

Riders for Health

RESEARCH BRIEFING | OCTOBER 2014

Delivering health to the last mile

Prospective Trial Results from
Southern Province, Zambia

STANFORD GRADUATE
BUSINESS SCHOOL OF

Reaching the Last Mile

Transport Enables Health Care Access for Rural Communities

The landlocked African nation of Zambia is one of the least densely populated nations in sub-Saharan Africa, where, overall, only 19% of roads are paved. The country of 14.6 million relies on motorcycles and four-wheeled vehicles to help health care workers traverse difficult roads to distant communities.

Working in clinics and conducting basic health services outreach in rural villages, environmental health technologists perform such tasks as measuring bacteria levels in water and food and taking steps to improve public health. In addition, they deliver maternal and child health care, often extending basic health services to people where they live.

Motorcycles were seen as absolutely crucial in achieving outreach.

Stanford anthropologist visiting experimental district

A recent 2.5-year, randomized study by the Value Chain Innovation (VCI) Initiative at Stanford Graduate School of Business found that systematic management of motorcycles used by health care workers to reach far-flung rural villages improved health ministry system performance in Zambia.

The \$2.3 million study, funded by the Bill & Melinda Gates Foundation, was conducted from October 2011 to March 2014 in eight districts of Southern Province, Zambia. It looked at the effect of fleet management by the U.K.-based social enterprise Riders for Health (Riders), which has been working with governments and non-governmental organizations in sub-Saharan Africa since the late 1980s,

and compared environmental health workers in four experimental districts with workers traveling in four control districts.

The VCI Initiative research team found such steps as providing full management of health workers' motorcycles, conducting regular preventive maintenance, and training workers enabled the health workers to travel almost 10 kilometers more per trip on average, reclaim remote swaths of their territories, and deliver more preventive health care to children. On a cost-per-kilometer basis, the systematic motorcycle fleet management cost was equal to the amount the control group spent on motorcycle management per kilometer in 2012.

Systematic management of four-wheeled vehicles also helped. However, this research summary focuses on results that came from managing the motorcycle fleet, which is the predominant means of transport for the workers in this study.

The study's results raise questions regarding the influence of transport management in other contexts. For example, more research is needed on whether providing better-managed and better-maintained fleets to other health care providers, like nurses, could have an impact on mortality and other health measures.

Why Did Health Care Delivery Improve?

Environmental health technologists were able to travel farther and, therefore, visit more locations and make more outreach visits on the Riders motorcycles. The study found the greater productivity and efficiency led to an increase in the preventive health care services delivered.



Health worker en route to outreach visit

The transport link in the health care supply chain grows stronger

SYSTEMATIC MOTORCYCLE MANAGEMENT:

- Increased motorcycle availability and use
- Increased health worker productivity
- Increased trips to more remote communities
- Improved community perceptions of health care system performance
- Resulted in equal fleet cost-per-kilometer between Riders and Ministry

SYSTEMATIC FOUR-WHEELED VEHICLE MANAGEMENT:

- Increased vehicle availability and use
- Increased trips to more remote communities
- Enabled more emergency trips
- Resulted in equal fleet cost-per-kilometer between Riders and Ministry



Village outreach site



An outreach clinic

The Stanford team noted subtle shifts in attitude among the people using health services and the health workers.

A survey of household residents showed a higher portion of household residents in an intervention village perceived improved health system performance compared with household residents in a control village.

Environmental health technologists also may have been more confident as they planned routes and made decisions about what to do with their limited and valuable time. The clinics reclaimed catchment areas, reported a member of the Stanford team.

What Is Systematic Fleet Management?

Riders provides systematic management of transportation fleets of motorcycles and four-wheeled vehicles to strengthen health care systems in Africa. Riders offers services such as planning budgets for health-related transport, sourcing vehicles and spare parts, managing fuel, and preventative maintenance. The enterprise now manages some 1,400 motorcycles and vehicles across seven African countries, and operates a sophisticated hub-and-spoke system in which Riders-trained technicians travel to villages where health workers are based.

In the Transport Resource Management (TRM) model, Riders takes over management (including preventive maintenance, on-demand repair, training, and fueling) of fleets already owned and deployed by the Ministry of Health or a nonprofit. The Transport Asset Management (TAM) program offers the same services, except that Riders purchases a new fleet and leases it out as a full-service solution, also providing the same management offered under TRM.

The Study Begins

The VCI Initiative began the study with the question: Can systematic health fleet management improve the effectiveness and efficiency of health care delivery? The research team consisted of Hau Lee, Kala Mehta, Eran Bendavid, Sonali Rammohan, Davis Albohm, George Muwowo, and Lesley Sept. A Stanford team of seven Zambia-based data collection officers collected weekly local data for 2.5 years. They were Firstwell Chitumbo, Chrispin Halwiindi, Fumbanani Mkandawire, Samson Muchumba, Lawson Mwamba, James Mwanza, and Mambwe Ngoma.

The research team evaluated how often the fleet was available for use, how often it was used for health work, and the extent to which a health worker could “reach”

The Backdrop

Zambia’s severe shortage of health care workers is exacerbated by the treacherous travel they undertake. For several months in the summer, some roads and dirt paths simply disappear as torrential rains inundate the surrounding floodplains.

Rural health care facilities are designed to serve people with basic health care services, such as vaccinations, limited diagnostics, and antenatal care deliveries. Yet, people can find it challenging to get to clinics several kilometers from home when they rely on walking or, in some cases, a bicycle to get there.

The transportation, or health fleet, used to reach people is often a mix of donated and purchased motorcycles and four-wheeled vehicles of varying makes and models. It is challenging for districts to set aside consistent budgets for fuel, maintenance services, and repair and to obtain the various spare parts needed to keep fleets running.



An Environmental Health Technologist en route to an outreach visit

Health in Zambia

1 in 3

residents lives on \$1.25 a day

65%

of the population is rural

591

maternal deaths for every 100,000 live births

55 & 58

male and female life expectancy

89

die for every 1,000 births

into rural areas. To get the perspective of villagers, the team deployed a household survey to explore community perceptions of health after Riders was introduced. Lastly, to give practical consideration to the affordability of the model, the team evaluated the cost-per-kilometer of the program.

At first, the team examined how transport operated and how much health care was delivered to rural areas without Riders. This was the five-month study baseline.

In the trial intervention, 70 motorcycles owned by Riders were provided in four experimental districts. The control group consisted of motorcycles owned by the Zambian Ministry of Health in experimental and control districts.

Under the direction of Ministry officials, Riders mobilized environmental health technologists — a cadre of health workers who are based at, and operate out of, government health facilities. Among the tasks performed by environmental health technologists are distribution of water chlorination tablets and education to stop unsafe butchery practices. They also provide basic health services. For example,

environmental health technologists provide disease-prevention education (like health education on hand washing and basic hygiene), immunize children in villages using a routine schedule, and provide Vitamin A supplements. They also monitor the growth of infants and children to avert mortality of children under 5.

The Stanford team of data collection officers conducted weekly interviews of health workers and transport managers. The team collected data on 183 out of the 257 total motorcycles in the control and experimental districts, as well as on 54 out of 88 four-wheeled vehicles. The team interviewed, in all, environmental health technologists based at 116 out of the 227 health facilities in Southern Province.

The 2.5-year field trial examined fleet logistics, health worker productivity, health reach to remote areas, community perceptions of health, and cost-per-kilometer.

Detailed Study Findings

Fleet Logistics

In the trial, Riders purchased and managed 70 motorcycles. Over the trial period, all 70 of the Riders motorcycles in the experimental districts remained operational, meaning they were functioning and had fuel. In the same period, 20% of the Ministry fleet became inoperable. In addition, Riders motorcycles were operational 5.5 days/week (50% more often) and used 2.0 days/week (21% more than Ministry motorcycles).

Was this simply the effect of more motorcycles being added to the experimental districts and the Riders fleet being newer?

The Stanford team controlled for differences in the age and quantity of motorcycles in the two study groups; even after this, increases in motorcycle logistics measures remained.

One of the severe limitations in Zambia is the shortage of health care workers. The difference in the number of days per week motorcycles were operational, versus used, could have been because of a lack of staff to operate them.

Health Worker Productivity

Environmental health technologists using Riders motorcycles performed more outreach visits to rural villages; four more visits per environmental health technologist per month. On each visit, the environmental health technologists served more people — on average about 30 more people per visit — indicating that the health workers were able to work more efficiently.

Health Worker Reach

Workers traveled an average of almost 10 kilometers more per trip. Health workers increased their reach (i.e., the number of



A health care worker conducting outreach

Riders' Systematic Management Services

- Training health care workers to use and maintain motorcycles; training drivers to use and maintain four-wheeled vehicles
- Fuel management
- Preventive maintenance done on an outreach basis
- On-demand repair
- Budgeting and planning
- Supply chain for replacement parts

trips per 5,000 people to villages 5–25 kilometers from their principal health facility) by 14% compared with health workers in control districts.

Again, the Stanford research team statistically controlled for the addition of vehicles and their newer age, and found that the increased visits in rural villages was seen even after taking into account the new vehicles added. This suggested that the improvements were linked to the Riders' fleet management model.

To validate findings, Global Positioning System (GPS) data from trackers attached to motorcycles and four-wheeled vehicles

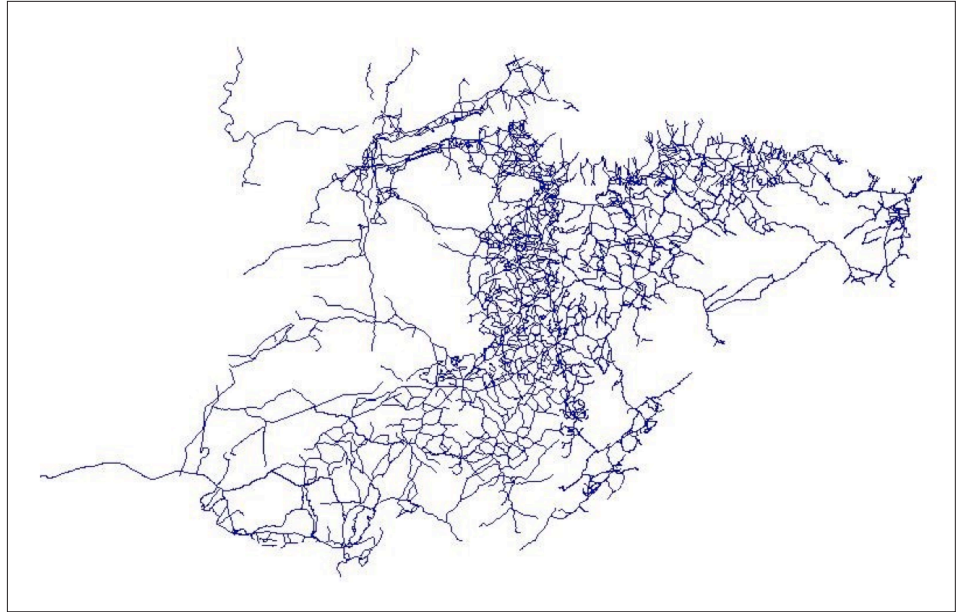
The major change was that his clinic 'reclaimed' its catchment area.

Stanford anthropologist speaking about Riders-mobilized environmental health technologists at a clinic

was used to create Geographic Information Systems (GIS) maps. The team created color-coded "heat maps" depicting the increase in health reach during the study in the experimental districts.

Fleet Cost-Per-Kilometer

This study did not focus on health outcomes, which are difficult to link to broad health systems interventions like Riders. Therefore, the team did not conduct a traditional cost-effectiveness analysis that is often associated with health interventions. Comparing costs to a measure of productivity was also not possible given that the two fleets were used in different ways (Ministry motorcycles were shared by several health workers, while Riders motorcycles were used only by environmental health technologists). Given this context, the team examined operational cost-per-kilometer of both fleets.



Mapping unmapped roads: GPS data from Stanford-tracked motorcycles and four wheel vehicles were combined with other data sources to create a new detailed map of roads, most of which do not exist on any existing maps today.

While the makes and models of the Riders and Ministry fleets differed, making a direct comparison challenging, the approach was to compare existing Ministry costs to those they would pay if they outsourced to Riders. The team compared the rate Riders charged to the Ministry, \$0.30, with the cost-per-kilometer (cpk) rate of the Ministry fleet in 2012, including depreciation, maintenance, fuel, and insurance. The Ministry's cpk range (at 95% confidence interval) was \$.20–\$.70. Since the Riders rate fell within this range, the team concluded that cost-per-

kilometer was equal between the Riders and Ministry fleets.

Cost comparisons may differ in other geographies. While the cpk of the Riders fleet and the Ministry fleet was similar in this case, the total cost of Riders was greater because there were more motorcycles and they traveled more kilometers. The need for additional resources and the ability to acquire them may differ based on the specific context, and is an important consideration for future adoption of similar programs. As ministries increase the size



Health care worker administering medicine to a baby

What Changed?

Fleet Logistics

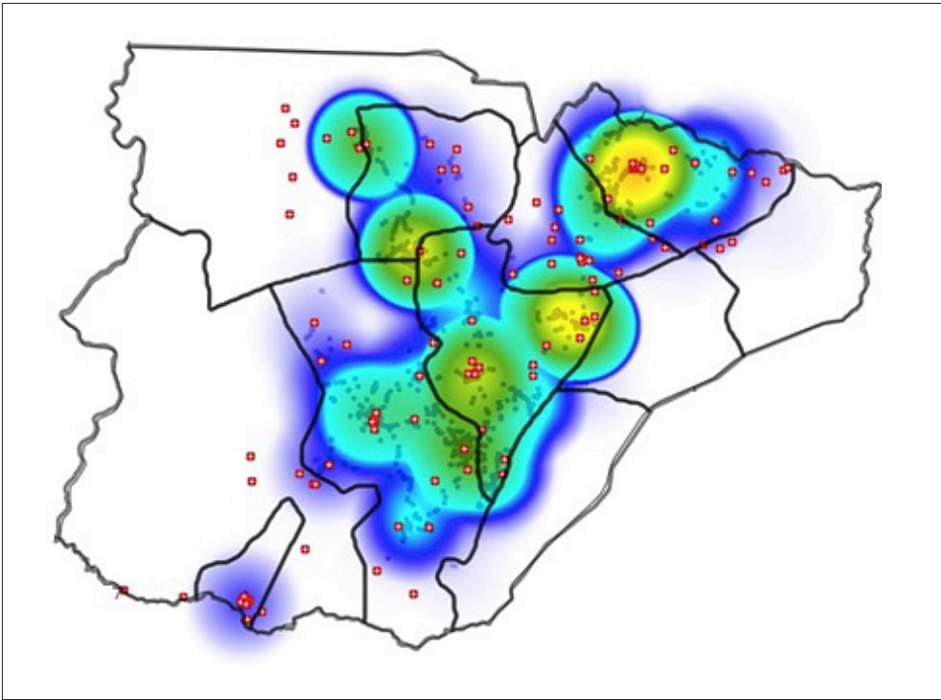
- Motorcycle uptime increased by 50%.
- Motorcycle utilization increased by 21%.

Health Reach

- Workers traveled 10km farther per trip.

Health Delivery

- Workers conducted 4 more outreach visits each per month.
- Workers served 30 more people per visit.
- Residents perceived improved health system performance.



GIS Heat Map

GPS trackers monitored the frequency of motorcycle trips from health clinics (red dots) to communities in experimental districts.

Figure created using Geographic Information Systems (ArcGIS/Esri, Redlands, Calif.). This system factors in the health worker's starting location, or the health facility, indicated by red dots. It also looks at area covered (i.e., trips to rural areas). Blue indicates fewer outreach trips and yellow indicates more trips.

of their health transport fleets, or as motorcycles break down and are replaced, cost-per-kilometer can be an important consideration when decision-makers are considering whether or not to outsource fleet management to an organization like Riders. In other settings, depending on the availability of data, it may even be possible to examine costs versus outputs or costs versus outcomes.

Conclusions and Looking to the Future

There are opportunities for more research in this area, such as how managed transport can improve both the flow of health care from the health facility out to rural areas and the flow of patients and medical tests in from rural areas to the health facility. One could also test how better mobilizing other direct health workers, such as nurses, can affect health outcomes. Beyond health, there are opportunities to research the impact of fleet management on agricultural value chains and the retail sector in developing countries with poor infrastructure. For instance, could fleet management help to overcome

distribution and sourcing challenges for companies buying from and selling to remote communities, thus aiding economic development?

This study demonstrates that, in Southern Province, Zambia, contracting out fleet management to Riders improved health worker productivity and health reach, and that fleet cost-per-kilometer was equal between Riders and the Ministry.

The research suggests that using a systematic fleet management program can increase the amount of health services delivered to people at the last mile — those who might not otherwise get the services they need. The findings have implications for the health sector in countries beyond Zambia. The results suggest that fleet management can contribute to stronger health system performance, which, depending on the type of health worker mobilized, could ultimately impact health outcomes such as preventable childhood illnesses like measles, childhood malaria, childhood mortality, unattended deliveries in rural villages, and maternal mortality.

Academic publication forthcoming. To learn more, visit:

www.gsb.stanford.edu/value-chain-innovation

About

The Value Chain Innovation Initiative at Stanford Graduate School of Business

Housed within Stanford Graduate School of Business, the Value Chain Innovation (VCI) Initiative brings together faculty and students from multiple schools, departments, and disciplines within Stanford University to conduct research on value chain innovation and disseminate learning in partnership with practitioners. The initiative seeks to understand the economic and social impacts of the global dynamics and digital communications that are reshaping business, industries, and ecosystems.

Research projects' focus may be structured as theoretical or model-based research, empirical research, or detailed field-based studies. Periodically, the VCI Initiative hosts events featuring thought leaders in the field of value chain strategy.

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Questions

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