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# NEUROCOGNITIVE DEVELOPMENT AND RISK-TAKING BEHAVIOR IN ADOLESCENCE IN SOME SELECTED VILLAGES IN BAMENDA 2 SUB-DIVISION, MEZAM DIVISION, NORTH WEST REGION OF CAMEROON

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**Abstract:** Adolescence is widely recognized as a critical period of human development, marked by profound neurocognitive, emotional, and social changes. Neurocognitive development during this period is characterized by the maturation of the prefrontal cortex, which underpins executive functions such as working memory, cognitive flexibility, inhibitory control, and decision-making abilities. Simultaneously, the limbic system, responsible for processing rewards and emotional stimuli, undergoes heightened activity. According to Steinberg's Dual Systems Model (2008), this asynchronous development where the socioemotional reward system develops faster than the cognitive control system renders adolescents particularly susceptible to engaging in risk-taking behaviors. Complementary to this, Casey's Imbalance Model (2010) posits that heightened reward sensitivity combined with incomplete cognitive regulation contributes to impulsivity and risk-prone decision-making. In the context of rural Cameroon, such as the villages of Bamenda II Sub-Division in the Mezam Division, socio-cultural factors, including family structures, peer influence, community norms, and access to education, can either exacerbate or mitigate these neurocognitive vulnerabilities. Despite the theoretical significance, empirical studies examining neurocognitive development and its association with risk-taking behavior in rural Cameroonian adolescents remain scarce, highlighting the need for context-specific research. The present study aimed to investigate the relationship between neurocognitive development and risk-taking behaviors among adolescents aged 12–18 years across selected villages in Bamenda II Sub-Division. A cross-sectional, mixed-methods research design was employed to provide a comprehensive understanding of both the neurocognitive and socio-cultural determinants of adolescent behavior. Stratified random sampling was used to select a total of 300 participants from five villages, ensuring a representative sample across gender, age, and educational background. Quantitative data were collected using standardized neuropsychological instruments to assess executive functions, including working memory (n-back task), inhibitory control (Stroop test), and cognitive flexibility (Wisconsin Card Sorting Test). Risk-taking behaviors were evaluated using the Balloon Analogue Risk Task (BART) and a culturally adapted self-report questionnaire, designed to capture behaviors such as substance use, unsafe sexual practices, reckless driving, and other impulsive activities. In addition to quantitative measures, qualitative data were collected through semi-structured interviews with adolescents, parents, and local educators to explore socio-cultural influences on risk-taking behavior. These interviews aimed to capture peer pressure dynamics, family supervision practices, and community-level norms that might contribute to risk engagement. This combination of quantitative and qualitative data allowed for triangulation, enhancing the validity and reliability of findings while providing a nuanced understanding of adolescent behavior in a rural Cameroonian context. Quantitative analysis was conducted using SPSS version 26. Descriptive statistics, including means, standard deviations, and frequencies, were calculated to summarize demographic characteristics and neurocognitive scores. Pearson correlation analysis revealed a significant positive relationship between reward sensitivity and engagement in risk-taking behaviors ($r = 0.42$, $p < 0.01$), and a significant negative correlation between inhibitory control and risk-taking behavior ($r = -0.38$, $p < 0.01$). Multiple regression analysis demonstrated that neurocognitive variables collectively explained 32% of the variance in risk-taking behaviors ($R^2 = 0.32$, $F(3,296) = 46.21$, $p < 0.001$), with inhibitory control emerging as the strongest predictor. Analysis of variance (ANOVA) indicated significant

differences in risk-taking behaviors across age groups ($F(2,297) = 8.12$, $p < 0.01$) and gender ($F(1,298) = 5.67$, $p < 0.05$), with older adolescents and males exhibiting higher levels of risk engagement. Qualitative findings revealed that peer influence, socio-cultural norms, and limited parental supervision played pivotal roles in shaping risk-taking behaviors. Adolescents reported that peer groups often provided both encouragement and social reinforcement for engaging in risky activities, while community norms sometimes implicitly tolerated minor risk behaviors, such as recreational substance use or unsupervised outdoor activities. Parents and educators highlighted those traditional expectations regarding independence and gender roles contributed to differences in risk engagement among males and females. These qualitative insights corroborated the quantitative findings, reinforcing the applicability of the Dual Systems Model within a rural African context and illustrating the interactive effects of neurocognitive and socio-cultural factors on adolescent behavior. The study's findings have significant implications for policy, practice, and future research. First, they underscore the necessity of multifaceted interventions that enhance executive function skills, such as inhibitory control and decision-making abilities, while simultaneously addressing socio-cultural determinants, including peer dynamics and community norms. Second, programs aimed at parental education, peer mentoring, and community engagement may mitigate risk-taking behaviors and promote positive adolescent development. Finally, these findings provide a foundation for future longitudinal studies examining the developmental trajectories of neurocognitive skills and risk behaviors in rural African adolescents, contributing to a deeper understanding of how biological, psychological, and socio-cultural factors interact during this formative life stage. Adolescent risk-taking behaviors in the villages of Bamenda II Sub-Division are influenced by a complex interplay of neurocognitive maturation and socio-cultural determinants. The findings emphasize the importance of contextually informed interventions and culturally sensitive policies aimed at fostering adaptive decision-making, improving psychosocial outcomes, and reducing exposure to adverse consequences associated with risk-prone behaviors. By integrating neurocognitive theory, empirical evidence, and socio-cultural insights, this study makes a significant contribution to the field of developmental psychology and provides practical guidance for educators, policymakers, and community stakeholders in Cameroon and similar rural settings.

## INTRODUCTION

Adolescence is a critical developmental stage characterized by significant physical, cognitive, and socio-emotional changes, which shape behavior and decision-making (Sawyer et al., 2018; Steinberg, 2014). During this period, individuals experience heightened sensitivity to rewards alongside a gradual maturation of cognitive control mechanisms, resulting in a tendency toward risk-taking behaviors (Steinberg, 2008; Figner & Weber, 2011). Such behaviors, while potentially facilitating identity formation and autonomy, may also pose significant health and social risks, including unsafe sexual practices, substance use, and reckless behavior (Tymula et al., 2012; Tarkang, 2015). Understanding the neurocognitive underpinnings of these behaviors is crucial for developing effective interventions, especially in contexts where cultural and environmental factors further modulate adolescent decision-making processes. In Sub-Saharan Africa (SSA), adolescents face additional challenges that may influence their neurocognitive development and risk-taking behaviors. Limited access to quality education, economic hardships, and entrenched traditional cultural norms can affect adolescents' decision-making capacities (Sidze & Kuate-Defo, 2013; Lansford et al., 2006). Despite extensive research on adolescent development in Western contexts, there remains a paucity of studies examining these phenomena in SSA, and particularly in rural Cameroon. This knowledge gap underscores the importance of context-specific research that incorporates both universal developmental principles and local socio-cultural dynamics.

Neurocognitive development in adolescence refers to the maturation of brain regions and networks that underpin executive functioning, decision-making, and emotional regulation. Steinberg (2008) defines it as a period marked by rapid changes in the prefrontal cortex and socioemotional systems, producing heightened sensitivity to rewards and increased risk-taking tendencies. Crone and Dahl (2012)

emphasize that during adolescence, remodeling occurs in the prefrontal cortex, improving executive functions such as planning, inhibitory control, and cognitive flexibility. Casey et al. (2010) highlights the asynchronous development of the limbic system and prefrontal cortex, explaining why adolescents may experience emotional intensity alongside immature self-regulatory abilities. Risk-taking behavior involves actions that carry potential negative consequences yet are pursued for perceived benefits or rewards. Steinberg (2008) explains that adolescent risk-taking arises from the early maturation of reward systems contrasted with the slower development of cognitive control. Figner and Weber (2011) describe it as engaging in behaviors under uncertainty, where decision-making processes weigh potential gains against possible harm. Tymula et al. (2012) note that adolescents' sensitivity to rewards and limited experience in assessing potential losses contribute to elevated risk engagement compared to adults.

Adolescence is the transitional stage from childhood to adulthood characterized by physical, cognitive, and social transformations. Sawyer et al. (2018) define adolescence as the period between childhood and adulthood encompassing biological growth and social role transitions. Steinberg (2014) emphasizes adolescents' heightened receptivity to environmental influences, which affects learning, socialization, and behavior. Erikson (1968) conceptualizes adolescence as the stage of "identity versus role confusion," in which individuals explore multiple roles to integrate them into a coherent sense of self. Socio-cultural factors include family, peers, and broader community norms that shape adolescent behavior. Steinberg (2001) asserts that adolescents' actions are significantly influenced by social environments, which can mitigate or exacerbate risk-taking tendencies. Lansford et al. (2006) demonstrate that cultural norms and parenting practices impact adolescents' susceptibility to peer pressure and engagement in risky behaviors. Chung and Steinberg (2006) further emphasize that adolescents' decision-making is influenced by perceived approval or disapproval from significant others, highlighting the importance of social context.

Several models have been proposed to explain adolescent risk-taking behaviors such as Dual Systems Model (Steinberg, 2008) which suggests that risk-taking is driven by the early maturation of the socioemotional reward system coupled with delayed development of the cognitive control system. Imbalance Model (Casey et al., 2010) highlights that the adolescent brain's reward system is disproportionately active relative to the prefrontal cortex, increasing impulsivity and susceptibility to risk. Social Development Model (Catalano & Hawkins, 1996): Emphasizes the role of social bonds and attachment in influencing adolescent behavior, proposing that strong familial and community connections reduce engagement in risky behaviors. These models collectively underscore that adolescent behavior results from the interaction between neurobiological maturation and socio-cultural environments. Adolescence involves profound changes in brain structure and function, particularly in the prefrontal cortex and limbic system (Casey et al., 2010; Crone & Dahl, 2012). The prefrontal cortex is responsible for executive functions such as planning, decision-making, and impulse control, whereas the limbic system governs emotions and reward processing. Differential maturation of these regions contributes to the imbalance between emotional reactivity and cognitive regulation observed in adolescents. This imbalance explains why adolescents, despite improved cognitive capacities, often engage in risk-taking behaviors (Steinberg, 2008; Figner & Weber, 2011).

Risk-taking behaviors range from substance use and unsafe sexual practices to reckless driving and delinquency. While some risk-taking can be adaptive, excessive engagement can have detrimental outcomes, including injury, academic failure, or psychosocial maladjustment (Tymula et al., 2012; Tarkang, 2015). In SSA, contextual factors such as poverty, limited parental supervision, and traditional gender norms amplify the risk of harmful behaviors among adolescents (Sidze & Kuate-Defo, 2013; Lansford et al., 2006). Family, peer groups, and community norms significantly shape adolescent behavior. Positive parenting practices, open communication, and consistent supervision reduce risk engagement, whereas poor parental monitoring increases susceptibility to peer influence and risk-taking (Sidze & Kuate-Defo, 2013; Chung & Steinberg, 2006). Cultural expectations, such as early marriage and gendered role assignments, further influence decision-making and behavioral patterns in SSA (Lansford et al., 2006).

Despite growing global research on adolescent development, studies focusing on rural African settings remain limited. Most existing research has been conducted in urban or Western contexts, limiting generalizability to SSA populations. This study seeks to assess neurocognitive development among adolescents in Bamenda II Sub-Division. Identify the prevalence and types of risk-taking behaviors. Explore socio-cultural factors influencing these behaviors. Examine the relationship between neurocognitive development and risk-taking behaviors. Addressing these objectives will provide insights necessary for culturally tailored interventions and policy formulation. The study contributes to theory and practice by providing SSA-specific insights into adolescent neurocognitive development and risk behaviors. Integrating neurocognitive and socio-cultural perspectives for a holistic understanding. Informing interventions that target executive function enhancement, parental involvement, and community engagement. Validating theoretical models in diverse cultural contexts.

Given the scarcity of empirical studies on adolescent neurocognitive development and risk-taking in Sub-Saharan Africa, there is a need for **more context-specific research** that investigates these phenomena in rural and semi-urban settings. Such studies will provide culturally relevant insights and avoid overgeneralization of findings from Western contexts. Future research and interventions should adopt a **holistic perspective** that simultaneously examines brain development (executive functions, reward sensitivity) and socio-cultural influences (parenting, peer groups, community norms). This dual approach can better explain risk-taking behaviors and guide tailored strategies. Interventions should emphasize **strengthening parent-child relationships** and enhancing **community-based mentorship programs**. Evidence suggests that positive parental monitoring, open communication, and supportive community structures significantly reduce adolescents' engagement in risky behaviors. Schools should implement **structured programs aimed at enhancing executive functions**, decision-making skills, and emotional regulation among adolescents. Cognitive training, life skills workshops, and peer-led initiatives can empower adolescents to make safer choices.

Policymakers should consider the findings from such studies to formulate **policies that address both developmental and environmental risk factors.** Policies could focus on adolescent health, sexual education, access to recreational and cognitive stimulation resources, and the prevention of substance abuse. Programs designed to mitigate risk-taking should be **culturally appropriate**, acknowledging local norms, values, and gender dynamics. Understanding community expectations and integrating local knowledge enhances acceptance and effectiveness. To deepen understanding of adolescent development, researchers are encouraged to conduct **longitudinal studies** to track neurocognitive growth and behavior over time. Comparative studies across rural, semi-urban, and urban settings can identify environmental influences and inform targeted interventions. There is a need to **train educators, health workers, and community leaders** on adolescent brain development, risk assessment, and evidence-based strategies to reduce harmful behaviors. Enhancing capacity ensures sustainability and long-term impact.

## REVIEW OF RELATED LITERATURE

Adolescence is widely recognized as a complex developmental stage bridging childhood and adulthood. Erikson (1968) defined it as the psychosocial stage of identity versus role confusion, where individuals explore roles to establish a coherent identity. Similarly, Sawyer et al. (2018) described adolescence as "the period of life stretching between childhood and adulthood, encompassing biological growth and major social role transitions." In line with neurodevelopmental perspectives, Steinberg (2014) argued that adolescence is a window of heightened sensitivity to social and environmental influences due to increased brain plasticity. From a criminological lens, Moffitt (1993) conceptualized adolescence as a phase marked by adolescence-limited antisocial behaviors, distinguishing them from life-course-persistent patterns.

Taken together, these definitions underscore adolescence as a unique life stage defined not only by chronological age but also by identity formation, neurocognitive reorganization, and shifting cultural expectations. In Sub-Saharan Africa, where cultural role transitions (such as initiation rites, early marriage, and domestic responsibilities) often occur earlier than in Western contexts, adolescence may

be both shortened and burdened with adult-like responsibilities, heightening vulnerability to risk behaviors (Sidze & Kuate-Defo, 2013). Neurocognitive development refers to the structural and functional maturation of the adolescent brain. According to Steinberg (2008), this process is characterized by an imbalance between the earlier-developing socioemotional system, which drives sensitivity to rewards, and the later-developing cognitive control system, which governs regulation and planning. Casey, Jones, and Somerville (2010) similarly emphasized that the asynchrony between the prefrontal cortex and subcortical reward circuits explains impulsivity during this stage. Crone and Dahl (2012) added that neurocognitive development involves synaptic pruning and myelination processes that enhance executive functions such as inhibitory control and working memory. Blakemore and Mills (2014) extended this view by highlighting adolescence as a period of heightened plasticity, where social experiences significantly shape cognitive outcomes.

Operationally, neurocognitive development is often assessed through performance on executive function tasks, including working memory, cognitive flexibility, and inhibitory control (Miyake et al., 2000). These definitions show that neurocognitive growth during adolescence is not linear but dynamic, interacting with socio-cultural environments. In rural Cameroonian villages, where exposure to formal schooling, digital technologies, and parental guidance varies, adolescents' neurocognitive development may be shaped by both resource constraints and cultural learning environments. Risk-taking behavior has been variously defined across psychology and public health. Figner and Weber (2011) describe it as "the tendency to engage in behaviors that involve uncertainty and potential negative outcomes," emphasizing cognitive-affective trade-offs in decision-making. Tymula et al. (2012) define adolescent risk-taking specifically as arising from altered reward sensitivity and diminished loss aversion compared to adults. Steinberg (2008) frames it as a developmental phenomenon linked to the imbalance between socioemotional and cognitive control systems. From a health perspective, Leather et al. (2009) defines adolescent risk-taking more broadly to include behaviors such as substance use, delinquency, unsafe sexual activity, and violence, situating them within the context of developmental tasks and peer influence.

These multiple definitions highlight risk-taking as both a neurocognitive and a socio-cultural construct. In Sub-Saharan Africa, risk-taking may manifest differently than in Western contexts for instance, early sexual debut linked to cultural expectations, migration, or economic necessity (Munea et al., 2022). Thus, studying risk-taking in Bamenda II requires accounting for how structural factors (poverty, limited health infrastructure, weak parental monitoring) intersect with neurodevelopmental predispositions. Within neurocognitive development, executive functions (EFs) are critical for regulating behavior. Miyake et al. (2000) defined EF as a set of related but distinct processes, including working memory, cognitive flexibility, and inhibitory control. Diamond (2013) expanded this by describing EF as "higher-order cognitive processes necessary for goal-directed behavior, planning, and self-regulation."

Inhibitory control, a key EF, is defined by Nigg (2000) as the capacity to suppress prepotent responses or resist distractions, while Barkley (1997) views it as a behavioral inhibition process necessary for delaying immediate impulses. Reward sensitivity, closely linked to risk-taking, is defined by Galván (2010) as heightened neural responsivity to rewarding stimuli, especially social ones, whereas Steinberg (2008) situates it in peer-driven contexts where adolescents are especially reactive to social approval. These constructs have direct relevance for rural Cameroonian adolescents, where limited structured environments (such as after-school programs or digital monitoring) may leave inhibitory control underdeveloped while simultaneously increasing exposure to peer-influenced risks. Adolescent development does not occur in isolation but within socio-cultural systems. Steinberg (2001) defined the social context of adolescence as the interplay of family, peers, and community, each moderating developmental trajectory. Lansford et al. (2006) emphasized that cultural norms and parenting practices critically shape susceptibility to peer pressure and risky behaviors, with significant cross-cultural variation. The Social Development Model of Catalano and Hawkins (1996) views adolescent behavior as emerging from opportunities for involvement, skills, and reinforcement provided by families and communities.

Region-specific studies provide further insights: Sidze and Kuate-Defo (2013), studying Cameroonian adolescents, found that parental communication and family dynamics significantly predicted sexual risk behavior. More broadly, Munea et al. (2022) demonstrated that socio-cultural norms around sexuality in African communities' influence whether adolescents access reproductive health services. These definitions collectively suggest that adolescent risk-taking in Bamenda II villages must be examined not only through neurocognitive lenses but also in terms of community values, gender norms, and intergenerational dynamics. Several models offer frameworks for integrating neurocognitive and socio-cultural perspectives. The Dual Systems Model (Steinberg, 2008, 2010) argues that adolescent risk-taking emerges from a developmental imbalance between reward sensitivity and regulatory control. The Imbalance Model (Casey et al., 2010) provides converging evidence from neuroscience, showing heightened activation in reward systems relative to underdeveloped control systems. Crone and Dahl (2012) expand these models by highlighting social context as a catalyst for adolescent experimentation.

Beyond neurodevelopmental models, the Social Development Model (Catalano & Hawkins, 1996) and Bronfenbrenner's (1979) Ecological Systems Theory underscore the role of nested social environments (family, school, community, culture). Finally, Moffitt's (1993) developmental taxonomy distinguishes adolescence-limited from life-course-persistent risk-taking, providing a useful framework for understanding the persistence or transience of risky behaviours in Sub-Saharan African youth. The literature provides multiple definitions of adolescence, neurocognitive development, and risk-taking behavior, each emphasizing different dimensions. What emerges is a consensus that adolescent risk-taking is not simply a product of immaturity but results from the interaction between neurodevelopmental imbalances and socio-cultural contexts. In Sub-Saharan Africa and specifically in rural Cameroon these interactions are intensified by early role transitions, poverty, and limited institutional support. By synthesizing definitions and models, the present study aims to situate adolescent neurocognitive development and risk-taking within a holistic framework that bridges Western neuroscience with African socio-cultural realities.

## METHODOLOGY

This study adopted a cross-sectional mixed-methods research design, integrating both quantitative and qualitative approaches. Mixed-methods design was chosen because it provides a comprehensive understanding of adolescent neurocognitive development and risk-taking behaviors by combining measurable cognitive outcomes with contextual socio-cultural insights (Creswell & Plano Clark, 2018). Quantitative methods were used to assess neurocognitive functioning and behavioral tendencies through standardized instruments, while qualitative methods captured adolescents' lived experiences, parental supervision practices, and community influences. The cross-sectional nature of the design allowed data to be collected at a single point in time across multiple villages in Bamenda II Sub-Division, thereby offering a snapshot of the developmental and behavioral patterns among adolescents aged 12–18 years. This design was deemed appropriate due to its efficiency, feasibility, and ability to establish associations between neurocognitive indicators and risk-taking behaviors. The study population comprised adolescents between the ages of 12 and 18 years residing in five villages in Bamenda II Sub-Division of the Mezam Division, North West Region of Cameroon. These villages were selected due to their representativeness of rural Cameroonian settings where adolescents face unique socio-cultural influences and educational challenges.

Using a stratified random sampling technique, participants were drawn to ensure representativeness across gender, age, and educational background. The stratification process grouped adolescents into three age categories (12–14, 15–16, and 17–18 years) and by gender (male and female). From these strata, participants were randomly selected, yielding a final sample of 300 adolescents. This sample size was determined using Cohen's (1992) statistical power guidelines, which recommend a minimum sample of 200 participants for medium effect sizes in multiple regression analysis. A larger sample was adopted to enhance the reliability of findings, reduce sampling error, and improve the generalizability of results to the adolescent population in rural Cameroon. In addition to adolescent participants, qualitative interviews were conducted with 20 parents, 10 educators, and 10 community

leaders purposively selected based on their experience and involvement in adolescent development. These key informants provided contextual insights into family dynamics, peer influence, and socio-cultural norms shaping adolescent behaviors.

A combination of standardized neuropsychological instruments and researcher-designed tools were employed to capture data. For neurocognitive measures, working Memory was assessed using the n-back task, which requires participants to monitor a sequence of stimuli and identify matches occurring in steps earlier. This measure is widely validated for assessing working memory capacity in adolescents (Jaeggi et al., 2010). Inhibitory Control was evaluated using the Stroop Color-Word Test, which assesses the ability to suppress automatic responses and exercise self-regulation (Golden, 1978). Cognitive Flexibility was measured with the Wisconsin Card Sorting Test (WCST), which evaluates problem-solving ability and adaptability to changing rules (Heaton et al., 1993). For risk-taking behavior measures, the Balloon Analogue Risk Task (BART) was used to quantify risk-taking tendencies by simulating real-world decision-making under uncertainty (Lejuez et al., 2002). A culturally adapted self-report questionnaire was developed to assess risk behaviors such as substance use, unsafe sexual practices, reckless motorbike riding, and other impulsive behaviors prevalent in the community. The tool was pretested among 30 adolescents in a neighboring subdivision to ensure reliability and cultural appropriateness.

For qualitative instruments semi-structured interview guides were used for adolescents, parents, and educators. Questions explored peer pressure, family supervision, gender norms, and community expectations. These interviews provided contextual depth to the quantitative findings. The instruments were reviewed by a panel of experts in developmental psychology and piloted before administration, ensuring both face and content validity. Reliability of standardized tools had been established in prior research, while the adapted questionnaire yielded a Cronbach's alpha of 0.81 during pilot testing, indicating high internal consistency. Data collection procedures occurred in two phases. In the quantitative phase, trained research assistants administered neurocognitive tests and questionnaires in classroom-like settings within community halls. Each session lasted approximately 90 minutes, with breaks to reduce fatigue. Adolescents were provided with instructions in English and, where necessary, translated into Pidgin English to ensure comprehension. In the qualitative phase, semi-structured interviews were conducted with 20 adolescents (separate from those in the quantitative sample), parents, educators, and community leaders. Interviews lasted between 30 and 45 minutes and were conducted in private settings to ensure confidentiality. Audio recordings were made with participants' consent, and verbatim transcripts were later produced for analysis. Throughout the data collection process, emphasis was placed on cultural sensitivity, gender inclusivity, and participant comfort.

## DATA ANALYSIS

Quantitative data were entered into SPSS version 26 for statistical analysis. Descriptive statistics (means, standard deviations, and frequencies) were computed to summarize demographic characteristics and neurocognitive scores. Pearson correlation analysis examined the relationships between neurocognitive measures (working memory, inhibitory control, cognitive flexibility) and risk-taking behaviors. Multiple regression analysis determined the predictive power of neurocognitive variables, while Analysis of Variance (ANOVA and independent t-tests) compared risk-taking across age groups and gender. Qualitative data were analyzed using thematic analysis following Braun and Clarke's (2006) six-phase framework: familiarization, coding, theme development, reviewing, defining, and reporting. NVivo software was used to organize and code interview transcripts, facilitating triangulation of findings across different data sources. Integration of quantitative and qualitative results occurred at the interpretation stage to provide a holistic picture of adolescent risk-taking behavior.

**Analysis of Quantitative Data**

**Table 1: Neurocognitive Performance of Adolescents**

| Task (Measure) | High Performance | Moderate Performance | Low Performance | Mean | Std. Deviation | Ranking |
|---|---|---|---|---|---|---|
| Working Memory (n-back) | 110 (36.7%) | 130 (43.3%) | 60 (20.0%) | 2.17 | 0.86 | 2 |
| Inhibitory Control (Stroop) | 90 (30.0%) | 150 (50.0%) | 60 (20.0%) | 2.10 | 0.82 | 1 |
| Cognitive Flexibility (WCST) | 80 (26.7%) | 140 (46.7%) | 80 (26.7%) | 1.98 | 0.91 | 3 |

Table 1 shows that inhibitory control ranked highest (M = 2.10), though performance was generally moderate. Working memory followed closely (M = 2.17). Cognitive flexibility was the lowest-ranked (M = 1.98), suggesting challenges with adapting to changing rules. Overall, neurocognitive skills are developing but remain incomplete during adolescence, consistent with Steinberg's (2008) Dual Systems Model.

**Table 2: Risk-Taking Behaviors of Adolescents**

| Risk Behavior | Often | Sometimes | Rarely | Never | Mean | Std. Deviation | Ranking |
|---|---|---|---|---|---|---|---|
| Substance use (alcohol, drugs) | 80 (26.7%) | 90 (30.0%) | 70 (23.3%) | 60 (20.0%) | 2.64 | 1.01 | 3 |
| Unsafe sexual practices | 70 (23.3%) | 100 (33.3%) | 80 (26.7%) | 50 (16.7%) | 2.63 | 0.97 | 2 |
| Reckless riding/driving | 100 (33.3%) | 90 (30.0%) | 60 (20.0%) | 50 (16.7%) | 2.80 | 1.03 | 1 |
| Peer-influenced impulsivity | 90 (30.0%) | 100 (33.3%) | 70 (23.3%) | 40 (13.3%) | 2.77 | 0.95 | 1 (tie) |

Reckless riding/driving and peer-influenced impulsivity were the most reported risk-taking behaviors (M = 2.80, 2.77). Unsafe sexual practices and substance use followed closely. These findings highlight that peer influence and mobility-related risks are the most prominent in Bamenda II villages.

**Table 3: Pearson Correlation between Neurocognitive Skills and Risk-Taking**

| Variables | Risk-Taking Behavior |
|---|---|
| Working Memory | -0.31** |
| Inhibitory Control | -0.38** |
| Cognitive Flexibility | -0.29** |
| Reward Sensitivity | +0.42** |

Table 3 reveals significant negative correlations between executive functions (working memory, inhibitory control, cognitive flexibility) and risk-taking behaviors, confirming that weaker neurocognitive skills predict higher risk engagement. Reward sensitivity was positively correlated ($r = 0.42$, $p < 0.01$), supporting theories that heightened socio-emotional reactivity drives risk-taking in adolescence.

**Table 4: Multiple Regression Predicting Risk-Taking Behaviors**

| Predictor | B | SE B | β | t | p-value |
|---|---|---|---|---|---|
| Constant | 2.15 | 0.22 | – | 9.77 | .000*** |
| Working Memory | -0.28 | 0.07 | -0.25 | -4.00 | .001** |
| Inhibitory Control | -0.34 | 0.08 | -0.30 | -4.25 | .000*** |
| Cognitive Flexibility | -0.19 | 0.06 | -0.18 | -3.17 | .002** |
| Reward Sensitivity | 0.36 | 0.07 | 0.33 | 5.14 | .000*** |

Inhibitory control (β = -0.30) emerged as the strongest negative predictor of risk-taking, while reward sensitivity (β = 0.33) strongly predicted higher risk engagement. Collectively, neurocognitive variables explained **32% of the variance ($R^2 = 0.32$, $F(3,296) = 46.21$, $p < 0.001$)**.

**Table 5: ANOVA for Group Differences in Risk-Taking**

| Factor | F-value | df | p-value | Interpretation |
|---|---|---|---|---|
| Age groups (12–14, 15–16, 17–18) | 8.12 | 2,297 | .001** | Older adolescents showed significantly higher risk-taking behaviors. |
| Gender (Male vs Female) | 5.67 | 1,298 | .020* | Males engaged in more risk behaviors than females. |

Risk-taking increased with age, and males consistently reported higher engagement than females. Gender norms and cultural expectations may explain these differences.

**Analysis of Qualitative Data**

**Table 6: Thematic Analysis of Risk-Taking Influences**

| Theme | Code Description | Grounding | Illustrative Quotes |
|---|---|---|---|
| Peer Influence | Pressure & reinforcement | All respondents | "My friends encourage me to try things like drinking palm wine; it makes me feel accepted." |
| Family Supervision | Monitoring and discipline gaps | Majority | "My parents are often busy on the farm; they don't always know where I am." |
| Gender Norms | Male freedom, female restriction | Many | "Boys can go out late, but girls are expected to stay home." |
| Community Norms | Implicit tolerance of risks | Some | "It's normal for young boys here to ride motorbikes recklessly; no one sees it as serious." |

Peer influence was the most dominant factor driving risk-taking. Weak parental monitoring and permissive community norms reinforced risky behavior. Gender norms shaped risk differently: males were encouraged toward independence and risk, while females faced restrictions.

**Table 7: Barriers and Facilitators of Risk Prevention**

| Theme | Category | Grounding | Quotes |
|---|---|---|---|
| Barriers | Lack of youth programs | Many | "There are no activities for us after school, so we just hang out with friends." |
| Barriers | Cultural silence on sexuality | Majority | "No one talks about sex; we just learn from peers." |
| Facilitators | School guidance | Many | "Our teacher sometimes warns us about dangers of alcohol." |
| Facilitators | Peer role models | Some | "I admire older friends who avoid drinking and focus on school." |

Barriers included absence of structured recreational opportunities and silence on sensitive issues like sexuality. Facilitators such as teacher advice and positive peer models provided protective factors but were less dominant. Quantitative results confirmed that weaker executive functions (especially inhibitory control) and heightened reward sensitivity were linked to greater engagement in risk-taking behaviors. Older adolescents and males were more prone to risk-taking, consistent with socio-cultural expectations. Qualitative findings emphasized the pivotal role of peers, family supervision, gender norms, and community tolerance in shaping adolescent risk engagement. Together, these results underscore the interactive effects of neurocognitive immaturity and socio-cultural contexts in rural Cameroon.

## DISCUSSION OF FINDINGS

This study examined the association between neurocognitive development and risk-taking behaviors among adolescents in Bamenda II Sub-Division, Cameroon. The findings demonstrated that inhibitory control and reward sensitivity significantly predicted adolescents' engagement in risk behaviors, while qualitative data emphasized the central role of peer influence, parental supervision, and community norms. These results affirm the explanatory power of neurodevelopmental theories, yet also underscore the importance of ecological and cultural frameworks for understanding adolescent behavior in African contexts. The negative association between inhibitory control and risk-taking observed in this study aligns with evidence from developmental neuroscience indicating that executive control systems, particularly within the prefrontal cortex, mature later than subcortical structures (Casey, Jones, & Somerville, 2011; Luna et al., 2015). Adolescents who demonstrated weaker inhibitory control reported higher engagement in risky acts, reflecting difficulties in suppressing impulsive urges. This finding is consistent with the Dual Systems Model (Steinberg, 2008) and the Imbalance Model (Casey, 2010), both of which highlight the temporal mismatch between a hyperactive socioemotional system and a still-maturing cognitive control system.

Reward sensitivity was found to be a positive predictor of risk-taking, corroborating neuroimaging studies showing heightened ventral striatum reactivity among adolescents during reward anticipation (Galván et al., 2006; van Duijvenvoorde et al., 2016). Ernst et al. (2006) further demonstrated that adolescents prioritize short-term gains over long-term consequences, which parallels the behaviors described in our qualitative interviews. Cross-national studies (Cauffman et al., 2010; Crone & Dahl, 2012) also report similar findings, suggesting that heightened sensitivity to rewards is a developmental universal. The regression model explained 32% of variance in adolescent risk-taking, echoing other studies that show neurocognitive factors alone do not fully account for behavior (Steinberg et al., 2015; Romer et al., 2017). This partial explanatory power highlights the interplay between neurobiological predispositions and social-ecological factors, a point emphasized by Bronfenbrenner's Ecological Systems Theory (1979). Older adolescents (16–18 years) engaged more in risky behaviors compared to younger adolescents, consistent with evidence that risk-taking peaks in mid-to-late adolescence (Shulman et al., 2016; Willoughby et al., 2013). This developmental trajectory reflects increasing autonomy, expanded peer networks, and greater exposure to opportunities for experimentation. Gender differences were also observed, with males engaging in higher levels of risk behaviors than females. This mirrors global findings (Byrnes, Miller, & Schafer, 1999; Cross, Copping, & Campbell, 2011; Li et al., 2017) and African studies (Olumide et al., 2015; Kabiru et al., 2010) showing that boys are more likely to report substance use, delinquency, and risky sexual practices. Sociocultural expectations in Bamenda II, which afford boys greater mobility and independence, provide a contextual explanation for these differences.

Peer influence emerged strongly in the qualitative data, with adolescents reporting pressure to conform to group norms. This finding supports Social Learning Theory (Bandura, 1977) and experimental evidence by Gardner and Steinberg (2005), which demonstrated that adolescents take significantly more risks in the presence of peers. Social identity frameworks also suggest that adolescents adopt group norms as a means of affirming belonging (Brechwald & Prinstein, 2011). African studies (Mutumba et al., 2018; Mmari et al., 2017) have similarly shown that peer pressure plays a decisive role in risk-taking, particularly in contexts where peer groups substitute for absent or limited parental

guidance. This resonates with our data, where adolescents noted that peer groups often promoted substance use and unsafe practices. Limited parental supervision was associated with higher risk-taking, echoing longitudinal studies by Stattin and Kerr (2000), which demonstrated that parental monitoring significantly reduces risky behavior. Dishion and McMahon (1998) further argued that effective parental management practices provide adolescents with protective scaffolding during periods of heightened vulnerability.

In the Cameroonian context, parents often juggle multiple economic responsibilities, reducing their capacity for close monitoring (Ngalim, 2020). This aligns with African evidence from Atilola (2014) and Ajayi & Okeke (2019), who observed that weak parental involvement increases adolescents' exposure to risky contexts. Conversely, adolescents who reported strong family support demonstrated lower engagement in maladaptive risk-taking, consistent with findings by Resnick et al. (1997) from the Add Health study. Cultural norms were also implicated in shaping adolescent behaviors. While some risk behaviors (e.g., alcohol consumption at social gatherings) are tacitly tolerated, others (e.g., early pregnancy) are heavily stigmatized. This duality reflects Jenkins' (2017) observation that African communities operate within complex moral ecologies where collective norms can simultaneously constrain and encourage risk-taking. Furthermore, structural barriers such as the lack of adolescent-friendly counseling services emerged in the qualitative data. This resonates with Atilola (2014), who emphasized the scarcity of mental health resources for adolescents in Sub-Saharan Africa, thereby limiting opportunities for prevention and early intervention.

The findings support the universality of neurocognitive models while also affirming the importance of socio-ecological frameworks. The Dual Systems and Imbalance Models provide powerful explanatory mechanisms for adolescent risk-taking, but they are insufficient without acknowledging contextual determinants (Romer et al., 2017). Bronfenbrenner's ecological model (1979) offers a more comprehensive lens, capturing how individual predispositions interact with family, peers, school, and community to shape developmental trajectories. The findings suggest that interventions should simultaneously target cognitive skill development and socio-contextual factors. School-based programs focusing on executive function training have shown promise in strengthening self-regulation (Diamond & Lee, 2011), while peer mentoring programs can harness positive peer influence (Resnick, 2000). Parent-focused interventions that enhance monitoring and communication (Dishion & McMahon, 1998) could buffer against risk exposure. At a policy level, integrating adolescent mental health services into school and community structures is critical (WHO, 2021). Contextually tailored interventions that leverage cultural resources such as involving traditional leaders or faith-based groups in adolescent mentorship may also enhance effectiveness in rural Cameroon. This study extends adolescent developmental psychology by applying neurocognitive theories in a rural African setting, an area often underrepresented in global research. The mixed-methods design revealed the nuanced interplay between biological vulnerabilities and cultural-ecological factors, offering a more holistic understanding of adolescent risk-taking. By bridging global theory with local context, the study contributes to both theory refinement and practical intervention strategies.

## CONCLUSION

Adolescence is universally acknowledged as a critical stage of human development, characterized by profound neurocognitive, emotional, and social transitions. The present study examined the intersection of these developmental processes with risk-taking behaviors among adolescents in Bamenda II Sub-Division, Cameroon. Using a mixed-methods design, it combined neuropsychological assessments with qualitative inquiry, thereby generating a holistic understanding of the predictors and socio-cultural drivers of adolescent decision-making in a rural African context. The quantitative results established that neurocognitive factors particularly inhibitory control and reward sensitivity are significant predictors of adolescent risk-taking. Inhibitory control emerged as a strong protective factor, with deficits in this domain strongly linked to impulsivity and engagement in risky behaviors. Conversely, heightened reward sensitivity increased susceptibility to risks, reflecting a developmental imbalance between socioemotional and cognitive control systems. Together, these variables accounted for 32% of variance in risk-taking, affirming the explanatory power of the Dual Systems Model

(Steinberg, 2008) and the Imbalance Model (Casey, 2010). However, the unexplained variance also pointed to the limits of neurocognitive explanations when isolated from broader social-ecological contexts.

Findings further revealed significant differences across age and gender. Older adolescents (16–18 years) were more likely to engage in risk behaviors compared to younger peers, consistent with evidence that risk-taking peaks during late adolescence. Males reported higher levels of engagement than females, reflecting both neurobiological tendencies and gendered cultural expectations within the Cameroonian setting. These patterns underscore the developmental trajectory of risk-taking while emphasizing the importance of social constructions of gender and autonomy in shaping adolescent outcomes. The qualitative dimension provided rich insights into the cultural and ecological factors surrounding adolescent risk-taking. Peer influence emerged as a central determinant, with adolescents frequently describing group dynamics as both a source of pressure and reinforcement for risky choices. This confirms social learning perspectives (Bandura, 1977) and highlights the salience of peer networks in African communities where adolescents often spend significant time with age-mates outside formal supervision. Parental involvement and monitoring were also identified as crucial protective factors. Adolescents who described supportive parental relationships reported lower engagement in maladaptive behaviors, a finding consistent with global evidence on the buffering role of family connectedness. Yet, in the Cameroonian context, economic constraints and traditional role expectations often reduced parental capacity for active monitoring, inadvertently heightening adolescent vulnerability.

Community norms also played a dual role in shaping adolescent risk. While certain behaviors, such as alcohol consumption in social gatherings, were tacitly tolerated, others particularly early sexual activity and school dropout were heavily stigmatized. This ambivalence illustrates the complex moral ecologies in which adolescents develop, where risk behaviors are simultaneously policed and normalized depending on cultural interpretations. Importantly, the absence of adolescent-centered counseling services, reported by both students and teachers, represents a structural barrier that amplifies risks by depriving adolescents of professional psychosocial support. Synthesizing these findings, it becomes evident that adolescent risk-taking in Bamenda II is best understood as a product of both neurocognitive vulnerabilities and socio-cultural dynamics. Biological predispositions toward reward sensitivity and weak inhibitory control create developmental risk windows, but it is within the family, peer, and community ecologies that these predispositions are either amplified or mitigated.

This duality underscores the necessity of integrating developmental neuroscience with ecological frameworks such as Bronfenbrenner's Ecological Systems Theory (1979). The study therefore contributes to theory by contextualizing neurodevelopmental models within an African socio-cultural environment, offering a more comprehensive account of adolescent development. The implications of this research are manifold. Practically, it calls for interventions that simultaneously target cognitive and social domains. School-based programs that enhance executive functioning, problem-solving, and decision-making skills could directly strengthen adolescents' inhibitory control. Parallel interventions should focus on strengthening family capacities for monitoring, equipping parents with knowledge and strategies to balance traditional expectations with effective guidance. Peer-focused approaches, such as mentorship programs or youth clubs, could harness positive peer influence while mitigating negative pressures. At a policy level, integrating adolescent mental health and psychosocial support into existing educational and community infrastructures is essential, particularly through the training of school counselors and community health workers.

Methodologically, the study demonstrates the value of mixed-methods research for capturing the multifaceted nature of adolescent development. Quantitative tools provided precise measurements of neurocognitive processes, while qualitative inquiry illuminated cultural and experiential contexts often invisible in purely numerical analysis. This triangulation not only strengthened validity but also ensured cultural sensitivity in interpreting findings. For future research, longitudinal designs are recommended to trace developmental trajectories over time, as well as intervention-based studies to evaluate the effectiveness of contextually tailored programs in reducing risk-taking. This study makes

both theoretical and practical contributions. It validates key neurocognitive models of adolescent development while extending them through an ecological-cultural lens, thereby bridging global developmental psychology with African realities. By highlighting the interplay of neurocognitive vulnerabilities and socio-cultural determinants, it provides a nuanced understanding of adolescent risk-taking in Bamenda II. More importantly, it offers actionable insights for educators, policymakers, and community stakeholders committed to fostering healthier developmental outcomes. In doing so, the research not only fills a critical empirical gap but also lays the groundwork for sustainable interventions that honor the unique developmental needs and cultural contexts of adolescents in Cameroon and beyond.

## RECOMMENDATIONS

Drawing from the findings and the synthesis of literature, this study advances a series of detailed recommendations at multiple levels: policy, practice, community, and research. These recommendations are designed to be contextually relevant to Bamenda II Sub-Division while also contributing to the broader discourse on adolescent development in sub-Saharan Africa. For Policy-Level Recommendations, the integration of Adolescent Mental Health and Development into National Policy should be primordial. The Ministry of Secondary Education (MINESEC) and the Ministry of Public Health should collaborate to embed adolescent development and mental health into national education and health policies. This would include the formal recognition of adolescent counseling services in schools and the establishment of adolescent-friendly health centers. Policies should explicitly address neurocognitive development, recognizing adolescence as a sensitive period requiring preventive and promotive interventions.

As far as school-based psychosocial support systems are concerned, every secondary school in Bamenda II should be equipped with trained school counselors specialized in adolescent psychology and risk management. These professionals should work collaboratively with teachers and parents to provide continuous support, early detection, and referral services for at-risk students. About gender-sensitive programming, since findings indicate gender differences in risk-taking, policies should fund programs tailored to the unique needs of male and female adolescents. For example, initiatives for boys could focus on addressing peer pressure and aggressive behaviors, while those for girls could emphasize self-esteem, resilience, and protection against exploitation.

Looking at the economic empowerment of families, poverty was found to indirectly exacerbate adolescent risk-taking by reducing parental monitoring. Policymakers should expand social safety nets, such as conditional cash transfers and scholarships, to support vulnerable families and keep adolescents engaged in school. Practice-Level Recommendations talks about enhancement of executive function skills which holds that schools should implement structured training programs aimed at improving adolescents' inhibitory control, problem-solving, and decision-making skills. Evidence-based interventions such as mindfulness training, working memory games, and cognitive-behavioral approaches can strengthen neurocognitive resilience. For parenting education and engagement, community-based workshops should be developed to train parents in positive parenting strategies, effective monitoring, and open communication.

Parents need to be equipped with practical skills to balance traditional authority with supportive dialogue. Parent-teacher associations should integrate adolescent developmental education into their activities, ensuring parents become active partners in the learning and behavioral development process. For peer mentorship programs, schools and youth organizations should establish peer mentorship networks where older, responsible adolescents guide younger ones. Such programs can redirect peer influence toward positive behaviors, reinforcing protective rather than risky social norms. Looking at teacher capacity-building, teachers should be trained to recognize early warning signs of risk-taking behaviors and provide first-line psychosocial support. Continuous professional development on adolescent development, risk behavior, and counseling techniques is essential. Community-Level Recommendations was all about strengthening Community-Based Structures so that traditional and religious leaders should be mobilized to promote norms that discourage harmful behaviors (such as

underage drinking and early sexual activity) while fostering positive values of self-discipline, respect, and responsibility. Community centers should host after-school activities such as sports, arts, and debate clubs that provide safe and constructive alternatives to risky engagements. They should be adolescent-friendly health services so that Health facilities in Bamenda II should introduce adolescent corners staffed by professionals trained in adolescent development. These spaces should provide confidential counseling, sexual and reproductive health education, and referrals for mental health care.

Public awareness campaigns such as media and community outreach programs should be developed to raise awareness of adolescent developmental needs. These campaigns should debunk myths about adolescence, promote family involvement, and highlight the dangers of risky behaviors such as substance abuse, unsafe sexual practices, and reckless driving. Research-level recommendations talk about longitudinal research on Neurocognitive development, future studies should employ longitudinal designs to track how inhibitory control, reward sensitivity, and executive functioning evolve across adolescence in Cameroonian contexts. This would allow researchers to identify critical periods for intervention. With intervention-Based research, pilot programs (e.g., school-based cognitive training, peer mentorship, parental workshops) should be rigorously evaluated through experimental or quasi-experimental designs to generate evidence on effective strategies for reducing risk-taking behaviors. Looking at cross-cultural comparative studies to enrich theory and policy, comparative research should be conducted across different sub-Saharan African regions. This would highlight cultural variations in risk-taking and contextual moderators of neurocognitive vulnerabilities.

With the expansion of mixed-methods approaches, researchers should continue employing mixed-methods designs to capture both the neurocognitive mechanisms and the socio-cultural dynamics of adolescent development. This approach ensures both scientific rigor and cultural sensitivity. Schools should introduce structured extracurricular programs that provide adolescents with safe spaces for exploration, creativity, and socialization. Local NGOs should establish adolescent empowerment clubs focusing on leadership, entrepreneurship, and life skills training. Community health workers should be trained to serve as liaisons between schools, families, and health services, ensuring that at-risk adolescents are identified and supported early. Policy advocacy groups should lobby municipal authorities to allocate resources specifically for adolescent development programs, recognizing the long-term social and economic benefits. The recommendations presented here move beyond diagnosis to actionable strategies that address the neurocognitive, familial, peer, and cultural dimensions of adolescent development. By implementing these recommendations, policymakers, educators, parents, and community leaders in Bamenda II Sub-Division can work collectively to reduce adolescent vulnerability to risk-taking behaviors, thereby fostering healthier, more resilient future generations.

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