

THEORETICAL DISCUSSION

Prehospital Trauma Care Systems: Potential Role Toward Reducing Morbidities and Mortalities from Road Traffic Injuries in Nigeria

Davies Adeloye, MBBS, MPH

Centre for Population Health Sciences, The University of Edinburgh Medical School, Edinburgh, Scotland

Correspondence:

Davies Adeloye, MBBS, MPH
Centre for Population Health Sciences
The University of Edinburgh Medical School
Teviot Place, Edinburgh EH8 9AG,
Scotland
E-mail: davies.adeloye@ed.ac.uk

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Abbreviations:

FRSC: (Nigerian) Federal Road Safety Corps
LASAMBUS: Lagos State Ambulance Services

NEMA: (Nigerian) National Emergency Management Agency

NGO: nongovernmental organization

NRSC: National Road Safety Council of Kenya

PTCS: prehospital trauma care system

RTI: road traffic injury

SAVAN: Save Accident Victims Association of Nigeria

WHO: World Health Organization

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Abstract

Introduction: Road traffic injuries (RTIs) and attendant fatalities on Nigerian roads have been on an increasing trend over the past three decades. Mortality from RTIs in Nigeria is estimated to be 162 deaths/100,000 population. This study aims to compare and identify best prehospital trauma care practices in Nigeria and some other African countries where prehospital services operate.

Methods: A review of secondary data, grey literature, and pertinent published articles using a conceptual framework to assess: (1) policies; (2) structures; (3) first responders; (4) communication facilities; (5) transport and ambulance facilities, and (6) roadside emergency trauma units.

Results: There is no national prehospital trauma care system (PTCS) in Nigeria. The lack of a national emergency health policy is a factor in this absence. The Nigerian Federal Road Safety Corps (FRSC) mainly has been responsible for prehospital services. South Africa, Zambia, Kenya, and Ghana have improved prehospital services in Africa.

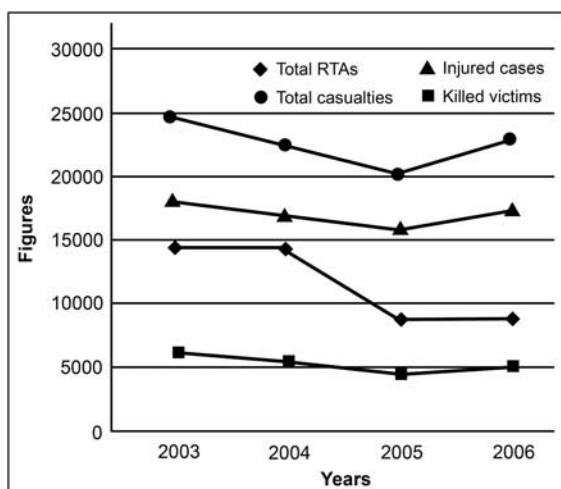
Conclusions: Commercial drivers, laypersons, military, police, a centrally controlled communication network, and government ambulance services are feasible delivery models that can be incorporated into the Nigerian prehospital system. Prehospital trauma services have been useful in reducing morbidities and mortalities from traffic injuries, and appropriate implementation of this study's recommendations may reduce this burden in Nigeria.

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Introduction

The number of road traffic crashes in Nigeria over the past three decades has been alarming. Most interventions to reduce the number of crashes have been unproductive. Between 2003 and 2006, 46,814 traffic crashes occurred, with 21,266 deaths reported (Figure 1). Current reports from the Federal Road Safety Corps (FRSC) show that road traffic accident deaths in Nigeria have reached a total of 24,850 (1.46% of all deaths in the country), with a crude death rate of 162 deaths and an age-adjusted death rate of 21.55 deaths/100,000 population respectively.¹ Currently, Nigeria is ranked number 191 out of 192 countries in terms of deadliest roads.¹ Due to this increasing number of road traffic crashes on Nigerian roads, experts believe death rates actually could be higher than estimated; several requests have been made to the government to include tackling this increasing public health burden in its priority list.²

Nigeria has no national prehospital system, no national ambulance service, and no policy supporting a prehospital system. The National Emergency Management Agency (NEMA) is the main national emergency body in Nigeria. It tackles only general disasters in the country and does not necessarily offer prehospital care. Hospitals within Nigeria do have accidents and emergency units, but these have not been coordinated to offer prehospital services. The FRSC is the major body that has contributed to emergency and prehospital response in Nigeria. But, the FRSC still needs professional inputs to significantly reduce traffic morbidities and mortalities. A prehospital trauma care system incorporated into emergency medical services could play a key role in reducing these high morbidities and mortalities. Basic prehospital trauma services offered in some low- and middle-income countries have been effective in reducing traffic fatalities;³ this fact is corroborated by the Cochrane reviews.⁴



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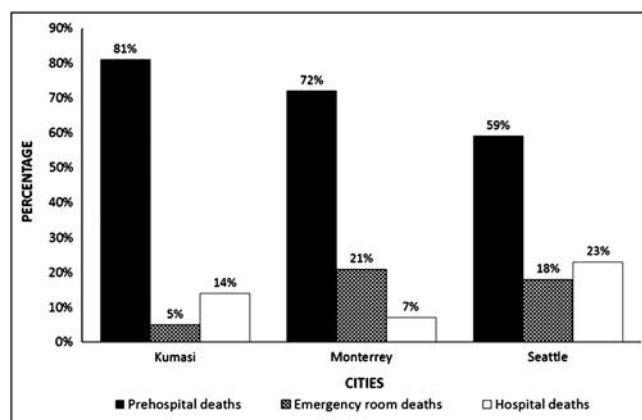
Figure 1. Road Traffic Fatality Profile in Nigeria in the Years 2003 to 2006¹

Abbreviation: RTA, road traffic accident.

A prehospital trauma care system is an integral part of Emergency Medical Services involved in instituting immediate care of injured victims at the scene of the incident through their arrival at health care facilities. This involves activities rendered by rescuers (first responders), paramedics and medics, and ambulance providers. The 2005 World Health Organization (WHO) publication on prehospital systems highlights three tiers of prehospital care: (1) care provided by laypersons in the community; (2) care provided by those who have received some level of prehospital care training; and (3) advanced prehospital trauma care provided by individuals highly skilled in the use of sophisticated life-support equipment and other emergency interventions.⁵ Trunkey's tri-modal distribution of trauma deaths⁶ notes that 50% of the associated deaths occur in the first hour of sustaining fatal injuries. Therefore, prehospital care should be instituted within this first hour in order to reduce fatal outcomes. This is referred to as the "Golden Hour."⁷

Globally, an estimated 1.2 million people are killed and 50 million additional people are injured annually from road traffic accidents. Due to the lack of functional prehospital medical services and other preventive options in low- and middle-income countries, these figures could increase by as much as 80% over the next decade.⁸ Studies show that in developing countries the majority of traffic-accident-related deaths occur during the prehospital phase, further emphasizing the need for an established prehospital response in Nigeria.³ A substantially greater percentage of deaths occur during the prehospital phase in Kumasi, Ghana compared with developed cities such as Monterrey, Mexico and Seattle, California USA (Figure 2). Another study estimated that one-third of prehospital deaths from traffic crashes are preventable.⁹ This suggests that appropriate intervention during the prehospital phase would be helpful in reducing traffic accident fatalities.

It is widely believed that efforts to prevent traffic crashes (primary intervention) are more appropriate interventions. Specific interventions focusing on the observation of road safety codes, road maintenance strategies, the use of motorcycle helmets, and checking the blood alcohol concentration of drivers, etc., are good primary preventative strategies. However, in Nigeria, provision of primary preventative measures has not impacted the number of road traffic deaths. This failure includes flawed



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Figure 2. Distribution of Trauma Death Sites in Three Cities²⁵

management of the agent (vehicles), the environment (roads), and the hosts (humans), with previous administrations poorly responding to help prevent the occurrence of traffic crashes in the country (Figure 3). A composite review and adoption of secondary preventative interventions (early diagnosis and treatment) could be beneficial and complementary to the existing primary measures. In view of this, the role of prehospital trauma care systems (a component of early diagnosis and treatment) in reducing the current morbidities and mortalities from road traffic injuries in Nigeria is the focus of this review. The aim of this review, therefore, is to compare and identify best prehospital trauma care practices in Nigeria and some other African countries in which the prehospital services operate, and to provide recommendations based on the findings.

Methods

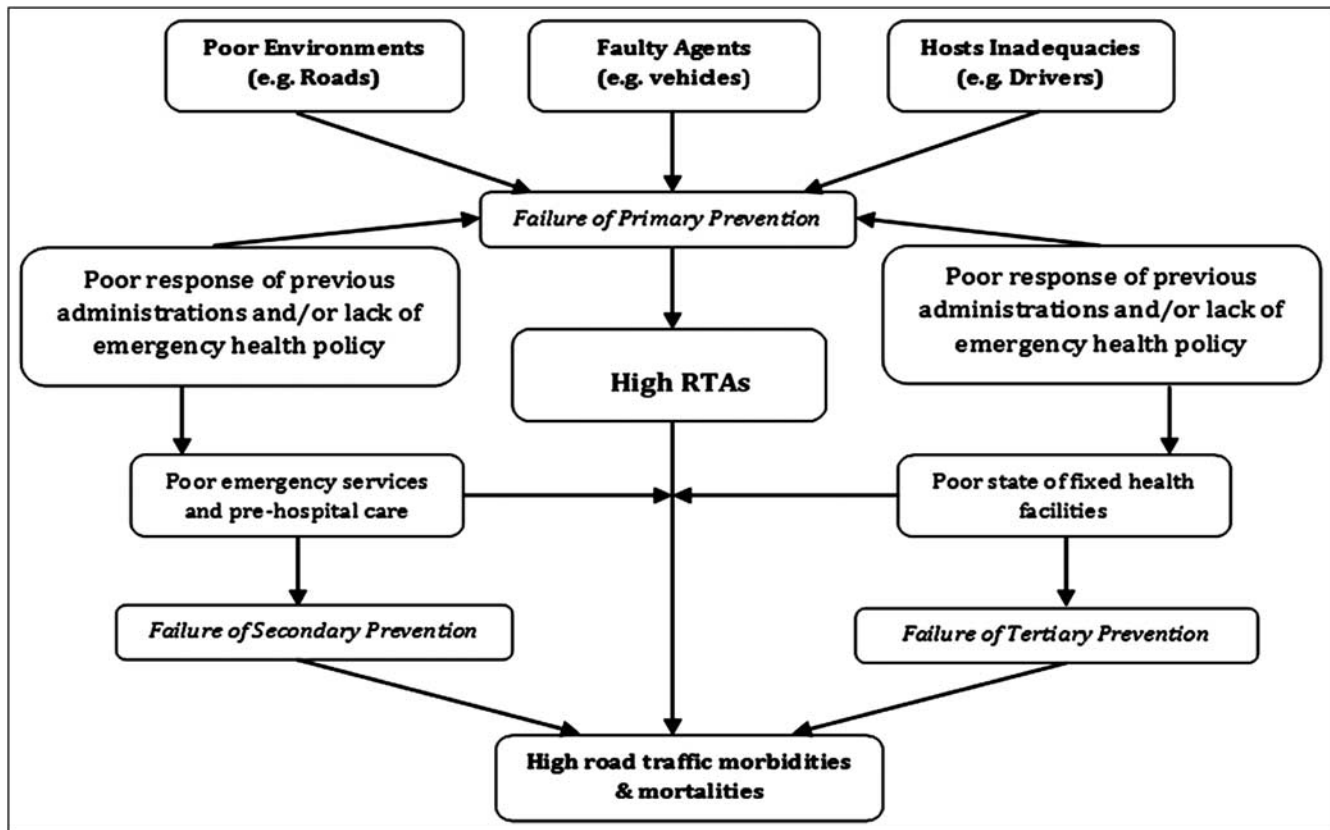
The methodology comprised a review of secondary, published articles, and grey literature obtained from various sources in Nigeria, some African countries (mainly Ghana, South Africa, Zambia, and Kenya), and databases of international organizations (World Health Organization, United Nations, World Bank). The rationale behind this methodology is due to the lack of data on prehospital systems. Nigerians are relatively new to this concept, which could make the collation of primary data difficult. However, data obtained from the review were ordered into a logical sequence using a conceptual framework specifically developed for this study. This framework included policies and structures related to prehospital care, first responders, communication facilities, transport facilities, and roadside emergency trauma units (Figure 4). An option appraisal is employed in the results analysis to identify strategies and determine the best delivery option by technically appraising some sets of criteria considered to be fundamental to any successful project.¹⁰

Results

Prehospital services in Nigeria are summarized in Table 1 and discussed in detail below.

Policies

Nigeria has no specific policy related to the establishment and operation of a prehospital trauma care system. The Nigerian National Health Policy adopted in 1988 was commended; but some health issues, including a national emergency and disaster



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Figure 3. Analysis of Causes of Road Traffic Accidents and Attendant Fatalities
Abbreviation: RTA, road traffic accident.

management system, were not included in the policy.¹¹ This policy has been reviewed by past administrations, but with no clear inclusion of prehospital system guidelines.

In contrast, the 1994 South African National Health Plan, the South African Health Sector Strategic Framework (1999–2000), and Strategic Priorities for the National Health System (2004–2009) clearly included emergency medical services and a prehospital trauma system in its targeted priorities.^{12,13} These strategies have helped to reinforce prehospital services in South Africa.

The National Health Policy of Ghana, which has a 5-year strategic plan, entails some prehospital services guidelines.¹⁴ Interestingly, the Ministry of Health also has its own transport policy that deals specifically with some issues of prehospital care.¹⁵ These policies have been complemented by the National Road Safety Policy and Strategy, which includes guidelines for on-the-scene management of road crashes and ways to maintain safety on highways.¹⁶

Structures

Structures in place for prehospital services in African countries are not very specific; some are incorporated into existing national emergency services, while others regard some components of the prehospital system as its main structure.

The Nigerian FRSC, a paramilitary structure responsible for road safety activities in the country, was created in 1988 through Decree No. 45 of 1988 as amended by Decree 35 of 1992. For some years, its functions also have involved the rendering of emergency services to accident victims. The Act 12, as amended by

Act 50 of 1999, brought the National Emergency Management Agency (NEMA) into existence. The NEMA mainly manages general disasters in Nigeria; it does not offer prehospital care.¹⁷

The Lagos State Government, of the 36 states in Nigeria, has a functional prehospital system. This prehospital service, also called the Lagos State Ambulance Services (LASAMBUS), was established in 2001, and works in concert with the state emergency services. To an extent, it has improved the emergency response time and quality of care provided to accident victims in the state (Table 2).¹⁸

South Africa is the only country on the African continent with an organized, statutory system of prehospital care.¹⁹ The prehospital system in South Africa works with private emergency companies to provide standard prehospital care to its citizens.¹⁹

The Zambian government has a Specialty Emergency Service that has been in operation since 1991 as an advanced life support and ambulance evacuation service; it complements the Zambian police emergency response in rendering prehospital care.²⁰

The National Road Safety Council of Kenya (NRSCCK) is responsible for safety on its highways.²¹ The success of NRSCCK is based upon the strong backing it receives from the government and Ministry of Health.²²

All of the above are structures that have helped prehospital care in the various contexts.

First Responders

The term “first responders” refers to laypersons, passersby, and police; it includes drivers present immediately after an

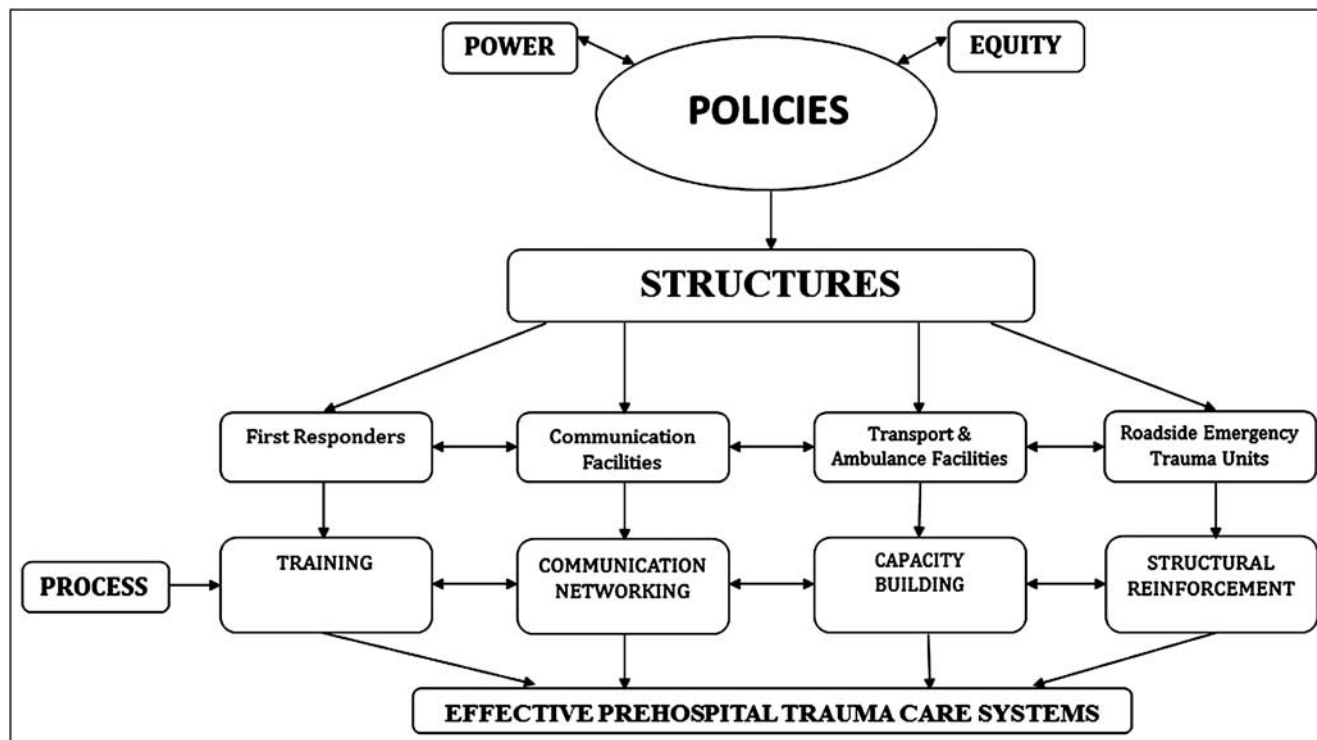


Figure 4. Conceptual Framework for a Prehospital Trauma Care System

Prehospital Component	Coverage and Distribution	Assessment
Policies	Specific policy unavailable	Non-functional
Structures	No national statutory body, aside from FRSC and NEMA	Partially functional structures in southwestern Nigeria; fairly established in Lagos
First responders	Police, FRSC, drivers, laypersons and relatives	Not effective; no legal/policy backing for activities.
Communication facilities	FRSC emergency lines and Lagos state lines	FRSC lines not effective; Lagos lines fairly functional
Transport and ambulance facilities	No national ambulance service	Fairly functional in Lagos, Yobe and Ogun States
Roadside emergency trauma units	Operated by FRSC	Used occasionally for prehospital functions

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Table 1. Prehospital Services in Nigeria

Abbreviations: FRSC, (Nigerian) Federal Road Safety Commission; NEMA, (Nigerian) National Emergency Management Agency.

accident/injury occurs. First responders’ activities in Nigeria have not been effective in providing prehospital care, probably because their efficacy in this regard had been disputed by past administrations, and existing laws in the country require that a rescuer/responder file some form of police report when helping crash victims.²³ Generally, the average Nigerian does not want to have any relationship with the police; this invariably limits the first responder’s involvement in providing emergency care.

Save Accident Victims Association of Nigeria (SAVAN) is a nongovernmental organization (NGO) established in 1996 and based at the University of Benin Teaching Hospital, Benin, Nigeria. The SAVAN organization has been involved in first

responders’ activities across the country by providing immediate help for crash victims until their relatives arrive. The government has not acknowledged the response efforts of SAVAN or other NGOs involved in crash scene management, which has limited their activities.

In a study conducted in Kenya, unknown persons were reported to be involved in the prehospital care of 76.1% of the injured victims, while the police and military personnel were responsible for prehospital care in 6.1% of the cases.²⁴ In South Africa, studies have demonstrated that 47.6% of accident victims were transported to hospitals by commercial and private means.¹⁹ The options appraisal focus, therefore, compares the capacity of

PTCS Components	Effectiveness	Organization	Equity Distribution	Feasibility		
				Financial	Political	Overall ^a
Policies and Structures	Effective	Not too difficult	May enhance equity	Stable funding required	Needs lobbying and experts' influence	+
Commercial drivers and laypersons	Effective	Quite cumbersome	Enhances equity	Stable funding required	Needs lobbying	+++
Military and police	Effective	Good	Strengthens rural prehospital systems	Stable funding required	Needs experts' influence	+++
Centrally controlled network	Effective	Requires highly technical organization	Enhances equity	Stable funding required	Needs experts' influence	++
Radio/mobile phones	Not effective	Requires a central control	May not enhance equity	Not expensive	Easy to negotiate	-
Government ambulance services	Effective	Requires good organization capacities	Enhances equity	Expensive	Needs lobbying	+++
Commercial and private services	Not effective	Requires additional government services	Enhances inequity	Very Expensive	Needs government's approval	-
Roadside emergency trauma units	May be effective	Requires monitoring and evaluation	Enhances equity	Stable funding required	Needs experts' influence	++

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Table 2. Prehospital Trauma Care System Options Appraisal^aKey: +, mildly feasible; ++, highly feasible; +++, moderately feasible; -, not feasible.

Abbreviation: PTCS, prehospital trauma care system.

commercial drivers and laypersons versus the capacity of military and police in offering prehospital care (Table 2).

In Ghana, 335 commercial taxi and minibus drivers were trained in providing basic first-aid skills to accident victims. In a 6-month follow-up interview, 61% of the trained drivers indicated that they had provided some form of first aid to accident victims after the course, and the corresponding report indicated marked improvement in the provision of various first-aid activities including crash scene management, external bleeding control, airway management, and splinting of the extremities.^{25,26} In Uganda and South Sudan, the police and military paramedics also were used effectively in reinforcing their rural prehospital systems.^{8,27}

Communication Facilities

No stable emergency communication system exists in Nigeria. With the introduction of mobile telecommunication services in 1999, widespread communications in Nigeria have improved; however, this has not been translated into improved emergency services. The Federal Road Safety Commission (FRSC) has emergency call numbers on its Web site: 0700-CALL-FRSC, 0700-2255-3772, and 08077690362; however, the long numbers, and reduced public access to the Internet and media do not make

this method of communication very effective. Recently a toll-free emergency number (122) was introduced.²⁸

Today, developed countries employ sophisticated means of emergency communication, digitally controlled from a central source, while some developing countries still use only radio/mobile-phones for their emergency communication.²⁹ The options appraisal compares the centrally controlled communication network with the use of radio/mobile-phones (Table 2).

The centrally controlled communication network employs enhanced prehospital communication such that all emergency calls are received through a central line, from which each call is forwarded to the nearest prehospital services. Zambian Specialty Emergency Services have a central communication network with seven emergency 24-hour landlines, 24-hour monitored high-frequency radios, fax lines, regularly checked electronic mail, satellite phones, and vehicle radios. The Zambian communication networks operate at a very high technical level.²⁰

South Africa also uses this model; a fixed central emergency call-line (112) receives all incoming calls in a control center in the Johannesburg metropolis.¹⁹

The use of radiophones and/or mobile phones as the means of connecting to prehospital services was applied in Lagos, Nigeria at the initial stages of the Lagos State Ambulance Services.

Prehospital Component	Strengths	Weaknesses
Policies	Policies are crucial to the successful establishment of a PTCS in any country	The lack of a specific PTCS policy in Nigeria has been unfavorable
Structures	These are umbrellas that determine the operational success of a PTCS	A structure not well planned could enhance gender and financial inequity. This is identified in Nigeria.
First responders	Commercial drivers, laypersons, military and police can be useful	Training could be tasking. Nigeria is deficient here.
Communication facilities	Communication networking improves prehospital response time	It requires a sound technical terrain. Efforts in Nigeria have not been productive
Transport and ambulance facilities	Ambulance service is a cost-effective intervention in averting traffic deaths	It is highly capital intensive. Nigeria ambulances are used mostly for inpatient and hospital referrals.
Roadside emergency trauma units	They could reduce inequity. Nigeria already has this component.	Not widely incorporated into global prehospital settings

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Table 3. Summary of Strengths and Weaknesses Identified in the Analysis of the Components of Prehospital Care in Nigeria
Abbreviation: PTCS, prehospital trauma care system.

The phone system was not very effective because there was no central control. However, with the introduction of a central control source, the services improved.¹⁸

Transport and Ambulance Facilities

Ambulance services have been provided by fixed health care facilities within the country; however, ambulances have been widely used by inpatients for hospital referrals and transfers, but have been used scarcely for prehospital services. A study in Kaduna, north-central Nigeria, revealed that there was no formal prehospital transport system for injured victims brought to the hospital.³⁰ Passersby, police, FRSC, and commercial drivers have been the main providers of emergency transportation at the scene of most traffic crashes, with 48.2% of accident victims being transported within the Golden Hour of trauma and others arriving at the emergency department within six hours of injury.^{23,31,32} In Lagos state, however, the state-owned ambulance service, LASAMBUS, operates and has been regarded as the most effective in the country.

In Kenya, ambulances accounted for 1.4% of the transported cases, with 51.9% reaching fixed health facilities within 30 minutes of accidents, and medical care instituted to 66.2% of victims within one hour of injury.²⁴ In South Africa, private and commercial transport services coexist with government ambulance services, and together they have improved the average prehospital transport time.¹⁹ These examples reflect two broad delivery models of prehospital transport: government ambulance services versus commercial and private services (Table 2).

Ghana Ambulance Service, a government ambulance service that procured 50 new ambulances in 2005, has begun training the paramedics and ambulance staff in a move to strengthen its prehospital transportation service.³³ This capacity building helped to achieve an increase in the number of ambulances placed at strategic locations with a consequent improvement in the average Ghanaian prehospital transport time.

In Namibia, the main functional prehospital transport system is privately owned, and the prehospital transport times have not improved there.³⁴ In contrast to Namibia, the South African commercial and privately owned ambulance services have

improved prehospital transport time; this can be attributed to government ambulance services that also operate in the country.³⁵

Roadside Emergency Trauma Units

Roadside emergency trauma units have not been widely incorporated into global prehospital settings. Nigeria, uniquely, has several trauma units that are operated by the FRSC, but for the most part, they have not been used effectively for prehospital services. Public health experts opined that if these units were well-equipped, they effectively could serve as first points of call for accident victims prior to transfer to fixed health facilities.

Discussion

As highlighted in the Results section, Nigeria does not have a national prehospital trauma care system (PTCS); however, limited PTCS structures exist in some parts of the country. The discussion here, based on the options appraisal (Table 2), entails the applicability to the Nigerian context of prehospital services available in other countries.

Appropriate policies are essential in implementing a prehospital system. The World Health Organization has recognized this, and has spelled out basic guidelines through its Department of Injuries and Violence Prevention. These guidelines include involving trained bystanders, community volunteers, and some medical professionals in the provision of sustainable prehospital trauma care.⁵

Specific policies on prehospital and emergency services have been beneficial in South Africa and Ghana. In view of the close contextual similarities of these two countries with Nigeria, the Nigerian government could learn much toward developing an emergency health care policy.

The WHO emphasized that there must be structures (relevant bodies) in place to take care of core administrative elements to ensure that prehospital trauma care system is sustainable and effective in any country.⁵ A specific and functional prehospital structure with branches within the various Nigerian states can effectively complement the existing FRSC structure.

The utilization of commercial drivers and laypersons as first responders could be effective in Nigeria, as evidenced in Ghana, but it requires good organization, standard training programs,

and financial commitment. The contributions of the police and military in offering prehospital care in Africa centers on their presence on highways while mounting roadblocks and checkpoints.²⁶ The use of the military and police could be effective in prehospital care in Nigeria also, and may not be difficult to organize, since the police already form an integral part of Nigeria's limited prehospital care. However, strong political and financial commitments may be needed.

A centrally controlled communication network could be very effective in Nigeria, but will require highly technical organization and steady financial backing. The use of radio/mobile phones has been ineffective, and thus is not advised.

A government ambulance service could be effective in Nigeria and may be available for the poor, women, and children. It also requires sound organization, financial commitment, and political backing.^{36,37} Commercial and private ambulance services are profit-oriented and expensive, and may not be readily available for those less privileged.

Roadside emergency trauma units already exist in Nigeria. If properly integrated into prehospital services, they can reinforce the emergency care system. This is an area for future research.

Overall, the use of commercial drivers and laypersons, military and police, a centrally controlled communication network, and

government ambulance services, in a background of a favorable policy and structure, could be feasible delivery models for prehospital services in Nigeria (Tables 1 and 3).

Conclusion

An established prehospital trauma care system could play a significant role in reducing morbidities and mortalities from road traffic accidents in Nigeria. A national emergency health policy may be fundamental to the establishment of a formal PTCS in Nigeria, aimed at reducing attendant fatalities and the overall public health burden from RTIs in the country.

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References

1. Federal Road Safety Commission (FRSC) Nigeria. *Road Traffic Crashes Data*. Abuja: FRSC Nigeria; 2010.
2. Labinjo M, Juillard C, Kobusingye OC, Hyder AA. The burden of road traffic injuries in Nigeria: results of a population-based survey. *Inj Prev*. 2009;15(3):157-162.
3. Mock C, Arreola-Risa C, Quansah R. Strengthening care for injured persons in less developed countries: A case study of Ghana and Mexico. *Inj Control Saf Promot*. 2003;10(1-2):45-51.
4. Bunn F, Kwan I, Roberts I, et al. *Effectiveness of Prehospital Care: A report by the Cochrane Injuries Group on Prehospital Care to the World Health Organization*. Geneva: World Health Organization; 2001.
5. Sasser S, Varghese M, Kellermann A, et al. *Prehospital Trauma Care Systems*. Geneva: WHO; 2005.
6. Trunkey DD. Trauma: accidental and intentional injuries account for more years of life lost in the United States than cancer and heart disease. *Scientific American*. 1983;249(2):28-35.
7. Lockett DJ. Prehospital trauma management. *Resuscitation*. 2001;48(1):5-15.
8. Peden M, Scurfield R, Sleet D, et al. *World Report on Road Traffic Injury Prevention*. Geneva: WHO; 2004.
9. Coats TJ, Davies G. Prehospital care for road traffic casualties. *BMJ*. 2002;324(7346):1135-1138.
10. Walley J, Wright J. *Public Health: An Action Guide to Improving Health*, 2nd ed. New York: Oxford University Press Inc.; 2010.
11. Aliyu ZY. Policy mapping for establishing a national emergency health policy for Nigeria. *BMC Int Health Hum Rights*. 2002;2(1):5.
12. African National Congress. *National Health Plan for South Africa*, 1994. <http://www.anc.org.za/ancdocs/policy/health.htm>. Accessed May 12, 2010.
13. South African Department of Health. South African Department of Health Policy documents, 2010. <http://www.doh.gov.za/docs/policy/index.html>. Accessed May 10, 2010.
14. Ghana Ministry of Health. *National Health Policy*. Accra: Ministry of Health; 2007.
15. Ghana Ministry of Health. *Transport Policy of the Ministry of Health*. Accra: Ministry of Health; 2004.
16. Ghana National Road Safety Commission. National Road Safety Commission, 2010. <http://www.nrsc.gov.gh/>. Accessed May 15, 2010.
17. National Emergency Management Agency Nigeria. National Emergency Management Agency 2010. <http://www.nema.gov.ng/>. Accessed April 4, 2010.
18. Lagos State Government Nigeria. Emergency Medical Services (LASEMS and LASAMBUS); 2010. <http://www.lagosstate.gov.ng/index.php?page=projectdetail&ptype=Programme&moid=110&mnu=module&mnsu=ministry&mpid=32&pocat=ministry&pocatsub=32>. Accessed April 6, 2010.
19. Goosen J, Bowley DM, Degiannis E, et al. Trauma care systems in South Africa. <http://www.sciencedirect.com/>. Accessed June 22, 2010.
20. Zambia Specialty Emergency Services. Specialty Emergency Services 2010. <http://www.ses-zambia.com/>. Accessed May 20, 2010.
21. Chitere PO, Kibua TN. *Efforts to Improve Road Safety in Kenya*. Nairobi, Kenya: Institute of Policy Analysis and Research; 2004.
22. Odero W, Khayesi M, Heda PM. Road traffic injuries in Kenya: magnitude, causes and status of intervention. *Inj Control Saf Promot*. 2003;10(1-2):53-61.
23. Oluwadiya KS, Olakulehin AO, Olatoke SA, et al. Pre-hospital care of the injured in South Western Nigeria: a hospital based study of four tertiary level hospitals in three states. *Annu Proc Assoc Adv of Automot Med*. 2005;49:93-100.
24. Macharia WM, Njeru EK, Muli-Musiime F, et al. *Severe Road Traffic Injuries in Kenya, Quality of Care and Access*. <http://www.bioline.org.br/abstract?id=hs09020&lang=en>. Accessed January 31, 2010.
25. Mock C, Tiska M, Adu-Ampofo M, Boyaky G. Improvements in prehospital trauma care in an African country with no formal emergency medical services. *J Trauma*. 2002;53(1):90-97.
26. Akande AT. Accident Emergency and Road Safety, 2009. <http://www.iq4news.com/?q=content/emergroad>. Accessed January 29, 2010.
27. Vanrooyen MJ, Erickson TB, Cruz C, et al. Training military medics as civilian prehospital care providers in Southern Sudan. *Prehosp Emerg Care*. 2000;4(1):65-69.
28. Federal Road Safety Commission Nigeria. Federal Road Safety Commission, 2010. <http://frsc.gov.ng/>. Accessed April 3, 2010.
29. Schopper D, Lormand JD, Waxweiler R. *Developing Policies to Prevent Injuries And Violence: Guidelines For Policy-Makers And Planners*. Geneva: World Health Organization; 2006.
30. Garba ES, Asuku ME, Ogirima MO, et al. Civilian conflicts in Nigeria: the experience of surgeons in Kaduna. <http://ajol.info/index.php/njstr/article/viewFile/12203/15262>. Accessed March 21, 2010.
31. Solagberu BA, Adekanye AO, Ofoegbu CK, et al. Clinical spectrum of trauma at a university hospital in Nigeria. *European Journal of Trauma*. 2002;28(6):365-369.
32. Solagberu BA, Ofoegbu CK, Abdur-Rahman LO, et al. Pre-hospital care in Nigeria: a country without emergency medical services. *Niger J Clin Pract*. 2009;12(1):29-33.
33. Ghanaweb. Ghana Ambulance Services, 2010. <http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=90215>. Accessed May 21, 2010.
34. Tintinalli J, Lisse E, Begley A, Campbell C. Emergency care in Namibia. *Ann Emerg Med*. 1998;32(3):373-376.
35. Brysiewicz P, Bruce J. Emergency nursing in South Africa. *Int Emerg Nurs*. 2008;16(2):127-131.
36. Kobusingye OC, Hyder AA, Bishai D, et al. Emergency Medical Services. In *Disease Control Priorities in Developing Countries*, 2nd ed. New York: The World Bank and Oxford University Press; 2006.
37. Kobusingye OC, Hyder AA, Bishai D, Hicks ER, Mock C, Joshipura M. Emergency medical systems in low- and middle-income countries: recommendations for action. *Bull World Health Organ*. 2005;83(8):626-631.