced by adolescents may mediate the associations.

Methods: Cross-sectional data from school students and their working parents were used, with 907 families from Kunming City, China. Stress at work was measured by the effort–reward imbalance questionnaire. Perceived parental support was assessed by an item on parental empathy and their willingness to communicate with the adolescent. Suicidal ideation was considered positive if students reported thoughts about suicide every month or more frequently during the previous 6 months. Logistic regression was used to examine the associations.

Results: We observed that parents' work stress was positively associated with low parental support, which was in turn associated with adolescent suicidal ideation. The odds ratio for parents' work stress and adolescent suicidal ideation was 2.91 (95% confidence interval: 1.53–5.53), and this association was markedly attenuated to 2.24 (95% confidence interval: 1.15–4.36) after additional adjustment for parental support. Notably, mothers' work stress levels exerted stronger effects on children's suicidal ideation than those of fathers.

Conclusion: Parents' work stress (particularly mother's work stress) was strongly associated with adolescent's suicidal ideation, and the association was partially mediated by low parental support. These results need to be replicated and extended in prospective investigations within and beyond China, in order to explore potential causal pathways as a basis of preventive action.

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1. Introduction

Suicidal ideation has been defined as “any self-reported thoughts of engaging in suicide-related behavior” [1]. Although it represents a state of enhanced susceptibility to emotional crisis and self-harm activity rather than a direct behavioral attempt, suicidal ideation was found to increase the risk of future suicidal attempt and suicide, especially in adolescence, which represents a potentially critical period in one's life course [2–4]. In view of the fact

that suicide is a prominent cause of adolescent mortality worldwide [5], it is of interest to explore the wider socio-environmental conditions that may contribute to the occurrence of suicidal ideation. For the following reasons, China represents a special case in this context: first, as far as reliable data are available, adolescent suicide rates in this country appear to be remarkably high, i.e., 6.7/100,000 young persons aged 15–19 years, in comparison with 5.0/100,000 in Japan and 4.0/100,000 in the UK, for example [5,6]. Secondly, as a consequence of the imposed one-child policy of

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reproduction, Chinese children and adolescents are confronted with high expectations from their parents of growing up successfully, especially with regard to academic achievement [7]. This mental and emotional pressure often leads to reduced wellbeing and mental distress [8,9]. Thirdly, a vast majority of parents living in urban areas in China are dual-earner couples, such that more than 90% of mothers are working full- or part-time [10]. In line with extensive reviews, psychosocial family environments are crucial to children's and adolescents' developmental health [11], including suicidal risks [12]. According to a recent meta-analysis this holds particularly true in China [13].

Earlier research has demonstrated that the employment status and stressful working conditions of parents, and specifically fathers' adversity, exert negative effects on children's wellbeing and mental health, including suicidal ideation and suicidal attempt [14–20]. However, most of these studies, which were mainly conducted in Western societies, have focused on fathers' employment and work environment as potential risk factors. Therefore, there is a lack of investigations on working parental couples. Internationally, husbands seem to consistently fulfill the role of the family's breadwinner [21], while the wives' role shows more variation across countries and settings [22]. In many Western countries, for instance, mothers often quit their job or switch to part-time employment during the period of child rearing. By contrast, in China, mothers generally remain in their original jobs. Data from the International Labor Office indicate that the average participation rate of women's employment is > 90% in China, while the corresponding numbers in remaining Asian countries as well as Africa, North America, and Europe are substantially lower [10]. In addition, a large cross-country study found that Chinese men are at the top rank concerning less engagement in housework [23]. Accordingly, China offers a special case for this research, compared with their spouses, Chinese mothers play the primary role of homemakers; at the same time they are additionally exposed to pressure from work [24,25]. This combined workload has been shown to increase the burden of Chinese women's work-related disease [26,27].

Considering the assessment of stressful working conditions, previous studies often applied questionnaire scales measuring the demand-control model of job strain [14–17,19]. This model defines stressful work in terms of a combination of high quantitative demands and low task-related control [28]. A complementary model, effort–reward imbalance, was shown to be of similar importance [29]. This model posits that a mismatch between high efforts spent and low rewards received in turn in a contractual exchange, such as the work contract, generates negative emotions and associated stress with adverse long-term consequences for health [30]. These negative effects are due to the proposition that a basic “grammar” of social exchange, the reciprocity of “give” and “take,” is violated. Reward frustration at work is experienced at the level of wage and salary, of social status (promotion prospects, job security), and of achievement-based appreciation or esteem. A psychometrically validated questionnaire measuring effort–reward imbalance at work in Chinese language has been developed [31]. Following the predictive utility of this measure in previous epidemiologic studies in China [27,32], we included a test of this model in the present study.

To provide a convincing conceptual scheme linking parents' work stress and support with adolescents' wellbeing we rely on the family systems theory proposed by Cox and Paley [33]. This approach considers the role of family as a hierarchically organized system composed by smaller subsystems (parents and children) and linked to more distant systems (such as work environments and employment arrangements). Accordingly, changes in the condition of one family member or in the patterns of relationships among them may affect the functioning of other members [33]. Along these lines several studies, mostly conducted in Western

societies, tested the hypothesis that parental stress originating from adverse work compromised their ability to provide appropriate social support to their children and adolescents [34–38]. Subsequently, this lack of support may turn out to be a risk factor of adolescent suicidal behaviors [39–42], though the mechanism is not fully understood. The literature shows that low parental support might influence children's sense of their own identity and autonomy [43]; and poor support from parents is associated with mental disorders in children (e.g., depression and anxiety) [44] and with victimization from bullying at school [45]. The findings have also been replicated in China [13] and all the above-mentioned mediators and/or moderators may contribute to suicidal behaviors.

In this study, we set out to analyze the associations of fathers' and mothers' stress at work, as measured by the effort–reward imbalance model, with adolescents' suicidal ideations, and to explore a potential mediating role of low parental social support. These associations are framed within the family systems theory [33], and, for the first time, are tested in a large sample of Chinese families with urban dual-earner couples. The following hypothetical models will be tested: (1) parents' work stress is associated with low parental support; (2) low parental support is associated with children's suicidal ideation; (3) parents' work stress is associated with children's suicidal ideation; and (4) low parental support mediates the association between parents' work stress and children's suicidal ideation.

2. Materials and methods

2.1. Study sample

This cross-sectional study was conducted in four public schools in Kunming City, China. In order to balance socioeconomic inequalities, these four schools were randomly selected from areas representing different levels of socioeconomic development among a total of 26 public schools scattered within the city. Three of the four schools taught students in Grades 7 through 12, and one school had students in Grades 10 through 12 only. We randomly selected one class from every grade in every school to participate in our study, resulting in a total of 21 classes included. A total of 1,249 students together with their parents from 21 classes were invited to participate. With support from the local education authority, a trained researcher from the University majoring in public health visited the classes to explain the study and distribute questionnaires (see below) to the students. The students who agreed to participate in our survey completed the adolescent questionnaires in the classes [46]. Then students took the parental questionnaires home and asked their parents for participation. In total, 1,089 nuclear families (1 working father, 1 working mother, and 1 studying adolescent) returned the questionnaires within 1 week (response rate 87.19%). All participants (fathers, mothers, and adolescents) gave individual written informed consent prior to their inclusion in the study, and both parents gave permission for their child's participation. The current report is based on a sample of 907 families without missing values. We have no indication that this sample was biased in terms of selection criteria, i.e., the characteristics of the excluded families did not differ significantly from those of the remaining families (data not shown). The results of the study entirely limited to adolescent questionnaires investigating correlates of suicidal ideation without use of parental data were published previously [46]. This current contribution, for the first time, analyzed the data of parental questionnaires linking to children's suicidal ideation, with a two-generation familial approach. This study protocol was approved by the Ethical Committee of the Kunming Medical University, and has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

2.2. Measures

Parents' work stress was measured by the original, psychometrically validated effort–reward imbalance (ERI) questionnaire at work [30], whereas the well-tested Chinese version was used in our study [31], assessing “effort” by six items (Cronbach α coefficient 0.70) and “reward” by 11 items (Cronbach α coefficient 0.78). Due to space restriction of the survey questionnaire, the intrinsic scale, “overcommitment” was not included in this current study. According to a predefined algorithm, a ratio between the two scales “effort” and “reward” (weighted by item numbers) was calculated in order to quantify the degree of mismatch between high “cost” and low “gain” at individual level. Based on solid evidence, the reduction of continuous data of this ratio to a dichotomous variable, where scores exceeding 1.0 represent a state of high stress, was applied in this analysis [30]. This approach enabled us to define two dichotomized work stress variables (high vs. low stress) from fathers and mothers, respectively. Subsequently, a combined variable for parents' work stress was developed containing the following four categories: (1) father low work stress + mother low work stress (reference group); (2) father high work stress + mother low work stress; (3) father low work stress + mother high work stress; (4) father high work stress + mother high work stress. These categories were used in all analyses of the full sample of families.

Parental support was measured by one single item and reported by adolescents: “In general speaking, my parents understand me, and would like to communicate with me about my problems and worries.” The response categories were “strongly disagree,” “disagree,” “agree,” and “strongly agree.” Adolescents answering with “strongly agree” or “agree” were classified as a group with high parental support, otherwise with low parental support. The item on parental support was modified and derived from one item of “During my first 16 years, my father/mother understands my problems and worries” which had the highest factor loading on the “Care” scale from the Parental Bonding Instrument [47], which has been widely used in Europe adolescents based on the World Health Organization collaborative cross-national survey of Health Behavior in School-aged Children [48].

Suicidal ideation was measured by a single question, “During the last 6 months, did you ever think about suicide?” The response categories were “rarely or never,” “about every month,” “about every week,” “more than once a week,” “about every day.” Adolescents indicating “about every month” or more frequently were considered to have suicidal ideation. This latter decision was based on information available from previously conducted studies, in particular the USA Youth Risk Behavior Survey [49], the European School Survey Project on alcohol and other drugs [50], and the Global School-based Student Health Survey [51].

In addition, information on fathers and mothers (age, employment, education, and self-rated health), and adolescents (age, sex, grade, smoking, alcohol drinking, physical activity, family wealth, and self-rated health) was collected (Table 1). These variables were included as covariates in multivariate regression models for statistical adjustment, as indicated by earlier systematic reviews conducted with an international focus [12], or with a focus on China [13], age, sex, family structure, family socioeconomic status, family members' health, parents' employment and working conditions, and children's unhealthy behaviors have been identified as risk factors of suicidal phenomena during adolescence.

2.3. Statistical analysis

In order to examine the associations between fathers' and mothers' ERI at work and children's suicidal ideation mediated by parental support, the four-step mediation analysis was applied

according to the recommendations by Baron and Kenny [53], using the entire sample. Therefore, we ran the following logistic regression models to explore the hypothesized associations depicted in Fig. 1. Step 1: we examined the association of parents' ERI at work with parental support, as perceived by the corresponding adolescent; Step 2: we assessed whether parental support was linked to their adolescents' suicidal ideation; Step 3: we investigated whether parents' ERI at work was related to the prevalence of suicidal ideation; and Step 4: whether this association was attenuated after adjustment for parental support. The results are displayed as odd ratios (ORs) and 95% confidence intervals (CIs), four logistic regression models were calculated for crude analysis, and another four multivariate logistic regression models were applied for adjustment for relevant covariates (see above paragraph).

Briefly, if one or more of the associations examined in Steps 1–3 did not attain statistical significance, it was usually concluded that mediation was unlikely present. If associations from Steps 1–3 were however significant, Step 4 of the analytical process was conducted. The extent of attenuation of the association by adjustment for the putative mediator (Step 4 vs. Step 3) was then assessed which was considered to reflect the extent of mediation. If the attenuated association in Step 4 was no longer significant, the finding suggests complete mediation; if the attenuated association in Step 4 was still significant, then partial mediation was indicated [53]. The indirect effect was a quantitative measure representing the amount of mediation [53]. In order to test its statistical significance, the corresponding 95% CI needed to be calculated, and an increasingly popular approach to this was bootstrapping. If the 95% CI did not contain zero, the indirect effect was considered statistically significant. Thus, the size of the indirect effect and the bias-corrected 95% CI were obtained through bootstrapping techniques with 1,000 replications. Doing so, we used a SPSS (SPSS Inc., Chicago, IL, USA) macro syntax called “PROCESS,” which had been provided by Hayes to expand mediation analyses to multi-categorical independent variables (i.e., parents' work stress in our study) [54]. We confirmed the model fit with the Hosmer–Lemeshow goodness-of-fit test. In all cases, appropriate model fits of the data were indicated ($p > 0.05$). Analyses were performed with the statistical program SPSS version 23 (SPSS Inc.).

3. Results

Table 1 shows the main characteristics of the study participants. Among adolescents, sex and grade were equally distributed, more than 70% of students were physically inactive, nearly 20% had some experience with alcohol drinking, but few adolescents smoked; more than 90% reported high or average family wealth, and good or fair health; about one third of the students indicated that they experience low social support from their parents; the overall 6-month prevalence rate of suicidal ideation was 10.2% among adolescents. Among parents, nearly 40% had received college education or above, about 30% experienced precarious employment (temporary or part-time work); more than 90% rated their health as good or fair. Regarding effort–reward imbalance at work, 42% of parents reported a high work stress level.

As shown in Table 2, associations among parents' ERI at work, perceived parental support, and adolescent's suicidal ideation remained robust throughout the adjustment procedure. Compared with both parents with low work stress, both parents with high work stress were associated with a substantially increased odds of displaying low social support, as perceived by their adolescent children (OR = 3.76, Step 1). We observed that mothers' work stress seemed to have a stronger effect on low parental support than was the case for fathers' work stress. Importantly, low parental support was associated with an almost three-times increased OR of suicidal

Table 1
Characteristics of the study sample (N = 907 families)

Variables		Mean ± SD or n (%)
Father's variables*		
Age	Y	43.3 ± 3.8
Education	High school or below	523 (57.7)
	College or above	384 (42.3)
Employment	Precarious (temporary or part-time work)	251 (27.7)
	Nonprecarious	656 (72.3)
Self-rated health	Good	581 (64.1)
	Fair	304 (33.5)
	Poor	22 (2.4)
Effort–reward imbalance at work	Low (ERI ratio ≤ 1)	522 (57.6)
	High (ERI ratio > 1)	385 (42.4)
Mother's variables*		
Age	Y	41.1 ± 3.4
Education	High school or below	563 (62.1)
	College or above	344 (37.9)
Employment	Precarious (temporary or part-time work)	300 (33.1)
	Nonprecarious	607 (66.9)
Self-rated health	Good	495 (54.6)
	Fair	381 (42.0)
	Poor	31 (3.4)
Effort–reward imbalance at work	Low (ERI ratio ≤ 1)	529 (58.3)
	High (ERI ratio > 1)	378 (41.7)
Adolescent's variables†		
Age	Y	15.9 ± 1.8
Sex	Boys	429 (47.3)
	Girls	478 (52.7)
Grade	Middle schools (Grade 7–9)	424 (46.8)
	High schools (Grade 10–12)	483 (53.2)
Smoking	No	849 (93.6)
	Yes	58 (6.4)
Alcohol drinking	No	730 (80.5)
	Yes	177 (19.5)
Physical activity	Active	263 (29.1)
	Inactive	644 (70.9)
Family wealth	High	377 (41.6)
	Average	468 (51.6)
	Low	62 (6.8)
Self-rated health	Good	576 (63.5)
	Fair	285 (31.4)
	Poor	46 (5.1)
Parental support	High	620 (68.4)
	Low	287 (31.6)
Suicidal ideation	No	814 (89.8)
	Yes	93 (10.2)

* Measures of father's/mother's covariates: Age, continuous measure (years); Employment, precarious (temporary contract or part-time work) versus nonprecarious (permanent contract and full-time work); Education, 4-point Likert scale of "Below high school", "High school", "College and university," and "Master or doctor" ("Below high school" or "High school" were grouped as "High school or below"; "College and university" or "Master or doctor" were grouped as "College or above"); and Self-rated health, one single question "Overall, how would you rate your health?" with 5-point Likert scale of "Excellent," "Very Good," "Good," "Fair," "Poor," and "Very Poor" ("Excellent" or "Very Good" or "Good" were grouped as "Good"; "Fair" was grouped as "Fair"; "Poor" or "Very Poor" were grouped as "Poor").

† Measures of adolescent's covariates (same measures as the World Health Organization collaborative cross-national survey of Health Behavior in School-aged Children [52]). Age, continuous measure (years). Gender, boys versus girls. Grade, middle schools (Grade 7–9) versus high schools (Grade 10–12). Smoking, one single question "At present, how often do you smoke tobacco?" with 4-point Likert scale of "I do not smoke," "Less than once a week," "At least once a week, but not every day," and "Every day" ("I do not smoke" was grouped as "No"; "Less than once a week" or "At least once a week, but not every day" or "Every day" were grouped as "Yes"). Alcohol drinking, one single question "At present, how often do you drink anything alcoholic?" with 4-point Likert scale of "I do not drink," "Less than once a week," "At least once a week, but not every day," and "Every day" ("I do not drink" was grouped as "No"; "Less than once a week" or "At least once a week, but not every day" or "Every day" were grouped as "Yes"). Physical activity: one single question "Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?" with 8-point Likert scale of "0 day," "1 day," "2 days," "3 days," "4 days," "5 days," "6 days," and "7 days" ("3 days" or "4 days" or "5 days" or "6 days" or "7 days" were grouped as "Active"; "0 day" or "1 day" or "2 days" were grouped as "Inactive"). Family wealth: one single question "How well off do you think your family is?" with 5-point Likert scale of "Very well off," "Quite well off," "Average," "Not very well off," and "Not all well off" ("Very well off" or "Quite well off" were grouped as "High"; "Average" was grouped as "Average"; "Not very well off" or "Not all well off" were grouped as "Low"). Self-rated health: one single question "How would you say your health is?" with 4-point Likert scale of "Excellent," "Good," "Fair," and "Poor" ("Excellent" or "Good" were grouped as "Good"; "Fair" was grouped as "Fair"; "Poor" was grouped as "Poor"). ERI, effort–reward imbalance; SD, standard deviation.

ideation in adolescents (OR = 3.08, Step 2), and the same was true for joint parental work stress (OR = 2.91, Step 3). After additional adjustment for parental support, the OR was markedly attenuated to 2.24 (Step 4). Still, mothers' high work stress exerted a stronger contribution to the risk of suicidal ideation than fathers' work stress. The lower bounds of the 95% CIs for the indirect effects exceeded zero [fathers' high work stress only: indirect effect = 15.53% (95% CI = 4.92%, 30.36%); mothers' high work stress only: 23.38% (7.97%, 42.91%); both parents' high work stress: 27.82% (10.36%, 46.87%)], indicating significantly partial mediation. Thus, low parental social support adds a rather modest contribution towards explaining associations of parents' work stress with adolescents' suicidal ideation.

4. Discussion

In the present study we demonstrated substantial associations of parents' psychosocial stress at work with prevalence of their adolescents' suicidal ideation that, in part, are mediated by low perceived parental social support. Suicidal ideation is thought to reflect states of hopelessness and despair generated from a wide range of individual and macro-sociocultural settings, including a familial atmosphere where prospects of growth and success are largely absent [1–3]. The study was located in the particular context of an urban population in China where dual-earning couples are frequently and simultaneously exposed to work-related

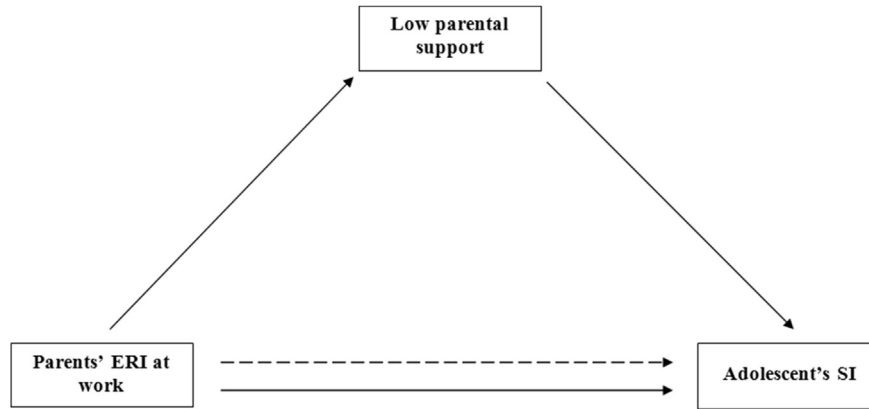


Fig. 1. Model of the mediating role of low parental support on the association between parents' effort–reward imbalance at work and adolescent's suicidal ideation. ERI, effort–reward imbalance; SI, suicidal ideation.

Table 2

Associations [odds ratio and 95% confidence interval (CI)] among parents' effort–reward imbalance at work, parental support, and adolescent's suicidal ideation (N = 907 families)*

Independent variables		Crude mediation analysis		Adjusted mediation analysis [†]		Indirect effect (95% CI) with full adjustment
		Dependent variables		Dependent variables		
		Low parental support (Step 1)		Low parental support (Step 1)		
Parents' ERI at work	Father low + mother low	1		1		–
	Father high + mother low	2.64 (1.74, 3.99)		2.70 (1.75, 4.17)		–
	Father low + mother high	3.35 (2.22, 5.06)		3.27 (2.13, 5.03)		–
	Father high + mother high	3.97 (2.69, 5.84)		3.76 (2.49, 5.66)		–
		Suicidal ideation (Step 2)		Suicidal ideation (Step 2)		
Parental support	High	1		1		–
	Low	3.28 (2.12, 5.09)		3.08 (1.90, 4.98)		–
		Suicidal ideation (Step 3)		Suicidal ideation (Step 3)		
Parents' ERI at work	Father low + mother low	1		1		–
	Father high + mother low	1.65 (0.82, 3.34)		1.68 (0.79, 3.57)		–
	Father low + Mother high	3.08 (1.64, 5.78)		2.64 (1.34, 5.19)		–
	Father high + mother high	3.41 (1.89, 6.15)		2.91 (1.53, 5.53)		–
		Suicidal ideation (Step 4)		Suicidal ideation (Step 4)		
Parents' ERI at work	Father low + mother low	1		1		Reference
	Father high + mother low	1.34 (0.66, 2.75)		1.27 (0.58, 2.80)		15.53% (4.92, 30.36)
	Father low + Mother high	2.40 (1.26, 4.58)		2.22 (1.11, 4.42)		23.38% (7.97, 42.91)
	Father high + mother high	2.55 (1.38, 4.69)		2.24 (1.15, 4.36)		27.82% (10.36, 46.87)

* Logistic regression.

[†] Adjusted mediation analysis: adjustment for the variables among both fathers and mothers (age, employment, education, and self-rated health), and variables among adolescents (age, sex, grade, smoking, alcohol drinking, physical activity, family wealth, and self-rated health). ERI, effort–reward imbalance.

stress [55], and where adolescent children face a major pressure from parents to perform successfully at school, in view of their potential social upward mobility [7]. The 10.2% prevalence rate of suicidal ideation in our study is in accordance with estimates from other population-based investigations, which have generally suggested that prevalence rates of suicidal ideation in adolescents ranged between 10% and 20% [50,51,56]. Notably, the lower bound of this estimated prevalence range may be somewhat lower in China (i.e., 5–20%) [57–59].

According to the family systems theory [33], changes in the conditions of one family member would affect the other members within the system. Our results lend support to this notion, in line with the previous studies [14–19,34–38]. However, those investigations, performed in the context of Western societies, either focused exclusively on fathers [14–16], or found mixed results for fathers and mothers [17,19,34]; notably, most studies maintained that compared with mothers, the fathers'

employment status and working conditions play a crucial role in affecting both parental support and children's wellbeing [18,35–38]. By contrast, our findings from China suggest that the role of mothers is more important in this regard. This unexpected finding can be explained by the Chinese culture of traditional sex roles where fathers act mainly as bread-winners and mothers primarily as homemakers, with additional labor market obligations. Beyond personal achievement, male career success is thought to reflect the honor and fame of his family. Therefore, men generally profit from their exclusive devotion to work. This is not the case for married Chinese women who are expected to cope with the double burden of home and family work and paid work. Under these conditions, mothers may be less capable and sensitive to respond to their children's need for care, attention, and love. Frustrated expectations more easily give rise to conflicts between adolescent children and their overburdened mothers [24,25].

This study has several limitations. Given its cross-sectional design we cannot draw any conclusion concerning the causal direction of observed associations. Owing to the complexity of the research question we addressed, various reverse or bidirectional associations are conceivable. For example, children's psychological dysfunctions and mental disorders which are associated with suicidal phenomena might exert negative effects on the parent–child relationships, thereby resulting in increased family-related stress [60]. Through the pathway of family-to-work conflict, such family stress may in turn translate into higher parental work stress [61]. In addition, as data on psychosocial stress and suicidal ideation were based on self-reported information at least associations of parental support and suicidal ideation among adolescents may be susceptible to common method variance [62]. Furthermore, the incongruence of temporality for the three key variables of our study might add to the difficulty of demonstrating an association of stressful conditions (parents' present work stress; parental support experienced over a longer period) with suicidal ideation (during the past 6 months), even within the restrictions of a cross-sectional study. A second limitation concerns the restricted control of conditions under which questionnaires were answered among parents. While adolescents' questionnaires were completed at school, the parents' modes of responding could not be monitored. Nevertheless, due to the culturally high concerns of Chinese parents to their children's academic success [7], we assume that the majority of the parents would volunteer to participate. Additionally, the potential informal pressure resulting from a motivating letter signed by the local education authority may have strengthened the proliferation of reliable information. Thirdly, we did not explore the full range of social exchange between parents and children, but focused on one aspect, parental social support perceived by adolescent children. For instance, parental control and supervision, an important determinant of adolescent suicidality, was not assessed [39–42,63]. The same holds true for potential additional risk factors of suicidal ideation, such as depression, bullying, severe learning difficulties, and school failure [2,12,64]. Fourthly, we applied the classic four-step analysis of mediation effects recommended by Baron and Kenny [53]. More recently, this approach has received critique from statisticians who proposed more appropriate procedures, such as pathway analysis [65]. However, as we introduced a binary variable as mediator there was no need for quantification of the intervening effect, as is the case in pathway analysis. Fifthly, given the fact that suicidal ideation is more frequent among girls [56], we also tested sex as a moderator of mediation. The results indicated moderating effect of sex was not significant (data not shown). Additional sex-specific analyses would be of interest. Finally, the findings of this study are restricted to a random sample of students in Grades 7 through 12 from four public schools in a large city in South-Western China and their dual-earner parents. While the likelihood of selective participation is limited by the high response rate (87.19%), the information is nevertheless restricted to this sample, and it is not known whether our results can be generalized to other settings.

These limitations are balanced by several strengths. Firstly, we were able to combine information from students and their parents on an important research question, the association of parents' work stress, parental support, and adolescent suicidal ideation. By applying psychometrically validated scales and internationally established indicators, by achieving a very high response rate, and by minimizing the risk of sample bias there are fair reasons to trust the reliability of data, and the observed associations are rather robust. Secondly, we integrated our empirical study into a broader conceptual framework, the family systems theory [33], and we assessed stressful working conditions with a validated questionnaire measuring the internationally established effort-reward

imbalance model [29,30]. In previous investigations, this model explained adverse health effects of stressful work in Chinese working populations, thus demonstrating its validity in the current context [26,27,31,32]. Thirdly, as this study collected data exclusively from dual-earner parents we were in a unique position to compare fathers' and mothers' work stress with regard to perceived parental support and adolescent's suicidal ideation. Importantly, our findings demonstrate that mothers' work-related stress is more strongly associated with the prevalence of problematic attitudes of their adolescent child than is the case with father's stress.

In conclusion, this study provides new knowledge on a topic of considerable public health interest, the associations of parents' work stress, parental social support, and adolescent's suicidal ideation, specifically in the context of dual-earner couples and a one-child family policy, as realized in China. If substantiated by prospective research, our findings lend support to preventive programs that tackle the adversities of stressful work as well as the challenges of improving the material and psychosocial family environment, not least by moving the traditional gender roles towards more equity [66,67].

Conflicts of interest

The authors declared no conflicts of interest.

Acknowledgments

The authors would like to thank all the students and their parents who participated in the questionnaire survey. We also gratefully acknowledge Li Shang (Kunming Medical University, Kunming, China), Tao Wang (Yunnan Provincial Department of Education, Kunming, China), Qing Li and Kunrong Shang (Panlong District Education Bureau, Kunming, China) for their excellent organization in data collection. Jian Li's research work was partly supported by a Marie Curie International Incoming Fellowship within the 7th European Community Framework Program (PIIF-GA-2008-220641). Johannes Siegrist was supported by a Senior Professorship Grant from the Faculty of Medicine, University of Düsseldorf, Düsseldorf, Germany.

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