



analysis of pedestrian accident costs in Sudan using the willingness-to-pay method



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ABSTRACT

The willingness-to-pay (WTP) with contingent valuation (CV) method has been proven to be a valid tool for the valuation of non-market goods or socio-economic costs of road traffic accidents among communities in developed and developing countries. Research on accident costing tends to estimate the value of statistical life (VOSL) for all road users by providing a principle for the evaluation of road safety interventions in cost-benefit analysis. As in many other developing countries, the economic loss of traffic accidents in Sudan is noticeable; however, analytical research to estimate the magnitude and impact of that loss is lacking. Reports have shown that pedestrians account for more than 40% of the total number of fatalities. In this study, the WTP-CV approach was used to determine the amount of money that pedestrians in Sudan are willing to pay to reduce the risk of their own death. The impact of the socioeconomic factors, risk levels, and walking behaviors of pedestrians on their WTP for fatality risk reduction was also evaluated. Data were collected from two cities—Khartoum and Nyala—using a survey questionnaire that included 1400 respondents. The WTP-CV Payment Card Questionnaire was designed to ensure that Sudan pedestrians can easily determine the amount of money that would be required to reduce the fatality risk from a pedestrian-related accident. The analysis results show that the estimated VOSL for Sudanese pedestrians ranges from US\$0.019 to US\$0.101 million. In addition, the willingness-to-pay by Sudanese pedestrians to reduce their fatality risk tends to increase with age, household income, educational level, safety perception, and average time spent on social activities with family and community.

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1. Introduction

1.1. Background

In Africa, vulnerable road users, such as pedestrians, cyclists, and users of two- or three-wheeled vehicles, have an increased rate of death and injury due to the consequences of traffic accidents. More than 50% of total road fatalities involve vulnerable road users, of which pedestrians are the largest group, as shown in Fig. 1 (WHO, 2013).

In Sudan, more than 2600 fatalities and 20,000 injuries due to traffic accidents are annually reported. Vulnerable road users—primarily pedestrians and riders of two- or three-wheeled

vehicles—comprise the group that is most affected among traffic accident victims. They represent approximately 54% of the total number of traffic accident fatalities in Sudan (GDT, 2010, 2011). Pedestrians account for a large proportion of road users among poor and low-income communities in developing countries, such as Sudan, and dominate the traffic accident fatalities listed in Table 1. However, the economic cost of traffic accidents in Sudan is unknown due to the unavailability of reliable data.

In developing countries such as Sudan, road safety improvements are lacking compared with the road safety improvements achieved in developed countries. This lack of development is due to the unavailability of reliable data, which can help decision makers take appropriate action. The transfer of techniques from developed countries to the varying conditions in developing countries most likely would not prove effective. In the majority of developing countries, road safety improvements are usually directed toward motorists rather than vulnerable road users, such as pedestrians (Downing, 1991). Therefore, performing this study in Sudan is important for the following reasons: (1) to address a common

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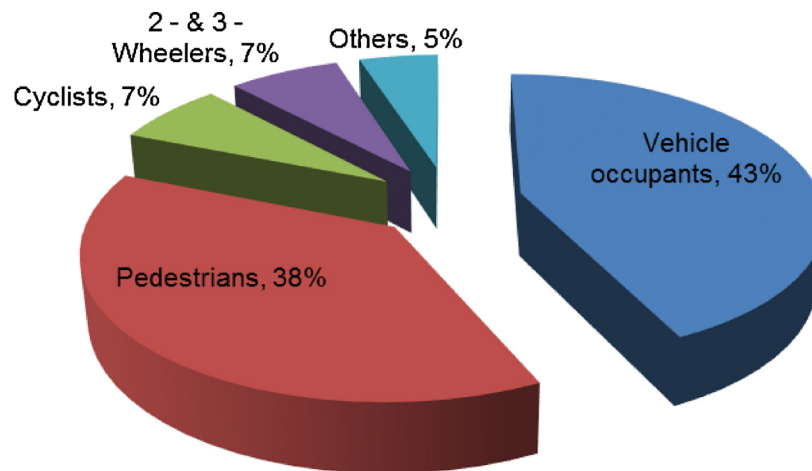


Fig. 1. Road traffic deaths by type of road user in Africa (WHO, 2013).

safety problem in most developing countries by targeting vulnerable road users, such as pedestrians; (2) to provide reliable information to assist in assessing the impact of road accidents among the targeted communities, allocating sufficient funds for safety improvements and achievement evaluation; and (3) to provide examples of the practical application of the willingness-to-pay (WTP) accident analysis method in developing countries.

In the literature, the estimation of road accident costs in the majority of developed countries and some developing countries has relied on the human capital (HC) method and the WTP method. Each of these methods is different, particularly when determining the estimated value of life. The HC method measures human output or productivity, whereas the WTP method measures the loss of quality of life. The WTP method addresses personal life enjoyment and can efficiently achieve maximization of social welfare objectives (BTE, 2000).

In recent years, the WTP method has replaced the HC method as the preferred global accident costing approach due to the critical limitations of the HC method in assessing socioeconomic issues and incompatibility with the cost-benefit analysis theory, which can be successfully overcome using the WTP method (Elvik, 1995; Silcock, 2003).

To provide a platform for the evaluation of road safety interventions in a cost-benefit analysis, the majority of previous accident cost studies estimate the value of statistical life (VOSL) of road users. This approach requires an estimation of the value of fatality risk reduction, which is measured by the price that an individual is willing-to-pay for this reduction, and reflects the loss of income and welfare for the remainder of his/her life (Bhattacharya et al., 2007).

In the past 20 years, the WTP with contingent valuation (CV) method has been applied in many studies to estimate accident cost (Le et al., 2011). However, this method has some constraints as noted by many researchers (McMahon and Dahdah, 2008). For instance, Whittington (1998) identified the difficulties of using the

WTP with the CV method, especially in developing countries, as follows:

- 1) It is not easy for the survey respondents to understand the economic concept of the valuation process in terms of willingness and the ability to pay to reduce their risk.
- 2) The construction of a CV scenario requires an understanding of the household demand for road safety infrastructure, whether they are willing to share some of the capital costs required for this infrastructure and whether they will connect to the infrastructure if it were to be installed.
- 3) The establishment of suitable referendum prices is required to provide an extensive range of prices, which indicates that the "highest price is not too low and the lowest price is not too high."
- 4) Addressing the ethical problems involved in conducting CV surveys and determining whether the outcome results are accurate, reliable, and fulfill ethical and moral standards, especially in developing countries, by treating the survey respondents with consideration and respect with regard to their privacy and morality.
- 5) Interpreting and ensuring clear and reliable responses from targeted respondents by designing an appropriate and simple questionnaire.

Despite the previously mentioned challenges, many studies continue to consider the WTP method to be a useful tool for estimating pecuniary amounts and a platform for evaluating the economic loss of road accident casualties (Elvik, 1995). Studies have shown that the WTP method combined with the CV method can offer suggestions for workable and appropriate review procedures to determine the VOSL in developing countries (Ortúzar et al., 2000).

Due to the lack of accident cost analyses, especially for accidents involving pedestrians who comprise the riskiest group of road users, the primary objective of this study is to analyze and determine the cost of pedestrian accidents in Sudan using the WTP approach combined with the CV approach. The pedestrian VOSL is estimated, and the impact of the socioeconomic characteristics, risk levels, and walking behaviors of pedestrians on their WTP for fatality risk reduction in Sudan are evaluated.

1.2. Contingent valuation (CV) analysis of willingness-to-pay (WTP)

Use of the CV approach in the analysis of accident costs requires careful consideration because the study results for some of the

Table 1

Proportion of pedestrian-involved accidents in the total number of road traffic fatal accidents in Sudan.

Source: (GDT, 2010, 2011).

Year	Pedestrians		Others		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
2011	858	41.5	1209	58.5	2067	100
2010	913	43.9	1164	56.1	2077	100
2009	930	44.1	1178	55.9	2108	100

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