Effects of maltreatment in the home setting on emotional and behavioural problems in adolescents: A study from Zhejiang Province in China

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Funding: The China Scholarship Council (CSC) and the Universities' China Committee in London (UCCL)

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Abstract

The aim of the study was to determine the effects of different types of maltreatment on adolescents' emotional/behavioural problems in Zhejiang Province, Eastern China [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN]. Adolescents aged 10-16 years in two urban and two rural schools were invited to complete a questionnaire survey, including experiences of maltreatment and emotional/behavioural problems. In total, 791 questionnaires were eligible for analysis. Preceding-year prevalence was 5.6 per cent for minor, 27.6 per cent for moderate, and 4.6 per cent for severe physical maltreatment, 47.5 per cent for emotional maltreatment, and 8.2 per cent for non-contact punishment. Witnessing domestic violence was reported by 49.4 per cent of the adolescents. Emotional maltreatment was consistently associated with a higher risk of emotional/behavioural problems (relative risk ratio (RRR) ranging from 1.85-2.36), after adjusting for other maltreatment exposures and socio-economic factors. Severe physical maltreatment showed the strongest association with behavioural problems (RRR=4.75[1.74, 12.98], *P*=0.002). Witnessing domestic violence alone was not associated with emotional/behavioural problems in adolescents. The effect size of emotional maltreatment was greater for girls, while physical maltreatment and non-contact punishment had greater effects among boys. There was a cumulative negative effect

with the increasing number of maltreatment types. The results indicate an important need to educate parents, to identify high-risk children, and to introduce a formal child protection system in China.

Key Practitioner Messages

- Emotional maltreatment was consistently and robustly associated with increased risk of both emotional and behavioural problems, after adjusting for other maltreatment exposures and socio-economic factors.
- Severe physical maltreatment showed the strongest association with behavioural problems but not with emotional problems, while witnessing domestic violence alone was associated with neither of them.
- Increase in the number of maltreatment types had a cumulative negative effect on child emotional and behavioural problems.

Keywords Child maltreatment; witnessing domestic violence; emotional problems; behavioural problems; China

Introduction

During the last few decades, the overall health status of children and adolescents in China has improved markedly. There has been a dramatic reduction in under-five mortality, with many cities now reporting under-five mortality rates of less than five (out of 1000), equivalent to some of the most advanced countries (Xi *et al.*, 2014). But child protection remains a low priority. Physical punishment and verbal aggression are culturally accepted within the Chinese society [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN] (Ji and Finkelhor, 2015). However, violent discipline can lead to physical injuries ranging from minor bruises and broken bones to head trauma, physical disability and even death (Unicef, 2014).

Research into child maltreatment in China has increased over the last decade. It shows a wide variation in incidence partly because of the use of different measurement tools across different study populations: 7.6–54.4 per cent for physical maltreatment and 11.0–79.5 per cent for emotional maltreatment (Gao *et al*., 2017; Wang *et al*., 2016a; Xu *et al*., 2008). A systematic review of 68 studies estimated that an average of 26.6 per cent of children under 18 had suffered physical maltreatment and 19.6 per cent emotional maltreatment (Fang *et al*., 2015). Studies show that boys experience more physical maltreatment than girls (Cui *et al*., 2016; Wang and Liu, 2014). There are a number of possible reasons for this. First, boys are more likely than girls to exhibit problem behaviours (Xing *et al*., 2011). Second, Chinese parents may have higher expectations of boys, who are expected in adulthood to become primary providers for their own families and aged parents, as well as to continue the family line (Hannum *et*

al., 2009). Third, boys are regarded as physically stronger than girls and better able to tolerate physical punishment. There are also marked differences across the age range with physical maltreatment more common in younger children. Wang and Liu (2014) collected data from 2518 father–mother dyads of children aged 3–15 years. They found that the prevalence of minor physical maltreatment (e.g., spanking) declined with age, and more severe forms of physical maltreatment (e.g., slapping on the face, hitting other body parts with a tool) increased from ages 3–7 years, and then decreased.

There is now increasing evidence to suggest a strong association between maltreatment, in all its forms, and emotional and behavioural problems in children and adolescents (Gilbert *et al.*, 2009). Research from China also provides some evidence for this (Wang *et al.*, 2016b; Xing and Wang, 2017), but most studies do not differentiate severity of physical maltreatment (Zhang *et al.*, 2016; Zhu *et al.*, 2017). In addition, there has been no systematic exploration of the effects of emotional maltreatment, the interactions between different types of maltreatment exposure, or the effects of witnessing domestic violence on child outcomes in the Chinese setting.

Witnessing domestic violence between adults in the household is increasingly regarded as a form of child maltreatment, in its own right, with many studies showing that domestic violence increases the risk of maltreatment of children (Chan, 2011; Gilbert *et al.*, 2009; Hamby *et al.*, 2010; Holt *et al.*, 2008). The combination of witnessing domestic violence and physical maltreatment has been shown to have a synergistic negative effect on children's behaviours [PUBLISHER – THE

PRECEDING UNDERLINED TEXT IS FOR THE MARGIN] (Chan *et al.*, 2011; Moylan *et al.*, 2010; O'Keefe, 1996; Shen, 2009). But evidence is mixed relating to their relative contributions (Moylan *et al.*, 2010; O'Keefe, 1996), and most studies have been limited to physical maltreatment, ignoring the co-occurrence of other types of maltreatment. More importantly, there is a paucity of research on this issue in mainland China.

Our aims were therefore: (1) to examine the effects of different types of maltreatment on child emotional and behavioural problems; (2) to explore the independent contribution of each exposure by considering them simultaneously; (3) to assess the cumulative effects of all exposures.

Methods

A questionnaire survey was carried-out among Chinese adolescents in urban and rural schools of Zhejiang Province, Eastern China [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN] from November 2014 to July 2015. Data were also collected from one parent of each participant in the same household, which allowed us to investigate child maltreatment from more than one perspective. This has been published previously (Ni *et al.*, 2017; Ni *et al.*, 2018). Zhejiang Province is one of the richest and most developed provinces in China, and is ranked fourth in nominal Gross Domestic Product (GDP) among all Chinese provinces. The population is around 56 million. The urban area for the study was Hangzhou, the provincial capital, which has seen very rapid change over the past two decades. It has

a total population of 9.5 million. The rural area was Xinfeng Town in Jiaxing with a population of 49 500 people.

Two urban schools (one primary and one secondary) in Hangzhou and two rural schools (one primary and one secondary) in Xinfeng Town, Jiaxing were recruited using convenience sampling. Three classes from Grade 5–6 in primary schools and Grade 7–8 in secondary schools were randomly selected to participate, resulting in a total of 24 classes. We recruited children aged 10–16 years. Children under 10 were excluded because the measurement tool for child maltreatment, the Conflict Tactics Scale Parent–Child (CTSPC) is recommended for use with children aged 10–18 years. School authorities gave permission for the study to be conducted after being provided with a detailed explanation of the study aims and methods. Parents were informed prior to the survey. Questionnaires and information sheets were distributed to the participants in classrooms by researchers working in pairs. Great care was taken to ensure that children understood what they were undertaking. All of the children were told that participation was not compulsory, that it was confidential and anonymous, and that they could stop at any time for any reason. Researchers stressed to the pupils that it was not a test, and that they should be honest and open in their responses. The researchers were present throughout to provide help with understanding the questionnaire if necessary. All participants gave verbal consent. The study was approved by University College London Research Ethics Committee and Zhejiang University Ethics Board. All participants were told that they could discuss any difficult issues with a counsellor and a phone number was provided. However, none of them availed themselves of this service.

Measures

Exposures

Because of the wide range of punishments known in China, questions about experience of maltreatment at home included 38 forms of maltreatment [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN]: 21 physical, 12 emotional and five non-contact forms of punishment. The items drew on a literature review and two existing validated tools that have been used in many countries: the International Society for the Prevention of Child Abuse and Neglect (ISPCAN) Child Abuse Screening Tool Children's Version (ICAST-C) and the CTSPC (Straus *et al.*, 1998; Zolotor *et al.*, 2009). ICAST-C has been used in a Taiwanese study, and CTSPC has been extensively used in Chinese populations (Chan, 2012; Feng *et al.*, 2015). The CTSPC is recommended for use with children aged 10–18 years (Oh *et al*., 2018). Because the physical maltreatment items differ in their severity, subscales indicating minor (5 items), moderate (9 items), and severe maltreatment (7 items) were used according to those defined in CTSPC. The Cronbach α for all maltreatment items in our sample was 0.877.

For each item, participants were asked about their experience during the previous year in the following categories: 0=never; 1=once or twice; 2=3–5 times; 3=6–12 times; 4=13–50 times; 5=more than 50 times. If it had not happened in the previous year but had happened before, they were also required to indicate the situation. Responses were summed to generate frequency scores for each scale of maltreatment (including subscales of physical maltreatment). However, in this sample, there were 68–92 per cent with a score of zero for physical maltreatment and non-contact punishment in the

past year. Given the extremely skewed distribution of the frequency scores, responses were recoded into dichotomous categories as either having or not having experienced maltreatment at home ('yes' versus 'no'). Experience of preceding-year physical maltreatment was further categorised into: 'severe', 'moderate', 'minor only'. It is worth noting that the category 'minor only' excluded the co-occurrence of moderate or severe forms, and the category 'moderate' excluded the co-occurrence of severe forms.

Experience of witnessing domestic violence was additionally measured with four questions from ICAST-C [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN], that is witnessing adults getting drunk and then behaving in a way that frightened the child, quarrelling, fighting, and threatening/hurting with implements at home, (not limited to the past year). Participants who answered 'yes' to any one of these four questions were classified as having been exposed to domestic violence.

To investigate the cumulative effects of multiple types of maltreatment, we generated an additional variable representing the number of types (0, 1, 2, 3 and 4).

Outcomes

Emotional and behavioural problems were assessed through the emotional symptoms and conduct problems scales of the Strengths and Difficulties Questionnaire (SDQ). The SDQ is a brief behavioural screening questionnaire (Goodman, 1997). It exists in

several versions and the one used in this study was suitable for 11–17-year-olds. The Chinese version is available online (Youthinmind, 2019) and has been widely used in China (Du *et al.*, 2008). Each scale has five items, with each item rated on a 3-point scale from 1 (not true) to 3 (certainly true). Examples of *emotional symptoms* are: 'I worry a lot' and 'I am often unhappy, downhearted or tearful'. Examples of *conduct problems* are: 'I get very angry and often lose my temper', 'I fight a lot' and 'I am often accused of lying or cheating'. The score for each scale is generated by summing the individual scores, with a total score ranging from 0 to 10. Higher scores indicate more problems. The recommended cut-offs for emotional and behavioural problems vary according to country (Goodman, 1997; Du *et al.*, 2008). We adopted bandings recommended by a Chinese study (Du *et al.*, 2008). For the emotional symptoms scale, participants were classified into three categories: (1) score=6–10 for emotional problems; (2) score=5 for borderline, and (3) score=0–4 for no emotional problems. For the conduct problems scale, scores≥5 were used for the classification of behavioural problems, scores=4 for borderline and scores≤3 for no behavioural problems. The Cronbach α for all scales in our sample was 0.787.

Covariates

This included sex, age, parents' education, number of children in the household, residence (urban or rural), family economic status (defined as perception compared with peers) and family structure (e.g., nuclear family, single-parent or remarried family).

Data analysis

The impacts of exposures on emotional and behavioural problems among adolescents were assessed using multinomial logistic regression [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN]. The risk of having emotional/behavioural problems for each maltreatment exposure was reported as relative risk ratios (RRRs) and their 95 per cent confidence intervals (CIs). We adjusted for socio-demographic factors. Next, we examined the independent effects of each exposure by considering all simultaneously in the model. Lastly, some evidence showed that different types of child maltreatment might affect boys and girls differently (Xing and Wang, 2013), so we tested the interaction between sex and each maltreatment exposure (see Table S1 in the online Supporting Information). A significance level of 0.05 was used when testing interactions. Boys and girls were then analysed separately due to the significance of the interaction between sex and physical/emotional maltreatment. In addition, although the SDQ is deemed appropriate for children aged 11 or over, three children in this study were aged 10. Excluding these children in the analyses did not alter the findings.

Missing data in this sample ranged from 0 per cent (including maltreatment exposures, outcomes, sex, age, and residence) to 13.3 per cent (maternal education) and 13.8 per cent (paternal education). We conducted a comparison of key characteristics between sample with missing data and sample with complete information and found that compared with completers, non-completers were more likely to be from urban schools and low-income families, which indicates that our data were not missing completely at random. Multiple imputations were used to impute data in order to minimise data loss (Sterne *et al.*, 2009). Imputation models included all model variables and were based on the missing at random assumption. Thirty imputed datasets were created, and a maximum length of 10 000 iterations was

used. Five imputed datasets have been suggested to be sufficient on theoretical grounds (Allison, 2000), and a larger number (at least 20) may be preferable to reduce sampling variability from the imputation process (Horton and Lipsitz, 2001). We present the imputed results. SPSS 23.0 was used for data analysis. SPSS uses fully conditional specification (FCS) or chained equations imputation. Linear regression is used for continuous variables and logistic regression is used for categorical variables. Regardless of the model type, categorical variables are handled using indicator (dummy) coding.

Results

Questionnaires were completed by 821 adolescents [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN]. The overall response rate was 99.8 per cent which can be attributed largely to the support and encouragement of teachers. Of these 30 were excluded because of missing key variables (e.g., items of exposures or outcomes), leaving a total of 791 completed questionnaires.

The socio-demographic profile can be seen in Table 1. The mean age of participants was 12.6 [SD =1.1], 48.5 per cent were girls, 44.2 per cent were only children and 46.9 per cent were from rural areas; 28.4 per cent, 61.8 per cent and 9.7 per cent reported high, middle and low income backgrounds, respectively.

Prevalence of different forms of child maltreatment during the past year can be seen in Table 2. Previous-year prevalence of maltreatment was: 37.7 per cent for total

physical (5.6% for minor, 27.6% for moderate and 4.6% for severe), 47.5 per cent for emotional and 8.2 per cent for non-contact punishment; 49.4 per cent of the adolescents reported witnessing domestic violence; 20.9 per cent reported more than three types of maltreatment. The percentage with no experience of maltreatment was 26.0 per cent.

Twelve per cent of the adolescents (12.5% of boys, 11.2% of girls) scored in the range for emotional problems, and 8.5 per cent (6.9% of boys, 10.2% of girls) borderline. Nine per cent of the adolescents (10.6% of boys, 6.8% of girls) scored in the range for behavioural problems and 8.6 per cent (9.6% of boys, 7.6% of girls) borderline. Here we describe the effects of maltreatment on emotional and behavioural problems in adolescents; results for borderline problems can be seen from tables (Table 3 and 4).

Physical maltreatment

Moderate and severe (not minor) physical maltreatment was positively associated with emotional problems after adjusting for socio-demographic factors (moderate: RRR=2.50[95% confidence interval =1.53, 4.10], $P<0.001$; severe: RRR=3.72[1.59, 8.74], $P=0.003$). The positive association of moderate physical maltreatment with emotional problems persisted though attenuated (RRR=1.82[1.06, 3.11], $P=0.029$), after controlling for all exposures. Experience of moderate and severe (but not minor) physical maltreatment was associated with an elevated risk of behavioural problems after adjustment (moderate: RRR=2.62[1.46, 4.71], $P=0.001$; severe: RRR=11.69[4.79, 28.54], $P<0.001$). When considering all exposures simultaneously,

the positive association of severe physical maltreatment with behavioural problems persisted though attenuated (RRR=4.75[1.74, 12.98], *P*=0.002).

Emotional maltreatment

Emotional maltreatment was positively associated with a higher risk of emotional and behavioural problems after adjustment for socio-demographic factors (RRR range: 2.55-3.72); the associations persisted but reduced slightly when controlling for all exposures (Emotional problems: RRR=1.85[1.10, 3.13], *P*=0.020; behavioural problems: RRR=2.36[1.25, 4.46], *P*=0.008).

Non-contact punishment

For non-contact punishment, there was an elevated risk of emotional (RRR=2.23[1.15, 4.32], *P*=0.017) and behavioural problems (RRR=4.03[2.01, 8.07], *P*<0.001) after adjusting for socio-demographic factors. But these relationships disappeared after controlling for other exposures.

Witnessing domestic violence

Witnessing domestic violence was associated with increased risk of emotional and behavioural problems after adjustment for covariates (RRR range: 1.79-2.36). But the positive associations disappeared after adjusting for other exposures.

Sex difference

Boys and girls were analysed separately due to the significance of the interaction between sex and physical/emotional maltreatment (results in ***Table S2 and S3***). Physical maltreatment was associated with emotional and behavioural problems in boys but not girls (RRR range: 3.20-6.66), whereas emotional maltreatment affected girls but not boys (RRR range: 2.57-4.07).

Cumulative effects

The risk of emotional and behavioural problems increased by number of maltreatment types. For emotional problems, the RRR was 1.63[1.34, 1.98] for each additional type of maltreatment (P<0.001; '*four types'* vs '*no'*: RRR=8.19[3.02, 22.18], P<0.001). For behavioural problems, the RRR was 2.05[1.62, 2.60] for each additional type (P<0.001; '*four types'* vs '*no'*: RRR=19.78[6.46, 61.23], P<0.001).

Discussion

Our findings demonstrate high levels of maltreatment in the home setting experienced by Chinese adolescents, considerable negative effects of this maltreatment on their emotional and behavioural problems, and increased risk with multiple types of maltreatment.

This study indicates the pervasiveness of child maltreatment in the home in China: nearly three-quarters of the adolescents experienced some type of maltreatment at home in the previous year [PUBLISHER – THE PRECEDING UNDERLINED

TEXT IS FOR THE MARGIN]; nearly half had experienced emotional maltreatment or had witnessed domestic violence; over one fifth were exposed to three or four types of maltreatment. Especially worrying is the fact that severe physical maltreatment, such as beating-up, choking and threatening with a knife, is not rare. These extreme forms go far beyond acts which would be regarded as justifiable in any setting as a form of parental discipline. We previously matched parent–child pairs from the same household to compare parent and child reports of parent-to-child maltreatment. It showed consistently lower figures reported by children than by parents (Ni *et al*., 2017; Ni *et al*., 2018). This suggests that parents are not hesitant to admit maltreating their children, possibly indicating its normalisation in China (Ni *et al*., 2017).

Prevalence rates in this study are much higher than in western countries (Gilbert *et al.*, 2009), and fall into the wide ranges reported by the Chinese studies. There were wide discrepancies in the prevalence in China: 7.6–54.4 per cent for physical maltreatment and 11.0–79.5 per cent for emotional maltreatment (Gao *et al.*, 2017; Wang *et al.*, 2016a; Xu *et al.*, 2008). High rates of maltreatment could be explained by the traditional cultural values and child-rearing beliefs in China. Physical punishment and verbal aggression are considered to be legitimate means of disciplining children, as suggested by (Ji and Finkelhor, 2015) and indicated by Chinese proverbs, such as ‘beating and scolding are an emblem of love’ and ‘the rod makes an obedient son’, similar to the English saying ‘spare the rod and spoil the child’. Traditional cultural values rooted in Confucian principles require children to display loyalty and respect to their elders (filial piety). Children are regarded as ‘impious’ or ‘disobedient’ when they fail to comply with their parents' instructions or fail to meet their parents'

expectations. In these situations, physical punishment and verbal aggression are widely used as a form of discipline, regarded as 'necessary' for raising children, and are regarded as an indication of parental involvement and caring concern (Zhu and Tang, 2011; Ni *et al.*, 2018).

Consistent evidence from Western countries and China has demonstrated the substantial negative effects of child maltreatment on the mental and physical health of children throughout their lives (Gilbert *et al.*, 2009; Wang *et al.*, 2016b). Our study confirms previous research findings of an association between maltreatment exposures and emotional and behavioural problems. The impacts of physical, emotional and non-contact maltreatment did not differ with age, but witnessing domestic violence might have more effects on older children (see Table S4 and S5 in the online Supporting Information). More importantly, this study throws light on the individual effects of each type of exposure. First, we show emotional maltreatment was strongly and consistently associated with increased risk of both emotional and behavioural problems, irrespective of other maltreatment exposures [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN]. This supports previous findings that emotional maltreatment was associated with an increase in behavioural problems and depressive symptoms in adolescents after controlling for physical maltreatment (Wang and Kenny, 2014). There is also some evidence suggesting that depression was significantly more strongly related to childhood emotional abuse than to physical maltreatment in adult psychiatric outpatients (Gibb *et al.*, 2007). Considering that emotional maltreatment is recognised as the most commonly used disciplinary behaviour (Wang and Liu, 2014), the results underscore

the importance of emotional maltreatment as a contributor to emotional and behavioural problems.

Second, we reveal that severe physical maltreatment had the strongest association with behavioural problems [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN]. This contrasts with previous findings of less effect of physical maltreatment on behavioural problems (McGee *et al.*, 1997). We also found that the negative effects of severe physical maltreatment on emotional problems, but they were largely explained by the co-occurrence of emotional maltreatment. This is consistent with previous studies which have shown that emotional maltreatment was the most significant predictor of psychological symptoms, including anxiety and depression (Gibb *et al*., 2007; McGee *et al.*, 1997) and that severe forms of physical maltreatment had no significant effects on child anxiety or other psychological outcomes (Miller-Perrin *et al.*, 2009; Wang *et al.*, 2016b). A possible explanation is that maltreated children internalise emotional maltreatment from parents, thus causing low self-esteem in children and leading to mental health problems such as depression (McGee *et al.*, 1997).

Third, moderate (but not minor) physical maltreatment was independently associated with emotional problems. Conclusions from existing research are mixed with some research showing no negative consequences of mild to moderate maltreatment, especially if it occurs in the context of a loving, caring relationship, or where explanation is provided (Larzelere, 2000; Paolucci and Violato, 2004). For instance, some studies showed that parental warmth and perceived 'normalisation' of violent

discipline may have moderating effects on the emotional and behavioural harm (Gershoff *et al.*, 2010; Lansford *et al.*, 2014). Our finding of minor physical maltreatment seems to support this argument. However, it is also worth noting that our study showed a prevalence of 5.6 per cent for minor physical maltreatment with 37.7 per cent for total physical maltreatment. In other words, we showed that in the Chinese setting, only a small proportion of parents merely used minor forms.

Fourth, the study points to child sex differences in the impact of maltreatment. We demonstrate that the effect of emotional maltreatment was greater for girls, in line with McGee *et al.*'s (1997) study of Canadian 11–17 years olds which showed that girls are more vulnerable to parental criticism and hostility. Hoffman *et al.* (1997) also suggested that girls may be more affected by signs of affection or rejection from others. We also show greater effects of physical maltreatment among boys than among girls, consistent with McGee *et al.*'s (1997) study which suggests physical maltreatment predicted behavioural problems among boys but not girls. However, two Chinese studies of children found physical maltreatment strongly predicted behavioural problems in girls (Xing and Wang, 2013; Xing *et al.*, 2011).

Lastly, we show that exposure to domestic violence alone was not associated with emotional and behavioural problems in adolescents. Evidence has been mixed on the effects of witnessing domestic violence. For instance, O'Keefe (1996) reported significant negative impacts, but Moylan *et al.* (2010) reported no effect. In addition, our finding of accumulating risk for emotional and behavioural problems with the number of types of maltreatment is important, considering the large size effects.

Clearly highest priority should be given to identifying adolescents who suffer multiple types of maltreatment.

This study has limitations. First, it was carried out in just four schools in urban and rural Zhejiang province, and can only be generalised with great caution. It is necessary to verify negative effects of child maltreatment on adolescents' emotional and behaviour problems in a larger representative sample in the future. Second, although exposures and outcomes were measured using validated questionnaires in this study, self-reports of past experience may have led to recall bias. Third, we only sampled adolescents aged 10–16, but it is possible that physical punishment is used differently with children at different developmental stages and may have different effects depending on the stage in which it is used. Therefore, more research is needed to examine whether the research findings can be translated to younger or older age groups of children [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN]. Fourth, data on emotional and behavioural problems were only collected from children. It would be beneficial for future research to include both parents and children to obtain information on exposures and outcomes. Fifth, while we analysed the cumulative effects of different types of maltreatment, we did not consider the role of severity and frequency. Finally, the cross-sectional design cannot address causality. It does not allow the temporal sequence of the associations to be assessed. For instance, children's behavioural problems may be more likely to elicit physical maltreatment from parents.

Conclusions and policy implications

This study has shown high levels of child maltreatment in the home setting and considerable emotional and behavioural harm caused to adolescents. There is clearly an important need to raise awareness among parents about the negative effects of maltreatment and appropriate methods for disciplining children. If there was awareness of the emotional and behavioural consequences for children, this could deter parents from using such forms of punishment, so our findings have important policy implications. This could be done through national campaigns, especially using social media platforms, which are widely used in China. Parent education could be provided in prenatal care settings or immunisation clinics.

Also crucially this study indicates the need to identify adolescents exposed to multiple maltreatment types and the need to invest in intervention programmes to alleviate harm caused to them. School-based programmes should be introduced, because teachers are in an optimal position to prevent, identify, and assist victims of child maltreatment because of their frequent contact with students.

This research shows the 'normalisation' of child maltreatment in China [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN], indicating the importance of gradually changing social and cultural norms relating to child discipline. This cannot be achieved by public education alone. It should be accompanied by the enactment of new laws and policies that make forms of violence punishable offences and the introduction of a formal child protection system. Notwithstanding this, it will take time, even generations, to achieve a cultural and social transformation.

Despite Chinese ratification of the UN Convention on the Rights of the Child in 1992, there was no legal definition of what constitutes child abuse until the introduction of

the new Anti-Domestic Violence Law of the People's Republic of China on December 27th, 2015 (National People's Congress of the People's Republic of China, 2015). The new law prohibits severe forms of physical and emotional maltreatment and specifies mandatory reporting of violence against children. However, a potential challenge for the enforcement of such a regulation is that individuals, including professionals, are generally not willing to intervene in what is regarded as private family matters.

In May 2013, China's Ministry of Civil Affairs issued the '*Notice on carrying out the pilot work of the social protection of minors*' as national guidance for the practice of a child protection system. A total of 98 cities and counties were identified as pilot areas from May 2013 to July 2014 and a further 78 in August 2014. Some basic elements of a modern child protection system have been advocated in these areas, such as responsible agencies, reporting systems and alternative services (Man *et al.*, 2017). However, there remain many challenges. Man *et al*.'s (2017) research showed that the pilot programmes did not work as effectively as expected. First, the pilot child protection programmes served more left-behind children, children with parents in prison, and children with seriously ill or disabled parents, rather than maltreated and neglected children. Second, for the first time, a reporting system has been set up in local communities as a part of the pilot protection programmes, such as reporting centres for violence against children and a 24-hour hotline for reporting suspected cases. However, it is questionable whether the reporting system is functioning or if the government merely paid lip service to it. Third, there is no leading agency taking formal responsibility for maltreated children, despite the fact that a number of governmental agencies are responsible for the protection of vulnerable children, for instance, civil affairs departments, Women's Federation, and public security departments. Another challenging issue facing child protection is how to place

maltreated children. Child welfare institutions and children's rescue and protection centres in China play important roles in providing alternative care services for vulnerable children, including placing them in foster homes or adoptive homes. But they are targeted at 'left-behind' children and children in adverse family situations. Unlike other countries, the foster care system in China only provides services for orphaned and abandoned children. Policy makers should consider expanding the current child protection programmes to maltreated children [PUBLISHER – THE PRECEDING UNDERLINED TEXT IS FOR THE MARGIN].

Lastly, there is a growing interest in social workers in child welfare and child protection. In December 2014, the Ministry of Civil Affairs issued '*Guidance for child social workers*' to specify the role of social workers including providing protection for maltreated children, and in December 2015, for the first time, the Anti-Domestic Violence Law regulated their role in reporting and preventing child maltreatment. Social workers have recently started to become involved in child protection in parts of some cities, for instance in Shanghai and Guangzhou. Their precise role is still being defined, especially in relation to child maltreatment, but this clearly marks progress and it is believed that they will become an important part of a child protection system in the future (Zhao *et al*., 2017).

Authors' contributions

YYN conceived the study, collected the data, undertook the data analysis and drafted the manuscript. TH contributed to the study design, helped interpret the data and revised the manuscript. LL contributed to the data analysis, data interpretation and

manuscript revision. XDZ contributed to the study design and data collection. All authors have read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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Table 1 Descriptive analysis of key variables (outcome, maltreatment exposure and socio-demographic)

Key variables	*n* (%)	Emotional problems *n* (%)		Behavioural problems *n* (%)	
		Borderline	Yes	Borderline	Yes
All children (N=791)	-	67(8.5)	94(11.9)	68(8.6)	69(8.7)
Socio-demographic variables					
Sex (N=791)					
Boy	407(51.5)	28(6.9)	51(12.5)	39(9.6)	43(10.6)
Girl	384(48.5)	39(10.2)	43(11.2)	29(7.6)	26(6.8)
Age (Mean±*SD*) (N=791)	12.6 ±1.1	-	-	-	-
10–11	167(21.1)	9(5.4)	25(15.0)	9(5.4)	13(7.8)
12	198(25.0)	14(7.1)	22(11.1)	19(9.6)	14(7.1)
13	224(28.3)	21(9.4)	26(11.6)	16(7.1)	19(8.5)
14	183(23.1)	21(11.5)	21(11.5)	21(11.5)	22(12.0)
15–16	19(2.4)	2(10.5)	0(0.0)	3(15.8)	1(5.3)
Single child (N=786)					
Yes	350(44.5)	30(8.6)	38(10.9)	38(10.9)	33(9.4)
No	436(55.5)	37(8.5)	55(12.6)	29(6.7)	36(8.3)
Mother's Education (N=686)					
Primary school or below	134(19.5)	6(4.5)	19(14.2)	8(6.0)	11(8.2)
Middle school	350(51.0)	32(9.1)	38(10.9)	36(10.3)	33(9.4)
High school	146(21.3)	15(10.3)	16(11.0)	15(10.3)	11(7.5)
University or above	56(8.2)	5(8.9)	6(10.7)	3(5.4)	5(8.9)
Father's Education (N=682)					
Primary school or below	125(18.3)	10(8.0)	19(15.2)	11(8.8)	13(10.4)
Middle school	341(50.0)	28(8.2)	40(11.7)	30(8.8)	29(8.5)
High school	145(21.3)	15(10.3)	15(10.3)	13(9.0)	15(10.3)
University or above	71(10.4)	4(5.6)	5(7.0)	7(9.9)	3(4.2)
Residence (N=791)					
Urban	420(53.1)	42(10.0)	51(12.1)	37(8.8)	42(10.0)
Rural	371(46.9)	25(6.7)	43(11.6)	31(8.4)	27(7.3)
Economic status (N=749)					
High-income	213(28.4)	18(8.5)	24(11.3)	18(8.5)	22(10.3)
Middle	463(61.8)	43(9.3)	52(11.2)	42(9.1)	38(8.2)
Low-income	73(9.7)	4(5.5)	15(20.5)	5(6.8)	7(9.6)
Family structure (N=779)					
Two biological parents	696(89.3)	58(8.3)	76(10.9)	61(8.8)	59(8.5)
Single parent	54(6.9)	4(7.4)	9(16.7)	4(7.4)	4(7.4)
Remarried	29(3.7)	5(17.2)	7(24.1)	2(6.9)	6(20.7)
Exposures					
Physical maltreatment (N=791)					
Severe	36(4.6)	4(11.1)	10(27.8)	5(13.9)	12(33.3)
Moderate	218(27.6)	21(9.6)	40(18.3)	28(12.8)	26(11.9)
Minor only	44(5.6)	7(15.9)	3(6.8)	2(4.5)	3(6.8)
No	493(62.3)	35(7.1)	41(8.3)	33(6.7)	28(5.7)
Emotional maltreatment (N=791)					
Yes	376(47.5)	42(11.2)	63(16.8)	44(11.7)	50(13.3)
No	415 (52.5)	25(6.0)	31(7.5)	24(5.8)	19(4.6)
Non-contact punishment (N=791)					
Yes	65(8.2)	6(9.2)	15(23.1)	4(6.2)	15(23.1)
No	735(92.9)	61(8.4)	79(10.9)	64(8.7)	54(7.4)
Witness of violence at home(N=786)					
Yes	388(49.4)	42(10.8)	57(14.7)	41(10.6)	45(11.6)
No	398(50.6)	25(6.3)	37(9.3)	26(6.5)	24(6.0)
Multiple types (N=786)					
Four types	32(4.1)	4(12.5)	11(34.4)	2(6.3)	11(34.4)
Three types	132(16.8)	13(9.8)	27(20.5)	18(13.6)	18(13.6)
Two types	180(22.9)	24(13.3)	20(11.1)	21(11.7)	21(11.7)
One type	238(30.3)	19(8.0)	23(9.7)	19(8.0)	11(4.6)
No	204(26.0)	7(3.4)	13(6.4)	7(3.4)	8(3.9)

Table 2 Prevalence of different forms of child maltreatment (*N*=791)

Items	Preceding year *n* (%)
Physical maltreatment	**298(37.7)**
Minor physical maltreatment	
Hit on the bottom with an object such as a stick, broom, cane or belt	73(9.2)
Slapped on the hand, arm or leg	73(9.2)
Slapped on the bottom with bare hand	38(4.8)
Pinched to cause pain	62(7.8)
Shook aggressively	32(4.0)
Moderate physical maltreatment	
Twisted ear	142(18.0)
Hit on head with knuckles	116(14.7)
Hit elsewhere (not buttocks) with an object such as a stick, broom, cane or belt	68(8.6)
Slapped on face or back of head	55(7.0)
Kicked her/him	53(6.7)
Threw or knocked down	27(3.4)
Hit with a fist	27(3.4)
Pulled hair	21(2.7)
Put chili pepper, hot pepper or spicy food in his/her mouth (to cause pain)	3(0.4)
Severe physical maltreatment	
Hit over and over again with object or fist (‘beat-up’)	28(3.5)
Choked to prevent breathing	11(1.4)
Threatened with a knife	5(0.6)
Used a hand or pillow to prevent breathing (smother)	2(0.3)
Burned or scalded or punctured with needles	3(0.4)
Pressed his/her head under water	2(0.3)
Used sharp objects to hurt, such as a knife and broken glass	1(0.1)
Emotional maltreatment	**376(47.5)**
Threatened to spank or hit but did not actually do it	160(20.2)
Insulted by calling [name] dumb, lazy or other names like that	202(25.5)
Shouted, yelled or screamed at him/her	162(20.5)
Threatened to invoke harmful people against him/her, ghosts or evil spirits	52(6.6)
Refused to speak or ignore	79(10.0)
Used public humiliation	74(9.4)
Cursed	71(9.0)
Told them you wished they were dead or had never been born	52(6.6)
Threatened to leave or abandon	40(5.1)
Blamed for parents' misfortune	40(5.1)
Said they would be sent away or kicked out of the house	31(3.9)
Threatened to hurt	16(2.0)
Non-contact punishment	**65(8.2)**
Locked out of home	25(3.2)
Forced to hold a position that caused pain (i.e. standing/kneeling)	37(4.7)
Withheld a meal as punishment	15(1.9)
Locked in the room	14(1.8)
Locked up or tied to restrict movement	5(0.6)
Overall	**460(58.2)**

Table 3 Impact of maltreatment on emotional problems: relative risk ratios (RRRs)[a] and 95% CIs

Exposures	*N* (%)	Adjusted for sex and age				Adjusted for sex, age and others [b]				Further adjusted for other exposures			
		Borderline	P	Yes	P	Borderline	P	Yes	P	Borderline	P	Yes	P
PM (Ref.=No)													
Severe	36(4.6)	2.54(0.82,7.89)	0.107	4.56(2.01,10.36)	<0.001	2.61(0.80,8.50)	0.110	3.72(1.59,8.74)	0.003	1.39(0.39,4.98)	0.617	2.04(0.79,5.24)	0.141
Moderate	218(27.6)	1.74(0.98,3.10)	0.061	2.56(1.59,4.13)	<0.001	1.75(0.97,3.16)	0.064	2.50(1.53,4.10)	<0.001	1.27(0.67,2.41)	0.463	1.82(1.06,3.11)	0.029
Minor only	44(5.6)	2.60(1.06,6.35)	0.036	0.88(0.26,3.00)	0.842	2.67(1.06,6.74)	0.038	0.88(0.26,3.03)	0.837	1.91(0.73,5.01)	0.189	0.67(0.19,2.35)	0.534
EM (Ref.=No)													
Yes	376(47.5)	2.29(1.36,3.86)	0.002	2.67(1.69,4.22)	<0.001	2.36(1.38,4.03)	0.002	2.55(1.59,4.07)	<0.001	1.88(1.04,3.38)	0.037	1.85(1.10,3.13)	0.020
NCP (Ref.=No)													
Yes	65(8.2)	1.61(0.65,3.99)	0.308	2.43(1.28,4.62)	0.007	1.66(0.65,4.21)	0.290	2.23(1.15,4.32)	0.017	1.16(0.43,3.15)	0.765	1.35(0.66,2.74)	0.407
WV (Ref.=No)													
Yes	388(49.4)	1.96(1.16,3.30)	0.012	1.79(1.15,2.78)	0.010	2.11(1.23,3.61)	0.007	1.79(1.13,2.83)	0.013	1.80(1.03,3.14)	0.038	1.43(0.88,2.31)	0.150
Multiple types (Ref.=No)													
4 types	32(4.1)	7.91(3.99,15.71)	0.003	9.09(5.58,14.78)	<0.001	9.47(2.35,38.13)	0.002	8.19(3.02,22.18)	<0.001	-	-	-	-
3 types	132(16.8)	3.92(1.51,10.19)	0.005	4.11(2.02,8.36)	<0.001	4.37(1.64,11.62)	0.003	4.06(1.95,8.44)	<0.001	-	-	-	-
2 types	180(22.9)	4.80(2.01,11.47)	<0.001	2.08(1.00,4.33)	0.050	5.07(2.08,12.39)	<0.001	2.08(0.98,4.40)	0.055	-	-	-	-
1 type	238(30.3)	2.51(1.03,6.11)	0.043	1.68(0.83,3.43)	0.151	2.69(1.09,6.67)	0.033	1.71(0.83,3.52)	0.147	-	-	-	-
Multiple types [c]	-	1.54(1.23,1.92)	<0.001	1.66(1.37,2.01)	<0.001	1.59(1.26,2.01)	<0.001	1.63(1.34,1.98)	<0.001	-	-	-	-

Abbreviations: PM, physical maltreatment; EM, emotional maltreatment; NCP, non-contact punishment; CM, child maltreatment; WV, witnessing domestic violence. **P*<0.05.

[a] RRR from multinomial logistic regression; Reference category: Normal

[b] Other covariates included the number of children, maternal and paternal education, urban/rural residence, economic status, and family structure.

[c] Treated as a continuous variable.

Table 4 Impact of maltreatment on behavioural problems: relative risk ratios (RRRs)[a] and 95% CIs

Exposures	*N* (%)	Adjusted for sex and age				Adjusted for sex, age and others [b]				Further adjusted for other exposures			
		Borderline	P	Yes	P	Borderline	P	Yes	P	Borderline	P	Yes	P
PM (Ref.=No)													
Severe	36(4.6)	3.72(1.29,10.73)	0.015	10.15(4.41,23.36)	<0.001	4.41(1.46,13.31)	0.008	11.69(4.79,28.54)	<0.001	3.00(0.92,9.77)	0.069	4.75(1.74,12.98)	0.002
Moderate	218(27.6)	2.35(1.37,4.04)	0.002	2.52(1.43,4.46)	0.001	2.48(1.43,4.32)	0.001	2.62(1.46,4.71)	0.001	1.91(1.05,3.48)	0.034	1.63(0.86,3.09)	0.136
Minor only	44(5.6)	0.72(0.17,3.14)	0.664	1.27(0.37,4.40)	0.703	0.72(0.16,3.17)	0.665	1.22(0.35,4.29)	0.759	0.50(0.11,2.25)	0.367	0.77(0.21,2.83)	0.694
EM (Ref.=No)													
Yes	376(47.5)	2.48(1.47,4.18)	0.001	3.52(2.02,6.12)	<0.001	2.69(1.57,4.61)	<0.001	3.72(2.11,6.57)	<0.001	2.12(1.18,3.82)	0.012	2.36(1.25,4.46)	0.008
NCP (Ref.=No)													
Yes	65(8.2)	0.87(0.30,2.51)	0.791	3.76(1.93,7.32)	<0.001	0.91(0.31,2.70)	0.871	4.03(2.01,8.07)	<0.001	0.48(0.16,1.49)	0.202	1.91(0.88,4.16)	0.104
WV (Ref.=No)													
Yes	388(49.4)	1.80(1.08,3.01)	0.025	2.17(1.29,3.66)	0.004	1.91(1.12,3.26)	0.017	2.36(1.37,4.04)	0.002	1.62(0.93,2.81)	0.087	1.73(0.97,3.06)	0.063
Multiple types (Ref.=No)													
4 types	32(4.1)	3.12(1.34,7.26)	0.177	14.65(8.58,25.02)	<0.001	4.16(0.76,22.67)	0.099	19.88(6.46,61.23)	<0.001	-	-	-	-
3 types	132(16.8)	5.21(2.10,12.95)	<0.001	4.54(1.89,10.87)	0.001	6.03(2.37,15.33)	<0.001	5.23(2.12,12.90)	<0.001	-	-	-	-
2 types	180(22.9)	4.25(1.75,10.30)	0.001	3.65(1.57,8.48)	0.003	4.60(1.86,11.36)	0.001	4.14(1.73,9.90)	0.001	-	-	-	-
1 type	238(30.3)	2.43(1.00,5.91)	0.051	1.18(0.47,3.01)	0.724	2.62(1.06,6.45)	0.037	1.33(0.51,3.44)	0.561	-	-	-	-
Multiple types [c]	-	1.52(1.22,1.89)	<0.001	1.96(1.56,2.46)	<0.001	1.60(1.27,2.02)	<0.001	2.05(1.62,2.60)	<0.001	-	-	-	-

Abbreviations: PM, physical maltreatment; EM, emotional maltreatment; NCP, non-contact punishment; CM, child maltreatment; WV, witnessing domestic violence. *P<0.05.

[a] RRR from multinomial logistic regression; Reference category: Normal

[b] Other covariates included the number of children, maternal and paternal education, urban/rural residence, economic status, and family structure.

[c] Treated as a continuous variable.

Table S1 Test for interactions between sex and maltreatment exposures

Exposure	Emotional problems (Ref.=No) – adjusted for sex and age				Behavioural problems (Ref.=No) – adjusted for sex and age			
	Borderline ***RRR(95%CI)***	**P**	**Yes** ***RRR(95%CI)***	**P**	**Borderline** ***RRR(95%CI)***	**P**	**Yes** ***RRR(95%CI)***	**P**
PM (Ref.=No)								
Severe*Sex	2.44(0.40,15.08)	0.336	0.80(0.06,10.53)	0.865	0.31(0.02,6.05)	0.442	-	-
Moderate*Sex	**4.89(1.43,16.80)**	**0.012**	1.94(0.73,5.12)	0.181	**0.18(0.06,0.57)**	**0.004**	**3.66(1.01,13.24)**	**0.048**
Minor only*Sex	0.47(0.04,6.12)	0.566	2.61(0.39,17.60)	0.326	**0.03(0.00,0.37)**	**0.006**	1.25(0.20,7.88)	0.812
EM (Ref.=No)								
EM*Sex	1.40(0.48,4.10)	0.538	0.97(0.39,2.43)	0.944	**0.19(0.06,0.63)**	**0.007**	1.11(0.36,3.44)	0.853
NCP (Ref.=No)								
NCP*Sex	3.37(0.33,34.08)	0.303	0.58(0.16,2.13)	0.409	1.38(0.13,15.23)	0.792	7.17(0.80,64.06)	0.078
WV (Ref.=No)								
WV*Sex	0.85(0.30,2.44)	0.763	1.11(0.46,2.69)	0.823	1.21(0.43,3.43)	0.716	0.76(0.26,2.25)	0.622

Abbreviations: PM=physical maltreatment; EM=emotional maltreatment; NCP=non-contact punishment; CM=child maltreatment; WV=witnessing domestic violence.

Table S2 Sub-analysis: impact of physical and emotional maltreatment among boys

Exposure	N (%)	Emotional problems (Ref.=No) - adjusted for age and all exposures		Emotional problems (Ref.=No) - adjusted for socio-demographic factors and all exposures		Behavioural problems (Ref.=No) - adjusted for age and all exposures		Behavioural problems (Ref.=No) - adjusted for socio-demographic factors and all exposures	
		Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)
PM (Ref.=No)									
Severe	24(5.9)	0.91(0.28,2.93)	4.45(1.45,13.66)*	0.89(0.07,11.37)	**4.79(1.39,16.45)***	0.49(0.06,4.25)	4.88(1.55,15.34)*	0.50(0.05,4.55)	**6.66(1.71,26.00)***
Moderate	125(30.7)	3.10(1.92,5.03)*	2.84(1.44,5.61)*	**4.13(1.48,11.52)***	**3.33(1.52,7.31)***	0.94(0.42,2.10)	2.51(1.08,5.82)*	1.01(0.44,2.35)	**3.20(1.32,7.76)***
Minor only	20(4.9)	3.91(0.96,15.88)	0.57(0.08,4.02)	4.66(0.94,23.15)	0.76(0.09,6.53)	0.32(0.04,2.62)	-	0.32(0.04,2.66)	-
EM (Ref.=No)									
Yes	201(49.4)	1.98(1.24,3.16)	1.70(1.19,2.43)*	2.14(0.82,5.57)	1.62(0.77,3.43)	1.39(0.67,2.88)	1.97(1.30,2.98)*	1.43(0.66,3.08)	2.10(0.88,4.99)

Abbreviations: PM=physical maltreatment; EM=emotional maltreatment. *P<0.05.

Table S3 Sub-analysis: impact of physical and emotional maltreatment among girls

Exposure	N (%)	Emotional problems (Ref.=No) - adjusted for age and all exposures		Emotional problems (Ref.=No) - adjusted for socio-demographic factors and all exposures		Behavioural problems (Ref.=No) - adjusted for age and all exposures		Behavioural problems (Ref.=No) - adjusted for socio-demographic factors and all exposures	
		Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)
PM (Ref.=No)									
Severe	12(3.1)	1.91(0.41,8.82)	0.97(0.17,5.59)	2.29(0.40,13.23)	0.75(0.11,5.14)	**16.98(3.06,94.19)***	5.03(0.91,27.96)	**29.41(3.32,260.68)***	8.00(0.86,74.41)
Moderate	93(24.2)	0.58(0.22,1.48)	1.12(0.51,2.44)	0.49(0.18,1.33)	1.00(0.44,2.31)	**4.36(1.67,11.37)***	0.72(0.24,2.17)	**5.10(1.77,14.75)***	0.73(0.22,2.47)
Minor only	24(6.3)	1.46(0.44,4.83)	0.70(0.15,3.33)	1.72(0.45,6.52)	0.74(0.15,3.63)	1.01(0.12,8.76)	1.73(0.44,6.80)	1.28(0.13,12.25)	1.92(0.40,9.21)
EM (Ref.=No)									
Yes	175(45.6)	1.98(0.92,4.25)	2.24(1.05,4.77)*	2.13(0.94,4.81)	**2.57(1.16,5.71)***	**4.07(1.37,12.06)***	**2.40(1.06,7.09)***	**5.40(1.67,17.44)***	**3.69(1.29,10.53)***

Abbreviations: PM=physical maltreatment; EM=emotional maltreatment. *P<0.05.

Table S4 Test for interactions between age (10-12 years vs 13-16 years) and witnessing domestic violence

Exposure	Emotional problems (Ref.=No) – adjusted for sex and age				Behavioural problems (Ref.=No) – adjusted for sex and age			
	Borderline *RRR(95%CI)*	**P**	**Yes *RRR(95%CI)***	**P**	**Borderline *RRR(95%CI)***	**P**	**Yes *RRR(95%CI)***	**P**
WV (Ref.=No)								
WV *Age	2.41 (0.76, 7.65)	0.134	**0.38 (0.15, 0.95)**	**0.037**	**0.33 (0.11, 0.96)**	**0.041**	1.04 (0.36, 3.04)	0.938

Abbreviations: WV=witnessing domestic violence.

Table S5 Sub-analysis: impact of witnessing domestic violence by age group

Exposure	Emotional problems (Ref.=No) - adjusted for sex and other exposures		Behavioural problems (Ref.=No) - adjusted for sex and other exposures	
	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)	Borderline *RRR*(*95%CI*)	Yes *RRR*(*95%CI*)
Children aged 10–12 years				
WV (Ref.=No)				
Yes	**5.52 (1.87, 16.32)***	1.08 (0.56, 2.08)	1.23 (0.53, 2.85)	**2.71 (1.11, 6.60)***
Children aged 13–16 years				
WV (Ref.=No)				
Yes	1.51 (0.79, 2.89)	**2.68 (1.34, 5.34)***	**3.10 (1.47, 6.52)***	**2.40 (1.20, 4.80)***

Abbreviations: WV=witnessing domestic violence. **P*<0.05.