Use of intermediate modes of transport for patient transport: a literature review contrasted with the findings of the Transaid Bicycle Ambulance Project in Eastern Zambia

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Introduction

This paper presents a distillation of the literature on the use of Intermediate Modes of Transport (IMTs) and then reviews the outcomes of the 2008/2009 Transaid Bicycle Ambulance Project undertaken in three districts of Zambia's Eastern Province.

The latest World Bank Transport Strategy puts the link between transport and development honestly and succinctly;

> *"Around the world, in much of development work, transport is the ultimate enabler. By serving other sectors of a nation's economy, it puts development goals within reach. We know, for instance, that an estimated 75 percent of maternal deaths could be prevented through timely access to childbirth-related care, facilitated by transport."*[i]

Access to efficient, affordable and safe transport in the developing world is limited and directly impacts upon the ability of individuals to seek timely health services. More than 60% of people in poor countries live more than eight kilometres from a healthcare facility. The link between the distance that an individual lives from a health facility and worsening maternal mortality figures is demonstrated by a case study from Cebu in the Philippines. The study identified a clear association between infant, child, and maternal mortality rates and distance to healthcare services, and it was found that a 10% increase in distance from a hospital was associated with a two per cent increase in all three mortality rates.[ii]

Access to health services in the developing world is poor but it gets significantly worse in the rural areas, as represented by an example from Ghana where it was found that while 79% of births in urban areas were supervised by a medical practitioner, the rural figure was as low as 33%.[iii] Maternal mortality indicators have received much attention of late as the deadline of 2015 for the Millennium Development Goals grows nearer. Maternal mortality however is a good indicator for demonstrating the efficiency of an entire health system; the availability of transport, and of medical supplies, the presence of trained health staff, and so on. The emergency and non-emergency transfer of maternal cases is. as such. an appropriate side theme on which to focus this paper.

The Problem

An example from Ethiopia highlights the mobility issues faced by pregnant women across the developing world. In a survey of its patients, the Fistula Hospital in Addis Ababa found that, on average, it takes women in labour 11 hours to reach a health care facility capable of addressing their needs and that both access to, and the inhibitive cost (due to poverty) of, transport were the two most important factors contributing to the occurrence of fistula.

Women in labour can spend several hours travelling on a makeshift stretcher and over difficult terrain that can induce other health complications for the mother and child. Where access to roads is available, delays of several days are often encountered as families try to raise the money necessary to pay for hiring a vehicle to transport the patient. Emergency transport costs are an overwhelming financial burden for families across Africa. This applies even over short distances.

The delays in access to health services caused by the difficulties in raising money are one of the important contributors to the occurrence of obstetric fistula and the increased vulnerability among Ethiopian women to it.[iv]

Figure 1. A patient being transported by bicycle ambulance in Chipata District, Zambia

At the same time funding to research and implement solutions to rural mobility issues is limited and is often weighted heavily towards infrastructure. Since 1985, about 15-20% of World Bank loans have been for transport investments (roads, ports, railways, etc), with nearly US$40 billion in loans and credits, of which about US$2.5 billion (about six per cent) has been specifically for rural transport.

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However nearly all this funding has been dedicated to infrastructure and large-scale transport systems. Transport planners have paid little attention to intermediate means of transport. The bias towards infrastructure and large-scale transport still exists in national governments and donor agencies, and is reflected in terms of budgets, personnel and professional training.[v]

Work undertaken by the British international NGO, Transaid, to review the health service transport capacity of many developing countries identified that, as the health impact from vehicles is not easily distinguishable from other health system components, transport management is ignored – and at great cost.[vi].

Use of Intermediate Modes of Transport (IMTs)

Intermediate modes of transport such as animal-drawn carts and bicycle or motorcycle ambulances offer a locally appropriate and low-cost solution to mobility in rural areas. In the case of IMT ambulances they often provide combined health services, not just maternal patient transfer. A bicycle ambulance in Malawi, for example, set up to improve emergency obstetric care, was also often used for injuries and other medical emergencies.

Because a lack of transportation is a major barrier to accessing emergency care, communities need to consider a range of locally appropriate alternatives. Commercial vehicles, the police, and relatives with motorised or non-motorised transportation can take seriously ill and injured patients to medical facilities.[vii] A study of motorcycle ambulances in Malawi found significant benefits brought about by the project:

> *"Motorcycle ambulances reduce the delay in referring women with obstetric complications from remote rural health centers to the district hospital, particularly under circumstances where health centers have no access to other transport or means of communication to call for an ambulance. They are also a relatively cheap and effective option for referral of patients in developing countries, particularly in rural areas with little or no public transport. Nineteen motorcycle ambulances can be bought for the price of one Toyota land cruiser car ambulance. Operating costs compare in a similar way. Motorcycle ambulances also potentially help reduce costs for women and their families to access Emergency Obstetric Care, although this was not the subject of this study."viii*

IMT ambulances do indeed receive significant demand among maternity cases. A bicycle ambulance project in Uganda found that one typical use was the transport of pregnant women, which accounted for 52% of all medical indications for transport.[ix] During a bicycle ambulance project undertaken in 2005 on the Zambia/Malawi border it was found that pregnancy related cases accounted for 18.5% of usage while malaria cases accounted for 30%.

Transaid's latest IMT projects were a motorcycle ambulance project undertaken in the Northern Nigeria state of Jigawa as part of the Partnership to Transport Health Systems project in 2007, and a bicycle ambulance project in Zambia's Eastern Province in conjunction with the international NGO World Bicycle Relief in 2008.

In June 2006 Transaid, with its industry partners in the UK, designed and developed a prototype motorcycle trailer ambulance as an initiative by PATH-Nigeria to assist pregnant women, and/or women with obstetric challenges, in rural Jigawa State to have access to safe delivery and general improved health care. Four motorcycle trailers ambulances were manufactured with local expertise under the supervision of Transaid, pre- tested and handed over to the Ministry of Women for use in the communities.[x] The project provided many learning points, and for a period made a significant impact.

> *"The community affirmed that before it developed problems, the trailer ambulance contributed immensely in providing access to pregnant women on emergency obstetric care; more than any other means of transport they ever used in carrying pregnant women and sick persons to health centres". xi*

Unfortunately a combination of budget and time constraints prevented the implementation of a comprehensive monitoring and evaluation system to quantify the impact of this intervention.

The use, maintenance and management of running costs for IMTs are each important components of these projects. In Northern Nigeria, Transaid aims to establish an Emergency Transport System in Yobe State. A key component of this will be the establishment of community managed Emergency Loan Funds (ELFs) to reduce the delay of obtaining funds in emergencies.

A similar scheme was established in Jigawa State and the report by the Safe Motherhood Initiative Demand-side Team (SMI-D) project manager explained that although village communities were slow to grasp the concept of the ELF, four of 36 participating villages have one in operation.[xii] This represents a significant opportunity to pilot ELFs on a bigger scale with a more community sensitive approach to demonstrate if there is greater uptake and sustainability.

The 2008/2009 Zambia Bicycle Ambulance Project

In 2008 Transaid implemented a bicycle ambulance project to respond to the urgent need of rural communities to access health facilities in the three districts of Petauke, Chipata and Katete in Zambia's Eastern Province. The project saw the production and distribution of 40 bicycle ambulances. The project was funded by the Canadian International Development Agency (CIDA) through the Canadian Funds for Local Initiatives. The project was implemented in collaboration with a number of Zambian and international

partners. Key to the implementation was the role of World Bicycle Relief, the lead partner.[d]

Figure 2. Three Districts in Eastern Province, Zambia that were the focus of the bicycle ambulance project

RAPIDS (*Reaching* HIV/*AIDS Affected People* with Integrated Development and Support) is a consortium led by World Vision International in partnership with Africare, Catholic Relief Services, Expanded Church Response, Salvation Army, World Vision Zambia, and the Population Council. This is a six-year (2004-2010), US$57.5 billion programme.

RAPIDS covers 53 districts throughout Zambia to provide home and community-based care for people living with AIDS, care and support for orphans and vulnerable children (OVCs), youth livelihood and promotion of abstinence among youth, and household resilience and improved food security for those affected by HIV/AIDS. In addition, RAPIDS provides policy and programmatic support at the National Level for OVCs. RAPIDS is working in collaboration with World Bicycle Relief to distribute 23,000 bicycles to Community Based Home Care Volunteers. The bicycle ambulances constructed during the Transaid project were distributed to the Community Based Home Care Volunteers.

The purpose of the Transaid project was three-fold;

1. Improve access to healthcare for community inhabitants in Zambia's Eastern Province;
2. Build capacity within Eastern Province for the construction and maintenance of bicycle ambulances;
3. Develop a report to offer solutions to issues of rural access and to highlight elements of best practice and recommendations for endorsement by international organisations

.

This project, whilst having been monitored and evaluated over only a four-month period so far, is on the way to achieving its three core objectives. It aimed to enable improved access to health facilities. Against this objective the project has been successful, with 96% of caregivers stating that the provision of a bicycle ambulance helped them to do their work in the community more effectively. Over the four months, according to data from 17 logbooks the bicycle ambulances were used 82 times by caregivers in the community to transport clients to receive healthcare.

Moreover, 86% of the trips undertaken were lifesaving according to the volunteer caregivers. This suggests, according to the monitoring and evaluation data collected that the project has saved some 70 lives in six months.

From the same 17 logbooks (each representing one bicycle ambulance) it was found that of the 71 trips with reasons provided, 28 (40%) were for clients seeking ART (anti retroviral treatment). Malaria and pregnancy accounted for 20% and 17% of journeys respectively.

Given reason for transport requirement	Number of trips	%
ART	28	39
Malaria	14	20
Pregnancy	12	17
Treatment	6	8
Old age	5	7
Dead body	2	3
Diarrhoea	2	3
Severe cut	1	1
Cracked skin	1	1
Total:	71	

Table 1. Number of Patients Transferred According to Reason Given

[d] Other partners included Disacare (a Zambian NGO), Design for Development, Bicycle Empowerment Network Namibia and the consortium partners from the RAPIDS project.

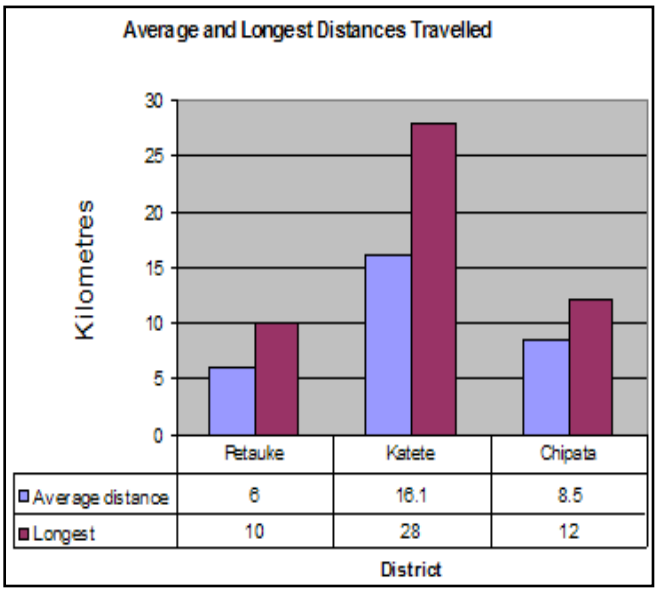

Figure 3. Average and longest distances travelled by bicycle ambulance per district

Communities have access to a free bicycle ambulance service. The clients are now able to receive medical attention in less time, whereas it used to take between two to three hours to take a patient to a rural health centre that was 2.5 km away using an ox-cart. It now takes an average of 30 minutes using a bicycle ambulance for the same distance. Where patients used to sit on bicycles to travel to a rural health centre, now they can lie flat on a bicycle ambulance which is safer and more comfortable.

The full canopy of the ambulance provides privacy - especially important for expectant mothers. The canopy also shelters the clients from the heat of the sun and the rain. The ambulance is readily available when needed, unlike the cart whose oxen have to be fetched from the fields, often far from the villages. The convenience of a stretcher has also made it much easier to cross rivers or to take routes on foot that a bicycle or ox-cart could not take.

Figure 4. The "Namibian" style of bicycle ambulance constructed during the Zambia project.

The 40 bicycle ambulances covered an average distance of 10.2 km over the four months they were monitored and they have been used in challenging road conditions, at night and in all weathers. By trialling three different designs of bicycle ambulance valuable feedback has been obtained to help identify the most appropriate design for future projects. Of the three difference designs trialled one, the bicycle ambulance with a full canopy and a non-flexible hitch, has stood out as the superior model with both the riders and beneficiaries stating a preference for this one.

Other important comments regarding the design from users include the following:

- A bicycle should accompany the ambulance permanently. This would also serve to prolong the life of the threads used in the hitch.
- The location of the metal hitch, when attached to the rear wheel frame rather than the seat-post, made turning right difficult.
- Tools should be provided with the ambulance including a pump, first aid kit, and bicycle spanners .
- Provide lights for night-riding when some emergency cases take place.
- Reduce the weight or provide bicycles with gears so that going uphill is easier.
- The provision of a high visibility vest and a raincoat should be considered
- The width of the Namibian design is wider than a standard door frame causing problems when moving patients

The project has also seen capacity built within Zambia's eastern province for the construction and maintenance of these bicycle ambulances. Ten field mechanics were trained in the construction and maintenance of the ambulances and played a key role in their construction.

The total cost of the project was US$43,000 including the production, distribution and monitoring and evaluation of the project. This is approximately half the cost of a motorised 4x4 ambulance and this amount provides communities with 40 bicycle ambulances with very low running costs and that provide numerous life-saving journeys.

Whilst the results to date are encouraging this remains a pilot project. Development should be tracked for the remainder of the year to gain a 12-month perspective. With the monitoring and evaluation showing the positive impact and the future potential of intermediate modes of transport when placed within clear reporting structures on the ground it is anticipated that this will support taking future bicycle ambulance projects to scale.

Conclusion

The literature review conducted for this paper demonstrated the shortage of operational and impact data regarding IMT projects. This may be indicative of the general lack of local knowledge on the impact of mobility and transport issues on

health because research is neglected for southern, low-income settings [xiii]

Information remains general or inconsistent for comparative cost effectiveness studies and no clear picture of overall cost to improve transport for health exists.[xiv] As a result it is understandably difficult to determine the financial sustainability of projects such as that undertaken by Transaid. The financial components of IMT projects, running costs and capital costs must be assessed in order to justify the appropriateness of IMTs as a long term solution to rural access to health. If the costs of such facilities are too high the burden upon those seeking emergency care could have *"adverse and often tragic consequences."*[xv]

"If there was no bicycle ambulance I was not going to sit here today and talk to you, I would have been wasted, thank you so very much".

"It's a facility which has come to save lives and I'm happy that I used it".

"Thank you very much, I would have died at home if it was not for the bicycle ambulance".

Figure 5. Clients' comments at interviews during Monitoring and Evaluation phase 2

The use of intermediate modes of transport as a health service delivery tool will not be taken seriously until data is available to demonstrate the impact they make upon health indicators, the cost effectiveness of IMTs and their sustainability. However this data will not come if IMT projects continue to be of relatively small scale, and with inadequate funding for comprehensive monitoring and evaluation.

The fear is that this represents a vicious circle: with not enough funding for comprehensive monitoring and evaluation no significant impact data is available, and so donors are unwilling to fund IMT projects. Evidence is also an issue. While Krasovec (2004) highlights:

> *"The scarcity of good research evidence on referral transportation."*[xvi]

Molesworth (2005) stated during her extensive review of mobility and health literature:

> *"There has been very little focused research to support development strategy, policy and interventions to enhance mobility for health. The case study presented here highlights the acute need for research to be conducted to provide a sound basis upon which planners and policy-makers might synergise and optimise mobility and health spending.*[xvii]

It is hoped that the outputs from the "Mobility and Health" International Networked Research Programme, and the 25 case studies included within it will produce quantitative health impact data of an appropriate scale to be used as a basis for sustainable mid to large scale projects (Figure 6).

The 2008/2009 Bicycle Ambulance Project in Eastern Province has shown the efficacy of using bicycle ambulances to provide access to health services. However, there is a growing, and urgent need for significant research into rural transport projects of a scale which can be useful for developing National or regional projects so that health benefits brought by these projects can support other development initiatives on an impactful scale.

- The need for public health policies and legislation to include consideration of transport as a component of health care delivery systems, including issues of management and coordination of various mobility options.
- Health investments should be part of an overall package that includes complementary services such as transport, houses for health care workers etc.
- Mainstream and strengthen capacity of community-based care givers as part of the health delivery/outreach system.
- Planning standards should acknowledge the existence of peculiar needs/conditions/settlement patterns and support special solutions for remote places such as hilly settlements, islands and areas with dispersed, low- population densities.
- Innovative use of ICTs as part of the referral support infrastructure.
- There is need to further unpack the complex set of factors that determine decision-making at the stage of first delay (refer to three delay model in p.7) and how this is linked to transport considerations.
- Safe transport and proper handling of patients during transportation is an important element in addressing health and transport linkages.
- There is need for a critical mass of closely monitored mobility projects that can help generate evidence of the benefits of low cost/community-based mobility and health solutions.

Figure 6. Key messages from the "Mobility and Health" workshop (hosted by IFRTD and gTKP, December 2008)

About Transaid

Transaid is an international development charity which seeks to reduce poverty and improve quality of life through providing better access to basic services such as health, education and economic opportunities in Africa and other parts of the developing world. By working with the UK and European transport and logistics industry Transaid builds local skills and knowledge to make transport safer, cheaper and more effective. Transaid has successfully undertaken a number of transport management projects throughout Africa including projects in South Africa, Ghana, Kenya and Mozambique. Transaid specialises in**:**

- building capacity of the public health authorities to provide effective, safe and cost efficient transport management systems to promote equitable access to primary health care services
- developing and improving logistics and supply chain systems to enhance the delivery of medicines, equipment and relief services to vulnerable communities
- providing technical and financial analysis of the transport component of relief and emergency programmes
- promoting effective partnership to support and enhance community participation in developing sustainable transport solutions in rural areas
- developing and delivering transport and logistics training and qualifications for public and private sector operators

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For details of the bicycle ambulance designs please contact info@transaid.org.

[i] Katherine Sierra, Vice President, Sustainable Development, *"Safe, Clean, and Affordable…, Transport for Development"*, The World Bank Group's Transport Business Strategy for 2008-2012

[ii] De Silva, R., Transport - *The Missing Link?: A catalyst for achieving the MDG*, Presentation for the International Federation of Rural Transport Development

[iii] Heyen-Perschon, J., (2005*), Report on current situation in the health sector of Ghana and possible roles for appropriate transport technology and transport related communication interventions*, Institution of Transportation and Development Policy

[iv] Hamlin, C., (2004), *Preventing Fistula: Transport's Role in Empowering Communities for Health in Ethiopia*, (August 30-September 13, 2004) BACK TO OFFICE REPORT, Addis Ababa Fistula Hospital

[v] Starkey, P., (2001), *Local Transport Solutions, People, Paradoxes and Progress, Lessons Arising from the Spread of Intermediate Means of Transport*, World Bank's Sub Saharan Africa Transport Policy Program, Working Paper No. 56

[vi] Hanson, R., (2004), *Transport Management Systems for Improved Access to Health – A Holistic Approach*, Transaid Presentation, 8th TransNet Event - Workshop on "Mobility & Health" (26.11.04)

[vii] Disease Control Priorities Project, (2008), *Strengthening Emergency Medical Services; A Matter of Life and Death in Low-Income Countries*, www.dcp2.org

[viii] Jan J. Hofman, Chris Dzimadzi, Kingsley Lungu, Esther Y. Ratsma, Julia Hussein, (2008), *Motorcycle ambulances for referral of obstetric emergencies in rural Malawi: Do they reduce delay and what do they cost*?, International Journal of Gynecology and Obstetrics 102, 191–197

[ix] Heyen-Perschon, J., *Summary on the FABIO/BSPW - Bicycle Ambulance Project* (Uganda), ITDP Europe

[x] Balogun, I, A., (2008), *Draft Report of the Assessment of Motorcycle Ambulance Trailers in Jigawa State*, Transaid, July 2008

[xi] Balogun, I, A., (2008), *Draft Report of the Assessment of Motorcycle Ambulance Trailers in Jigawa State*, Transaid, July 2008

[xii] Victor Mengot, Sarah Amahson, Umar Farouk Wada, (2005), *Feasibility Study into Options for Extending Emergency Transport for Safe Motherhood in Jigawa*, Nigeria Partnership for Transforming Health Systems (PATHS)

[xiii] Schmid, R., (2004), *Report of the workshop on "Mobility & Health"*, TransNet event, 26.11.04, Hotel "Bern", Bern, Switzerland

[xiv] Babinard, J., (2006), *Transport for health in developing countries; Overview of issues and measures to improve access – MDG4&5 context*, presentation, January 30, 2006, Transport and Urban Development (TUDTR), The World Bank

[xv] Macintyre, K., Hotchkiss, D, R., (1999), *Referral revisited: Community Financing Schemes and Emergency Transport in Rural Africa*, Social Science & Medicine 49 (1999) 1473±1487

[xvi] Murray, S, F., Pearson, S, C., (2006), *Maternity referral systems in developing countries: Current knowledge and future research needs*, Social Science & Medicine 62 (2006) 2205–2215

[xvii] Molesworth, K., (2005), *Mobility and Health: The Impact of Transport Provision on Direct and Indirect Determinants of Access to Health Services*