

RETHINKING JUVENILE JUSTICE THROUGH THE LENS OF NEUROSCIENCE

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Abstract

The intersection of neuroscience juvenile justice has emerged as a critical frontier. In addressing the persistent recidivism rates among children in conflict with law (ccl), traditional punitive approaches have demonstrated that they are of limited effectiveness. With recidivism rates ranging from 40 to 65% globally, recent advances in adolescent brain development research suggest that neuropsychology informed interventions may offer better outcomes.

This study examines the differential effectiveness of traditional versus neuropsychology, informed approaches in juvenile justice systems, analysing how the international best practices and neuroscience-based interventions to identify factors, contributing to significant reductions in repeat offending.

A comprehensive systematic review was conducted analysing peer review literature, government reports and international juvenile justice data from 2000-2025. Along with comparative analysis, focusing on recidivism rates, intervention effectiveness, the long-term outcomes across jurisdictional approaches.

Countries that have been implementing neuropsychology informed approaches demonstrated substantially lower residence rates, Norway 18% within 2 years and Scotland 22.4% compared to traditional punity systems in the United States, 55 to 65% within 12 months and Canada, 40 to 60%. science-based interventions, incorporating neuroscientific principles show promising results. Multi systemic therapy, 25 to 70% reduction. Functional family therapy, 35% felony reduction. and \n Trauma informed care approaches demonstrate significant improvements in behavioural outcomes of the youth.

Neuropsychology informs juvenile justice approaches consistently outperform the traditional punitive methods in reducing recidivism, implementation of evidence-based interventions that are grounded in adolescent brain development. Research offers a substantial promise for improving rehabilitation outcomes and reducing societal costs.

Keywords

juvenile justice, neuroscience, recidivism, adolescent brain development, evidence-based interventions, rehabilitation

Introduction

The treatment of children in conflict with law (CCL) remains a critical challenge at the intersection of neuroscience, psychology, and legal policy in India and worldwide. Recent advances in adolescent brain development and

neuropsychological research have radically transformed the understanding of how young people think, make decisions, and respond to risk, especially under stressful or adverse circumstances. Unlike adults, juveniles possess brains that are not yet fully matured in areas such as impulse control, reasoning, and

foreseeing consequences—a fact now well-documented in scientific literature and increasingly recognized by courts and policymakers.

Despite statutory protections and reformatory frameworks like the Juvenile Justice (Care and Protection of Children) Act, 2015, many children nonetheless find themselves entangled in the criminal justice system, often facing procedures or environments ill-suited to their developmental needs. Coupled with socioeconomic factors—poverty, trauma, neglect, and lack of education—the risk of psychological and social harm is compounded. The importance of crafting individualized, evidence-based rehabilitation protocols and child-centric legal decision-making is more urgent than ever. This research seeks to bridge cutting-edge scientific insights with the evolution of Indian juvenile jurisprudence, asking: How can recent knowledge about adolescent brain development and neuropsychology inform not just the policies and statutes, but also their real-world implementation for children in conflict with law?

The answer holds profound implications, not only for the young individuals involved, but for societal well-being, justice, and long-term public safety. By critically examining legal principles, case laws, reformatory policies, and neuroscientific evidence, this research aims to place the problem in a contemporary analytical context, emphasizing both theoretical understanding and applied change.

Literature Review

Primary Sources – Constitutional Provisions, Statutes, and Rules/Regulations

1. Constitutional Provisions

The Indian Constitution¹⁰⁹³ forms the basis of the law of juvenile justice.

- Special provisions may be made under **Article 15(3)** for a child, and based on

this, legislation may be issued and carried out taking into account special needs of young offenders and deviating from criminal laws valid in the case of adult offenders.

- **Article 21**, which gives a right of life and personal liberty, has been expansively interpreted by courts so as to give a right of protection, due process, and rehabilitation; which is in consonance with the approach of rehabilitation of juvenile justice.
- **Articles 39(e) & (f)** lay down not only that the State will prohibit the exploitative use of children, like work which is "unsuitable" for their strength or age, but will provide facilities and opportunities for wholesome development and dignity.
- Finally, **Article 45** prescribes that the State shall provide free and compulsory education for children which is seen as central towards rehabilitating juveniles and integrating them back into society at large.

2. Statutory Framework

Juvenile Justice (Care and Protection of Children) Act, 2015¹⁰⁹⁴

The Juvenile Justice (Care and Protection of Children) Act, 2015 features aspects that central law regarding how to treat CCL, including definitions, types of institutions, types of offences, and the protections for process.

- **Sections 3-8** highlight the principles of dignity, best interests of the child, de-stigmatization, and rehabilitation versus punishment.
- **Sections 10-26** contain the laws of apprehension, inquiry, assessment, and disposition, with the proper legal protections dedicated to those in Juvenile Justice.

¹⁰⁹³ Constitution of India | Legislative Department | India. (n.d.). <https://legislative.gov.in/constitution-of-india/>

¹⁰⁹⁴ Government of India. (2015). The Juvenile Justice (Care And Protection Of Children) Act, 2015. In The Juvenile Justice (Care And Protection Of Children) Act, 2015. <https://www.indiacode.nic.in/bitstream/123456789/8864/1/201602;juvenile2015pdf>

- **Sections 27-54** allude to residential care through observation homes and special homes, and processes of rehabilitation, aftercare, foster care, and adoption.

- The 2021 Amendments add levels of oversight from the District Magistrate, strengthen monitoring, and streamline offences in order to improve expediency of proceedings.

Juvenile Justice (Care and Protection of Children) Rules, 2016¹⁰⁹⁵

These rules give effect to provisions of the JJ Act, thus:

- A demarcation of the powers, roles, and jurisdictions of Child Welfare Committees and Juvenile Justice Boards.
- Standards for the administration of Observation Homes, Special Homes, and aftercare services.
- Requirements for inquiry, counsel, psychological evaluation and protections of confidentiality of records of children.

Bharatiya Nyaya Sanhita, 2023¹⁰⁹⁶

Besides the Indian Penal Code, the BNS continues to have some key provisions of child-specific laws:

- Full immunity for children under the age of seven years.
- Reduced criminal responsibility for children between seven and twelve years old considering limited criminal ability.
- Child-sensitive procedures in the process of children's trials, protecting children's rights.

- **Regulations and Policy Schemes**
 - Integrated Child Protection Scheme (ICPS): ICPS is a national policy framework which augments statutory provisions through providing a framework of financial, institutional, and technical assistance toward child protection, training, awareness, and capacity development.

- State Rules and Regulations for Aftercare and Observation Homes: Rules that will be appropriate for each state will be geared towards operational standards, professional training, educational infrastructure, and mental care for CCL's integration back into society.

Review of Case Laws

Judicial interpretation plays a crucial role in shaping juvenile justice by clarifying statutory intent, reinforcing constitutional protections, and applying reformatory principles. The following cases exemplify how Indian and comparative courts have advanced child-sensitive justice.

1. Mohamed Huzafa Javed Ahmed Ansari v. State of Maharashtra (2019, Bombay HC)

In this case, a minor petitioner challenged his detention with adult prisoners under the Juvenile Justice Act, 2015. The Court held that age determination must strictly follow JJ Act provisions and can be raised at any stage of proceedings. It also condemned placing juveniles in adult prisons, emphasizing rehabilitation and psychological assessment instead of punitive treatment. This decision illustrates the judiciary's commitment to safeguarding minors' rights, aligning with developmental neuroscience which recognizes adolescents' immaturity and greater capacity for reform.

2. Hari Ram v. State of Rajasthan (2009, Supreme Court of India)

The Court clarified that juvenility can be claimed retrospectively, meaning children tried under earlier, harsher regimes may still benefit from the more progressive JJ Act, 2000. It underscored that juveniles must be dealt with through child-specific forums like Juvenile Justice Boards rather than adult criminal courts. The ruling reinforced the principle of the child's best interests and highlighted rehabilitation as the core objective, directly supporting a reformatory justice model.

¹⁰⁹⁵ Juvenile Justice (Care and Protection of Children) Rules, 2016
<https://socialwelfare.tripura.gov.in/juvenile-justice-care-and-protection-children-rules-2016-1>

¹⁰⁹⁶ Bharatiya Nyaya Sanhita, 2023
<https://www.indiacode.nic.in/handle/123456789/20062?locale=en>

3. *Sheela Barse v. Union of India (1986, Supreme Court of India)*

Through a public interest litigation, the Court mandated humane custodial standards for children, including access to health, education, and psychological well-being. It required regular judicial inspections of observation homes and established complaint mechanisms to prevent abuse. This landmark case institutionalized child-centric oversight and set early judicial standards for protecting children in custody, advancing the principle of dignity and humane treatment.

Comparative Jurisprudence (U.S. Supreme Court Cases):

4. Roper v. Simmons (2005): Abolished the juvenile death penalty, citing scientific findings on adolescent brain development and reduced culpability.

5. Graham v. Florida (2010): Prohibited life imprisonment without parole for juveniles in non-homicide cases, reinforcing rehabilitation over retribution.

6. Miller v. Alabama (2012): Limited mandatory life sentences for juveniles, requiring individualized sentencing that considers developmental factors.

Review of Articles

1. Casey, B. J., & Steinberg, L. (2024). **The role (and limits) of developmental neuroscience in informing justice policy.** *Policy Insights in the Behavioral and Brain Sciences, PMC.*– Discusses how neuroscience may inform legal solutions but explicitly cautions against the use of brain science in a determinative sense. Stresses the need to bring together scientific findings with other social and legal realities.¹⁰⁹⁷

2. Bazemore, G., & Umbreit, M. (2023). **Conceptualizing juvenile justice reform: Integrating the public health model with restorative justice.** *Children and Youth Services Review, ScienceDirect.*– Supports the integration

of restorative justice with public health to address immediate trauma and harm and support long-term reintegration of juveniles into the community. Demonstrates the efficacy of diversion and family-centered practices.¹⁰⁹⁸

3. Cohen, A. O., & Casey, B. J. (2022). **Adolescent brain science and juvenile justice reform.** *Frontiers in Neuroscience.*– Describes the ways that adolescent brain immaturity affects culpability and decision making. Calls for more developmentally appropriate sentencing and rehabilitation.¹⁰⁹⁹

4. Scott, E. S., & Steinberg, L. (2021). **Healthy adolescent development and the juvenile justice system.** *Wiley Interdisciplinary Reviews: Cognitive Science.*– Argues for the connections between healthy developmental environments and lower recidivism. Endorses the use of evidence informed interventions, such as mentoring, educational opportunities, and psychological care.¹¹⁰⁰

5. Sharma, R., & Khan, S. (2022). **Implementation challenges of the Juvenile Justice Act in India: A socio-legal perspective.** *LingCure Journal.*– Discusses systemic impediments in India, including untrained personnel, inadequate infrastructure, and inconsistent application of scientific measures in juvenile cases.¹¹⁰¹

6. Patel, V., & Dey, A. (2025). **Juvenile justice and child rights in India: A critical analysis of policy and practice.** *South Eastern European Journal of Public Health (SEEJPH).*– Discusses disjunctions in practice and law in India. Discusses the effect stigma has in addition to wider societal inclination for retribution which dilutes rehabilitative opportunities of the JJ Act.¹¹⁰²

¹⁰⁹⁷ B.J. Casey & Laurence Steinberg, *The Role (and Limits) of Developmental Neuroscience in Informing Justice Policy*, 11 *Pol’y Insights Behav. & Brain Sci.* (2024) (cautioning against neuro-determinism in legal sentencing).

¹⁰⁹⁸ Gordon Bazemore & Mark Umbreit, *Conceptualizing Juvenile Justice Reform: Integrating the Public Health Model with Restorative Justice*, 145 *Child. & Youth Servs. Rev.* (2023)

¹⁰⁹⁹ Alexandra O. Cohen & B.J. Casey, *Adolescent Brain Science and Juvenile Justice Reform*, 16 *Frontiers in Neuroscience* (2022).

¹¹⁰⁰ Elizabeth S. Scott & Laurence Steinberg, *Healthy Adolescent Development and the Juvenile Justice System*, 12 *Wiley Interdisciplinary Revs.: Cognitive Sci.* (2021)

¹¹⁰¹ R. Sharma & S. Khan, *Implementation Challenges of the Juvenile Justice Act in India: A Socio-Legal Perspective*, 6 *LingCure J.* (2022).

¹¹⁰² V. Patel & A. Dey, *Juvenile Justice and Child Rights in India: A Critical Analysis of Policy and Practice*, 13 *S. Se. Eur. J. Pub. Health* (2025)

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8. Steinberg, L, and Scott, E. (2019). **Adolescent brain development and juvenile justice.** Cambridge: Cambridge University Press. A foundational text exploring adolescent neuroscience and legal accountability. Argues that adolescents cannot be held to the same level of standards as adults because of underdeveloped maturity.¹¹⁰⁴

Statement of Problem

The statement of problem in this research is the clear divergence on scientific comprehension about brain maturation among adolescents and its implementation in action within India's juvenile justice. Rehabilitation being the underlying principle, J.J.(Care & Protection of Children) Act, 2015 is based on a child-centric approach and individual rehabilitation plan to ensure reintegration. But its day-to-day execution is often far from those best intentions. A significant number of juveniles engaged in delinquent behaviour are frequently confronted by retributive environments, procedural delays, inefficient psychological evaluating mechanisms and pervasive criminalisation bias. Not only do such practices dilute the intended legislative intent, but also they are prejudicial to rights and developmental potential of a child.

Neuroscience advancements show that adolescents are more susceptible to peer pressure, take greater risks and have less developed executive functioning. In the meantime, these characteristics also demonstrate their great potential for

rehabilitation and behavioral therapy. Indian court judgments, laws and institutional processes rarely employ or implement developmental science.

In this article, we explore the extent to which legal doctrine- culpability, age determination and rehabilitation philosophy- reflects our contemporary scientific understanding. It also identifies systemic problems like shortage of trained professionals, paucity of resources and deep rooted social norms prioritizing punishment over rehabilitation.

Finally, the study emphasizes the imperative need to align law, policy, and developmental science to create individualized, science-based mechanisms. The integration is crucial to providing genuine rehabilitation, sustainable reintegration, and effective protection of children's rights in the juvenile justice system.

Research Methodology

This is underpinned by a mixed method that incorporates the doctrinal, analytical and quantitative methods:

Online Data Collection: Pertinent materials, literatures, legal texts, case laws and policy documents were collected through Google Scholar, SCOPUS, Web of Science, ScienceDirect online databases and legal databases including SCC Online law reporter database as well as government and legislative websites for authenticity of most recent literature.

Research Design: Various doctrinal sources like the Juvenile Justice (Care and Protection of Children) Act, 2015; constitutional provisions; Supreme Court and High Courts' judgments were reviewed to study legal principles, procedural safeguards and institutional set-ups associated with juvenile justice.

Analytical Research: This research compared provisions of the statutes and reasons expressed in court opinions with what neuroscience studies tell us about brain development in adolescents. The analysis took into account reformative policies, leading cases and best practices from other jurisdictions in

¹¹⁰³ Nat'l Rsch. Council, *Reforming Juvenile Justice: A Developmental Approach* (Richard J. Bonnie et al. eds., 2013)

¹¹⁰⁴ Laurence Steinberg & Elizabeth Scott, *Adolescent Brain Development and Juvenile Justice* (2019)

overall identification of gaps and formulating evidence-based recommendations for reforms.

Quantitative research: Nowadays it is possible to retrieve statistical data on juvenile delinquency, recidivism and rehabilitation from governmental or international databases in providing empirical evidence that would be useful for policy evaluation recommendations.

Research Questions

1. How much less recidivism is achieved by traditional punishment versus a neuropsychology based juvenile justice system?
 2. What are the most effective neurobiologically informed evidence-based intervention in reducing recidivism?
 3. What has Norway, Germany and the Netherlands done to successfully adopt neuropsychological informed methods in their prisons and what were the contributing factors to these significant drop in recidivism?
 4. What are the barriers to implementation and systemic issues related to integrating neuropsychology-informed strategies into current juvenile justice systems?
 5. What is the potential for incorporating tools to assess neurobiological factors into juvenile justice decision making?
- b. To examine how what is known about adolescent brain development and neuropsychological functioning can be translated into statute, court decisions and rehabilitation programs.
 - c. To explore the efficacy and limitations of existing reformative policies and institutions (Juvenile Justice Boards, observation homes, aftercare services) in realizing individualized, evidence-based rehabilitation.
 - d. To draw attention to theoretical and practical obstacles that stand in the way of child-focused, science-informed approaches to juvenile justice.
 - e. To propose policy, and procedural changes for enhanced congruency between juvenile justice and state of the art knowledge about neuropsychology, child rights and public welfare.

Scheme of Study(Body)

Background: The Problem of Repeat Offending (Recidivism) Among Juveniles

Recidivism is defined as the tendency of a convicted criminal to re-offend, which remains a persistent challenge in juvenile justice system worldwide. and in jurisdictions that have primarily relied on punitive or traditional correctional approaches, recidivism rates can remain distressingly high sometimes even exceeding sixty percent among juveniles as demonstrated in the US within three years of release. In contrast , systems which have adopt a more rehabilitative, therapeutic or neuroscience informed approach have achieved remarkable reductions in repeat offenders. These notable differences demand a careful study, especially in the Indian context. A

Research Objectives

- a. To critically analyze the progress and present status of legal provision for children in conflict with law in India, vis à vis recent developments in neurosciences.

reformative rhetoric sometimes fails to translate into actual practice.

Comparative Statistical Analysis: Past (Punitive) vs. Neuroscience-Informed or Therapeutic Approaches

A. International Studies of Recidivism Rates

Country/System	Recidivism Rate	Time Period	Approach Type
Norway (Traditional)	25% (5 years)	5 years	Punitive
Norway (Rehabilitation)	18% (2 years)	2 years	Rehabilitation-focused
USA (Juvenile prisons)	60% (3 years)	3 years	Mixed
UK (Juvenile)	30–40% (1 year)	1 year	Mixed
India (Adults)	8.1% (repeat)	Annual	Punitive
India (Juveniles, est.)	40–50% (3 years)	3 years	Mixed

Key findings are:

- The rehabilitation focused approaches for example, in Norway¹¹⁰⁵ and selected US states¹¹⁰⁶ using MST and FFT have shown a substantial reduction in the amount of re-offenders.
- While in India, adult criminal recidivism is lower at 7 to 8%¹¹⁰⁷, repeat offending, among juveniles is estimated at 40 to 50% over a 3-year period, much higher than the formal statistics suggest, due to the underreporting and the gaps in following up.

Indian Data on Trends in Juvenile Recidivism

The official NCRB data suggest that the rate of reported juvenile crimes has decreased by approximately thirty percent from 2013(43,506)

to 2022(30,555), but this masks certain chronic issues, such as:

- In 2014, out of 48,230 juveniles arrested 2609 were repeat offenders and among adults. The rate is 7.8%
- Some studies focusing on lack of mentoring and follow up shows the recidivism rates as high as 40% in three years for juveniles released from the institutional care.

Neuropsychological and Science Based Interventions: What Works?

New approaches have been sparked. By the use of neuroscience in juvenile justice

1. Therapeutic, restorative and brain-based interventions in the US. Juvenile detention brain-based growth mindset therapies resulted in observable changes in the attitudes toward behavioural control and self-efficacy, as well as substantial knowledge improvements. The effectiveness was particularly notable for having a

¹¹⁰⁵ Yukhnenko et al. (2023), *The Lancet Psychiatry* (global review); Norwegian Ministry reports (post-reforms).

¹¹⁰⁶ Hunkin et al. (2025), *J. Amer. Acad. Child Adolesc. Psychiatry*; CSG Justice Center (2015 US highs).

¹¹⁰⁷ <https://ncrb.gov.in> data (2014: ~2,600 repeat offenders from 48,000 arrests = ~5% detected; studies est. 30-50% true rate over 3 years due to underreporting); *IJCRT* (2022 Kerala/All-India ~0.86-1% detected)

negative correlation with the number of prior detentions underscoring the importance of early intervention before ingredient criminal thinking takes hold.

2. Cognitive behavioural intervention (CBI), multiple studies have demonstrated that structured evidence based CBI can achieve meaningful, lasting reductions in residism. Especially when its applied in a developmentally sensitive family engaged manner.
3. Multi-systemic therapy(MST), it is proven to reduce re-arrest rates by 42% and out-of-home placements by 54% in high youth, youth outperforming conventional ways like probation , institutionalisation and conventional counseling.
4. Functional family therapy analysis of over 75 studies indicate substantially lower recidivism than probation or standard correctional interventions.
5. Mental health courts and problem-solving courts, these courts emphasise treatment and judicial oversight over punishment has achieved a 42% reduction in re-offending among participants. Particularly when targeting youth with substance abuse or mental health issues.
6. Restorative justice programs, studies show modest to moderate reductions in recidivism. Despite more conflicting evidence for 1st time offenders and those who participate in vacuum offender mediation, the results are more encouraging.

It should be highlighted that incarceration, based therapeutic communities have not been consistently effective in reducing recidivism among youth, particularly those suffering with substance use disorders.

Why Does Neuroscience-Informed Approaches Reduce Repeat Offending?

Developmental sensitivity interventions grounded in neuroscience, acknowledge the delayed maturation of adolescent brain especially in the regions of the brain, responsible for impulse control risk, assessment and emotional regulation. Making second chances developmentally appropriate, rather than merely charitable.

Behavioural change, mechanisms, programs such as MSD and CBI focus the rewiring of cognitive pathways and leveraging neuroplasticity to facilitate adaptive decision-making in brains. Empirical research highlights that every year of delayed incremental system entry for children correlates with an incremental reduction in the long-term offending.

Holistic family and community engagement. Studies indicate family and community-based interventions. When combined with individualised counselling and trauma-informed care makes the gold standard for reducing recidivism.

What can India learn from international models?

- Norway stands as the gold standard, with a 2 year recidivism rate of 18%. And a 5 year rate of 25% due to the relentless focus on rehabilitation, individualised case management and careful reintegration into the community.
- Germany and Netherlands have expanded the use of social therapeutic units in their juvenile justice method. However, Germany's data underscores mixed results If programs are not sufficiently individualised, or if there is a lack, a family or community continuity.
- US and UK, where speciality courts exist, evidence-based therapies and community mentoring are fully supported, recidivism is considerably lower than in punitive institutions, heavy

states (42% reductions in US's MST programs).

India: Progress, Gaps, and Barriers

Improvements were made to the juvenile justice act after 2015, strengthening procedural protections and placing more emphasis on the idea of A child in need of care and protection. Yet, the actual implementation remains inconsistent. The key challenges are:

- The lack of professional training for staff in neuroscience and trauma-informed practices.¹¹⁰⁸
- Overcrowding and lack of post-release monitoring with mentoring absent for 42% of released juveniles, this population sees a 40% recidivism within 3 years.¹¹⁰⁹
- Inadequacy in family engagement, the aftercare, vocational, and mental health support.¹¹¹⁰
- The continued association with criminalised peer groups due to ineffective institutional practices that can perpetuate cycles of offending rather than disrupting them.¹¹¹¹

Recommendations for future policies and their implementation

- Mandating, early neuroscience based intervention and individual risk needs assessment for all children entering the system even before criminal thinking becomes entrenched.
- Scale up proven programs such as MSD, FT and cognitive behavioural interventions with family and community engagement along with trauma support as code features
- Develop restorative victim, offender conferencing as a diversion for

nonviolent or first time offenders. Thus, protecting them from the risk of criminal network formation.

- Ensuring robust after-care mentoring, an education, vocational training as legal rights, not just as discretionary extras.
- Strengthen legal aid, identity documentation, and the social welfare integration for released youth.
- Invest in staff training, increased psychologist recruitment and drama informed care at the front lines.
- Monitor recidivism, an outcome with rigour by using periodic data collection and transparent publication.

There is a clear meta-analyzed consensus that integrating neuroscience, a neuro-psychology into juvenile justice dramatically, reduces the repeat offending, compared to traditional punitive methods. The world's lowest recidivism rates are achieved where youth justice systems invest in individualised treatment, while also prompting family and community reintegration, and informed neuroscience-based rehabilitation. India's best forward lies in embracing these empirically validated practices throughout both policy and daily implementation for a future in which children are seen and served as developing beings with immense potential for their growth and transformation rather than as irredeemable offenders.

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