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Noise pollution safety practices among exposed population in the bus termini of Nairobi city county, Kenya

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Abstract
Background: Noise pollution remains a public health challenge in African cities. High levels of noise in urban centers are associated with traffic and occur in and around bus termini. Exposure to such elevated noise levels could result in myriad health problems including hearing loss, annoyance and sleep disturbances among other auditory and non-auditory effects. Although levels of noise in urban centers are considerably documented, little is extant about community coping mechanisms.
Purpose: The purpose of the study was to establish the safety practices against noise pollution among exposed population in the termini in Nairobi City County, Kenya.
Methodology: This was a cross-sectional study targeting the population operating daily in gazetted bus termini within Nairobi central business district. A sample size of 422 participants determined by Fishers *et al* (1983) formula was randomly drawn from the population working within nine (9) bus termini for more than 8 hours a day. A self-administered, semi-structured questionnaire was used to collect data on the safety practices adopted by respondents. Univariate Chi-square test of independence was used to compare respondents' demographic characteristics and coping mechanisms.
Results: A total of 397 respondents completed the survey (response rate = 94.08%). Majority (67.5%) of the respondents were male. More than half (53.9%) had tertiary education and 52% were matatu operators. The study respondents reported using a number of safety measures to reduce the harmful effect of noise exposure including use of PPE (53%), reducing engine power (70%), staying away from noisy places (54%) and closing windows and doors (66%).
Conclusion: Although respondents reported a number of coping mechanisms the measures are insufficient to protect exposed populations against the effects of environmental noise. Policy-level and community-wide interventions are required not only to enable communities cope with noise pollution but more essentially to reduce generation of noise in bus termini.

Keywords: safety practices, noise pollution, community members, termini in Nairobi city county

Introduction

Noise is an increasingly ubiquitous and growing menace, yet an underestimated form of pollution [1]. Noise is a more widespread pollution that may cause interferences in various realms of life. Even exposure to relatively low levels of noise can have adverse effects on human health if experienced over extended periods of time [2].

Exposure to extremely high levels of noise is a major avoidable cause of permanent hearing impairment worldwide. In developing countries, environmental noise (especially traffic noise) is an increasing risk factor for hearing impairment and other health-related risks [3]. A recent case-control study reported that Exposure to road traffic noise in excess of 70 dB increased the risk of damage to the auditory system by up to 900% [4].

Hammer *et al*. (2014) [5] reported that noise-induced hearing loss (NIHL) affects 10 to 15 million people in the USA. In the UK, research shows that the young adults have severe hearing difficulties that point to noise at work [6]. Furthermore, Basner *et al.* (2014) [7] indicated that cases of tinnitus emerge as a result of exposure to concert noise around Nottingham and England. The International Labor Organization (ILO) [8] has noted the lack of reliable data on the situation of persons with disabilities in Kenya, mostly the hearing disability.

Despite these implications of noise pollution across the world, many developing nations like Kenya lack robust legislation on noise pollution as well as programs to prevent noise-induced hearing loss and other noise health-related problems. Where such legislation exists such as National Environmental Management Authority (NEMA) and Environmental Management and Coordination Act of 1999, there is often lack of adequate enforcement to control noise pollution [9].

In addition, there has been inadequate public health studies and interventions directed towards assessing the prevalence, risk factors and health costs of environmental noise [10]. However, studies conducted in Kenyan urban centers indicate high levels of noise pollution. Amulla & Misati (2021) [11] reported noise levels exceeding 70dBA in Kisumu city. In Nairobi, Wawa and Mulaku (2015) [9], measured noise levels from predetermined source of noise with the aim of documenting spatial distribution of noise levels in the Nairobi Central Business District. Their study observed high levels of noise between 61-78db. Another study by Kogutu and co-authors (2021) [12] reported noise

levels in excess of 98db across bus termini in Nairobi. These studies paint a grim picture of the status of noise pollution in Kenyan urban centers, particularly in Nairobi, but they did not report community coping mechanisms. Against this backdrop, the present study investigated the safety measures adopted among exposed population in the termini in Nairobi City County to protect themselves against noise pollution.

Materials and Methods

The study used a cross-sectional study design. The target population comprised of men and women who operated daily in the gazetted bus termini within Nairobi central business district namely; Old Nation Bus Station, Ngara Bus Station, Railways Bus Station, Tyskys Bus Station, St Peters Clavers, Latema Bus Station, Central Bus Station, Ronald Ngala Bus station, Moi Lane(Mondlane). The accessible population was defined as community members comprising of business vendors, conductors, drivers, and supervisors within the respective bus termini. The Fishers *et al* (1983) formula was used to determine the sample size and a random sample of 422 community members working within nine bus termini for more than 8 hours a day were approached and recruited in the study. A self-administered semi-structured questionnaire was used to collect data to identify perceived health risks of noise and safety practices across bus termini. Univariate Chi-square test of independence was used to compare respondents' occupation and reported safety practices. A *p*-value less than 0.05 was considered statistically significant. Analysis was done using Statistical Package for Social Sciences (SPSS)-software Version 20.

Results and Discussion

Demographic Characteristics of Respondents

A total of 397 respondents completed the survey representing a response rate of 94.08%. As indicated in table (I) more than half of the respondents reported to have achieved tertiary level of education as represented by 53.9% (n=206). Being a matatu operator (conductors, drivers) was the leading occupational activity at 52.2% (n=202) as compared to other occupational activities such as business vendors and terminus regulators. Respondents who reported to have worked for a period of between one to five years at the respective bus termini were 45.1% (n=176). In terms of days spent at work, again more than half of the respondents reported to be spending up to 4 full days working at the bus termini as represented by 52.7%(n=205). Nearly half of the respondents 49.1% (n=189) spent between 4-8 hours as compared to 38.7 %(n=149) who spend more than 8 hours at the respective bus terminus per day.

Table 1: Descriptive summary of demographic characteristics

Demographic	Categories	*n*	*%*
Gender	Male	266	67.5
	Female	128	32.5
Education	Primary	51	13.4
	Secondary	125	32.7
	Tertiary	206	53.9
Occupation	Matatu Operators	202	52.2
	Business vendor	122	31.0
	Terminus Regulators	38	9.7
Length in Years spent at Termini	Less than 1 year	81	20.8
	1 to 5 years	176	45.1
	6 to 10 years	64	16.4
	11 to 15 years	69	17.7
No of days spent at the termini	1 to 2 days	41	10.6
	3 to 4 days	205	52.7
	5 days and above	143	36.8
Number of hours spent at Termini per day	1 – 4 hours	47	12.2
	5 - 7 hours	189	49.1
	8 hours and above	149	38.7
Termini	Central	48	12.1
	Latema	46	11.6
	Moi-lane	35	8.8
	Ngara	50	12.6
	Old Nation	47	11.8
	Railways	38	9.6
	Ronald Ngala	31	7.8
	Tuskys	56	14.1
	St Peters Claver	46	11.6

Safety Practices Used as Measures against Noise Pollution among Respondents across Termini

Uptake of safety practices was assessed among respondents who included matatu/bus drivers, conductors/touts, business vendors and terminus clerks. Figure 1 shows safety practices and measures used by respondents. A higher proportion of respondents at 70.8% (n=279) indicated that they would reduce energy level when driving at bus termini as compared to 32.245 (n=128) who indicated otherwise. On the use of personal protective equipment (PPE) 53.14% (n=211) indicated that they were using personal protective equipment as compared to 48.85% (n=186) who stated otherwise. On minimizing external interruption from noise 66.75% (n=265 of the respondents indicated that they would consider closing windows to eliminate outside noise while 33.25% (n=132) indicated otherwise. On reducing frequent exposures 55.92% (n=222) of the respondents indicated they would change job schedules to coincide with time when

noise levels are at lowest. On the other hand, 54.41 % (n=216) indicated they would stay away from noisy environment and work for fewer hours in the noisy environment respectively.

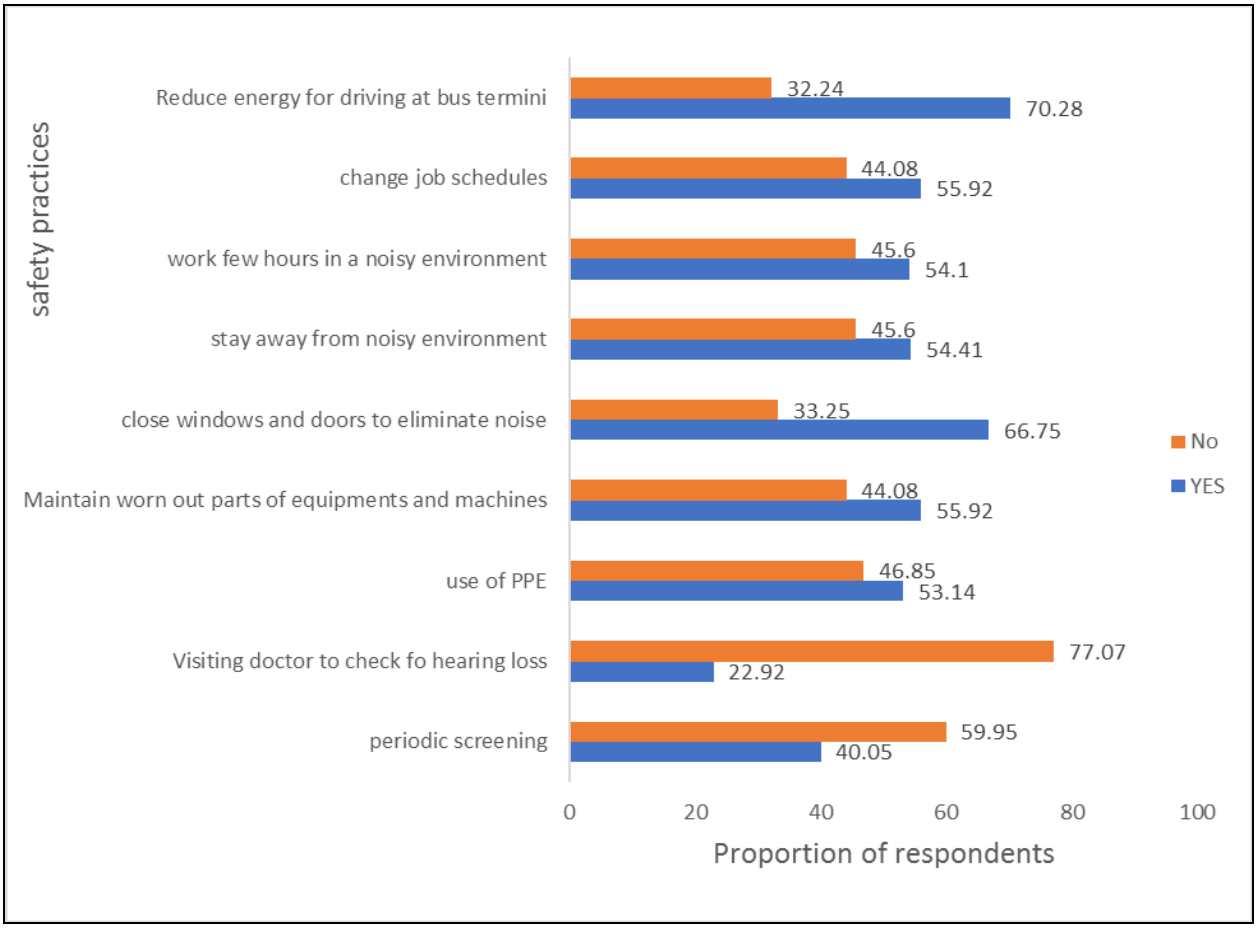

Fig 1: A bar graph: Safety practices on noise among respondents across termini

Association between Respondents' Occupation and Utilization of Safety Practices

Table II shows the results of chi-square test on respondents' occupation and utilization of safety practices. Safety practices that were significantly associated with respondents' occupational groups included; working few hours in the noisy environment ($\chi2=7.746$; df=2; $p<0.021$); closing windows and doors to eliminate noise ($\chi2=3.89$; df=2; $p<0.05$) and walking away from noise ($\chi2=5.29$; df=2; $p>0.024$). A higher proportion of respondents across all the occupational groups significantly reported not using personal protective equipment ($\chi2=9.683$; df=2; $p<0.016$).

Table 2: Chi-square Test on type of Occupation and uptake of safety practices

		Type of Occupation			
Safety Practices		**Matatu Operators**	**Business Vendors**	**Terminus Regulators**	**Chi-Square Test**
Work Few Hours in Noisy Environment	Yes	105	67	28	($\chi2=7.746$; df=2; $p<0.021$) *
	No	101	54	9	
Use Personal Protective Equipment	Yes	97	51	15	($\chi2=9.683$; df=2; $p<0.016$) *
	No	110	70	22	
Periodic Screening on Hearing Loss	Yes	92	44	17	($\chi2=2.412$; df=2; $p>0.299$)
	No	114	77	20	
Close Windows and Doors to Eliminate Noise	Yes	133	87	28	($\chi2=3.89$; df=2; $p<0.05$) *
	No	75	32	9	
Walk Away from Noisy Environment When Free	Yes	106	66	25	($\chi2=5.29$; df=2; $p<0.024$) *
	No	93	54	12	

Respondents' opinion on measures to control noise pollution

Figure II shows measures suggested by respondents towards controlling noise pollution at bus termini. Respondents were largely opposed to the measures assessed with just 6.8% (n=27) agreeing that passengers should queue while waiting for buses, 4.78% (n=19) agreeing that hawking should be banned at bus terminus, 14.11% (n=56) agreeing that bus termini should be separated from markets, 10.83% (n=43) agreeing to restricting hooting in bus termini.

The control measure that was mostly favoured by the respondents was enforcement of laws to control noise at bus terminus (20.4%, n=81).

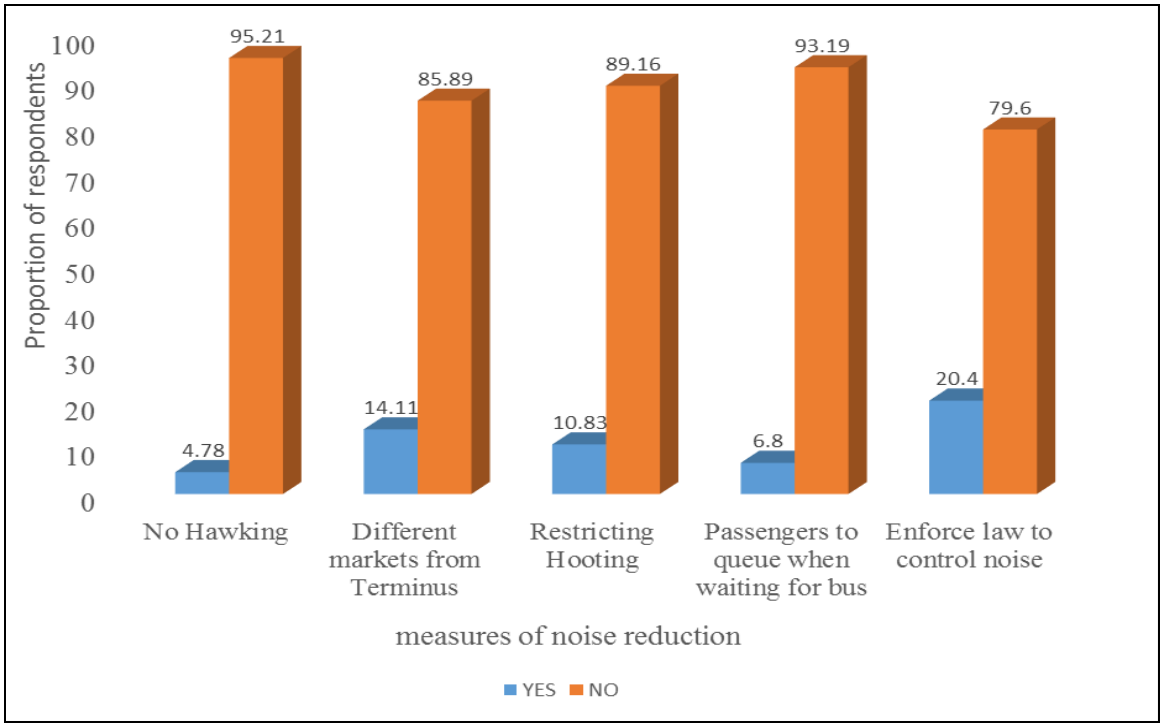

Fig 2: A Bar graph illustrating respondents' opinion on measures to control noise pollution

Discussion

The study participants reported using a number of safety practices and measures in order to reduce the harmful effect of noise exposure. Some of the practices being utilized across all occupational groups included; working few hours in the noisy environment, closing windows and doors to eliminate noise and walking away from the noise. A higher proportion of respondents across all the occupational groups reported not using personal protective equipment on their ears to reduce noise effects.

At a personal level, it was observed that respondents would consider closing windows to minimize external interruption from noise. As earlier reported most respondents considered noise as an annoyance in the city bus terminus hence, they would consider closing windows as a way of limiting the level of annoyance. It is evident that closing windows only works in controlling external noise but may not control internal noise coming from the music systems fitted inside the public buses and matatu. Olayinka (2013) [13] in his study on effective noise control measures and sustainable development in Nigeria concurs with the findings of this study by suggesting that noise results from citizen's behaviour (driver, music player and hawkers) hence there is a need to educate the public on noise pollution.

It was observed from this study that respondents would consider changing job schedules to coincide with the time when noise levels are low.While other respondents would consider staying away from the noisy environment and work for fewer hours in the noisy environment respectively. It is evident that these actions point to the individual measures taken to protect oneself from harmful effects of noise pollution. While these steps may work at an individual level, there is a need to have measures that work at all levels, since there are people who spend most of their time at the bus terminus. For example, Pelegrin and colleagues (2015) [14] suggested that routine monitoring of noise levels and assessment of hearing status are part of effective hearing conservation programs. In contrast, it was observed from this study that periodic screening was the least used measure to track the effect of noise pollution to an individual. Therefore, at the individual level, it will be necessary for those who spend more than 8hours a day at the bus terminus to undergo periodic screening for hearing impairment.

Some respondents agreed that controlling noise pollution would require restricting hooting in bus terminus. This is because uncontrolled hooting in bus termini as vehicles struggle to find their way in and out of the terminus generates much noise. Uncontrolled hooting is a behavioural problem that requires systematic education on behavioural change on part of the drivers. As indicated by Olayinka (2013) [13] noise pollution can be reduced by prescribing noise limits for vehicular traffic, ban on honking of horns in certain areas, in addition, he recommends that public vehicles drivers should be educated not to horn unnecessarily on the roads.

Another safety measure reported in this study was reducing engine power at bus termini. Driving at high acceleration emit significant energy changes in the vehicle which in-turn produces high noise levels [15]. Reducing engine power can thus result in reduction of noise.

Public order and organisation in bus terminus are key in controlling noise pollution in cities. As observed from this study respondent suggested that passengers should queue while waiting for buses as a way of controlling noise. This is a practical suggestion since in most cases noise at the bus terminus emanates from bus/matatu conductors calling and pleading with passengers to board their vehicles. This is in line with the findings of the study by Olayinka (2013) [13] who suggested that public awakening is very essential for the control and prevention of environmental noise pollution. Since noise results mostly from the citizens' behaviour, public education would produce good results in the long term. Similar observations were reported by Ozer *et al.* (2009) [16] who recommended that increasing the public awareness can be mentioned among other noise preventive methods in urban areas.

Conclusion

This study confirms that there is low uptake of noise control measures in the general public. On the other hand, this study has demonstrated a lack of public awareness on the importance of routine screening for hearing noise especially among those who are frequently exposed to high noise levels. This study has equally demonstrated that creating order in the public transport system would help reduce noise levels in the city of Nairobi. The study has further demonstrated that challenges posed by noise pollution on human health and the environment have not yet received full attention. Although statutory provisions regulating noise levels in Kenya do exists there implementation and enforcement are still low, and there is a need to scale up enforcement of laws on noise pollution.

Unique contribution to theory, practice and policy

There is need for annual screening for hearing loss and other noise health risks among exposed population of the Central business District of Nairobi City. There is need for awareness and sensitization campaigns on noise health risks/effects among the community dwellers of central business district of Nairobi City. There is a need step up enforcement of noise regulations in and around the bus termini of Nairobi city.

Conflict of interest

The authors declare no conflict of interest

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