



Vuvuzela – good for your team, bad for your ears

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To the Editor: Excitement surrounding the 2010 Soccer World Cup is mounting, with less than a year to go before the first kick-off. Half a million soccer fans from all over the world are expected to converge in South Africa to enjoy this major sporting event, which will make history as the first to be hosted on the continent of Africa. Spectators can look forward to the beautiful African landscapes, the rich cultural heritage, the diversity of the rainbow nation, and the lively rhythm of Africa. They will also experience the unique sound of the African horn, called a vuvuzela, which is blown by most avid South African soccer supporters. It is a proud symbol of South African soccer, having evolved over the past 15 years into a symbol of hope and unity for many people in the country.¹

Traditionally made from a kudu horn, the vuvuzela was used to call together meetings and could be heard by distant peoples summoned to attend. Today soccer stadiums in South Africa are invariably filled with its loud and raucous sound, which reverberates with energy to the exhilaration of supporters. The intensity of the sound caught the attention of the global soccer community during the 2009 Confederation Cup recently concluded in South Africa and in anticipation of the forthcoming World Cup in 2010. Despite complaints by international commentators, players and audiences, FIFA has approved the Vuvuzela as part of the signature South African World Cup.¹ It is not surprising, however, that the international soccer community would be astounded at the loudness of the vuvuzela and its non-stop chorus throughout the duration of a soccer match.

To determine exactly what intensity of sound the vuvuzela produces, and the possible related hearing risks, a calibrated type 1 sound level meter was used to measure the sound intensity and spectrum produced by an official vuvuzela at four distinct distances from the bell of the instrument where the sound exits. The measurements included a recording at the ear of the person blowing the vuvuzela, at the bell, and at

1- and 2-metre distances from the bell. A person without prior experience with a vuvuzela blew it while two recordings were made at each of the four sound recording sites. To ensure an equivalent environment to a typical open stadium game, the recordings were made outside on a large open lawn area.

The maximum sound output, averaged between the two recordings at each recording site, varied between 113 and 131 dBA (Fig. 1). The intensities between repeated measures for separate instances of blowing the vuvuzela varied by less than 1.4 dB for all recording sites except the 2-metre distance condition, where it varied by 4.6 dB between the first (114.9 dBA) and second (110.3 dBA) recording. The frequency spectrum of the sound was broad and flat with largely equivalent energy across the frequency spectrum from 250 to 8 000 Hz. Fig. 1 illustrates the permissible noise exposure time without hearing protection in relation to the intensities produced by the vuvuzela at the various distances from it.

According to the South African National Standard regulating occupational noise exposure in South Africa,² no one within a 2-metre radius of a vuvuzela, including the person blowing it, should be exposed to it continually for more than a minute. At an intensity of 100 dBA a person should be exposed to less than 15 minutes of such noise per day, and the permissible time is halved with every 3 dB increase in intensity.^{2,3} According to South African occupational noise exposure legislation,^{2,4} at the lowest recorded intensity of 113 dBA subjects should not be

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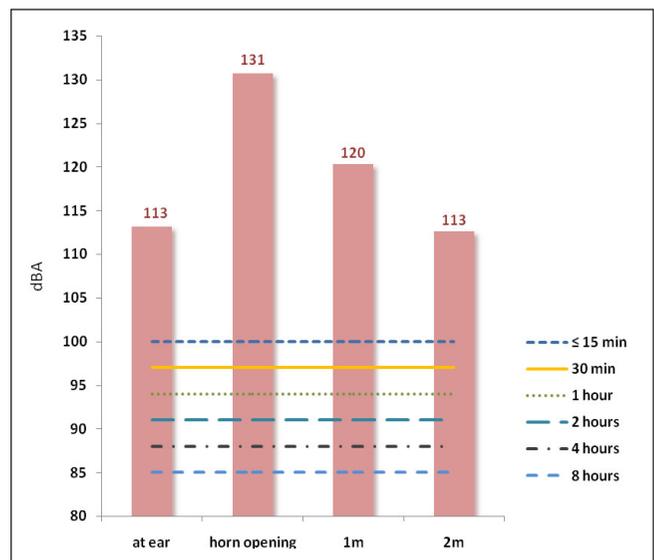


Fig. 1. Average sound level measurements (dBA) of a vuvuzela with the SANS2 recommendations for duration of sound exposure allowed at specific intensities (every 3 dB increase halves the allowed exposure time, starting at 8 hours for 85 dBA). Two recordings were made at each of the four distances from the bell of the vuvuzela.





exposed for more than 1 minute without hearing protection. This places all bystanders within a 2-metre radius in the severe risk category for permanent hearing loss. Intensities at each of the recording sites far exceeded the legislated levels of occupational noise exposure allowed without hearing protection. Even with hearing protection the intensity produced at the bell of the vuvuzela is still unacceptably high (≥ 130 dBA).^{2,4}

These measurements are an important indication of the recreational risk vuvuzelas pose to spectators. Until investigated further, it can only be assumed that if a single vuvuzela emits a sound that is dangerously loud to those in at least a 2-metre radius, the cumulative effect of numerous vuvuzelas, typically blown together for the duration of a soccer match, may have an additive effect, putting spectators at a significant risk of noise-induced hearing loss. Exceeding the recommended exposure time for the intensities produced by the vuvuzela can irreversibly damage the delicate hair cells of the cochlea.³ Although initial threshold shifts in hearing may not be noticed by exposed persons, the effects over time result in progressive and permanent sensory hearing loss. Although there is significant individual variability in susceptibility to noise-induced hearing loss, no one is immune to the devastating effects of loud sound over a prolonged period of time, especially at the intensity levels produced by the vuvuzela. Noise-induced hearing loss is a disabling condition

with significant social consequences in addition to its limiting effect on educational and vocational prospects.

Although more investigations are required, initial findings certainly demonstrate that the vuvuzela exceeds the permissible occupational noise exposure levels in South Africa and poses a significant recreational risk of noise-induced hearing loss. Preventive measures such as public awareness and hearing protection should be prioritised as an important health care approach in sporting events where the vuvuzela is used, especially in view of the upcoming World Cup. The vuvuzela has reached iconic status and should be kept as part of the South African soccer culture, but measures to protect spectators' hearing must be considered of paramount importance.

References

1. Fédération Internationale de Football Association (FIFA). Vuvuzela: a symbol of South Africa. 19 June 2009. <http://www.fifa.com/confederationscup/news/newsid=1073689.html> (accessed 28 July 2009).
2. SANS10083:2004. *The Measurement and Assessment of Occupational Noise for Hearing Conservation Purposes*. Pretoria: South African National Standards, 2004.
3. Franz RM, Phillips JL. Noise and vibration. In: Guild R, Ehrlich RL, Johnston JR, Ross MH, eds. *Handbook of Occupational Health Practice in the South African Mining Industry*. Braamfontein: Safety in Mines Research Advisory Committee (SIMRAC), 2001: 193-230.
4. Department of Labour. The determination of permanent disablement resulting from hearing loss caused by exposure to excessive noise and trauma. Circular Instruction No. 171. Compensation for Occupational Injuries and Diseases Act, No.130 of 1993. Republic of South Africa. *Government Gazette* 2001; 16 May.

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