

# TRANSPORT PAPERS

TP-12  
AUGUST 2006



## Maternal and Child Mortality Development Goals: What Can the Transport Sector Do?

Julie Babinard  
Peter Roberts



**TRANSPORT  
SECTOR  
BOARD**



# MATERNAL AND CHILD MORTALITY DEVELOPMENT GOALS: WHAT CAN THE TRANSPORT SECTOR DO?

---

Julie Babinard, Peter Roberts



**THE WORLD BANK**  
Washington, D.C.



**TRANSPORT  
SECTOR  
BOARD**

© 2006 The International Bank for Reconstruction and Development/The World Bank  
1818 H Street NW  
Washington, DC 20433  
Telephone 202-473-1000  
Internet [www/worldbank.org](http://www.worldbank.org)  
Published August 2006

The findings, interpretations, and conclusions expressed here are those of the authors and do not necessarily reflect the views of the Board of Executive Directors of the World Bank or the governments they represent.

This paper has been produced with the financial assistance of a grant from TRISP, a partnership between the UK Department for International Development and the World Bank, for learning and sharing of knowledge in the fields of transport and rural infrastructure services.

To order additional copies of this publication, please send an e-mail to the Transport Help Desk [transport@worldbank.org](mailto:transport@worldbank.org)

Transport publications are available on-line at <http://www.worldbank.org/transport/>

## TABLE OF CONTENTS

Acknowledgments .....	v
Executive Summary .....	vii
1 Introduction .....	1
2 The Heavy Burden of Maternal and Child Mortality .....	1
2.1 Extent of Maternal and Child Mortality .....	1
2.2 Causes of Maternal and Child Mortality .....	2
3 Health Interventions to Prevent Maternal and Neonatal Mortality.....	4
3.1 Structure of Maternal and Child Care in the Health and Referral Network.....	4
3.2 Care as a Package.....	6
3.3 The Importance of Skilled Professionals and Availability of Obstetric Care.....	7
3.4 Current Status of Maternal and Child Interventions .....	8
4 The Role of Transport in Accessing Maternal and Child Health Care.....	9
4.1 Transport in the Health System and Referral Network.....	9
4.2 The Management and Operation of Health Transportation Vehicles. ....	10
4.3 Transport and Road Infrastructure to Improve Access to Maternal and Child Health Care .....	11
4.4 The “Three-Delays” Model for Assessing the Role of Transport in Accessing Emergency Care .....	14
5 Transport-Related Barriers that Delay Access to Maternal and Neonatal Care .....	15
6 Transport Interventions to Reduce Costs and Improve Access to Care.....	17
7 Implications for Transport .....	24
8 Policy Recommendations to Improve Transport for Maternal and Child Health .....	29
8.1 Key Findings .....	29
8.2 Recommendations.....	30
8.3 Knowledge Gaps .....	31
References.....	33
Glossary .....	39

## LIST OF FIGURES AND TABLES

### TABLES

Table 1. Maternal Mortality by Region, 2000 .....	2
Table 2. Levels of Care .....	5
Table 3. Transport Arrangements to Access Health Facilities for Antenatal and Delivery and Postnatal Phase .....	20
Table 4. Supply and Demand Transport Barriers and Interventions for Maternal and Child Care .....	25
Table 5. Transport Targets and Indicators Related to MDG 4 & 5 .....	26
Table 6. Estimates of the Number of Maternal and Child Deaths (Potentially) Averted through Transport Access and Various Emergency Transport Interventions .....	28

### FIGURES

Figure 1. Causes of Maternal Death Related to Pregnancy and Childbirth .....	3
Figure 2. Causes of Death in the First Month of Life (Neonatal Period) .....	4
Figure 3. Continuum of Care Interventions for Maternal and Neonatal Health Care .....	6
Figure 4. Percentage of Women Receiving Antenatal Care by Region .....	8
Figure 5. Proportion of Births Attended by Skilled Health Personnel by Region .....	8
Figure 6. Distance and Time to the Nearest Health Service (Delivery Care) by Rural and Urban Residence .....	12
Figure 7. Mode of Transport to the Nearest Health Service (Delivery Care) .....	13
Figure 8. Maternal and Child Health Indicators in Rural Pakistan, by Type of Road .....	13
Figure 9. "Three-Delays" Model in Accessing Emergency Maternal Care .....	14

### BOXES

Box 1. Interventions Needed for Maternal and Infant Health .....	7
Box 2. Examples of Transport-Related Barriers to Maternal and Child Care .....	17

## **ACKNOWLEDGMENTS**

This Technical Paper has been prepared as part of the World Bank's programme on Transport for Social Responsibility. The programme is led by the central Transport Unit (TUDTR) and is supported through the trust fund provided by the United Kingdom's Department for International Development (DFID) under the Transport and Rural Infrastructure Sharing and Learning Programme (TRISP) with the Bank.

This Paper responds to growing awareness among both health and transport sector specialists in international development that, in many developing countries, inadequate transport often imposes critical constraints on achieving key health sector outcomes. Accordingly, the authors have consulted with members of the World Bank's Health, Nutrition and Population Department. They have also benefited from discussions with a wide range of international and specialist organizations including the UNDP Millennium Project, the World Health Organization, the International Forum for Rural Transport and Development, IT Transport, Cornell University and the Institute for Transportation and Development Policy. The materials and comments which have been received from all are gratefully acknowledged. However, the authors are solely responsible for the views expressed in the paper, for the conclusions drawn and for any errors that may remain.

Julie Babinard is a Consultant. She is a full-time member of the TUDTR team and has experience in the areas of health, nutrition, and agricultural and environmental policy.

Peter Roberts is the Lead Specialist for Infrastructure Services in TUDTR. He heads the Transport Results Initiative and the thematic group for Transport for Social Responsibility.





## EXECUTIVE SUMMARY

The reduction of child mortality and the improvement of maternal health are two of the Millennium Development Goals (MDGs). Child and maternal mortalities continue to represent severe burdens in many developing countries. Every year, 527,000 women in developing countries die of pregnancy-related complications and nearly 4 million children die during their first month (accounting for 40 percent of all deaths under 5 years of age) with nearly all (98 percent) of them in developing countries. The risks of dying from pregnancy-related complications and a child dying under the age of five are highest in Sub-Saharan Africa.

The risk of a mother or an infant dying can be significantly reduced by a continuum of basic care, which should include preventive measures and a skilled attendant during childbirth with access to the necessary equipment, drugs, and other supplies for effective management of any pregnancy-related complications. Yet, many women spend excessive time trying to reach a health facility with the capacity to treat obstetric or infant complications. It is estimated that 75 percent of maternal deaths might be prevented through timely access to essential emergency childbirth-related care.

This paper focuses on the ways in which transport and road infrastructure play key roles in the overall delivery of and access to health services, and in the effectiveness of the health referral process. Many households do not have the reliable, suitable, and affordable transport services that are essential for access to care during the critical perinatal and neonatal periods. Emergency access to care is also critical because many childbirth-related complications are unpredictable and the majority of births in developing countries continue to take place at home.

Various financial, social and institutional factors of supply and demand can impose severe constraints on the effectiveness of transport. Moreover, poor families often cannot afford the cost of transport to health facilities. As a consequence, walking remains the primary mode of transportation for women and their young children, thereby severely limiting their ability to reach needed care. Other factors that can delay access by women and their children include the family's decision to seek care, the availability of suitable transport, and the perceived availability and quality of health services. Ineffective transport can result from limited services and slow travel times by various transport modes operating on roads in poor condition.

Where neither public nor suitable private services are available, some communities have adopted transport measures to improve physical access and reduce delays in reaching care. However, there are challenges of institutional capacity, equity and affordability to sustain such initiatives. In some countries, privately operated transport is used with the cost being reimbursed by the health sector to address equity issues. Where a motor vehicle service is not available, alternative lower cost forms of transport, such as bicycle or motorcycle ambulances, have been used with some success.

Improved transport and roads for poorly served communities will contribute to reducing maternal and child mortality rates. However, transport interventions which are specifically designed to improve access to health services should be planned as part of a long-term integrated health and transport strategy, thereby ensuring that essential services are both affordable and financially sustainable. Community participation and mobilization are also crucial to ensure that transport arrangements are appropriate and socially acceptable. Improved communications can be an important complement, particularly for emergencies occur. Transport services for newborns need to relate to the arrangements made for mothers.

This paper has been prepared as part of the programme of the Transport for Social Responsibility thematic group, managed by the World Bank central Transport Unit (TUDTR). The paper contributes to a dialogue that has been initiated by the thematic group with health sector specialists in the World Bank, the World Health Organization, and other partners, as a response to a review of the implementation of the Millennium Development Goals.



# **MATERNAL AND CHILD MORTALITY DEVELOPMENT GOALS: WHAT CAN THE TRANSPORT SECTOR DO?**

## **1 INTRODUCTION**

The inclusion of both maternal and child mortality reduction as the Fourth and Fifth Millennium Development Goals (MDGs) has stimulated increased attention to multi-sectoral nature of these challenges. The transport sector has a critical role to play in achieving these MDGs.

Reducing maternal mortality by three-quarters from its 1990 level is the fifth MDG. The maternal mortality ratio and the proportion of deliveries with a skilled attendant are used to monitor progress towards this goal. Death from pregnancy-related causes represents one of the most preventable categories of female death worldwide. Currently, the level of risk for a woman to die of pregnancy-related cause shows the widest disparity between developed and developing countries of all human development indicators.

Reducing child mortality is the fourth MDG. This goal is directly related to improving the health status of mothers and the care they receive before, during, and immediately after giving birth. Neonatal death, or death during the first month of a child's life, represents nearly forty percent of all under five child deaths and could be prevented by adequate care to the mother.

Transport services affect access to both preventive and emergency childbirth care, playing a key role in the survival of women and their newborns, as complications in birth may rapidly become life-threatening. It is estimated that more than 75 percent of maternal deaths could be prevented through timely access to essential childbirth-related care.

The literature shows that in low income countries, particularly in rural areas, considerable time is spent by women and their families in waiting for transportation and traveling to health facilities. In addition, poor roads, too few vehicles and high transportation costs are major causes of delay in decisions to seek and reach emergency obstetric and postnatal care.

There are examples of interventions that have successfully improved transport in order to provide better access to maternal and child care. However, evidence of sustainable good practice at the country or regional level remains limited. Studies are primarily of community interventions in Africa, making overall comparisons between interventions and across the various levels of referral difficult. Although more evidence is needed to determine what can be done within transport to improve access, it is clear that the link with the health sector needs to be made as transport alone will not fix the problem of lack of quality care at the end of the referral chain.

## **2 THE HEAVY BURDEN OF MATERNAL AND CHILD MORTALITY**

### **2.1 Extent of Maternal and Child Mortality**

Every year, 529,000 women—more than one every minute—die worldwide due to complications arising from pregnancy and childbirth (Table 1). Nearly all of these deaths (99 percent) occur in developing countries, where a woman's lifetime risk of dying from pregnancy-related complications is about forty-six times higher than it is in developed countries. The risk of dying from pregnancy-complications is highest in Sub-Saharan Africa, where in some countries the maternal mortality ratios are more than 1,000 deaths per 100,000 live births (compared to 20 in developed countries and a world average of 400). Of the twenty countries with the highest rates of maternal mortality, nineteen are in Sub-Saharan Africa.

**Table 1. Maternal Mortality by Region, 2000**

(United Nations MDG Regions)	Maternal Mortality Ratio (maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:
Africa	830	251,000	20
Sub-Saharan Africa	920	247,000	16
Northern Africa*	130	4,600	210
Asia	330	253,000	94
Eastern Asia	55	11,000	840
South-Central Asia	520	207,000	46
South-Eastern Asia	210	25,000	140
Western Asia	190	9,800	120
Latin Am. & Carib.	190	22,000	160
Oceania	240	530	83
Developing regions	440	527,000	61
Developed regions**	20	2,500	2,800
World total	400	529,000	74

\* Excludes Sudan, which is included in Sub-Saharan Africa.

\*\* Includes, in addition to Europe, Canada, the United States of America, Japan, Australia, and New Zealand, which are excluded from the regional totals.

Source: WHO (2004).

Around 10.6 million children still die each year before reaching their fifth birthday. Globally, mortality rates of children under five years of age have fallen since the 1970s: infant and under 5 childhood rates in developing countries have fallen from 146 per 1,000 live births in 1970 to seventy-nine in 2003 (WHO 2005). However, in many countries, particularly in Sub-Saharan Africa, child mortality rates have recently stagnated or reversed, partly due to failures of health systems to provide good quality care, but also due to poverty, HIV/AIDS, and humanitarian crises which have impacted access to health care (WHO 2005). The main category of child mortality is neonatal death, which accounts worldwide for up to 40 percent of deaths of children under five. Almost all (98 percent) neonatal deaths occur in developing countries, representing an estimated 4 million deaths worldwide each year. The biggest shares of neonatal deaths are in Africa (28 percent) and South-East Asia (36 percent). This is not the full scale of child mortality as these figures do not include the estimated 3.3 million stillbirths each year, for which the availability and accuracy of data are limited. Moreover, it is estimated that for every newborn death, there are at least another twenty children who suffer from birth injury, infection, and complications arising from preterm birth and other neonatal conditions.

## 2.2 Causes of Maternal and Child Mortality

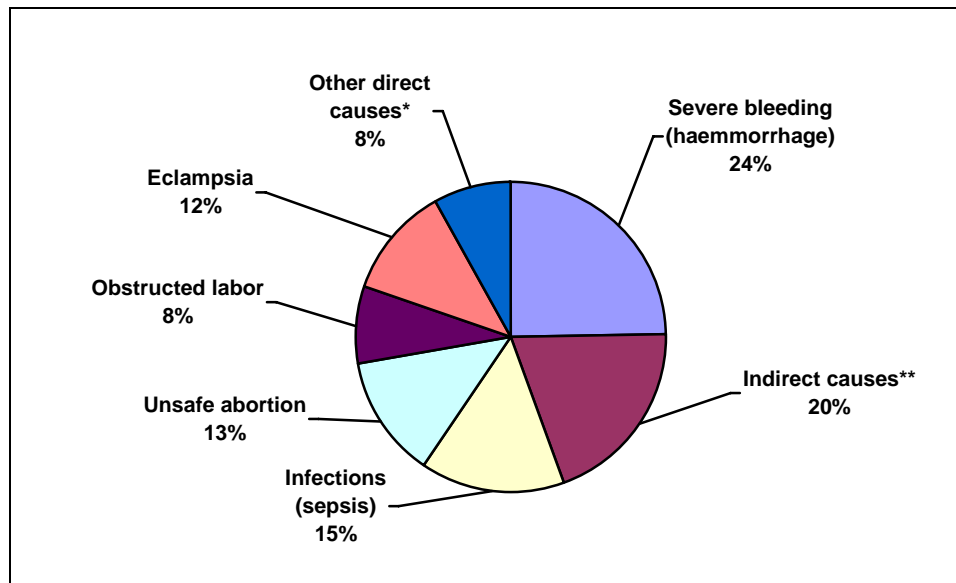
The majority of maternal and child deaths continue to result from a combination of biological, medical, and social factors, which are often inextricably linked (Stekelenburg et al. 2004; Bhutta 2005). Identifying the causes behind maternal deaths is a first step in understanding how the transport sector can contribute to reducing the burden of maternal and child mortality in developing countries.

Maternal death, as defined by the ninth and tenth revisions of the International Statistical Classification and Related Health Problems (ICD), is "*the death of a woman while pregnant or within forty-two days of the end of the pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes*" (WHO 2004b). Under this definition, maternal death involves a temporal and causal link between pregnancy and death, which would not have occurred if a woman had not been pregnant.

Maternal deaths result from a wide range of both indirect and direct causes (Figure 1):

- *Direct maternal deaths* result from conditions or complications, or the management thereof, which are unique to pregnancy and occur during the antenatal, intrapartum, or postpartum period. Sixty to eighty percent of maternal deaths are due to five direct causes: hemorrhage, obstructed labor, eclampsia, sepsis, and unsafe abortion (See Glossary for some definitions on these conditions). These direct complications are unpredictable and tend to occur within hours or days after delivery with between 11 percent and 17 percent of maternal deaths occurring during childbirth itself, and between 50 percent and 71 percent in the postpartum period (WHO 2005).
- *Indirect maternal deaths* result from a previous existing disease, or disease that developed during pregnancy and that was not due to direct obstetric causes but was aggravated by the physiologic effects of pregnancy. Maternal deaths due to indirect and likely preventable causes represent 20 percent of the total number of deaths worldwide. These deaths are caused by diseases (pre-existing or concurrent), or by an existing medical condition or by compromised health due to poor nutrition and disease that is worsened by pregnancy or delivery. Typical diseases include malaria, anemia, hepatitis, cardiovascular diseases or HIV infection. Women whose health is already compromised are more likely to be vulnerable to pregnancy-related complications. Likewise, community-based or sociocultural factors such as attitudes and practices toward pregnancy can influence maternal mortality (Stekelenburg et al. 2004; Okolocha et al. 1998).

**Figure 1. Causes of Maternal Death Related to Pregnancy and Childbirth**

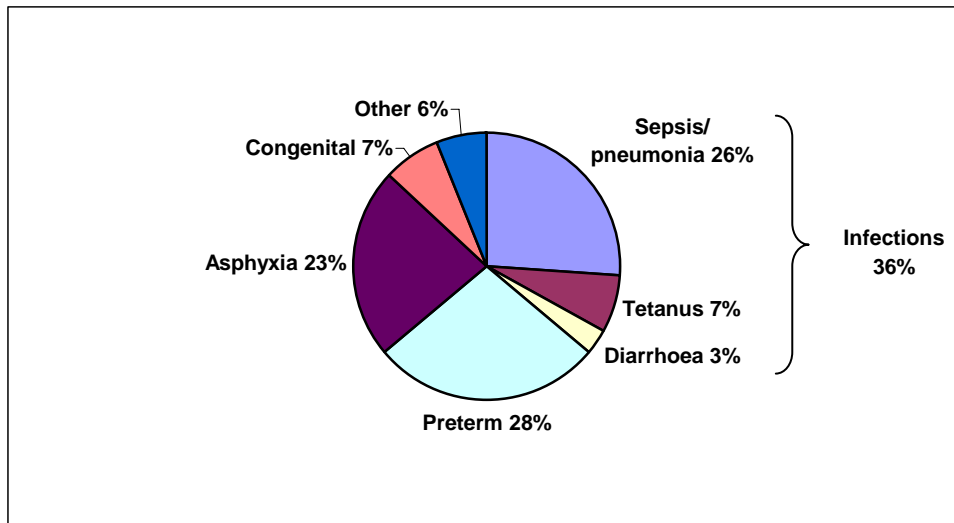


(Total is more than 100% due to rounding)  
 \* Other direct causes include ectopic pregnancy, embolism, and anesthesia-related complications.  
 \*\* Indirect causes include anemia, malaria, and heart disease.  
 Source: WHO (1999).

Effective interventions to improve maternal health could significantly reduce the risk of an infant dying. A large proportion of infant deaths and disabilities originate during pregnancy and are determined by a woman's condition and the circumstances of birth rather than by the condition of the child itself (WHO 1994). The risk of death for children under 5 years doubles if their mothers die in childbirth (Lule et al. 2005). Three-quarters of neonatal deaths happen in the first week of life, with the highest risk of death being during the first day of life (Figure 2). Globally, the main direct causes of neonatal death are estimated to be preterm birth (28 percent), severe infections (26 percent), and asphyxia (23 percent); neonatal tetanus, an easily preventable disease, accounts for a smaller proportion of deaths (7 percent). In addition, there are many indirect causes of neonatal deaths, the most important of which is low birth weight (LBW), with between 40 percent and 70 percent of all neonatal deaths

occurring among those weighing less than 2,500 g at birth. Other indirect causes of perinatal and neonatal deaths include poor status of maternal health and nutrition, and untreated maternal infections. Maternal complications in labor also carry a high risk of neonatal death, especially among the poor. Finally, maternal and fetal malnutrition and failure to exclusively breast-feed also contribute prominently to the risk of death.

**Figure 2. Causes of Death in the First Month of Life (Neonatal Period)**



Source: Lawn et al. (2005).

### 3 HEALTH INTERVENTIONS TO PREVENT MATERNAL AND NEONATAL MORTALITY

#### 3.1 Structure of Maternal and Child Care in the Health and Referral Network

The majority of pregnancy-related complications are preventable through properly organized health services and appropriate referral facilities.

Typically, the organization of maternal and child care in a national health care system relies on three main types of activities delivered by the health sector:

- the provision of a range of health services at designated facilities;
- access by the population to the facilities in order to receive the health benefits;
- outreach services or services brought to patients such as health education and awareness programs as part of preventive care and behavior change measures.

The provision of maternal and child care are strongly inter-related and their functioning is subject to a stratified network of health facilities at the national, provincial, and district levels from which the range of health services are delivered to, or accessed by, the population which is being served. The design of this network follows the hierarchy of the health sector functions, extending through a referral process from first-hand contact and diagnosis at the home and community level to increasingly specialized (and costly) medical responses and treatments at the secondary or tertiary level (Table 2). To operate, this network must be supplied with the necessary skills (medical staff, technicians, support staff, etc.) and consumables (diagnostics, pharmaceuticals, medical supplies, etc.).

National programmes and policies for maternal and child health are housed within the Ministry of Health, which runs secondary and tertiary facilities, but it is generally at the district level, particularly in Sub-Saharan Africa, that health care services are delivered, including maternal and child care. Districts include all elements of the national administration and are responsible for identifying needs, planning, and securing both private and public resources necessary to implement programs.

The capacity of a district health system varies in each country but typically covers a population of between 150,000 and 350,000 and comprises a district hospital or first referral level, a district health center with dependent sub-centers, dispensaries, health posts and mobile clinics, and the community itself with its various types of health workers (WHO 1991). At the district level or first referral level, obstetric procedures and adequately trained staff as well as facilities and equipment are required in order to conduct emergencies, particularly those that are life-threatening.

**Table 2. Levels of Care**

<b>Level of Care</b>	<b>Possible Options</b>	<b>Functional Description (staff and services provided)</b>
Tertiary	Central, National or tertiary hospital	Highly specialized staff and technical equipment, mainly devoted to in-patient care, usually located in the main towns and often only in the capital city. Bed size ranges from 300 to 1500 beds. Responsible for coordinating and collaborating with all district hospitals and community clinics in its area of responsibility in order to ensure that surgical care is available throughout the region and that well-functioning wireless communication and ambulance systems are available.
Secondary	Regional or Provincial hospital	Services provided differ greatly by function, with five to ten clinical specialties. Bed size ranges from 200 to 800 beds. Obstetrics and gynecology specialist services available can include emergency care, ultrasound and prenatal diagnosis, kangaroo mother care, and basic urogynecology. Pediatric specialties can include neonatal low and high care, general and pediatric surgery.
First Referral	District, Rural or Community hospital	Few specialties, mainly internal medicine, obstetrics-gynecology, pediatrics, general surgery or general practitioners. Population covered typically ranges between 150,000 and 350,000. Bed size ranges from 30-200 beds with limited laboratory services. Responsible to serve as first referral for community clinics and to coordinate the clinics in its area of responsibility with the provision of wireless communication. District hospitals ideally refer patients requiring complex surgical care to a tertiary-level hospital.
Primary-level care	Primary health center (PHC)/ station/ clinic	These facilities serve a population of 10,000 to 20,000 people with several doctors and the potential to function as a first referral hospital. Staffed by multidisciplinary team of professional (doctors, nurses or midwives), auxiliary health workers and trained traditional birth attendants with the capacity to detect problems, manage mild complications, stabilize and refer to higher-level care if necessary. Provide prenatal, delivery (including management of complicated abortion), and postpartum care (including family planning and postabortion counseling) as well as care for the newborn.
Community care	Health post/ Village-based dispensary	Diverse group of facilities, typically small in size, that provide basic preventive and curative care (environmental health, first aid and diagnosis, treatment of common diseases). Some centers can include a worker trained in midwifery and family planning; others can act as a periodic hosting of a mobile maternal and child health clinic. Some facilities may be devoted to special-programme care activities, such as safe motherhood, tuberculosis control or immunizations. These centers can include a general practitioner, a midwife, or a family planning practitioner.
	Mobile services	Mobile teams, often based at larger health units, reach remote populations on periodic schedule, providing limited basic maternal and child curative health services through registered nurses or midwives.

Sources: WHO (1991; 1993); Mulligan et al. (2003).

At the family and community level, family members, Traditional Birth Attendants (TBAs), and other influential Community leaders and healers are supporting agents for women and newborn health preventive and emergency care.

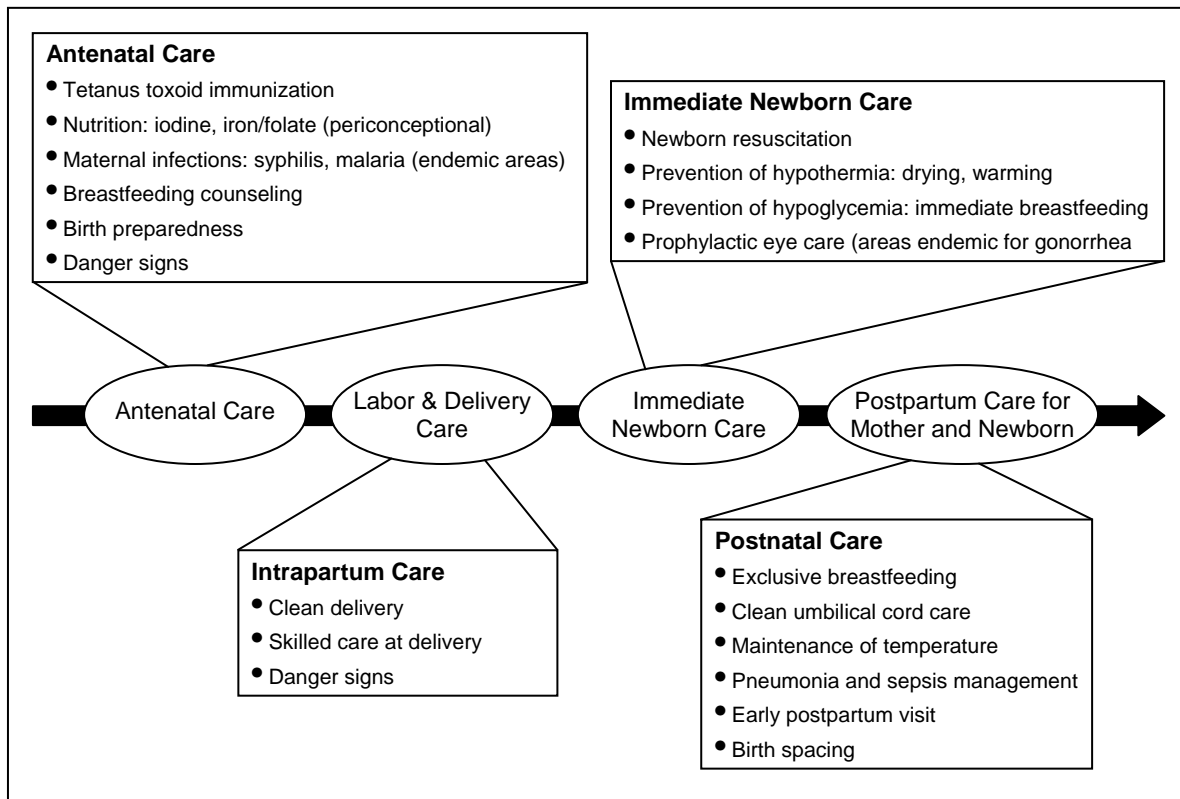
Implementation of health measures for maternal and child care will depend on the local setting, the coverage capacity of facility delivery and the availability of health and community workers—factors that are themselves subject to both capital and recurrent resource constraints.

The balance between urban and rural facilities in the network is critical as it influences the type of health care provided, access to services and costs. However, data on the adequacy and levels of service provision as well as on the referral flows for many developing countries remain scarce. As a result, the number of beds available in a facility is often used as a substitute to predict activity and to provide recommendations on the number of people to be served at the various levels of care.

### 3.2 Care as a Package

Both preventive and strategic interventions are needed to treat the numerous factors that contribute to maternal and child mortality. Appropriate care in developing countries requires an integrated approach with various interventions at different levels to ensure a continuum of care that benefits both mother and child simultaneously (Figure 3). Setting up a continuum of care for both maternal and child health is essential because both neonatal and child health is affected by factors that have an influence on maternal health. Health interventions for maternal and child health include birth preparedness; recognition of and appropriate response to danger signs in the antenatal period; skilled health care at delivery; recognition of and response to intrapartum danger and signs; and early postnatal visits to provide anticipatory guidance and recognition as well as the management of maternal and newborn illness (Bhutta et al. 2005) (Box 1).

**Figure 3. Continuum of Care Interventions for Maternal and Neonatal Health Care**



Source: Bhutta et al. (2005).



**Box 1. Interventions Needed for Maternal and Infant Health**

<b>Maternal interventions</b>	
<b>Prior to or During Pregnancy</b>	
<ul style="list-style-type: none"> <li>• Preparedness and counselling on safe childbirth</li> <li>• Treatment of maternal complications</li> <li>• Infection control in endemic areas (malaria, syphilis and hookworm)</li> <li>• Control of nutritional deficiencies</li> <li>• Immunizing the mother with tetanus toxoid</li> <li>• Avoiding harmful substances</li> </ul>	
<b>During Childbirth</b>	
<ul style="list-style-type: none"> <li>• Safe and clean delivery with a skilled attendant</li> <li>• Effectively managed pregnancy complications</li> <li>• referral for essential obstetric care</li> </ul>	
<b>For the Newborn</b>	
<ul style="list-style-type: none"> <li>• Routine care and vigilance for all newborns, during 6-12 hrs after birth</li> <li>• Special care for preterm and/or low birth weight infants, incl. Kangaroo Care</li> <li>• Identification and treatment of infections</li> <li>• Support for mothers on providing newborn care, and on recognizing danger signs and taking appropriate action</li> <li>• Immunization</li> <li>• Prevention of vertical HIV/AIDS transmission</li> </ul>	
<b>Neonatal Interventions</b>	
<b>Interventions Prior to or During Pregnancy</b>	
<ul style="list-style-type: none"> <li>• Nutritional Interventions</li> <li>• Malaria Prophylaxis</li> <li>• Maternal Immunization</li> </ul>	
<b>Interventions During Delivery</b>	
<ul style="list-style-type: none"> <li>• Prevention and Management of Delivery Complications</li> <li>• Resuscitation of the newborn</li> </ul>	
<b>Interventions After Delivery</b>	
<ul style="list-style-type: none"> <li>• Kangaroo Care Method</li> <li>• Breastfeeding and Nutritional Support</li> <li>• Prevention and Management of Infections</li> </ul>	

**3.3 The Importance of Skilled Professionals and Availability of Obstetric Care**

Although prevention plays a fundamental role in the health management of maternal and neonatal health, a key factor in lowering both maternal and child mortality is the presence during childbirth of a skilled attendant or person skilled in midwifery, combined with ready access to other levels of care. When childbirth-related complications happen, there is a need for timely and safe transfer of the mother and/or infant to the appropriate hospital or health care center with the necessary equipment, drugs and other needed supplies for effective management of the problem (WHO 2005; Gelband et al. 2001).

Timely access to care is essential because many childbirth-related complications are unpredictable and the majority of births in developing countries continue to occur at home (Bhutta et al. 2005). While home delivery in itself is not a cause of maternal and child deaths, it becomes a risk factor when home deliveries occur without a skilled attendant and when facilities for management of emergencies are inaccessible.

Skilled care during childbirth requires the presence of a doctor or midwife, or a nurse with midwife skills, who is trained to manage labor and delivery, recognize complications, and offer either emergency treatment or immediate referral to health centers for more advanced care (Skilled Care 2002).

Many women who develop complications have one or more detectable factors. However, there are limits to the value of screening procedures for predicting maternal complications as the majority of women who share these risk factors do not necessarily develop serious problems (WHO 2005; Weil and Fernandez 1999). It is estimated that about 15 percent of all pregnancies result in high- and low-risk complications that occur randomly.

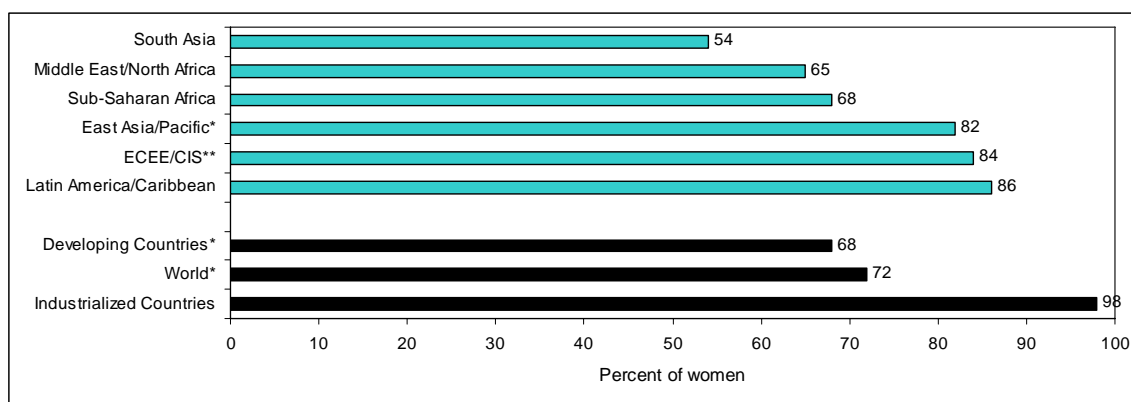
Accessing timely care in the event of a health complication also puts emphasis on the importance of an efficient referral system in which a woman or child can be moved within the health system to the right level of care, being dispensed either at a hospital or a district health center. It is recommended that an efficient referral system should cover, on average, 30,000 to 50,000 people in a zone with a radius of between 10 and 30 km, with an average response time of 3-6 minutes (Weil and Fernandez 1999; Kobusingye et al. 2005). In most low income countries, experience shows that the speed and effectiveness of the referral remains far below this standard. In Mexico, the average response time reported was 10 minutes with an area of 1 team per 100,000 people; in Vietnam, five teams are expected to serve 3 million people with a recorded average of 30 minutes (Kobusingye et al. 2005).

### 3.4 Current Status of Maternal and Child Interventions

Appropriate health interventions could have a tremendous impact on mortality rates of women; it is estimated that three-quarters of the current maternal deaths might be averted if full provision of the key maternal mortality interventions were to be achieved in developing countries (Wagstaff and Claeson 2004). However, maternal health program efforts in developing countries remain highly deficient, particularly in rural areas.

Efforts to monitor progress in the coverage of antenatal care show that the majority of women worldwide have at least one antenatal visit with a skilled professional during pregnancy. However, women in developing countries continue to receive significantly less care, with only two out of three women receiving some antenatal care. In South Asia, this rate is as low as one out of two (WHO 2003) (Figure 4). Globally, only 39 percent of rural women are estimated to have adequate access to the average maternal and neonatal health routine service, as compared with 68 percent of urban women (Bulatao and Ross 2002).

Figure 4. Percentage of Women Receiving Antenatal Care by Region



\*Excluding China

\*\*Central and Eastern Europe/Commonwealth of Independent States and Baltic States

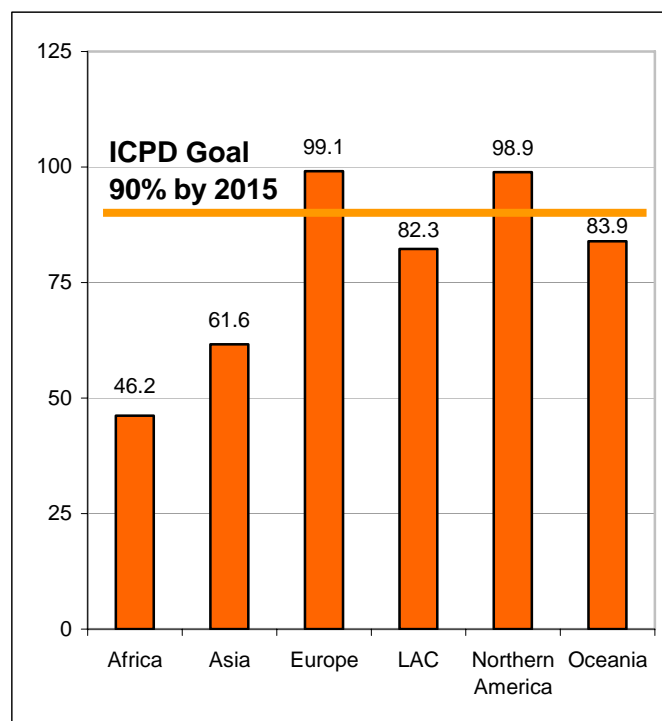
Source: UNICEF/WHO 2002. Data from Demographic and Health Surveys (DHS), multiple Indicator Cluster Surveys (MICS) and other national surveys, late 1990s to 2001. 104 countries. Averages weighted by number of births.

The proportion of births attended by skilled health personnel, one of the two key indicators (along with the maternal mortality ratio) selected to monitor progress toward the improvement of maternal health (MDG5), also remains low in most developing countries. While over 63 percent of births worldwide are attended by a skilled health worker, this proportion is only about 34 percent in the least developed countries (Figure 5). Africa and Asia are the furthest away from the International Conference on Population and Development (ICPD) goals which aim at having 80 percent of births attended by skilled health workers by 2005 and 90 percent by 2015 (WHO 2005b).

Uncertainty over the appropriate level of obstetric coverage has tended to centralize resources for essential obstetric care to the level of district hospital. This leaves many referral facilities

without the means to handle the estimated need of around 15 percent of pregnancies that are likely to experience complications (Murray and Pearson 2005). In addition, a recent review of maternal and neonatal health services in 49 developing countries indicates that on average there is only a 43 percent probability that trained staff in facilities designed to provide maternal health services can arrange for transport to the next level of care in cases of obstructed labor (Bulatao and Ross 2002).

**Figure 5. Proportion of Births Attended by Skilled Health Personnel by Region**



Source: WHO 2005b.

## 4 THE ROLE OF TRANSPORT IN ACCESSING MATERNAL AND CHILD HEALTH CARE

### 4.1 Transport in the Health System and Referral Network

Transport plays a critical role in the delivery of and access to health services, and in the overall effectiveness of the referral process. In effect, transport and road infrastructure act as a key link between potential accessibility and actual utilization of health services.

Transport is essential for the distribution of drugs, blood and other supplies necessary for care and proper operations of health facilities. It also enables the timely transfer of patients between health facilities and to the different levels of care of health referral systems. Efficient transport systems and roads facilitate access by health workers to often sparsely populated rural areas as well as the necessary monitoring and supervision of health services and initiatives.

Transport and road infrastructure also have a major influence on a patient as well as a community's ability to access health care. When the ratio of health facilities to population is low or uneven, transport and roads can ensure a more adequate distribution of and access to care. In addition, the role of transport to reach facilities can be more complex as transport can provide a link to care when the nearest health facility may not be the most accessible or when the nearest one is not perceived as the most effective. Reversely, poor road infrastructure or lack of transportation can influence patients to seek health care from less trained providers as long as they are more accessible.

In the referral system, transport facilitates access to both preventive and emergency care, which can be provided at the various care levels of the system—either in the community or at a health care facility such as a health center or a district or national hospital. Transporting a patient from the location of an acute event or injury to a health facility or hospital is a critical element of pre-hospital care. Once at a facility, the triage process in the pre-hospital subsystem determines which patients get transported to the facility with the adequate level of care.

Recent attempts at measuring the costs of interventions necessary to strengthen health systems, such as the WHO-CHOICE database, and in particular the costs of extending coverage of maternal and newborn care, show that extending coverage for 75 countries would push current levels of expenditure from \$US1 billion in 2006 to US\$6.1 billion in 2015 (WHO 2005). Transport requirements within the health system are estimated to represent 5 percent of the needed increase.

In parallel to the needs for future funding to provide universal health coverage, further research and specific policies for efficient and sustainable transport to access health services, and maternal and child care in particular, will be needed. Typically, population density is used as proxy for determining the transport needs of a particular population or catchment area in relation to the location of health facilities. However, this type of measurement often fails to consider obstacles that may be caused by the actual location of health facilities or by the state and quality of or lack of access to transportation infrastructure. As a result, studies seeking to determine health sector needs fail to consider factors affecting access variability such as the range of services that are actually provided at any particular health center and the different travel times that may apply to different categories of roads or to travel by different transport modes (Martin et al. 2002). Another drawback is that transport costs for health improvements should take into account costs such as vehicle purchase, and operating and maintenance costs. In addition, studies have remained too general or inconsistent to be able to compare costs across projects and to get a cost effectiveness picture because there tends to be no distinction between capital and recurring costs (Ensor and Cooper 2004).

#### **4.2 The Management and Operation of Health Transportation Vehicles**

In high income countries, transport systems are generally adequate and operated either by the public or the private sector; systems are available for the entire population and usually supplemented by an ambulance service, which provides transport to key health facilities in the event of an emergency or infirm individuals. Travel by the poor, for health or other purposes, can be provided as a public good through a subsidized scheme if necessary. In the U.S. for example, ambulance services are provided by local governments, community volunteer organizations, and hospital groups; whereas in France, ambulance services are provided by emergency medical organizations attached to hospitals, under legislative control (JICA 2005).

Many developing countries face the problem of organizing health services delivery with the support of transport services in a manner that provides adequate quality and coverage of health care to their populations. Usually the health budget is insufficient to cover the cost of operating this fleet, particularly in view of the exceptionally high costs of running conventional vehicles under the very difficult conditions that prevail in many developing countries. The problems are compounded by the difficulty of managing and controlling the use of public sector motor vehicles in situations where very little transport is normally available. Vehicles are commonly diverted to meet staff needs or other illegitimate purposes until they are no longer operable. If no specific personnel or budget is allocated in order to replace and maintain the vehicle fleet, countries can be burdened with aging vehicle fleet, which can result in increasing fuel consumption and repair and maintenance costs (Gauthier 2005).

The majority of countries in Sub-Saharan Africa and Asia have been unable to sustain the fleet of ambulances and other vehicles which had been envisaged as part of a publicly funded health service. As a result, ambulances are used only to transfer patients between health facilities and not from the scenes of injury or from their homes (Kobusingye et al. 2004). Moreover, privately operated transport is rarely available in many rural areas – and when it

does operate, it is often not affordable. As a result, patients are most likely to reach medical facilities or doctors by walking. Even in South Africa, one of the least poor countries in Sub-Saharan Africa, more than 40 percent of the population accesses health services on foot (Department of Transport, 2003). While walking does overcome the problem of transport services being unaffordable, it is very time consuming and constitute a severe constraint for the many rural people who are "time-poor." Walking can also be arduous and the effort of walking long distances on difficult paths can constitute a serious barrier, which can be made even more serious when a person is affected by a serious medical condition.

For countries where roads are in good condition, it has been suggested that a four-wheel drive should be envisaged to transport patients over distances greater than 30km; a motorcycle between 20-30 km distances and bicycles from 5 to 20 km (Gauthier 2004). Also, motorcycle trailers and four-wheel drives or ambulances might work best with good road infrastructure and sustainable financial support. Bicycles and stretcher carts might work best in resource constrained environment. Animal drawn carts can also be an option but may not always be culturally acceptable (ITDP 2005b).

#### **4.3 Transport and Road Infrastructure to Improve Access to Maternal and Child Health Care**

Transport services are complementary to maternal and child health services because they facilitate access to care during the critical perinatal and neonatal periods. These services are particularly important in sparsely populated rural areas of most developing countries, where the ratio of health facilities tends to be low, as health facilities have large catchment populations widely dispersed over many hundreds of square miles.

Access to transport as well as greater proximity to health facilities has been linked to lower levels of maternal and child deaths, and identified as one of the several factors affecting attendance to antenatal care and hospital choice (Rose et al. 2001). Likewise, perinatal health status as measured by the frequency of low birth weights, neonatal death, stillbirth, and early neonatal morbidity is significantly improved with access to motorized transport (Ondimu 2001).

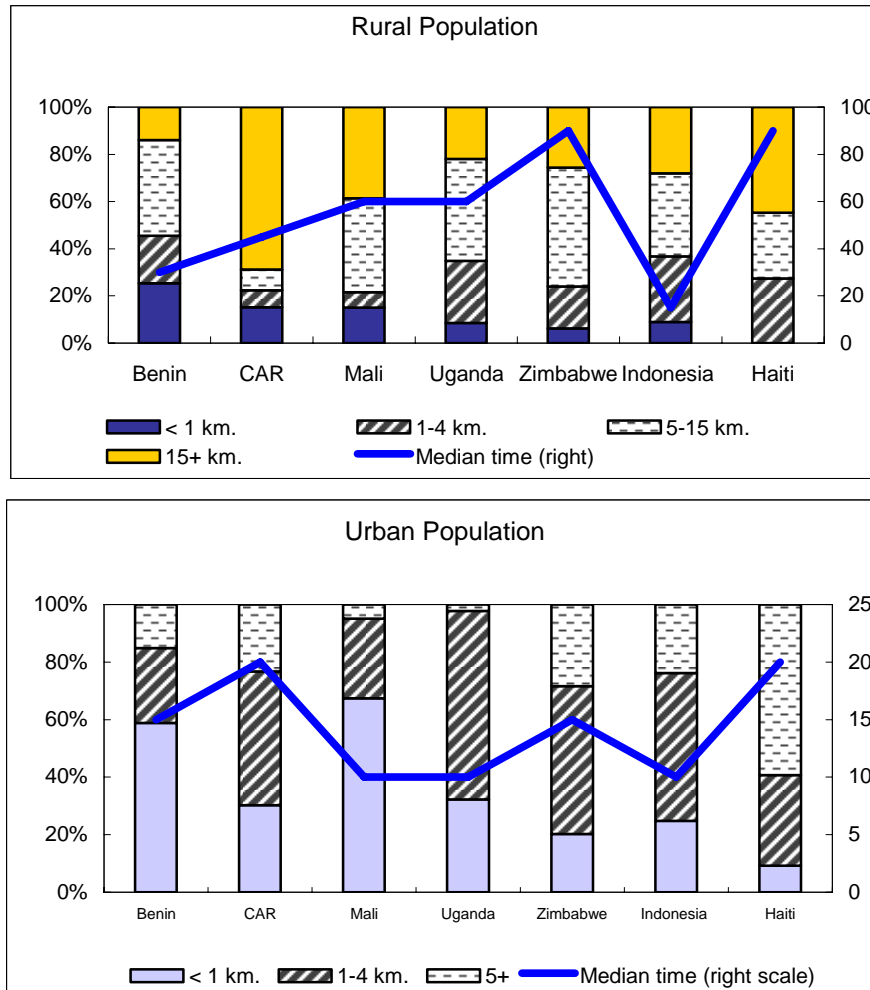
In many countries, however, women living in rural and remote areas have less easy access to health services than women living close to urban centers. Also, since not all health facilities provide maternal and child health services, distance and traveling time to access these services tend to be much greater. Data collected between 1993 and 1996 in round III of Demographic Health Surveys (DHS-III) of 10 countries reported that between 40 and 75 percent of all women or an average four out of five women live within 5 km of the nearest health facility (Rose et al. 2001). Access to maternal services in rural Africa is best in Benin (median distance to services is 5 km) and worst in Mali (median distance is 11-13 km). In Mali, Uganda and Zimbabwe, more than half of rural women live further than 5 km away from the nearest health facility that provides some form of maternal care; and in Mali, more than one-third of the women live beyond 15 km (Figure 6).

These distances are aggravated if the quality and efficiency of road infrastructure is poor. While in four countries (Benin, Uganda, the Philippines, and Bolivia), at least half of the population have access to an all-weather road, the majority of women in Mali and Haiti live in communities accessed only by a seasonal road; and in Uganda, about 13 percent of women rely on using a river path or train line for access. Indonesia is the only country where the majority of women use motorized transport (Figure 7). During the rainy season in many countries, travel time may increase substantially as roads can become impassable, particularly for communities where the main means of access is via a seasonal road.

Results from the recent Pakistani Integrated Household Survey (PIHS) also illustrate clearly the link between proximity to health facilities and higher rates of utilization of key maternal and neonatal health services. PHIS data for 2001/2002 indicate that attendance rates for pre- and postnatal care tend to be higher in urban than in rural areas. Some 35 percent of mothers who gave birth during the three years prior to the survey went for prenatal consultations during their pregnancy; attendance rate was much higher in urban (63 percent) than rural

areas (26 percent). Likewise, births were more likely to take place at home in rural than urban areas: 86 percent of the births in rural areas took place at home compared with 56 percent in urban areas. Postnatal consultation rates were much lower in general than prenatal rates, but again, the rates were lower in rural than in urban areas (Pakistan GoP 2002).

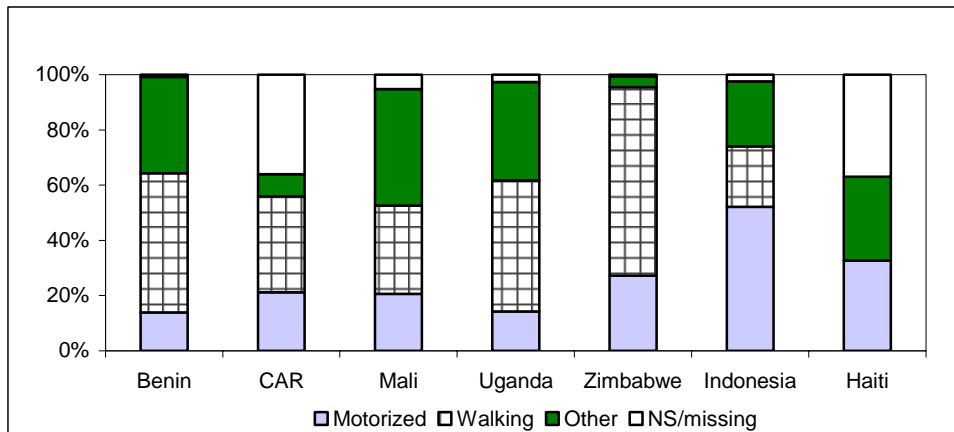
**Figure 6. Distance and Time to the Nearest Health Service (Delivery Care) by Rural and Urban Residence**



CAR= Central African Republic  
 Source: Rose et al. 2001.

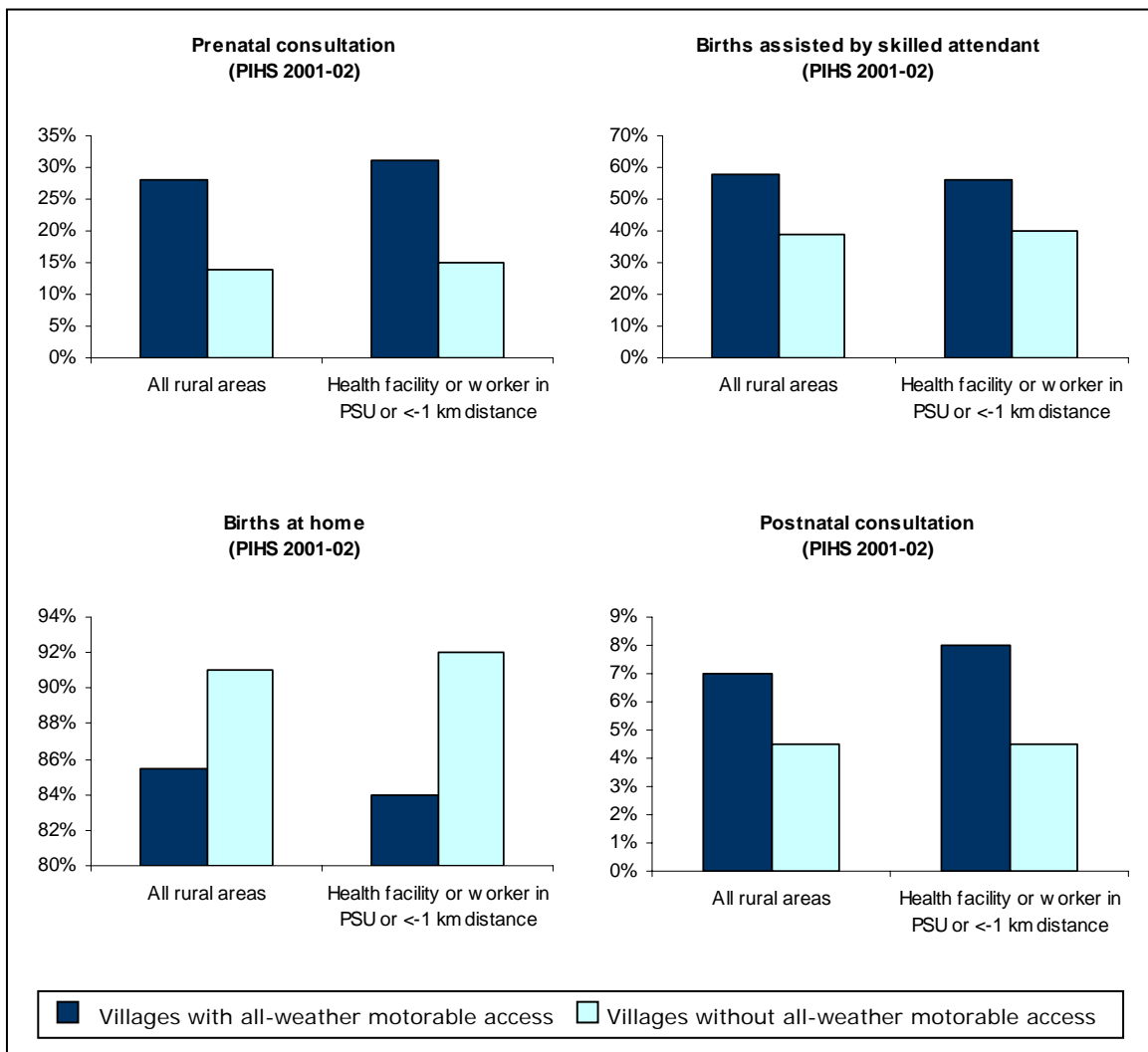
Even when a main health facility is within a village or less than one kilometer from a village, access to adequate maternal and neonatal care still vary depending on whether a woman has access to road transport and infrastructure. Women in villages who lack access to an all-weather motorable road tend to have less access to health services for all three important phases of childbirth—antenatal, delivery and postnatal (Figure 8). About 28 percent of women in villages with road access had prenatal consultations compared to only 14 percent in villages without road access; while 58 percent of all births in villages with road access were assisted by a skilled attendant compared with 39 percent for women without road access. Similar trends regarding access to antenatal care have been noticed in other countries. In Indonesia, 64 percent of women who live near a paved road received antenatal care by a medically-trained midwife, compared to 38 percent of women living near a non-paved road (Ishimori 2003). Also in Pakistan, more births took place at home when the household did not have road access and a greater number of postnatal consultations occurred when the household did have access to a road.

**Figure 7. Mode of Transport to the Nearest Health Service (Delivery Care)**



CAR= Central African Republic  
 Source: Rose et al. 2001.

**Figure 8. Maternal and Child Health Indicators in Rural Pakistan, by Type of Road**



Note: PSU refers to Primary Sampling Units (PSUs)  
 Source: Pakistan Integrated Household Survey (PHIS) 2001-02 as reported in Dalil

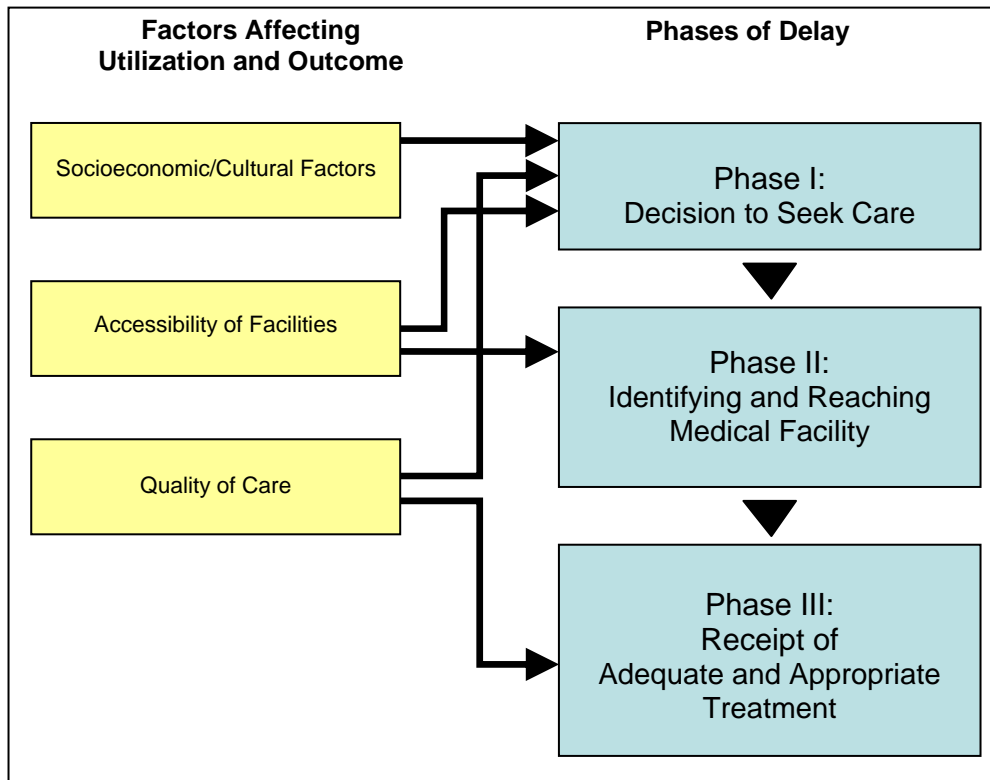
**4.4 The “Three-Delays” Model for Assessing the Role of Transport in Accessing Emergency Care**

In the context of maternal and child health referrals, transport also plays a key role when many cases of pregnancy-related complications or emergency health situations are referred from the local health centre or district hospital to the provincial level. As most of these complications cannot be adequately managed at lower levels due to inadequate equipment, supplies, drugs and inexperienced staff, transport ensures adequate and timely referral to district or provincial hospitals in case of obstetric emergencies (Murray and Pearson 2005; Nordberg et al. 1996; Macintyre and Hotchkiss 1999).

The effectiveness of maternal and child emergency interventions as well as of the referral process to move patients from one level of care to the next depends on the speed with which care is provided and on geographical accessibility to a facility where obstetric care is available. In this context, poor roads and lack of transport are a key factor in delaying access to the appropriate level of care. The “three-delays” model of Thaddeus and Maine provides a framework for understanding the barriers to accessing emergency maternal health (Thaddeus and Maine 1994) (Figure 9):

- (1) a first delay occurs in the decision to seek care because the woman, with her family, does not recognize signs of a life-threatening emergency, thereby waiting too long before deciding to seek care;
- (2) a second delay occurs in reaching the facility once the decision has been made to seek care; and
- (3) a third delay occurs in obtaining the appropriate care once the woman has reached the health facility.

**Figure 9. “Three-Delays” Model in Accessing Emergency Maternal Care**



Source: Thaddeus and Maine, 1994.



## 5 TRANSPORT-RELATED BARRIERS THAT DELAY ACCESS TO MATERNAL AND NEONATAL CARE

Empirical evidence from developing countries that quantifies the availability and access to transport for health reasons is scarce. However, research in this area shows that several factors explain how poor transport constitutes a major barrier for women and children to access adequate medical care, particularly emergency care, at a health facility (Box 2). The primary mode of transportation for women in labor remains walking, and care-seeking practices often reflect the fear of delivery en route, the physical hardships of traveling in such a state, and cultural practices (Rose et al. 2001).

**Transport related costs.** Transport related costs can be a primary factor in deterring patients from obtaining treatment. Even when a vehicle can be obtained, costs can be prohibitive and not even related to distance (Shehu et al. 1997). Poor patients in developing countries often cannot afford to travel to a distant hospital if they have to pay all the charges associated with the trip. Studies carried out in Burkina Faso and northeast Brazil show that transport costs accounted for 28 percent and 25 percent, respectively, of the total patient costs of using hospital services (Ensor and Cooper 2004). A study in Bangladesh suggested that transport was the second most expensive item for patients after medicines (Ensor and Cooper 2004). In rural Sudan, a study showed that about half of the families cited transport costs as the reason for not taking their children with referral need to a hospital (Mohammed Al Fadil et al. 2003). Although not clearly documented, lack of financial resources to pay for patient travel to a hospital or clinic may also influence a health worker to decline referral (Nordberg 1996). During an assessment of reproductive health services made in Lao in 2000, the cost of transportation to the district hospital was reported to range from the equivalent of US\$0.30–0.45 for less than 8 km to about US\$9.20 when the village was more than 70 kilometers away; in one province, emergency transport to the provincial hospital was reported to cost up to US\$15. These costs are substantial in a country where per capita GNI is only US\$390 (in 2004 US\$) and with 6 percent and 30 percent of the population living under \$1 and \$2 a day (in PPP terms), respectively. Not surprisingly, there was evidence that this cost of transport constituted a major concern in deciding referrals.

**Prolonged travel time and distance.** Location and poor transport often impose important opportunity costs in terms of time on both patients and relatives, particularly during peak periods of economic activity such as harvest time. Excessive time and distance can influence patients not to seek care at a health institution and can also be a contributing factor to why women choose to deliver at home rather than at a health facility (Chisembele 2001; Bale et al. 2003). In Zambia, a recent review showed that although 96 percent of respondents would have preferred to deliver in a clinic, only 54 percent actually did so. A key contributing factor was long distance, with 50 percent of the women having to walk for two hours or more to reach a clinic and only 35 percent of those living more than two hours away delivering at a health institution compared with 71 percent of those living within two hours walking distance (Stekelenburg et al. 2004). Likewise, in Sierra Leone access to health facilities is greatly limited by long distances between communities and health facilities as well as long travel times; the time required to reach a hospital can range from a minimum of three hours if a vehicle is ready to depart to over twenty-four hours if the vehicle has already left for the day (Samai and Sengeh 1997).

**Limited access and unreliable transport.** In addition to bearing a negative impact on service utilization, poor access and lack of reliable transport also explain why families delay seeking care in an emergency situation or arrive too late at health facilities for effective treatment. In Zambia, a study conducted between 1998 and 2000 showed that 76 percent of the women had to walk to the clinic to receive care and 50 percent had to walk for two hours or more. While 71 percent of those living within two hour walking distance delivered in a health institution, only 35 percent of those living further away did (Stekelenburg et al. 2004).

Lack of ambulances and shortage of other means of transport in remote areas also delay the management of life-threatening complications, particularly on non-market days or during the rainy season (Shehu et al. 1997). In Tanzania, 63 percent of the women who died after reaching a hospital had traveled 10 kilometers or more for treatment (Biego 1995). In India, a study found that half of the maternal deaths reported occurred before the women reached a

treatment facility; most of them had traveled by bus, rickshaw or bullock cart and only 9 percent by ambulance (Pendse 1999). The impact on child mortality is also significant. In urban Guinea-Bissau, 20 of 125 acutely ill children died either on their way to the hospital or while waiting in the reception area of an outpatient clinic (Sodemann et al. 1997).

The problems of poor transport services can also be compounded by inefficiency in the road system, resulting in additional delays due to traffic congestion or to problems caused by inadequate direction signs.

**Risk perception and choice.** In addition to expectations of transport cost and delay, the perception or risk of low quality care and inefficient service at health facilities has been found to influence the initial decision of a woman or her family to seek care, and in determining whether or not transport should be sought to reach a health facility. Studies examining maternal mortality reported that a lack of confidence in the quality of care, lack of available medical options, lack of equipment and services, and a frequently abusive attitude of personnel were crucial factors in delaying or preventing decisions to seek care (Wilson et al. 1997; Barnes-Josiah et al. 1998; Stekelenburg et al. 1998). In Haiti, close to 70 percent of the maternal deaths were linked to a delayed decision to get medical care, whereas delays in transportation only appeared to be significant in about 17 percent of maternal deaths (Barnes-Josiah et al. 1998).

**Cultural norms and practices.** In some societies, cultural norms and practices can influence the recognition of complications and/or risk factors during pregnancy, birth, and post-partum periods, thereby inhibiting women from seeking health care outside the home, either for themselves or their children. Sociocultural factors such as the fear of being stigmatized, or complications that may be seen as the result of insubordination or infidelity to the husband have also been reported as factors that delay women in seeking care and may lead to consultations with traditional and spiritual healers before going to the hospital (Wilson et al. 1997). A woman may also need approval within her household in order to seek emergency care. A survey in a rural district in Mali investigated the levels of knowledge, attitudes, and practices related to maternal health care among women of reproductive age and corresponding household heads. The survey revealed that over 70 percent of women and household heads cited the husband as the principal decision maker for decisions about whether or not to seek care in the face of a sign of potential danger during pregnancy (Smith et al. 2004).

Cultural practices and prevailing norms can also strongly influence the decision to use transport, thereby constraining the delivery of health care. In Malawi, where a bicycle ambulance was set up to improve emergency obstetric care, cultural beliefs deterred pregnant women from using bicycle ambulances (Lungu et al. 2001; Cham et al. 2005). In several cases, where bicycles or motorcycles were introduced to facilitate community visits by health visitors, midwives and other individuals providing care did not feel able to use such vehicles (Gauthier 2005).

**Inadequate neonatal transport services.** Although evidence is scarce, it is estimated that shortage or lack of transport specialized in meeting the needs of newborn or premature children with a critical illness can significantly contribute to neonatal mortality. Newborn or premature children who are required to be quickly and safely transferred to a different health facility or specialized neonatal intensive care unit have particular needs while in transit. In most cases, however, developing countries lack well-functioning and suitably equipped vehicles and, when equipment is available, the transport team is often not adequately trained to be able to use it effectively. Specialized transport equipment for newborn that is not available includes proper-sized bags and masks, mobile incubators, monitors, equipment for temperature regulation, or transport ventilators (Kazemian et al. 2004).

### Box 2. Examples of Transport-Related Barriers to Maternal and Child Care

#### Costs

- Hiring transport was very expensive –Tanzania (Ahluwalia et al. 2003).
- Fuel costs were too high- Uganda (Krasovec 2004).
- Drivers were unwilling to transport women at affordable fares – N.W. Nigeria (Shehu et al. 1997).
- Poor roads may increase the difficulty and the time of travel to a health facility and lead to increase in transport prices – N.W. Nigeria (Shehu et al. 1997).

#### Risk Perception & Choice

- Obtaining transport was considered a family rather than a community responsibility – Tanzania (Ahluwalia et al. 2003).
- Cultural beliefs restricted the use of transport bicycles - Malawi (Krasovec 2004).
- Women may not want to be publicly seen in labor and fear an increased risk of obstetric labor if seen in public - Malawi (Krasovec 2004).
- Drivers of commercial vehicles often hesitate before carrying women with obstetric emergencies; they fear their vehicles will be soiled or that the patient might die before reaching a health facility – N.W. Nigeria (Shehu et al. 1997).

#### Access

- Ambulances are either not available or not accessible at certain times – Malawi (Lungu et al. 2001); North Gambia (Walraven et al. 2000)
- Fuel shortages - Uganda (Krasovec 2004).
- Lack of options and money for transportation to health facilities delayed the receipt of timely services - Tanzania (Ahluwalia et al. 2003).
- Poor roads - Uganda (Krasovec 2004).
- Health facilities were without ambulances – Gambia (Cham et al. 2005).
- Transportation is not easy to obtain on market days – N.W. Nigeria (Shehu et al. 1997).

#### Excessive Travel Time & Distance

- Long distance, visiting different health facilities, poor road and vehicle conditions contributed to prolonged traveling time – Gambia (Cham et al. 2005).
- The average distance between the referral hospital and the communities in the research area is 56 km, a distance that can take up to 2-3 h in a vehicle during the rainy season - Sierra Leone (Samai and Sengeh 1997).

#### Inadequate Neonatal Care in Transport System

- Lack of specialized equipment to regulate the temperature of newborns during transport - Iran (Kazemian et al. 2004)

## 6 TRANSPORT INTERVENTIONS TO REDUCE COSTS AND IMPROVE ACCESS TO CARE

Some countries have adopted and adapted a range of transport measures to improve physical access while reducing delays in reaching care. Options surveyed have primarily focused on reducing the first two of the three main delays identified as having an impact on how long it takes a woman to receive adequate emergency care – namely, the delay in deciding to seek care and the delay in reaching facilities. In general, however, evidence linking effective transport interventions to successful health outcomes remains limited in scale to the level of a district, region or a group of villages (Table 3). In addition, it can be difficult to compare interventions since available studies focus on transport constraints at various levels of referral.

**Availability of and access to transport infrastructure.** Improvements in rural transport infrastructure have been shown to reduce the time it takes to reach health facilities by increasing access to transport services in various ways. Improvements of rural roads and infrastructure range from making previously unusable roads suitable for local transport alternatives such as donkey carts and two or three-wheel vehicles to extending the coverage and reducing the cost of local motor transport services. Improvements of rural roads can also facilitate pedestrian use. An evaluation of a World Bank-funded rural road rehabilitation project in Vietnam found that the overall improvement in road infrastructure reduced by

nearly seventeen minutes the average walking time required to reach the closest hospital, and that time savings as a result of the project were especially pronounced for the poorest 40 percent of households who reduced their walking time by twenty-two minutes (Van de Walle and Cratty 2002).

***Improving timeliness of transport response.*** Where health sector resources are very limited, innovative interventions have been implemented to improve access to emergency transport while reducing delay in reaching health facilities. Communities, sometimes with the assistance of health authorities, have set up community-based emergency transport systems. The success of these initiatives has been mixed and review of this experience shows some of the factors that are likely to be important in this respect.

Since 1998, motorcycle ambulances have been introduced in several African countries through the Safe Motherhood Project. The largest project is in Eastern South Africa where a dozen units, each covering a radius of about 50 km, are operated by the health department of the Oliver Tambo District in both rural and urban communities supporting local hospitals and remote clinics. In Malawi, ambulances have been introduced in a phased approach covering 2-3 districts per year with a major focus on community participation. Produced locally, these ambulances, which are engineered by the Ranger Production Company, have also been introduced in Malawi and Ghana under the SMP (eRanger 2005).

Efficient and reliable transport systems often go hand in hand with communication technologies such as two-way radios and mobile phones to ensure that the referral system is fast and efficient. Effective communication between the community and the transport operator is particularly important in rural areas where the population is dispersed and demand is low. The rapid spread of mobile telephone technology has increased the prospect for better communications in the referral process for an increasing number of communities which are currently underserved. A project in Sierra Leone provided radios to summon vehicles to take women to hospital in the case of an obstetric emergency; results showed that 38 percent of the women who came with the project vehicle arrived in good condition compared to 30 percent of those who came by other means (Samai and Sengeh 1997).

Intermediate forms of communication are reported to be effective in improving access to emergency transport in some situations. In West Africa, the International Planned Parenthood Foundation not only negotiated with a local transport association that their members be ready to take pregnant women to hospital; it has also established that transporters will be alerted by a yellow flag placed on the side of the road to alert drivers that a woman is in urgent need of transport. The BBC reported that there has been a significant reduction in maternal mortality as a result of this initiative (BBC 2005).

Other forms of communications have also helped overcome situations when transport was unavailable or inexistent. The project "Rural Extended Services and Care for Ultimate Emergency Relief (RESCUER)—a joint effort between the United Nations Population Fund, Uganda's Ministry of Health and Population Secretariat, and local authorities—has provided traditional birth attendants and midwives with very high frequency (VHF) radios and walkie-talkies to improve the referral system; as well as by posting them in health posts, the referral hospital ambulance and in the district medical officer's vehicle (IK Notes 2002).

***Reduction or elimination of transport costs.*** Many countries have found that reducing or eliminating transport costs is necessary to ensure access to needed services. Efforts have been made using various financing mechanisms both at the individual and at the community level to cover these costs. Fee schedules set at the community level and in consultation with local people have been designed to reflect distances between villages and primary health units; such fees have improved access and also helped pay for operation and maintenance costs of vehicles (Samai and Sengeh 1997). Prepayment and pooled insurance schemes have also been used, offering several advantages over fees for service—such as the ability to pay for transport after the patient has received care (Krasovec 2004). For example, in Sierra Leone transport fees included transport of the women's body back to the primary health unit in the event that she died on her way to the hospital (Samai and Sengeh 1997). In the

Samburu district, Kenya, a community insurance scheme was designed to incorporate transport costs into an overall benefits package, covering transport costs as high as US\$60 per year for a household premium of US\$5 per year (Macintyre, K. and DR Hotchkiss. 1999). Furthermore, interventions to cover the indirect opportunity costs incurred by patients and their relatives when seeking care have been found to stimulate access to and use of transport. These interventions can cover payment to compensate patients for time off work, travel and general inconvenience (Ensor and Cooper 2004).

At the community level, various funding mechanisms for emergency transport schemes have offered practical solutions to operate transport referral systems. Such interventions have often been initiated in West Africa through the Prevention of Maternal Mortality (PMM) network,<sup>1</sup> and have consisted in setting up a system to help share, pay in advance or defer some of the costs of obstetric care; providing emergency fuel funds; and setting up vehicles with communications technology to ease up referrals (Samai and Sengeh 1997; Shehu et al. 1997). In addition, several community-driven development programs have demonstrated that women's access to health services can be improved by making arrangements with local transporters and by organizing emergency interest-free loans financed and managed by the communities (Eisen et al. 1997). In both Malaysia and Sri Lanka the Health Sector provided free or subsidized transportation to hospitals for response to emergencies, in rural areas primarily; in the absence of or lack of access to an ambulance or other forms of official transportation (Sri Lanka evidence), field staff were authorized to hire private transportation for emergency referral and were reimbursed by the Ministry of Health. As a result transport options sought by staff gradually evolved from a bullock cart or a buggy in remote areas to contracting taxis or private vehicles (Pathmanathan et al. 2003).

***Adapting transport to social and cultural norms.*** Transport approaches that consider cultural concerns about privacy and desire for accompanying family members at the referral facility have been shown to improve the frequency and use of the service (Krasovec 2004). The successful introduction and use of hand-operated and bicycle powered ambulances has been reported from the Gambia and Tanzania. In the Gambia female patients have accepted to be carried on the modified sidecar of a motorcycle ambulance which has been introduced by Riders for Health, a non-government organization that specializes in helping the health services in low income countries to establish and manage appropriate vehicle fleets. Moreover, female health assistants in the Gambia are willing to ride motorcycles in order to increase the coverage and scope of their activity.

Various community approaches to improve transport systems have also been successful in including training activities for village and community leaders to discuss problems specific to transporting mothers with obstetric emergencies; activities to sensitize drivers to the specific transport needs of pregnant women and to be more respectful of those being transported have also been successful (Ahluwalia et al. 2003; Shehu et al. 1997; Krasovec et al. 2004; Samai and Sengeh 1997). Training sessions have also been crucial in facilitating the participation of labor unions and drivers in community-based transport schemes (Shehu et al. 1997). Various community-based transport interventions have also demonstrated that transport is not simply a family responsibility, serving instead a broader function for the community and also encouraging the sustainability of community-wide support for transport systems focused on emergency care (Ahluwalia et al. 2003). Also, other initiatives such as involving women and their families to identify reproductive problems; to recognize danger signs, and to mobilize for referral when complications arise have proven to have a positive impact have proven to have a positive impact (Skilled Care 2002; WHO 2005).

---

<sup>1</sup> The Prevention of Maternal Mortality (PMM) network was established in 1988 as part of the Safe Motherhood Initiative (SMI)—launched in 1987—and consists of 11 research-based teams in West Africa (seven in Nigeria, two in Ghana, and two in Sierra Leone) and one U.S. team; it is based at the Center for Population and Family Health at Columbia University, New York. Each team in Africa is made of a nurse-midwife, an obstetrician-gynecologist, a social scientist, and a community medicine specialist. The team in the US provides technical assistance and support.

Table 3. Transport Arrangements to Access Health Facilities for Antenatal and Delivery and Postnatal Phase

Modes of Transport	Country examples (Source)		Comments/ Notes
	Antenatal Care	Delivery/ Postnatal	
<b>Non-motorized</b>			
Walking		Central and Upper River Divisions, The Gambia (Cham et al. 2005)	Some health facilities are without ambulances; also lack of fuel for the ambulance; unavailability of the ambulance at certain times.
		Tanzania (Ahluwalia et al. 2003)	(8 percent of 52 villages)
	Mali (Smith et al. 2004)		Lack of transport is cited as a reason for non-use of prenatal services by 12 percent of women.
	Guatemala (Rodríguez 2005)	Guatemala (Rodríguez 2005)	About 22 percent of the population reaches the nearest health facility by foot.
	South Africa (DoT South Africa, 2005)	South Africa (DoT, South Africa, 2005)	Forty percent of all trips to medical facilities are on foot while 31 percent of all trips are done using public transport.
	Zambia (Chisembele 2001)		Close to 90 percent of mothers in antenatal phase walk to clinic.
	Zambia (Stekelenburg et al. 2004)	Zambia (Stekelenburg et al. 2004)	Fifty percent of women must walk >2h to reach health facility; about 72 percent women had antenatal visits; 35 percent of women who walk > 2h away delivered in health facility.
	Senegal (ITDP 2005)	Senegal (ITDP 2005)	Forty-two percent of the rural population relies on walking as the main mode of transport to reach health facilities.
	Uzbekistan (Uzbekistan 2004)	Uzbekistan (Uzbekistan 2004)	The pilot rural primary care program will be scaled-up nationally with some refinements and extended to urban area pilots. In the most remote locations without any means of transport means (and communications), a number of vehicles capable of moving a patient if necessary, as well as staff, will be provided.
	Sierra Leone (Samai and Sengeh 1997)		Up to 3 h to travel 8-12 km to the health center by foot due to hilly terrain and poor road conditions; patients are transported in hammocks; an additional three hours from health center to referring hospital by motor vehicle.
Animal transport		Tanzania (Ahluwalia et al. 2003)	Ox carts (4 percent of 52 villages)
	Senegal (ITDP 2005)	Senegal (ITDP 2005)	The primary mode of transport for longer communal and non-walking distance to a health facility is the donkey trailer; however, such transport mode is uncomfortable for patients and can take up to two days to reach a facility.
Animal transport		Central and Upper River Divisions, The Gambia (Cham et al. 2005)	Lack of motorized transport forced families to opt for alternative means of transport such as using a cart with a donkey, ox or a horse.

Modes of Transport	Country examples (Source)		Comments/ Notes
	Antenatal Care	Delivery/ Postnatal	
<b>Non-motorized Cont.</b>			
Three-wheeled or auto-rickshaws		Tanzania (Ahluwalia et al. 2003)	Modified tricycles with a platform (41 percent of 52 villages)
	Udaipur, Rajasthan, India (Pendse 1999)	Udaipur, Rajasthan, India (Pendse 1999)	A third of the women use more than one mode of transport to reach the hospital. Often, a woman is carried on someone's back from her village to the nearest motorable road; then put on a small private vehicle like bus or truck to reach to the city; and then put on a three-wheeler to reach the hospital.
Bicycle ambulance		Malawi (Lungu et al. 2001)	The ambulance is actually used for other medical emergencies.
		Uganda (Krasovec 2004)	Bicycle ambulances are the most common means of transport used in the RESCUER project; some other forms of public transport and foot are also used.
<b>Private or commercial/ public motorized</b>			
Private bus, mini-bus		Udaipur, Rajasthan, India (Pendse 1999)	For city transport primarily.
		Northern Nigeria (Shehu 1999)	Thirty percent of the pregnant women identified lack of transport as a delay factor in seeking health care; to access care, the majority of women had to hire private commercial transport.
Taxi		Ghana (Nkyekyer 2000)	Fifty-nine percent of peri-partum referrals to a Ghanaian teaching hospital came by taxi.
Tractor		Tanzania (Ahluwalia et al. 2003)	Tractor with a trailer (~8 percent of 52 villages)
Four-wheel drive/ Jeep Land cruiser		India (Pendse 1999)	Jeep is preferred to private taxi, which is more expensive; 62 percent of women who died in childbirth had traveled by jeep.
		Sierra Leone (Samai and Sengeh 1997)	A four-wheel drive was purchased, posted at the hospital as part of emergency transport system.
Motorcycle		Ghana (ITDP 2005b)	70 percent of the motorcycles are used by community health officials; however despite high demand for transferring patients from villages to health facilities or from health facilities to the district hospital, carriage of patients on motorcycles takes place only 2-3 times a year.
Public bus		Guatemala (Rodríguez 2005)	Close to two-thirds of the population reaches the nearest health facility by public bus.
Boats or canoes		Tanzania (Ahluwalia et al. 2003)	(21 percent of 52 villages)
		Ghana (ITDP 2005b)	Since 2000, motorized boats are used in riverine regions, especially near the Volta River

Modes of Transport	Country examples (Source)		Comments/ Notes
	Antenatal Care	Delivery/ Postnatal	
<b>Specialized health transport</b>			
Motorcycle ambulance		Gambia (Riders for Health 2005)	Community-operated, multi-purpose vehicle in sidecar configuration.
		Malawi, Ghana, South Africa (eRanger 2005).	Motorcycle ambulances have shown to significantly improve referral times to hospital; they provide huge cost benefits over four-wheel drive ambulances in capital and maintenance costs; and they can access the same areas as four-wheel drive vehicles.
		Tanzania (IT Transport 2002)	Ambulance trailer (also used for other tasks), operated by local entrepreneurs.
Ambulance		Guatemala (Méndez Pérez 2005)	Only 13 percent of health facilities have a vehicle for transporting patients; between Nov. 2004 and Feb. 2005, 48 pregnant women could not be transported with this vehicle, 71 percent were forced to rent a private vehicle; 29 percent used a firetruck and paid for gas.
		Senegal (Gauthier 2005)	Only one out of every eight ambulances is in working condition.
		Zambia (Chisembele 2001)	Only 6.5 percent of the health centers have an ambulance or vehicle.
		Lao PDR (WHO 2000)	None of the district hospitals had an ambulance ready for obstetric emergencies; patients had to make their own transportation arrangements in case of emergency.
	South Africa (Penn-Kekana and Blaauw 2002)	South Africa (Penn-Kekana and Blaauw 2002)	About 23 percent of the Primary Health Clinics (PHCs) do not have access to an ambulance necessary to transport patients to the next level of care; and about 43 percent of the ambulance response time >1 h.
		Honduras (Danel 1998)	Following an MOH initiative, an ambulance was assigned to each area hospital and the Red Cross set up a subsidiary in rural areas; communities were also relied upon to prepare for obstetric emergencies and for the need to have emergency transportation available; TBAs and community health volunteers ensure that transportation support this effort.
	Udaipur, Rajasthan, India (Pendse 1999)	Udaipur, Rajasthan, India (Pendse 1999)	Only 8 percent of the women in 1994-96 and 6 percent in the 1983-85 studies were transported by the main city hospital ambulance; also, transport was not provided for serious cases from primary health centers to the district hospital.
Ambulance (with radio system)		Rural Niger (Bossyns et al. 2005)	The only way for a woman with obstructed labor to reach the hospital prior to the radio-ambulance system was to walk 75 km or go by camel.



Modes of Transport	Country examples (Source)		Comments/ Notes
	Antenatal Care	Delivery/ Postnatal	
<b>Specialized health transport <i>Cont.</i></b>			
Mobile clinic	Bolivia (Reaching Out 2002)	Bolivia (Reaching Out 2002)	Two mobile units in Chuquisaca make rounds to 11 municipalities, to more than 40 communities and serving 12,000 women of reproductive age. From Jan. to June 2002, the clinics provided more than 6,000 medical consultations.
<b>Access to Road Network</b>			
Road Improvement/ Rehabilitation	Senegal (ITDP 2005)	Senegal (ITDP 2005)	It was envisaged to improve the surface of rural roads between health posts and health centers to allow driving of two-wheel cars instead of more expensive four-wheel cars; it was considered to be too expensive and not financially sustainable due to very low population density in rural areas and frequent repairs that may be needed due to extreme weather conditions that periodically damage the roads (sand storms during the dry season and periodic flooding during the rainy season).
	Morocco (NPRR-2 2006)	Morocco (NPRR-2 2006)	The Second National Rural Roads Project aims to increase road access to poor rural areas; about 46 percent of the country's rural population does not currently have access to an all-weather road.
	Vietnam (Vietnam 2006; van de Walle and Cratty 2002)	Vietnam (Vietnam 2006; van de Walle and Cratty 2002)	The Third Vietnam Rural Transport Project aims to continue improving rural transport and leads to, among other benefits, increased access to health services; the rural transport network serves 75 percent of the total population and 90 percent of the country's poor households but low incomes and poor road conditions result in 90 percent of passengers and goods being moved by foot, animal, bicycle, motorcycle, or <i>cong nong</i> (light trucks) with very high travel costs.
	Honduras (Danel 1998)	Honduras (Danel 1998)	At least one major road was constructed into a previously inaccessible area with a very high maternal mortality.
	India (India 2004)	India (India 2004)	India's Rural Connectivity Program (PMGSY) aims to bring lower transport costs and faster speed for movement of people and goods in rural areas. Some of benefits of the project include more regular and reliable public transport and incentives for service providers such as health personnel. Villages with all-weather road access have populations with higher levels of access to health services.

***Appropriate and cost-effective neonatal transport options:*** There is a remarkable paucity of studies on transport interventions targeted to newborns despite the critical importance of this type of transport for ensuring access to essential health care. Some of the requirements are similar to those for mothers, particularly as the baby may need to be accompanied by his/her mother, who may also be a patient. But there are also specific transport needs for the newborn. For example, a simple Styropor box showed promise for preventing hypothermia, a major cause of death for newborn in developing countries, which could be used as an alternative to transport incubators (Bhutta et al. 2005).

## 7 IMPLICATIONS FOR TRANSPORT

In many developing countries, where transport is either lacking or inadequate to provide access to maternal and child health services, evidence shows that increasing demand for transport is far more complex than simply increasing the provision of roads and transport systems. Direct monetary and non-monetary factors that affect demand for transport include travel and opportunity costs. There is also a number of significant non-transport, indirect factors. These demand constraints are primarily linked to the quality of care at the health facility (the third delay in the Thaddeus and Maine framework), social and cultural behaviors and choices, as well as synergies between the transport and health sectors that must be improved in the context of transport so that quicker and more affordable transport links can be established between households or communities and health facilities (Table 4).

***Local transport service is essential for many remote communities to access key health services.*** In many low income countries the majority of the population lives in rural areas where population densities are often very low. Establishing and sustaining adequate transport services for such areas continues to be one of the main development challenges. Without reasonable transport services, delivering community healthcare visits and maintaining reliable supplies of medicines and other consumables becomes too difficult and costly. The local road network will tend to be of low standard with little or no maintenance. Skilled health staff (and other public employees) can be unwilling to be posted to such isolated locations. Others, like ghost workers, can be listed on the payroll but do not exist or work only part time. Such poor level of commitment is commonly reported in remote rural locations and remoteness and difficulty of access tend to be strongly correlated with absenteeism (WHO 2006). These issues are reflected in the inclusion of a Rural Access Index in the Results Measurement Framework for IDA-14 (IDA 2005).

The Rural Access Index (RAI) is the proportion of the rural population that has adequate access to the transport system. Current values of the RAI indicate that some 900 million rural dwellers world wide do not have adequate access. Of these, 700 million live in IDA countries. Access is poorest in the Sub-Saharan African region where, in aggregate, only 30 percent of the rural population has adequate access to transport (Roberts et al. 2006).

The need to improve rural transport has been recognized for decades as a very high priority for Sub-Saharan Africa. This priority has been addressed, within the limited resources of those countries, mainly by substantial investments in extending or upgrading the rural road networks. However, much more remains to be done as reflected by the current low value of the RAI for the region. This was recently recognized in a report endorsed by the African Ministers of Transport (Africa Union, 2005). The report highlights the critical role of Rural Access and other key contributions by the transport sector to achieving the MDGs. An extract from the report in Table 5 summarizes this role for the key Health MDGs 4 and 5, which are the focus of this paper.

Table 4. Supply and Demand Transport Barriers and Interventions for Maternal and Child Care

Transport barriers		Transport interventions	
Supply	Demand	Supply	Demand
<p>➤ <b>Transport cost</b></p> <ul style="list-style-type: none"> <li>-long distance</li> <li>-poor roads</li> <li>-lack of vehicles</li> <li>-high input prices</li> </ul> <p>➤ <b>Input prices</b></p> <ul style="list-style-type: none"> <li>-fuel cost</li> <li>-capital cost</li> </ul> <p>➤ <b>Shortage or lack of specialized transport</b> for newborn/ premature infants and/or pregnant women</p> <p>** ➤ <b>Lack of medical supplies and staff during transportation</b></p> <p>➤ <b>Inefficient signage and mapping system; traffic congestion</b></p>	<p>➤ <b>Monetary factors</b></p> <ul style="list-style-type: none"> <li>-low income</li> <li>-opportunity cost</li> </ul> <p>➤ <b>Non-monetary factors</b></p> <ul style="list-style-type: none"> <li>-long distance</li> <li>-few vehicles</li> <li>-poor roads</li> <li>-opportunity cost for relative of patient traveling to health facility</li> </ul> <p>(➤) <b>Social/Cultural factors</b></p> <ul style="list-style-type: none"> <li>-seeking help = "weakness"</li> <li>-expected transport delay</li> <li>-expected low quality of care</li> <li>-not aware danger signs</li> <li>-fear of stigma</li> <li>-man is decision-taker)</li> </ul>	<p>➤ <b>Road rehabilitation/</b> upgrading of local road networks</p> <p>➤ <b>Community-based emergency transport systems</b> with communication technologies to ease up referral</p> <p>➤ <b>Appropriate and cost efficient neonatal transport technologies</b></p> <p>➤ <b>Transport means adapted to meet women needs</b></p> <p>(➤) <b>Improved medical services)</b></p> <p>** ➤ <b>Medical supplies as well as paramedical/medical staff on board transportation means</b></p>	<p>➤ <b>Cheaper transport alternatives</b></p> <ul style="list-style-type: none"> <li>-Non-Motorized transports (NMTs)</li> <li>-Financing mechanisms (fuel funds; fee schedules; prepayment; pooled insurance scheme)</li> </ul> <p>(➤) <b>Incentives to reduce cost of lost-working time)</b></p> <p>(➤) <b>"Culturally sensitive" education and community training</b></p> <ul style="list-style-type: none"> <li>-Community leaders; families; labor unions; drivers)</li> </ul> <p>(➤) <b>Information about appropriateness of health services)</b></p>

Source: Adapted from Ensor and Cooper, 2004; Grossman 2000.

➤ direct transport barrier or intervention

(➤) indirect transport barrier or intervention

\*\* Inter-sector cooperation between transport and health

**Table 5. Transport Targets and Indicators Related to MDG 4 & 5**

<b>Targets</b>	<b>Indicators</b>
<b>Rural access and urban mobility</b> improved for reliable supply of inputs to health facilities, to provide affordable access for all households and to enable cost effective outreach health activities	% Health centers, clinics, etc. with reliable rural access. % of households reporting constraints on access to health services because of: <ul style="list-style-type: none"> <li>• Distance</li> <li>• Cost / difficulty of travel</li> <li>• Poor quality health service</li> <li>• Unit cost immunization / capita</li> <li>• Unit cost / coverage of outreach services / capita</li> </ul>
<b>Emergency transport response</b> for medical crisis in rural communities improved through community communications facilities linked to improved transport services	% Emergency patients unable to reach health care in time: Expectant or postnatal mothers Children under 5 years

Source: Africa Union et al. 2005.

**Transport to access maternal and child health care must be affordable.** High transport costs represent important constraints for women and their families who need to access health facilities for both preventive and also emergency care. A key issue therefore is how to improve transport access in a way that is both affordable and sustainable for these two levels of care.

Community and local government interventions to make transport affordable have mostly focused on financial arrangements to facilitate payment for transport services. These arrangements can complement the more expensive road improvements that can help reduce vehicle operating costs and thereby increase access to health and other facilities. For preventive care, evidence shows that ambulatory medical care has been provided by the private sector and financed by user fees (Pathmanathan et al. 2003). For emergency care, free or subsidized emergency transportation for rural areas has been effective in some cases. In the absence of, or lack of access to, an ambulance and other forms of official transportation for emergency care, it has proven successful to authorize health staff to hire private transportation, with the cost of this being reimbursed by the Ministry of Health (Pathmanathan et al. 2003). Likewise, community interventions have shown that commercial transport owners and communities can at times be mobilized to provide affordable emergency transport (Shehu et al. 1997).

When communities have set up a reliable emergency mechanism at the local level, sustainability of transport funding mechanisms as well as the necessity not to entail major capital outlays have been important issues. In some instances, concerns have been raised about fund depletion and the need to raise the rate of interest to offset the cost of loan defaulters (Ensor and Cooper 2004).

**Emergency transport plays critical role in accessing critical maternal and child care.**

The availability of a suitable vehicle can be a critical factor to reach health facilities and for the provision of emergency care. As the majority of life-threatening pregnancy-related complications cannot be predicted and require prompt access to care, there are strong incentives to focus transport interventions for maternal and child care on emergency transport. It is estimated that the interval from the onset of antepartum hemorrhage to death can be twelve hours, while the interval from postpartum hemorrhage to death can be as short as two hours (Krasovec 2004). A number of community-based emergency transport interventions have successfully improved maternal health outcomes (Table 6). Likewise, if 75

percent of pregnant women could be saved through the timely delivery of obstetric care each year, we could expect nearly 14,500 children to be saved each year<sup>2</sup>.

***Community-based transport can be effective in providing access to maternal and child care.*** In addition to being a successful approach to establishing funding mechanisms, community mobilization can be a critical element in developing and maintaining a transport system that links communities to functioning health facilities (Ahluwalia et al. 2003). Community interventions offer the advantage of responding to the various supply and demand constraints facing transport systems, including cultural reluctance by women and/or men to seek health outside their home, making obstetric health an emergency priority for transport systems, and establishing funding mechanisms for emergency transport (Ensor and Cooper 2004). Bringing services directly to poor people has also proven to be an effective intervention to mitigate isolation and reduce lost work-time. Mobile clinics have been used to provide antenatal, postnatal, family-planning, and child health services (Reaching Out 2002). Likewise, community involvement can also be a key condition for success as transport interventions better reflect population needs and constraints; in the Iganga district of Uganda, concerns raised at the community level led to the replacement of inappropriate tricycles with small four-wheel drives that could better navigate on poor roads (IK Notes 2002).

***The private sector and transport unions can help provide transport for health access.*** In the absence of effective public emergency transportation, private transport may constitute an alternative. However, usually there are no incentives for operators to provide a rapid transport response in order to access either emergency health needs or preventive maternal and child care. Engaging with transport unions has proven, in some cases, to be a successful way in finding affordable and reliable transport options to provide emergency obstetric care (Shehu et al. 1997).

***Transport interventions must be set in parallel with improvements in the quality of health care services and delivery.*** Lack of awareness of the severity of an obstetric complication and mistrust in the type of health services available often remain the most important reasons for delaying action to reach care (Shehu et al. 1997). Services will likely continue to be underutilized and emergency obstetric transport unreliable if they are perceived negatively by pregnant women and communities. In Sierra Leone, improvements in transport led to increasing women's access to effective care; however, some of the improvements may have been a direct impact of additional women using the referral facility because of its improved reputation (Samai et al. 1997). In India, improvements in Rajasthan's road and transport facilities almost doubled the number of women, who had traveled more than 100 km to reach the local hospital; however, although more women arrived at the hospital, most of them could not be saved and died in the hospital instead of dying at home in the past, where their deaths would likely never have been recorded (Pendse 1999).

In many rural areas of developing countries, herbalists and traditional birth attendants (TBAs) continue to be the first choice for help (Olaniran et al. 1997). If the quality of care at hospitals is poor and seen as likely to lead to death, communities and primary health care centers may be reluctant to promptly take patients to such facilities even when the transport capacity exists (Kobusingye et al. 2005).

In Malaysia, the gradual improvement of both health facilities and transport contributed to significant reductions in both maternal and neonatal mortality. Women and their families were encouraged to deliver in a health facility rather than at home; while transport and related services were provided at no cost to families and significant improvements in the quality of hospital care were accomplished through quality assurance efforts (Koblinsky et al. 1999; Bale et al. 2003).

<sup>2</sup> Nearly 14,500 (or 14,481.375) children could be saved each year if 75 percent of pregnant women could be saved through the timely delivery of obstetric care  $[(529,000 * 75\%) \times 79/2/1,000 \text{ live births per year}]$ .

**Table 6. Estimates of the Number of Maternal and Child Deaths (Potentially) Averted through Transport Access and Various Emergency Transport Interventions**

Country	Key findings
Rural Niger: (Bossyns 2005)	1) Following the introduction of the radio-ambulance system, the number of emergency evacuations from periphery/ health center to the district hospital increased from 10 to 197 (holding the number of health facilities and the quality of the road constant). 2) In 14 percent of the calls, the obstetric or medical problems could be dealt with by the ambulance team without evacuating the patient to the District hospital.
Sierra Leone (Samai and Sengeh 1997)	Putting an emergency vehicle in the local hospital and a system of communication (first with motorbikes and then with radios) in the eight primary health units, increased the number of women from 0.9 to 2.6 per month and reduced mortality rates from 20 to 10 percent among women with obstetrical complications.
Rural areas around the town of Farafenni, North Gambia (Walraven et al. 2000)	Ambulance services became available between dispensary, the health center, and the referral hospital in the capital. Telephones were also added in larger villages. Between 1982 and 1998, the proportion of women delivering in a health facility increased from 4.6 percent to 18 percent.
South Africa (Hall 2004)	Annual perinatal surveys identified transportation problems as a direct avoidable cause of perinatal deaths (2.6 percent in 2000; and 5.3 percent in 2001). Lack of transport for moving patients between institutions accounted for 13.6 percent of maternal deaths reported in 1998.
Tanzania (Ahluwalia et al. 2003)	The share of women treated at the district hospital of obstetric complications increased from 4 percent of pregnant women in 1997 to about 15 percent in 2001.
Uganda (IK Notes 2002)	The RESCUER project helped reduce mortality rates in the Iganga district by 40 percent between 1996 and 1999.
Honduras (Krasovec 2004)	A government initiative, which among other factors equipped all district hospitals with an ambulance and improved roads and communications and reduced maternal mortality ratios from 182 to 108 per 100,000 women between 1990 and 1997.
Udaipur, Rajasthan, India (Pendse 1999)	Improvement in roads and transport facilities led to increase in number of women who died at the hospital and traveled >100 km in the hope of surviving from 11 percent in 1983-85 to 20 percent in 1994-96.
Zimbabwe, rural province of Masvingo (Fawcus et 1997)	1) 50 percent of the maternal deaths of hemorrhage could be blamed on the absence of emergency transport at the community level 2) Lack of transportation was a major factor in 28 percent of the 105 maternal death studied.
Nkoranza district, Midwest Ghana (MaterCare 2006).	In the 15 months following inception of an ambulance service, 364 mothers and two babies were transferred by an ambulance to the hospital following birth-related health complications; over 30 percent of the mothers transferred required medical attentions that, if delayed, could have been fatal for the mother and her child, subsequently.

**Transport interventions must be set in the context of a comprehensive health referral system.** A mapping exercise or inventory of available maternal health facilities and services with a needs assessment of referral points can be an entry point in determining weaknesses and gaps in the system as well as in formulating a plan to ensure a minimum level of referral care and services (IK Notes 2002). There have been various initiatives to help public health services improve the management of their transport fleets. A non-governmental organization, Transaid, has mobilized professional transport operations expertise to study health sector fleets in Kenya, Nigeria, Zimbabwe, eight provinces in South Africa, Ghana and Côte d'Ivoire (Transaid 2005; Timpson 2004). Transaid works to assess the size and condition of existing fleets and management systems in place to improve the efficiency of service delivery. Another non-governmental organization, Riders for Health, has provided assistance by establishing motorcycle ambulances and health outreach services in Africa. Since 2002 Riders for Health has been appointed by the Gambian Government to be responsible for all its vehicle management—beginning with the Department of State for Health. (Riders for Health 2005).

***Trained drivers and medical staff and supplies contribute to effective emergency transport.*** Recognition of severe obstetric complications and provision of immediate or urgent care at first contact facilities such as primary health care centers can improve the efficiency of emergency transport system. With appropriate training in the principles of triage and essential equipment and supplies, staff can stabilize conditions on site or sort out sick patients and make appropriate triage and treatment decisions to take patients to the next level of care (Razzak et al. 2002). The triage process staff in a pre-hospital phase can determine which patients get transported to which facility instead of merely taking patients to the nearest facility (Kobusingye et al. 2005). In both Malaysia and Sri Lanka, measures to stabilize the health condition of women with complications, and the availability of blood supplies, ensured the successful transportation of patients to the next level of care (Pathmanathan et al. 2003). When triage is not possible, having trained drivers with equipment can also make a significant difference in improving emergency transport. Having medical staff on board emergency transportation, or trained drivers who know how to position patients or how to use the transport equipment, can also be beneficial. In the Gambia, Riders for Health are training drivers of motorcycle ambulances in the essentials of patient handling and care from the point of collection, during transport and while being transferred to the hospital (Riders for Health 2005).

## **8 POLICY RECOMMENDATIONS TO IMPROVE TRANSPORT FOR MATERNAL AND CHILD HEALTH**

### **8.1 Key Findings**

Reliable, suitable and affordable transport plays a key role in enabling expectant mothers and newborn children to receive vital health care and in encouraging families to seek this care. However, there are various financial, social and institutional factors of supply and demand that can severely limit, both directly and indirectly, the effectiveness of transport in delivering and accessing health services, particularly in less developed countries. In addition, access to health services by women and their infants is limited by factors that can “delay” access and include a family’s decision to seek care, the availability of suitable transport, and the perceived availability and quality of services at the relevant health facility.

In under-served rural or peri-urban areas of developing countries, transport can be inefficient in helping families reach health facilities and thereby create a major delay in accessing care, which can be particularly deleterious when access to emergency care is needed. Inefficiencies in transport can be caused by very limited services and slow travel times by various transport modes operating on roads in poor conditions. Moreover, poor families are often not able to afford the cost of transport to health facilities. As a result, for many women and their infants walking is the only means by which they can reach health facilities. This effectively limits their ability to reach health facilities, particularly if the women are suffering from an incapacitating health condition.

When providing adequate transport coverage within the health service is impractical, transport that is privately operated can be used for accessing preventive and emergency care. In some countries, private transport is accepted and can be reimbursed by the health sector. However, when the poor are left to pay for their own transport, there are important issues of equity regarding affordability and access to essential services.

In some locations, which are inaccessible to conventional motor vehicles or where there is inadequate demand to sustain a regular motor transport service, alternative forms of transport have been used with some success. The lower capital and operating costs of bicycle or motorcycle ambulances have helped some communities operate their own services. These operations have generally been developed on a multi-purpose basis in order to complement the infrequent transport demand for health purposes. In some rural areas, improvement of the road network may be needed to facilitate access to key health services. However, these improvements have to bring wider social and economic benefits to the community if they are to be sustainable.

Community-based transport can meet local needs where neither public nor suitable private services are available. However, for community transport arrangements to be sustained, the full costs of such community services must be recovered, raising issues of local institutional capacity, equity and affordability.

Communications can significantly increase the utilization rate and response time of transport vehicles in areas with low population density, thereby strengthening transport provision in underserved areas, particularly when providing an emergency response.

## 8.2 Recommendations

In light of the transport constraints and opportunities reviewed in this paper, the following recommendations summarize the issues that should be considered with respect to transport in order to improve maternal and child health care as well as reduce mortality rates in particular.

***Improving access to effective emergency transport could help reduce maternal and child mortality rates.*** It is estimated that 75 percent of the women who die in the course of childbirth do so as a result of inadequate emergency transport. Public health services in most countries do include an ambulance service that can transport patients rapidly to the level of care required in order to deal with a particular health crisis. However, in most low income countries such public ambulance services have not been sustained effectively, providing very limited, or no service. As a result, many segments of the population, particularly in rural or peri-urban areas are not covered and have to make their own arrangements to reach the appropriate health facility in case of an emergency.

***Transport and health are interdependent sectors for an effective referral system.*** Transport improvements are necessary but not sufficient for a more effective delivery of maternal and child health services. Emergency care should not be equated with solely providing ambulances or focusing on transport services while neglecting the role of care that can be provided in the community and at a health facility. Additional research on appropriate and cost-effective strategies should be done to improve the availability and timeliness of adequate transport; and also to ensure that transport carries specialized equipment and is operated by staff that have the essential training to meet the critical health needs of mothers and newborns in transit.

***Transport contributions to an effective health care system are more effective when planned as part of a long-term integrated strategy.*** Improvements in accessing health services can be achieved by either increasing the ratio of clinics to patients, improving the effectiveness of the transport system for reaching existing facilities, or, most likely, through a combination of these. The location and management of health facilities must be planned in relation to the targeted populations and taking into account the expected transport capacity within the health service and available to all sections of the population.

***Transport should be affordable while also financially sustainable.*** Transport costs and financing mechanisms for improved access to maternal and child care remain an issue, in particular for poor rural households. As a result, it is necessary to consider financial mechanisms that facilitate paying for transport, particularly in the event of a health crisis. This is often accepted as a national or local government responsibility on the grounds of equity but frequently it is a responsibility that is largely unmet. There has been some success with various types of community funding schemes to spread risk and share the cost of emergency transport. However, community priorities have tended to promote emergency transport for maternal and child care rather than transport measures designed to improve access to preventive care.

***Transport options for accessing maternal and child care should be culturally acceptable.*** Women and their families will use a variety of transport modes when necessary. However, some forms of transport are culturally unacceptable in particular situations. As a result, transport options must be adapted and tested in the local context. In some cases, reluctance to use a specific transport mode can be overcome through negotiation with the



women and their families. This process can be assisted at the community level by modifying the behavior of transport providers and their operating staff through raising their awareness and/or through training. Such training would, for instance, include good practice in moving patients and in positioning them during transport.

***There are simple transport measures as well as non-road interventions that could be implemented using locally available resources.*** A transport needs assessment can help determine the best and easiest transport interventions that can be implemented. A vehicle with a stretcher is ideal but almost any of the various modes of transportation available to carry a woman and/or newborn to a health facility should be considered, depending on distance, road conditions, and cultural acceptance. Measures to improve signage and mapping systems or to gain priority over traffic can also improve emergency transport access.

***Transport options for infants should be related to the arrangements for mothers.*** Newborn health depends on services in the continuum of care for mothers, so transport services for maternal care and emergencies should accommodate provisions for transporting infants safely. Complex technology is not necessary to avoid most deaths of premature infants since extra attention to warmth and feeding as well as prevention of early infections can make a significant difference at low marginal cost.

### 8.3 Knowledge Gaps

Measures that have been put in place in developing countries to overcome significant transport-related constraints to access maternal and child care could be replicated where the local context seems favorable and comparable. However, further interventions should be carefully reviewed and monitored to ensure that they can be successfully scaled up, replicated and/or adapted to contribute to the intended improvements. The following research areas should be considered to enhance knowledge and derive additional benefits on future transport improvements:

- ***Compare financial and time costs for poor and non-poor households to access all forms of health intervention for improved maternal and child health outcomes.***
- ***Determine the scope for engaging transport enterprises that can support the delivery of maternal and child care services.***
- ***Identify at which level of referral different improvements in transport systems would be most beneficial for improved maternal and child care.***
- ***Investigate how a health center network might be expanded through services provided by private transport operators and what might be the balance between road rehabilitation and improvement programs as compared with increasing the number of facilities.***
- ***Review proven options for introducing performance-based incentives in order to obtain more effective transport services from public and private operators.***



## REFERENCES

- African Development Bank (ADB). 2005. *Transport and the Millennium Development Goals in Africa*. A joint publication with: Africa Union, UN Economic Commission for Africa, the World Bank, and the European Union. February.
- African Union et al. 2005. *Transport and the Millennium Development Goals*. Report in collaboration with the United Nations Economic Commission for Africa (UNECA), the African Development Bank (AfDB), the European Union (EU), and the World Bank (SSATP). February.
- Ahluwalia, I.B., T.Schmid, M. Kouletio, and O. Kanenda. "An evaluation of a community-based approach to safe motherhood in northwestern Tanzania." *International Journal of Gynecology and Obstetrics* 82 (2003): 231-240.
- Bale, Judith R., Barbara J. Stoll, and Adetokunbo O. Lucas, Ed. 2003. *Improving birth outcomes: Meeting the challenge in the developing world*. Committee on Improving Birth Outcomes. Board on Global Health. Institute of medicine of the national academies. Washington, D.C.: The National Academies Press.
- Barnes-Josiah, Debora, Myntti, Cynthia, and Antoine Augustin. "The Three Delays as a framework for examining maternal mortality in Haiti." *Social Science & Medicine* 46, No. 8 (1998): 981-993.
- BBC. 2005. "MDG 2015 – Goal 5: Improve Maternal Health – Case study, West Africa." [http://www.bbc.co.uk/worldservice/specials/1112\\_mdg/page6.shtml](http://www.bbc.co.uk/worldservice/specials/1112_mdg/page6.shtml)
- Biego, G., ed. 1995. "Survey on Adult and Childhood Mortality, Tanzania." Calverton, MD: Macro International.
- Bossyns, Paul, Ranaou Abache, Mahaman Sani Abdoulaye and Wim Van Lerberghe. "Unaffordable or cost-effective?: introducing an emergency referral system in rural Niger." *Tropical Medicine and International Health* 10, No. 9 (September 2005): 879-887.
- Bulatao, Rodolfo A., and John A. Ross. "Rating maternal and neonatal services in developing countries." *Bulletin of the World Health Organization* 80, No. 9 (2002).
- Buttha, Zulfiqar A., Gary L. Darmstadt, Babar S. Hasan, and Rached A. Haws. "Community-Based Interventions for Improving Perinatal and Neonatal Outcomes in Developing Countries: A Review of the Evidence." *Pediatrics* 115, No. 2 (February 2005).
- Cham, Mamady, Johanne Sundby, and Siri Vangen. "Maternal mortality in the rural Gambia, a qualitative study on access to emergency obstetric care." *Reproductive Health* 2 (2005): 3.
- Chisembele, Maureen C. 2001. "Report on essential obstetric care needs assessment 2001" in Chadiza, Katete, and Lundazi Districts. EOC Needs Assessment Draft Report 2001. October. (Zambia).
- Danel, Isabella. 1998. *Maternal mortality reduction, Honduras, 1990-1997: A Case Study*. Report prepared for the World Bank.
- Department of Transport (DoT), Republic of South Africa. 2005. *National Household Travel Survey 2003 – Technical Report*. Pretoria. August.
- Ensor, Tim, and Stephanie Cooper. "Overcoming barriers to health services access: influencing the demand side – Review article." *Health Policy and Planning* 19, No. 2 (2004): 69-79. Oxford University Press.

- eRanger. 2005. "Case studies on South Africa, Ghana, and Malawi – eRangers motorcycle ambulance units designed to deliver." <http://www.eranger.com/>
- Fawcus, S., Mbizvo, M., Lindmark, G., Nystrom, L. "A Community-based investigation of avoidable factors for maternal mortality in Zimbabwe. *Studies in Family Planning* 27, No. 6 (1996): 319-327.
- Gauthier, Aimée. "Using Bicycles to Save Lives." *Sustainable Transport* (Winter 2004): 8-29.
- \_\_\_\_\_. "More Than Just Roads and Trucks: Scaling Up for Healthcare Mobility in Africa." *Sustainable Transport* (Winter 2005): 20-25.
- Gelband, H., J. Liljestrand, L. Nemer, M. Islam, J. Zupan, and P. Jha. 2001. "The Evidence Base for Interventions To Reduce Maternal and Neonatal Mortality in Low and Middle-Income Countries." CMH Working Paper Series. WG5 Paper No. 5. Geneva: The World Health Organization.
- Grossman, M. 2000. "The Human capital model." In *Handbook of health economics*. Culyer AJ, Newhouse JP (eds.) Volume 1A. Amsterdam: North-Holland.
- Hall, Wendy. 2004. "Transport – An Essential Resource for Health Services" Chapter 2 In *Decentralising Health Services in South Africa: Constraints and Opportunities*. The Local Government and Health Consortium. April. Durban, South Africa: Health Systems Trust.
- India. 2004. "Third Rural Roads Project. Project Appraisal Document." Energy and Infrastructure Unit, India Country Management Unit, South Asia Regional Office. World Bank Official Document. P077977. August 16.
- IDA, International Development Association. 2005. *Working Together to Achieve the Millennium Development Goals*. Report from the Executive Directors of the International Development Association to the Board of Governors. Additions to IDA Resources: Fourteenth Replenishment. Approved by the Executive Directors of IDA on March 10.
- IK Notes. 2002. *Maternal Health Care in Rural Uganda: Leveraging Traditional and Modern Knowledge systems*. No. 40. January. Washington, DC: The World Bank.
- IT Transport. 2002. "Motorcycle trailer-ambulance- Improved access to health services" <http://www.ittransport.co.uk/documents/Bicyclembulance.pdf>
- ITDP. Institute for Transportation & Development Policy. 2005. "Report on current situation in the health sector of Senegal and possible roles for non-motorized transport interventions." Mission report Dec. 28, 2004 to Jan. 8, 2005 by Dr. Jürgen Heyen-Perschon.
- ITDP. Institute for Transportation & Development Policy. 2005b. "Report on current situation in the health sector of Ghana and possible roles for appropriate technology and transport related communication interventions." Mission report March 22 to April 2, 2005 by Dr. Jürgen Heyen-Perschon.
- Ishimori, Koichiro. 2003. *The Impact of Road Development on the Health of Pregnant and Parturient Women*. Results from collaborative research project between The Japan Bank for International Cooperation (JBIC) and the United Nations Population Fund (UNFPA). July-October.
- JICA, Japan International Cooperation Agency 2005. *Japan's Experiences in Public Health and Medical Systems: Towards Improving Public Health and Medical Systems in Developing Countries*. Institute for International Cooperation. March.
- Kazemian, Mohammad, Seyed-Hossein Fakhraee, and Farzaneh Zonouzi. "Neonatal Transport in Tehran: A Cause for Much Concern." *Archives of Iranian Medicine* 7, No. 4 (October 2004).

Krasovec, K. "Auxiliary technologies related to transport and communication for obstetric emergencies." *International Journal of Gynecology and Obstetrics* 85, Suppl. 1 (2004): S14-S23.

Kobusingye, Olive C., Adnan A. Hyder, David Bishai, Eduardo Romero Hicks, Charles Mock, and Manjul Joshipura. 2005. "Emergency medical systems in low- and middle-income countries: recommendations for action." *Bulletin of the World Health Organization* 83, No. 8 (2005).

Lawn, Joy E., Simon Cousens, Jelka Zupan. "4 million neonatal deaths: When? Where? Why?" Neonatal Survival 1. (for the Lancet Neonatal Survival Steering Team). Vol. 365 (March 5, 2005).

Lawn, Joy E., Jelka Zupan, Geneviève Begkoyian, and Rudolf Knippenberg. 2006 "Prevention of Chronic Disease by Means of Diet and Lifestyle Changes," Chapter 44 in *Disease Control Priorities in Developing Countries*. Jamison et al. Second Edition. A copublication of Oxford University Press and The World Bank.

Lule, Elizabeth, G.N.V. Ramana, Nandini Oomman, Joanne Epp, Dale Huntington and James E. Rosen. 2005. "Achieving the Millennium Development Goal of Improving Maternal Health: Determinants, Interventions, and Challenges." Washington, D.C.: World Bank, Health, Nutrition, and Population (HNP) Discussion Paper. March.

Lungu, K., Kafosa, V., Hussein, J., & Ashwood-Smith, H. "Are bicycles ambulances and community transport plans effective?" *Malawi Medical Journal* 12, No. 2 (2001): 16-18.

Macintyre, Kate, and David Hotchkiss. "Referral revisited: community financing schemes and emergency transport." *Social Science & Medicine* 19 (1999): 1473-1487.

Martin, D., H. Wrigley H., S. Barnett, P. Roderick. "Increasing the sophistication of access measurement in a rural healthcare study." *Health & Place* 8 (2002): 3-13.

MaterCare Internacional. 2005. "Maternal Health Project in Nkoranza"  
<http://www.matercare.org/Nkoranza.asp>

Méndez Pérez, Lucrecia. Dra. 2005. "Informe Final – Evaluación del Sistema de Referencia y Repuesta de la Emergencia Obstétrica." Proyecto de Salud Básica para Grupos Vulnerables. Guatemala. Junio 17. Preparado por el Ministerio de Salud Pública, República de Guatemala y El Banco Mundial.

Mohammed Al Fadil, Sumaia, Samira Hamid Abd Alrahman, Simon Cousens, Flavia Bustreo, Ahmed Shadoul, Suzanne Farhoud & Samia Mohamed El Hassan. "Integrated Management of Childhood Illnesses strategy: compliance with referral and follow-up recommendations in Gezira State, Sudan." *Bulletin of the World Health Organization* 81, No. 10 (2003).

Morocco. 2006. "Second Rural Roads Project. Project Appraisal Document." Finance, Private Sector and Infrastructure, Maghreb Department, Middle East and North Africa Region. World Bank Official Document. PO94007. April 10.

Mulligan J, Fox-Rushby J, Adam T, Johns B, Mills A. 2003. (Revised June 2005). "Unit Costs of Health Care Inputs in Low and Middle Income Countries," Disease Control Priorities Project Working Paper No. 9, DCP, NIH, USA.

Murray, Susan, and Stephen C. Peason. "Maternal referral systems in developing countries: Current knowledge and future research needs." *Social Science & Medicine* (2005). Article in press.

Nkyekyer, K. "Peripartum referrals to Korle Bu teaching hospital, Ghana – A descriptive study." *Tropical Medicine & International Health* 5, No. 11 (2000): 811-817.

Nordberg, E., S. Holmberg S., and S. Kiugu. "Exploring the interface between first and second level of care: referrals in rural Africa." *Tropical Medicine and International Health* 1, No. 1 (February 1996): 107-111.

Okolocha, C., Chiwuzie J., Braimoh S., Unuigbo J. and P. Olumeko. "Socio-cultural factors in maternal morbidity and mortality: a study of a semi-urban community in southern Nigeria." *Journal of Epidemiology and Community Health* 52, No. 5 (1998): 293-297.

Olaniran, N., S. Offiong, J. Ottong, E. Asuquo, and F. Duke. "Mobilizing the community to utilize obstetric services, Cross River State, Nigeria." *International Journal of Gynecology and Obstetrics* 59, Suppl. 2 (1997): S181-S189.

Ondimu, Kennedy Nyabuti. "Determinants of perineal health problems in Kisumu district, Kenya." *International Journal of Health Care Quality Assurance* 14, No. 5 (2001): 200-211.

Pakistan GoP. 2002. *Pakistan Integrated Household Survey (PHIS) Round IV: 2001 – 2002*. Federal Bureau of Statistics, Statistics Division. Government of Pakistan, Islamabad. <http://www.statpak.gov.pk>

Pathmanathan, I., J. Liljestrand, J.M. Martins, L.C. Rajapaksa, C. Lissner, A. De Silva, S. Selvaraju, and P. J. Singh. 2003. *Investing in Maternal Health: Learning from Malaysia and Sri Lanka*. Washington, D.C.: The World Bank, Health, Nutrition, and Population Department.

Pendse, Vinaya. "Maternal Deaths in an Indian Hospital: A Decade of (No) Change?" *Reproductive Health Matters – Special Issue on Safe Motherhood Initiatives* (1999): 119-127.

Penn-Kekana, Loveday and Blaauw, Duane. 2002. *A rapid appraisal of maternal health services in South Africa - a Health Systems Approach*. Center for Health Policy Health Systems Development Programme (funded by the UK Department of International Development). HSD/WP/01/02.

Razzak, Junaid A. and Arthur L. Kellermann. "Emergency medical care in developing countries: is it worthwhile?" *Bulletin of the World Health Organization* 80, No. 11 (2002).

"Mobile Clinics Make the Rounds in Rural Bolivia." *Reaching Out* 22 (Fall 2002).

Riders for Health. 2005. "Logistics – TRM – National Government Programmes – The Gambia" <http://www.riders.org/en/html/gambia.php>

Roberts, Peter, Shyam, KC, and Cordula Rastogi. 2006. "Rural Access Index: A Key Development Indicator." *Transport Papers* TP-10. March.

Rodríguez, Enrique O. Dr. 2005. "Informe Final – Diagnóstico de la situación de recursos de comunicación y transporte en el Sistema de Referencia y Repuesta en los Servicios de Salud" Proyecto de Salud Básica para Grupos Vulnerables. Guatemala. Junio. Preparado por el Ministerio de Salud Pública, República de Guatemala y El Banco Mundial.

Rose, Mandy; Abderrahim, Noureddine; Stanton, Cynthia; and Darrin Helsel. 2001. *Maternity Care: A Comparative Report on the Availability and Use of Maternity Services. Data from the Demographic and Health Surveys Women's Module & Services Availability Module 1993-1996*. MEASURE Evaluation Technical Report Series, No. 9. Chapel Hill, North Carolina: Carolina Population Center, University of North Carolina at Chapel. May.

Samai, O., and P. Sengeh. "Facilitating emergency obstetric care through transportation and communication, Bo, Sierra Leone." *International Journal of Gynecology and Obstetrics* 59, Suppl. 2 (1997): S157-S164.

- Shehu, D., A.T. Ikeh, and M.J. Kuna. "Mobilizing transport for obstetric emergencies in northwestern Nigeria." *International Journal of Gynecology and Obstetrics* 59, Suppl. 2 (1997): S173-S180.
- Shehu, Dora J. 1999. "Community participation and mobilisation in the prevention of maternal mortality in Kebbi, northwestern Nigeria." In *Safe Motherhood initiatives: critical issues*, edited by Marge Berer and TK Sundari Ravindran. Oxford, England, Blackwell Science, 1999: 218-26. (Reproductive Health Matters)
- Skilled Care during Childbirth: Country Profiles: Botswana, Malaysia, Sri Lanka, and Tunisia*. 2002. Safe Motherhood Inter-Agency Group. New York, NY: Family Care International.
- Smith, Kimberly, Tania Dmytraczenko, Beaura Mensah, and Ousmane Sidibé. 2004. "Knowledge, Attitudes, and Practices Related to Maternal Health in Bla, Mali: Results of a Baseline Survey." Bethesda, MD: The Partners for Health Reform *plus* Project, Abt Associates Inc. June.
- Stekelenburg, J., S. Kyanamina, M. Mukelabai, I. Wolffers and J. van Roosmalen. "Waiting too long: low use of maternal health services in Kalabo, Zambia." *Tropical Medicine and International Health* 9, No. 3 (March 2004): 390-398.
- Sodemann, M., Jakobsen M.S., Molbak K, Alvarenga IC, Aaby P. "High mortality despite good care-seeking behavior: a community study of childhood deaths in Guinea-Bissau." *Bulletin of the World Health Organization* 75 (1997): 205-12.
- Transaid. 2005. *Study of Health Transport Systems in Africa*. Accessible from "Transaid: Transport for life" website – case studies page.  
[http://www.transaid.org/what/case\\_studies.htm](http://www.transaid.org/what/case_studies.htm)
- Thaddeus, Sereen and Deborah Maine. "Too far to walk: Maternal mortality in context" *Social Science & Medicine* 38, Issue 8 (April 1994): 1017-1170.
- Timpson, Andrew. 2004. "Evaluation of the Transaid Transport Management Project with Department of Health, RSA – Final Report" Department of Health, RSA. Funded by the UK Department for International Development. October.
- Uzbekistan. 2004. "Health II Project. Project Appraisal Document." Human Development Sector Unit (ECSHD), Europe and Central Asia Region. World Bank Official Document. P051370. August 5.
- van de Walle, Dominique, and Dorothyjean Cratty. 2002. "Impact Evaluation of a Rural Road Rehabilitation Project." Washington, D.C.: The World Bank. January.
- Vietnam. 2006. "Third Rural Transport Project. Project Appraisal Document." Transport Sector Unit, East Asia and Pacific Region. World Bank Official Document. P075407. January 25.
- Wagstaff, A., and Mariam Cleason. 2004. *The millennium development goals for health: Rising to the challenges*. Washington, D.C.: The World Bank.
- Walraven, G., M. Telfer, J. Rowley and C. Ronsmans. "Maternal mortality in rural Gambia: levels, causes and contributing factors." *Bulletin of the World Health Organization* 78, No. 5 (2000).
- Weil, Olivier and Hervé Fernandez. "Is safe motherhood an orphan initiative?" *Lancet* 354 (1999): 940-43.
- WHO (World Health Organization). 1991. *Essential elements of obstetric care at first referral level*. Geneva: The World Health Organization.

\_\_\_\_\_. 1993. *Care of Mother and Baby at the Health Centre*. Maternal Health and Safe Motherhood Programme. Report of a Technical Working Group. Department of Reproductive Health & Research. World Health Organization: Geneva, Switzerland. July 5-9.

\_\_\_\_\_. 1994. *Mother-baby package: Implementing safe motherhood in countries*. Geneva: The World Health Organization.

\_\_\_\_\_. 1997. *Coverage of maternity care. A listing of Available information*. WHO/RHT/MSM/96.28. Geneva: The World Health Organization.

\_\_\_\_\_. 1999. *Reduction of Maternal Mortality: A Joint WHO/UNFPA/UNICEF/World Bank Statement*, Geneva: The World Health Organization.

\_\_\_\_\_. 2000. *A Strategic Assessment of Reproductive Health in the Lao People's Democratic Republic*. With the Ministry of Public Health, The Lao PDR, Institute of Maternal and Child Health.

\_\_\_\_\_. 2003. *Antenatal Care in Developing Countries - Promises, achievements, and missed opportunities*. An analysis of trends, levels, and differentials, 1990-2001. A joint UNICEF-WHO publication. Geneva: The World Health Organization.

\_\_\_\_\_. 2004. *Maternal Mortality in 2000: Estimates Developed by WHO, UNICEF, and UNFPA*. Geneva: The World Health Organization.

\_\_\_\_\_. 2004b. *Beyond the Numbers: Reviewing maternal deaths and complications to make pregnancy safer*. Geneva: The World Health Organization.

\_\_\_\_\_. 2005. *The World Health Report 2005: Make every mother and child count*. Geneva: The World Health Organization.

\_\_\_\_\_. 2005b. *Skilled Attendant at Birth, 2004 Global Estimates*. Monitoring and Evaluation, Department of Reproductive Health and Research. Geneva: The World Health Organization.

\_\_\_\_\_. 2006. *The World Health Report 2006: Working together for health*. Geneva: The World Health Organization.

Wilson, J.B., A.H.K. Collison, D. Richardson, G. Kwofie, K.A. Senah, E.K. Tinkorang, (The Accra PMM Team). "The maternity waiting home concept: the Nsawam, Ghana experience." *International Journal of Gynecology and Obstetrics* 59, Suppl. 2 (1997): S165-S172.



## GLOSSARY

### HEALTH AND MEDICAL

**Eclampsia:** The occurrence of seizures not attributed to another cause during pregnancy, usually after the 20th week.

**Ectopic pregnancy:** A fertilized egg has implanted outside the uterus, usually in the fallopian tubes

**Kangaroo mother care:** Technique that involves continuous skin-to-skin contact between mother and baby to provide thermal stability and promote exclusive breastfeeding for clinically stable preterm infants.

**Maternity waiting homes:** Places where women at high risk of complications can stay and receive supervision during the last month of pregnancy.

**Neonatal:** of, relating to, or affecting the newborn and especially the human infant during the first month after birth.

**Perinatal:** Of, relating to, or being the period around childbirth, especially the five months before and one month after birth.

**Postpartum:** occurring immediately after birth; after birth period.

**Obstetric fistula:** Neglected obstructed labor is the most common cause of fistula; it develops when blood supply to the tissues of the vagina and the bladder (*vesicovaginal fistula*) and/or rectum (*rectovaginal fistula*) is cut off during prolonged obstructed labor, after which tissues die and a hole forms. Women with vesicovaginal fistula become incontinent of urine and may also suffer from vaginal stenosis, amenorrhoea, infertility, and nerve palsy; those with rectovaginal fistula also suffer from incontinence of feces. Fistula victims also suffer profound psychological trauma resulting from their utter loss of status and dignity.

**Sepsis:** Severe infection that is present in the blood and spreads throughout the body. Sepsis can develop following infection by microorganisms including bacteria, viruses, fungi, and parasites. Sepsis is an important morbid condition because of its consequences on both fetal and maternal outcomes. In pregnancy, sepsis is a potentially severe threat

to both mother and fetus, due to possible multiorgan failure and uncontrolled inflammatory response. In the mother, some of the immediate consequences include septicaemia, endotoxic shock or the development of peritonitis or abscess formation leading to surgery. In newborns, it is also called sepsis neonatorum or neonatal septicemia. Infection in babies can be contracted during pregnancy, from the mother's genital tract during labor and delivery, or after birth from contact with others. Sepsis in a newborn is more likely to develop when the mother has had pregnancy complications that increase the likelihood of infection.

### TRANSPORT

**Intermediate Means of Transport (IMTs):** Varied range of transport solutions that are intermediate in scale and may involve different forms of lower technology. These transport modes increase local transport capacity and improve working conditions at relatively low cost. They are most commonly used for relatively short distances of up to 20 kilometers. Intermediate road transport modes can have small motors (such as motorcycles, power tiller trailers) or non-motorized (NMTs). Equivalent intermediate water-based means of transport include canoes, rafts, and other small boats.

**Infrastructure:** Plays a key role in promoting economic growth and poverty reduction. Basic infrastructure, such as transport, water and sanitation, communications, and energy, can give people access to markets, political processes and social services. Rural areas present specific challenges to each infrastructure sub-sector because of economic and geographical constraints such as low population densities, limited economic activity, high unit costs for service and the fact that rural infrastructure is highly heterogeneous. As a result, different institutional, financial and technical aspects must be taken into consideration when seeking to promote universal access while guaranteeing the sustainability of investments.

**Non-motorized transport (NMTs):** Category of intermediate means of transport which are

non-motorized such as handcarts, bicycles, and animal-powered transport.

Road reconstruction: Renewing the road structure, generally using existing earthworks and road alignments to remedy the consequence of prolonged neglect or where rehabilitation is no longer possible.

Road rehabilitation: Selective repair, strengthening, and correction of a road trunk or network to restore structural strength and improve quality of the ride.

Road maintenance: Local routine repair of roadways and pavement, grading of unpaved surfaces, regular maintenance of drainage, cleaning and control of vegetation, and maintenance of traffic furniture and control equipment.

Transport: Infrastructure sector that provide the main means of physical access to work, markets, health services, education and other services and affects the potential for economic growth and trade. Patterns of transport demand and supply are linked to population density and income levels as well as social, economic and environmental factors. Transport

patters range from low transport density in low-income rural areas with few motorized vehicles to medium to high transport density in high-income urbanized areas. There are various transport challenges facing developing countries, including the ability to afford and access transport services, inadequate and/or insufficient maintenance, lack of quality and inadequate design to meet passenger needs.

Transport infrastructure: All fixed physical facilities (paths; access or feeder roads; primary, secondary and tertiary trunk roads; waterways; bridges; railway tracks) associated with the movement of freight or passengers, such as right-of-way, track or terminals, and associated traffic management.

Transport modes: There are several distinct transport modes, which serve different freight and passenger transport needs and in different ways: road transport, maritime and inland waterway transport, air transport, mass rapid transport, railway transport, and many kinds of informal transport.

Transport services: All activities associated with the conveyance of passengers or freight.