

Research Article

Neuro-Protective Criminal Justice: A New Paradigm For Child Criminal Responsibility And Protection

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ABSTRACT

Contemporary criminal justice systems predominantly assess child criminal responsibility through fixed age thresholds and formal legal capacity while often disregarding neuroscientific evidence concerning brain development, impulse regulation, and limited decision making capacity. This article proposes neuro protective criminal justice that integrates neuroscience, neurolaw, and child centered human rights into criminal law policy. The study aims to examine the conceptual foundation of neuro protective criminal justice, analyze child criminal liability under Indonesian law, and develop a model of neurological protection within the child criminal justice system. This research employs a normative juridical method using statutory, conceptual, and comparative approach. The analysis demonstrates that age based responsibility doesn't adequately reflect children's vulnerability to social and structural influences. It argues for a framework that prioritizes rehabilitation, prevention of neurological and psychological harm, and long term developmental well being through restorative justice, therapeutic interventions, and diversion. This study positions neuro protection as a foundational principle of child criminal justice while providing normative guidance for legal reform consistent with neuroscientific knowledge and international child protection standards. The study concludes that Indonesia should introduce regulations requiring neurological development analysis throughout juvenile criminal proceedings and reform legal practices across all components of its legal system.

Keywords: Neuro-Protective Criminal Justice; Child Criminal Responsibility; Neurolaw

A. INTRODUCTION

The modern criminal justice system has long been built on the premise of offenders' rationality that is that people who commit criminal acts have enough cognitive ability and free will to grasp both the nature and the consequences of what they do (Logan et al., 2025). This premise underlies classical criminal responsibility, which centers on mens rea, awareness, and the capacity to choose freely between lawful and unlawful behavior. In practice, this model has

been applied widely, including to children who come into conflict with the law, even as an increasing body of scientific evidence indicates that children's cognitive, emotional, and neurological capacities are fundamentally different from those of adults (Fondacaro, 2014). The conflict between traditional criminal law doctrines and current scientific understanding of child brain development poses a key, still unresolved challenge for contemporary criminal justice systems. International data show that

children's participation in criminal justice systems continues to be a major and widespread phenomenon. International reports show that each year millions of children interact with justice authorities, not only as suspects, defendants, or offenders in criminal proceedings, but also as victims, witnesses, or participants in civil and administrative proceedings, including alternative care measures and asylum hearings. Across this wide range of legal encounters, it is estimated that 259,000 children worldwide were deprived of their liberty in detention settings in 2024, indicating children who were formally held by the administration of criminal justice because they were in conflict with the law (UNICEF, 2025). According to the UN Global Study on Children Deprived of Liberty (2019), roughly 410,000 children face de jure deprivation of liberty annually, with another 1.41 million enduring de facto confinement within justice systems, ranging from police lockups to prisons. Fresh data from 2024 reveals a stark picture: on any given day, nearly 259,000 children were behind bars. Yet, these numbers barely scratch the surface. Because many jurisdictions still lack consistent, full-scale data tracking, the true number of children stripped of their liberty is undoubtedly much higher, highlighting a glaringly underreported crisis in global juvenile justice (United Nations, 2025). Indonesia is no exception, where official records continue to point to a high and complex rate of youth involvement in the criminal justice system. According to statistics from the *Directorate General of Corrections,*

Ministry of Law and Human Rights, there were 1,574 child prisoners in Indonesian correctional facilities as of May 27, 2025, with the vast majority being male and housed across prisons, detention centres, and Special Child Guidance Institutions (LPKA) (Ridwan, 2025). Meanwhile, law enforcement data from the *National Criminal Information Center (Pusiknas) of the Indonesian National Police* reveal that, between 1 January and 20 February 2025 alone, 437 children were reported as suspects in theft cases, 460 in assault and collective violence, and 349 in drug-related offences, with other incidents involving school-age youths and even children under 12, underscoring the range of offences that bring children into contact with police (Pusiknas Bareskrim Polri, 2025). These figures reflect both formal custodial sentences and initial contact with law enforcement, highlighting ongoing challenges in preventing child offending and managing children's legal encounters in ways that are developmentally appropriate and consistent with child protection standards.

In many jurisdictions, children continue to be subjected to pretrial detention, custodial sentencing, and procedural practices that closely mirror adult criminal justice processes, despite the existence of international standards mandating special protection (Goldson & Kilkelly, 2013). These practices persist notwithstanding substantial empirical evidence demonstrating that early and formal contact with punitive justice mechanisms heightens the risks of stigmatization, psychological trauma, and long-term recidivism,

while potentially disrupting children's cognitive, emotional, and social development (Perry et al., 2018). Consequently, the issue of child criminal responsibility cannot be confined to normative legal doctrine alone, but must be understood as a multidimensional concern intersecting with mental health, neurodevelopmental science, and broader questions of social sustainability and intergenerational justice (Akhmad et al., 2023).

Within positive law, child criminal responsibility is generally determined through the establishment of a minimum age of criminal responsibility. This age-based approach is favored for its legal certainty and administrative simplicity (Delmage, 2013). However, it presents a fundamental problem by reducing the complex developmental processes of childhood to a purely chronological parameter. Research in developmental neuroscience and neuropsychology consistently demonstrates that biological age does not necessarily correspond with cognitive, emotional, and social maturity (Steinberg & Icenogle, 2019). Two children who are exactly the same age can show strikingly different abilities for self-regulation, forward planning, and awareness of risk, with these differences largely determined by their environment, exposure to trauma, socio-economic background, and schooling (Fine et al., 2016). In the past twenty years, advances in neuroscience have significantly transformed how we understand the developing brain (Brown, 2019). Neuroimaging indicates that the prefrontal cortex the center for executive functioning, logical

reasoning, and risk evaluation is one of the final brain regions to reach full maturity, frequently extending into early adulthood (Fernando et al., 2023). The limbic system, by contrast, matures far earlier, fueling emotional reactivity and thrill-seeking tendencies. This developmental imbalance makes young people especially vulnerable to impulsivity and susceptibility to peer pressure. Accordingly, unlawful or delinquent behavior in children should not be interpreted as merely a deliberate, entirely autonomous decision; instead, it should be understood as emerging from a complex interaction between an immature brain and external environmental influences (Teicher & Samson, 2016).

Neurodevelopmental vulnerability is further compounded by the socio-structural realities faced by many children who come into conflict with the law (Şentürk, 2024). Empirical studies across jurisdictions demonstrate a strong correlation between children's involvement in criminal justice systems and factors such as poverty, family violence, substance abuse, limited access to education, and inadequate mental health services. Children exposed to chronic trauma, neglect, or structural violence frequently exhibit impaired emotional regulation and cognitive functioning, which directly affect their capacity to comply with legal norms. In this context, a criminal justice approach that emphasizes individual culpability without accounting for neuropsychological vulnerability risks producing outcomes that are substantively unjust (Tesink, 2025).

Although international legal instruments consistently emphasize the principle of the best interests of the child and the need for rehabilitative approaches in child justice, their implementation often remains largely declaratory. Criminal justice systems continue to operate within retributive and deterrence-based frameworks, even when applied to children (Widowati, 2024). Punishment is frequently justified as a mechanism of retribution and general deterrence, premised on the assumption that the threat of legal sanctions will discourage future offending (Fernando et al., 2025). Nevertheless, empirical studies suggest that children display diminished responsiveness to long-term punitive threats, while being more strongly shaped by immediate outcomes and peer-related influences. This discrepancy prompts core questions about the effectiveness and the normative legitimacy of punitive criminal-justice measures in cases that involve children.

In current legal theory, *neurolaw* has developed as an interdisciplinary area designed to narrow the gap between legal reasoning and neuroscientific knowledge (Meynen, 2014). *Neurolaw* is not intended to supplant normative legal analysis with biological determinism; instead, it seeks to strengthen legal doctrine by incorporating empirical findings about human cognition and behavior (Vincent, 2014). In the realm of child justice, *neurolaw* offers a basis for reassessing ideas of culpability, responsibility, and punishment by drawing on knowledge of brain development and neurobiological

vulnerability (Lawrence, 2022). This perspective contests conventional legal assumptions that treat children's moral and legal responsibility as equivalent to adults'.

Despite its growing academic influence, the integration of *neurolaw* into child criminal justice remains constrained by conceptual and institutional resistance (Balynska et al., 2019). Concerns regarding legal relativism, the misuse of scientific evidence, and the potential erosion of legal certainty are often invoked to justify the preservation of conventional age-based and punitive approaches (Aggarwal & Ford, 2013). At the same time, the failure to engage with neuroscientific findings risks perpetuating legal practices that are misaligned with empirical realities and substantive justice. This tension highlights the need for a new paradigm capable of accommodating scientific knowledge while maintaining normative coherence within criminal law (Chandler et al., 2019).

The idea of *Neuro-Protective Criminal Justice* is presented as an answer to the shortcomings of reactive and punitive models of criminal justice. Under this approach, criminal justice systems especially those that involve children should serve not only to uphold legal standards, but also to protect neurological and psychological development (Fondacaro & O'Toole, 2015). In this framework, protection is not limited to ensuring freedom from physical harm; instead, it involves preventing cognitive impairment, psychological trauma, and social dysfunction that can arise from disproportionately

severe legal interventions. A neuro-protective approach conceptualizes children as legal subjects undergoing critical stages of neurological development, requiring that all criminal justice responses be evaluated in light of their long-term developmental impact.

Growing empirical evidence indicates that non-punitive approaches including diversion, restorative justice, and community-based programming are more effective at lowering rates of child reoffending than custodial sentencing. Interventions that prioritize cognitive rehabilitation, psychosocial assistance, and social reintegration appear to enhance children's self-regulation and social accountability. Together, these results support the view that child justice systems ought to be structured to facilitate neurological maturation rather than to impede it through stigma, institutionalization, and social exclusion.

For developing nations, reforming youth justice is an uphill battle compounded by tight budgets, understaffed agencies, and a severe shortage of mental health care. All too often, legal systems in these regions default to a rigid, bureaucratic approach—prioritizing strict procedural compliance over tailored support for a child's unique needs. Consequently, children who break the law are handled as risks to be managed rather than vulnerable individuals deserving of care and growth. Bringing a neuro-protective lens into these systems requires far more than rewriting laws on paper; it demands a deep structural and cultural overhaul of how justice agencies operate.

Discussion of children's criminal responsibility cannot be separated from wider philosophical disputes about the aims of criminal law. It remains contested whether criminal law is meant only to punish violations of norms, or whether it also involves an ethical duty to safeguard human development. A neuro-protective approach redirects attention away from retribution toward the prevention of harm, away from punishment toward recovery, and away from formal certainty toward substantive justice. In this framework, children's criminal responsibility is not primarily treated as a matter of who should be punished; instead, it is framed as a question of how the legal system ought to respond to wrongdoing while not undermining children's neurological and psychological development.

The state of the art (previous studies) is presented to demonstrate the novelty of the present research in comparison with prior scholarship. Accordingly, five previous studies are critically reviewed before proceeding to the main discussion. The first previous study, entitled "*Neurodevelopmental Justice: Rethinking Adolescent Criminal Responsibility in Puerto Rico*" by Edicer Ramírez-Rivera and Karen G. Martínez-González, examines the premise that the neurological development of young individuals remains incomplete, even into their early twenties. Based on this finding, the authors argue that criminal responsibility should not be determined solely by chronological age but should also take into account the neurological development of the offender. The distinction between that study and

the present research lies in their respective scopes (Ramírez-Rivera & Martínez-González, 2025). The earlier study mainly explores the shift from adolescence to adulthood by treating the development of neurological functions as the foundation for criminal responsibility. By comparison, the current research focuses specifically on neurological maturity as a legal factor when assessing a child's criminal responsibility. In addition, by incorporating neuroscience into the child criminal justice system, this research aims to create a durable framework that safeguards children's fundamental rights while reducing the psychological burden created by punitive legal measures.

The study conducted two prior studies earlier, titled "Between Reform and Retribution: Navigating Ambiguity in India's Juvenile Justice System" by Additti Munshi, Melissa LaCaze, and Sharvari Karandikar, examines India's child criminal justice system. It argues that India's child criminal justice system has experienced multiple legislative reforms aimed at strengthening the protection of children's rights. However, a substantial disparity remains between legal reforms and their day-to-day implementation. The authors point to the legal framework and law enforcement institutions as the main drivers of this mismatch. While statutory reforms have moved toward a more child-centred orientation, legal institutions still function within a conventional paradigm that prioritizes retributive and punitive justice. Consequently, the study argues that institutional reform and a corresponding

transformation of legal culture are necessary to ensure that law enforcement practices align with the objectives of legislative reform (Munshi et al., 2026). The present research differs from the above study in both its analytical perspective and its proposed solution. While the previous study concentrates on evaluating the consistency between legal reform and institutional implementation and recommends comprehensive reform of the traditional legal structure, the present study focuses on integrating neuroscience into Indonesia's child criminal justice system. Within this framework, chronological age should no longer serve as the sole benchmark for determining criminal responsibility. Instead, children's neurological maturity should also constitute a fundamental legal consideration, thereby providing more comprehensive protection of children's fundamental rights through a developmentally informed criminal justice system.

The third previous study, entitled "Conceptualizing Juvenile Justice Reform: Integrating the Public Health, Social Ecological, and Restorative Justice Models" by Keisha April et al., argues that although contemporary child criminal justice systems have largely moved away from repressive approaches, their implementation by legal institutions continues to generate significant challenges, including over-criminalization, racial disparities, high recidivism rates, and limited community-based interventions. Accordingly, this study argues that legal reform should take a multisystem approach, recognizing

that child delinquency is shaped by social, economic, and environmental factors. From this standpoint, the authors present the Juxtaposed Juvenile Justice Model as a proportional framework intended to ensure the effective protection of children's fundamental rights (April et al., 2023). The current research departs from the earlier study in both its theoretical orientation and its proposed solution. Whereas the prior study supports the Juxtaposed Juvenile Justice Model as a proportional means of reconciling punishment with the protection of children's fundamental rights, the present study proposes an integrated model of the child criminal justice system grounded in neuroscience. Rather than treating chronological age as the sole basis for determining criminal responsibility, this research highlights children's neurological development as a core legal consideration. This approach aims to advance children's long-term well-being by protecting their psychological development and future prospects, while also fostering a more child-centred criminal justice system.

The fourth previous study, entitled "Pertanggung Jawaban Pidana Terhadap Anak yang Berkonflik dengan Hukum Menuju Keadilan Restoratif" by Aan Handriani and Abdul Aziz, examines the implementation of child sentencing in Indonesia. The study argues that the current system remains heavily dependent on imprisonment as the primary criminal sanction. Such dependence on custodial punishment places children at substantial risk of psychological vulnerability, because incarceration can generate

enduring trauma that harms their emotional development and future life prospects. The authors also argue that this situation indicates the continuing dominance of a traditional legal framework grounded in retributive and punitive principles. Accordingly, they call for a shift toward restorative justice, chiefly by introducing diversion measures that involve families and the broader community, so that children who come into conflict with the law can receive sanctions that are socially embedded and oriented toward the future (Handriani & Aziz, 2025). The difference between the earlier study and the current research is found in their respective approaches to legal reform. Whereas the previous study identifies diversion as the principal solution to the repressive nature of the child criminal justice system, the present research adopts a broader interdisciplinary perspective by integrating neuroscience and psychology into the legal framework. This integration is intended to provide a more sustainable and future-oriented foundation for reforming the modern child criminal justice system while strengthening restorative principles through scientifically informed legal policymaking.

The fifth previous study, entitled "Reformulasi Syarat Diversi: Kajian Ide Dasar Sistem Peradilan Pidana Anak" by Faisal and Derita Prapti Rahayu, criticizes Article 7 of the Child Criminal Justice System Act (UU SPPA) for limiting children's access to diversion when they are charged with offences carrying a statutory sentence of seven years' imprisonment or more. The authors argue that children's entitlement to

diversion should be applied more comprehensively, regardless of the length of the potential sentence, because the protection and fulfilment of children's rights should be guaranteed equally. They emphasize that every child possesses the capacity for rehabilitation and positive change, depending on how the State responds to their unlawful conduct. Accordingly, the study recommends that restorative justice should be available to all children, except in cases involving particularly serious offences, such as terrorism, premeditated murder, rape, and large-scale narcotics trafficking, which require exceptional legal treatment to ensure justice (Faisal & Rahayu, 2021). The present research differs from this previous study in both its focus and proposed framework. While the previous study primarily advocates the expansion of diversion to guarantee equal protection of children's rights, the present research seeks to strengthen such protection through the integration of neurolaw and developmental neuroscience into the child criminal justice system. Accordingly, criminal responsibility should be determined not only by chronological age but also by children's neurological maturity, thereby establishing a more scientifically informed and child-centred legal framework that provides stronger protection for children's fundamental rights.

Despite the growing body of scholarship on child justice, restorative justice, and child protection, existing studies largely continue to frame child criminal responsibility through fixed age thresholds, welfare-based mitigation, or

procedural accommodation, without systematically integrating neuroscientific insights into the core doctrines of criminal responsibility and punishment. The literature has yet to articulate a coherent normative framework that positions neurodevelopmental vulnerability as a foundational principle of child criminal justice rather than a supplementary consideration. This article addresses this gap by asking: (1) how should child criminal responsibility be reconceptualized in light of contemporary neuroscientific knowledge on brain development and decision-making capacity; (2) to what extent do existing legal frameworks particularly within Indonesian child justice reflect or fail to reflect neurodevelopmental realities; and (3) how can criminal law doctrines and policies be reoriented toward a neuro-protective model consistent with international child protection standards. The article contributes to the literature both theoretically, by advancing Neuro-Protective Criminal Justice as a distinct normative paradigm within criminal law, and normatively, by offering a structured framework for future legal reform that aligns child criminal justice with neuroscience, neurolaw, and child-centered human rights principles.

This article contributes to the literature in three significant ways. First, it advances a novel theoretical framework of Neuro-Protective Criminal Justice, repositioning neurodevelopmental vulnerability as a foundational normative principle of child criminal responsibility rather than a peripheral mitigating

factor. By integrating neurolaw and developmental neuroscience into criminal law theory, the article moves beyond age-based and welfare-oriented models that currently dominate child justice scholarship. Second, the article provides a normative–doctrinal analysis of child criminal responsibility within the Indonesian legal framework, demonstrating how existing statutes reflect partial protection yet fail to internalize neurodevelopmental considerations in determining culpability, procedure, and sentencing. This analysis situates Indonesia not as a purely local case, but as a representative jurisdiction for examining broader structural limitations in contemporary child justice systems. Third, the article offers a future-oriented and comparative reform framework, drawing on international best practices and restorative justice models to propose concrete directions for legal reform aligned with neuroscience, child-centered human rights, and long-term social sustainability.

B. RESEARCH METHODS

This research employs a normative legal method by integrating statutory, conceptual, comparative, and futuristic approaches (Marzuki, 2021). The statutory approach is used to examine and critically assess the legal framework governing child criminal responsibility and protection, particularly Law No. 11 of 2012 on the Child Criminal Justice System (UU SPPA), Law No. 1 of 2023 concerning the Indonesian Criminal Code (KUHP 2023), Criminal Procedure Code as enacted under Law No. 20 of 2025 (KUHP

2025), Law No. 1 of 2026 on Adjustment of Criminal Sanctions, and Government Regulation Number 65 of 2014 on Guidelines for Implementing Diversion and Handling Children under 12 (Twelve) Years of Age. These legal instruments are analyzed to determine the extent to which current positive law accommodates neurodevelopmental considerations in defining criminal responsibility, procedural safeguards, diversion mechanisms, and sentencing policies for children in conflict with the law. The conceptual approach is applied to examine fundamental doctrines of criminal law, including culpability, proportionality, and the objectives of punishment, while incorporating interdisciplinary insights from neurolaw and developmental neuroscience. This approach enables the construction of Neuro-Protective Criminal Justice as a normative framework that aligns legal reasoning with scientific knowledge on child brain development without undermining legal certainty or accountability. The comparative approach analyzes child justice models and neuro-informed criminal responsibility frameworks in selected jurisdictions that emphasize restorative justice, diversion, and rehabilitation-oriented responses to child offending. This comparison serves to identify normative patterns and best practices that may inform the refinement of Indonesia's child criminal justice system under the post-KUHP and post-KUHAP legal architecture. The futuristic approach is employed to assess the normative direction of criminal justice reform by anticipating the integration of neuro-protective principles into

future policy development and judicial interpretation, particularly within the procedural structure established by KUHAP 2025. This research is descriptive-prescriptive in nature (Febriawati & Ramon, 2026). Descriptively, it maps and systematizes existing legal norms governing child criminal responsibility. Prescriptively, it formulates normative recommendations aimed at strengthening neuro-protective orientations in child criminal justice policy and practice. The collected legal materials comprising primary legal sources, secondary legal literature, and relevant interdisciplinary studies are analyzed using content analysis to identify normative gaps, interpret legislative intent, and construct coherent legal arguments consistent with contemporary scientific insights and child protection standards (Kusumastuti et al., 2026).

C. RESULT AND DISCUSSION

1. Conceptual Foundations of Neuro-Protective Criminal Justice in Child Justice Systems

The concept of criminal responsibility has long been anchored in the classical assumptions of rational agency, moral autonomy and free will. Within traditional criminal law theory, liability is based on the idea that people have enough cognitive ability to understand that their actions are wrong and to control their behaviour accordingly (Sartorio, 2025). These assumptions underpin retributive justice models, which conceptualise punishment as a morally justified response to culpable wrongdoing. However, when

this framework is transposed to child justice systems, deep conceptual tensions are revealed. Due to their ongoing cognitive, emotional and neurological development, children do not fit neatly within the classical criminal law paradigm of the fully rational legal subject (Keating, 2018).

Neurolaw, a multidisciplinary domain that joins legal theory with neuroscience, offers a vital perspective for reconsidering these tensions (Bush & Tussey, 2013). Instead of rejecting responsibility in full, neurolaw examines how far legal doctrines genuinely correspond to empirically testable capacities of human cognition and behavior. Within the field of juvenile justice, neurolaw questions the assumption that children have decision-making abilities comparable to those of adults (Kramers-Olen, 2015). Evidence from developmental neuroscience indicates that brain maturation unfolds as a gradual, non-linear process, especially in areas linked to executive functioning, impulse control, foresight, and moral reasoning. Taken together, these findings require a re-evaluation of core criminal law notions, including culpability, proportionality, and the justification for punishment when it is applied to children (Ayu et al., 2026).

Central to neurolaw's relevance in child justice is the scientific understanding of brain development during the childhood. Neurodevelopmental research consistently indicates that the prefrontal cortex, which supports planning, impulse inhibition, risk appraisal, and the assessment of long-term outcomes, keeps maturing well into early

adulthood (Constantinidis & Luna, 2019). By contrast, subcortical regions linked to emotion, reward sensitivity, and novelty seeking emerge earlier and develop more quickly. This developmental mismatch results in a neurobiological profile in which children and adolescents show heightened susceptibility to impulsive behavior, peer influence, and emotionally motivated decision-making (Handayani & Hardiyanti, 2025). This susceptibility is not pathological; rather, it is developmentally typical.

Contemporary developmental neuroscience offers strong empirical evidence for treating children differently within criminal justice systems (Corrado & Mathesius, 2014). Findings consistently show that the maturation of the prefrontal cortex underlying executive functions such as impulse control, risk appraisal, and long-term planning persists into late adolescence and early adulthood. At the same time, subcortical limbic systems associated with reward sensitivity and emotional reactivity develop earlier, creating a neurobiological imbalance that heightens adolescents' vulnerability to impulsive and risk-prone behavior. Leading neuroscientific studies emphasize that these developmental characteristics are normative rather than pathological, and that adolescents' decision-making capacity is systematically more context-dependent and susceptible to peer influence than that of adults (Kurniawan et al., 2025). National-level scientific consensus further cautions that exposure to stress, coercive environments, and

punitive institutional settings during these critical developmental stages may adversely affect neural and psychological development, thereby undermining rehabilitation goals (Kamalludin et al., 2025). These findings reinforce the normative claim that child criminal justice systems must be structured not merely to accommodate youthfulness procedurally, but to actively protect ongoing neurodevelopment.

These findings challenge the traditional legal assumption that reaching a specific birthday suddenly endows a child with full criminal accountability. While using fixed age limits makes administrative work easier, it serves as a blunt instrument that ignores complex brain science. Through a neurolaw lens, chronological age alone is simply too weak an indicator of a child's true legal capacity (Rahmawati et al., 2025). Two kids who are the exact same age can inhabit completely different worlds when it comes to self-control, moral reasoning, and vulnerability to peer pressure—heavily influenced by their history of trauma, economic background, schooling, and mental health. The reliance on age as a determinant of responsibility thus risks oversimplifying human development and obscuring substantive inequities (Kristianto et al., 2025).

Critiques of age-based criminal responsibility do not suggest abandoning legal certainty; instead, they call for its recalibration. Legal systems routinely use individualized assessments in other areas of law, including competency to stand trial, mental capacity, and

sentencing mitigation (Setiyowati et al., 2026). Applying comparable individualized considerations to child criminal responsibility is consistent with established legal principles while more accurately reflecting scientific understanding. Neuro-Protective Criminal Justice extends this reasoning by arguing that neurodevelopmental vulnerability should serve as a normative baseline in child justice, rather than an exceptional factor raised only for mitigation.

Retributive justice, which remains strongly embedded in many child justice systems, is especially ill-suited for children when considered through a neurodevelopmental perspective. Retributivism assumes moral blameworthiness rooted in autonomous choice. However, if a child's capacity for decision-making is structurally limited by ongoing brain development, the moral rationale for imposing punitive suffering becomes increasingly fragile. Punishment, under such conditions, risks becoming not a response to culpable wrongdoing, but an imposition of harm upon individuals whose capacity for self-regulation is biologically incomplete. This raises profound ethical and legal concerns regarding proportionality and fairness.

Moreover, using deterrence to rationalize punishing children is of limited practical value. The concept of deterrence relies on the assumption that an individual can weigh future dangers against immediate benefits through logical calculation before taking action. However, brain science indicates that children seldom reason in this manner; they prioritize immediate

rewards and peer approval far more than abstract, remote threats of legal consequences (Latifiani et al., 2022). Consequently, severe punishments intended to deter crime often backfire, not only failing to alter behavior but also actively undermining a child's development. Persisting with deterrence-based policies therefore highlights how out of step current laws are with biological realities.

Neuro-Protective Criminal Justice represents a decisive departure from punishment- and deterrence-centered frameworks, redirecting the objective toward preventing harm, enabling healthy development, and helping young people reintegrate into society. Central to this model is a shift in the guiding question within juvenile courts. Rather than focusing on how severely a young person ought to be punished, it asks how the system can respond to wrongdoing without intensifying the person's biological, emotional, or social difficulties. This outlook places child justice within a more profound ethical obligation to safeguard human development (Mahfud et al., 2026)

The notion of protection within Neuro-Protective Criminal Justice extends beyond physical safety to encompass cognitive integrity, emotional stability, and social functioning. Legal interventions particularly detention, incarceration, and adversarial court proceedings can exert profound neuropsychological effects on children. Contact with carceral settings, social stigma, and institutional violence has been found to weaken emotional regulation, strengthen the formation of

antisocial identity, and derail educational pathways (Nasution et al., 2025). From a neuroprotective perspective, these effects represent harms that must be considered alongside any claimed advantages of punishment.

This paradigm also draws upon restorative justice theory, which emphasizes accountability, repair, and reintegration rather than retribution. However, neuroprotective criminal justice advances restorative justice by explicitly anchoring it in neuroscientific knowledge. Accountability, within this framework, is not equated with suffering (Natalis, 2026), but with processes that foster moral learning, empathy development, and behavioral regulation. Restorative mechanisms such as victim-offender mediation, community-based interventions, and therapeutic programs are understood not only as substitutes for punishment, but as normatively superior responses that better match children's developmental needs.

Conceptually, Neuro-Protective Criminal Justice challenges the anthropocentric bias of traditional criminal law, which prioritizes abstract norm enforcement over human vulnerability. By centering neurodevelopment, this framework redirects criminal law toward a relational and contextual account of wrongdoing. Children's actions are interpreted within networks of familial, social, and structural influences rather than isolated acts of individual moral failure. This approach does not deny agency, but places it within realistic constraints, thereby supporting more proportionate and humane legal responses.

The integration of neurolaw into child justice also raises important questions regarding equality before the law (Cohen & Casey, 2014; Natalis & Purwanti, 2025). Critics may argue that neuro-protective approaches risk differential treatment and legal uncertainty. However, formal equality that ignores relevant differences can produce substantive injustice. Treating children as if they possess adult-like cognitive capacities in the name of equality obscures their vulnerability and entrenches disadvantage. Neuro-Protective Criminal Justice embraces substantive equality by recognizing that different developmental capacities warrant differentiated legal responses.

From a doctrinal standpoint, this paradigm invites a re-examination of core criminal law principles, including mens rea, punishment objectives, and procedural safeguards. Mens rea assessments traditionally focus on intent and knowledge, but neurolaw suggests that such assessments must also consider developmental capacity to form and sustain intent. Procedural safeguards, such as the right to counsel and the right to a fair trial, require recalibration to ensure that children can meaningfully participate in legal proceedings. Neuro-protective logic supports enhanced protections, simplified procedures, and child-sensitive adjudication processes.

Importantly, Neuro-Protective Criminal Justice does not endorse impunity. Instead, it aims to match responsibility to capacity and response to development. Children are recognized as moral agents in formation, capable of learning, growth, and change. Accordingly,

legal responses are structured to support these processes rather than hinder them. This approach embodies a forward-looking model of justice that prioritizes durable social outcomes over immediate punitive gratification.

At a theoretical level, the paradigm resonates with broader shifts in criminal law philosophy toward preventive, rehabilitative, and restorative models. It also conforms to international human rights principles that stress the child's best interests and restrict deprivation of liberty to a measure of last resort. By grounding these principles in neuroscientific evidence, Neuro-Protective Criminal Justice strengthens their normative legitimacy and practical relevance.

Accordingly, this paradigm is built on three interlocking pillars: neuroscientific understanding of child development, a critical reassessment of age-based and retributive doctrines, and a normative commitment to protection-oriented justice. Together, these elements challenge the persistence of punitive orthodoxy in child justice systems and open space for a more coherent, evidence-based, and ethically grounded approach to child criminal responsibility.

By reframing child justice through a neuro-protective perspective, criminal law is recast as an instrument of social care as well as social control. The law's response to child offending becomes a site for safeguarding developmental potential rather than merely enforcing norms. This shift underscores the evolving role of criminal justice in complex societies where scientific

knowledge, human rights, and ethical responsibility increasingly intersect.

2. Child Criminal Responsibility under Indonesian Law: A Normative Analysis of the UU SPPA, KUHP 2023, and KUHAP 2025

The regulation of child criminal responsibility in the Indonesian legal system is not contained within a single legal instrument, but rather dispersed across several statutes that collectively form the normative architecture of child justice (Suciati & Setiyono, 2023). Law No. 11 of 2012 on the Child Criminal Justice System (UU SPPA) operates as a *lex specialis* governing children in conflict with the law, while Law No. 1 of 2023 concerning the Indonesian Criminal Code (KUHP 2023) provides the general substantive framework of criminal liability. Procedural mechanisms are regulated under Law No. 20 of 2025 on the Criminal Procedure Code (KUHAP 2025), which applies broadly to all criminal proceedings while incorporating restorative justice principles. In addition, Law No. 1 of 2026 on the Adjustment of Criminal Sanctions introduces post-KUHP harmonization of penalties, indirectly influencing the sentencing structure applicable to children.

Taken together, these four instruments reflect Indonesia's gradual shift toward a more child-sensitive criminal justice system. However, they also reveal significant normative gaps, particularly regarding the explicit incorporation of neurodevelopmental considerations into the determination of criminal responsibility,

procedural safeguards, and sentencing policies for children.

a. Age Thresholds of Criminal Responsibility under the UU SPPA and Their Relationship with KUHP 2023

The UU SPPA defines a child in conflict with the law as a person who has reached the age of 12 but is under 18 years old. Children below the age of 12 cannot be subjected to criminal prosecution and must instead be placed within social protection and welfare mechanisms (Marlina et al., 2018). This provision reflects a protective legislative approach by recognizing that children below a specified age do not have the minimum capacity required for criminal responsibility (Pillay, 2015).

However, the age-based framework adopted by the UU SPPA remains categorical. Under this law, once a child reaches the age of 12, they are treated as having sufficient capacity to assume criminal responsibility, without allowing consideration of individual differences in cognitive, emotional, or neurological maturity. From a neurolaw standpoint, this assumption is flawed, because chronological age operates only as an administrative substitute rather than a reliable measure of neurodevelopmental capacity.

KUHP 2023 reiterates conventional principles of criminal responsibility, including legality, culpability, and individual accountability (Malau, 2023). Although the Code shows a more humanistic orientation than its predecessor, it does not independently develop a substantive doctrine of child criminal responsibility. Instead, it

defers to special legislation, namely the UU SPPA, for matters concerning children. As a result, the substantive criminal law framework continues to rely on age thresholds rather than development-based responsibility, thereby perpetuating a formalistic approach to child culpability.

A specific examination of Article 40 of the 2023 Criminal Code and Government Regulation No. 65 of 2015 confirms that children under the age of twelve cannot be held criminally liable; the explanatory notes to these provisions cite scientific reasons rooted in psychological considerations, specifically a child's emotional, intellectual, and mental maturity. Implicit in this framework is the fact that Indonesia's child justice system retains a formalistic perspective, using the "age of the child" as a basis for exemption from criminal liability. Yet, as previously noted, children over the age of twelve may possess neurological or developmental levels that do not align with the general or ideal standard for that age group. A child's cognitive, psychological, and neurological development is heavily influenced by factors such as social environment, economic status, and education level. Circumstances that can significantly impede the developmental process for individual children. The normative relationship between the UU SPPA and KUHP 2023 illustrates that Indonesian criminal law still conceptualizes child responsibility as a mitigated version of adult responsibility, rather than as a distinct category grounded in developmental science. Consequently, neurodevelopmental vulnerability

remains implicit rather than normatively decisive within the structure of criminal liability.

b. Principles of Criminal Responsibility and the Non-Punitive Orientation of the UU SPPA

The UU SPPA is underpinned by a set of guiding principles that signal a departure from purely retributive justice. These encompass the principles of protection, the best interests of the child, proportionality, the avoidance of retaliation, and placing deprivation of liberty as a last resort (Adzana et al., 2025). Taken together, these principles reflect a normative commitment to reducing the harmful impacts of criminal justice involvement on children.

Even with this protective orientation, the conceptual framework of criminal responsibility under the UU SPPA remains largely conventional. Responsibility continues to rest on the classical idea of fault (*mens rea*), though it is moderated through diminished sanctions, diversionary measures, and procedural safeguards. The law does not explicitly connect culpability to the child's neurodevelopmental capacity or cognitive maturity. As a result, the UU SPPA adopts a dual approach: children are recognized as responsible legal subjects, yet the consequences of responsibility are softened through protective measures. This approach differs fundamentally from a neuro-protective paradigm, which would position developmental limitation as the primary normative foundation for determining both responsibility and response. Under the current framework, protection functions as a corrective

mechanism rather than as a constitutive principle of criminal liability.

c. Diversion as a Core Mechanism and Its Normative Limitations

Diversion constitutes one of the central pillars of Law No. 11 of 2012 on the Child Criminal Justice System (UU SPPA) and reflects the normative orientation of Indonesian child criminal law toward minimizing the destructive impact of formal criminal proceedings on children's development (Faizin et al., 2025). Article 7(1) of the UU SPPA expressly mandates the implementation of diversion at every stage of the child criminal process, namely during investigation, prosecution, and judicial examination. Normatively, this obligation signifies legislative recognition that adversarial and coercive criminal procedures carry a substantial risk of psychological, social, and long-term developmental harm to children. Accordingly, the resolution of child cases through restorative justice mechanisms is conceived as a response more consistent with the best interests of the child. Nevertheless, the normative design of diversion under the UU SPPA is not universal in scope. Article 7(2) of the UU SPPA restricts the application of diversion to offences punishable by imprisonment of less than seven years and to cases that do not involve recidivism. This limitation underscores that diversion is treated as a conditional mechanism dependent on the juridical classification of the offence and the offender's criminal history, rather than as a response inherently grounded in the child's

developmental condition. Consequently, diversion under the UU SPPA operates more as an instrument of selective criminal policy than as a comprehensive embodiment of the principle of developmental protection for children.

From the perspective of neurolaw and developmental neuroscience, these restrictions raise significant conceptual concerns. Children's neurodevelopmental vulnerability manifested in limited impulse control, heightened sensitivity to situational pressure, and strong dependence on social context does not correlate directly with the legal gravity of an offence. A child who commits a serious offence remains within the same phase of neurological development as a child who commits a minor offence. Therefore, limiting diversion on the basis of statutory sentencing thresholds, as stipulated in Article 7(2) of the UU SPPA, risks undermining the very objective of diversion itself, namely the prevention of developmental harm resulting from children's exposure to the formal criminal justice system.

This construction reveals a normative tension between the protective objectives of child justice and the residual retributive logic that persists within the system. Although the UU SPPA declaratively rejects retribution and positions punishment as a measure of last resort, the offence-based design of diversion indicates that the seriousness of the act continues to play a dominant role in determining the legal response. Within a neuro-protective criminal justice framework, such an approach is problematic, as it prioritizes retributive symbolism over the

prevention of developmental harm the very rationale underlying the differentiation between child and adult criminal justice.

Further developments under Law No. 20 of 2025 on the Criminal Procedure Code (KUHP 2025) demonstrate an expanded recognition of restorative justice within the general framework of criminal procedure. KUHP 2025 opens avenues for restorative resolution not only in child cases but also in cases involving adult offenders, as part of a broader humanistic reform of criminal procedural law. However, it is important to note that KUHP 2025 does not contain provisions that explicitly mandate the use of developmental, psychological, or neurocognitive assessments as a basis for decision-making regarding diversion or restorative justice, whether in child or general criminal cases. The absence of such explicit regulation indicates that the recognition of restorative justice under KUHP 2025 continues to operate primarily at a procedural and discretionary level, rather than at a substantive level that internalizes findings from developmental neuroscience. Decisions concerning diversion and restorative resolution remain predominantly guided by formal juridical considerations such as offence classification and law enforcement interests without a legal obligation to assess a child's developmental capacity and neuropsychological vulnerability on an individualized basis. Accordingly, while diversion under Article 7 of the UU SPPA and the strengthening of restorative justice under KUHP 2025 represent important normative advances,

both instruments have yet to fully embody a neuro-protective paradigm. Diversion has not been framed as a straightforward outcome of children's neurodevelopmental conditions; instead, it is treated as a limited exception governed by offence-based reasoning and considerations of recidivism. Without a normative reconstruction that explicitly links diversion to the protection of children's neurological and psychological development, this mechanism risks remaining a policy compromise within a system that remains structurally oriented toward conventional models of criminal responsibility (Sulistiyawan & Ilham, 2026).

d. Procedural Safeguards for Children under the UU SPPA and KUHAP 2025

Procedural protection constitutes one of the most robust components of Law No. 11 of 2012 on the Child Criminal Justice System (UU SPPA). The statute provides a set of procedural rights expressly designed for children who are in conflict with the law, thereby reflecting the recognition that children need differentiated treatment throughout criminal proceedings. (Fadilah et al., 2025). Article 3 of the UU SPPA enumerates fundamental principles of child justice, including humane treatment consistent with the child's dignity, the right to legal assistance, the right to be accompanied by parents or guardians, and the prioritization of the child's best interests throughout the process. These guarantees are operationalized through specific procedural entitlements, such as the preparation of social inquiry reports by community counselors to inform

decision-making at every stage of the process, as mandated under Articles 27 and 60 of the UU SPPA. In addition, the UU SPPA imposes substantive limits on the severity of sanctions that may be imposed on children. Article 69(2) explicitly prohibits the imposition of capital punishment and life imprisonment on child offenders, while Articles 32 and 33 affirm that arrest and detention may only be carried out as a measure of last resort and for the shortest appropriate period of time. Taken together, these provisions express a legislative purpose of protecting children from the most damaging elements of criminal punishment and of ensuring that the removal of liberty does not become a standard reaction to wrongdoing by children. Further procedural reinforcement is provided by Law No. 20 of 2025 on the Criminal Procedure Code (KUHAP 2025), which enhances safeguards for suspects and defendants in general by strengthening the right to legal counsel, expanding access to restorative justice mechanisms, and recognizing forms of judicial pardon or judicial forgiveness within the criminal process. Although these protections are not child-specific in design, their expansion indirectly benefits children by raising the overall standard of procedural fairness and by introducing more flexible, non-punitive pathways for case resolution. Despite these advances, both the UU SPPA and KUHAP 2025 continue to operate within a paradigm of procedural accommodation rather than developmental protection. The procedural framework primarily adjusts formal

legal processes to account for the child's age and legal status, without imposing an explicit obligation to assess the child's cognitive maturity, neurodevelopmental capacity, or psychological vulnerability as part of procedural decision-making. Neither instrument requires developmental or neuropsychological assessments as a condition for evaluating a child's capacity to understand legal proceedings, to engage substantively in their defense, or to give informed consent at critical stages such as interrogation, diversion negotiations, or trial. As a result, children may still be subjected to procedural experiences such as police questioning, prosecutorial bargaining, or courtroom examination that exceed their developmental capacity to comprehend legal consequences and exercise their procedural rights effectively. This gap underscores a structural limitation within Indonesia's child justice framework, where procedural safeguards function largely as formal guarantees rather than as mechanisms designed to actively protect children's ongoing cognitive and neurological development.

e. The Implications of Law No. 1 of 2026 on the Adjustment of Criminal Sanctions

Law No. 1 of 2026 on the Adjustment of Criminal Sanctions aims to harmonize penalty structures across Indonesian criminal legislation in accordance with the classification system introduced by KUHP 2023. Although the law does not specifically regulate child offenders, its restructuring of imprisonment and fines has

indirect consequences for children subject to criminal sanctions. Abolishing rigid minimum sentences and replacing them with more flexible sentencing categories opens the door to punishment that is more proportionate and tailored to individual circumstances. At the same time, in the absence of explicit guidance that connects sentencing discretion to developmental considerations, this flexibility may be applied through an adult-oriented lens. Because there are no directives for sentencing children that are specifically grounded in neurodevelopmental vulnerability, the reform's capacity to bring about meaningful change in child justice is curtailed.

A cross-instrument analysis of the UU SPPA, KUHP 2023, KUHAP 2025, and Law No. 1 of 2026 reveals a consistent pattern, while Indonesian law acknowledges the need for special protection for children, it does not explicitly integrate neurodevelopmental science into its normative foundations. Child protection is primarily presented as aiming to reduce punishment, provide diversion, and implement procedural safeguards, rather than as a duty to prevent developmental harm that results from criminal justice intervention itself. This absence indicates that Indonesian child justice remains situated within a transitional paradigm. The legal system has moved beyond overtly punitive approaches but has not yet embraced a neuro-protective model in which developmental vulnerability functions as a central normative principle. Accordingly, current legal instruments offer a valuable protective baseline, yet they also

leave substantial conceptual and doctrinal room for reform guided by neurolaw and developmental science.

3. Toward a Neuro-Protective Model of Child Criminal Justice: Comparative Insights and Future Legal Reform

The movement toward a neuro-protective model of child criminal justice reflects a broader transformation in global criminal law, in which punishment-centered paradigms are increasingly questioned in light of empirical evidence, human rights norms, and interdisciplinary knowledge. Comparative legal developments demonstrate that many jurisdictions have gradually moved away from rigid, age-based and retributive child justice systems towards more developmental-sensitive, restorative and individualised approaches. These transformations provide valuable insights for reimagining child criminal justice beyond doctrinal reform, toward a model that structurally integrates neurodevelopmental protection as a guiding legal principle.

In several common law jurisdictions, particularly the United States, neuroscientific evidence has significantly influenced constitutional jurisprudence concerning child offenders. Key legal precedents from the U.S. Supreme Court fundamentally redefined juvenile justice, affirming that children are biologically distinct from adult offenders. Citing scientific evidence on adolescent brain maturity, limited self-control, and susceptibility to outside pressure, the Court moved to abolish the most severe penalties for young people—including the death

penalty and non-parolable life terms (Levick, 2019). Although these developments remain grounded in constitutional proportionality analysis, they also implicitly recognize that criminal responsibility and punishment should be calibrated to developmental capacity rather than to formal culpability alone. Although the U.S. model has not fully institutionalized neuro-protection as a statutory principle, its jurisprudence demonstrates how neuroscientific insights can reshape foundational criminal law doctrines (Freeman, 2006).

By contrast, a number of European jurisdictions have implemented more systemic approaches to development-oriented child justice. States such as Germany, the Netherlands, and the Scandinavian countries highlight education-focused sanctions, welfare-based interventions, and individualized assessments that go beyond chronological age. In Germany, for instance, child criminal law applies not only to minors, but, in certain circumstances, also to young adults whose developmental maturity is comparable to that of adolescents. This flexible approach to age implicitly acknowledges that neurodevelopment does not stop abruptly at the point of legal majority. Although German law does not explicitly invoke neuroscience, its doctrinal willingness to use developmental assessment closely corresponds to neuro-protective principles (Röpcke et al., 2020).

Restorative justice has emerged as a central pillar of child justice reform in many jurisdictions, particularly in New Zealand and

Canada. New Zealand's youth justice system prioritizes family group conferencing, community participation, and consensus-based resolution, placing the child's social reintegration and moral learning at the center of the justice process. These mechanisms shift the focus away from punishment and toward relational repair, accountability through dialogue, and future-oriented responsibility. From a neuro-protective perspective, such approaches are especially significant because they minimize exposure to adversarial and coercive procedures that may disrupt emotional regulation and identity formation during critical developmental stages (Lynch, 2008).

Canada's Youth Criminal Justice Act similarly emphasizes restraint, proportionality, and the avoidance of custodial measures. The Act explicitly recognizes that the criminal justice system must respond to young persons in a manner that promotes rehabilitation and reintegration while holding them accountable in ways that are meaningful and developmentally appropriate (Kuehn & Corrado, 2011). Even though neuroscience is not explicitly incorporated into statutory language, Canadian child justice policy demonstrates an appreciation that children's cognitive and emotional abilities call for distinct legal responses. These comparative models demonstrate that neuro-protection can be operationalized through doctrinal flexibility, restorative mechanisms, and welfare-oriented institutional design, even in the absence of explicit neuroscientific terminology.

Beyond Western legal systems, international human rights law provides a compelling foundation for a neuro-protective approach to youth justice. Global standards have long insisted that locking up children should be an absolute last resort, applied for the briefest possible time. While these rules were originally framed through the lens of human rights, they align perfectly with what brain science now proves: incarceration actively damages young brains, mental health, and social stability. This overlap between human rights and neuroscience makes one thing clear the justice system's job isn't just to follow fair court procedures, but to actively protect a child's brain from harm.

Despite these advances, comparative experience also reveals persistent limitations. Many jurisdictions continue to rely on formal age thresholds and offense-based categorizations that constrain individualized, development-sensitive responses. Even where restorative justice mechanisms exist, their application is often discretionary, uneven, or restricted to less serious offenses. This targeted implementation mirrors a fundamental tension between developmental reasoning and the hierarchical structure of traditional criminal law, which places greater emphasis on the severity of the offense than on the offender's capacity. A neuro-protective model challenges this hierarchy by reframing seriousness not solely in terms of legal harm, but also in terms of the potential developmental harm caused by the justice system's response.

Looking ahead, advancing reform in child criminal justice calls for moving away from the implicit accommodation of developmental vulnerability toward the explicit normative recognition of neuro-protection as a core guiding principle. Such a shift entails more than the expansion of diversion or restorative programs; it requires reconfiguring the conceptual architecture of criminal responsibility itself. Within a neuro-protective approach, responsibility is treated as a dynamic, developing capability rather than as a fixed legal status obtained at a particular age. Legal responses must therefore be adaptive, proportionate, and oriented toward supporting developmental trajectories rather than imposing static sanctions.

Implementing policy reform in this framework would require embedding developmental assessments into child justice decision-making. Rather than depending solely on age or offense classification, courts and prosecutors could be obligated to consider interdisciplinary evaluations of cognitive maturity, emotional regulation, exposure to trauma, and social context. These assessments would not serve to excuse wrongdoing, but to inform the selection of responses that promote accountability without inflicting developmental harm. Importantly, such mechanisms already exist in limited form within social inquiry reports and probation systems; a neuro-protective reform would elevate their normative significance within the adjudicative process.

Another crucial aspect of future reform concerns the reworking of procedural settings. Neuro-protective child justice requires procedures that children can truly understand and in which they can genuinely take part. This entails using simplified language, adopting courtroom practices that are sensitive to children, and implementing decision-making processes that lessen fear, confusion, and coercion. Comparative experience shows that adversarial procedures originally designed for adult defendants may weaken children's capacity to exercise their rights effectively, converting formal protections into hollow promises. Under a neuro-protective model, meaningful participation is treated as a substantive obligation rather than a mere procedural formality.

Sentencing policy likewise needs adjustment within a neuro-protective framework. Comparative findings further indicate that custodial sanctions are among the most damaging interventions for children, carrying long-term effects on mental health, educational achievement, and social integration (Hasibuan, 2022). Accordingly, future reform should prioritize non-custodial measures that pair accountability with therapeutic and educational support. Where deprivation of liberty is unavoidable, neuro-protective principles require that detention conditions be developmentally appropriate, trauma-informed, and oriented toward rehabilitation rather than discipline.

On an institutional scale, building a neuro-protective system for children relies on seamless

teamwork across courts, social work agencies, mental health professionals, and schools. Evidence from various jurisdictions shows that when these sectors operate in isolation, rehab efforts fail and repeat offenses rise. On the flip side, holistic frameworks that target the root social and developmental causes of youth offending achieve far more lasting success. Ultimately, neuro-protection forces us to stop viewing child justice as merely a punishment mechanism, reframing it instead as a shared responsibility across multiple public sectors.

At the same time, meaningful reform hinges on transforming the day-to-day culture inside legal institutions. Because judges, prosecutors, and police officers are on the front lines of interpreting child justice norms, their mindsets directly dictate how the law comes to life. Experience across different legal systems reminds us that updating statutes without changing institutional habits rarely works. If neuro-protective justice is to take root, we need ongoing training, cross-field collaboration, and practical standards that make a child's developmental vulnerability a non-negotiable factor in every legal decision.

Against this backdrop, introducing neurolaw into law school curricula and courtroom logic is more relevant than ever. This does not mean replacing moral or legal reasoning with brain scans—neuroscience shouldn't be seen as a silver bullet or an oversimplification of human behavior. Rather, these empirical insights help judges make more informed normative calls

rooted in real-world human biology. Legal systems elsewhere that have embraced brain science show that law can adapt and modernize without sacrificing its fundamental principles or independence. A neuro-protective model thus represents not a retreat from legal reasoning, but its refinement through informed and context-sensitive analysis.

Viewed through a neuro-protective lens, the comparative experiences discussed in this article reveal a clear normative spectrum rather than a uniform model of child justice. Jurisdictions such as the United States demonstrate partial neuro-protective recognition, where neuroscientific insights influence constitutional limits on punishment but remain largely confined to proportionality review within a fundamentally retributive framework. By contrast, systems such as Germany and several Northern European jurisdictions reflect a structurally adaptive approach, allowing developmental maturity to inform the application of child law beyond rigid age thresholds, thereby aligning more closely with neuro-protective principles despite the absence of explicit neuroscientific language. New Zealand and Canada illustrate a process-oriented neuro-protective orientation, where restorative justice mechanisms and community-based interventions reduce exposure to adversarial and custodial procedures that are known to undermine developmental well-being. Taken together, these models suggest that neuro-protection in child justice can operate at different normative levels: constitutional restraint, doctrinal flexibility, and

procedural design while also revealing the persistent dominance of retributive logic where seriousness of offence continues to outweigh developmental vulnerability. This synthesis underscores that a fully articulated neuro-protective model requires not the mere coexistence of restorative practices, but a coherent integration of developmental science into the foundational doctrines of responsibility, procedure, and sentencing. Ultimately, we must tread carefully so that neuroscience is not weaponized in ways that harm children's rights or deepen social stigma. Protecting a child's brain development should never turn into an excuse to label them as 'defective' or reduce their whole identity to brain scans. A young person's developmental vulnerability should trigger support and care not surveillance, over-policing, or forced intervention. Lessons from other legal systems remind us that neuro-protection only works when rooted in human rights, honoring a child's inherent dignity, voice, and capacity to change.

Taken together, comparative insights and future-oriented analysis suggest that a neuro-protective model of child criminal justice is neither utopian nor incompatible with existing legal traditions. Rather, it marks an evolutionary move toward a framework that brings criminal law into line with scientific understanding, human rights commitments, and ethical accountability to future generations. Drawing on international practices and preparing for emerging challenges, child justice systems can be reshaped to deliver

responses that are not only legally valid, but also developmentally fair.

D. CONCLUSION

This study demonstrates that child criminal justice can no longer be understood merely as a derivative of adult criminal law with procedural modifications, but must instead be reconstructed as a distinct legal regime grounded in fundamentally different conceptual and normative foundations. Advances in neuroscience, particularly those concerning neurodevelopmental immaturity in children and adolescents, challenge the classical assumptions of criminal law regarding full rationality, free will, and culpability as the basis of criminal responsibility. In this context, *neurolaw* offers a critical analytical framework that exposes the tension between traditional legal doctrines and empirical realities of child brain development, while simultaneously providing the basis for a more evidence-based and development-sensitive model of justice. Through conceptual analysis, this article affirms that child criminal responsibility cannot be reduced to chronological age alone. Although age-based thresholds offer legal certainty, they remain inherently reductive and insufficiently responsive to variations in cognitive, emotional, and psychosocial development among children. Accordingly, *Neuro-Protective Criminal Justice* is advanced as a normative paradigm that places the protection of children's neurological and psychological development at the core of child justice. This paradigm does not negate criminal

responsibility but recalibrates it in proportion to developmental capacity, shifting the orientation of punishment from retribution toward harm prevention, restoration, and long-term rehabilitation. The normative analysis of Indonesian positive law encompassing the Child Criminal Justice System Act (UU SPPA), the 2023 Criminal Code (KUHP 2023), the 2025 Criminal Procedure Code (KUHP 2025), and the Law on the Adjustment of Criminal Sanctions reveals that Indonesia has established a relatively progressive legal foundation for the protection of children in conflict with the law. Principles such as the child's best interests, diversion, restorative justice, and limiting custodial sanctions signal a clear move away from overtly punitive approaches. Nonetheless, these safeguards are still largely institutional and procedural, and they have not yet been grounded in an explicit neurodevelopmental rationale. Indonesian law has not fully incorporated insights from developmental neuroscience when determining criminal responsibility, shaping sentencing policy, or designing procedures in cases involving children. Comparative analysis also strengthens these conclusions, showing that many jurisdictions have increasingly implemented flexible, restorative, and development-focused child justice frameworks. International practices demonstrate that effective child protection does not necessarily require explicit neuroscientific language, but does demand a fundamental shift away from punitive orthodoxy toward responses that emphasize moral learning, social reintegration, and

developmental well-being. From a future-oriented perspective, meaningful reform of child criminal justice requires the institutionalization of neuro-protective principles through developmental assessment mechanisms, child-sensitive procedures, non-custodial sanctions, and integrated cross-sectoral governance. Viewed this way, Neuro-Protective Criminal Justice marks a pivotal shift in how we think about and design laws for youth. It moves criminal law away from being a blunt tool for punishing misbehavior, recasting it as a moral safeguard for a child's growth and the broader well-being of the community. By weaving together brain science, restorative practices, and core child rights, this framework delivers a system that is legally sound, fair to a child's developmental stage, genuinely compassionate, and built for lasting social impact.

This research highlights the need for comprehensive reforms throughout the legal system, including its regulatory framework, institutional structure, and legal culture. At the regulatory level, Article 40 of the 2023 Criminal Code should be amended to clarify that criminal liability is not confined to children under the age of twelve. Instead, it should also apply to older children who are still legally recognized as minors, provided that an assessment of their neurological capacity has been conducted. This strategy should also be built into implementing regulations, including the SPPA Law and Government Regulation No. 65 of 2015 on Guidelines for Diversion and the Treatment of Children Under 12 Years of Age. Nevertheless,

regulatory reform by itself is not enough. It must be backed by changes in both legal institutions and legal culture. Agencies charged with dealing with child-related cases should consistently carry out comprehensive assessments of a child's neurological capacity at every phase of the legal process. Such evaluations can help ensure that legal determinations do not harm key elements of a child's development, including psychological, neurological, and mental well-being. By embedding these reforms across all parts of the legal system, the juvenile justice system can more effectively align with current advances in neuroscience, respect child-centered human rights principles, and foster more sustainable social outcomes.

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