



# Exploratory study involving observation of traffic behaviour and conflicts in Nigeria using the Traffic Conflict Technique



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## ABSTRACT

Road traffic crashes are a major public health problem affecting those living in developing countries, exacerbated by the lack of available resources to tackle the issue (WHO, 2015). Whilst crash reduction measures have been developed and implemented, there has been limited success in developing countries and the crash rate keeps increasing. Partly to blame are the lack of empirical research and high quality crash data. Data do exist – but their reliability is questionable, with respect to the data collection methods used and underreporting. This study, undertaken in Nigeria, used surrogate safety measures based on systematic observation of traffic behaviour and conflicts to assess the behaviour of different road users and investigate the role various factors play in determining conflict severity. Data were analysed using the Traffic Conflict Technique and binary logistic regression. Results show that direction of traffic, time of day and the relevant road user's age, gender and speed are important determinants of conflict severity. This study highlights the applicability of surrogate safety measures in traffic safety assessment in a developing country and demonstrates that quality data needed for road safety assessment in developing countries could be collected over a short period of time by making use of resources which are readily available.

## 1. Introduction

Road traffic fatality and injury rates in developing countries have continued to increase. WHO (2015) reports an uneven distribution of crash rates, with nearly 90% of total crashes in the world occurring in low and middle income countries which have only 47% of the world's registered vehicles. The African region is the worst hit with a fatality rate of 26.6% per 100,000 population (WHO, 2015). Hyder (2002) highlights the heavy burden road traffic injuries places on developing nations and states that it costs them at least \$100 billion a year; this is twice as much as the aid received worldwide and these losses hinder economic and social development. Those affected mostly represent the most active group of any population and represent a very large percentage of the workforce. Peden et al. (2002) has shown that road traffic injuries have become a major cause of Disability-Adjusted Life Year (DALY) losses in developing countries because a greater number of children and men in their productive ages suffer these injuries, and according to Bishai et al. (2008), the fatality rates in these countries is estimated to increase by 80% from 1990 to 2020, unless appropriate measures are taken.

Transport systems and infrastructure have expanded rapidly in

developing countries, while little has been achieved in preventing crashes or lessening their severity (Almqvist and Hydén, 1994). According to Peden et al. (2004), rapid motorisation, poor road and traffic infrastructure, as well as the behaviour of road users have all contributed immensely to increases in road traffic crashes and fatalities in Africa.

Over the years, road safety measures have been developed and whilst success has been recorded in developed countries, less has been achieved in developing countries; in fact, the crash rate keeps increasing (WHO, 2015). Partly to blame are the lack of empirical research and high quality crash data. This scarcity of data has been emphasised by Dowing (1991) where he estimates that there may be 20 person-years of research effort each year in developing countries compared to over 500 in developed countries.

The number of road crashes, casualties and associated consequences, all emanating from crash data are the most commonly used measure of assessment for road safety (Wegman, 2013). Data on traffic crashes are important for monitoring and assessing progress on programmes where intervention has taken place and most of all for measuring trends and targeting intervention programmes on specific and identified causes of road traffic crashes. Road crash data could also help

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in defining the magnitude of the matter by comparing it with other causes of death in order to make informed decisions (WHO, 2015).

Road crash data collection has been an issue of concern for a long time; whilst in developed countries methodologies have evolved from the use of traditional methods such as questionnaires (Reason et al., 1990), interviews (Nielsen, 2011), travel diaries (Stopher and Greaves, 2007) to the use of mobile phones (Aguilera et al., 2012), GPS recorders (Gong et al., 2012), instrumented vehicles (UDRIVE; SHRP2) and driving simulators (Comte and Jamson, 2000), this is not mirrored in developing countries. Most research in developing countries is based on interviews and questionnaires (Batool et al., 2011; Newnam et al., 2014; Peltzer and Renner, 2003; Persson, 2008). Lack of data in the developing countries has been a constraint to many developmental projects especially in the area of driver behaviour and road safety. This paucity of data has been attributed to the high cost of direct data collection, lack of established government information sources and low penetration of technology (Jug, 2014). One of the objectives of the Decade of Action (WHO, 2009) is to improve the quality of road safety data at the national, regional and global levels. Improving data quality makes interpretation, analysis and application of an outcome more relevant, it helps target interventions to specific and identified problems.

Nigeria has the highest fatality in Africa, with a rate of 33.7 deaths per 100,000 population per year far above the regional average of 24 deaths per 100,000 population (WHO, 2013). In Nigeria, the Federal Road Safety Corps (FRSC) and the traffic police are responsible for collecting and registering information on crashes but they are poorly harmonised resulting in under-reporting. Road traffic crash data are generally only presented as a summary with little or no detail regarding road users involved. As most road safety campaigns in Nigeria are based on road crash data, therein lies the problem; according to Osayomi (2013), whilst several road safety intervention efforts have been implemented, crashes keep increasing. Intervention efforts cannot yield much without proper research targeted at specific identified needs.

Properly collected, documented and analysed crash data helps to provide an understanding of why crashes occur, determination of crash severity, factors influencing the risks of getting involved in a crash and hence what measures to put in place to either reduce or prevent their occurrence. With a continued increase in crash rate in developing countries, reductions cannot be achieved without rich data including information about time of day, traffic conditions, type of manoeuvre made by those involved in the crashes and so forth. However, directly applying research methods and results from countries perceived to have made significant improvements in achieving reduction in crash rates to other countries who have achieved less may not be a viable approach. This is because circumstances, environment and conditions differ and it is very important, especially for safety purposes, to conduct country specific research in order to make reliable decisions for safety analysis. However, it is still important to explore how low and middle income countries can improve their road safety records by learning from high income countries (WHO, 2004). According to Wegman (2010), developing countries could analyse road safety problems and design road safety strategies, using the experiences of developed countries and thereby speed up progress.

Many crashes can be prevented by implementing effective road safety measures; this relies on decision makers having information on the effectiveness of different causes of action before investing in them. According to Muhlrud (1993), appropriate behavioural information can be obtained at relatively low cost and is a great advantage as support for safety policies. The observation of human behaviour in real traffic situations is a useful means of investigation as it provides greater knowledge of road user behaviour and interaction of various road users as well as means to identify and describe some of its determining features.

The magnitude of the road safety problems in developing countries will require more information than can be elicited from crash data. Lord

and Mannering (2010) and Savolainen et al. (2011) have shown that to urgently address the enormous social losses caused by road crashes, there is a need to gain a better understanding of factors, events and circumstances that could lead to a crash. This cannot easily be achieved with past crash data. Crash numbers are too small, take a very long time to collect and collate, the method of collection and reporting is biased and not informative. The need for a more comprehensive and informative understanding of the connections, various factors and events leading to a crash, relationship between behaviour of road users by considering both unsuccessful and successful interactions, informed the application of the Traffic Conflict Technique (TCT) in this study. To our knowledge, the TCT has not been used for road safety assessment in Nigeria.

This study, therefore, uses direct behavioural observation to examine traffic behaviour and conflicts of various road users in Nigeria using non-crash data and to investigate the role various factors play in determining conflict severity. Cost-effective methods of data collection using locally available resources were employed, and this has provided information on the operation of different traffic systems which is important in safety diagnosis.

## 2. Method

### 2.1. The traffic Conflict Technique

This study uses the Traffic Conflict Technique (TCT) as an alternative to analysing crash statistics. The TCT was adopted because of the limitations associated with crash data in Nigeria. The TCT is a method of observation, where near-crashes (conflicts) are recorded and used for predictions of accident risk and studies of events leading to crash situations. A conflict situation is defined as when two or more road users approach each other in time and space to such an extent that a collision is imminent if their movements remain unchanged (Amundsen and Hydén, 1977). Conflict points are locations where the travel paths of road users cross. If the paths and speeds of two road users lead to them passing a specific conflict point at the same time, then at least one road user must change their speed or direction to avoid a collision. This means that at least one road user must be aware of the other prior to the conflict point and correctly assess their location, speed and path trajectory.

According to Hyden and Stahl (1979), a serious conflict is similar to a crash, a situation that nobody puts him/herself into deliberately. One of the advantages of the TCT is that it is possible to collect sufficient data within a short period of time because traffic conflicts occur more frequently than crashes (Hyden, 1987). Other activities such as speed measurement, behavioural observation etc. can also be undertaken at the same time. With regards to the validity of the TCT (correlation between conflicts and crash frequency), Hauer and Gårder (1986) showed that serious conflicts and crashes belong to the same process, just with a different degree of seriousness; crashes can be described more or less as a continuation of serious conflicts at a higher severity on the scale. The Malmo study in 1983 (Grayson et al., 1984) where eight teams from different countries simultaneously made conflict observations at different intersections demonstrated that differences in observer reliability were not significant and that observers were able to detect 75% of serious conflicts. Video recording is also helpful in conflict studies as it aids in checking observer reliability and confirming conflict severity (Svensson and Carsten, 2007).

The traffic conflicts observed in this study were analysed using the Swedish TCT (STCT). This method was developed by Hyden (1975), who hypothesised there to be a close relationship between conflicts and crashes. The technique uses objective units to measure the severity of conflicts and studies only serious conflicts, recorded manually by observers. The STCT has been widely adopted in many studies on conflict analysis both in developed and developing countries e.g. Thailand, Denmark, Finland, Uganda, Sri Lanka, Turkey, Costa Rica, Jordan,

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