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The Role of Parental Support in Restoring Neurocognitive and Physiological Regulation Following Childhood Grief: An Emotion-Regulation-Based Interventional Study

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ABSTRACT

Parental death during childhood is a major developmental adversity that may disrupt emotion regulation, executive functioning, autonomic regulation, and grief adaptation. Because children depend heavily on surviving caregivers for co-regulation, family-based interventions may be especially important for reducing prolonged grief symptoms and supporting recovery of cognitive and physiological functioning. This quasi-experimental pretest-posttest study evaluated an eight-session Emotion Regulation and Parental Support (ERPS) program among 60 bereaved children aged 8-12 years. Participants were allocated to an intervention group (n = 30) or waitlist control group (n = 30). Outcomes included executive functioning (Stroop interference), working memory (Digit Span Backward), physiological arousal (systolic and diastolic blood pressure and resting heart rate), emotion regulation (Emotion Regulation Checklist), and prolonged grief symptoms (PG-13-C total score). Analysis of covariance (ANCOVA) was used to compare posttest outcomes between groups while controlling for baseline scores. The intervention group showed substantially greater improvement than the control group across all outcome domains. Significant adjusted between-group effects were found for Stroop interference, $F(1, 57) = 68.42$, $p < .001$, $\eta^2 = .55$; Digit Span Backward, $F(1, 57) = 32.18$, $p < .001$, $\eta^2 = .36$; systolic blood pressure, $F(1, 57) = 14.55$, $p < .001$, $\eta^2 = .20$; diastolic blood pressure, $F(1, 57) = 11.20$, $p = .001$, $\eta^2 = .16$; resting heart rate, $F(1, 57) = 19.85$, $p < .001$, $\eta^2 = .26$; ERC emotion regulation, $F(1, 57) = 95.40$, $p < .001$, $\eta^2 = .63$; ERC lability/negativity, $F(1, 57) = 58.30$, $p < .001$, $\eta^2 = .51$; and prolonged grief symptoms, $F(1, 57) = 82.10$, $p < .001$, $\eta^2 = .59$. Reductions in Stroop interference were correlated with reductions in resting heart rate ($r = .48$, $p < .01$), and improvements in Digit Span Backward were correlated with reductions in grief symptoms ($r = -.52$, $p < .01$). The findings suggest that a structured parental support and emotion regulation program can improve neurocognitive, physiological, and psychological outcomes in bereaved children. The results support the clinical value of caregiver-inclusive interventions that target co-regulation and adaptive grief processing.

Keywords: *childhood bereavement; parental support; emotion regulation; prolonged grief; executive function; autonomic regulation; family intervention*

1. Introduction

Childhood bereavement, particularly the loss of a parent, constitutes one of the most profound developmental adversities, exerting multifaceted effects on emotional, cognitive, physiological, and social functioning. From an attachment perspective, early relationships with caregivers form the foundation for emotional security, and the disruption of these bonds through parental death can

significantly destabilize a child's internal working models of safety and support (1). The loss experience is not merely an acute emotional event but a chronic developmental challenge that unfolds over time, influencing trajectories of adaptation and maladaptation. While grief is a normative and expected response, a subset of children exhibit persistent and impairing symptoms that align with conceptualizations of prolonged grief disorder, including intense yearning, emotional dysregulation, avoidance behaviors, and functional impairment (2-4). Contemporary research emphasizes that variability in grief outcomes reflects the interaction of individual, familial, and contextual factors rather than a uniform response pattern (5).

Developmental psychology highlights that children's capacity to process and regulate emotional experiences is still maturing, rendering them particularly vulnerable to disruptions caused by loss. Emotion regulation, defined as the processes by which individuals influence the experience and expression of emotions, is central to adaptive functioning (6). In children, these regulatory processes are heavily dependent on external scaffolding provided by caregivers, who model, guide, and co-regulate emotional responses (7). When a parent dies, this regulatory system is compromised, potentially leading to heightened emotional reactivity, mood instability, and difficulties in modulating distress (8). Empirical evidence indicates that deficits in emotion regulation are closely linked to maladaptive grief responses and broader internalizing problems in bereaved youth (9).

The neurobiological underpinnings of these processes further underscore the importance of developmental timing and environmental context. Brain systems involved in emotional processing and cognitive control, including the prefrontal cortex and limbic structures, undergo significant maturation during childhood and adolescence (10). Exposure to stress and adversity during these sensitive periods can alter neural development, affecting executive functioning, attention, and emotional reactivity (11). Chronic activation of stress-response systems, often conceptualized as toxic stress, has been associated with long-term changes in physiological regulation, including dysregulation of the autonomic nervous system and increased vulnerability to physical and mental health مشکلات (12, 13). In the context of bereavement, these neurobiological alterations may manifest as difficulties in inhibitory control, working memory deficits, and heightened physiological arousal.

Cognitive functioning is particularly relevant in understanding how children process grief-related information. Executive functions, including inhibitory control, cognitive flexibility, and working memory, are essential for adaptive coping and emotional regulation. Tasks such as the Stroop paradigm have demonstrated that emotional interference can impair attentional control in individuals experiencing psychological distress (14). Similarly, standardized measures of cognitive ability, such as those developed by Wechsler, provide insight into the role of working memory and executive processes in adaptive functioning (15). Disruptions in these cognitive systems may hinder children's ability to process loss, integrate emotional experiences, and engage in goal-directed behavior.

Theoretical models of grief provide further context for understanding these processes. The dual process model posits that adaptive coping involves oscillation between loss-oriented and restoration-oriented activities, allowing individuals to gradually integrate the loss while maintaining engagement with daily life (16). For children, this oscillation is often mediated by caregivers who help structure routines and provide opportunities for both emotional expression and distraction. Worden's task-based model similarly emphasizes the active processes involved in mourning, including accepting the reality of the loss, processing the pain of grief, adjusting to a changed environment, and maintaining a continuing bond with the deceased (17). These frameworks highlight that successful adaptation requires both intrapersonal and interpersonal resources, with caregiver support playing a pivotal role.

Parental support emerges as a critical protective factor in this context. Research consistently demonstrates that supportive caregiving, characterized by warmth, responsiveness, and effective communication, is associated with better psychological outcomes in bereaved children (18, 19). Caregivers who are able to acknowledge and validate children's emotions, maintain consistent routines, and provide a secure base facilitate adaptive coping and resilience. Conversely, caregiver distress, emotional unavailability, or avoidance of grief-related discussions can exacerbate children's difficulties, increasing the risk of

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prolonged grief and related psychopathology (20). The role of parental support extends beyond emotional comfort to include modeling coping strategies, guiding problem-solving, and fostering a sense of stability in the face of disruption.

Recent empirical studies further elaborate on the mechanisms through which parental support influences child outcomes. For instance, supportive parenting has been shown to enhance executive functioning and self-regulation through positive family interactions and constructive conflict resolution processes (21). Similarly, parental and peer support jointly contribute to adaptive behavioral outcomes, mediating the effects of stressors such as bullying and reducing engagement in maladaptive behaviors (22). In educational and developmental contexts, parental involvement has been linked to improved motivation, emotional well-being, and academic achievement, highlighting its broad impact on child development (23, 24). These findings suggest that parental support operates as a multifaceted resource, influencing cognitive, emotional, and behavioral domains.

The integration of emotion regulation frameworks with family-based perspectives provides a comprehensive understanding of bereavement adaptation. Functional neuroimaging studies indicate that cognitive control mechanisms, such as reappraisal and attentional regulation, play a central role in modulating emotional responses (25). Interventions that enhance these skills, particularly when combined with caregiver involvement, may promote more adaptive processing of grief-related experiences. Expressive approaches, such as writing about emotional experiences, have also been shown to facilitate psychological and physiological regulation, supporting the integration of traumatic memories (26). These approaches align with broader theories of experiential learning, which emphasize the role of active engagement and reflection in developing adaptive coping strategies (27).

Importantly, the heterogeneity of grief responses underscores the need for tailored interventions. While many children demonstrate resilience and gradual recovery, others experience persistent difficulties that require targeted support (5). Diagnostic frameworks for bereavement-related disorders have evolved to capture these variations, emphasizing developmental considerations and the need for age-appropriate assessment (2, 4). Early identification of at-risk children is critical for preventing the escalation of symptoms and promoting adaptive trajectories.

Emerging research also highlights the role of self-regulation and environmental support in broader developmental domains. For example, engagement in structured activities, such as music training, has been associated with improvements in self-regulation and cognitive functioning, mediated by parental support and environmental scaffolding (28). Similarly, parental support has been linked to reductions in anxiety and improved self-acceptance among adolescents, indicating its relevance across developmental transitions (29). These findings reinforce the notion that supportive caregiving not only buffers against adversity but also promotes positive developmental outcomes.

In the context of childhood bereavement, these insights converge to suggest that effective interventions should address both individual and relational processes. Programs that integrate emotion regulation training with caregiver involvement have shown promise in enhancing coping skills, improving family communication, and reducing psychological distress (18, 19). By targeting the caregiver-child dyad, such interventions leverage the natural context of development, facilitating the generalization and maintenance of adaptive skills.

Despite significant advances, gaps remain in the literature regarding the integration of neurocognitive, physiological, and emotional domains in bereavement interventions. While existing programs have demonstrated efficacy in improving psychological outcomes, fewer studies have examined their impact on cognitive functioning and physiological regulation. Given the interconnected nature of these systems, a comprehensive approach that addresses multiple domains may yield more robust and sustained benefits. Furthermore, cultural and contextual factors may influence the effectiveness of interventions, highlighting the need for research in diverse populations.

The present study, titled "The Role of Parental Support in Restoring Neurocognitive and Physiological Regulation Following Childhood Grief: An Emotion-Regulation-Based Interventional Study" , is situated within this emerging framework, seeking to integrate theoretical and empirical insights into a structured intervention that addresses both

child-focused and caregiver-mediated processes. By examining the effects of an emotion regulation and parental support program on neurocognitive performance, physiological arousal, and psychological outcomes, the study aims to contribute to a more comprehensive understanding of bereavement adaptation in children.

Therefore, the aim of this study is to investigate the effectiveness of an emotion regulation and parental support intervention in improving neurocognitive functioning, physiological regulation, and grief-related outcomes among children experiencing parental loss.

2. Methods and Materials

2.1. *Study Design and Participants*

The ERPS program consisted of eight weekly 90-minute sessions. Each session included a 45-minute child group, a 30-minute parent group, and a 15-minute joint parent-child activity. The intervention was informed by family bereavement prevention principles and emotion-regulation training. The child component focused on emotional awareness, grief expression, relaxation, cognitive reappraisal, problem solving, and future-oriented coping. The parent component focused on psychoeducation, recognition of distress cues, validation, co-regulation, maintenance of routines, and supportive communication.

Session themes included: building safety and psychoeducation; identifying and labeling emotions; understanding the stress response; cognitive reappraisal; expressive writing and narrative processing; social support and peer connection; problem solving and future orientation; and relapse prevention. Joint activities were used to practice co-regulation skills and strengthen caregiver-child communication around grief-related experiences.

2.2. *Measures*

Neurocognitive outcomes were assessed using the Stroop Color-Word Test and Digit Span Backward. The Stroop interference score was used as an indicator of inhibitory control and conflict monitoring, with lower scores indicating better performance. Digit Span Backward was used as an indicator of working memory, with higher scores reflecting better working memory capacity. Physiological arousal was indexed using resting heart rate and systolic and diastolic blood pressure. These measures were treated as indirect indicators of autonomic regulation and stress-related physiological activation. Emotion regulation was assessed using the Emotion Regulation Checklist (ERC), a widely used caregiver-report measure of emotion regulation and lability/negativity in children. Prolonged grief symptoms were assessed using the child grief symptom measure reported in the study as PG-13-C total score. Higher grief scores indicate more severe grief-related impairment.

2.3. *Procedure and Statistical Analysis*

At baseline, participants and guardians completed the psychological measures, physiological indices were recorded, and cognitive tasks were administered by trained research assistants in a quiet assessment room. The ERPS group then received the eight-week intervention, while the waitlist control group continued routine activities. Posttest assessment was completed within one week after the final intervention session using the same assessment battery. Data were analyzed using SPSS version 27. Descriptive statistics were calculated for demographic and outcome variables. The normality of residuals, homogeneity of variances, and homogeneity of regression slopes were examined before ANCOVA. The primary analyses used ANCOVA to compare posttest scores between groups while controlling for corresponding pretest scores. Partial eta squared (η^2) was used to estimate effect size. Pearson correlations were calculated to examine associations among changes in cognitive, physiological, and grief-related outcomes.

3. Findings and Results

The final sample included 60 children and their surviving guardians. As summarized in Table 1, the intervention and control groups were comparable before the intervention. No significant between-group differences were found for child age, gender distribution, time since loss, deceased parent, or age of the deceased parent. The mean age was approximately 10 years, and most children had lost their father.

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Table 1

Demographic characteristics of participants by group

Variable	Intervention Group (n = 30)	Control Group (n = 30)	Statistical Test	p-value
Child's age, mean ± SD	10.25 ± 1.41	10.15 ± 1.52	t = 0.45	0.655
Gender, n (% male)	16 (53.3%)	15 (50.0%)	$\chi^2 = 0.07$	0.795
Time since loss, months	11.40 ± 3.12	12.20 ± 3.45	t = -0.82	0.415
Deceased parent, n (% father)	21 (70.0%)	20 (66.7%)	$\chi^2 = 0.08$	0.772
Age of deceased parent	38.40 ± 5.10	37.90 ± 5.60	t = 0.34	0.732

Table 2 shows the pretest and posttest means for all dependent variables. At baseline, both groups had broadly similar scores. After the intervention, the ERPS group showed clear improvement in executive functioning, working memory, physiological regulation, emotion regulation, emotional lability, and prolonged grief symptoms. In contrast, the waitlist control group showed minimal change. Figure 1 illustrates that the ERPS group had markedly greater neurocognitive improvement than the control group, especially for reduced Stroop interference. Figure 2 shows that the ERPS group also had larger reductions in systolic blood pressure, diastolic blood pressure, and resting heart rate, indicating stronger physiological down-regulation. Figure 3 demonstrates that psychological gains were concentrated in the ERPS group, with higher emotion regulation and lower lability/negativity and prolonged grief symptoms.

Table 2

Descriptive statistics for dependent variables at pretest and posttest

Variable	Group	Pretest Mean ± SD	Posttest Mean ± SD
Stroop Interference Score (sec)	Intervention	45.20 ± 8.45	28.15 ± 6.30
Stroop Interference Score (sec)	Control	44.85 ± 8.10	43.90 ± 7.95
Digit Span Backward	Intervention	6.40 ± 1.20	8.10 ± 1.40
Digit Span Backward	Control	6.30 ± 1.15	6.45 ± 1.10
Systolic Blood Pressure (mmHg)	Intervention	118.50 ± 10.20	110.20 ± 8.40
Systolic Blood Pressure (mmHg)	Control	117.80 ± 9.80	116.90 ± 9.50
Diastolic Blood Pressure (mmHg)	Intervention	76.40 ± 7.10	70.50 ± 6.20
Diastolic Blood Pressure (mmHg)	Control	75.90 ± 6.90	75.40 ± 6.80
Resting Heart Rate (bpm)	Intervention	92.00 ± 8.50	84.50 ± 7.20
Resting Heart Rate (bpm)	Control	91.50 ± 8.10	90.80 ± 7.90
ERC - Emotion Regulation	Intervention	22.10 ± 4.30	32.50 ± 3.80
ERC - Emotion Regulation	Control	21.85 ± 4.10	22.40 ± 4.00
ERC - Lability/Negativity	Intervention	28.40 ± 5.60	18.20 ± 4.50
ERC - Lability/Negativity	Control	27.90 ± 5.40	27.40 ± 5.20
PG-13-C Total Score	Intervention	32.50 ± 6.20	18.40 ± 5.10
PG-13-C Total Score	Control	31.90 ± 6.00	30.80 ± 5.80

Figure 1

Neurocognitive improvement from pretest to posttest by group. For Stroop interference, improvement indicates reduction in interference time; for Digit Span Backward, improvement indicates an increase in raw score.

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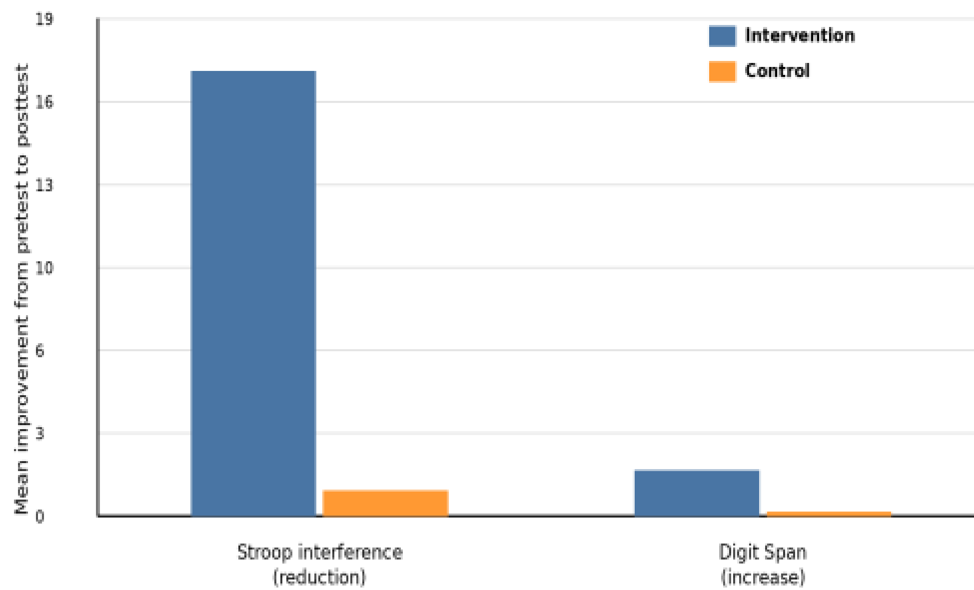

Figure 2

Change in physiological arousal from pretest to posttest by group. Negative values indicate lower posttest physiological arousal.

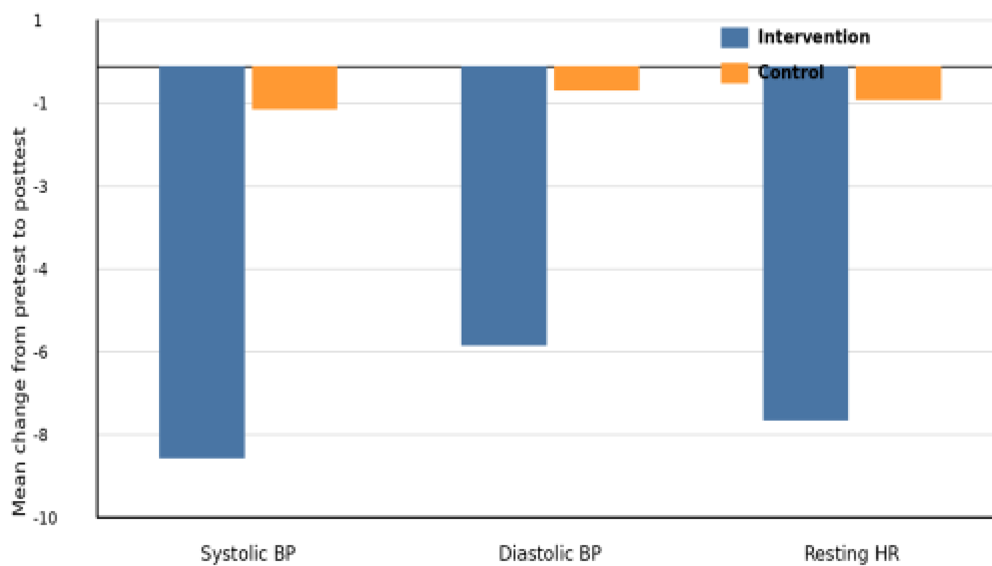

Figure 3

Psychological improvement from pretest to posttest by group. Improvement indicates higher ERC regulation and lower ERC lability and PG-13-C grief scores

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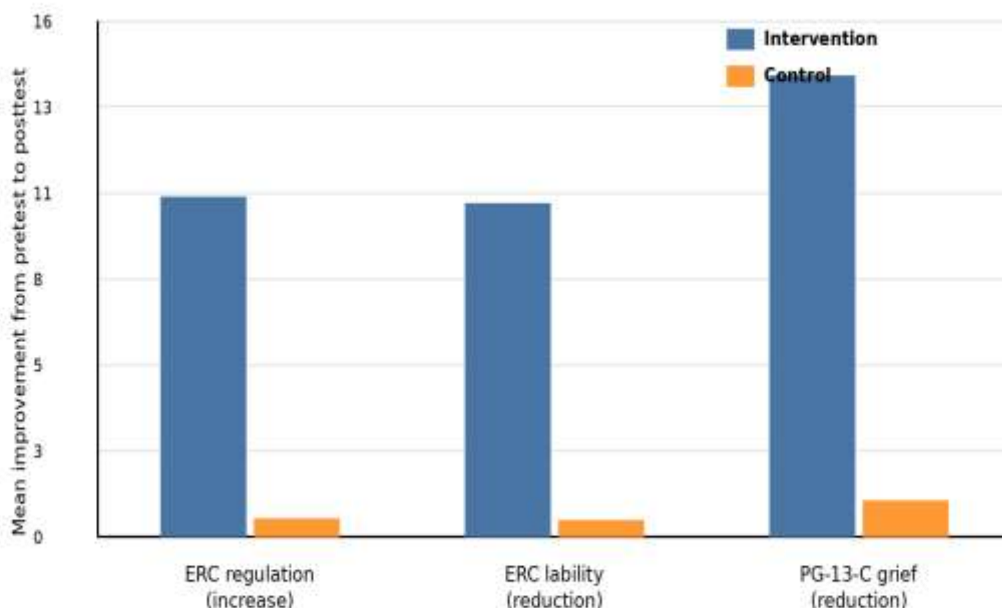

After controlling for pretest scores, ANCOVA showed significant adjusted between-group differences for all outcomes, as summarized in Table 3. The largest effects were observed for ERC emotion regulation ($\eta^2 = .63$), prolonged grief symptoms ($\eta^2 = .59$), Stroop interference ($\eta^2 = .55$), and ERC lability/negativity ($\eta^2 = .51$). These effect sizes indicate that the ERPS program produced meaningful improvements across psychological, neurocognitive, and physiological domains.

Table 3

ANCOVA results for posttest outcomes controlling for pretest scores

Dependent Variable	Source	df	Mean Square	F	p-value	η^2
Stroop Interference	Group	1	2450.15	68.42	< .001	.55
Stroop Interference	Error	57	35.81			
Digit Span Backward	Group	1	28.50	32.18	< .001	.36
Digit Span Backward	Error	57	0.88			
Systolic BP	Group	1	420.30	14.55	< .001	.20
Systolic BP	Error	57	28.89			
Diastolic BP	Group	1	210.45	11.20	.001	.16
Diastolic BP	Error	57	18.79			
Resting HR	Group	1	380.20	19.85	< .001	.26
Resting HR	Error	57	19.15			
ERC Emotion Regulation	Group	1	680.50	95.40	< .001	.63
ERC Emotion Regulation	Error	57	7.13			
ERC Lability/Negativity	Group	1	590.20	58.30	< .001	.51
ERC Lability/Negativity	Error	57	10.12			
PG-13-C Grief	Group	1	1850.60	82.10	< .001	.59
PG-13-C Grief	Error	57	22.54			

Exploratory correlation analyses indicated that improvement in inhibitory control was associated with reduced autonomic arousal. Specifically, reductions in Stroop interference were positively correlated with reductions in resting heart rate ($r = .48$, $p < .01$). Improvements in working memory were associated with lower grief severity, as increases in Digit Span Backward were negatively correlated with reductions in PG-13-C

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scores (r = -.52, $p < .01$). These associations suggest that cognitive recovery, physiological regulation, and grief adjustment may be interrelated processes in bereaved children.

4. Discussion

The present study examined the effectiveness of an Emotion Regulation and Parental Support (ERPS) intervention in improving neurocognitive functioning, physiological regulation, emotional regulation, and prolonged grief symptoms among bereaved children. The findings provided strong support for the study hypotheses, demonstrating that children who participated in the ERPS program showed significantly greater improvements across all measured domains compared to those in the waitlist control group. Specifically, substantial gains were observed in executive functioning, as evidenced by reduced Stroop interference, and in working memory, reflected by increased Digit Span Backward performance. These findings suggest that targeted interventions that combine emotion regulation training with parental support can enhance higher-order cognitive processes that are often compromised following exposure to traumatic loss and chronic stress (10, 11). From a neurodevelopmental perspective, improvements in executive functioning may indicate enhanced top-down regulation of attention and behavior, which is essential for adaptive coping in emotionally challenging contexts.

The observed improvements in cognitive functioning align with theoretical models emphasizing the role of environmental input and experience-dependent plasticity in shaping the developing brain. Brain plasticity research suggests that supportive caregiving environments can facilitate recovery and reorganization of neural systems affected by stress and adversity (27). In bereaved children, who often experience disruptions in attention, memory, and inhibitory control, structured interventions that provide repeated opportunities for practicing regulation strategies may strengthen neural pathways associated with executive control. The reduction in Stroop interference observed in the intervention group is consistent with improved inhibitory control and reduced emotional interference, which has been linked to better psychological adjustment in children experiencing distress (14). Similarly, gains in working memory capacity may reflect improved cognitive flexibility and the ability to maintain and manipulate information in the presence of emotional distractions.

In addition to cognitive improvements, the intervention produced significant reductions in physiological arousal, as indicated by decreases in systolic and diastolic blood pressure and resting heart rate. These findings suggest that the ERPS program contributed to improved autonomic regulation, potentially through mechanisms such as relaxation training, emotional processing, and caregiver-mediated co-regulation. Chronic stress and unresolved grief have been associated with sustained activation of physiological stress systems, which can impair both mental and physical health over time (12, 13). The reduction in physiological arousal observed in this study is therefore clinically meaningful, as it indicates a shift toward a more regulated and adaptive physiological state. Moreover, the significant correlation between reductions in Stroop interference and decreases in resting heart rate suggests an interconnection between cognitive and physiological regulatory systems, supporting integrative models of emotion regulation that emphasize the coordination of neural, cognitive, and bodily processes (25).

The psychological outcomes further reinforce the effectiveness of the ERPS intervention. Children in the intervention group demonstrated substantial improvements in emotion regulation and marked reductions in emotional lability and prolonged grief symptoms. These findings are consistent with the central role of emotion regulation in adaptive grief processing, as highlighted in the literature (6, 8). Improved emotion regulation may enable children to tolerate and process grief-related emotions without becoming overwhelmed, thereby reducing the likelihood of maladaptive coping strategies such as avoidance or suppression. The significant decrease in prolonged grief symptoms is particularly noteworthy, as persistent grief reactions can interfere with developmental functioning and increase the risk of long-term psychopathology (3, 4). The magnitude of the observed effects suggests that the intervention not only alleviated symptoms but also promoted adaptive processes that support recovery.

The role of parental support in facilitating these outcomes is a key contribution of this study. The ERPS program explicitly targeted caregiver involvement, emphasizing the importance of co-regulation, emotional validation, and

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supportive communication. This approach is grounded in attachment theory, which posits that caregivers serve as a secure base from which children can explore and process emotional experiences (1). When caregivers respond sensitively to children's distress, they help modulate emotional arousal and provide a framework for understanding and managing emotions. The findings of the present study align with previous research demonstrating that positive parenting practices and caregiver support are associated with better psychological adjustment in bereaved children (18, 19). By enhancing caregiver skills, the intervention likely strengthened the relational context in which children develop and apply emotion regulation strategies.

Furthermore, the findings are consistent with broader empirical evidence highlighting the influence of parental support on child development. Studies have shown that supportive parenting contributes to the development of executive functioning and self-regulation through constructive interactions and problem-solving processes (21). In addition, parental and peer support have been found to mediate the impact of stressors on maladaptive behaviors, underscoring the protective role of social support systems (22). The current results extend this literature by demonstrating that parental support not only influences behavioral and emotional outcomes but also contributes to improvements in cognitive and physiological functioning in the context of bereavement.

The intervention's emphasis on skill-building is also supported by theoretical and empirical work on coping and resilience. The dual process model of bereavement suggests that adaptive coping involves oscillating between confronting the loss and engaging in restorative activities (16). The ERPS program facilitated this process by providing children with tools for emotional expression, cognitive reappraisal, and problem-solving, while also encouraging engagement with everyday activities. Similarly, Worden's task-based model emphasizes the importance of actively processing grief and adapting to life after loss (17). By addressing these tasks within a supportive relational context, the intervention may have accelerated the natural course of adaptation.

The use of expressive techniques, such as narrative processing and emotional labeling, may also have contributed to the observed improvements. Expressive writing and emotional disclosure have been shown to facilitate psychological and physiological regulation by helping individuals organize and integrate emotional experiences (26). In bereaved children, who may struggle to articulate complex emotions, structured opportunities for expression can enhance emotional awareness and reduce distress. These processes are consistent with experiential learning models, which emphasize the role of active engagement and reflection in developing adaptive skills (27). Additionally, the incorporation of structured activities and routines may have provided a sense of stability and predictability, which is critical for children coping with loss.

The findings also align with research on the long-term consequences of parental death, which indicates that early loss can have enduring effects on psychological and physiological functioning (20). By intervening during a critical developmental window, the ERPS program may have mitigated these long-term risks and promoted more adaptive trajectories. The improvements observed in this study suggest that early, family-based interventions can play a crucial role in preventing the escalation of symptoms and supporting resilience. Moreover, the integration of cognitive, emotional, and physiological outcomes provides a more comprehensive understanding of intervention effects, highlighting the interconnected nature of these domains.

The results further support the importance of considering individual differences in grief responses. While some children demonstrate resilience and recover naturally over time, others experience persistent difficulties that require targeted intervention (5). The significant effects observed in this study suggest that the ERPS program may be particularly beneficial for children with elevated grief symptoms, providing them with the tools and support needed to navigate the grieving process. This is consistent with diagnostic frameworks that emphasize the need for developmentally sensitive approaches to identifying and treating prolonged grief in children (2).

5. Conclusion

Finally, the findings contribute to a growing body of literature emphasizing the role of structured interventions in enhancing self-regulation and adaptive functioning. Recent research has highlighted the importance of self-regulation

and parental support in facilitating skill transfer across domains, including cognitive and creative activities (28). Similarly, parental support has been linked to improved emotional well-being and reduced anxiety in adolescents, indicating its relevance across developmental stages (29). The present study extends these findings by demonstrating that a targeted intervention can simultaneously improve multiple domains of functioning in bereaved children.

Several limitations should be acknowledged. The study employed a quasi-experimental design rather than a randomized controlled trial, which may limit causal inferences. The sample size was relatively small and drawn from a specific cultural and geographic context, potentially restricting the generalizability of the findings. The absence of long-term follow-up data prevents conclusions about the durability of the intervention effects. Additionally, the use of indirect physiological measures limits the ability to draw definitive conclusions about underlying neurobiological mechanisms.

Future research should aim to replicate these findings using larger, more diverse samples and randomized controlled designs. Longitudinal studies are needed to assess the persistence of intervention effects over time and to examine developmental trajectories of recovery. Incorporating multi-method assessments, including neuroimaging and biomarkers such as heart rate variability, would provide deeper insight into the mechanisms underlying observed changes. Further research should also explore the differential effectiveness of intervention components to identify the most impactful elements of caregiver involvement and child-focused training.

From a practical perspective, the findings underscore the importance of integrating parental support into interventions for bereaved children. Mental health professionals, educators, and policymakers should consider implementing family-based programs that enhance caregiver skills and promote supportive communication. Training programs for parents can equip them with strategies for co-regulation, emotional validation, and maintaining routines, thereby strengthening the caregiving environment. Schools and community organizations can also play a role by providing resources and support for bereaved families, facilitating early identification and intervention.

Authors' Contributions

All authors contributed substantially to the study and to manuscript development, and all approved the final version.

Declaration

Artificial intelligence was used only for language polishing, academic editing, organization of the manuscript, and generation of visual figures from the numerical results supplied by the authors. AI was not used to collect data, perform the statistical analyses, fabricate findings, or generate unverifiable references. The authors reviewed and verified the final manuscript and remain fully responsible for its content.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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