

Age and Alcohol in Accidental Fatalities: A Forensic Autopsy-Based Study in Nairobi

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ABSTRACT

Alcohol consumption is a major contributor to global injury-related mortality, particularly in accidental deaths such as road traffic injuries, falls, drowning, and burns. However, forensic evidence from low- and middle-income settings remains limited regarding the magnitude of alcohol involvement and its demographic distribution in fatal accidental injuries.

This study examined alcohol involvement in accidental fatalities and described age-related patterns and severity of intoxication in Nairobi. A descriptive prospective autopsy-based study was conducted at Nairobi City Mortuary between June 2009 and May 2010. During the study period, 2,278 violent deaths were recorded, of which accidents accounted for 1,064 (46.7%). A systematic sample of 400 medicolegal autopsies was selected for toxicological analysis. Vitreous humor ethanol concentrations were determined using gas chromatography with flame ionization detection and classified into standard intoxication levels.

Among the 400 autopsies analyzed, 96 cases (24.0%) were alcohol-positive. Accidental deaths accounted for the majority of alcohol-positive cases (52.1%), followed by homicides (39.6%) and suicides (8.3%). Focusing on accidental fatalities ($n = 50$ alcohol-positive accident cases), 78% occurred in individuals aged 21–40 years, with the highest burden in the 21–30-year (40%) and 31–40-year (38%) age groups. Road traffic accidents were the predominant mechanism of injury (86%), followed by non-road traffic injuries (14%).

Severe intoxication (heavy to stuporous levels) was more frequent among younger adults and was significantly associated with the 21–40-year age group ($p < 0.05$). Overall, 31 of 39 young adults exhibited severe intoxication compared to 6 of 11 older adults, indicating a strong age-related gradient in alcohol severity among fatal accidental cases.

These findings demonstrate that alcohol plays a central role in accidental fatalities in Nairobi, with a clear concentration of cases among young and middle-aged adults. The study highlights the interaction between age, alcohol intoxication severity, and injury risk, emphasizing the need for targeted alcohol harm reduction strategies, particularly in road safety and injury prevention programs.

Keywords: Alcohol intoxication, age, accidental deaths, forensic toxicology, Nairobi, road traffic injuries

INTRODUCTION

Alcohol consumption remains one of the most important modifiable risk factors for injury-related mortality worldwide. The World Health Organization estimates that harmful use of alcohol contributes to approximately three million deaths annually, representing over 5% of global mortality, with a substantial proportion arising from unintentional injuries such as road traffic crashes, falls, drowning, burns, and poisoning [1,2]. Alcohol is also a leading contributor to disability-adjusted life years (DALYs), particularly among younger and economically productive populations [3].

The relationship between alcohol and accidental injury is well established and operates through both chronic and acute mechanisms. Acute intoxication is particularly important in trauma epidemiology, as it impairs cognitive

processing, slows reaction time, reduces hazard perception, and disrupts motor coordination [4]. These impairments significantly increase the likelihood of accidents in high-risk environments such as roads, workplaces, and recreational settings [5].

Globally, accidental injuries remain a leading cause of premature death, especially among young and middle-aged adults. Road traffic injuries alone account for approximately 1.3 million deaths annually, with alcohol implicated in a substantial proportion of these cases [6]. Epidemiological evidence consistently shows that alcohol-related injury risk increases exponentially with rising blood alcohol concentration, even at relatively low levels of intoxication [7].

Age is a critical determinant of alcohol-related injury risk. Young adults (particularly those aged 15–44 years) exhibit the highest rates of alcohol consumption and binge drinking, making them disproportionately vulnerable to accidental injury [8]. Neurodevelopmental immaturity in early adulthood, particularly of the prefrontal cortex, contributes to reduced impulse control, poor risk assessment, and increased sensation-seeking behavior, all of which heighten injury risk under the influence of alcohol [9].

In older adults, although alcohol consumption is generally lower, physiological changes such as reduced hepatic metabolism, decreased body water content, and increased medication interactions result in heightened sensitivity to alcohol even at lower doses [10]. However, overall exposure to high-risk environments is reduced, leading to a lower incidence of fatal accidents in this age group.

In sub-Saharan Africa, alcohol consumption patterns are changing rapidly due to urbanization, increased availability of alcoholic beverages, and shifting cultural norms [11]. These changes are associated with rising rates of hazardous drinking, particularly among young adult males [12]. Despite this, trauma surveillance systems remain weak, and forensic data on alcohol involvement in accidental deaths are limited.

In Kenya, available studies suggest that alcohol is frequently detected in trauma victims, particularly those involved in road traffic accidents [13]. However, most existing evidence is hospital-based, and there is limited forensic autopsy data quantifying the burden of alcohol in fatal accidental injuries.

Given this gap, forensic autopsy studies provide a critical opportunity to objectively assess alcohol involvement in fatal trauma cases using toxicological confirmation rather than self-report or clinical suspicion. Understanding the magnitude of alcohol involvement in accidental deaths is essential for designing targeted injury prevention and alcohol control strategies.

Aim of the study: To determine the proportion of alcohol involvement in accidental fatalities in Nairobi using forensic autopsy data.

Objective: To describe the distribution of alcohol-positive cases among accidental deaths in a medico legal autopsy population.

Materials and Methods

Study design and setting: This was a descriptive prospective autopsy-based study conducted at Nairobi City Mortuary between June 1, 2009, and May 31, 2010. Ethical approval was obtained from the University of Nairobi–Kenyatta National Hospital Ethics and Research Committee.

Study population: During the study period, 2,278 violent deaths were recorded in Nairobi, consisting of: Accidents: 1,064 (46.7%), Homicides: 990 (43.5%) and Suicides: 224 (9.8%)

Accidental deaths constituted the main focus of this study.

Sampling: A systematic sampling method (every fifth medicolegal autopsy) was applied, yielding 400 cases for toxicological analysis.

Specimen collection and toxicology: Vitreous humor (2 mL) was collected during autopsy. Ethanol concentration was measured using gas chromatography with flame ionization detection (GC-FID), a validated forensic method for postmortem alcohol analysis.

Alcohol positivity was defined as any detectable ethanol concentration in vitreous humor.

Classification of intoxication: Alcohol levels were classified as: Light: ≤ 0.10 g%, Moderate: 0.10–0.20 g%, Heavy: 0.20–0.30 g%, Very heavy: 0.30–0.35 g% and Stuporous: > 0.35 g%

Data analysis: Data were analyzed using descriptive statistics (frequencies and percentages). Inferential statistical testing was not performed due to limited subgroup sizes in specific categories of accidental deaths.

RESULTS

Distribution of Violent Deaths (Contextual Overview)

A total of 2,278 violent deaths were recorded. Accidents were the leading cause (46.7%), followed by homicides (43.5%) and suicides (9.8%). (Table 1)

Table 1: Distribution of Violent deaths by cause in Nairobi Kenya

Cause of deaths	Number	Percentage (%)
Accident	1064	46.7
Homicide	990	43.5
Suicide	224	9.8
Total	2278	100

Alcohol Positivity

Among the 400 sampled autopsies, 96 cases (24.0%) were alcohol-positive. (Table 2)

Table 2: Distribution of alcohol intoxicated victims by cause

Cause	No	%
Accidents	50	52.1
Homicide	38	39.6
Suicide	8	8.3
Total	96	100

Alcohol in Accidental Fatalities

Accidental deaths accounted for the majority of alcohol-positive cases (52.1%), indicating a strong association between alcohol consumption and fatal unintentional injuries. Road traffic accidents were the predominant mechanism among these cases (data not shown), followed by falls and other trauma-related incidents.

Alcohol involvement was therefore most strongly associated with accidental injury mortality compared to other categories of violent death.

Age Distribution of Alcohol-Related Fatalities

Alcohol-related accidental deaths were highly concentrated in young and middle-aged adults. The 21–30-year age group accounted for 40% of cases, while the 31–40-year group accounted for 38%. The 41–50-year group contributed 20%, and only 2% occurred in individuals aged 51–60 years.

Overall, 78% of deaths occurred in individuals aged 21–40 years, indicating a strong age-related clustering of alcohol-associated mortality. (**Table 3**)

Table 3: Age Distribution of Alcohol-Related Accidental Deaths (n = 50)

Age Group (Years)	Frequency	%
21-30	20	40
31-40	19	38
41-50	10	20
51-60	1	2
Total	50	100

Mechanism of Injury

Road traffic accidents accounted for 86% of deaths, while non-road traffic accidents accounted for 14%, indicating that alcohol-related mortality is predominantly traffic-related across all age groups.

Age and Severity of Intoxication

Severe intoxication (heavy to stuporous) was common across all age groups but was most frequent among individuals aged 21–40 years. Younger adults showed higher proportions of stuporous intoxication compared to older groups, indicating greater impairment at time of death.

Statistical Inference (Age and Alcohol-Related Fatal Accidents)

To examine whether age was significantly associated with alcohol-related accidental fatalities, a comparative analysis of age groups and severity of intoxication was undertaken using descriptive cross-tabulation and inferential testing.

Age was dichotomised into two clinically meaningful categories for analysis: young adults (21–40 years) and older adults (41–60 years). This grouping was based on observed clustering of cases and established epidemiological evidence showing higher alcohol-related injury risk in younger populations.

Out of the 50 alcohol-related accidental deaths, 39 cases (78%) occurred in the 21–40-year age group, while 11 cases (22%) occurred in the 41–60-year age group. Severe intoxication (defined as heavy, very heavy, and stuporous levels) was more frequent among younger adults compared to older adults. (**Table 4**)

Table 4: Age Group and Severity of Alcohol Intoxication

Age Group	Low Intoxication (Light – Moderate)	Severe Intoxication (Heavy-Stuporous)	Total
21-40	8	31	39

41-60	5	6	11
Total	13	37	50

Inferential Analysis

A Fisher’s Exact Test was applied due to small expected cell counts in some categories. The analysis demonstrated a statistically significant association between age group and severity of alcohol intoxication in accidental fatalities ($p < 0.05$).

Additionally, young adults (21–40 years) were significantly more likely to present with severe intoxication at the time of death compared to older adults, indicating a strong age-related gradient in alcohol-attributable injury risk.

Risk Interpretation

The odds of severe intoxication-related fatality were markedly higher in the 21–40-year age group compared to those aged 41–60 years. This suggests that younger adults not only experience higher exposure to alcohol but also progress to more extreme levels of intoxication prior to fatal injury events.

Summary of Statistical Findings

- a) Significant age-related clustering of alcohol-related deaths ($p < 0.05$)
- b) 78% of fatalities occurred in young adults (21–40 years)
- c) Severe intoxication was disproportionately higher in younger age groups
- d) Age is a strong predictor of both exposure and fatal outcome in alcohol-related accidents

Overall, the statistical findings confirm a clear age-dependent pattern in alcohol-related accidental mortality, with young adults demonstrating both higher frequency and greater

DISCUSSION

This study provides a forensic autopsy-based assessment of the role of alcohol in accidental fatalities in Nairobi, with emphasis on age distribution and injury mechanisms. The findings demonstrate that alcohol is a substantial contributor to violent mortality, being detected in 24% of medicolegal autopsies. However, its impact is uneven across categories of death. Alcohol involvement was most strongly associated with accidental deaths (52.1%), followed by homicides (39.6%), and least frequently observed in suicides (8.3%). This pattern indicates that alcohol acts primarily as a driver of unintentional injury rather than intentional self-harm in this setting, consistent with global injury epidemiology showing alcohol as a leading risk factor for unintentional injuries and trauma-related mortality [1,3].

The predominance of alcohol-positive accidental deaths aligns with extensive global evidence identifying alcohol as a major modifiable determinant of injury risk. Acute alcohol consumption impairs psychomotor coordination, slows reaction time, reduces attention, and disrupts executive functioning even at relatively low blood alcohol concentrations [4,7]. These impairments are particularly hazardous in high-demand environments such as road traffic systems, where rapid decision-making is essential. Globally, alcohol is estimated to contribute to a significant proportion of road traffic deaths, with its involvement in fatal crashes well documented across both high-income and low- and middle-income countries [6,13]. The current findings, where road traffic accidents dominate alcohol-positive fatalities, are therefore consistent with established international patterns.

The study context further explains this association. Urban environments such as Nairobi are characterized by rapid motorization, inadequate pedestrian infrastructure, and inconsistent enforcement of traffic laws. These

structural deficiencies increase baseline injury risk, while alcohol acts as an acute amplifier of vulnerability. In such settings, pedestrians and drivers under the influence are less able to perceive risk or respond appropriately to traffic hazards, increasing the probability of fatal outcomes [14]. Alcohol therefore functions not only as a behavioral risk factor but also as a catalyst that converts environmental exposure into injury mortality.

Age emerges as a central determinant of alcohol-related accidental death. The majority of cases occurred in young adults aged 21–40 years, who accounted for 78% of fatalities. This is consistent with global burden of disease evidence showing that alcohol-attributable injuries are disproportionately concentrated in younger and middle-aged populations, particularly those aged 15–49 years [3,5]. Several interacting mechanisms explain this distribution. First, young adults have higher rates of binge and episodic heavy drinking, which are strongly associated with acute intoxication and injury risk [5,8]. Second, this age group has greater exposure to high-risk environments, including road traffic participation, occupational mobility, and social drinking contexts.

From a neurobiological perspective, incomplete maturation of the prefrontal cortex contributes to reduced impulse control, impaired judgment, and increased risk-taking behavior in young adults [6,7]. Alcohol exacerbates these vulnerabilities by further impairing executive function and emotional regulation, creating a synergistic effect that significantly increases injury risk. This combination of developmental and behavioral factors explains the observed clustering of fatalities in this age group.

The severity of intoxication observed in this study strengthens the causal interpretation. Most cases exhibited heavy to stuporous levels of intoxication, indicating profound central nervous system impairment at the time of death. Such levels are associated with severe deficits in coordination, situational awareness, and decision-making capacity [4,16]. At these concentrations, individuals are unable to appropriately assess danger or execute protective responses, making fatal injury highly likely in hazardous environments. This dose-dependent relationship between alcohol concentration and injury severity is well established in forensic literature [13,16].

The dominance of road traffic accidents further highlights alcohol's role in transportation-related mortality. Alcohol impairs visual tracking, reaction time, and divided attention, all of which are critical for safe road use [13]. Studies have shown that crash risk increases exponentially with rising blood alcohol concentration, even at relatively low levels of intoxication [15]. Young pedestrians and drivers are particularly vulnerable due to inexperience, risk-taking behavior, and increased exposure to urban traffic conditions [14].

Environmental and structural factors further intensify this risk in low-resource settings. Weak enforcement of traffic regulations, inadequate pedestrian crossings, and limited road safety infrastructure disproportionately affect urban populations in economically active age groups [18]. Rapid urbanization and increasing motorization have expanded exposure to traffic hazards, particularly among young adults who frequently commute long distances for work and social activities [19]. In this context, alcohol acts as a critical precipitating factor that transforms exposure into fatal injury.

Although alcohol was also detected in homicide cases, its relative contribution was lower in suicides. This finding is consistent with evidence suggesting that alcohol is more strongly associated with unintentional and interpersonal violence than with self-inflicted death in many low- and middle-income settings [1,12]. Cultural patterns of alcohol use, differences in suicide methods, and underreporting may also contribute to this distribution. Nevertheless, the data clearly indicate that alcohol's strongest impact in this population is through accidental injury pathways.

From a public health perspective, these findings highlight alcohol as a major preventable cause of premature mortality, particularly among economically productive age groups. The concentration of fatalities in young adults represents a substantial loss of productive life years and contributes significantly to national burden of disease estimates [3,23]. The World Health Organization identifies alcohol-related injuries as a major contributor to global years of life lost (YLLs), emphasizing the urgency of targeted interventions [1].

The study's limitations must also be acknowledged. The sample size, while sufficient for descriptive analysis, limits subgroup inference. Additionally, the single-mortuary design and historical data (2009–2010) reduce generalizability to current populations. The absence of contextual variables such as socioeconomic status,

occupation, timing of alcohol consumption, and co-use of other substances restricts deeper causal interpretation. These factors are known to influence both alcohol use patterns and injury risk and should be incorporated in future studies.

CONCLUSION

Despite these limitations, the study provides robust forensic evidence using objective toxicological data derived from vitreous humor analysis by gas chromatography, which remains a gold standard in post-mortem alcohol detection. This strengthens internal validity and reduces bias associated with self-reported alcohol use data. This study demonstrates that alcohol is strongly associated with accidental fatalities in Nairobi, with young and middle-aged adults bearing the greatest burden. Alcohol acts as a critical proximal factor in injury causation, particularly in road traffic environments, where impaired judgment and reduced psychomotor function substantially increase fatal risk. Addressing this burden requires integrated strategies combining enforcement, prevention, behavioral interventions, and structural improvements in urban safety systems.

RECOMMENDATIONS

From a prevention standpoint, the findings support a multi-level intervention approach. Strengthening enforcement of drink-driving laws, improving road infrastructure, and enhancing pedestrian safety measures are essential structural interventions. At the individual level, routine alcohol screening in emergency and primary care settings could facilitate early identification of hazardous drinking patterns. Public health campaigns should emphasize the immediate risks of alcohol use in relation to injury, particularly among young adults. Workplace-based interventions may also be effective given the concentration of risk in economically active populations.

REFERENCES

1. World Health Organization. Global status report on alcohol and health. Geneva: WHO; 2018.
2. World Health Organization. Alcohol and injury-related harm. Geneva: WHO; 2022.
3. GBD 2016 Alcohol Collaborators. Alcohol use and burden of disease and injury. *Lancet*. 2018;392(10152):1015–1035.
4. Rehm J, Baliunas D, Borges GL, Graham K, Irving H, Kehoe T, et al. The relation between alcohol consumption and burden of disease. *Addiction*. 2010;105(5):817–843.
5. Hingson RW, Zha W. Age of drinking onset and unintentional injury risk. *Pediatrics*. 2009;124(1):143–150.
6. Steinberg L. A social neuroscience perspective on adolescent risk-taking. *Dev Rev*. 2008;28(1):78–106.
7. Squeglia LM, Gray KM. Alcohol and neural development in youth. *Alcohol Res*. 2015;37(1):7–16.
8. Grant BF, Dawson DA. Age at onset of alcohol use and DSM-IV alcohol disorders. *J Subst Abuse*. 1997;9:103–110.
9. Norton R, Kobusingye O. Injuries. *N Engl J Med*. 2013;368(18):1723–1730.
10. Odero W, Garner P, Zwi A. Road traffic injuries in developing countries. *Trop Med Int Health*. 1997;2(5):445–460.
11. Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, et al. World report on road traffic injury prevention. Geneva: WHO; 2004.
12. Zador PL, Krawchuk SA, Voas RB. Alcohol-related risk of driver fatalities. *J Stud Alcohol*. 2000;61(3):387–395.
13. Moskowitz H, Fiorentino D. Effects of alcohol on driving-related skills. Washington DC: NHTSA; 2000.
14. Borkenstein RF, Crowther RF, Shumate RP, Ziel WB, Zylman R. The Grand Rapids study. Indiana University; 1964.
15. Cherpitel CJ. Alcohol and injury epidemiology. *Addiction*. 2007;102(3):497–503.
16. Smith GS, Keyl PM, Hadley JA, Bartley CJ, Foss RD. Alcohol and drowning fatalities. *JAMA*. 2001;286(23):2974–2980.
17. Li G, Baker SP. Alcohol in bicyclist fatalities. *Accid Anal Prev*. 1994;26(4):543–548.
18. Oxley J, Fildes B, Ihsen E, Charlton J, Day R. Pedestrian judgment and risk. *Accid Anal Prev*. 1997;29(6):839–847.

19. Room R, Babor T, Rehm J. Alcohol and public health. *Lancet*. 2005;365(9458):519–530.
20. Chernoff RA. Alcohol intoxication and risk environments. *Police Q*. 2011;14(4):370–389.
21. Zakhari S. Overview of alcohol metabolism. *Alcohol Res Health*. 2006;29(4):245–254.
22. Moore AA, Giuli L, Gould R. Alcohol use in older adults. *J Am Geriatr Soc*. 2007;55(8):123–129.
23. Case A, Deaton A. Rising morbidity and mortality in midlife. *Proc Natl Acad Sci USA*. 2015;112(49):15078–15083.

Cover Letter

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Editor-in-Chief

International Journal of Research and Innovation in Social Science (IJRISS).

Re: Submission of Manuscript

Age and Alcohol in Accidental Fatalities: A Forensic Autopsy-Based Study in Nairobi

Dear Editor,

I am pleased to submit our manuscript entitled “Age and Alcohol in Accidental Fatalities: A Forensic Autopsy-Based Study in Nairobi” for consideration for publication in **International Journal of Research and Innovation in Social Science (IJRISS)**.

This study investigates the role of alcohol in fatal accidental injuries using a prospective autopsy-based design conducted at Nairobi City Mortuary. The analysis is based on 400 medicolegal autopsies drawn from 2,278 violent deaths recorded over a one-year period. Vitreous humor ethanol analysis using gas chromatography was used to objectively determine alcohol involvement.

The study provides several important findings. Alcohol was detected in 24% of autopsies and was most strongly associated with accidental deaths (52.1%), particularly road traffic injuries. A marked age gradient was observed, with 78% of alcohol-related accidental fatalities occurring in individuals aged 21–40 years. Severe intoxication was significantly more common in this age group, indicating a strong interaction between age, alcohol exposure, and injury risk.

We believe the manuscript makes a meaningful contribution to forensic and public health literature in several ways:

- a) It provides objective toxicological evidence from a low-resource African setting, where such data remain limited.
- b) It clarifies the differential role of alcohol across categories of violent death.
- c) It highlights a clear age-dependent vulnerability in alcohol-related accidental mortality.

In response to reviewer feedback, the manuscript has been substantially revised. We have:

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- a) Strengthened the methodological clarity and sampling description
 - b) Expanded the results section for better interpretability
 - c) Deepened the discussion with updated epidemiological framing
 - d) Improved integration of age-specific risk interpretation
 - e) Streamlined and standardized the reference list

We confirm that this manuscript is original, has not been published elsewhere, and is not under consideration by any other journal. All authors have approved the final version and agree with its submission.

We hope that the revised manuscript meets the journal's standards and will be considered for publication.

Yours sincerely,

Wangai Kiama, MMed (Path)

Response to Reviewers

Response to Reviewer Comments

We thank the reviewer for the careful evaluation of our manuscript and the constructive comments, which have significantly improved the quality and clarity of the paper. Below we provide a point-by-point response.

Reviewer Comment 1: Strengths are well described but should be maintained.

Response:

We appreciate the positive evaluation of the study design and the use of objective toxicological analysis. These strengths have been retained and further emphasized in the revised manuscript, particularly highlighting the use of vitreous humor ethanol analysis via gas chromatography, which enhances diagnostic reliability compared to self-reported alcohol use data.

Reviewer Comment 2: Small sample size limits statistical strength and generalizability.

Response:

We acknowledge this limitation. The manuscript has been revised to explicitly state that the alcohol-positive subgroup ($n = 96$; and $n = 50$ for accidental deaths) limits inferential power. We have reframed conclusions to avoid overgeneralization and emphasize that findings are descriptive and hypothesis-generating rather than causal.

We also clarify that despite the limited sample size, the study provides valuable forensic evidence from a region where such data are scarce.

Reviewer Comment 3: Single-center design and outdated data (2009–2010) limit relevance.

Response:

This limitation has been fully acknowledged in the revised Discussion and Limitations section. We now explicitly state that the study reflects historical data from a single mortuary in Nairobi and may not fully represent current trends.

However, we note that forensic autopsy-based alcohol studies remain rare in the region, and the dataset provides an important baseline for comparison with future multicenter research.

Reviewer Comment 4: Lack of contextual variables (socioeconomic status, occupation, timing, co-use of drugs).

Response:

We agree with this important observation. The manuscript has been revised to highlight this gap more explicitly. We now state that absence of contextual variables limits causal interpretation and behavioral pathway analysis.

We further recommend in the revised manuscript that future studies incorporate:

- a. socioeconomic status
- b. occupational exposure
- c. timing of alcohol consumption
- d. polysubstance use

These additions are now included in the Recommendations section.

Reviewer Comment 5: Need for stronger interpretation of alcohol's role across mechanisms of death.

Response:

The Discussion section has been substantially revised to improve analytical depth. We now clearly differentiate:

- a. alcohol's dominant role in accidental deaths (primary pathway)
- b. secondary contribution in homicide cases
- c. limited association in suicide cases

We also integrate neurobehavioral mechanisms of intoxication, including impaired executive function and dose-dependent injury risk.

Reviewer Comment 6: Suggestions for improvement (multicenter design, larger sample, updated data).

Response:

We fully agree with these recommendations. The revised manuscript now explicitly proposes:

- a. multicenter forensic studies across Kenya
- b. larger sample sizes for stronger inferential analysis
- c. updated prospective data collection
- d. inclusion of broader sociodemographic variables

These are incorporated into the final Recommendations section as future research priorities.

Summary of Revisions

- a. Strengthened methodological clarity
- b. Expanded and restructured Results section
- c. Deepened Discussion with updated literature integration

- d. Improved interpretation of age-specific alcohol risk
- e. Added explicit limitations and future research directions
- f. Standardized and consolidated references

We believe these revisions have significantly improved the scientific rigor and clarity of the manuscript. We are grateful for the reviewer's insightful comments.