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Application of an integrated behaviour-change model on grandparental adherence towards childhood domestic injury prevention in Hong Kong: a longitudinal study

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ABSTRACT

Background/purpose Every year, unintentional injury claims thousands of children's lives and causes disabilities in many more. For very young children, these injuries often occur at home. The risks of domestic injury can be reduced through proper implementation of injury preventive measures. In this study, we investigated the motivational and belief processes underlying childhood domestic injury prevention in grandparent caregivers based on the integrated model of self-determination theory and theory of planned behaviour.

Method Grandparents (n=299, mean age=62.61 years, SD=5.91, men=20.07%) of 0–2-year-old infants and toddlers self-reported their perceived psychological need support, autonomous motivation, perceived behavioural control (PBC), subjective norms, attitude, intention and adherence with regard to domestic injury prevention for their children at two time points (T1: baseline, T2: 4-month follow-up).

Results/outcomes Data were analysed with structural equation modelling, and the proposed model yielded an acceptable fit with the data: χ^2=905.09 (df=531), Comparative Fit Index=0.94, Tucker-Lewis Index=0.93, root mean square error of approximation=0.05 and standardised root mean square residual=0.078. Our results supported our hypothesis, demonstrating significant and positive associations between the following key constructs: (1) psychological need support from family and autonomous motivation; (2) autonomous motivation and social-cognitive beliefs; (3) social-cognitive beliefs and intentions; and (4) intention and behavioural adherence. Subjective norms and PBC, but not attitudes, were also found to significantly mediate the indirect effects of psychological need support and autonomous motivation on intention and behavioural adherence.

Conclusions Overall, the integrated model seems to be a feasible framework for explaining grandparents' domestic injury prevention behaviour.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Unintentional injury (eg, domestic injury) is one of the leading causes of childhood mortality and disability. It is important that caregivers of infants and toddlers (eg, grandparents) fully adhere to the safety measures against domestic injury.

WHAT THIS STUDY ADDS

⇒ Drawing on the integrated model, our study contributes to a preliminary understanding of the motivational process underpinning grandparent-for-grandchild domestic injury prevention. Our results showed that the pathways of psychological need support and autonomous motivation to intention and behavioural adherence are mediated by social-cognitive beliefs and thus provide a theoretical basis for future interventions for enhancing behavioural engagement.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Many families rely on grandparents to provide daily supportive childcare, so they are as important as parents in terms of preventing children from domestic injury. However, research has placed very little attention to the psychological mechanism underpinning how grandparent caregivers could facilitate domestic injury prevention for infants and toddlers. Our study is the first application of an integrated behaviour-change model that explains grandparent caregivers' motivation and social-cognitive beliefs regarding domestic injury prevention behaviour. Our findings may not only offer theoretical insights by extending the application of the theory into a new health context but they may also be useful for future development of effective interventions for promoting grandparent caregivers' commitment to domestic injury prevention.

INTRODUCTION

Unintentional injury is one of the leading causes of childhood mortality and disability. The annual global estimate of unintentional injury mortality rate is 80.5 per 100 000 children aged under 4, accounting for 522 167 immature deaths.[1] Most young children are injured in the home environment.[2] Likewise, surveillance reports in Hong Kong showed that 64.5% of unintentional injuries that required medical attention in children aged less than 4 occurred at home[3] and that 45.9% of childhood fatal incidents occurred at home.[4] Injury risks are largely mitigated by the consistent application of safety precautions such as active supervision and home adaptation.[5] It is estimated that at least one-third of childhood mortality due to unintentional injury could be prevented.[3] However, these precautions are seldom universally implemented. In Hong Kong, only 66.7% of caregivers adopt general domestic safety precautions for young children.[6] The lack of caregivers' commitment towards childhood domestic injury prevention may be due to their underestimation of injury risks and severity,[7] false perception of domestic accidents as an inevitable and normal part of upbringing and unfavourable weighing of potential risk against inconvenience.[8] Therefore, this study employed a theory-based approach to investigate the motivational and decision-making processes underlying domestic injury prevention behaviours within a significant population group of caregivers, grandparent caregivers.

The integrated model unites concepts from self-determination theory (SDT) and the theory of planned behaviour (TPB) to formulate an effective explanation of behavioural variances[9] and details the psychosocial sequence of behaviour from the distal motivational antecedents to the proximal decision-making process. The distal self-regulatory process within the integrated model is described in SDT, which highlights that social environments that satisfy fundamental psychological needs nurture a more adaptive form of motivation, autonomous motivation.[10] In contrast to individuals with controlled motivation, who perform due to external pressure and desire to maintain internal ego (eg, pride or guilt avoidance), those with autonomous motivation engage in behaviour that is aligned with their own interests and goals, or of great personal importance and often obtain more favourable outcomes such as enhanced performance, long-term behavioural adherence and maintenance and better psychological well-being.[11] The gap between motivational antecedents and behaviour can be bridged by the social-cognitive constructs and behavioural intentions from TPB. TPB posits that intention formulation is determined by three social-cognitive constructs: (1) attitude (ie, degree of positive or negative appraisal of the behaviour), (2) subjective norms (ie, perceived appropriateness and social pressure to perform the behaviour) and (3) perceived behavioural control (PBC, perception and beliefs in one's own ability and efficacy to perform the behaviour).[12] Individuals who view the behaviour as positive, socially acceptable and easy to perform are more likely to intend to perform the behaviour of interest.

The integrated model has also been used to explain preventive behaviours against various types of unintentional injury, including the prevention of sports[13] and occupational[14 15] injuries and parental adoption of sun protective behaviours for their children.[16] Aside from SDT and TPB models, other health and behavioural models have been used to account for the childhood domestic injury prevention, including the health belief model (which focuses on factors such as perceived severity and susceptibility)[17 18] and Hadden model (which focuses on environmental factors),[19] and the knowledge, awareness and practice model (which consider knowledge acquisition, awareness of risks and the translation of knowledge into preventive practices).[20–22] However, these models do not explicitly outline how caregivers' motivation and beliefs are related directly and indirectly to their behavioural adherence to domestic injury prevention. The integrated model of SDT and TPB may offer a plausible theoretical explanation in this regard, but no studies so far have investigated the application of this model specifically in the context of domestic injury prevention among infants and toddlers. Therefore, our aim is to address this literature gap and seek a more comprehensive understanding of the underpinning psychosocial and social-cognitive factors that contribute to individuals' adherence towards domestic injury prevention in early childhood.

The current study examines whether the tenets of the integrated model of SDT and TPB are applicable to explaining grandparents' injury prevention behaviours in protecting their 0–2-year-old grandchildren from domestic injury. We narrowed the age group of participants' grandchildren to 0–2 years, as infants and toddlers in this age group have the highest domestic injury incidence and severity compared with older children.[2 23 24] Grandparents were chosen as our target participants, as a growing number of grandparents now play an active role as their grandchildren's main caregiver when both parents join the workforce,[25 26] and little research has shed light on the grandparents' perspectives. As previous studies focusing solely on SDT or the TPB generally supported the universalities of these theories across age groups,[27 28] we expected the integrated model could proficiently predicted behavioural adherence in grandparent caregivers. Specifically, the relationships among psychological need support, autonomous motivation and positive outcomes would remain consistent in studies with older adults.[27] Additionally, although not all socio-cognitive variables have been found significant in the studies regarding TPB in older adults, PBC appeared to be a consistent factor in the prediction of intention towards health behaviours across these studies.[28–30] Therefore, it is plausible that PBC might hold greater weight in intention formation in older population.

Our study employs a two-wave longitudinal design to allow a test of the pathways of the integrated model at

the change-score level. Rooted in the framework of the integrated model, the following five hypotheses were formulated:

(H1) Grandparents' perception of psychological need support provided by their family members would be directly and positively associated with grandparents' autonomous motivation in childhood domestic injury prevention.

(H2) Grandparents' autonomous motivation in childhood domestic injury prevention would be directly and positively related to the social-cognitive constructs from TPB.

(H3) Grandparents' social-cognitive beliefs would form a direct positive association with their intention to prevent childhood domestic injury.

(H4) Grandparents' intention would be directly and positively associated with their behavioural adherence to prevent childhood domestic injury.

(H5) A positive indirect effect of psychological need support on behavioural adherence to prevent childhood domestic injury would be observed. In other words, social-cognitive constructs and intention serve as mediators in the pathways between psychological need support and behavioural adherence.

METHOD

Sample

Grandparents were recruited through social media platforms from October 2021 to November 2021. A total of 522 entries were received, and after accounting for eligibility and duplicated entries, invitations were sent to 338 participants. Our sample consisted of 299 grandparents (mean age=62.61 years, SD=5.91, men=20.07%) who completed the self-report survey at two time points (T1: baseline (October 2021 to November 2021), T2: 4-month follow-up (February 2022 to March 2022)). The average follow-up time was 17.24 weeks. Participants' inclusion criteria were (1) having at least one grandchild aged between 0 and 2 years, (2) providing supportive childcare for said grandchild(ren) and (3) being literate in Chinese. The surveys were distributed through the online platform Qualtrics. The number of participants exceeded our expected sample size of 266, which was estimated by power analysis based on an effect size of 0.10 (taken from the lower boundary of the effect size from previous injury prevention models),[13 31] alpha of 0.05, power of 0.90 and a conservative estimation of 40% dropout at follow-up.

The grandchildren of our participants (mean age=16.69 months, SD=6.69 months, boy=53.85%) had not started kindergarten education, and only some took part in preschool courses (10.37%) or playgroups (2.00%). As such, they spent a considerable amount of time in the home environment. In addition, a majority of their parents were full-time employees (mothers: 63.88%, fathers: 89.97%), so our participants provided childcare support to their grandchildren for 4.59 days (SD=1.96) per week or 9.61 hours (SD=6.24) per weekday. The majority of our participants were retired (67.22%) and had not attended any first aid (95.65%) or childcare training courses (90.30%). For a history of domestic injury, 61.88% of participants' grandchildren had encountered domestic accidents, and 52.43% of these accidents led to injuries.

Instruments

A total of six main variables were measured. A 6-item short-form of the Health Care Climate Questionnaire was employed to measure the extent to which grandparents perceive that their family members support their psychological needs.[32] The 6-item autonomous motivation subscale was taken from the Treatment Self-Regulation Questionnaire[33] for the evaluation of autonomous motivation in childhood domestic injury prevention. Social-cognitive constructs, including subjective norms (three items), PBC (six items) and attitude (six items), as well as intention (three items), were examined by the TPB Questionnaire.[34] The shortened version of the Self-Reported Injury Prevention Adherence Scale was used to evaluate the participants' frequency (one item) and effort (one item) of preventing domestic injuries from their grandchildren.[35] To avoid measurement bias, the Chinese versions of all the chosen questionnaires demonstrated satisfactory reliability and validity in the context of injury prevention.[13–15 35 36]

All questionnaires were adopted for the childhood domestic injury prevention context and presented in Chinese. Online supplemental appendix A details the full scales (including the items, stems and anchor) that were used in the study. In addition to the main variables of the SDT and TPB measures, demographic information (eg, age, gender, education background and household income), a brief history of domestic injuries (eg, injury causes and types) and caretaker information (eg, number of hours grandparents spent with children per day) were also collected.

Data analysis

To evaluate the relationships among the changes in model variables, itemwise standardised residual change scores were calculated by regressing the follow-up responses on baseline responses for each study variable. Descriptive statistics, reliability coefficients, correlation coefficients and standardised residual change scores were computed using SPSS software (V 26). Structural equation modelling with a robust maximum likelihood estimation method was employed to examine the model fit and parameter estimates of the hypothesised pathways (Mplus V.8.1). The estimator can remain robust even for non-normal data.[37] The indirect effects between SDT/TPB variables and domestic injury prevention adherence were examined by mediation analysis. The attrition rate at T2 was 6.69% (T2: n=279) due to non-response, with total missing data ranging from 6.69% to 7.02%. Missing data analysis across constructs revealed that the missing data were completely at random (Little's Missing

Completely At Random (MCAR) test: χ^2 (78)=89.215, p=0.18). These cases were excluded from the analysis to facilitate the calculation of standardised residual change scores. Multiple goodness-of-fit indices, including the root mean square error of approximation (RMSEA), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI) and the standardised root mean square residual (SRMR), were used to assess the overall model fit. The traditional cut-off values, CFI and TLI values>0.90 and RMSEA and SRMR values<0.08, were used as an indication of an acceptable model fit.[38] In addition to testing the proposed integrated model, we also examined the goodness of fit and the indirect effects of the SDT-only model, TPB-only model and reverse-effect (TPB→SDT) model to compare our main results against those of the alternative models.

RESULTS

All measures exhibited satisfactory internal consistency across two time points (Cronbach's alpha: 0.90–0.96, Raykov's rho: 0.87–0.95). The linearity of the regression paths was confirmed with Ramsey's Regression Equation Specification Error Test (RESET) and fitted versus residuals plots. Some demographic variables were found to be significantly correlated with the study variables. These include the number of days grandparents spent with children per week, number of hours grandparents spent with children per day, grandparents' educational level, household income, the number of children in the household and the gender of the grandchildren. As such, they were added into the model as covariates to statistically account for their potential confounding effects on the model pathways. Table 1 displays the descriptive statistics, score reliability coefficients and zero-order correlations of the study variables.

The proposed model exhibited an acceptable fit with the data: χ^2=905.09 (df=531), CFI=0.94, TLI=0.93, RMSEA=0.05 (90% CI=0.05 to.06) and SRMR=0.08. For alternative models, although the SDT-only model, TPB-only model and reverse-effect (TPB→SDT) model were found to have satisfactory fit (CFI>0.90, TLI>0.90, RMSEA<0.08 and SRMR<0.08; see table 2), these alternative models fitted significantly better than the proposed model (ΔCFI>0.01). However, the indirect effects of the mediation pathways were mostly supported in our proposed model (p<0.05 for 14 out of 18 mediation pathways), but not in the reversed-effect model (p<0.05 for 6 out of 18 mediation pathways, see the indirect effects of the reversed-effect model in online supplemental appendix C). Therefore, our proposed integrated model was chosen as the final model since it offered a more robust and comprehensive explanation, encompassing the motivational antecedents to behavioural actualisation. Figure 1 presents the standardised parameter estimates (β) of the direct pathways in the proposed integrated model (see online supplemental appendix B for unadjusted estimates).

Path estimates fully supported our hypotheses. As proposed, we found a positive and significant effect of psychological need support on autonomous motivation. In turn, autonomous motivation was positively and significantly associated with subjective norms, PBC and attitude. Consistent with our hypothesis, these three social-cognitive beliefs were found to be positively and significantly associated with intention. Finally, in support of H4, there was a positive and significant relationship between intention and behavioural adherence to childhood domestic injury prevention.

The parameter estimates for the indirect pathways partially supported our hypothesis (H5, summarised in table 3). The positive and significant indirect effects of psychological need support and autonomous motivation on behavioural adherence were found to be mediated by subjective norms, PBC and intention. Contrary to our expectation, attitude did not serve as a significant mediator in the indirect paths.

DISCUSSION

This study was the first to examine the motivational and reasoning processes underlying grandparents' adoption of domestic injury prevention for their grandchildren. The results demonstrated significant direct and indirect effects of psychological need support, autonomous motivation, and social-cognitive factors on grandparents' intentions and behavioural adherence to childhood domestic injury prevention and mostly supported the hypotheses derived from the integrated model.[39] Interestingly, our findings showed that the constructs of SDT and TPB may have varying impacts on childhood domestic injury preventive behaviour. Identifying these key factors might provide useful insights for building behaviour-change interventions for grandparent caregivers.

Consistent with the distal motivational regulation of behaviour specified by SDT,[10] we found that psychological need support from other family members and grandparents' autonomous motivation in childhood domestic injury prevention were positively and significantly associated. The results confirm our hypothesis (H1) and are comparable to the findings in sports and occupational injury prevention contexts.[13 15] The large amount of variance in autonomous motivation (60%) explained by psychological need support underscores the importance of providing grandparents with a need-supportive climate within the childcare setting. Unlike parental caregivers, grandparental caregivers often navigate a delicate balance between maintaining their own autonomy and satisfying the preferences of the parents.[40] Therefore, need-supportive climate may help to mitigate conflicts and avoid compromises on the part of grandparents. In this context, need-supportive behaviours consist of including grandparents in the discussion of required safety measures, providing rationales behind the necessary precautions and acknowledging and valuing

Table 1 Descriptive statistics, zero-order correlations and reliability coefficients of the variables (n=299)

Correlations	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Change scores (T1–T2)														
Needs support	–													
Motivation	0.68**	–												
SN	0.48**	0.57**	–											
PBC	0.63**	0.56**	0.65**	–										
Attitude	0.55**	0.68**	0.60**	0.57**	–									
Intention	0.50**	0.63**	0.73**	0.63**	0.59**	–								
Adherence	0.57**	0.57**	0.57**	0.56**	0.51**	0.73**	–							
Controlled variable (T2)														
Injury	0.04	0.02	0.04	0.05	0.03	0.06	0.07	–						
Demographic variable (T1)														
Days per week	0.04	0.01	0.05	−0.01	0.02	0.05	0.06	0.06	–					
Hours per day	0.14*	0.14*	0.16*	0.11	0.15*	0.14*	0.13*	0.00	0.47**	–				
Education	0.04	−0.08	−0.07	−0.08	0.04	−0.03	−0.03	−0.03	−0.08	−0.03	–			
Income	0.06	0.07	0.07	0.07	0.14*	0.15*	0.07	0.05	0.03	0.02	0.06	–		
No. of children	0.09	0.04	0.03	0.11	−0.03	0.07	0.17**	−0.04	0.01	−0.04	−0.02	−0.02	–	
Gender	−0.10	−0.07	−0.07	−0.10	−0.06	−0.06	−0.12*	−0.10	0.01	−0.09	0.05	0.02	–	–
Mean	−0.001	−0.02	−0.01	−0.003	−0.02	−0.01	−0.01	0.61	4.59	9.61	1.56	5.25	1.27	–
SD	0.89	0.86	0.89	0.89	0.88	0.94	0.97	1.12	1.96	6.24	0.70	2.22	0.50	–
Cronbach's alpha	0.96	0.95	0.90	0.93	0.93	0.95	0.93	–	–	–	–	–	–	–
Raykov's rho	0.95	0.94	0.87	0.94	0.93	0.94	0.94							

Needs support=psychological need support; motivation=autonomous motivation; injury=injury incidence; days per week=number of days grandparents spent with children per week; hours per day=number of hours grandparents spent with children per day; education=grandparent's education level; income=household income; no. of children=number of children in the household; and gender=children's gender. *p<0.05, two tailed. **p<0.01, two tailed.
PBC, perceived behavioural control; SN, subjective norms.

Table 2 Model fit indices of self-determination theory, theory of planned behaviour and the integrated model

Model name	χ2	RMSEA	CFI	TLI	SRMR
Integrated model	905.09	0.05	0.94	0.93	0.078
Reversed model	830.54	0.05	0.95	0.94	0.076
SDT-only model	334.86	0.05	0.96	0.96	0.063
TPB-only model	134.19	0.04	0.98	0.97	0.059

Reversed model=model with reversed effect.
CFI, Comparative Fit Index; RMSEA, root mean square error of approximation; SDT, self-determination theory; SRMR, standardised root mean square residual; TLI, Tucker-Lewis Index; TPB, theory of planned behaviour.

grandparents' experience and effort in domestic injury prevention.

Autonomous motivation promoted social-cognitive beliefs, which in turn resulted in increased domestic injury prevention intention and behaviour. This confirms our hypotheses (H2–H4) and fully supports the use of the integrated model for explaining childhood domestic injury prevention behaviour. Again, the results are consistent with the findings in prior injury prevention research.[13 15] Interestingly, PBC had the largest effect on the explanation of intention. One possible explanation for this result is the influence of injury attribution on injury prevention behaviour. Given that PBC is conceptualised as a measure of perceived controllability and self-efficacy,[41] our findings are in line with the findings of the previous correlational studies which suggested that individuals' injury prevention practices, such as higher levels of supervision, fewer risky behaviours and safer home environments, have been shown to be associated with their perceived controllability and self-efficacy.[42 43] Grandparents who are fatalistic and perceive that domestic injuries are uncontrollable are likely to possess a lower intention to prevent domestic injury. Additionally, the large effect of PBC on intention may be attributed to grandparents' concerns about their physical ability to prevent such injuries. As functional ability was shown to be a determinant of effort-exerting activity in older adults,[44] whether grandparents perceive limitations in their physical capabilities can affect their sense of control and self-efficacy in preventing injuries.

The full mediation effects of psychological need support and autonomous motivation on behavioural intention and adherence were found to be significant only through subjective norms and PBC. Although the results only partially supported our hypothesis (H5), they demonstrate that social (ie, subjective norms) and control (ie, PBC) beliefs are necessary for translating autonomous motivation into intention and behaviour. This finding corroborates the idea that autonomously motivated individuals align their beliefs to better form and carry out their intentions. Notably, the SDT constructs exerted their positive effects on grandparents' engagement in childhood domestic injury prevention predominantly through subjective norms. Indeed, social norms have been shown to be a strong predictor of how caregivers make health-related decisions for their children.[45 46] The findings could be attributed to the phenomenon of individuals internalising the beliefs and expectations of significant others. Individuals then conform to such social influences, as they perceived these social norms as

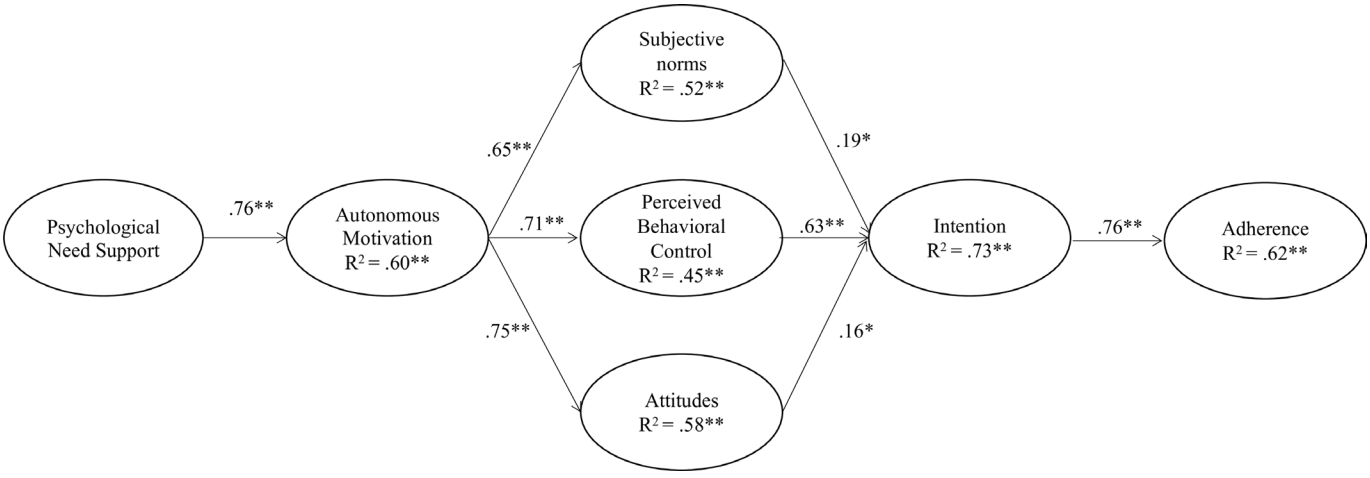

Figure 1 Path estimates for the integrated model of self-determination theory and theory of planned behaviour in childhood domestic injury prevention. The paths associated with the control variables (ie, number of days grandparents spent with children per week, number of hours grandparents spent with children per day, grandparents' educational level, household income, number of children in the household and the gender of the grandchildren) are omitted. *p<0.05, two-tailed; **p<0.001, two-tailed.

Table 3 Results from the mediation analysis of the integrated model of self-determination theory and theory of planned behaviour in childhood domestic injury prevention

Path	Mediator(s)	Indirect effects (95% CI)
Need support→subjective norm	Autonomous motivation	0.54*** (0.44 to 0.54)
Need support→perceived behavioural control (PBC)	Autonomous motivation	0.49*** (0.40 to 0.60)
Need support→attitude	Autonomous motivation	0.57*** (0.49 to 0.65)
Need support→intention	Autonomous motivation, subjective norm	0.53*** (0.20 to 0.48)
Need support→intention	Autonomous motivation, PBC	0.09* (0.02 to 0.17)
Need support→intention	Autonomous motivation, attitude	0.09 (0.01 to 0.17)
Need support→behavioural adherence	Autonomous motivation, subjective norm, intention	0.26*** (0.15 to 0.37)
Need support→behavioural adherence	Autonomous motivation, PBC, intention	0.07* (0.02 to 0.13)
Need support→behavioural adherence	Autonomous motivation, attitude, intention	0.07 (0.01 to 0.13)
Autonomous motivation→intention	Subjective norm	0.45*** (0.27 to 0.63)
Autonomous motivation→intention	PBC	0.13* (0.03 to 0.23)
Autonomous motivation→intention	Attitude	0.12 (0.02 to 0.22)
Autonomous motivation→behavioural adherence	Subjective norm, intention	0.35*** (0.02 to 0.49)
Autonomous motivation→behavioural adherence	PBC, intention	0.10* (0.03 to 0.17)
Autonomous motivation→behavioural adherence	Attitude, intention	0.09 (0.01 to 0.17)
Subjective norm→behavioural adherence	Intention	0.48*** (0.32 to 0.65)
PBC→behavioural adherence	Intention	0.15* (0.04 to 0.26)
Attitude→behavioural adherence	Intention	0.12* (0.02 to 0.22)

Need support=psychological need support.
*p<0.05, two tailed; ***p<0.001, two tailed.

beneficial to their own goals and autonomy support.[39] In a need-supportive environment, grandparents are motivated not only by their own desire to safeguard their grandchildren but also by realising parents' expectations of prioritising safety and upholding certain supervision practices. With these normative beliefs, grandparents are more likely to have stronger intentions and behavioural adherence towards domestic injury prevention. This is particularly relevant to Asian societies, where supportive grandparenting is a culturally valued intergenerational expectation. In contrast, grandparents in Western societies may harbour less familial and social expectations and responsibilities for the provision of childcare.[47] The different caring roles may have motivational and practical implications for domestic injury prevention. Future studies can investigate the reciprocal relationships between autonomous motivation and the socio-cognitive beliefs between parents and grandparents to better understand the role of significant others on home safety for families with young children.

Altogether, our study offers original evidence for the application of the integrated model in predicting childhood domestic injury prevention provided by grandparents. However, some potential limitations should be noted. First, we contacted potential participants via social media platforms, such as parenting chat rooms. This online recruitment procedure might have introduced selection bias, as only parents active in parenting groups were exposed to the recruitment. This might explain why our sample was over-represented by female and younger parent participants and could potentially be more influenced by social norms.[48] However, as we asked the parents to relay the questionnaire to the grandparent caregivers, we hoped to minimise the effect of this sampling bias. Second, while well-established scales with high reliability and validity were used to assess the primary constructs in SDT and TPB, self-reported measures are still subjected to social desirability and response bias.[49] In particular, it was found that caregivers tended to over-report their safety practices towards their children.[50] More objective approaches, for example, home visits and behavioural observation,[51] can be used to evaluate grandparents' behavioural adherence to domestic injury prevention. Nonetheless, such auditing would be difficult to execute due to privacy and health concerns. Third, the longitudinal design of the current study renders the data correlational in nature. Hence, we could not draw causal conclusions regarding the relationships between variables from the main effects. Future research might consider adopting an experimental or interventional design to generate higher levels of evidence. Fourth, although we controlled for some potential confounding demographic and caregiver-based variables, other child-based and situational determinants (eg, constraints in the

home safety environment and children's temperament) were not examined.[5] Future studies might consider their incorporation into the behavioural model. Finally, it is crucial to acknowledge that our sample comprised homogenous Chinese grandparents from Hong Kong, China. Since different features of grandparenting can be found in different societies, our results may not be generalisable to other regions or cultures.[52] Moreover, this study focused on supportive caregiving, but domestic safety is also highly important in settings involving other modes of grandparenting, such as skipped-generation or kinship caregiving.[53] To determine the applicability of the integrated model in these settings, replication studies in other countries and target groups are highly warranted.

CONCLUSION

Despite the growing numbers of grandparent caregivers, there is a dearth of childhood injury prevention research that includes grandparents as target participants. Our results provide initial evidence that a psychological need-supportive climate is essential for promoting autonomous motivation, which in turn relates to better attitude, social and control beliefs that facilitate intention formation and behavioural adherence to childhood domestic injury prevention in grandparent caregivers. Given the importance of autonomous motivation, social norms and PBC in facilitating behavioural adherence, future interventions may focus on promoting familial support to cultivate autonomy in and foster appreciation towards grandparent caregivers, while providing them with necessary assistance in ensuring child safety. These findings support the use of the integrated model to explain domestic injury prevention behaviour and lay the foundation for future theory-based interventional research.

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