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Road Traffic Injury Is an Escalating Burden in Africa and Deserves Proportionate Research Efforts

Emmanuel Lagarde

Research into road safety in developing countries is scarce, especially in Africa. This is inconsistent with the size of the problem: it has been predicted that by 2020, road traffic injuries will rank as high as third among causes of disability-adjusted life years (DALYs) lost [1]. While South-East Asia has the highest proportion of global road fatalities (one-third of the 1.4 million occurring each year in the world), the road traffic injury mortality rate is highest in Africa (28.3 per 100,000 population when corrected for under-reporting, compared with 11.0 in Europe [2]). I selected African countries with recent available data on road mortality and number of vehicles in use (Table 1). When comparing death per 10,000 vehicles, the contrast appears even more stark, with 1.7 deaths per 10,000 vehicles in high-income countries across the world [3] and more than 50 in low-income African countries.

In addition, while developing countries already account for more than 85% of all road traffic deaths in the world [4–6], the upsurge in the number of vehicles per inhabitant will result in an anticipated 80% increase in injury mortality rates between 2000 and 2020 [2]. In Africa, it has been estimated that 59,000 people lost their lives in road traffic crashes in 1990 and that this figure will be 144,000 people by 2020, a 144% increase [7]. By contrast, developed countries have experienced a decreasing trend since the 1960s.

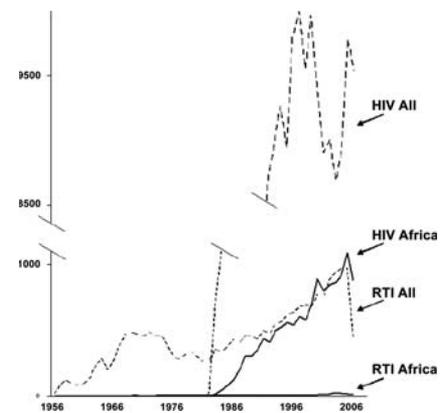
Because road traffic injuries have long been considered to be inevitable and caused by random, unpredictable events, the international community's response to this worldwide public health crisis came relatively late. The World Health Organization (WHO)

arranged a consultation meeting in April 2001, which led to a report entitled "A 5-year WHO strategy for road traffic injury prevention" that summarises the main recommendations from the working group [8]. In 2003, the United Nations Secretary-General sounded the alarm with an official statement [9] describing the global public health challenge posed by road traffic injuries and encouraging Member States to address the problem. One of the recommendations is to promote and facilitate research on this subject, especially in low-income countries where knowledge gaps often jeopardise appropriate resource allocation. Much needs to be done. Global research and development funding for road traffic injuries were estimated in 1996 to range from US\$24 to US\$33 million, compared with more than US\$900 million for HIV/AIDS [1]. Moreover, the overwhelming majority of this money is spent in developed countries.

I reviewed published studies from Africa in the field of road traffic injuries to identify pending priorities for future research programmes that would enable the promotion of effective public health policies in road safety.

Trends in Road Traffic Injuries in Africa

The number of vehicles per inhabitant is still low in Africa: less than one licensed vehicle per 100 inhabitants in low-income Africa versus 60 in high-income countries. Fleet growth leads to increased road insecurity in developing countries [10–12]. This explains, for example, the reported 400% increase in road deaths in Nigeria between the 1960s and the 1980s [13]. Available historical data from developed countries show that it is only when a development threshold is achieved that the road mortality starts to decrease [7,14,15]. Such a threshold is far from



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Figure 1. Number of References Related to Road Traffic Injury and HIV/AIDS, from the PubMed Database

(Figure: A. Flores)
RTIs, road traffic injuries

being reached in sub-Saharan Africa. Indeed, in South Africa, the most developed African country, there were already 17 licensed vehicles per 100 inhabitants in 2005, and no decline in road traffic deaths has been observed so far [16].

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Abbreviations: DALY, disability-adjusted life year; WHO, World Health Organization

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The Essay section contains opinion pieces on topics of broad interest to a general medical audience.

Crash and Casualty Characteristics

A comprehensive literature review published in 1997 showed that pedestrians accounted for between 41% and 75% of all road traffic deaths in developing countries [17]. In Africa, pedestrians and passengers of public transportation are the most affected [17]. They represented 80% of all road traffic deaths in Kenya in 1990 [18] and 67% of all road traffic injuries as recorded in Ghana in the 1989–1991 period [19]. Pedestrians alone accounted for 55% of road traffic deaths in Mozambique in the 1993–2000 period [20], and 46% of road traffic deaths in Ghana between 1994 and 1998 [21]. This large proportion of vulnerable road users is explained by a traffic mix of incompatible users (pedestrians, cyclists, motorbikes, cars, and trucks) with, for example, communities living within the vicinity of roads or the lack of pavement along large urban streets.

The severity of road traffic crashes is also likely to be much greater in Africa than anywhere else, because many vulnerable road users are involved, but also because of the poor transport conditions such as lack of seat belts, overcrowding, and hazardous vehicle environments. Death/injury ratios are, however, not easy to compare because of the differential reporting bias for fatal and non-fatal injuries.

Surveillance

The paucity of surveillance data from African countries leads to

uncertainties, and probably to major under-estimates of the size of the problem [22]. Implementing an effective and sustainable information system related to road traffic injuries should be among the first priorities, as this enables us to address three decisive objectives. First, the monitoring of trends in road traffic injuries is a unique tool to assess the effectiveness of new prevention policies. Second, such a tool also allows for a useful account of the characteristics of traffic insecurity, helping the prioritisation of effective interventions (identification of hot spots, vulnerable road users, regional variations, and so on). Third, issuing persuasive figures through regular national or regional reports will help advocate for the allocation of appropriate resources. Current efforts from many African countries need to be encouraged and evaluated, and success stories should be replicated. Data can come from death statistics [23,24], hospital registries [18,20,25,26], and even from population surveys [27–30]. Collection of police reports is, however, the most frequent system implemented in several African countries [20,21,31–35]. These initiatives need to be generalised, standardised, and, most importantly, evaluated and optimised accordingly.

Pre-Hospital and Hospital Emergency Care

In Ghana, a study conducted in a rural area showed that most injured people are transported to hospitals staffed by

general practitioners with no training in trauma care [36]. Even in urban centres, mortality is high because of disorganisation and lack of adequate equipment or trained personnel [37–39]. Limitations that explain the poor outcome for people involved in road traffic crashes in Africa have been identified, and include lack of trained surgeons, intensive care staff, and field paramedics; underserved medical facilities; inappropriate dedicated transportation; and disorganised or non-existent emergency and trauma services.

Improvement in this area is not an easy task. Even a developed country like the United States needed several years to achieve effectiveness of its trauma care system [40]. There are examples of successful cost-effective interventions implemented in low-income countries, both for pre-hospital care [41,42] and hospital care [43], and a consensus is now emerging about the need for a training package for trauma teams designed for use in Africa. Evaluation of such a program in Uganda has been reported recently [44]. It is therefore necessary to carefully assess which low-cost interventions that can be implemented in African countries are most likely to be effective in improving recovery or survival among persons with life-threatening injuries.

Prevention

Research efforts enabling progress in primary and secondary prevention involve several fields: the human factor,

Table 1. Traffic Fatality Indicators in Africa

Region	Income Level	Country	Year ^b	Vehicles in Use	People Killed in Road Traffic Accidents	Deaths per 100,000 Population	Deaths per 10,000 Vehicles
Sub-Saharan Africa	Low-income	Ethiopia	2002	121,179	1,628	2.3	134.3
	Low-income	Rwanda	2000	26,554	401	4.5	151.0
	Low-income	Senegal	1999	136,471	646	5.7	47.3
	Low-income	Sierra Leone	1999	12,693	66	1.2	52.0
	Low-income	Uganda	1999	120,048	1,527	5.5	127.2
	Lower middle- income	Namibia	2002	166,998	340	16.9	20.4
	Lower middle- income	Swaziland	2001	85,446	255	22.8	29.8
North Africa	Upper middle- income	South Africa	2002	6,549,901	12,198	26.8	18.6
	Upper middle- income	Morocco	2000	1,643,978	3,627	12.2	22.1
	Upper middle- income	Syrian Arab Republic	2004	669,218	1,653	8.9	24.7
	Upper middle- income	Tunisia	2004	945,054	1,533	15.4	16.2
	High-income countries ^a		2004 ^c	585,433,946	104,501	10.8	1.7

Source: World Road Statistics 2006. International Road Federation.

^a32 countries with \$10,726 and more GNI per capita in 2006.

^bYear selected was the most recent with available data on both number of vehicles in use and road traffic deaths.

^c2002 or 2003 for 13 countries out of 32.

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including behaviours and driving capacities, vehicle conditions, and infrastructure. Although those topics are relevant to road safety all over the world, there are specificities in Africa that need to be taken into account.

African public perception of the risks of road traffic injury must be understood in order to be able to adapt and apply prevention campaigns that have proved successful elsewhere. Because research in this field has never been a priority, almost nothing is known. Most available results are from South Africa and are concerned with superstition of cab drivers [45], perception of accident causes [46], youth risk behaviours [47], and psychosocial impact of road traffic injuries on drivers and relatives [48]. A study from Tanzania [49] has compared perceptions in rural and urban areas, and points out the key role of the media. In regards to actual prevention campaigns, I found one study reporting the perceptions of 50 professional drivers in Ghana of a campaign using TV spots [50].

The risk associated with drinking and driving has been thoroughly described in developed countries, but is certainly also a key determinant in developing countries, as shown in Kenya [51], Nigeria [52,53], Tanzania [54], and South Africa [55]. The Kenyan study is particularly interesting as it shows that alcohol not only plays a major role

in road crashes involving 4-wheeled vehicles, but also plays a significant role for 2-wheeled vehicles and pedestrians [51].

Speed control probably carries the greatest potential to save lives. The key factor in the effectiveness of traffic regulations is the drivers' perception that they run a high risk of being detected and punished for infractions [56]. Unfortunately, in Africa, the combination of a low enforcement level, frequent corruption of police officers, and low public awareness dooms any traffic regulation, including speed control, to failure. A report from Ghana illustrated how, in recognition of the shortcomings of enforcement, speed bumps and rumble strips were installed and reduced fatalities by 55% [57].

Almost everything remains to be done in the field of medical driving incapacities. I found only two studies on the subject from Africa, related to visual impairment of drivers in Nigeria [58] and South Africa [59]. The potentially high prevalence of drivers' incapacities calls for intense research efforts to identify and prioritise medical conditions responsible for substantial numbers of road traffic injuries.

Even though the impact of vehicle condition has almost never been scientifically assessed [60], the issue was recognised early as a priority for traffic safety. Two problems have

been identified in this respect: lack of maintenance and importation of old vehicles. In most African countries, there is no inspection requirement, and whenever legally mandated safety standards are advocated they have been ruled out, as it is considered that vehicle owners cannot afford the corresponding buying and maintenance costs. As far as importations are concerned, several African countries have instituted laws limiting or banning importation of the oldest vehicles, but applying them is often demanding. In Senegal, for example, a law was promulgated in 2001 which banned importation of cars older than five years and trucks older than 10 years, but the law only started to be applied in 2003.

Finally, road infrastructures are also a component of road safety and are often prioritised by governments and funding agencies. However, scientific evaluation studies are missing [61], mainly because of the lack of appropriate surveillance accident data. Current infrastructure interventions are often inappropriate, as it is impossible to localise and prioritise points of intervention [31].

Road Safety and Development

As recently advocated by Khayesi and Peden [22], road safety in Africa is "part of the broader development process". The situation is particularly worrying in this continent because of the combination of incompatible road users, poor vehicle condition, under-developed infrastructure, lack of risk awareness, and ineffective enforcement jeopardised by corruption or bribery. The road transport system is the dominant form of inland transportation and carries more than 95% of passenger traffic. This sector is often prioritised in donor development plans in countries such as Cameroon [62], Ghana [63], Gabon [64], and Senegal [65], to cite only a few African countries receiving European Union development aid. Road transportation is essential to access markets and services, and to unlock agricultural potential, which will lead to improved incomes in rural areas. Road safety concerns could also endanger income from tourism. Foreign affairs departments are increasingly cautioning their nationals against road injury risk, just as with infectious

disease risk [66]. In a study of 794 German tourists who had travelled to Kenya, Tanzania, Senegal, The Gambia, India, Nepal, Thailand, or Brazil, more than 5% experienced an accident [67].

Past Research Efforts

In order to gauge the magnitude of past research efforts in road traffic injuries from Africa, I performed an automatic search in the PubMed database with the MeSH (a medical indexing system) term “accidents, traffic” and found a total of 25,320 references. Of these, only 290 were selected by adding the MeSH term “Africa”. For the purpose of comparison, I performed the same search with MeSH term “HIV” and found 193,695 references, of which 12,674 related to Africa. Figure 1 shows how these figures evolved between 1956 (the first year for which a related citation was found in PubMed) and 2006. Clearly, the number of publications related to Africa has been increasing only slightly since the late 1980s, while publications from all over the world have escalated exponentially, from about 100 per year in the 1960s to almost 1,000 per year today. Only the comparison of curves is of interest here, as many studies related to road traffic safety (and to HIV/AIDS) have been published in journals not referenced in PubMed.

An Ad Hoc Committee on health research was convened in 1996 by WHO and provided estimates of research and development expenditures for major global health problems using a capture–recapture method [1]. In 1990, expenditure per one DALY lost was US\$85 for HIV/AIDS and US\$0.83 for road traffic injuries (the ratio is 102).

Conclusion

Many results on road injury prevention are available from developed countries. We now urgently need to scale up surveillance and research efforts in developing countries in order to determine how to build on these results [68,69], taking regional specificities into account. A proper surveillance system should produce reliable data handled by trained epidemiologists to issue intervention priorities. Indispensable research actions include the assessment of population knowledge, attitudes, and

behaviours; identification of regional intervention priorities; effectiveness and cost-effectiveness evaluations of interventions; and evaluation of care management practices and training procedures.

In Africa, driving a car is still considered a privilege, an enviable option, not a risky task with inherent responsibilities. Unfortunately, Africa has other burning public health priorities. Documented success stories in road safety are needed to demonstrate that road traffic accidents need not be inevitable and unpredictable, but are avoidable. Changing the mindset of road users will be a challenge, but many lives are at stake. ■

Supporting Information

Alternate Language Article S1. Translation of the manuscript into French by EL

Found at doi:10.1371/journal.pmed.0040170.sd001 (201 KB DOC).

References

- Ad Hoc Committee on Health Research Relating to Future Intervention Options (1996) Investing in health research and development. Geneva: World Health Organization. Available: http://www.who.int/tdr/publications/publications/investing_report.htm. Accessed 22 May 2007.
- Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, et al. (2004) World report on road traffic injury prevention. Geneva: World Health Organization. Available: http://www.who.int/world-health-day/2004/infomaterials/world_report/en/. Accessed 22 May 2007.
- Observatoire National Interministériel de Sécurité Routière (2005) La sécurité routière dans les pays de l'Union Européenne. Available: <http://www.securite-routiere.gouv.fr/IMG/Synthese/Europe.pdf>. Accessed 22 May 2007.
- Nantulya VM, Reich MR (2002) The neglected epidemic: Road traffic injuries in developing countries. *BMJ* 324: 1139–1141.
- Ameratunga S, Hijar M, Norton R (2006) Road-traffic injuries: Confronting disparities to address a global-health problem. *Lancet* 367: 1533–1540.
- Mohan D (2002) Road safety in less-motorized environments: Future concerns. *Int J Epidemiol* 31: 527–532.
- Kopits E, Cropper M (2005) Traffic fatalities and economic growth. *Accid Anal Prev* 37: 169–178.
- World Health Organization (2002) A 5-year WHO strategy for road traffic injury prevention. Available: http://www.who.int/violence_injury_prevention/publications/road_traffic/5yearstrat/en/index.html. Accessed 22 May 2007.
- United Nations General Assembly (2003) Global road safety crisis. Report of the Secretary-General. Available: http://www.unece.org/trans/roadsafe/docs/SG_report_e.pdf. Accessed 22 May 2007.
- Mekky A (1985) Effects of rapid increase in motorization levels on road fatality rates in some rich developing countries. *Accid Anal Prev* 17: 101–109.
- Garg N, Hyder AA (2006) Exploring the relationship between development and road

- Public Health 16: 487–491.
- Ka AS, Imbert P, Diagne I, Seye MN, Gerardin P, et al. (2003) [Epidemiology and prognosis of childhood injuries in Dakar, Senegal.] [Article in French]. *Med Trop (Mars)* 63: 533–538.
- Oluwasanmi AJ (1993) Road accident trends in Nigeria. *Accid Anal Prev* 25: 485–487.
- Bishai D, Quresh A, James P, Ghaffar A (2006) National road casualties and economic development. *Health Econ* 15: 65–81.
- Vasconcellos EA (1999) Urban development and traffic accidents in Brazil. *Accid Anal Prev* 31: 319–328.
- Road Traffic Management Corporation (2006) December 2005 road traffic report on number of registered, un-roadworthy and un-licensed vehicles, driving licences, PrDPs, traffic volumes, speed, distance travelled and fatal crashes. Available: <http://www.arrivealive.co.za/documents/stats/2005part1a.pdf>. Accessed 22 May 2007.
- Odero W, Garner P, Zwi A (1997) Road traffic injuries in developing countries: A comprehensive review of epidemiological studies. *Trop Med Int Health* 2: 445–460.
- Odero W, Khayesi M, Heda PM (2003) Road traffic injuries in Kenya: Magnitude, causes and status of intervention. *Inj Control Saf Promot* 10: 53–61.
- Gorell R (1997) Accident data collection and analysis: The use of MAAP in the sub-Saharan region of Africa. 3rd African Road Safety Congress, Pretoria, 14–17 April 1997. Available: http://www.transport-links.org/transport_links/filearea/publications/1_560_PA3230_1997.pdf. Accessed 22 May 2007.
- Romao F, Nizamo H, Mapase D, Rafico MM, Jose J, et al. (2003) Road traffic injuries in Mozambique. *Inj Control Saf Promot* 10: 63–67.
- Afukkaar FK, Antwi P, Oforu-Amaah S (2003) Pattern of road traffic injuries in Ghana: Implications for control. *Inj Control Saf Promot* 10: 69–76.
- Khayesi M, Peden M (2005) Road safety in Africa. *BMJ* 331: 710–711.
- London J, Mock C, Abantanga FA, Quansah RE, Boateng KA (2002) Using mortality statistics in the development of an injury surveillance system in Ghana. *Bull World Health Organ* 80: 357–364.
- Butchart A, Peden M, Matzopoulos R, Phillips R, Burrows S, et al. (2001) The South African National Non-Natural Mortality Surveillance System—Rationale, pilot results and evaluation. *S Afr Med J* 91: 408–417.
- Kobusingye OC, Lett RR (2000) Hospital-based trauma registries in Uganda. *J Trauma* 48: 498–502.
- Bartolomeos K, Peden M (2004) WHO-supported injury surveillance programs in Africa: Mozambique and Ethiopia. *African Safety Promotion* 1: 34–37.
- Nordberg E, Kimani V, Diwan V (2000) Household survey of injuries in a Kenyan district. *East Afr Med J* 77: 240–244.
- Mock CN, Abantanga F, Cummings P, Koepsell TD (1999) Incidence and outcome of injury in Ghana: A community-based survey. *Bull World Health Organ* 77: 955–964.
- Mock CN, Forjuoh SN, Rivara FP (1999) Epidemiology of transport-related injuries in Ghana. *Accid Anal Prev* 31: 359–370.
- Kobusingye O, Guwatudde D, Lett R (2001) Injury patterns in rural and urban Uganda. *Inj Prev* 7: 46–50.
- Institut des Sciences et des Techniques de l'Équipement et de l'Environnement pour le Développement (2001) Guide méthodologique: Sécurité routière en Afrique—Enseignements de l'expérience 1994–2001. Available: http://www.isted.com/publications/francais/guide_securite.htm. Accessed 22 May 2007.

32. Odero W (1995) Road traffic accidents in Kenya: An epidemiological appraisal. *East Afr Med J* 72: 299–305.
33. Barengo NC, Mkamba M, Mshana SM, Miettola J (2006) Road traffic accidents in Dar-es-Salaam, Tanzania during 1999 and 2001. *Int J Inj Contr Saf Promot* 13: 52–54.
34. Asogwa SE (1978) Road traffic accidents: A major public health problem in Nigeria. *Public Health* 92: 237–245.
35. Jegede FJ (1988) Spatio-temporal analysis of road traffic accidents in Oyo State, Nigeria. *Accid Anal Prev* 20: 227–243.
36. Mock CN, nii-Amon-Kotei D, Maier RV (1997) Low utilization of formal medical services by injured persons in a developing nation: Health service data underestimate the importance of trauma. *J Trauma* 42: 504–511; discussion 511–503.
37. London JA, Mock CN, Quansah RE, Abantanga FA, Jurkovich GJ (2001) Priorities for improving hospital-based trauma care in an African city. *J Trauma* 51: 747–753.
38. Ndiaye A, Camara S, Ndoye A, Dansokho A, Sow CM, et al. (1993) [Mortality caused by traffic accidents at the Traumatology and Orthopedics Center of Grand-Yoff. A 2-year study. Apropos of 156 cases]. [Article in French]. *Med Trop (Mars)* 53: 487–491.
39. Solagberu BA, Kuranga SA, Adekanye AO, Ofoegbu CPK, Udoffa US, et al. (2003) Preventable trauma deaths in a country without emergency medical services. *Afr J Trauma* 1. Available: [http://www.afjtrauma.com/preventable_trauma_deaths_\(full_article\).htm](http://www.afjtrauma.com/preventable_trauma_deaths_(full_article).htm). Accessed 22 May 2007.
40. Nathens AB, Jurkovich GJ, Cummings P, Rivara FP, Maier RV (2000) The effect of organized systems of trauma care on motor vehicle crash mortality. *JAMA* 283: 1990–1994.
41. Arreola-Risa C, Mock CN, Lojero-Wheatly L, de la Cruz O, Garcia C, et al. (2000) Low-cost improvements in prehospital trauma care in a Latin American city. *J Trauma* 48: 119–124.
42. Husum H, Gilbert M, Wisborg T, Van Heng Y, Murad M (2003) Rural prehospital trauma systems improve trauma outcome in low-income countries: A prospective study from North Iraq and Cambodia. *J Trauma* 54: 1188–1196.
43. Ali J, Adam R, Butler AK, Chang H, Howard M, et al. (1993) Trauma outcome improves following the advanced trauma life support program in a developing country. *J Trauma* 34: 890–898; discussion 898–899.
44. Lett R, Kobusingye O, Asingwire N, Ssenooba F (2004) Trauma team training course: Evaluation of Ugandan implementation. *African Safety Promotion* 2: 78–92.
45. Peltzer K, Renner W (2003) Superstition, risk-taking and risk perception of accidents among South African taxi drivers. *Accid Anal Prev* 35: 619–623.
46. Butchart A, Kruger J, Lekoba R (2000) Perceptions of injury causes and solutions in a Johannesburg township: Implications for prevention. *Soc Sci Med* 50: 331–344.
47. Flisher AJ, Ziervogel CF, Chalton DO, Leger PH, Robertson BA (1993) Risk-taking behaviour of Cape Peninsula high-school students. Part VI. Road-related behaviour. *S Afr Med J* 83: 486–490.
48. Peltzer K, Renner W (2004) Psychosocial correlates of the impact of road traffic accidents among South African drivers and passengers. *Accid Anal Prev* 36: 367–374.
49. Astrom AN, Moshiro C, Hemed Y, Heuch I, Kvale G (2006) Perceived susceptibility and perceived causes of road traffic injuries in an urban and rural area of Tanzania. *Accid Anal Prev* 38: 54–62.
50. Blantari J, Asiamah G, Appiah N, Mock C (2005) An evaluation of the effectiveness of televised road safety messages in Ghana. *Int J Inj Contr Saf Promot* 12: 23–29.
51. Odero W (1998) Alcohol-related road traffic injuries in Eldoret, Kenya. *East Afr Med J* 75: 708–711.
52. Asogwa SE (1980) Some characteristics of drivers and riders involved in road traffic accidents in Nigeria. *East Afr Med J* 57: 399–404.
53. Aguwa CN, Anosike EO, Akubue PI (1982) Road accidents in Nigeria: Level of alcohol in the blood of automobile drivers. *Cent Afr J Med* 28: 171–174.
54. Patel NS, Bhagwat GP (1977) Road traffic accidents in Lusaka and blood alcohol. *Med J Zambia* 11: 46–49.
55. Myers RA, Taljaard JJ, Penman KM (1977) Alcohol and road traffic injury. *S Afr Med J* 52: 328–330.
56. O'Neill B, Mohan D (2002) Reducing motor vehicle crash deaths and injuries in newly motorising countries. *BMJ* 324: 1142–1145.
57. Afukaar FK (2003) Speed control in developing countries: Issues, challenges and opportunities in reducing road traffic injuries. *Inj Control Saf Promot* 10: 77–81.
58. Alakija W (1981) Poor visual acuity of taxi drivers as a possible cause of motor traffic accidents in Bendel State, Nigeria. *J Soc Occup Med* 31: 167–170.
59. Humphriss D (1987) Three South African studies on the relation between road accidents and drivers' vision. *Ophthalmic Physiol Opt* 7: 73–79.
60. van Schoor O, van Niekerk JL, Grobbelaar B (2001) Mechanical failures as a contributing cause to motor vehicle accidents South Africa. *Accid Anal Prev* 33: 713–721.
61. Berhanu G (2004) Models relating traffic safety with road environment and traffic flows on arterial roads in Addis Ababa. *Accid Anal Prev* 36: 697–704.
62. Coopération Cameroun-Communauté européenne (2001) Cadre de stratégie de la coopération. Available: <http://www.snvworld.org/cds/rgEUp/Strategy%20papers/Cameroon.pdf>. Accessed 22 May 2007.
63. Republic of Ghana-European Community (2002) Country Strategy Paper and Indicative Programme for the period 2002–2007. Available: <http://delgha.ec.europa.eu/en/publications/CSP-NIP%20Ghana%202002-2007.pdf>. Accessed 22 May 2007.
64. Coopération Gabon-Communauté européenne (2001) Stratégie de coopération et programme indicatif. Available: http://www.fnh.org/francais/fnh/uicn/pdf/gabon_ce_strat.pdf. Accessed 22 May 2007.
65. Sengal-Communauté européenne (2002) Document de stratégie de coopération et programme indicatif pour la période 2002–2007.
66. US Department of State (2007) Road safety overseas. Available: http://travel.state.gov/travel/tips/safety/safety_1179.html. Accessed 22 May 2007.
67. Rack J, Wichmann O, Kamara B, Gunther M, Cramer J, et al. (2005) Risk and spectrum of diseases in travelers to popular tourist destinations. *J Travel Med* 12: 248–253.
68. Forjuoh SN (2003) Traffic-related injury prevention interventions for low-income countries. *Inj Control Saf Promot* 10: 109–118.
69. Hazen A, Ehiri JE (2006) Road traffic injuries: Hidden epidemic in less developed countries. *J Natl Med Assoc* 98: 73–82.