



Prevalence of Injuries among High School Students in Kieni West (District) in Nyeri County, Central Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. Author PNW designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors JN and EG managed the literature searches, while author JTM managed the Statistical analyses of the study while author EM managed the literature review and corroborated the discussion section. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2014/9760

Editor(s):

(1) Leszek Labeledzki, Institute of Technology and Life Sciences, Kujawsko-Pomorski Research Centre, Poland.

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(4) Anonymous, Centre for Injury Prevention and Community Safety, Tanzania.

Complete Peer review History: <http://www.sciencedomain.org/review-history.php?iid=712&id=22&aid=6488>

Original Research Article

Received 27th February 2014

Accepted 26th August 2014

Published 10th October 2014

ABSTRACT

Background: Injury among high school students has received disproportionately little attention as a public health concern in Kenya.

Objective: To establish the prevalence of injuries occurring among high school students in Kieni West District, Nyeri County, Central Kenya.

Methods: A Cross sectional study design was adopted where stratified random samples were recruited disproportionately to ensure adequate representation of most of segments of student population. Data was collected from 498 students (n = 294) girls and (n = 204) boys who were

systematically randomly sampled from 83 classes from all ten schools in Kieni West district. Participants were asked about injuries they had sustained in the preceding 6 months. The injuries were coded using classification methods derived from International Classification of External Causes of Injuries (ICECI). The existing healthcare facilities and health records in the schools were examined and the principals of the schools were interviewed.

Results: A total of 1490 injuries had occurred among the 498 respondents. Boys had higher mean number of injuries per student (3.39 ± 0.65 n = 204) than the girls' (2.72 ± 0.46 , n = 294), a difference that was statistically significant ($t=12.7$, $P<0.05$, $df= 496$). The leading causes of injury were falls (31%) and sporting activities (29%). Falls were more common among girls (32%) than among boys and were mainly attributed to slipping and tripping. Boys sustained most of their injuries from sporting activities (32%) particularly from the more impulsive contact sporting activities. However the cause of injury was independent of the gender of the respondents ($\chi^2 = 0.05$; $P>0.05$; $df = 4$)

Conclusion: Injury is a major but largely neglected contributor of disease burden among high school students in Kenya. The leading causes of these injuries- falls and sporting activities- are all preventable. It is important that effective interventions are developed, implemented and sustained to minimize the impact of injury among students. It is further suggested that safety management in schools should be re-evaluated in a bid to improve safety management status in schools.

Keywords: Student; fall; injury; healthcare; preventable.

1. INTRODUCTION

Healthcare problems in Low and Middle Income Countries (LMIC) are multifaceted and result from a combination of factors among them being injury which causes disease [1]. Accidents are the most preventable of the major causes of death and disability among the young and the middle aged who have many healthy and productive years ahead of them [2]. However, Injuries and deaths by all causes are in the increase in LMIC [3]. According to the WHO Global Health Estimates of 2013, injuries were the third broad cause of death in the Low and Middle Income Countries (LIC) in year 2011[4].

Most of the injuries among students are minor, so healing takes place rapidly without residual disfigurement or disability. However, superficial scarring as in 2nd or 3rd degree burns and in lacerations that may lead to skeletal deformity are likely common outcomes. Injuries on the central or peripheral nervous systems, though rare, may have grave neurological outcomes such as neuropsychiatric variations in memory, attention, language, personality changes and even permanent paralysis. For every person who dies through an injury, several others live on with varying degrees of disability [5].

Injury in LMIC is not recognized as a major public health issue by the local authorities due to lack of robust data on injury burden. This inhibits the development of effective preventive strategies for injury prevention [6]. In Kenya, substantial documentation has been done in the field of

sports related injuries [7,8,9] and on Road Traffic Accidents [10,11,12,13] but not as much has been accomplished in injuries occurring in learning institutions. Other areas along which documentation of injuries has been observed are Corporal Punishment and Human Rights [14] and Schools' unrests [15].

There are about 6300 high schools in Kenya with a total student population of 1.8m [16]. Traditionally, these schools are classified as private or public, boarding or day schools; and mono-sex and mixed. There exist risks of injury at school since students undertake various physical activities such as sporting, laboratory and workshop [17].

To the best of the researchers' knowledge, no studies have investigated on the prevalence of injuries among students in high schools in Central Kenya. The aim of this paper is to report on the prevalence and causes of injuries among high school students in a rural area in Central Kenya.

2. METHODS

A cross-sectional survey was conducted in the month of September 2010 in the ten schools in the present Kieni west district. The study area though purposively chosen was ideal since it had six different types of high schools namely the Mixed and Single sex, Day and Boarding, Private and Public schools that represent the main school categories in Kenya.

2.1 Ethics and Consent

Approval for this work was obtained from the Board of Post Graduate Studies, School of Pure and Applied Sciences, Kenyatta University, Kenya. Research permit was sought from the Ministry of Education and Central Province Provincial Education office and from the Heads of the participating schools. Consent to access data from students was sought from the schools' authority, and every class was briefed on the research details before commencement to the data collection. Informed consent was sought from the potential participants before the onset of the data collection, with emphasis being laid that the right to participate or withdraw in the study was entirely theirs. The views of the principals who refused access to their schools and the students who declined to participate were respected and exempted from the research.

2.2 Sampling and Data Collection Method

Samples were recruited from each school based on students' levels (forms/grade), class, gender and category of school. So as to get a great degree of representation of all students, the students' population in every school was divided into four strata with each stratum consisting of the level of the respondents in the schools. Each stratum formed a sampling frame from which six students were selected [18]. In case the school was mixed (had both boys and girls) each stratum was further divided into two substrata, one for the boys and the other for the girls. Each substratum formed a sampling frame from where three boys and three girls were respectively selected per class. The selection of the respondents was done using the small tables of random digits with the class list of the students providing the elements of the population. The respondents completed self-administered questionnaires and were guided through an interview on retrospective case analysis to elicit more information within the stipulated time. The completed questionnaires were coded to provide anonymity of the participants to the authors. The injury sites in the body were classified as Arm: Hand which included the wrist, hands and fingers; Leg: which included the foot and ankle; Head: which included the scalp, face and eyes; and others which included those unspecified parts of the body surface that had not been included above [19].

The questionnaires were reviewed to assign the cause using (ICECI) Version 1.2 of July 2004,

and site of injury using Lund and Browder Chart and the Rule of Nine Chart [19]. An injury was defined as a physical damage done to a person or part of his body [20]. It must have occurred at school or when in a school outing, required a medical or student attention and resulted in restriction in an activity. Injury recurrences were taken as two injury reports. The school principals (heads of high schools), nurses and matrons where present were purposively selected, interviewed and asked to provide the register in which they kept information on accidental injuries.

2.3 Study Setting

The data presented in this paper was collected from 204 boys and 294 girls from ten high schools in the study area (0 23'S, 36 56'E) in Central Province, Kenya. The age of the respondents was between 14 and 19 years and the entire student population was 2675, where 1373 were girls. Due to unequal numbers of boys and girls students in the study population, disproportional stratified random sampling was carried out to ensure equitable representation of all respondents. The study area though expanse (546 km²) had 13 high schools, 10 of which were purposively chosen.

2.4 Data Analysis

Data analysis was carried out using SPSS version 14 for descriptive and inferential statistical analysis. Descriptive statistics were tabulated using numbers (n), proportions (%) or mean \pm SD, as appropriate. The parts of the body injured were grouped in 5 categories as (1) legs (upper leg, lower leg, foot, toe) (2) head (face- eyeball, ear, mouth) (3) arms (elbow, lower arm, upper arm), (4) hands (wrist, palm, upper hand, fingers) and (5) others (internal body parts, upper and lower trunk, pubic region, neck, or any other part the respondent could not fit in categories 1-4). The statistical analyses performed included the t-test for means comparison, χ^2 analysis in testing the extent of relationship among variables with 95% levels of confidence and the levels of significance for all statistical tests was $\alpha < .05$. Estimated numbers of injuries were rounded to the nearest unit.

3. RESULTS

Among the student population of 1373 girls and 1302 boys, 294 girls and 204 boys participated in the study. Twenty two out of 294 girls (7.5%) and

27 out of 204 boys (13.2%) declined to take part in the study. The corresponding response rate was 90.2%. However, those who declined to participate were replaced with others who were equally randomly selected. None of the principals from the 10 schools declined to participate in the study and they readily provided health information as requested by the authors. A total of 1490 injuries were incurred among 498 students within the period of study as shown in Fig. 1 below.

Boys had a higher rate of injury occurrence (Mean=3.39±0.65) than the girls (Mean=2.72±0.46), a difference that was statistically significant ($t = 8.99$, $p < 0.05$, $df = 496$). Naturally, the students were expected to report to school administration events that lead to injuries for injury management. Most of the injuries (59%) that occurred among the respondents were reported with girls having a higher reporting rate (69%) than boys (43%). The injury-reporting rate was least among the form one students (30%) and highest among the Form three students (73%). There was a positive correlation between the injury occurrence and injury reporting ($r = 0.32$; $p > 0.05$; $df = 10$), though the correlation was not statistically significant at ($p = 0.05$).

The respondents from public schools had a higher mean number of injuries (3.07±0.715) than those from the private schools (2.56±0.318) though they showed no significant statistical difference ($t = 1.57$; $p > 0.05$, $df = 8$). Most of the injuries (62%) occurred in the legs of respondents. There was a statistical difference in the site of injury on the body and the gender of the respondent ($\chi^2 = 27$; $p < 0.05$; $df = 4$).

The major causes of injury were categorized as related to sporting activities, fall, tools, bites and miscellaneous causes. Sports related injuries included falls during sports activities, contacts with players, and sports equipment and strenuous movements. Falls excluded falls during Sports activities but included falls from stairs, buildings and raised levels, ladders, beds and leveled and unleveled ground. Working tools included hand tools such as hammers, pangas and hoes; piercing and cutting tools such as geometrical equipment and knives. Miscellaneous causes of injuries included electric shock from wiring or electrical appliances, from unmarked trenches as well as injuries caused by

stampedes particularly during times of student's unrests among other causes. Fig. 2 illustrates the percentages of injuries and their causes in the four classes of students.

It was observed that fall-related injuries were highest (33%) and (34%) among form one (F1) and form two (students respectively while sporting activities caused most of the injuries among the form three (33%) and four (31%) students. There was significant statistical dependence in the cause of the injury and the class of the respondent ($\chi^2 = 59$; $p < 0.05$; $df = 12$).

Seven schools (70%) had at least one fire extinguisher while the rest had none. Only one school (10%) had police or fire brigade hot line to use in case of an emergency. Two schools (20%) had once had a fire drill for the students and staff members. Even where the fire extinguishers and first aid kits were present in any school, they were kept under lock and key by the principal or a senior staff member hence access at all times was impossible.

4. DISCUSSION

The study area was reasonably representative of the schools in Central Kenya in terms of diversity of the students and schools in the country's education system. The study showed that injuries were prevalent among students and resulted from diverse causes. This was consistent with the study by Peltzer [21] who showed that in six African countries, the mean percentage over all the of adolescents reporting one or more serious injuries within the past 12 months was 68.2%, ranging from 38.6% in Swaziland to 71.5% in Zambia . Noorbhai et al. [22] observed that 80% of adolescent cricketers in KwaZulu-Natal experienced cricket-related musculoskeletal pain.

There was no life-threatening injury reported by any respondent. However, an average frequency of 3 injuries in six months per student is worth attention. The injury rate in the general population in the East African countries is about 2.6 per year though under-reporting of these incidences hinder collection of accurate and comprehensive information on injury occurrence [23]. Laflamme and Petersson [24] demonstrated that schools would be considered as the largest workplace in the Low Income Countries; hence injuries were quite frequent occurrences.

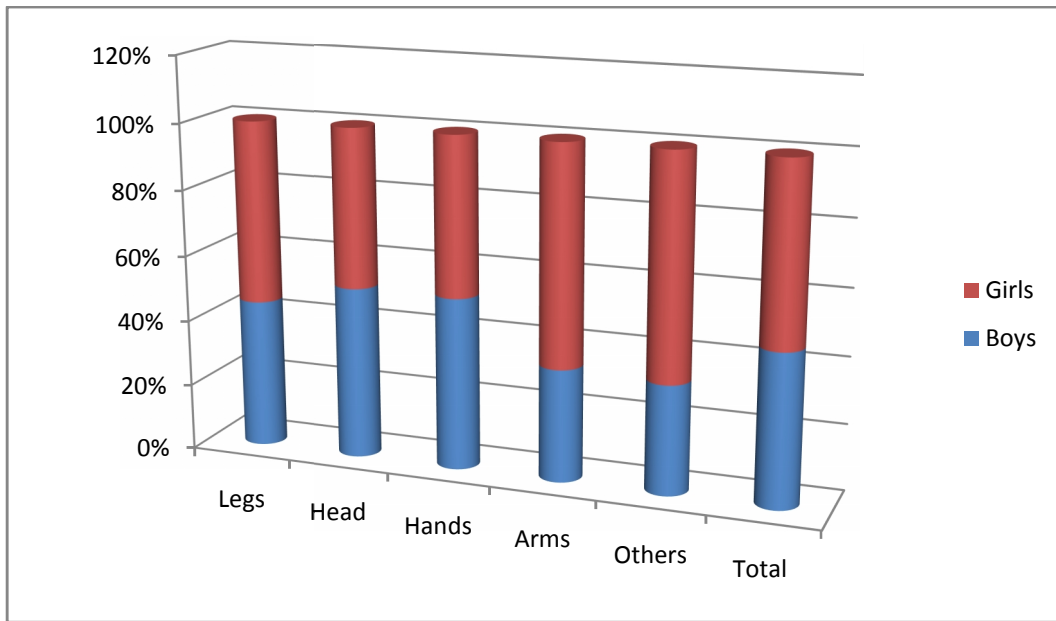


Fig. 1. Percentages of frequencies of injuries on various body sites

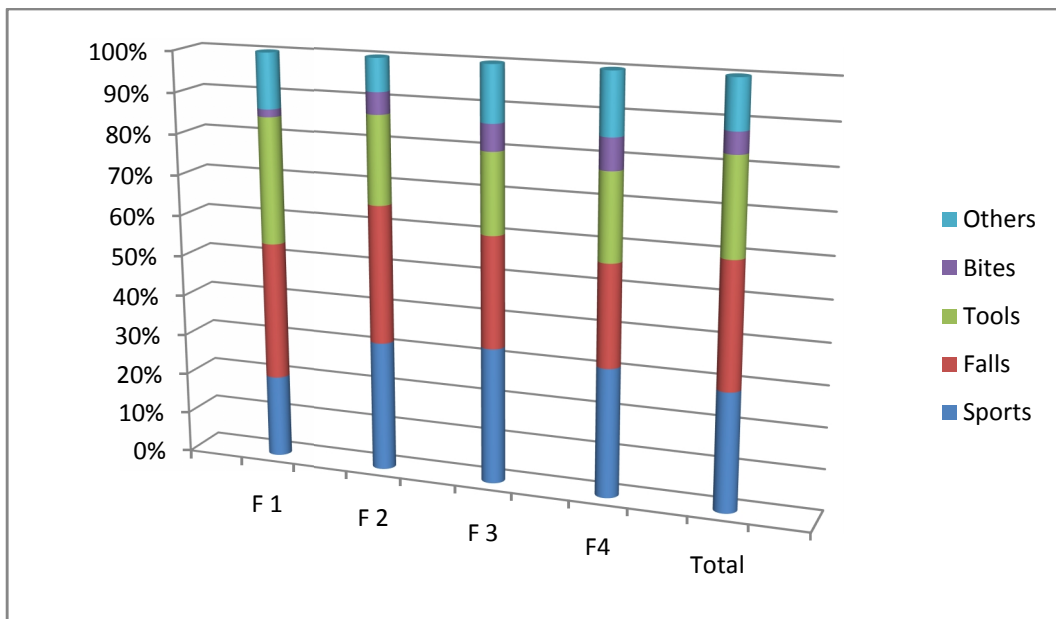


Fig. 2. Percentages of aetiologies of injuries and the class of the respondents

The injury occurrence rate was highest among the boys in form two classes, a fact attributable to hyper activeness and high risk-taking behavior of students at that level as they strive to seek recognition in school setup [25].

Boys had a higher rate of injuries than girls. This result was consistent with study by Wilson et al. [26] that showed that in a school based survey in Tanzania, males were over-represented among those injured. These results further agrees with the outcome from study by Peltzer and Pengpid,

[27] who showed that the percentage of adolescents reporting one or more serious injuries within a period of 12 months in four Southeast Countries was slightly more often in boys (50.5%) than girls (34.3%) [27]. However the injury occurrence in any given class of respondents was independent of the gender of the student. Further observations made on the schools' co-curricular activities showed that girls participated on sporting activities that were less violent as compared to boys' activities. The major sporting activity for girls was netball while boys

were more associated with soccer which involves more interaction, contact and utilization of much hard tackles thus making the boys much more vulnerable to injuries than girls. Scott observed that generally boys tend to be reckless and impulsive but girls tend to be more careful and attentive especially when performing complex activities ranging from contact sports to road crossing [28]. He further suggested that boys exhibit adult type of behavior though they do not make appropriate judgments. They tend to have slower reaction time than girls. Elision studied 125,690 records in the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) in the period between April 1, 1990 to June 7, 1993 for patients aged between five to nineteen years [29]. He observed that out of the total injuries reported, the males had incurred 67% of them. Contact situations in sports lead to intense tackles hence increase possibilities of injuries. This phenomenon was observed by Wekesa and Asembo [30] who showed that since goalkeepers do not have frequent contact situations, they sustain fewer injuries than midfielders as the former are least involved in contact situations.

Only 10 per cent of the schools kept and updated medical records that included the reported injuries. The 59% overall injury reporting / occurrence rate, though having a positive but not significant correlation indicated that the respondents from the groups that incurred higher number of injuries had higher reporting rates. However, the non-reported injuries (41%) must be of students' health concern. Voorhoeve observed that the majority of injuries with prognoses that worsens with time would be preventable if only they were promptly managed [31]. Razzak and Luby [32] explained that in Low and Middle Countries, injuries are underreported for such reasons as poor access to health services. Such inevitable consequences as unreliability of official statistics and non-transferability of lessons from developed countries (HIC) resulted to reduction in aggression in injury prevention.

Legs were the most frequently reported sites of injuries partly because they make up about 40% of the entire body surface area hence they are exposed to various injury causing agents such as falls on rough ground surfaces. The results are consistent with Noorbhai et al. [22] who in their study among adolescent cricketers in KwaZulu-Natal observed that cricket-related musculoskeletal pain was observed on such anatomical sites as knee (30%), lower back (29%), shoulder (17%), ankle (13%) and thigh

(11%). The most common anatomical sites were lower extremities (39%), followed by upper extremities (36%) and lower back (18%). These results are consistent with other findings by Stretch (2003) who reported that the lower limbs (50%), upper limbs (23%), and back and trunk (23%) were most commonly injured in South African cricketers [33]. Milsom et al. [34] reported that in South African schoolboy cricketers 34% of injuries were sustained to the upper limbs, 34% to the lower limbs and 31% to the back and trunk.

Falls on other objects such as nails and barbed wires eventually resulted in puncture wounds, bruises and lacerations. Laflamme and Petersson [24] observed that accidents at school were mainly in form of bruises, cuts, sprains and fractures. WHO [35] estimated that in 2011, about 173 million DALYs were lost in LMIC from unintentional injuries with falls contributing to about 21million (12%) of this burden.

The study showed that most of the injuries among the girls were as a result of falls, just as Cardona et al. [3] observed that non-fatal injuries due to falls disproportionately affected women in rural Indian population. In this study, it is suggested that a variety of interventions must be put in place to prevent falls and to reduce the severity of fall-related injuries among students. Further research is needed to explore, tailor and adapt effective interventions for the students populations in high schools based on the risk factors and context assessment.

5. IMPLICATIONS

The major causes of injuries among the students were sports activities. The Government through the Ministry of Education, Science and Technology and in liaison with the Ministry of Sports, and National Heritage should ensure that only qualified trainers, coaches and referees handle sporting teams in order to reduce sports related injuries, which contribute a third of all accidental injuries in schools. Since in the teacher-training curriculum in Kenya teachers are not trained to handle injuries, first-aid training from relevant and competent quarters should be emphasized among the games teachers and students.

The Safety Standards Manual for Schools in Kenya targets the physical aspects of the school and highlights the safety needs in prevention of unforeseen events and circumstances [36]. This underscores the need to identify specific

programs targeting the improvement of students' health and commit funding for such programs. As injury among students is a significant public health problem, policies and programs related to their recognition, reporting, prevention, reduction and rehabilitation of students are urgently needed.

6. CONCLUSION

The study was mainly descriptive in nature hence answering questions of 'What causes?' other than an analytical question 'Why?' It relied on data collected from recall other than data that is collected when events are observed. However since injury related studies in schools in Low Income Countries are rare, the information presented can help in provision of baseline information in deriving indicators that can be used in stronger longitudinal studies in student population. Before the study was conducted, it was already known that Injuries were a significant public health problem in Low and Middle Income Countries and there was inadequate documentation in injury occurrence at schools. However the study was able to quantify them into figures which showed prevalence being higher among boys than girls. The students in form two class had the highest rate of injury occurrence (Mean=4) injuries per student within the period of six months) while the form one class students had the least (34.4%) injuries-reporting rate. The major causes of injuries among the students were sports activities among the boys and falls among the girls.

ACKNOWLEDGEMENTS

The author most sincerely thanks Prof. Calistas K.P.O. Ogol and Prof. Ephantus W. Kabiru both from Kenyatta University for supervising him as he undertook the study.

FUNDING

The principal investigator in the study is a self sponsored PhD student at JKUAT. He did not receive any funding from any other source than his own.

ETHICS APPROVAL

This study was conducted with the approval of the ethics committee of Kenyatta University, Kenya.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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