



Rural transport interventions to improve maternal health outcomes

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Question

Please identify examples of programmes to improve rural transportation with the objective of improving maternal health outcomes, and summarise lessons learned from these programmes.

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The K4D helpdesk service provides brief summaries of current research, evidence, and lessons learned. Helpdesk reports are not rigorous or systematic reviews; they are intended to provide an introduction to the most important evidence related to a research question. They draw on a rapid desk-based review of published literature and consultation with subject specialists.

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1. Overview

Rural transport interventions have been shown to improve maternal health outcomes. This rapid review synthesises findings from academic, practitioner, policy and non-governmental organisation (NGO) sources that discuss maternal mortality and transport. The report focusses on evidence on interventions from low- and middle-income countries (LMICs), in Africa and Asia, in particular.

While there is descriptive discussion of ideas for transport provision and interventions, there is considerably less reflection on measurable outcomes and reliable evaluation within the literature. As a result, there is limited reliable data on what works, how and why.

Key findings from this review include:

- Timely treatment is vital to lowering maternal mortality rates
- There is limited empirical evidence to show effectiveness in reducing adverse outcomes associated with labour and delivery
- A number of transport interventions are available (e.g. motorcycle, bicycle and vehicular ambulances); Communications that complement the transport provision are also important.
- Finance schemes (e.g. community-led savings schemes, vouchers) can help facilitate access to maternal healthcare
- Public health change can decrease delays associated with accessing timely maternal healthcare
- Interventions need to be sensitive to local conditions and circumstances
- All interventions cannot be assumed to be successful in facilitating improved healthcare access
- There is a need for increased monitoring and evaluation of transport interventions
- Non-existence of a transport operational management system can be a major challenge
- Procurement of new vehicles and motorbikes is perceived as a solution to challenges faced in managing transport resources in health delivery services
- While the importance of improved transport and roads to reducing maternal and child mortality rates is recognised, the failure of transportation services is also an important finding
- Since healthcare decision-making is a complex process drawing on multiple factors and perspectives, interventions do not always translate into improved outcomes

The evidence provided is drawn from a broad range of international contexts. However, due to restrictions in time and space allocated to the study, there are some limitations to the level of detail with which specific interventions, cases and implementation practices are discussed. The study includes findings from a number of examples of projects with a specific focus on women's access to healthcare, although some facilitating activities around such programmes include reference to the need for wider community and male support. The review did not explore disability issues.

2. Rural access to maternal healthcare

Background

By 2050, rural communities are expected to represent 34% of the global population (SLoCaT, 2017). Maternal mortality is highest in rural areas and poorer communities (WHO, 2018). Approximately 830 women die from preventable causes related to pregnancy and childbirth worldwide every day with 99% of all maternal deaths occur in developing countries (WHO, 2018).

In terms of the Sustainable Development Goals (SDGs), it is vital that people in rural areas are not left behind. Of particular concern, with respect to maternal health, are: SDG 3 to ensure good health and well-being; SDG 5 to empower women in rural areas; SDG 10 to reduce inequality, and SDGs 9 and 11 to contribute to sustainable infrastructure and communities for all:

Currently, women in rural areas are still up to three times more likely to die while giving birth than women living in urban centres. Good rural access to maternity clinics reduces this risk tremendously (SLoCaT 2017).

For many women, giving birth is a dangerous endeavour (Bhopal et al., 2013). Barriers to access to healthcare for pregnant women in rural areas include poor road networks, meteorological conditions and terrain (e.g. footpaths which are only passable outside of the rainy season, and the need to carry women when streams cut off the road); support (family, community, and professional); dependence on others for decision-making; cultural issues (preference for traditional health workers, embarrassment and beliefs); cost, availability and speed of transport; lack of comfortable and safe positioning during transport, and distance from life-saving care (Atuoye et al., 2015; Wilson, 2013; Hussein et al., 2011).

Timely medical treatment is an important factor in preventing maternal mortality. Data from Northern Nigeria estimate the average interval between onset of obstetric complication and death in the absence of medical intervention is two hours in the case of post-partum haemorrhage, 12 hours for an ante-partum haemorrhage, and one day for a ruptured uterus (PRRINN, 2013). Thaddeus and Maine's (1994) three delay model of maternal mortality is well-recognised in the literature and consists of delay in seeking care, delay in arrival at a health facility, and delay in the provision of adequate care. Based on this model, Maternity Worldwide (nd) identifies three groups of factors which may stop women and girls accessing the maternal health care they need as:

1: Delay in decision to seek care due to:

- The low status of women (compared to men)
- Poor understanding of complications and risk factors in pregnancy, and when to seek medical help
- Previous poor experience of health care
- Acceptance of maternal death
- Financial implications

2: Delay in reaching care due to:

- Distance to health centres and hospitals
- Availability and cost of transportation

Poor roads and infrastructure
Geography e.g. mountainous terrain, rivers

3: Delay in receiving adequate health care due to:

Poor facilities and lack of medical supplies
Inadequately trained and poorly motivated medical staff
Inadequate referral systems

In terms of access to healthcare, Delay 2 is of most relevance. It relates to geographic, physical accessibility and lack of infrastructure factors, such as distribution of facilities, travel time from home to facility, availability and cost of transportation and poor road conditions (Fiagbe et al, 2012; Thaddeus and Maine, 1994). However, cultural and socio-economic factors associated with Delay 1 can also influence decisions affecting access. For example, local support, understanding of medical risk and autonomy of decision-making can influence women's ability to minimise delay in reaching care described by Delay 2.

Despite the evident link between maternal mortality outcomes and transport, there is a lack of research on the nature of the relationship and the viability and effectiveness of interventions. Ehiri et al. (2018) have recently produced a protocol for a systematic review on emergency transportation interventions because they assert that there is little empirical evidence to show effectiveness in reducing adverse outcomes associated with labour and delivery, although obstetric emergency transportation interventions are being implemented in LMICs. Bhopal et al. (2013) suggest that the second delay, where transport infrastructure is key in allowing a woman to reach care, has been a relatively neglected field of study. Similarly, Fiagbe et al., 2012:257) state that:

It is becoming accepted that poor access to transport may play a role in maternal deaths and conditions such as fistula, but there is little research available on the veracity of this assertion and what may be the effective interventions. In fact, little mention is made with regards to the causes of maternal death and its relationship with transport.

3. Transport interventions

Access to transport

Wilson (2013: 111-112), in a systematic review of interventions to reduce maternal mortality in developing countries, reports that:

In many low income countries it is estimated that less than one percent of the population has access to conventional emergency transport, such as an ambulance. Motorised vehicle ownership is rare in low income countries, with the vehicle to person ratio as low as 30:100,000 people. Such shortage of vehicles means that very few people have access to transport for work, social or health purposes, even though transport systems were recognised as a fundamental human need over three decades ago. For many, access to transport services is not within easy reach; in Ethiopia, approximately half of all rural households had to travel distances over 15km to access public transport. Even if

vehicles were available in many low income countries, road systems are insufficient, and often unsafe.

Most births in low and middle income countries occur outside of health facilities, and as most obstetric complications are unpredictable, access to emergency care in a timely manner is essential to reduce preventable deaths.

While it is reported that the majority of pregnant women and mothers do not make any advance preparation for transportation while pregnant (Issac et al., 2014), a number of models to address the issue of emergency transport for maternal and newborn health have been suggested. These are focussed on minimising delay and enabling access to appropriate health care via varied interventions and initiatives, and have been categorised below by type:

Transport modes

- Motorised ambulances, either motor vehicles or motorbikes, or in some cases, bicycle ambulances, supported by two-way radio communication systems (Lema, 2011)
- Motorised taxi services with reliable mobile phone support (Peters et al., 2018; Bryan et al. 2017)
- Dedicated vehicles for maternity care (Schoon, 2013) e.g. 'a man with a van' (MADE, 2012)
- Free ambulance provision (Godefay et al., 2016)
- Community partnerships with local private transport owners, supported by effective communication system (Lema, 2011)
- Private transport vehicle union-based scheme (PRRINN, 2013)

Finance schemes

- Establishment of community loan funds, cost-sharing, insurance schemes, etc. (Lema, 2011)
- Fuel vouchers, free vehicle servicing vouchers, and cash vouchers (Mutebi and Ekirapa, 2015; Green, 2014)
- Removal of user fees (Lema, 2011)
- Diversified livelihoods dedicated to generating maternal transport funding (Williamson, 2015)
- Encouragement of personal savings (Future Health Systems, 2016)

Public health interventions

- Establishment of maternity waiting homes (Lema, 2011)
- Increased access to emergency obstetric care (EmOC) (Lema, 2011)
- Emergency obstetrics and neonatal care referral facility with complementary effective communications system (Tayler-Smith et al., 2013)

4. Lessons learned

Interventions in operation

The effectiveness of the interventions described in the literature is often unreported, although there is general acceptance that effective transport for obstetric health emergencies is essential (Godefay et al., 2016) and that good vehicles and road infrastructure are perceived as a key link between potential accessibility and actual utilisation of maternal health services (Fiagbe et al., 2012). The following are examples of different interventions in operation:

Government interventions

When South Africa's Free State Department of Health issued 18 dedicated vehicles for maternity care, a sustained reduction in mortality was observed due to the availability of prompt and effective inter-facility transport to facilitate access to centres with skills available to manage obstetric emergencies (Schoon, 2013). Similarly, in the Gambia, Godefay et al. (2016) found that the uptake of freely available ambulance service in connection with women's obstetric needs correlated with substantially reduced pregnancy-related mortality, although the authors caution that the study design did not allow for cause and effect to be attributed. Nevertheless, they indicate that halving of pregnancy-related mortality in sampled districts suggests provision of transport to delivery facilities may be a key innovation for successful maternal health care.

NGO interventions

Communications that complement the transport provision are also important. For example, when Médecins Sans Frontières (MSF) established an emergency obstetrics and neonatal care referral facility linked to an ambulance system for transfer of women with obstetric complications from peripheral maternity units in Kabazi district in rural Burundi, they highlighted the need to implement an effective communication system with the transport provision to minimise referral delay (Tayler-Smith et al., 2013). The introduction of motorcycle taxi services in rural Sierra Leone and Liberia has transformed speed of access and mobility options for women travelling to maternal health facilities. Peters et al. (2018) report that participants using this service rely on being able to make a phone call to a rider in the case of an emergency. Between September 2014 and July 2016, 4105 pregnant women benefitted from the service, all women with maternal complications survived and 96% of babies lived. The proportion of women delivering at a health facility increased from 64% to 89%. Porter (2014) suggests that the spread of mobile phones significantly complements the motorcycle taxi services by enabling a quick method of solving a medical emergency rather than having to search for a vehicle.

In rural Sierra Leone, six eRanger motorbike ambulances were provided by the Kambia Appeal, a UK-registered charity, in 2006 for emergency referrals. Bhopal et al. (2013) evaluated the intervention's success, reporting that the ambulances are used regularly, well-known in communities, acceptable, accessible and valued by those they serve. They suggest that some of the intervention's acceptance and usage relates to district wide traditional birth attendant training and sensitisation activities, which were provided when the service was introduced, as this created a high level of awareness of its importance to women in labour. The authors also

highlight the applicability of motorbike ambulances in remote areas with poor roads that are inaccessible by other vehicles.

Emergency Transport Systems (ETSs)

The provision of a cost-effective emergency transportation service has the potential to significantly reduce maternal deaths. Bryan et al. (2017) report on an innovative Emergency Transport System (ETS), based around linked health worker training and facility upgrades, in two rural districts in Tanzania, to which they attribute the saving of 57 maternal lives and a 27% decrease in maternal mortality. The system is technology-based using a toll-free number to a 24/7 dispatch centre where a trained dispatcher triages the patient. Emergency transportation is then arranged to the nearest health care facility or district hospital. Private taxis with drivers trained in proper handling of obstetric emergencies extend the transport fleet by complementing the limited ambulance availability. In rural Pakistan, MADE (2012) report on a simple solution 'the man with a van' which is a transportation intervention for women in need of emergency maternal care. It relies on local people being willing to lend their vehicles to transport women and the coordination of communication by mobile phone or messenger. The man is reimbursed for his contribution, and costs associated with transfer of a woman to emergency care has been calculated as £5-10 per journey.

Community-based ETSs and strategies can fill a crucial gap in the referral chain by transporting expectant mothers to health facilities cheaply and efficiently (Atuoye et al., 2015; PRRINN, 2013). The ETS model used in rural Nigeria made use of locally-available passenger transport vehicles driven by commercial drivers belonging to the National Union of Road Transport Workers (NURTW). Union officials were trained and cascaded the driver training down through communities. The system depends on 4 trained drivers in each community who assist women in being as comfortable as possible on the journey to nearest facility equipped to handle maternal emergencies. The driver then waits for further instructions. Costs are minimised with drivers encouraged to only seek payment for fuel which is kept in the local community. Between December 2009 and September 2013, 19,811 women were transferred with the programme exceeding its target of 5,000 ETS transfers by September 2013. The average reduction in cost of emergency transport was 70% in Zamfara and 41% in Katsina, northwest Nigeria.

Other community-led initiatives have also been reported. For example, a women's group in Andalambezo, Madagascar led by a local community health worker created a communal savings fund, collecting 200 Ariary (USD0.05) every week from local women to fund emergency transport. When takings tailed off, a community discussion led to the idea of honey production for sale with money received going directly to a community fund. Initially, the funds are being used to pay for cattle carts to send 4-6 pregnant women to routine anti-natal appointments. However, with continued concern about giving birth en-route to care, the group is considering use of funds to build a small house next to a healthcare facility where pregnant women can wait to ensure facility delivery. Williamson (2015) reports that this community-based initiative provides greater access to formal healthcare, improved maternal and child health outcomes and diversified livelihood options.

Other financial interventions may consist of voucher schemes to provide free transport for pregnant women going to deliver in both government and not for profit health facilities. Such a scheme in the Pallisa district of Uganda increased maternal and child health awareness locally,

as well as timely access to care and transport providers benefitted from savings received from transporting women (Mutebi and Ekirapa, 2015). Fuel vouchers, free vehicle servicing vouchers, and cash vouchers linked to distance travelled and other incentives, both cash and in kind, were associated with higher performance amongst drivers in Northern Nigeria, with Green (2014) indicating that the average cost of incentives per safe delivery or maternal death averted was USD9.33. Similarly, Hussein et al. (2011), in a systematic review of policy and programme interventions to reduce maternal mortality, report that, in several South Asian settings, the organisation of communities to generate funds for transport has reduced neonatal deaths.

Community involvement

Another important aspect of community mobilisation in pregnant women's health care is involvement of men, older women and community leaders in places where behaviour is dependent on their approval. Ensor et al.'s (2014) report on safe motherhood action groups in Zambia states that men were encouraged to become emergency transport drivers, community leaders to train as community volunteers and older women (who had often been traditional birth attendants) were encouraged to become mother's helpers and trained to recognise obstetric danger signs. Communities were supplied with bicycle ambulances, ox and donkey carts, dependent on terrain type, and boats for people near the river. Health centres were provided with motorcycle ambulances and local volunteers identified to operate and maintain the vehicles. Significant increases in use of emergency transport were seen in final surveys (conducted in October 2012) compared to baseline (conducted between December 2010 and May 2011): 75% of deliveries took place at healthcare facility after intervention compared with 49% before. The proportion of women using emergency transport increased by between 12.4% and 18.7%.

Future Health Systems (2016) point out the need for focussing on mobilising multiple levels of resources – community, financial, social and human - for maternal and newborn health. They found that women who saved for maternal healthcare were more likely to deliver at a health facility. These women could easily arrange transport to and from hospital without having to worry about waiting and the men in the community were relieved that when they were not home, their spouses could still secure transport. A facilitated intervention by Future Health Systems Uganda encouraged participation in existing financial social networks to provide transport for mothers who were group members. The team also bought tricycle motorbike ambulances and enabled local 'boda-boda' taxi drivers to help with referral transport from lower level health facilities to health centres and district hospitals.

A similarly collaborative intervention based on providing funds for emergency transportation in India reduced maternal deaths. Transport arrangements were made through informal contacts with people and small businesses with tractors/vans/other alternative mode available and drivers were paid to provide journeys. During the project year, only six maternal deaths occurred among each of 1,880 unregistered and 5,648 registered pregnancies. None of the deaths were in mothers who had claimed referral money from the project.

Challenges

In their study in the Asante-Akim North Municipality of Ghana, the municipality with the largest recorded maternal mortality for the three years leading up to the research, Fiagbe et al. (2012) looked at the types of transport being used to access maternal health services. Public transport

was identified as the main mode (65.0% of pregnant women respondents and 56.7% of health management respondents), followed by walking (28.9% and 26.6% respectively), personal cars (3.7% and 6.7% respectively) and motorbikes (1.6% and 10% respectively). The authors suggest that

...the lack of available and reliable transport revealed in the study attests to the reason why there is delay in seeking maternal health services. This is corroborated in a study conducted in Zambia where seventy six percent of pregnant women had to walk to the clinic to receive care and fifty percent also had to walk for two hours or more to receive maternal services (Stekelenburg, 2004). Even when public transportation is available, there may be various barriers for people to use it in accessing healthcare facilities, including cost, unreliable bus schedules, long traveling times, bad weather conditions, and safety at bus stops (McCray 2000: 23-24).

Bad roads compound the problem of transporting pregnant women. In some districts, motorbikes are the main means of transport. The closeness of health workers to the health facility further calls for the good roads so as to transport patients from the hinter areas to facilities (Fiagbe et al., 2012:261).

Their study findings indicate further that a majority of health management staff suggest that the non-existence of a transport operational management system and inadequate vehicles are the major transport challenge faced by staff. Procurement of new vehicles and motorbikes were also found from the study to be perceived as a solution to challenges faced in managing transport resources in health delivery services.

It is also important that interventions are tailored to local conditions. Kyei-Nimakoh et al (2017) highlights that strategies need to be country-specific and take full account of supply- and demand-side access barriers to obstetric care in individual locations. Elmusharaf (2015) suggests that there are three challenges to create a supportive environment in which demand-side strategies can effectively improve access to maternal health services: addressing decision-making norms, engaging in inter-generational dialogue, and designing contextually appropriate communication strategies. For Green et al (2013, p. 29), the importance of addressing household and community level barriers ('demand-side' barriers) that prevent timely utilisation of health services and which negatively affect health outcomes in low-income country contexts (Ensor and Cooper, 2004) is vital:

Among the range of demand-side barriers, physical access constraints such as long distances to health facilities, poor terrain and lack of transport options can play an important role in delaying or preventing the use of health services. Physical access barriers often work in tandem with concerns about the affordability of transport. They may also be integrally linked to barriers that derive from household or community preferences, attitudes and social norms. For example, in Muslim contexts restrictions on women's mobility or cultural constraints that prevent interaction with males outside the immediate family may prevent women from using commonly available modes of transport, even in an emergency. Hence it is important to understand how physical access barriers manifest in particular social, cultural and economic contexts (Green, 2004; Babinard and Roberts, 2006).

While the importance of improved transport and roads to reducing maternal and child mortality rates is recognised (Babinard and Roberts, 2006), the failure of transportation services is also an important finding of this review. Raj et al. (2015:99) report on the role of emergency transport associated with maternal deaths in Unnao district, Uttar Pradesh in India. The research indicated that inter-facility transfer appropriateness and timeliness of referral were major contributing factors in maternal deaths. It was found that there were only:

...10 ambulances available at 15 facilities against 19 required as per Indian Public Health Standards (IPHS). About 47% of the deaths took place in a facility, 30% en route to a health facility and 23% at home. Twenty five percent of women were taken to one facility, 32% were taken to two facilities, and 25% were taken to three facilities while 19% were not taken to any facility before their death. Sixteen percent of the pregnant women could not arrange transportation to reach any facility. The mean time to make arrangements for travel from home to facility-1 and facility-2 to facility-3 was 3.1 hours; whereas from facility-1 to facility-2 was 9.9 hours. The mean travel time from home to facility-1 was 1 hour, from facility-1 to facility-2 was 1.4 hours and facility-2 to facility-3 was 1.6 hours.

Sometimes it is local barriers that contribute to transport failure. In a study in Tanzania, the policy of sending ambulances for emergency maternal health admissions was constrained by a lack of funds at the district level to pay for fuel, maintenance and repairs to keep ambulances on the road (Hanson et al., 2017).

Decisions made around transport provision can also result in poor outcomes. Butrick et al. (2014) found that women at 24 weeks of pregnancy or more were given preference for ambulance transport even when signs of shock were equivalent. The authors suggest that policy-makers aiming to lower maternal mortality need to address transport issues regardless of the aetiology of haemorrhage or week of pregnancy. They also report that a systematic review of studies examining why women die when they reach hospital found that 12 of the 16 studies recorded inadequate emergency transport as a factor contributing to maternal mortality (Knight et al., 2011).

With delay in arriving at health facility acknowledged as a leading non-clinical factor in maternal mortality, a study in the Wakiso District of Uganda highlights the cultural and social norms that can affect transport uptake in some communities. Aldrich (2014) reports on a study that revealed that gendered norms and practices significantly influence women's mobility. Interviews suggested that norms governing management and control of resources for mobility contributed most significantly to travel constraints. Male partners frequently managed family finances and control women's daily access to spending money. If women experienced an obstetric emergency, they rarely had possession of an adequate amount of money to pay for appropriate or safe transport. In this context, interventions focused on empowering women socially and economically may contribute to reductions in maternal deaths and improved maternity experiences.

Thaddeus and Maine (1994) underline that some studies indicated that, contrary to investigators' expectations, physical proximity does not necessarily increase utilisation of facilities. They report that road improvements significantly reduced travel distance and time to health centres in Kenya's Meru District, but admission rates at local hospitals did not show substantial improvements. They caution that road improvements alone do not necessarily guarantee uptake in utilisation of services because of other barriers such as financial costs. Thus, it is important to

note that, since healthcare decision-making is a complex process drawing on multiple factors and perspectives, interventions do not always translate into improved outcomes (Orcutt, 2012).

Solutions

Orcutt (2013:24-25) describes a case study in Eastern Zambia where reaching healthcare facilities is challenging due to poor infrastructure and roads, limited transport resources, high cost of transport, and lack of communication. She highlights the importance of developing sensitive understandings of the unique challenges to access in each location:

Gradations of poverty and varied distribution of risk for maternal mortality between villages have been created through unequal health access and unequal provision of access opportunities. Improving transport and health infrastructure in Eastern Zambia to achieve universal access to healthcare facilities is, therefore, of the utmost importance in reducing maternal mortality. Whilst this approach is vital to improve maternal health in the long-term, options to improve the present situation, such as the introduction of affordable and appropriate modes of transport to facilitate rapid transfers to the clinic, should also be considered. Qualitative research should be carried out before implementation of any transport health intervention in order to understand the unique infrastructure challenges faced in each village, how to achieve universal access across all villages in the region and the best way to prioritise transport resources.

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