

Association Between Grandparental Co-Residence and Early Childhood Injury in the UK

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Abstract In contemporary Western societies, accidents and injuries are the most common cause of death in early childhood. This makes them a major social and health policy issue and an important child well-being indicator. Here we compared the risk of home injuries between children who co-reside in three-generational households with grandparents and children who do not co-reside with grandparents. Moreover, we investigate whether grandparental presence is associated with decreased injuries in different risk situations, measured by family- and child-related factors. Using the British Millennium Cohort Study ($n = 12,319$ children between the ages of 9 months and 3 years), we found that children who co-reside with grandparents had a lower probability of home injuries than children who do not co-reside with grandparents. In addition, grandparental co-residence was associated with a decreased risk of injuries more strongly in boys than girls. The results are discussed with reference to older adults' beneficial role of supporting their offspring.

Keywords Children · Grandparents · Injuries · Millennium Cohort Study · Three-generational households

1 Introduction

In modern Western nations, accidents and injuries are the most common cause of death in early childhood (Unicef 2007; WHO 2008), making it a major social and health policy concern. Accordingly, early childhood injuries are important child well-being indicators, and studies are needed to analyse the associations between preventive factors and injuries. A growing body of research shows that several family- and child-related factors correlate with an increased risk of childhood injuries (e.g.,

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Myhre et al. 2012; Pearce et al. 2010). However, to our knowledge, the correlation between grandparental presence and childhood injuries has not been previously studied in contemporary Western societies. In the present study, we compare the risk of home injuries between children who co-reside in three-generational households with grandparents and children who do not co-reside with grandparents in the UK.

Grandparents' opportunities to impact their grandchildren's well-being could be greater than ever before (Coall and Hertwig 2010, 2011). Due to increased life expectancy, the proportion of older adults and the total number of grandparents are rising in Western societies (OECD 2014). Today, grandparents and grandchildren may have more shared years than any previous time (Coall and Hertwig 2010; Mare 2011). In addition, due to decreased fertility rates (Billari & Kohler, 2004), grandparents have fewer grandchildren, which means that they may be able to invest more resources in each grandchild. Although the number of three-generational households has declined during the last century, family members face an increasing responsibility to take care of each other in this era of retracting welfare state services. In practice, this means that three-generational households may become more common again, as they were at the beginning of the 20th century (Ruggles 2003).

1.1 Grandparents and Child Well-Being

In recent decades, an increasing number of studies have investigated grandparental impact on grandchild well-being with several indicators, including child development, educational achievements and health (see Dunifon 2013; Sear and Coall 2011 for reviews). These studies have shown that the involvement of non-resident grandparents often correlates with improved child outcomes. For instance, Lussier et al. (2002) found that grandparental involvement correlates with fewer emotional and behavioural problems among British toddlers (see also Tanskanen and Danielsbacka 2016 for similar results). Furthermore, support for the valuable role of the involvement of non-resident grandparents has been provided, in particular, in studies analysing the correlation between grandparental involvement and child well-being in risk situations such as low socioeconomic standing and single-parent families (Sear and Coall 2011).

Several studies have also investigated the impact of co-resident grandparents on child well-being. Although studies are lacking that investigate whether co-residing grandparents decrease the risk of injuries among toddlers, grandparental presence is often associated with grandchild outcomes measured by, for instance, academic achievement and psychological well-being among children (see Dunifon 2013; Dunifon et al. 2014 for reviews). Moreover, previous studies have shown that in three-generation households, the presence of grandparents may have either positive or negative outcomes for their grandchildren. The negative outcome of grandparental presence has been detected in studies investigating educational achievements among adolescents (e.g., Kreidl and Hubatkova 2014; McLanahan and Sandefur 1994). These studies have shown that children living with grandparents tend to receive lower educational test scores compared to children living without grandparents.

When grandchildren are infants or toddlers, grandparental co-residence is often found to benefit grandchildren. For instance, Mollborn and colleagues (2011) showed with US data that African-American toddlers living in three-generational arrangements received better cognitive test scores compared to their counterparts living in households

without grandparental presence. Research using data from historical and developing societies has even shown that the presence of grandparents correlates with lower mortality rates for small children (e.g., Lahdenperä et al. 2004; Sear and Mace 2008). In these subsistence societies, a significant way in which grandparents may have kept their small grandchildren alive was their prevention of severe injuries that may have led to death (see Coall and Hertwig 2010 and responses for discussion). However, it is an open question whether grandparents still play a role in preventing their grandchildren's injuries in contemporary developed societies.

The extra hands that co-residing grandparents provide to parents of small children can in several ways prevent the risk of injuries. Co-residing grandparents may either look after the grandchildren themselves or contribute to doing household tasks, providing support to parents who, in turn, have more time to spend with their children. In general, grandparental support may lead to lower levels of parental stress, which can also improve the well-being of grandchildren (Dunifon and Kowaleski-Jones 2007; Mutchler and Baker 2009). However, the beneficial effect of grandparental presence may vary between different family- and child-related factors. Here we study whether grandparental co-residence has a protective impact, preventing early year injuries in several risk situations.

Previous studies have shown that several child-related factors are associated with an increased risk of injuries among toddlers. Boys tend to have more injuries than girls (e.g., Reading et al. 2008; Tanskanen et al. 2015), and when the number of siblings increases, so does the likelihood of injuries (e.g., Myhre et al. 2012; Ramsay et al., 2003). Perhaps surprisingly, research from the UK has shown that children belonging to the ethnic majority have injuries more often compared to children who belong to an ethnic minority (e.g., Tanskanen et al. 2015). In addition to child-related factors, several family-related factors have been shown to correlate with toddler injuries. Maternal age has been found to associate with injuries such that children with younger mothers have a higher risk of injuries than children with older mothers (e.g., Kendrick et al. 2005; Pearce et al. 2010). In families with lower financial resources, childhood injuries are found to be more common compared to families with higher resources (e.g., Hong et al. 2009; Reading, Langford, Haynes, & Lovett, 1999). Similarly, children with less educated mothers in a lower socioeconomic position tend to have a higher risk of injuries compared to children with more educated mothers in a higher position (e.g., Bruce et al. 2004; Hong et al. 2009).

1.2 Study Questions

In the present study, we investigate the association between grandparental co-residence and toddler injuries in the UK. We study two questions (Q):

Q1. Is grandparental co-residence associated with a decreased risk of injuries among toddlers?

Q2. Is grandparental co-residence more strongly associated with a decreased risk of injuries in different risk situations?

In the case of Q1, we compare injuries between children who live with and without grandparents. In the case of Q2, we detect the interactions between grandparental co-residence and family- and child-related risk factors. Family-related risk factors are

decreased maternal age, low education, low family income, disadvantaged socioeconomic position, and single motherhood. Child-related risk factors are indicated by the child's gender (boys have a higher risk than girls), ethnicity (ethnic majority children have a higher risk than ethnic minority children) and number of siblings (the risk of injuries increases with the number of siblings).

2 Material and Methods

We used the Millennium Cohort Study (MCS) from a longitudinal survey carried out in the UK. The MCS collects information on children born at the beginning of the new millennium in England, Wales, Scotland and Northern Ireland. In the present study, we used first and second wave data collected when the children were aged 9 months and 3 years. In the MCS, the respondents are parents or parental figures who have answered questions concerning their cohort member children, themselves and their family. The MCS prioritized biological mothers for interview participation, and thus, almost all of the main respondents are the biological mothers of the target child (Hansen 2010). For our analytic sample, we selected cases where the main respondents were the biological mothers and were living in the same household with the target child. Only single-mother and two biological parent families were included, because of the low number of single-father and step-parent families in the data (together less than 1 %). Finally, in the cases of twins and triplets, only one child of the set was included. After these exclusions, the analytic sample included 12,319 cohort member children.

Our dependent variable measured the target child's home injuries. In the MCS, mothers were asked whether the target child experienced any accident or injury at home between the ages of 9 months and 3 years for which he/she had been taken to a doctor, health centre or hospital. It is likely that the great majority of injuries happened at home are accidental and thus unintended rather than intended (i.e., due to the child abuse etc.) (Pearce et al. 2010, 2012). Altogether 25 % of the children in the study sample reported having had such an injury at home.

The main explanatory variable measured whether the child has lived with a grandparent in a three-generational household between the ages of 9 months and 3 years. The household type was coded as being "three generational" if the grandparent was present in the first, second or both waves. This way it was possible to measure the potential grandparental effect when grandparent was present at least some point during the time monitored here. In the sample, 9 % of the children lived in the same household with a grandparent. Of these grandparents, 62 % were grandmothers and 38 % grandfathers (age: $M = 53$ years, $SD = 9.3$).

We employed binary logistic regression analyses with fixed effects that controlled for between-country variation (regression with country dummies). In the models, we controlled for several potential confounding factors that have been shown to correlate with toddler injuries in previous studies (e.g., Kendrick et al. 2005; Myhre et al. 2012; Pearce et al. 2010). These were the child's gender, ethnicity, number of siblings, maternal age, education and socioeconomic position, family type (single mother or intact), financial situation of the family, quality of the residential area (ranging from 1 to 10 where 1 = bottom quality decile and 10 = highest quality decile), number of safety equipment items in the household (i.e., none, safety gate, fire guard, smoke alarm,

electric socket cover; ranging from 0 to 4) and the presence of other adults in the household (i.e., other relatives or non-relatives). With the exception of the child's number of siblings, maternal age, financial situation of the family, neighbourhood quality and number of safety measures, all variables were categorical and were transformed into dummy variables for the regression analyses. We ran sensitivity analyses and found that results were similar whether categorical or dummy variables were used. The descriptive statistics are presented in Table 1.

In the Results section, we first present correlations between the independent variables. After that, we investigate whether more injuries occur in households where grandparents are present compared to households where grandparents are not present. Next, we analyse what other independent variables correlate with childhood injuries. Finally, we include interaction terms in the models and investigate the interactions between grandparental presence and family-related factors (i.e., maternal age, education and socioeconomic position, family income and family type) and between grandparental presence and

Table 1 Descriptive statistics (%/mean) ($n = 12,319$)

	%/mean	SD
Child's gender (%)		
Boy	50.1	
Girl	49.9	
Child's ethnicity (%)		
Belongs to an ethnic majority	83.2	
Belongs to an ethnic minority	16.8	
Number of siblings (mean)	1.0	1.07
Maternal age (mean)	29.8	5.83
Maternal education (%)		
NVQ level 1	8.0	
NVQ level 2	28.6	
NVQ level 3	14.3	
NVQ level 4	28.1	
NVQ level 5	3.5	
Other	17.6	
Maternal socioeconomic circumstance (%)		
Semi-routine, routine and not working	44.7	
Lower supervisory, technical, small employers and own account	9.2	
Intermediate	17.5	
Managerial and professional	28.6	
Perceived financial situation of the family (mean)	1.8	0.93
Family type (%)		
Two-parent	79.7	
Single-mother	20.3	
Other adults in household (%)		
No	95.1	
Yes	4.9	
Residential area quality (mean)	5.0	3.00
Number of safety equipment (mean)	2.2	1.18

child-related factors (i.e., child's gender, ethnicity and number of siblings). In the Results section, we present only the interaction terms that are statistically significant.

3 Results

We first provide bivariate correlations of the independent variables. Table 2 shows that the strongest correlations were between maternal socioeconomic circumstance and the quality of the residential area. When maternal circumstance increased, so did the quality of the residential area. In addition, there were strong positive correlations between maternal age and socioeconomic circumstance, between maternal age and the child's number of siblings, between maternal age and the quality of the residential area and between maternal socioeconomic circumstance and the financial situation of the family. Table 2 also shows strong negative correlations between maternal age and family type and between family type and the quality of the residential area, meaning that older maternal age correlates with increased single motherhood and that single motherhood correlates with a lower quality residential area. Finally, there were negative correlations between the child's ethnicity and the quality of the residential area and between the child's ethnicity and the number of safety equipment items, meaning that the quality of the residential area and the number of safety equipment items are lower in ethnic minority than majority families.

Table 3 shows that those children living with grandparents had a significantly lower probability for injuries compared to children not living with grandparents. These results are illustrated in Fig. 1, where the predicted probabilities for injuries are 22 % for the group "coresidence with grandparent" and 25 % for the group "no coresidence with grandparent".

Table 3 also shows that several other factors besides grandparental presence correlated with injuries. Boys were significantly more likely to be injured than girls. Children belonging to an ethnic minority had a lower risk of injury than children

Table 2 Correlations between independent variables ($n = 12,319$)

	1	2	3	4	5	6	7	8	9	10
1 Child's gender	–									
2 Child's ethnicity	0.004									
3 Number of siblings	0.002	0.12								
4 Maternal age	–0.004	–0.05	0.32							
5 Maternal education	0.01	0.22	0.12	0.10						
6 Maternal socioeconomic circumstance	–0.002	–0.18	–0.19	0.36	0.01					
7 Perceived financial situation of the family	–0.002	–0.14	–0.14	0.13	–0.04	0.27				
8 Family type	–0.01	0.03	–0.02	–0.30	0.001	–0.25	–0.24			
9 Other adults in household	–0.01	0.19	–0.11	–0.21	0.02	–0.12	–0.02	0.14		
10 Residential area quality	–0.02	–0.29	–0.12	0.30	–0.05	0.43	0.25	–0.28	–0.14	
11 Number of safety equipment	–0.02	–0.30	0.02	0.14	–0.10	0.18	0.13	–0.12	–0.11	0.22

Bold numbers indicate significant associations: $p < 0.05$

Table 3 Predicting the probability of injuries in early childhood (country fixed effects) ($n = 12,319$)

	OR	SE	z	p	95 % CIs	
					Lower	Upper
Grandparental co-residence						
No (ref.)	1.00					
Yes	0.83	0.08	-1.99	0.047	0.70	0.997
Child's gender						
Boy (ref.)	1.00					
Girl	0.74	0.03	-7.19	<0.001	0.68	0.80
Child's ethnicity						
Belongs to an ethnic majority (ref.)	1.00					
Belongs to an ethnic minority	0.66	0.05	-6.04	<0.001	0.57	0.75
Number of siblings	1.04	0.02	1.77	0.077	1.00	1.09
Maternal age	0.97	0.00	-6.41	<0.001	0.96	0.98
Maternal education						
NVQ level 1 (ref.)	1.00					
NVQ level 2	1.26	0.11	2.75	0.006	1.07	1.48
NVQ level 3	1.10	0.10	0.98	0.329	0.91	1.32
NVQ level 4	1.15	0.11	1.49	0.136	0.96	1.38
NVQ level 5	1.14	0.17	0.90	0.368	0.85	1.53
Other	0.98	0.09	-0.17	0.867	0.82	1.18
Maternal socioeconomic circumstance						
Semi-routine, routine and not working (ref.)	1.00					
Lower supervisory, technical, small employers and own account	0.91	0.07	-1.17	0.243	0.78	1.06
Intermediate	0.81	0.05	-3.26	0.001	0.71	0.92
Managerial and professional	0.88	0.06	-1.87	0.062	0.77	1.01
Perceived financial situation of the family	0.93	0.02	-2.82	0.005	0.89	0.98
Family type						
Two-parent (ref.)	1.00					
Single-mother	1.08	0.06	1.37	0.172	0.97	1.21
Other adults in household						
No (ref.)	1.00					
Yes	0.997	0.11	-0.03	0.976	0.80	1.25
Residential area quality	0.98	0.01	-2.93	0.003	0.96	0.99
Number of safety equipment	1.05	0.02	2.69	0.007	1.01	1.09

belonging to the ethnic majority. Lower maternal age was associated with a higher risk of injury. Children with mothers with an educational level of NVQ level 2 had more likely injuries compared to children with mothers with NVQ level 1. Children with mothers in mid-level work positions had a lower probability of injuries than those children whose mothers did more routine or menial work, or who were unemployed. Children from financially more secure households were less likely to be injured than children from financially less secure households. In addition, when the quality of the residential area decreased, the risk of injury increased. Finally, when the number of safety measures in the household increased, so did the probability of injury.

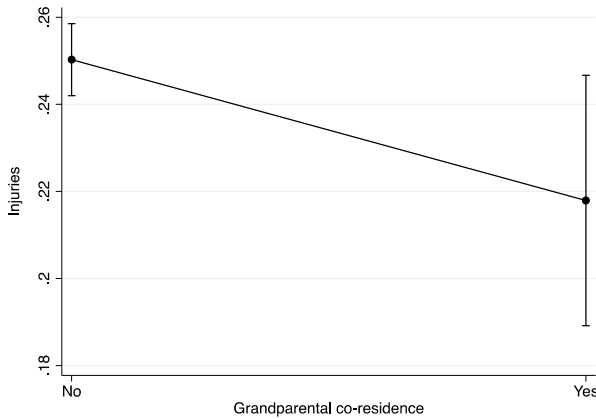


Fig. 1 Association between home injuries and grandparental co-residence (predicted probabilities and 95 % confidence intervals) ($n = 12,319$)

We also investigated the interactions between grandparental presence and family-related factors measured by maternal age, education and socioeconomic circumstance, family income and family type. However, we found no significant interactions between grandparental presence and family-related factors in any of the models (results not shown in tables or figures).

Next, we analysed the interactions between grandparental co-residence and child-related factors. Based on these results, grandparental co-residence was associated with a decreased risk of injuries more strongly in boys than girls. These results are presented in Table 4 and illustrated in Fig. 2. We found that grandparental co-residence was associated with decreased risk of injuries in boys but not in girls (ref = 1.00; boys: odds ratio = 0.72, SE = 0.03, $p < 0.001$; girls: odds ratio = 1.03, SE = 0.15, $p = 0.829$). In the case of other child-related factors (i.e., ethnicity and number of siblings), we found no significant interactions between grandparental presence and these factors (results not shown in tables or figures).

Table 4 Associations between child’s gender and injuries by grandparental co-residence (country fixed effects) ($n = 12,319$)

	OR	SE	z	p	95 % CIs	
					Lower	Upper
Grandparental co-residence						
No (ref.)	1.00					
Yes	0.72	0.03	-7.49	<0.001	0.66	0.78
Child’s gender						
Boy (ref.)	1.00					
Girl	0.70	0.08	-3.01	0.003	0.55	0.88
Grandparental co-residence × child’s gender	1.43	0.22	2.36	0.018	1.06	1.94

Control variables: child’s ethnicity, number of siblings, maternal age, education and socioeconomic position, family type, financial situation of the family, the quality of the residential area and number of safety equipment and the presence of other adults in the household

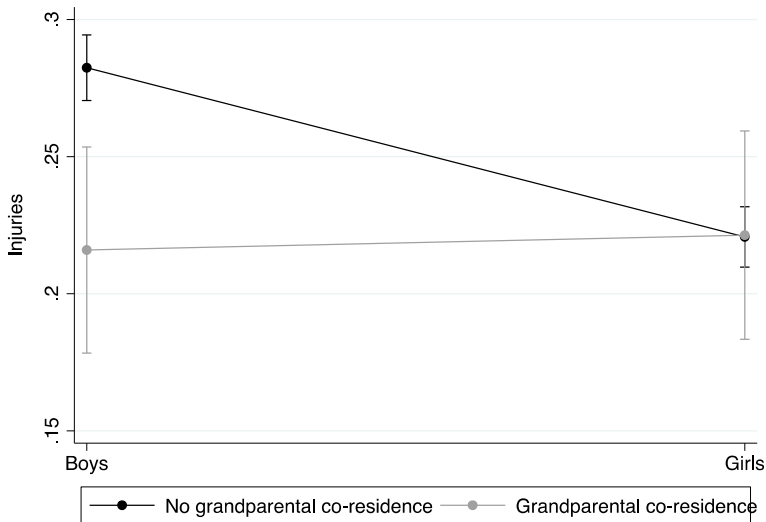


Fig. 2 Associations between child's gender and home injuries by grandparental co-residence (predicted probabilities and 95 % confidence intervals) ($n = 12,319$)

4 Conclusions

Early childhood injury is a major social and health policy concern and thus an important child well-being indicator. In the present study, we investigated the association between grandparental co-residence and early childhood injury in the UK. We found that children who co-reside with grandparents had a lower probability of being injured at home compared to children who did not reside with grandparents.

Previous studies investigating the association between grandparental presence and child well-being have produced mixed results. Although some have found that grandparental presence benefits grandchildren (Aquilino 1996; DeLeire and Kalil 2002), others have found the opposite (Kreidl and Hubatkova 2014; McLanahan and Sandefur 1994). The present findings point to the positive sides of living with grandparents. Based on previous studies, the positive effect grandparents have on grandchild well-being often tends to be relatively small (see Sear and Coall 2011 for a review). Further, according to the present results, the impact grandparents have on preventing childhood injuries tends to be small. However, even if small, it is still notable that the association exists after controlling for several potential confounding factors and for such a severe outcome measure as injuries in early childhood.

In addition, we found that several other factors besides grandparental co-residence were associated with injuries. Boys had a higher risk of injuries than girls, and children belonging to an ethnic minority had a lower risk than children belonging to the ethnic majority. Both of these results are in line with several previous studies (e.g., Reading et al. 2008; Tanskanen et al. 2015). Also in line with previous results, lower maternal age was associated with a higher risk of injury (e.g., Kendrick et al. 2005; Pearce et al. 2010). Overall, children from lower socioeconomic standings have a higher risk of injuries than children from higher socioeconomic standings, providing support for previous studies (e.g., Bruce et al. 2004; Hong et al. 2009). In addition, when the number of safety measures in a household increased, so did the probability of injury.

This is in line with recent studies conducted in the UK (e.g., Pearce et al. 2012; Tanskanen et al. 2015) and could be related to the fact that lively children have more injuries and thus their parents are more likely to follow safety recommendations. On the other hand it could be that the safety equipment are not used correctly and thus they do not prevent injuries for this reason. Moreover, it is an open question whether these equipment were relevant in the first place. Unfortunately, because of the data limitations we were not able to study these issues in this paper and call for future studies to response these questions. Finally, children living in lower quality residential areas had a higher probability for injuries compared to children from higher quality areas. This finding is also in accordance with previous studies (e.g., Haynes et al., 2003; Kendrick and Marsh 2001).

After scrutinizing different interactions between different risk factors and grandparental presence, we found that grandparental co-residence was more strongly associated with a decreased risk of injuries in boys than girls. The reason for this result is not clear. It could be related to the fact that overall boys tend to be more accident prone than girls. Perhaps when spending time with their grandchildren, grandparents pay more attention to grandsons than granddaughters and consequently can be more likely to prevent injuries among grandsons. Because previous studies have consistently shown that boys have a higher risk of injuries than girls (e.g., Reading et al. 2008; Tanskanen et al. 2015), our gender-based result also provides support for the prediction that grandparental co-residence is beneficial among high risk children. However, we did not find evidence for this prediction in the case of the other risk factors investigated.

Based on previous findings grandparental support tends to benefit grandchildren (e.g., Tanskanen and Danielsbacka 2012), particularly in child and family risk situations (see Sear and Coall 2011 for review). Perhaps surprisingly, in the present study we found no evidence for this prediction other than in the case of the child's gender, meaning that grandparental co-residence was not more strongly associated with a decreased risk of injuries among children who have younger mothers, whose mothers have a low education and disadvantaged socioeconomic position, and among children from low income and single-mother families. These results may be related to the fact that the child well-being indicator used in the present study differs from those used in previous studies. Toddler injuries are qualitatively different measures for child well-being compared to the developmental and educational attainments investigated in previous studies. Moreover, we found that grandparental presence was not correlated more strongly with a decreased probability of injuries among ethnic majority children and among children with a higher number of siblings compared to others, factors that in previous studies have both increased the risk of injuries among children.

Our study has several strengths. The results are based on large-scale and representative data, and we were able to control for several potential confounding factors that have been shown to correlate with injuries in early childhood in previous studies. In addition, we were able to study severe injuries that have happened in the home environment. Finally, the data allowed us to examine whether grandparental co-residence is associated with the decreased risk of toddler injuries in several family- and child-related risk situations. Obviously, our study also has limitations. Because the data does not include information concerning non-residing grandparents, we were unable to control for the background variables on the grandparental level. In addition, with this data, we were unable to study whether those children whose grandparents are

their primary carers have more or less injuries than others. Finally, because of the data structure, it was impossible to investigate grandparental effects on childhood injuries in single-father families. We hope future studies will investigate these questions.

Future studies are also needed to analyse grandparental impact with cross-national data. Large cross-national differences exist in the frequency of three-generation coresidence (Kreidl and Hubatkova 2014; Pilkauskas and Martinson 2014). However, studies are scarce that analyse the impact of grandparents on child well-being in different nations. Ideally, these studies should investigate children at different ages and different child well-being indicators, because previous studies have shown that the grandparental effect tends to vary based on these factors. Moreover, longitudinal studies are needed to analyse the grandparental effect on child well-being over the life course of grandchildren.

Our study has some policy implications. Due to population ageing and an increased proportion of older people in the UK and other Western countries, policy-makers are often concerned about the amount of public expenditure on the elderly. In these debates, older adults are often seen only as a social and economic burden to society. The present findings show that this is not the case. Moreover, in policy debates, the fact that older people provide a huge amount of support to their children and grandchildren is often ignored (e.g., Hank and Buber 2009). Because the net flow of material and social support goes from older generations towards younger ones (e.g., Albertini et al. 2007; Igel and Szydlik 2011), social policies providing support for the elderly may benefit not only the elderly themselves but also their offspring. Thus, by providing public support for the elderly, policy-makers can strengthen the safety net that grandparents represent to their children and their families.

In the contemporary UK policy agenda, grandparents have long been almost invisible. Because grandparental presence tends to decrease childhood injuries, policy-makers should consider how to enable grandparents to take part in their grandchildren's lives. One way to do this is to encourage grandparents to live near their offspring. Moreover, members of the extended family should be supported in spending time with each other. One way to do this is that government provides some monetary or non-monetary benefits for those grandparents who look after their offspring. To conclude, when planning preventive measures for small children, the potentially valuable input from grandparents should be taken into account.

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