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EVALUATION

IMPROVING TB DIAGNOSIS: PERFORMANCE EVALUATION OF THE TB CARE MEDICAL SPECIMEN TRANSPORT SYSTEM IN ZIMBABWE

DECEMBER 2014

This publication was produced at the request of the United States Agency for International Development (USAID). It was prepared independently by Social Impact, Inc.

Cover photo: TB CARE Specimen Transport System courier, riding from laboratory to clinic
Photo credit: D. Roumis, 2014

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This publication was produced at the request of the United States Agency for International Development (USAID). It was prepared independently by Danae Roumis, Samuel Clark, Reuben Musarandega, Roy Mutandwa, Reggie Mutetwa, and Tinashe Sande, on behalf of Social Impact, Inc.

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ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
CDR	Case Detection Rate
DHE	District Health Executives
DMO	District Medical Officer
EC	Evaluation Café
EHT	Environmental Health Technician
FGD	Focus Group Discussion
GoZ	Government of Zimbabwe
HBC	High Burden Country
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
HQ	Headquarters
KII	Key Informant Interview
KNCV	KNCV Tuberculosis Foundation
M&E	Monitoring & Evaluation
MOHCC	Ministry of Health and Child Care
NTP	National Tuberculosis Control Programme
PE	Performance Evaluation
PMD	Provincial Medical Director
RFH	Riders for Health
SI	Social Impact
SSI	Semi-Structured Interview
SSM	Sputum Smear Microscopy
ST	Specimen Transport
TAT	Turnaround Time
TB	Tuberculosis
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization
X/MDR-TB	Extra/Multi-drug Resistant TB

DEFINITIONS

TB Suspect: Any person who presents with symptoms and/or signs suggestive of TB, in particular unexplained productive cough of 2 weeks or more. (1)

Case of TB: A definite case of TB or one in which a clinician has diagnosed TB and has decided to treat the patient with a full course of TB treatment. Any person who is commenced on anti-TB treatment should be recorded as a case. (1)

Definite case of TB: A case of TB in which the Mycobacterium bacillus has been identified by culture, by newer diagnostic tools or one or more sputum smear was/were positive for acid fast bacilli (AFB). (1) A definite case of TB (defined below) or one in which a health worker (clinician or other medical practitioner) has diagnosed TB and has decided to treat the patient with a full course of TB treatment. (4)

Case Detection Rate (CDR): Number of new TB cases detected out of the estimated number of new TB cases (in population) (3)

TB Smear Not Done: Pulmonary TB cases without smear results. (4)

Treatment Completed: A TB patient who completed treatment without evidence of failure but with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable.

Treatment Completed Rate: Number of new smear-positive pulmonary TB cases registered in a specified period that completed treatment and did not meet the criteria for cure or failure out of the total number of new smear-positive pulmonary TB cases registered in the same period. (3)

Cured: A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear- or culture-negative in the last month of treatment and on at least one previous occasion. (2)

Cure Rate: Number of new smear-positive pulmonary TB cases registered in a specified period that were cured out of the total number of new smear-positive pulmonary TB cases registered in the same period. (3)

Treatment Success: The sum of "cured" and "treatment completed." (2)

Treatment Success Rate: Number of new smear-positive pulmonary TB cases registered in a specified period that were cured plus the number that completed treatment, out of the total number of new smear-positive pulmonary TB cases registered in the same period. (3)

Treatment Failed: A TB patient whose sputum smear or culture is positive at month 5 or later during treatment. (2)

Treatment Failure Rate: Number of new smear-positive pulmonary TB cases registered in a specified period that are smear positive 5 months or later after initiating treatment, out of the total number of new smear-positive pulmonary TB cases registered in the same period. (3)

Lost to follow up: A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more. (2)

Not Evaluated: A TB patient for whom no treatment outcome is assigned. This includes case "transferred out" to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit. (2)

Definition Sources:

(1) *Zimbabwe National TB Guidelines, Fourth Edition (2010)*
(2) *WHO Definitions and Indicators (2013)*
(3) *WHO Compendium of Indicators for TB Control (2004)*
(4) *WHO Treatment of Tuberculosis Guidelines, Fourth Edition (2010)*

ACKNOWLEDGMENTS

The team would like to acknowledge USAID/Zimbabwe for its support of this evaluation, and assistance in coordinating with national stakeholders. Special thanks to Julie Chen (evaluation COR), Hamfrey Sanhokwe (Alt. COR), as well as Mathews Maruva (USAID/Zimbabwe M&E), Dr. Ruth Bulaya-Tembo (ST System Activity Manager), USAID/Zimbabwe Mission Director, Melissa Williams, along with other reviewers, for their valued and thoughtful input into the evaluation and feedback on preliminary results.

The team would also like to extend its gratitude to the MOHCC and NTP, at national, provincial, and district levels, for their facilitation of the project and the evaluation and the time they set aside to sit for interviews. The team admires their dedication to improving TB diagnosis in Zimbabwe.

The evaluation team could not have completed its work without the cooperation and assistance of The Union and Riders for Health (RFH). Several members of these implementing partner organizations made themselves available on multiple occasions for questions, interviews, and data requests, with unquestioning cooperation, a collaborative approach, and a clear appreciation of the opportunity to learn about and improve the specimen transport system. The team also would like to thank participants of the two debriefs in Harare, and for the insightful comments and feedback on preliminary results.

Many thanks to the evaluation team's logistician and research assistant, Tinashe Sande, who worked tirelessly to ensure all of the pieces came together during fieldwork. Thank you also to L. Mutizwa for translation support, as well as those who assisted with pre-testing of the data collection instruments. Thanks to Dr. S. Sakallah for input into the methodology and data collection tools. The evaluation team also extends thanks to Jean-Camille Kollmorgen and Alessandra Barbiero at Social Impact for their support and coordination.

Last but not least, the evaluation team would like to thank all of the respondents and participants involved in data collection in the districts: the team is very grateful for the input and hopes this report contributes to a strong ST system and improved TB diagnosis in Zimbabwe. Thank you.

GEOGRAPHIC COVERAGE

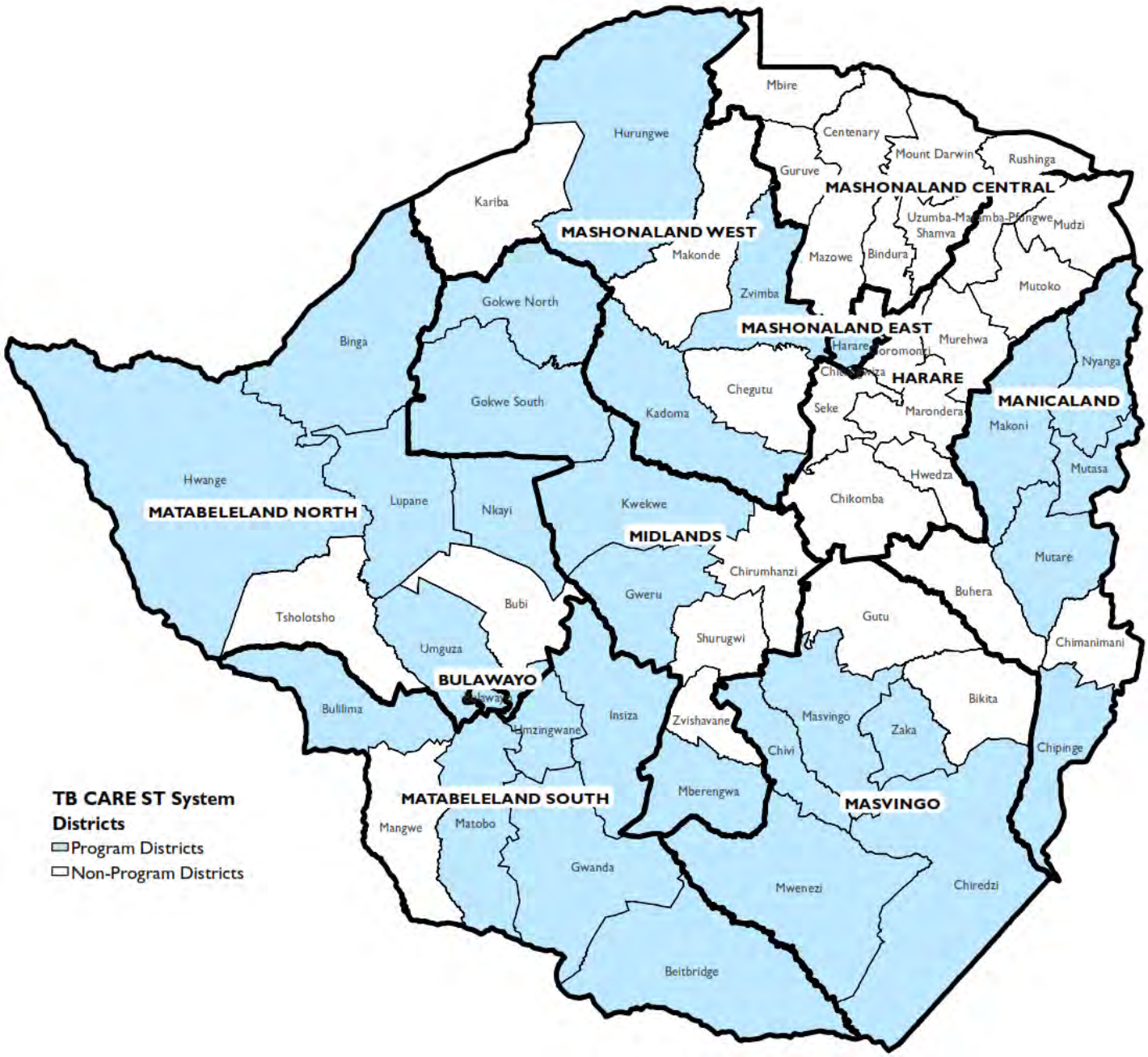


FIGURE 1. GEOGRAPHIC COVERAGE, TB CARE ST SYSTEM IN ZIMBABWE

Note: Kadoma district has since been split into Mhondoro-Ngezi and Sanyati districts, both of which are included in the ST system.

EXECUTIVE SUMMARY

PROJECT BACKGROUND

Tuberculosis is one of the most severe public health threats in Zimbabwe. Zimbabwe ranks 17th among 22 countries in the world designated as high burden countries (HBCs), with an estimated incidence of 562 per hundred thousand population.[1] As in other southern African countries, the TB epidemic is largely driven by HIV/AIDS; an estimated three-fourths of all TB patients are co-infected.[2] The Zimbabwe National TB Control Programme (NTP) has prioritized activities to improve TB diagnosis among its strategic objectives, in order to disrupt disease transmission in the community and reduce TB-related deaths.[3] USAID has supported Zimbabwe's TB control efforts through the $225m TB CARE I program since 2009, implemented by the International Union against Tuberculosis and Lung Disease (The Union) along with its collaborating partners, the World Health Organization (WHO) and the KNCV Tuberculosis Foundation (KNCV).[4] The TB CARE program aims to strengthen national capacity in Zimbabwe for policy direction and program coordination for TB, and to support service delivery for effective TB control interventions.

The NTP has identified a strategic need to strengthen referral networks and transport logistics between peripheral health facilities and laboratories.[5] In response to this need, a medical specimen transport (ST) system was initiated in 2010 as part of the TB CARE technical area of ensuring "universal and early access to TB diagnosis, care, and treatment." The ST system is implemented by The Union through Riders for Health (RFH), in collaboration with the Zimbabwe Ministry of Health and Child Care (MOHCC) through the NTP. To date, USAID has invested $1.4m in the ST system in Zimbabwe.[6] The overarching objectives of the TB CARE ST system include increasing timely access to laboratory TB diagnosis and results, which is expected to lead to faster initiation on treatment, better patient monitoring during the course of treatment and, ultimately, better TB patient outcomes and reduced TB transmission in the community.

The mainstay of the TB CARE ST system is a cadre of motorcycle couriers, enlisted to conduct specimen transport full-time. Couriers bring laboratory test results to each clinic, and at the clinics, pick up new sputum specimens to bring back to the laboratory for testing. Clinics are visited on a daily basis in urban areas, and on a weekly basis in rural areas. Most districts in the program currently have one assigned courier. Larger volumes of specimens and results tend to be transported in urban areas because of higher population density, more clinics, and a typically heavier TB burden. To date, couriers in urban districts (Harare, Bulawayo, and Chitungwiza) have transported an average of 2245 sputum specimens per quarter, and couriers in all other districts have transported an average of 255 sputum specimens per quarter. Couriers travel longer distances over more challenging terrain in rural areas. In some rural districts, couriers can travel up to about one to two hundred kilometers per day.

The TB CARE specimen transport system was first piloted in the three urban districts of Harare, Bulawayo, and Chitungwiza, starting in 2010. Following the pilot, the ST system was next expanded in 2012 into five rural districts (Umguza, Umzinwane, Gokwe North, Zaka, and Makoni). It has since been expanded further, and is now operational in a total of 33 districts (see Figure 1).

[1] WHO (2013), Global TB Report 2013
[2] USAID/Zimbabwe (n.d.), Global Health
[3] NTP Five Year Strategic Plan, 2010-2014
[4] USAID (n.d.), TB CARE I, Zimbabwe
[5] NTP Five Year Strategic Plan, 2010-2014
[6] This value includes all yearly budgets from 2010 to present.

EVALUATION PURPOSE

The purpose of this performance evaluation is to assess the implementation, effectiveness, integration, and sustainability of the TB CARE medical specimen transport (ST) system in Zimbabwe. The results will inform the Zimbabwe Ministry of Health and Child Welfare (MOHCC) and USAID about ways to strengthen ST systems and maintain quality of implementation during potential scale-up and expansion. The results of the evaluation will be shared with USAID/Zimbabwe, the Zimbabwe MOHCC and NTP, implementing partners (The Union and RFH), USAID/Washington, and other TB program partners in Zimbabwe. This report will be disseminated through the USAID Development Experience Clearinghouse (DEC), and will be shared through the MOHCC to TB program stakeholders at the province and district levels in Zimbabwe.

METHODOLOGY OVERVIEW

This performance evaluation employed a mixed methods design, including qualitative and quantitative data collection and analysis. The team began by conducting a desk review of available project documents, relevant literature, tools, and data. Data collection then took place over four weeks in Zimbabwe, in September and October 2014. The six-person evaluation team conducted over 67 interviews with program stakeholders, including national, province, and district TB program officials, USAID and implementing partner staff, health workers, laboratory staff, and couriers. The team also conducted six focus groups with a total of 36 TB patients, and a participatory workshop with 12 participants including TB coordinators, health workers, laboratory staff, and couriers.

Qualitative data were collected in a total of 14 districts: Harare, Bulawayo, Chitungwiza, Hurungwe, Makonde, Zvimba, Gweru, Zvishavane, Umguza, Tsholotsho, Umzingwane, Beitbridge, Masvingo, and Mutare. Districts were purposively selected to maximize geographic coverage, include a range of longevity in the program, and balance urban and rural perspectives (Figure 3).[7] The team transcribed and conducted thematic analysis on the full set of qualitative data, guided by the four evaluation questions. The evaluation team extracted quantitative data from RFH and Zimbabwe NTP routine monitoring databases. Using quantitative data, the team examined trends over time for each indicator extracted. RFH data were available only for program districts, whereas NTP data were available for all districts nationally. The team used NTP data to conduct simple before-after/with-without comparisons, using quarterly, national data from 2008 to present.

The main strengths of the evaluation methodology include the mixed methods approach and inclusion of respondents across multiple levels of the health system as well as districts with varying longevity in the program with wide geographic coverage. These factors allowed the team to triangulate between respondents and between qualitative and quantitative sources, as well as gain insight into program implementation in various stages and contexts. The main limitations include the small sample of non-program areas, a lack of quantitative data for certain indicators of interest, and a potential for recall and desirability bias among certain respondents. Ideally, the sample would have included a better balance of program and non-program districts. The evaluation team applied substantial effort to mitigate challenges and work within constraints. Despite the limitations, the team is confident in its approach and findings.

[7] For additional detail on district, site, and respondent selection, see *Methodology* in the main report, and Appendix 1.

FINDINGS & CONCLUSIONS

IMPLEMENTATION: ***What factors may have facilitated or inhibited the success of the medical specimen transport system? Were there management practices which were either a hindrance or a help to the success of the transport system? What lessons can be learned from the variations in implementation of the transport system between different geographic areas?***

- **Overall, the TB CARE ST system has been implemented successfully in both urban and rural areas of Zimbabwe. The Union and RFH are regarded as effective and reliable partners, and buy-in across levels of the health system for the specimen transport system is strong. Challenges related to implementation that are under the control of implementing partners are anticipated to be relatively straightforward to address.**

- The system addresses a distinct and well-defined need with respect to specimen transport, which had been identified by the NTP. This has resulted in a system that is responsive to local needs.
- The buy-in for this program is high across all levels of the health system, in urban and rural areas alike. Respondents attribute this to a combination of factors including flexibility on the part of MOHCC and implementing partners with program design, collaborative planning and management during implementation, and the consistent reliability of the system.
- Day-to-day management and supervision of the couriers is decentralized to the district level, which results in efficiencies in implementation. Couriers can directly work with district management teams to address commonplace issues or questions, and consult RFH central offices for specific issues.
- Couriers consistently use logbooks to track mileage as well as track specimens and results ferried. Health workers and laboratory staff are asked to endorse these logbooks daily, which fosters a high level of accountability for the couriers and implementers alike.
- The ST system is consistently reliable across districts, with a clear and regular schedule, a consistent fuel supply, and couriers dedicated full-time to specimen transport. Stakeholders interviewed across geographic contexts express a high degree of satisfaction with implementation to date.
- Couriers cover longer distances on more challenging terrain in rural areas. The perceived desire to have a courier density that has high cost efficiency yields (e.g. specimens ferried per courier) could be resulting in under-servicing of rural districts, and overstretching the couriers and motorcycles.
- Some elements of cost-sharing or collaboration, including laboratory training of couriers on specimen handling, or in-kind contributions of infection control provisions from clinics and labs, do not appear to occur uniformly across all districts. Some couriers face occasional challenges related to equipment, including variable sizes of carrier boxes and sputum cups.

EFFECTIVENESS: ***How has the medical specimen transport system strengthened the diagnosis of tuberculosis and other diseases in the supported areas of Zimbabwe? How has the transport system improved access to TB diagnostic services? How has the transport system improved timeliness of TB diagnosis? How has the transport system improved TB treatment?***

- **The ST system has strengthened TB diagnosis by decentralizing diagnostic services from district to peripheral health facilities. This increases access to diagnosis for patients by reducing the burden of traveling to district facilities to receive services. It empowers health workers to collect sputum specimens regularly instead of referring patients to district facilities, and results in increased patient trust in the health system. The regular and reliable courier schedule maintains daily turnaround times in urban areas, and weekly turnaround times in rural areas. TB treatment is also improved by the ST system, because timely access to TB diagnosis enables faster initiation on treatment,**

which can lead to better patient outcomes and reduced transmission in the community. A number of contextual factors external to the program also influence effectiveness; some help facilitate success while others limit the extent of program effectiveness.

- The ST system has enabled clinics to regularly collect sputum specimens, to send for testing at the laboratory, instead of referring patients to district facilities. This means that the ST system has reduced physical, financial, and time-cost barriers to obtaining TB diagnosis for patients.
- The ST system appears to have increased the timeliness of TB diagnosis at clinics by reducing the turnaround time (TAT) from specimen collection to return of results. Patients in urban areas receive results the next day, and those in rural areas receive results in one week. Respondents report that prior to the ST system, TATs could be weeks or, in some cases, months. Positive results are often communicated directly to clinics from districts by phone/messaging, reducing TAT further.
- In some cases, couriers and health workers reported that the courier may return to clinics as needed to pick up specimens or deliver results. This can further reduce the TAT and indicates the flexibility of the system, though it may also suggest a need for greater frequency in rural areas.
- Among TB patients presenting at clinics, the ST system facilitates earlier treatment initiation and reductions in patients lost to follow-up before treatment initiation. Increased timeliness is also important for those who receive smear-negative results, since they require follow-up testing. The effect of the ST system on TB treatment outcomes are more challenging to isolate from other influences; however, the ST system's contribution was readily acknowledged by respondents.
- Improved treatment, with related efforts including contact tracing, enables the health system to contribute to reducing infections in the community. However, the ST system does not have the scope to conduct community outreach, so other efforts to increase awareness and willingness to seek diagnostic testing will remain important.
- In some districts, not all health facilities are covered, which means that improvements in access to TB diagnosis do not extend to the entire district populations. In a few instances, back-up riders were reportedly not as strict in adhering to ST schedules.
- Contextual factors external to the program including increased HIV/AIDS and TB integration, health worker trainings, and establishment of microscopy centers have further enabled program success and helped build demand and capacity for TB testing. The use of mobile technology has enabled faster communication of results. Economic stabilization has also improved availability of supplies, medication, and personnel. Other programs, including TB CARE, have contributed to TB services, in part by training health workers and providing decision support tools to clinics.
- Other external factors limit the full extent of program effectiveness, most notably including lack of specimen storage capacity at clinics, misunderstandings of specimen viability, and inadeqaute specimen packaging practices. There is no written standard operating procedure (SOP) on specimen collection procedures that can be referenced by health facilities, couriers, and laboratories.

INTEGRATION: *To what extent is the system integrated with routine health services?*

- **The TB CARE ST system is relatively well integrated with other health services, as it is being used to transport a range of specimens, materials, and communications between peripheral clinics and district facilities. The system has the potential to be utilized further by other health services. The ST system is also well integrated with existing TB program management structures at the district and service delivery levels which has allowed for flexibility in implementation.**
- While the ST system was developed to address TB specimen transport, it is used regularly for transportation of other specimens, facilitating integrated management of patients, especially those co-infected with HIV. It is also utilized to transport a range of medical specimens, materials,

documents, and communications. This physical link between district and peripheral facilities is already supporting other health services, but there is potential for further service integration.

- The ST system is well integrated into existing TB program structures, particularly at the district level. Health administrators and district TB coordinators are heavily involved in the day to day coordination of the system. The ST system is less integrated centrally, at the national level. This configuration has brought efficiencies to the program in these first years of implementation, and has promoted learning about the system.
- There appears to be an opportunity for better integration of ST system indicators with NTP data. The NTP currently does not collect information related to specimen transport. The partnership with TB CARE may present an opportunity for the NTP, The Union, and RFH to jointly consider how specimen transport indicators (such as turnaround time, specimen rejection, and time to treatment) could be integrated and included in routine monitoring activities.

NON-PROGRAM DISTRICTS

- **Overall, non-program area systems were reported to be irregular and unreliable in the districts visited. As a result, the norm in these areas still appears to be patient referrals to district facilities, similar to the way respondents from program districts described their circumstances before the introduction of the ST system. The ST system has the potential to add value in non-program districts.**

- In the non-program districts visited, there are no systems or personnel exclusively dedicated to ST. In these areas, ST is usually conducted by a combination of environmental health technicians (EHTs), NGO partners, or health workers themselves. Personnel or NGO partners assigned to ST usually do not have the time or resources to carry out ST activities consistently, since they must balance competing priorities, and often lack adequate vehicles, fuel, servicing, safety equipment, and biohazard measures. NGO contributions often run in parallel to district structures; the evaluation team heard reports of ST coming to a stand-still when partners pulled out of a district.

SUSTAINABILITY: *How can the medical specimen transport system be made more sustainable? What mechanisms have been put in place to ensure an appropriate exit strategy?*

- **There are several factors embedded in the current system which facilitate long-term sustainability. Buy-in is strong at all levels of the health system. The program has demonstrated the importance of a courier function that is dedicated solely to specimen transport. There is a notable amount of in-kind cost-sharing by the MOHCC, including the provision of back-up couriers, disinfection supplies, district-level management, and safe storage for motorcycles. The main limiting factor to sustainability of the ST system relates to financial resources in the current economic environment, suggesting that a full transition to MOHCC would not be feasible in the immediate future.**

- One enabling factor for the sustainability of the ST system is strong government commitment along with strong buy-in from all levels of implementation. The ST system is important to the MOHCC since it is critically important to minimize patient referrals to district facilities. Current MOHCC and City Council inputs to the management and oversight of the ST system will assist in ensuring sustainability, since the program is operating within – and not parallel to – existing structures.
- The main limiting factor to sustainability of the ST system relates to financial resources, suggesting that a near-future transition to MOHCC would not be feasible. Program sustainability cannot be conceptualized outside of Zimbabwe's broad economic context.
- Strong technical partners and support for maintenance of the motorcycle fleet will remain critical for future program sustainability, since this underpins the reliability of the system. Another key input to consider for future sustainability is the dedicated courier who is assigned exclusively to the ST

system. The courier function may not be easily transferable to government or municipalities in the immediate term. Financial considerations and the goal of supporting MOHCC adoption of the program will have to be weighed against the need to maintain the current level of quality and level of effort that couriers are currently able to allocate to specimen transport.

RECOMMENDATIONS

Implementation & Effectiveness	Integration	Sustainability	Expansion
R1. Develop a written SOP on specimen collection for use by health facilities, labs, and couriers **R2.** Provide specimen storage capacity at health facilities, in order to mitigate biohazard & facilitate daily collection of sputum specimens by health workers **R3.** Strengthen trainings for couriers on infection control by collaborating with district laboratories **R4.** Strengthen supply arrangements for safety provisions for courier from health facilities and laboratories **R5.** Increase responsiveness to courier requests for support **R6.** Integrate additional ST performance monitoring indicators to better track effectiveness **R7.** Consider distance and terrain in allocation of couriers to districts	**R8.** Maintain streamlined management at national level and integrated approach at district level for system efficiency **R9.** Increasingly orient the system toward an integrated specimen transport system	**R10.** Continue to lobby for increases in national health budget to facilitate financial contribution from the government to the ST system **R11.** Prioritize specimen transport in other health budgets, including Global Fund, Health Transition Fund (HTF), Results-Based Financing (RBF), Health Services Fund (HSF), health center committee fund, among others **R12.** Consider a staggered phase-in for transition of the program into MOHCC management and operation without strict timelines **R13.** Consider expanding field orderly role to assume ST courier duties, so that the program can draw on an existing cadre which can be supported by any health system funding	**R14.** Because of the clear importance of, and need for, a reliable ST system, continue expansion in other districts, considering R1-R13. **R15.** During expansion, prioritize partnership with a strong technical support partner, such as RFH, for motorcycle maintenance and technical support

1. INTRODUCTION AND BACKGROUND

CONTEXT

Tuberculosis is one of the most severe public health threats in Zimbabwe. It is among the leading causes of pre-mature mortality in the country,[8] and the second most common cause of death among infectious diseases, following HIV/AIDS. Zimbabwe ranks 17th among 22 countries in the world designated as high burden countries (HBCs), with an estimated incidence of 562 per hundred thousand population.[9] As in other southern African countries, the TB epidemic is largely driven by HIV/AIDS; an estimated three-fourths of all TB patients are co-infected.[10] Efforts to stem the TB epidemic focus, in part, on improving diagnosis. Delays in TB diagnosis facilitate disease transmission in the community and can contribute to the development of drug resistance, both of which place additional strain on the health system. As such, the Zimbabwe National TB Control Programme (NTP) has prioritized activities to improve TB diagnosis among its strategic objectives, in order to disrupt the transmission chain and reduce TB-related deaths.[11]

TB CARE PROGRAM IN ZIMBABWE

USAID has supported Zimbabwe's TB control efforts through the $225m TB CARE I program since 2009.[12] TB CARE is implemented in Zimbabwe by the International Union against Tuberculosis and Lung Disease (The Union) along with its collaborating partners, the World Health Organization (WHO) and the KNCV Tuberculosis Foundation (KNCV). The overall goal of the TB CARE program is to strengthen national capacity in Zimbabwe for policy direction and program coordination for TB, as well as to support service delivery for effective TB control interventions. So far, an estimated 6 million rural residents and 2.6 million urban residents have benefited from the program.[13]

MEDICAL SPECIMEN TRANSPORT SYSTEM

Specimen transport (ST) is an important aspect of improving TB diagnosis in Zimbabwe. Effective and reliable ST is essential to ensuring access to laboratory-confirmed diagnosis of TB, as well as regular patient monitoring during treatment; it also enables laboratories to plan workloads and avoid backlogs. In its most recent strategic plan, the NTP identified the need to strengthen referral networks and transport logistics between peripheral health facilities and laboratories.[14]

In response to this need, a medical specimen transport system was initiated in 2010 as part of the TB CARE program, implemented by The Union through Riders for Health (RFH), in collaboration with the Zimbabwe Ministry of Health and Child Care (MOHCC) through the NTP. It is implemented under the first TB CARE technical area of ensuring "universal and early access to TB diagnosis, care and treatment." To date, USAID has invested $1.4m in the ST system in Zimbabwe.[15]

The TB CARE specimen transport system was first piloted in the three urban districts of Harare, Bulawayo, and Chitungwiza, starting in 2010. Following the pilot, the ST system was next expanded in 2012 into five rural districts (Umguza, Umzinwane, Gokwe North, Zaka, and Makoni). It has since been expanded further, and is now operational in a total of 33 districts (see Figure 1 above).

[8] IHME (2013), GBD 2010 Zimbabwe Country Profile
[9] WHO (2013), Global TB Report 2013
[10] USAID/Zimbabwe (n.d.), Global Health
[11] NTP Five Year Strategic Plan, 2010-2014
[12] USAID (n.d.), TB CARE I, Zimbabwe
[13] USAID (n.d.), TB CARE I, Zimbabwe
[14] NTP Five Year Strategic Plan, 2010-2014
[15] This value includes all yearly budgets from 2010 to present.

The mainstay of the TB CARE ST system is a cadre of motorcycle couriers, enlisted to conduct specimen transport full-time. When a courier cannot be identified from among existing health system employees, Riders for Health employs a courier directly from the community. Couriers are trained in motorcycle riding and basic maintenance by RFH in Harare, followed by on-route training in each district. RFH provides couriers with motorcycles, safety and riding gear, basic maintenance kits, carrier boxes for specimens, satchel bags, regular fuel allocations, regular servicing in each province, and logbooks (one tracks mileage/fuel and another tracks specimens/results ferried). District laboratory staff are enlisted by RFH to provide specimen handling training to the couriers in each district.

Couriers begin their day at district facilities. From there, couriers bring laboratory test results to each clinic, and at the clinics, pick up new sputum specimens to bring back to the laboratory for testing. Clinics are visited on a daily basis in urban areas, and on a weekly basis in rural areas. While the program was designed as part of TB control efforts, it strengthens the physical link between district and peripheral health facilities, and thus has the potential to serve the health system more broadly.[16] Accordingly, couriers transport other specimens from clinics to labs, and also carry materials from district facilities to clinics as needed.

Currently, most districts in the program have one assigned courier.[17] Courier workloads are context-specific; larger volumes of specimens and results tend to be transported in urban areas because of higher population density, more clinics, and a typically heavier TB burden. To date, couriers in urban districts (Harare, Bulawayo, and Chitungwiza) have transported an average of 2245 sputum specimens per quarter, and couriers in all other districts have transported an average of 255 sputum specimens per quarter. Couriers travel longer distances and over more challenging terrain in rural areas. In some rural districts, couriers can travel up to about one to two hundred kilometers per day.

The TB CARE ST system aims to achieve a number of objectives related to improving TB diagnosis and treatment in Zimbabwe (see *Results Framework* in Appendix I for more detail). In summary, these objectives include increasing timely access to laboratory TB diagnosis and results, which is expected to lead to faster initiation on treatment, better patient monitoring during the course of treatment and, ultimately, better TB patient outcomes and reduced TB transmission in the community.

FIGURE 2. TB CARE ST SYSTEM SPECIMEN CARRIER BOX

[16] Riders for Health (2012), Program Impact Report, Zimbabwe
[17] Urban districts and a small number of rural districts have more than one courier.

EVALUATION PURPOSE & AUDIENCE

The purpose of this performance evaluation is to assess the implementation, effectiveness, integration, and sustainability of the TB CARE medical specimen transport (ST) system. The results will inform the Zimbabwe Ministry of Health and Child Welfare (MOHCC) and USAID about ways to strengthen ST systems and maintain quality of implementation, for consideration with regard to program scale-up and expansion, and future interventions of this kind. There is a gap in knowledge about best practices for specimen transport, despite widespread recognition of the importance of improving diagnostic services for TB.[18,19] This evaluation provides evidence that assists in beginning to fill this gap in Zimbabwe.

The results of the evaluation will be shared with USAID/Zimbabwe, the Government of Zimbabwe (MOHCC, NTP), implementing partners (The Union, RFH), USAID/Washington, and other TB program partners in Zimbabwe.[20] This report will be disseminated through the USAID Development Experience Clearinghouse (DEC), and will also be shared through the MOHCC to TB program stakeholders at the province and district levels in Zimbabwe.

EVALUATION QUESTIONS

This evaluation addresses evaluation questions covering four main themes related to the ST system:

1. **Implementation**: What factors may have facilitated or inhibited the success of the medical specimen transport system?
    a. Were there management practices which were either a hindrance or a help to the success of the transport system?
    b. What lessons can be learned from the variations in implementation of the transport system between different geographic areas?
2. **Effectiveness**: How has the medical specimen transport system strengthened the diagnosis of tuberculosis and other diseases in the supported areas of Zimbabwe?
    a. How has the transport system improved access to TB diagnostic services?
    b. How has the transport system improved timeliness of TB diagnosis?
    c. How has the transport system improved TB treatment?
3. **Integration**: To what extent is the system integrated with routine health services?
4. **Sustainability**: How can the medical specimen transport system be made more sustainable?
    a. What might make the system more sustainable?
    b. What mechanisms have been put in place to ensure an appropriate exit strategy?

[18] Nkengasong JN, et al. (2010)
[19] The NTP Five Year Strategic Plan, 2010-2014, p. 37, lists operations research as a strategic objective, while acknowledging the limited amount available to date.
[20] A debrief with several TB program stakeholders was held in Harare, in October 2014, to present and gather feedback on preliminary findings.

2. METHODOLOGY

OVERVIEW

This performance evaluation employed a mixed methods design, including qualitative and quantitative data collection and analysis. Data collection took place over a period of four weeks in Zimbabwe, in September and October 2014. The six-person evaluation team included expertise in qualitative and quantitative evaluation methods, as well as sector expertise of public health programs and tuberculosis epidemiology and control. Prior to beginning data collection, the evaluation team undertook a desk review of available primary and secondary documents provided by USAID/Zimbabwe. The team also compiled other relevant reports, research, tools, and data pertaining to TB in Zimbabwe and specimen transport logistics more broadly. Qualitative data collection in Zimbabwe consisted of a series of interviews with with respondents representing a comprehensive range of staff involved in implementing the TB CARE ST system. The evaluation team began data collection as a full team in order to ensure consistency across interviews, and then split into two sub-teams of three, to maximize the number of district site visits that could be conducted. Quantitative data were abstracted from the Riders for Health monitoring database, as well as the Zimbabwe NTP routine monitoring databases.

QUALITATIVE DATA

Qualitative data was collected through key informant interviews, semi-structured interviews, focus group discussions, and a participatory workshop.[21] Key informant interviews (KIIs) were conducted with higher level stakeholders, including The Union, RFH, MOHCC, and NTP staff as well as provincial medical directors and TB coordinators. The team also interviewed officials from the AIDS and TB Unit, and the Laboratory Services directorate. Semi-structured interviews (SSIs) were conducted with district health administrators, health workers at clinics, laboratory staff, and couriers. In a small number of cases, the evaluation team spoke with mechanics involved with the TB CARE ST system. Focus group discussions (FGDs) were conducted with groups of 5 to 8 TB patients, on the premises of clinics where they receive TB care.[22] Lastly, a half-day participatory workshop, called the Evaluation Café (EC), convened participants including TB coordinators and focal persons, couriers, health workers from clinics, and laboratory staff. Participants were organized into groups that included representatives from each category and each district. Group discussions were guided by prompts aligned with the evaluation questions; groups then presented the results of their discussion in a plenary session. The workshop format contrasts with that of a typical interview, and allows feedback to emerge through peer-to-peer dialogue, debates, and discussion. In total, over 67 respondents were interviewed in the KIIs and SSIs. Six FGDs were conducted, with a total of 36 participants. The Evaluation Café included 12 participants.

Qualitative data collection covered a total of 14 districts: Harare, Bulawayo, Chitungwiza, Hurungwe, Makonde, Zvimba, Gweru, Zvishavane, Umguza, Tsholotsho, Umzingwane, Beitbridge, Masvingo, and Mutare. Eleven (11) of these were visited by either the full team, or one of the two sub-teams; the remaining three were Harare, Chitungwiza, and Zvimba, which were included in the Evaluation Café workshop. District selection was conducted purposively, according to a set of criteria to maximize geographic coverage, district longevity in the program,[23] and achieve a balance of urban and rural perspectives (see Figure 3).[24] Selection of non-program districts was done primarily on the basis of

[21] A total of 10 data collection instruments were developed for qualitative data collection: a key informant interview (1), a program & non-program version of the health administrator interview (2), health worker interview (2), and laboratory staff interview (2), plus the courier interview (1), focus group discussion guide (1), and the Evaluation Café workshop guide (1).
[22] Health workers were not present during focus group discussions.
[23] All district selections were limited to those which had at least 6 months as part of the program, to ensure that respondents had sufficient time to experience and reflect on any changes that may have occurred as a result of the program.
[24] During sampling, the team also used NTP indicators from 2013 Q1-Q3 related to diagnosis, to target districts with higher TB burdens.

accessibility along routes planned for program districts, in provinces where at least one district was in the program. In order to maximize the number of program districts that could be visited during the data collection phase, and to attempt to account for province-level factors that could influence any comparison between program and non-program districts, the team decided not to visit any districts in provinces where no district was yet participating in the TB CARE ST system.[25] Hospitals, laboratories, and clinics were selected on the basis of criteria applied consistently in each district, related to their participation in the program, distance from the district facilities, and overall TB burden. Up to two clinics per district were visited. See Appendix 1 for detail regarding site and respondent selection.

QUANTITATIVE DATA

The evaluation team extracted quantitative data from two sources. First, the team extracted the following indicators from the Riders for Health monitoring database: the number of TB specimens, the number of total specimens (when available), and the number of TB results, ferried between clinics and laboratories. These data were available for all districts included in the TB CARE ST system, quarterly, since the start date in each district; analogous data was not available from any source for non-program districts. The team also obtained data from the Zimbabwe NTP, and extracted indicators from routine monitoring databases with TB notifications (Form 6) and outcomes (Form 7), by district and by quarter, from 2008 to present. Indicators extracted include: the number of patients examined with sputum smear microscopy for TB diagnosis, the number of cases of TB smear not done, cure rates, and treatment completion rates. These data were available for all districts nationally. The evaluation team requested data starting from 2008. Therefore, data from the NTP database were available for a period of at least two years prior to the introduction of the ST system in program districts, as well as for non-program districts for comparison.

DATA ANALYSIS

Qualitative data were entered into a standard data capture template developed by the evaluation team for each type of interview during data collection. Sub-teams conducted de-briefs every other day to discuss emerging themes. Following the completion of data collection, the team conducted thematic analysis on the full set of qualitative data, guided by the four evaluation questions. With the quantitative data described above, the evaluation team conducted longitudinal analysis, evaluating trends over time, for each indicator extracted. With RFH data, the team analyzed trends over time since the start of the program, first in each district, as well as in urban areas and rural areas in aggregate. Using NTP data, the evaluation team examined trends over time, comparing areas with and without the program, before and after the program start date(s),[26] at the district level as well as at the province level. Feedback from stakeholders gathered during in-country de-briefs at the conclusion of data collection were also integrated into the final analyses.

[25] This includes Mashonaland Central and Mashonaland East provinces.

[26] The team originally planned to analyze quantitative data by conducting a simple before-after/with-without analysis using data from the Zimbabwe MOHCC Health Management Information System (HMIS) and TB CARE databases. In the early phases of data collection, it became evident that the staggered-start nature of program implementation would present challenges in categorizing "without" areas as comparisons for areas with different start dates of the program. Despite this complication, the evaluation team believes that the trend analysis better enables an examination of patterns over time, and the opportunity to contextualize the analysis of quantitative data better than would be possible with a simple calculation of averages before and after/with and without the program.

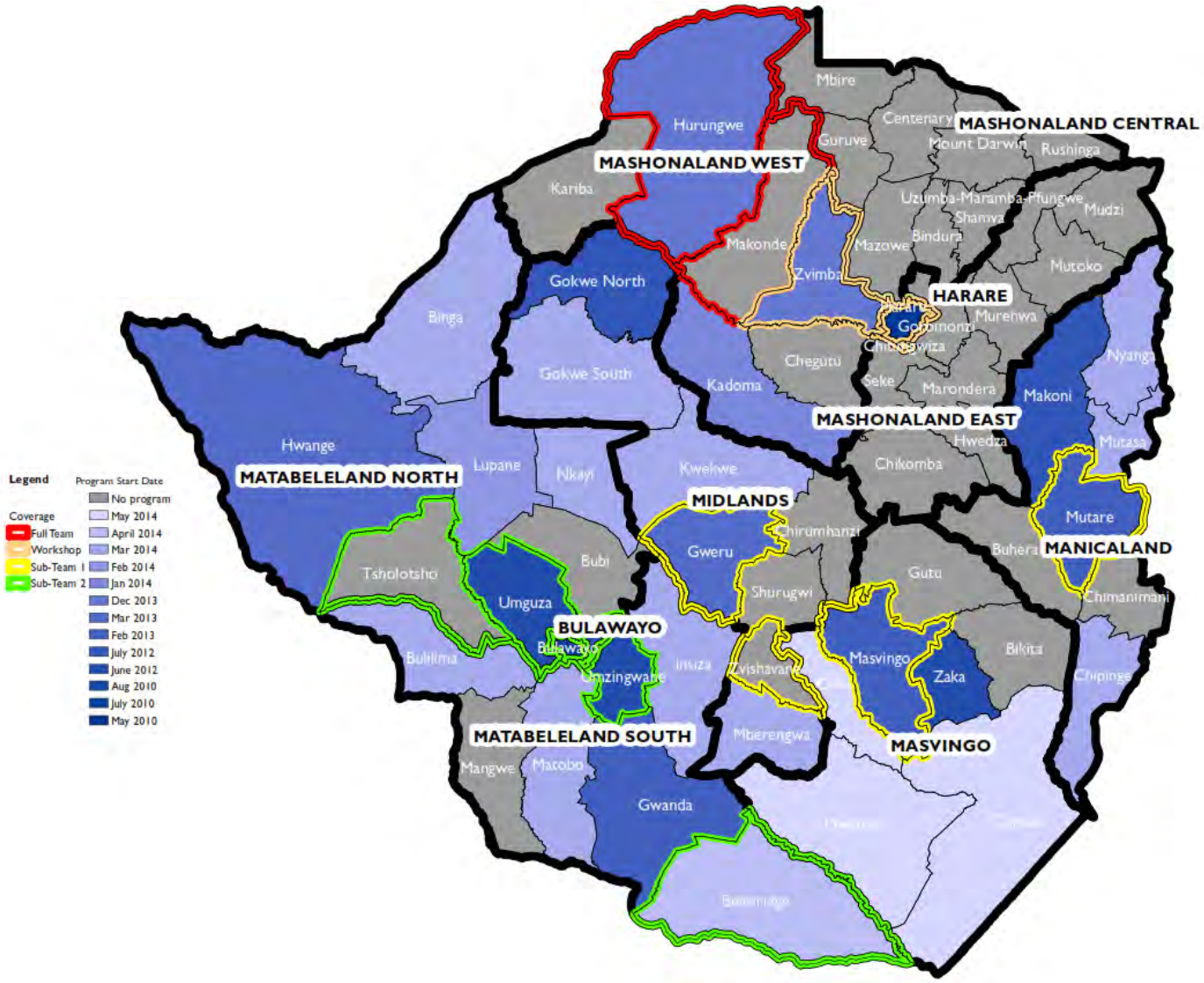


FIGURE 3. DISTRICT SELECTION AND DATA COLLECTION

TABLE 1. DISTRICTS IN ZIMBABWE, BY PROGRAM STATUS AND START DATE

Start date	2010 Q3	2012 Q2	2013 Q1	2013 Q4	2014 Q1		2014 Q2
PROGRAM DISTRICTS	Bulawayo Chitungwiza Harare	Makoni Zaka Umguza Umzingwane Gokwe North	Mutare & Mutare City Gwanda Gweru Kwekwe	Hurungwe Sanyati Zvimba	Chipinge Mutasa Nyanga Mhondoro-Ngezi Binga Lupane Nkayi	Beitbridge Bulilima Insiza Matobo Gokwe South Mberengwa	Chiredzi Chivi Masvingo Mwenezi Hwange

	Districts from provinces with ST program			*Districts from provinces without ST program*		
NON-PROGRAM DISTRICTS	Buhera	Bikita	Chirumhanzi	Bindura	Rushinga	Mrehwa
	Chimanimani	Gutu	Mvuma	Centenary	Shamva	Mudzi
	Chegutu	Bubi	Shurugwi	Guruve	Chikomba	Mutoko
	Kadoma	Tsholotsho	Zvishavane	Mazoe	Goromonzi	Seke
	Kariba	Mangwe		Mbire	Hwedza	UMP
	Makonde			Mt Darwin	Marondera	

STRENGTHS AND LIMITATIONS

Strengths

The evaluation methodology made use of a wide range of qualitative and quantitative data, and facilitated triangulation between different categories of respondents. Likewise, districts included in data collection were spread across a wide geography and included both urban and rural areas. Including districts with varying longevity in the program provided the team with valuable insight into program implementation at various stages, which is especially useful since the evaluation is largely cross-sectional in nature. The availability of data from the NTP program strengthened the trend analysis, since it facilitated a long-term view of trends in important indicators, and a comparison between groups of districts with and without the ST system. The use of the Evaluation Café participatory workshop yielded useful information that helped refine findings and recommendations – feedback from this session indicated that participants also found the dialogue with colleagues and peers from other perspectives in the system to be a worthwhile exercise. Lastly, the evaluation team was composed of members with a range of complementary expertise in evaluation, tuberculosis programming, and the Zimbabwean health care system.

Limitations

The first limitation faced by the team was the need to prioritize the list of district site visits, given the time allotted for data collection and the desire to include as many program districts as possible. Ideally, the sample would have included more districts in total, but especially a better balance of program and non-program districts, as well as districts from provinces that have not yet introduced the ST system at all. One disadvantage of not including more non-program districts is the potential risk that other existing programs that function well in other areas could be missed; this also limited robust comparisons of program and non-program areas. Also, as a result of site selection criteria, facilities farthest from district laboratories could not be included in the sample, and those clinics may have different experiences than clinics closer to the central facilities. Secondly, the team had hoped to use a quantitative measure of turnaround time to assess the effectiveness of the ST system in improving timeliness, but such data is not routinely tracked by Riders for Health, The Union, or the NTP. Collecting this data would have required in-depth data abstraction from health facility registers with a full representative sample of program and non-program areas across the country, which could not be completed in the time allotted for this evaluation and without the necessary approvals to extract data from patient records. The team asked respondents about their perception of changes in turnaround time, but these responses cannot replace record abstraction.[27] Also, there is potential for recall bias when asking staff about the status of TB diagnosis services before the program. For respondents in the health system for many years, experience of shortages and other challenges during times of economic hardship prior to dollarization in 2009 may also play a role in the differences recalled between pre- and post-program circumstances. There is also the possibility of desirability bias in non-program areas particularly in the way they described functionality of existing ST systems; there was a tendency to portray a favorable situation at the beginning of interview, but describing it as heavily challenged by the end. Lastly, the evaluation team was not able to conduct any verification of the quantitative data obtained from RFH or the NTP by cross-checking raw paper forms. The team remains confident in its findings despite these challenges.

[27] Note that with/without comparisons may have even still been difficult were data abstraction possible, since it is possible that many clinics without the ST system would not be referring specimens to a laboratory, and therefore the concept of turnaround time would not necessarily be applicable to those patients who were physically referred to a hospital for diagnosis. See *Effectiveness* for more detail.

3. FINDINGS

IMPLEMENTATION

What factors may have facilitated or inhibited the success of the medical specimen transport system? Were there management practices which were either a hindrance or a help to the success of the transport system? What lessons can be learned from the variations in implementation of the transport system between different geographic areas?

Summary of Implementation Successes
• The TB CARE ST system targets a distinct and well-defined need
• Program design is responsive to local needs, due to flexibility of MOHCC and implementing partners
• Systematic planning and coordination procedures are in place for start-up in each district
• Open communication facilitates good working relationship between couriers and health workers/labs
• Consistent reliability of system across districts attributed to clear schedule, consistent fuel supply, and courier dedicated full-time to specimen transport
• Zero-breakdown policy and decentralized maintenance approach keeps motorcycles operational
• Decentralization to districts of day-to-day management and coordination creates efficiencies
• Consistent use of logbooks for specimen/results tracking and mileage fosters accountability

The TB CARE ST system has been implemented with clear success to date. The system addresses a distinct and well-defined need with respect to specimen transport, which had already been identified by the NTP. This has resulted in a system that is responsive to local needs. The buy-in for this program is high across all levels of the health system, in urban and rural areas alike. Respondents attribute this high level of buy-in to a combination of factors including flexibility on the part of MOHCC and implementing partners with program design, collaborative planning and management during implementation, and the consistent reliability of the system.

The flexibility of both the MOHCC and the implementing partners on program design has played an important role in the successful implementation of the program. For example, in districts where a rider could not be identified from an existing cadre in the health system, RFH has directly employed a courier from the community. National stakeholders had agreed to move forward with this approach, despite initial reservations about sustainability, based on the clear need that the program addressed, and to facilitate the process of learning about how to implement the system in different contexts around the country. Implementing partners have worked closely with provincial and district health executives in program planning and coordination, decentralized day-to-day management to the district level, and allowed for context-specific customization of courier schedules and routes. The implementing partners have employed a consultative approach, rather than passing down an overly prescribed program.

FIGURE 4. MOTORCYCLES AT RFH HEADQUARTERS

RFH has established a set of systematic procedures for planning and coordination in each district. Start-up in each district includes an initial meeting with the provincial and district medical officers and health executive teams, meetings with laboratory staff, and baseline assessments with key stakeholders including health workers and laboratories. RFH then works closely with the district TB coordinator in each district to plan routes and recruit a courier, including the identification of a back-up rider.[28] This collaborative planning process appears to have resulted in a good working relationship between the implementing partners and district health executives.

Day-to-day management and supervision of the couriers is decentralized to the district level,[29] which results in efficiencies in implementation. Couriers can directly work with district management teams to address commonplace issues or questions, and only need to consult the RFH central offices for specific issues such as breakdowns or monthly reporting. Major concerns are handled by RFH. For example, TB CARE ST system couriers have fuel allocations from RFH which allows them to avoid potential interruptions in fuel supply, and helps keep the system running smoothly.

Communication between couriers and health system personnel, including health workers and laboratory staff, was consistently reported to be open and constructive. In many cases, respondents noted that couriers often communicated by phone with health workers or laboratory staff when needed, to relay important information or alert them of any potential delays. In some rural districts, some couriers said that they would call clinics that would be passed on a given day's route to inquire about whether they needed anything delivered, such as request forms, drugs, or sputum cups. In this way, the couriers serve as a communication link between central and peripheral facilities.

Couriers and health workers enjoy a good working relationship
"[The courier] is very good, he is excellent. Even yesterday I was telling him – you are good, you are really doing your work."

The TB CARE ST system is consistently reliable across districts. While the details of each district system vary slightly, they all share a set of common characteristics that include a clear and regular schedule, a consistent fuel supply, and couriers dedicated full-time to specimen transport. Fuel supply can be a persistent challenge for district vehicles, but ST system couriers have a dedicated allocation from the TB CARE program. ST system couriers are dedicated to specimen transport, and as such are able to adhere to schedules and maintain the type of regular pick-up and drop-off system that allows health workers and laboratory staff to plan effectively, including managing workloads and scheduling patient follow-ups. Patient trust in the system is also bolstered by the fact that test results are available on the day they return to the clinic.

The implementing partners have instituted a regular maintenance schedule based on time or distance, often referred to as the "zero break-down policy." There is a decentralized maintenance approach, whereby couriers visit a mechanic located in the province for maintenance and repairs, meaning that servicing needs can be met locally. Breakdowns or malfunctions were occasionally reported, though in most cases were addressed promptly by province mechanics or RFH central offices. As one indication of smooth program implementation, there were only a few instances in any of the districts visited where

FIGURE 5. COURIER SAFETY GEAR

[28] Back-up riders are typically selected from an existing cadre in the health system, such as an Environmental Health Technician, or a Field Orderly.
[29] This includes couriers that are employed by RFH, as well as those who had been identified through an existing cadre in the ministry/city councils, as was done in the urban districts.

the back-up rider had to be activated. In addition to ensuring safe functioning of the motorcycles, couriers consistently use safety gear, including riding jackets and reflectors, helmets, kidney belts, riding gloves, and other equipment.

Couriers consistently use logbooks to track mileage as well as to track specimens and results ferried. Health workers and laboratory staff are asked to endorse these logbooks daily, which fosters a high level of accountability for the couriers and implementers alike. Couriers are held to account for fuel and motorcycle use as well as adherence to routes and schedules; tracking the number of specimens and results ferried reflects on courier performance as well as the functioning of the system as a whole. Using the RFH monitoring databases, which contain aggregated information for each district from courier logbooks, the evaluation team was able to extract data on the number of TB specimens and TB results ferried by the couriers in program districts since the start of the program. Figure 7 and Figure 8 show the trends over time of the first three urban districts, and the first five rural districts.

The number of TB specimens and results ferried are expected to correspond, though the number of results transported may at times be lower as a result the fact that other vehicles in districts can contribute to specimen transport, for example when conducting supervision and support or outreach visits; however, these vehicles would be expected to ferry results more often than they would be expected to ferry sputum specimens. Seasonal fluctuations are largely influenced by patterns of migrant workers returning to Zimbabwe in the last 2 quarters of each calendar year. One visible pattern is the number of results far exceeding specimens early in the program (Figure 7). Back-logs of results at the laboratories can manifest in a very high number of results transported at the start of the program; whereas positive results may be communicated by phone or otherwise to clinics in order to start patients on treatment, negative results are not given such priority. Without a dedicated ST system, the hard-copy results may accumulate at the laboratories. The introduction of the ST system provides a way for these hard copies to return to the clinics.

Other non-cyclical upticks or down-turns can be influenced by events occurring within districts, such as short-term outreach programs or other factors.[30] For example, in the first three quarters of 2013 in Harare, a sputum collection outreach program resulted in a surge of specimens transported. District-level data sometimes show increases in the number of specimens collected after an initial period when the health workers and community are getting used to the program. Subsequent surges do not necessarily reflect a surge in TB in the community; rather, this could be explained by the fact that patients in the area needing a diagnosis might have previously been unable to travel to district facilities, and the ST system now allows health workers to take and send their sputum specimens to the laboratory. According to RFH, the level of specimens ferried then converges to a normal pattern.

FIGURE 6. TB CARE ST SYSTEM COURIER MOTORCYCLE

[30] Riders for Health staff have a thorough knowledge of the reasons behind dips, peaks, and other seemingly unexpected trends in the data. However, such information had to be obtained during in-person meetings, and was not systematically recorded as part of the database, to explain unexpected trends to any users of the database. Implementing partners could consider ways to systematically capture explanations for unexpected patterns alongside the data in the M&E database to enable wider use by government partners and other TB stakeholders.

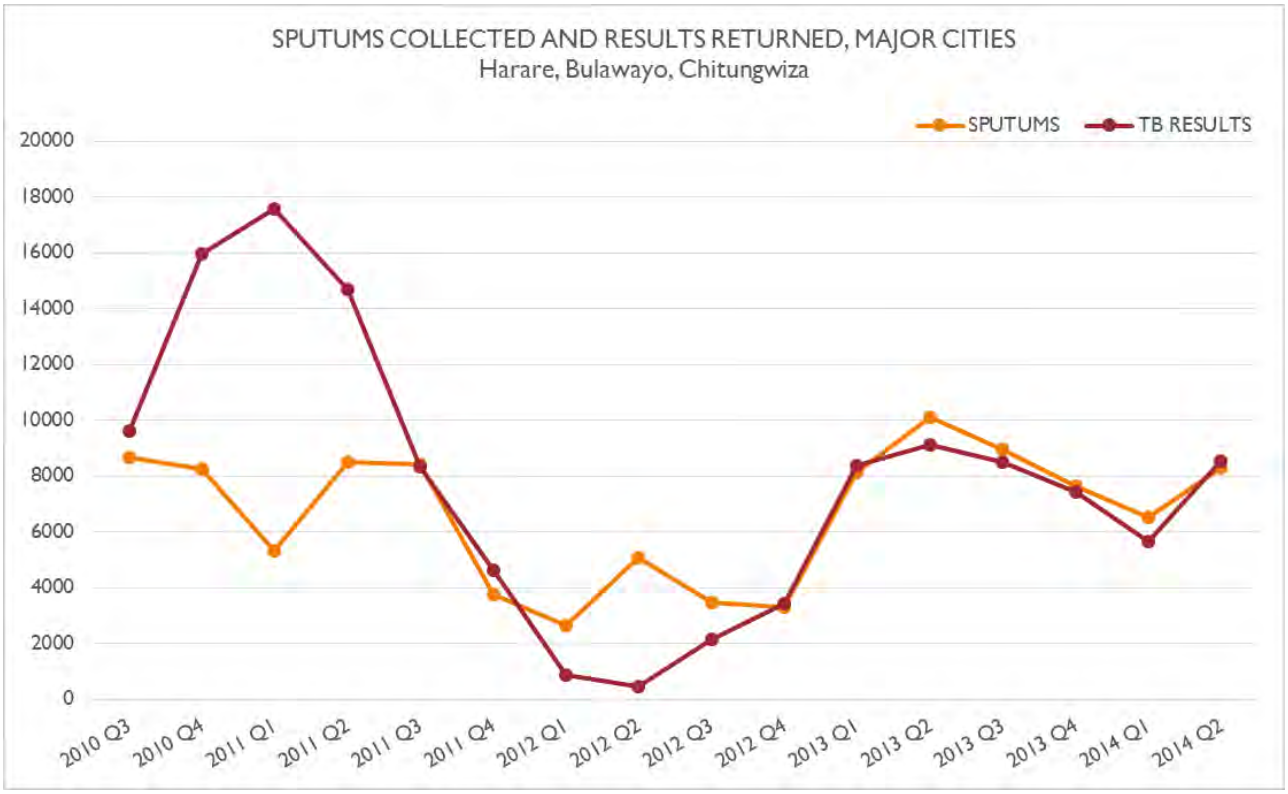


FIGURE 7. SPUTUMS COLLECTED & TB RESULTS RETURNED: MAJOR CITIES, SINCE 2010

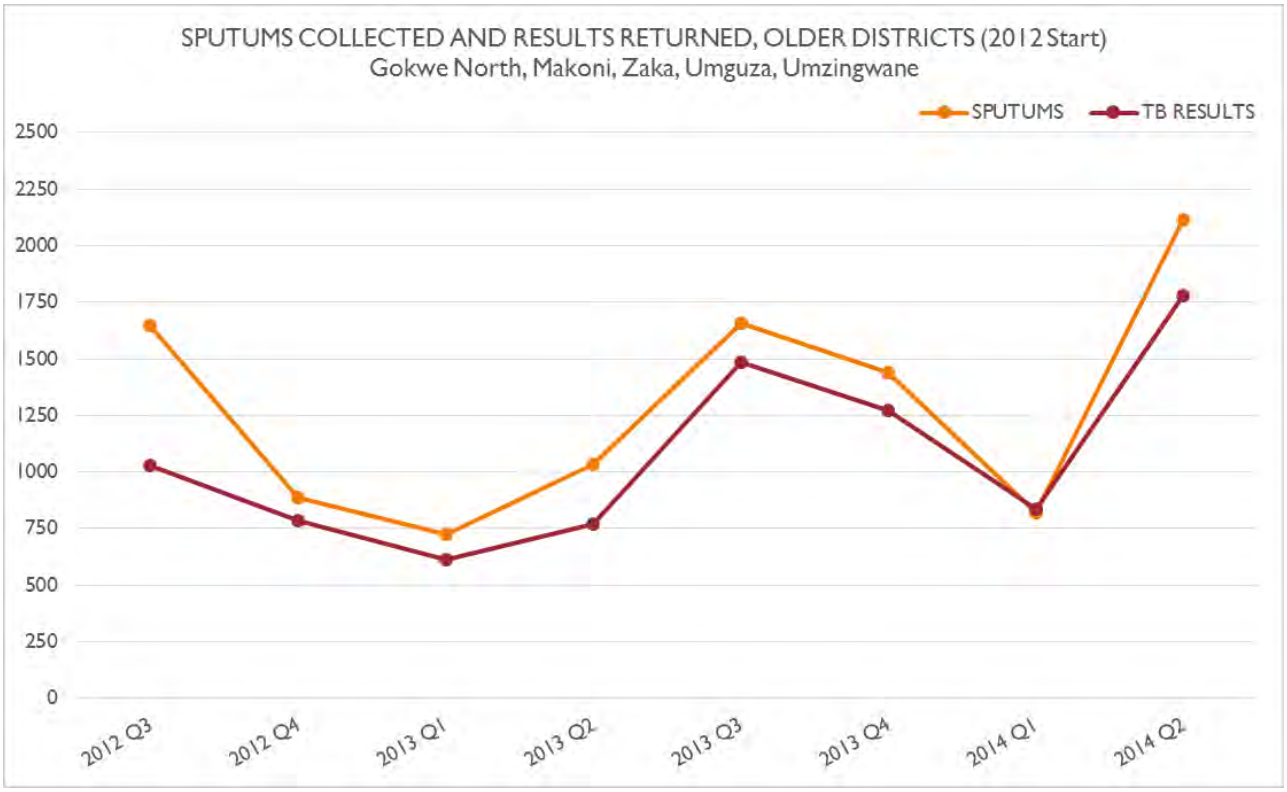


FIGURE 8. SPUTUMS COLLECTED & TB RESULTS RETURNED: OLDER DISTRICTS, SINCE 2012

Stakeholders interviewed across geographic contexts express a high degree of satisfaction with implementation to date. Respondents were asked to provide their subjective assessment of the overall quality of implementation, by giving a rating of 1 through 5. While generalizability is limited by the small sample size, the results are suggestive of a high degree of satisfaction with program implementation among respondents interviewed. Average ratings are shown in Figure 9. Laboratories tended to rate lower because of dissatisfaction with specimen packaging and labeling, which is somewhat external to the performance of the system itself, but is addressed in the following section.

Ratings were elicited using a Likert scale where 1 is the worst rating, and 5 is the best rating.

FIGURE 9. SUBJECTIVE ASSESSMENT OF THE QUALITY OF ST SYSTEM IMPLEMENTATION

Summary of Implementation Challenges
• Couriers cover longer distances on more challenging terrain in rural areas
• Sensitization of clinics and laboratories does not occur uniformly across all districts
• The in-kind supply of safety provisions for couriers is not occurring consistently across districts
• Carrier boxes of variable sizes can present challenges to couriers
• Sputum cups of variable sizes can present challenges for packing carrier box efficiently
• Some couriers may be burdened by requests for off-route errands
• Courier requests are occasionally met with delayed responses
• Gaps in training of health workers on specimen collection, handling, and packaging

Couriers cover longer distances on more challenging terrain in rural areas. To date, one courier has been allocated to each of the rural districts, with a small number of exceptions, regardless of geographic spread or terrain. This may present a key limiting factor to continued success of the program, as some of the couriers in larger districts may be more prone to burn-out or turnover, and because a single motorcycle bears the burden of the full set of distances to cover health facility-to-laboratory routes each week. In large districts, covering long distances regularly could shorten the motorcycle lifespan, even if servicing occurs according to a best-practice schedule. The perceived desire to have a courier density that has high cost efficiency yields (e.g. specimens ferried per courier) could be resulting in under-servicing of rural districts with lower courier numbers, and overstretching the couriers with long routes on bad terrain; major cities all have multiple couriers. Recommendations for additional couriers in some districts, which have been developed by implementing partners, merit serious consideration.

Despite a clear plan in place for sensitization of clinics and laboratories on the ST system, trainings do not appear to occur uniformly across all health facilities and laboratories. Some health facilities and laboratories were not properly sensitized before the system started. Similarly, while RFH engages laboratories to provide couriers with training on specimen handling. It appears that this did not materialize for some couriers. Some reported that they had not yet received specimen handling and infection control training from laboratories, as originally planned.

FIGURE 10. COURIER PACKS CARRIER BOX AND TRAY USING GLOVES SUPPLIED BY CLINICS

While infection control provisions for couriers are supposed to be supplied by clinics and laboratories, as part of the agreed-upon MOHCC in-kind contribution to the ST system, this does not appear to occur consistently. Couriers are supposed to be supplied with certain infection control provisions (e.g., medical gloves, mouth masks, and cleaning detergents/disinfectants) by the clinics and laboratories. This may not be communicated clearly to clinics, as some reported giving such materials as a favor, while others questioned why the courier did not have his/her own supply of these materials. In some areas couriers were foregoing the use of gloves or disinfectant, for example, in order not to burden health workers and labs with repeated requests.

Couriers face occasional challenges related to equipment, including variable sizes of carrier boxes and sputum cups. Variations in the size of carrier boxes are due in part to changes in the way RFH has procured these boxes over time. Small boxes are often not large enough to fit all specimens on a given route or day, especially in urban areas. In such cases, couriers may make extra trips to the laboratory, before proceeding on the route (Figure 12, left panel). This puts pressure on the courier to maintain their schedule despite the detour, and adds distance to the route. Alternatively, in some cases the carrier boxes appeared to be too large for some couriers (Figure 12, right panel). One courier mentioned that this blocked the rear view, and also easily breaks off the anchoring on the motorcycle. RFH has a long-term view to provide all couriers boxes of a standard size, procured locally, which may ameliorate some of these challenges. Similarly, the use of variable sizes of sputum cups can prevent efficient packing of carrier boxes. RFH has provided some couriers with a foam tray, made by indenting the surface with holes that match the size of a certain sputum cup. While the intention is to facilitate efficient packing and help prevent spillages, some clinics use cups of varying sizes, which do not fit into the indented tray.

FIGURE 11. COURIER MOTORCYCLE WITHOUT ADEQUATE CARRIER BOX

FIGURE 12. CARRIER BOXES OF VARYING SIZES

Requests for off-route errands may challenge courier adherence to planned schedules and routes. In some cases, couriers are asked carry out off-route tasks, such as running errands to various facilities, or in some cases delivering mail to the post office. In general, the courier system has been recognized for its potential to serve as a physical link between central and peripheral facilities (see *Integration* for further elaboration). However, it is important to note that an abundance of requests that are not aligned with the courier schedules or routes have the potential to divert his/her attention, timeliness, and may affect morale. The team noted that the instances where this was noted as a challenge tended to be in places where the courier had been identified from an existing cadre in the health system.

Generally, the decentralized approach to management is an element of program success, but in a few cases, responsiveness to courier requests is delayed. For example, there are occasional reports of delays in routine or unscheduled maintenance; one courier described having cycled through multiple faulty bikes, while another experienced a delay in getting spare parts.[31] Other examples included a logbook that had not yet been replaced, and delays in receiving materials needed to repair the carrier box attachment, resulting in makeshift solutions (Figure 11), or a reliance on satchel bags for packing sputum specimens, which is supposed to be used for blood samples and other specimens. Overall, such challenges appeared to be the exception to the rule.

There also appear to be gaps in training for health workers around specimen collection, handling, and packaging. Noting that this issue is outside of the direct control of implementing partners, it may still hinder the program. Health workers in different districts described practices that varied widely. Some health workers reported properly triple-packaging sputum cups, while others took minimal packaging measures, even leaving them outdoors in a box or in gloves, sometimes without checking contents, closure, labeling, or packaging. There is also varied understanding of specimen viability, i.e. the amount of time a specimen remains viable for testing while packaged properly, which affects specimen collection practices (see *Contextual Factors* for further elaboration.)

Couriers contribute to improved specimen handling and packaging

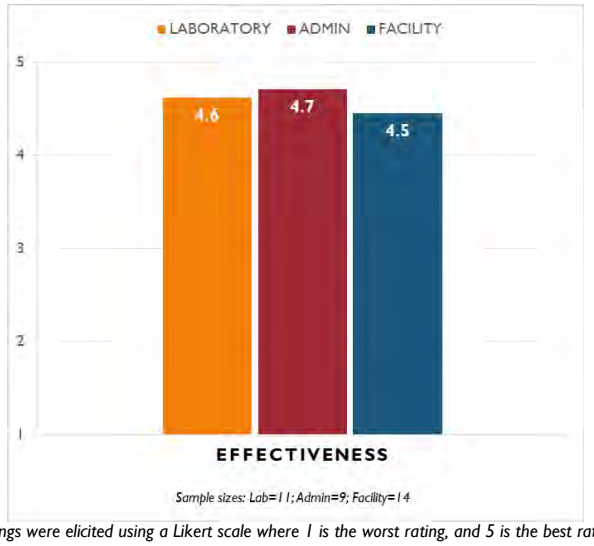
"Previously we were just leaving the sputum specimens anywhere on a table, with first the forms on the table, and then the sputums on top, the form and sputum container were not attached together. ***But the courier showed us how to do it properly.*** *We package it together with the lab request form. We put a strap around the sputum container [sealer tape] to make sure it's fully sealed and won't spill. Then we put the form on the container with elastic. We put them all together in a box, the cardboard box, which is closed and only opened to put more sputums in. The courier wears gloves, then takes the box and transfers the samples from within that box into the sample cooler box on his bike. He keeps a box of gloves (medical gloves) inside his cooler box. "*

[31] Without triangulating with all province-level mechanics, it is difficult to pinpoint the root of some of the maintenance and servicing issues.

EFFECTIVENESS

How has the medical specimen transport system strengthened the diagnosis of tuberculosis and other diseases in the supported areas of Zimbabwe?

Program effectiveness was broken down into the three sub-themes identified in the evaluation questions: access, timeliness, and treatment.[32] For each of these sub-themes, the evaluation team assessed successes and challenges, as well as external, or contextual, factors that also influence program effectiveness. After discussing of each sub-theme during interviews, respondents were asked to rate their subjective assessment of the overall effectiveness of the ST system, considering access, timeliness, and treatment together. Again, while sample size limits generalizability, respondents rated the overall effectiveness of the program favorably (Figure 13).



Ratings were elicited using a Likert scale where 1 is the worst rating, and 5 is the best rating.

FIGURE 13. SUBJECTIVE ASSESSMENT OF ST SYSTEM EFFECTIVENESS

FIGURE 14. COURIER MOTORCYCLE HOUSED AT DISTRICT HOSPITAL

[32] The evaluation team focused on information and indicators that could be obtained through qualitative interviews and secondary quantitative data, following the methodology. Some aspects of questions around program effectiveness suggest the need for a more rigorous impact evaluation with a valid comparison group, and thus could not be tackled as part of this evaluation.

ACCESS

How has the transport system improved access to TB diagnostic services?

Successes

• The TB CARE ST system has increased access to TB diagnosis at peripheral health facilities (clinics)
  ○ Clinics are sending sputum specimens, instead of referring patients to district facilities
  ○ Financial and opportunity cost barriers to patients seeking diagnosis have been reduced
• Health facilities are now collecting sputum specimens on a regular basis (daily or weekly)
• Widespread perception of increase in sputum specimen collection at clinics
• Widespread perception of reduced number of cases of TB smear not done

Challenges
• Improvements in access is variable between urban and rural areas because of daily/weekly schedule • In some districts, the ST system does not yet cover all health facilities

The ST system has resulted in increased access to TB diagnosis at peripheral health facilities (clinics). This is because clinics are now able to send sputum specimens for testing to the laboratory, instead of referring patients to district facilities. This means that the ST system has reduced physical, financial, and time-cost barriers to obtaining TB diagnosis for patients. In the majority of districts visited by the evaluation team, standard practice at health facilities prior to the introduction of the ST system was to refer patients to district facilities for TB diagnosis, which could be expensive and time-consuming for patients – sometimes prohibitively so – especially for those living one or two hundred kilometers from district facilities, or those too sick to travel. The ST system now allows clinics to take specimens from patients on site, and send them to laboratories for testing. This decentralization allows patients to access TB diagnostic services closer to where they live. To the extent that these factors prevented patients from seeking TB diagnosis, the ST system has expanded access in the community to TB diagnosis.[33] Decentralization also contributes to decongestion of patients seeking diagnosis at district facilities.

Similarly, the ST system has capacitated clinics to send sputum specimens to the district laboratory for testing on a regular basis (daily in urban areas, weekly in rural areas). The reliability of the schedule has instilled trust among health workers in specimen transport – a benefit which is passed on to patients seeking a diagnosis. The ability for health facilities to send specimens and receive results on a regular schedule means that sputum collection is also done on a regular basis at the clinics to match that schedule. Health workers are confident that the courier will come on the appointed day and time, to retrieve specimens and deliver results from the previous pick-up. The reliability of the system was recognized by all respondents, including TB patients. A more infrequent or irregular system would result in hesitance among health workers to collect specimens on site, since they would not be able to assure patients of a specific date to return for results. The certainty of receiving a result within a specified number of days increases health worker and patient trust in the system as a result.

District health executives recognize the value of ST decentralization

"Specimens collected are increasing. More people are being screened, and [we] have decentralized everything. [You] could find before the program that people were even sleeping at the district to wait to get their results! But now we can just phone clinics to give them positive results, and all the results go back to the clinics, and giving people their results implies a positive thing for others who they could otherwise infect."

It is important to acknowledge that many districts had existing processes in place for specimen transport, such as using district

[33] It is important to acknowledge that these findings relate to patients who are already willing to present at clinics with symptoms; it is out of the scope of this evaluation to explore other potential community-level barriers, such as stigma or other attitudes or practices that would prevent individuals from seeking care at a clinic altogether. To the extent that greater trust in the system diffuses in the community and prompts others to visit the clinic for diagnosis, greater access may be resulting among the community through increased willingness to present for diagnosis, as a result of the ST system. However, other outreach activities would be needed in order to achieve greater coverage of screening and testing, and therefore an increased number of patients accessing the system in general, leading to increased case detection rates.

vehicles during outreach visits or support and supervision. In some areas, other programs had been initiated by major MOHCC partners. However, based on observations and interviews, schedules tended to be infrequent (once or twice monthly), could be subject to fuel shortages, and often do not have the ability to transport specimen safely or quickly. Other methods, such as assignment of environmental health technicians (EHTs) or other staff to specimen transport, are also subject to irregularity, because of motor or fuel constraints or the need to attend to other priorities; for example, in rainy seasons EHTs could be engaged in malaria control for weeks at a time. For a patient that presents at the clinic the day after a district or EHT visit, health workers would not collect a specimen and wait for it to be retrieved weeks later, but rather would refer the patient to the district, or find alternative means of transporting the specimen, such as personal vehicles, public transport, or private motorists.

Health workers describe previous consequences of patient-side barriers to TB diagnosis

"Those who didn't go at all to the district would end up coming back to the clinic with the same symptoms, saying they didn't have money to go to the district. We would just have to start them on antibiotics, antibiotics, antibiotics…we would not be able to start them on TB drugs…

…Beforehand it was just amoxicillin, paracetamol, then they go home, they are coughing, they come back to the clinic. Amox-paracet-home-coughing-clinic-amox-paracet

…even sometimes we are out of amoxicillin so we were just giving paracetamol!"

One quantitative indicator of expanded access to TB diagnostic services would be the proportion of TB suspects that were tested for TB with sputum smear microscopy.[34] However, assessing changes in this indicator would have involved comprehensive data abstraction in a large sample of clinics nation-wide from both program and non-program districts, going back several years, in order to be able to make statistically valid conclusions. The evaluation team was not able to conduct this type of data collection, but supplemented qualitative interviews with questions asking about changes in access at clinics and also with analysis of quantitative data from the NTP.

Respondents were asked to state their perception about how sputum specimen collection at clinics had changed since the start of the ST system; 85% reported an increase in sputum specimen collection,[35] 5% reported no change, and 10% said they didn't know (Figure 15).[36]

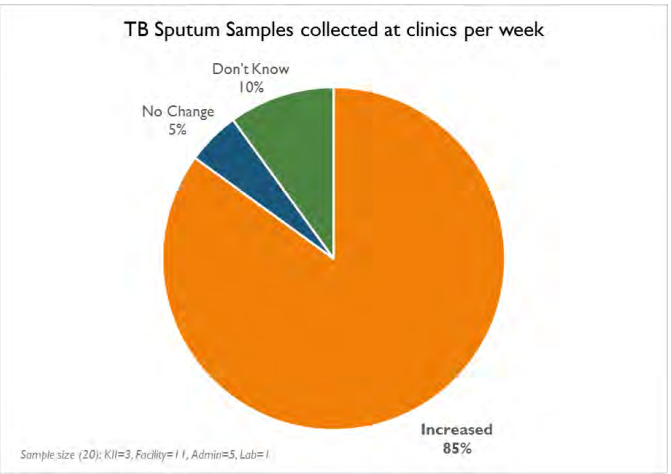


FIGURE 15. SUBJECTIVE ASSESSMENT: CHANGE IN CLINIC SPUTUM COLLECTION

[34] Stakeholders present at the evaluation team's debrief in Harare reiterated the importance of this indicator; as such, it has been included in the evaluation team's recommendations for follow-on studies, found in Appendix 3.

[35] Generalizability is limited by the small sample size, but the results suggest strong consensus among respondents and triangulate with other qualitative evidence.

[36] The evaluation team noted that in some cases where respondents reported "don't know" to this and other questions presented elsewhere in this report, it was because the respondent had not been working at the facility before the start of the program, and thus did not feel that they could answer this question confidently.

The evaluation team examined two quantitative indicators related to increased access to TB diagnosis: the number of TB suspects examined for TB diagnosis with sputum smear microscopy, and the number of TB cases with "sputum not done".

(1) Suspects examined for TB diagnosis with sputum smear microscopy (SSM)

Data showing the number of TB suspects examined for TB diagnosis with sputum smear microscopy (SSM) are presented below, obtained by extracting data from the NTP national database, for all districts in the country, on a quarterly basis since 2008. Figure 16 presents the data for districts with and without the program. Districts with the program are grouped by the dates at which the TB CARE ST system was introduced, to take into account the staggered-start nature of the program. In Figure 17, the same data is presented, aggregated to provinces with and without the program.[37] Assuming an underlying TB burden that is relatively stable (and therefore a relatively stable number of TB suspects)[38], one would expect that increased access to TB diagnosis would lead to an increase in the number of suspects examined with sputum smear microscopy.

Overall, the trend moves in the expected upward direction for all areas both with and without the TB CARE ST system, albeit at different rates.[39] In addition, these trends appear to have begun prior to the introduction of the ST system; the start of the ST system does not seem to bring about any distinct changes in these trends. The apparently pre-existing trend, and the fact that non-program areas display the expected trend as well, could be explained by a combination of factors. First, a widespread stabilization of the economy started in 2009, which reduced stock-outs of medications and supplies, and may have slowed turn-over or out-migration of health workers. Secondly, the TB CARE program has heavily supported NTP priorities of integrated HIV/AIDS and TB care and services. Efforts were directed toward screening HIV/AIDS patients for TB and vice versa, and health workers were trained and given support tools for TB screening, diagnosis, and management. The intensification of integrated services for HIV/AIDS and TB therefore could have contributed to the observed trends, both in areas with and without the ST system. It is also possible that non-program areas are compensating with other modes of specimen transport, though the evaluation team finds some evidence that such systems may not always perform as well as the TB CARE ST system (see *Non-Program Districts*).

A higher number of suspects examined within provinces is seen within provinces with the ST system (Figure 16). It is important to keep in mind that only 2 provinces (Mashonaland Central and Mashonaland East) are included among those without the ST program, which could be driving part of the observed difference, since the data presented are in absolute numbers. However, a higher *rate of increase* in suspects examined with sputum smear microscopy is also observed in the provinces with the program, which may indicate that province-level factors are also influencing TB indicators, such as resources, personnel, and management. TB burden could also be an important factor influencing the observed trend; those with the program may have more suspects in general, given that they cover urban areas, and many areas with mining, and those that contain higher proportions of migrant workers.

The absence of a clear effect in the national data of the TB CARE ST system does not contradict the findings presented above, and in Figure 15. Rather, they can be seen as complementary. While the ST system may not have brought about changes in the overall trend of this indicator nationally, the ST system has allowed *clinics* to carry out the responsibilities of sputum specimen collection, decentralizing diagnosis during this time from district to peripheral facilities.

[37] Note that not all districts in program provinces are program districts. Individual graphs for the first eight districts (Harare, Bulawayo, Chitungwiza, Gokwe North, Makoni, Zaka, Umguza, and Umzingwane) are provided in Appendix 2.

[38] The World Health Organization (WHO) Global TB Report (2014) shows relatively stable (albeit slightly decreasing) TB burden (prevalence and incident cases estimated) between 2008 to present, the years represented in the figures below. See Appendix 3 for the evaluation team's recommendations for follow-on studies.

[39] There are some exceptions at the individual district level. District level data are presented in Appendix 2.

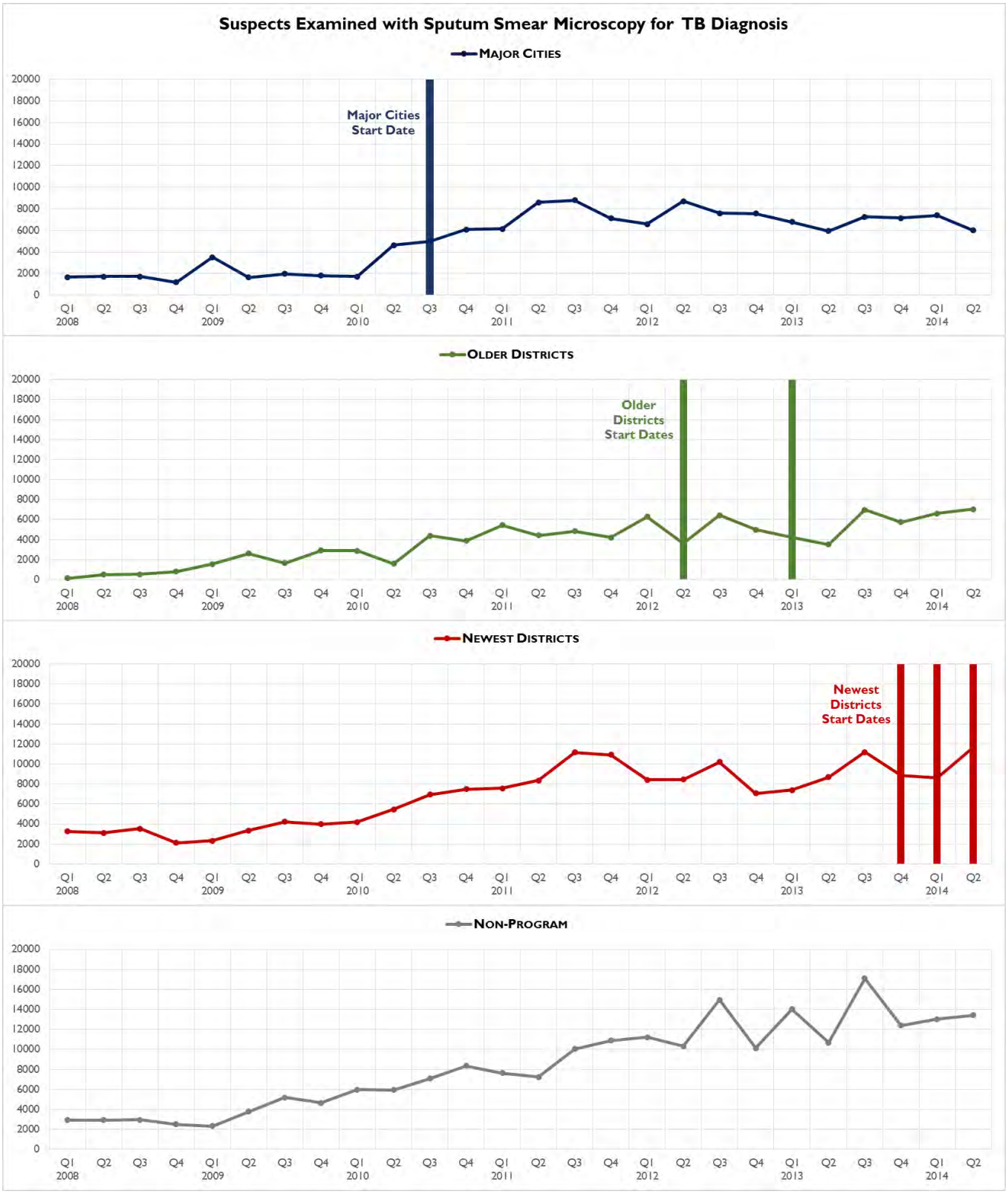


FIGURE 16. TB SUSPECTS EXAMINED WITH SSM FOR DIAGNOSIS (DISTRICTS), 2008-2014

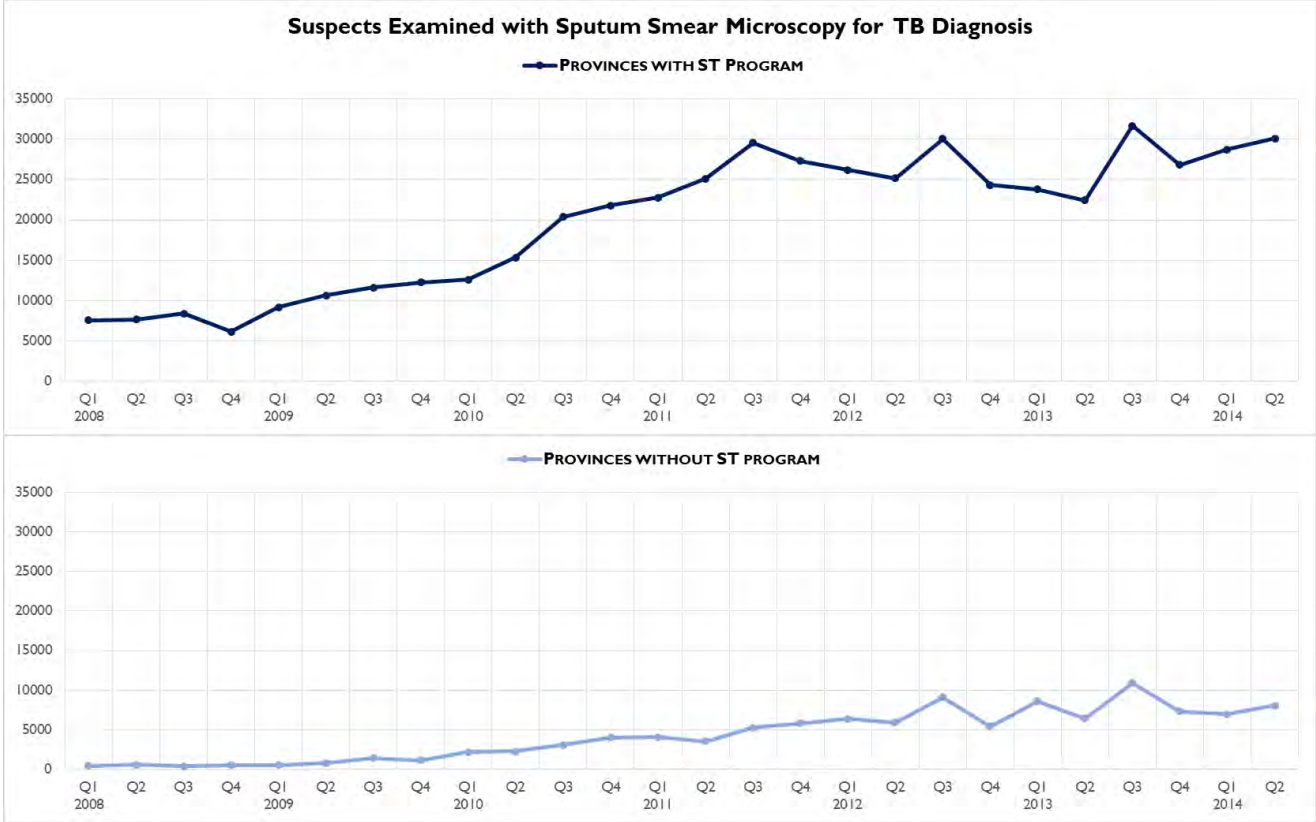


FIGURE 17. TB SUSPECTS EXAMINED WITH SSM FOR DIAGNOSIS (PROVINCES), 2008-2014

(2) Cases of TB "Smear Not Done"

Patients who have been diagnosed with TB *without* a sputum smear microscopy are designated as "TB smear not done." These cases results in diagnoses through other means, such as when a physician decides to start a patient on TB drugs on the basis of a chest x-ray or their clinical condition.[40] NTP guidelines and strategic plans aim to limit the number of cases of TB with sputum not done. As a part of increasing access to TB diagnosis, the ST system would be expected to facilitate a decrease in this indicator. As described above, patients now have increased access to TB diagnosis closer to their home at clinics, and therefore face fewer barriers in seeking a diagnosis. Most physicians are stationed at district facilities. Since only physicians, and not nurses or lower cadres, are authorized to initiate a patient on TB treatment without a sputum smear microscopy result, there is a higher likelihood of a reduction in smear not done when TB diagnosis is increasingly decentralized to the peripheral clinics.

Data for this indicator are presented below. First the evaluation team asked respondents for their perceptions of changes in this indicator since the introduction of the ST system in their district (Figure 18). Second, the team extracted data from the NTP routine monitoring database for all districts in the country, on a quarterly basis since 2008. (Figure 19, Figure 20). Figure 19 presents the data for districts with and without the program. Districts with the program are grouped by the dates at which the TB CARE ST system was introduced, to take into account the staggered-start nature of the program. In Figure 20, the data is presented aggregated to provinces with and without the program.[41]

[40] The national TB guidelines dictate that all TB suspects should be first have a sputum sample tested via sputum smear microscopy, and only if it comes back negative, the next step is to obtain a chest x-ray.

[41] Note that not all districts in program provinces are program districts. Individual graphs for the first eight districts (Harare, Bulawayo, Chitungwiza, Gokwe North, Makoni, Zaka, Umguza, and Umzingwane) are provided in Appendix 2.

There is widespread agreement among respondents, about a decrease in cases of "TB smear not done" as a result of the ability to send sputum specimens and receive results reliably. When respondents were asked to reflect on changes in the number of cases of TB with smear not done, 76% reported a decrease in smear not done since the start of the ST system. No change was reported by 10% of respondents, and 14% said they didn't know, often because of their inability to consistently track patients that had been referred to the district for diagnosis.[42]

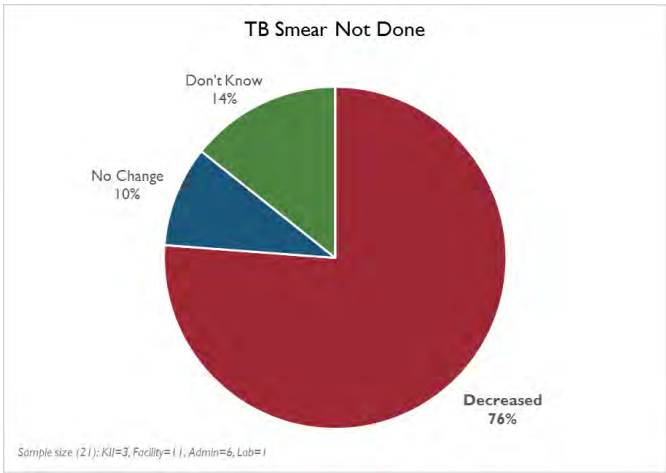


FIGURE 18. SUBJECTIVE ASSESSMENT: CHANGE IN TB SMEAR NOT DONE

Figure 19 and Figure 20 below present the national data from the NTP database, comparing areas with and without the program. As with the previous indicator, all areas follow the expected downward trend over time, albeit at different rates, and the introduction of the TB CARE ST system does not seem to exert any visible effect on the level or trend of this indicator in the areas with the program.

Similar explanations as for the previous indicator apply here as well. That is, pre-existing trends and comparable program/non-program area trends could be influenced by improvements in the economic situation which result in fewer stock-outs in clinics, hospitals, and laboratories and a more stable health workforce (likely contributing to the precipitous decline seen in some areas after 2009); integrated HIV/AIDS and TB services instituted through concurrent TB CARE activities could precipitate better screening and increased laboratory diagnosis for TB; and compensation in non-program areas with other modes of specimen transport. Figure 20 shows that areas with the TB CARE ST system experience a much more dramatic a rate of decrease for this indicator over this time period, compared to areas without the program. However, in addition to the likely influence of diffuse economic stabilization, it is important to note that the starting level is about five times higher in provinces with the ST system, and as above, it is important to keep in mind that there are only two provinces without the program (Mashonaland Central and Mashonaland East). Also, those provinces with the program may have different underlying TB burdens, as well as other hard-to-observe characteristics such as readiness to implement TB control programs.

The observed trends for this indicator may also suggest "last mile" challenges. In other words, it may be easier to reduce the indicator from a higher starting point, by implementing system-wide interventions such as reducing stock-outs, training health workers, or decentralizing diagnosis to clinics. Addressing a small number of incidents after such interventions are in place can be more challenging.

[42] Generalizability is limited by the small sample size, but the results suggest strong consensus among respondents and triangulate with other qualitative evidence.

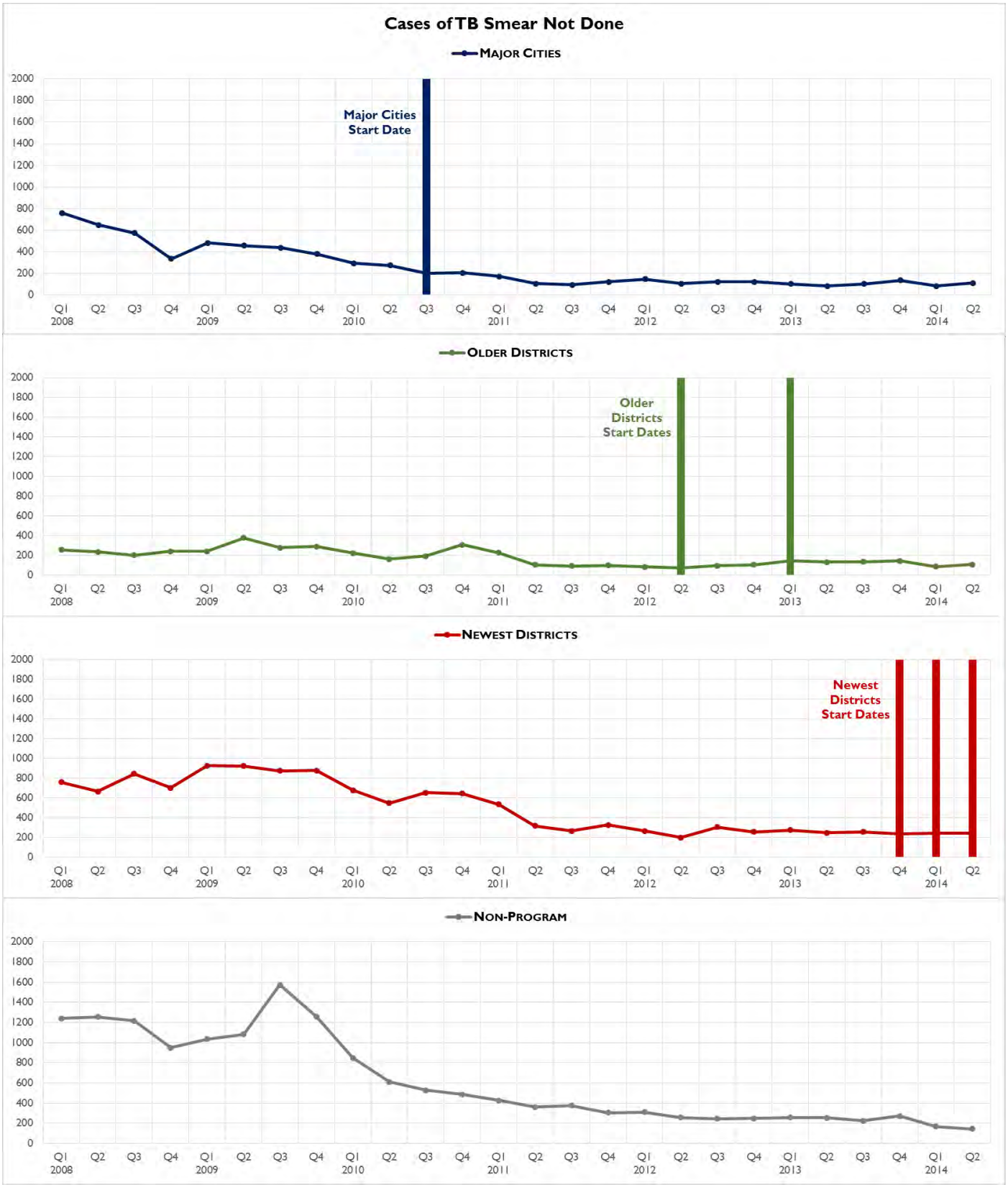


FIGURE 19. CASES OF TB SMEAR NOT DONE (DISTRICTS), 2008-2014

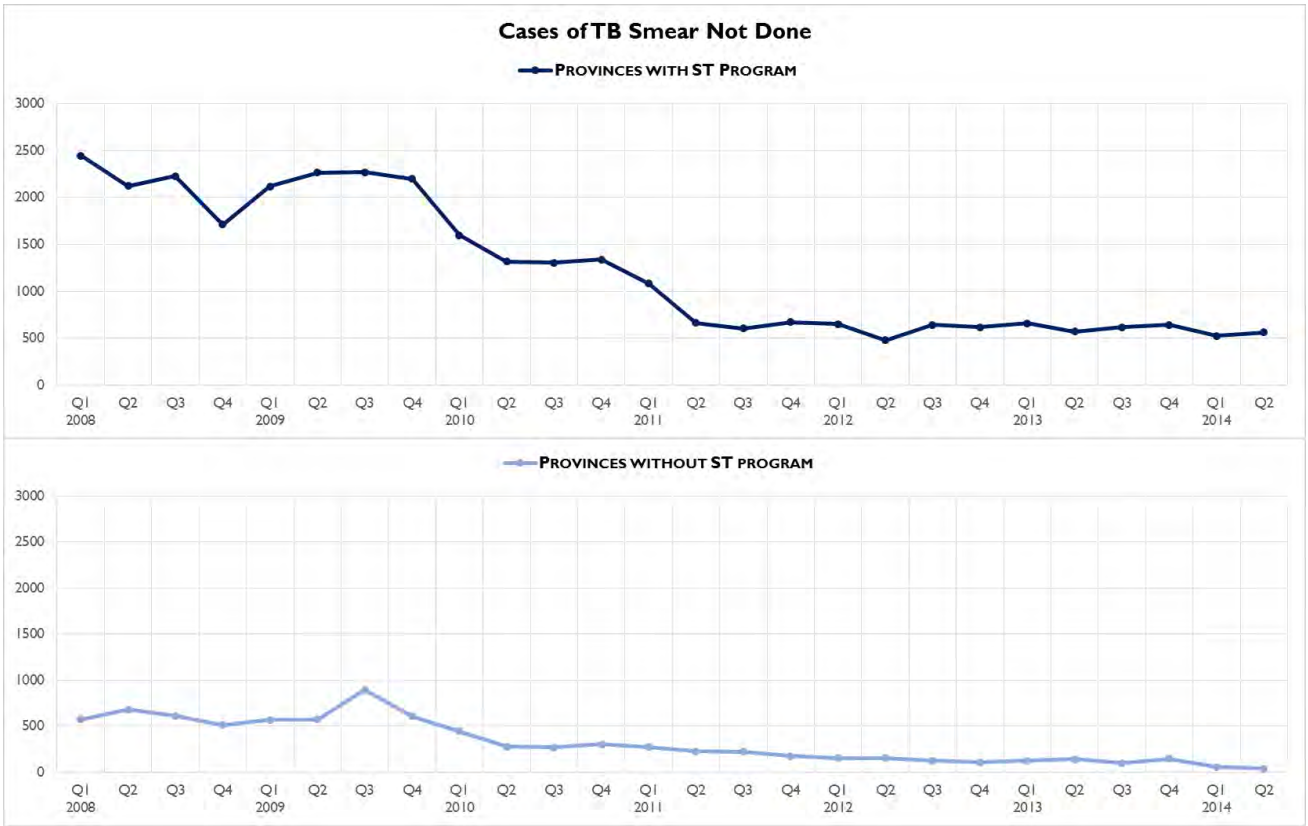


FIGURE 20. CASES OF TB SMEAR NOT DONE (PROVINCES), 2008-2014

Increases in specimen collection and improved convenience to patients vary between urban and rural areas. In urban areas, the ST system is available to health facilities on daily basis as compared to the rural facilities where each facility is visited by the service once per week. While decentralization facilitates access closer to a patient's home, there are still improvements that could be made to increase access to TB diagnosis for rural populations, since the weekly schedule often means that health facilities do not actually collect sputum specimens from patients on a daily basis; rather, health workers tend to wait until the day or two before the courier is scheduled to arrive to collect specimens. This means that patients who have already come to the clinic are often asked to come back in a few days when the clinic is prepared to collect specimens.[43] The main reasons driving these specimen collection practices relate to storage capacity and health worker training (described further in *Contextual Factors*).

In some districts, not all health facilities are covered, which means that improvements in access to TB diagnosis do not extend to the entire district populations. Some districts with the program are implementing the ST system in a small section of the province, for example in a town or urban center. Patients with greater distance and time burdens to reach a facility, in other more rural parts of the district, are therefore not necessarily reached by the program at this time. It should be noted that in some cases, the evaluation team did hear reports of intentions to expand the program to other areas within these districts, with a view toward full coverage.

[43] Where clinics follow the method of taking one specimen on the spot, and another specimen the next morning (spot-morning), patients may also be asked to come back more than once.

TIMELINESS

How has the transport system improved timeliness of TB diagnosis?

Successes
• Regular and reliable schedule leads to consistent daily (urban) and weekly (rural) turnaround times   ○ Positive test results are communicated with even greater urgency in most cases • Consistent reports of decrease in turnaround time by those who had some existing ST processes • In some cases, courier returns to clinics as needed, ad hoc, to pick up specimens or deliver results
Challenges
• Timeliness is variable between urban and rural areas, largely by design (daily versus weekly) • In some areas, findings suggest the presence of unreliable or inconsistent back-up systems

The ST system appears to have increased the timeliness of TB diagnosis at clinics by reducing the turnaround time (TAT) from specimen collection to return of results. As described in *Implementation*, patients in urban areas receive results the next day, and patients in rural areas receive results in one week, from the time their specimens are picked up at clinics. Health workers and administrators report that prior to the program, existing specimen transport (e.g. through the use of district vehicles or other health personnel) could take a week or more in urban areas, and up to several weeks or months in rural areas. Many health workers reported previously having to throw away specimens when they were not picked up in time, due to perceptions that they would no longer be viable. As a result, many clinics did not collect sputum specimens from patients. As elaborated above, most health workers noted that before the program, they would usually refer patients to district facilities for diagnosis. As such, turnaround time would not have been an applicable concept since individual patient circumstances and means, combined with speed of service at district hospitals, would dictate how fast a diagnosis could be obtained.[44]

TB DIAGNOSIS TURNAROUND TIME:

1 day in urban districts

1 week in rural districts

This finding, however, should be considered in the context of how diagnostic results are communicated. Smear-positive (confirming TB) results are consistently communicated to clinics as soon as they are available in order to facilitate rapid initiation of treatment. Positive results are usually communicated by phone or instant messaging applications (either from laboratories or district administrators to clinics). Hard copy smear-positive results would then be available to clinics on the day the courier is next scheduled to return. So, verbal notification of smear-positive results may be comparable between urban and rural areas. Upon being notified of a positive result, clinics follow slightly varying procedures. Some call patients back to ask them return to the clinic as soon as possible to be put on treatment, even before receipt of the hard copy result. Others insist that the hard copy is available before starting the patient on treatment, and will call the patient or reach out via a community nurse or village health worker to ask them to come back on the same day that the courier is next expected, so that they can get their result and be initiated on treatment.

[44] Precise, quantitative estimates of TAT from specimen collection to return of results were not possible to collect as part of this evaluation. Turnaround time is not systematically monitored by the implementers or by the NTP. It would need to be calculated using data from the TB presumptive registers, extracting the dates that a specimen was collected and sent, and the date when the result returned. Some clinics noted also that the date when a specimen returned was not consistently entered into the register, so data quality would also be a concern. Reportedly, RFH periodically extracts some of this data during its half-yearly data collection activities, but this may not be sufficient from a routine monitoring point of view for tracking timeliness on an ongoing basis at a national scale. Therefore, estimates gathered as part of this performance evaluation are only those based on perceptions of the interviewees. Nevertheless, triangulation of results from stakeholders at all levels of the program, including patients, expressed their strong convictions that turnaround time had decreased. Likewise, the evaluation team also did not find any evidence of sample rejection rates at laboratories being tracked routinely by implementing partners or the NTP. These indicators would be important to monitor from the standpoint of trying to disentangle how practices at the health facilities and laboratories are affecting turnaround time and thus timeliness of diagnosis (since patients would have to be called back to provide another sample), versus how the transport system itself is affecting timeliness.

The increased timeliness of receiving smear-negative results is also important for TB suspects, who require follow-up testing and diagnostic services following a smear-negative result. National guidelines call for a repeat sputum smear microscopy test in presumptive TB patients (TB suspects) with smear-negative results before that same patient is investigated with chest radiography. Increased timeliness expedites process of getting a diagnosis in the case of smear-negative patients, who might otherwise have had to return a second and third time to a district facility for the same process. Some patients described having had to find accommodation near the district hospital to wait for results and referrals for chest radiography prior to the introduction of the ST system.

TB patients provide positive feedback on timeliness of ST system

"It's very reliable because every Tuesday and Wednesday the samples are collected from 8-10am for these specific days…"

"It worked very well since I got my results faster."

"It is useful because I was tested and given treatment faster; it cuts travel cost and you can do other activities while waiting for your results."

In some cases, couriers and health workers reported that the courier may return to clinics as needed, to pick up specimens or deliver results. For example, some couriers explained that if results were available for a clinic that they knew they would pass by, even if not their appointed day, they might stop there to drop off those results. In rural areas, this cuts the turnaround time under a week. In addition, some health workers reported that when they received a specimen from a patient who they evaluated to be an especially sick or urgent case, they may call the courier to ask if he/she would be willing to make an unscheduled stop to pick up those specimens. This demonstrates good communication and working relationship between couriers and health workers and indicates the flexibility of the system, though it may also suggest a need for greater frequency in rural areas.

In some cases, the team noted that times when the main courier was off the road because of motorcycle repair or other circumstances, back-up riders were reportedly not as strict in adhering to ST schedules. In some areas there is lack of a reliable back-up services in the event the motorbike rider is not available or the bike is out of service. This affects timeliness of diagnostic services, and weakens the reliability of the system as a whole. Back-up riders are usually identified by the districts, and included staff from a range of cadres, including TB coordinators, environmental health technicians, and field orderlies. The evaluation team noticed that field orderlies tended to function most reliably as back-up riders, since the myriad demands on other cadres make it more challenging for them to be conducting specimen transport full-time until the courier is back on the road. In a small number of cases, the team heard reports of the courier being off the road, with no back-up activated for up to several weeks, during which time regular specimen transport was not occurring.

TREATMENT

How has the transport system improved TB treatment?

Successes
• Among TB patients presenting at clinics, the ST system facilitates earlier treatment initiation and reductions in patients lost to follow-up before treatment initiation • The ST system facilitates better patient management, by allowing for consistent access to follow-up sputum specimen testing, so that cure or treatment failure can be ascertained
Challenges
• Any challenges faced in improving access or timeliness will limit contribution to improved treatment

Among TB patients presenting at clinics, the ST system facilitates earlier treatment initiation and reductions in patients lost to follow-up before treatment initiation. As a measure of program performance, TB treatment outcomes are more causally distant from specimen transport, compared to access or timeliness. However, the ST system's contribution was readily acknowledged by respondents, especially health workers. Respondents consistently explained that access to timely diagnosis leads to earlier treatment initiation (time to treatment), and reductions in patients lost to follow-up before treatment. As described in previous sections, the ST system facilitates access to timely diagnosis, and establishes the clinics as a central part of the diagnostic process. Prior to the program, when patients were referred or went themselves to district facilities for diagnosis, some would not return for care and treatment after providing their specimen or after receiving their result. Now, clinics are more involved, can schedule patient follow-ups to initiate treatment and leverage their resources (including relationships with village health nurses or community health workers) to coordinate outreach in the community to prevent loss to follow-up. Any challenges the program faces with regard to facilitating access and timeliness are similarly likely to impact time to treatment and loss to follow-up.[45] Improved treatment, with other efforts such as contact tracing, enables the health system to contribute to reducing infections in the community. Since untreated patients can be a source of new infections, better treatment helps stem the epidemic more broadly.

ST system improves monitoring of TB patient outcomes

"I cannot say per se whether the transport has contributed itself to better treatment but the TB program is evaluated by patient outcomes, especially the cure rate, and now at least we are able to have cure rates statistics because people are having sputums done. We no longer have the "not dones" – the national limitation for "not dones" is at 5% but this district, in the past, it could even go up to about 10%. Now we're much closer to 0%, unless there is a strong clinical reason to initiate a patient we always do sputums now. In one quarter we even managed to reach 87% cure rate, higher than national average. We have a lower defaulter rate."

The ST system also facilitates better patient management, by allowing for consistent access to follow-up sputum specimen testing, so that cure or treatment failure can be ascertained. NTP guidelines require that follow-up sputum specimens are tested after treatment initiation at two and five months, and at completion. A patient can only be designated as "cured" when at least two follow-up smear tests are negative for TB.[46] Without laboratory confirmation of smear conversion at the end of treatment (from positive to negative smear results), a patient can only be designated as "treatment completed". With greater access to sputum specimen testing, health workers are better able to ascertain cure, or otherwise suspect treatment failure, which would prompt drug susceptibility testing using GeneXpert technology, and possibly a new course of therapy.

[45] As with other indicators that could be used to monitor program performance, time-to-treatment from diagnosis, as a link between timeliness and treatment, is not routinely tracked by RFH or the NTP. Large-scale data abstraction, as described elsewhere in this report, would be necessary in order to use this indicator to track program impact on treatment of TB patients.

[46] The World Health Organization (WHO) definition of "cured" is: a pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear- or culture-negative in the last month of treatment and on at least one previous occasion. The definition of "treatment completed" is a TB patient who completed treatment without evidence of failure but with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable (WHO 2013).

Overall, 72% of respondents perceived a decrease in lost to follow-up before treatment initiation after the start of the TB CARE ST system, while 17% of respondents said there was no change, and 11% said that they didn't know (Figure 21).[47]

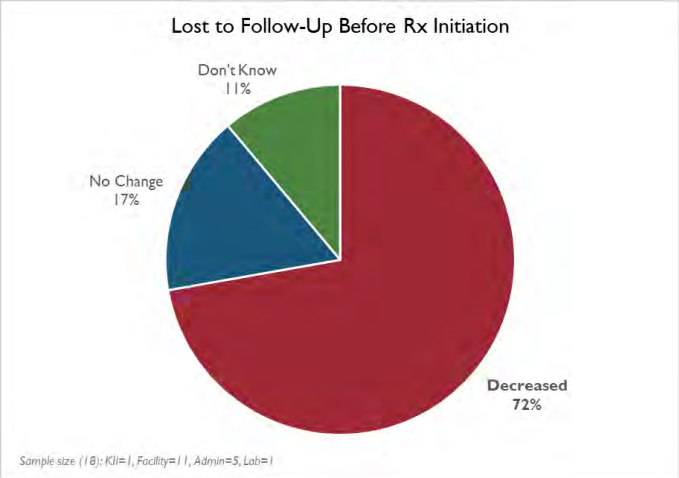


FIGURE 21. SUBJECTIVE ASSESSMENT: CHANGE IN LOST TO FOLLOW-UP

Two quantitative indicators from the NTP routine monitoring databases were examined in relation to TB treatment: (1) cure rates, and (2) treatment completion rates. These indicators are complements, as the "treatment completion" designation is only indicated where cure cannot be confirmed through laboratory testing. Cure rate and treatment completion rate for a given time period (e.g. quarter of the year) share the same denominator: number of TB patients registered in that period of time. Therefore, trends in cure and treatment completion rates are expected to move in opposite directions. Cure rate would be expected to increase with the introduction of the ST system because of the increased capacity to test follow-up sputum specimens during treatment of a TB patient; the inverse is true of treatment completion rate.

(1) Cure Rate and (2) Treatment Completion Rate

In Figure 22, these indicators are plotted together, by district, divided by start date as with the previous NTP indicators presented. Overall, both indicators remain relatively level over time with only slight increases or decreases and there are no clear differences between districts with and without the program; nor are there any clearly observable differences after the start of the ST system in program districts, where data was available. Overall, major cities appear to have a higher level of cure rate, between 70 and 90%, compared to other districts, and accordingly, a lower treatment completion rate, very close to 0% and never above 10%. In other program districts, cure rates fluctuate between 50 and 70%, and treatment completion rates fluctuate generally between 10 and 20%.

In Figure 23 and Figure 24, these indicators are plotted by province type. While provinces without the ST system generally display more variation over time, and provinces with the ST system are steadier over time, there are not any substantial, observable differences between provinces with and without the ST system on average over time. Cure rates fluctuate between 60 and 70% over time for provinces with the ST system, and between 50 and 80% among provinces without the program. For treatment completion rate, provinces with the program fluctuate between about 10 and 15%, while those without the program fluctuate between 5 and 25%.

[47] Generalizability is limited by the small sample size, but the results suggest strong consensus among respondents and triangulate with other qualitative evidence.

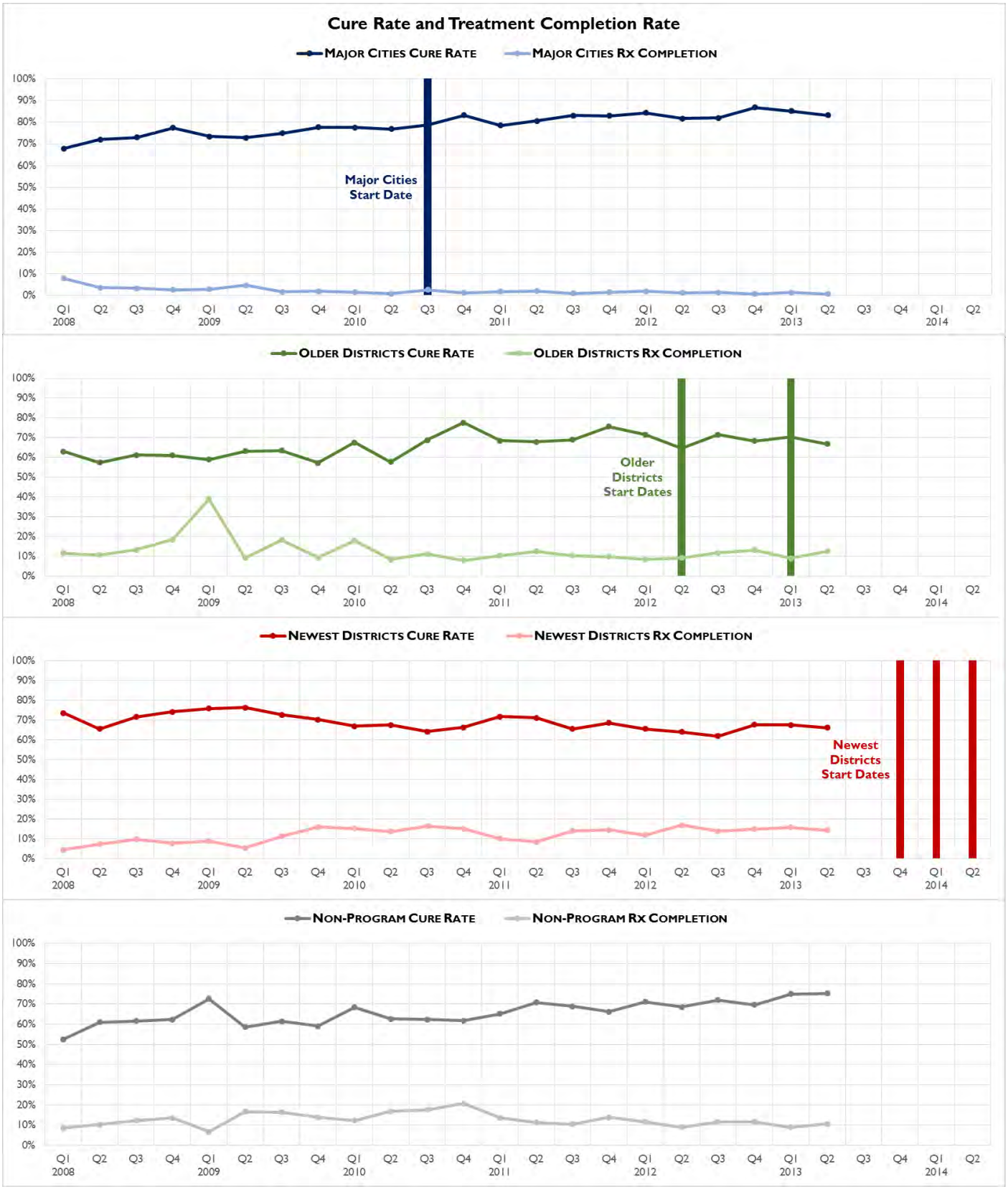


FIGURE 22. CURE RATE AND TREATMENT COMPLETION RATE (DISTRICTS), 2008-2014

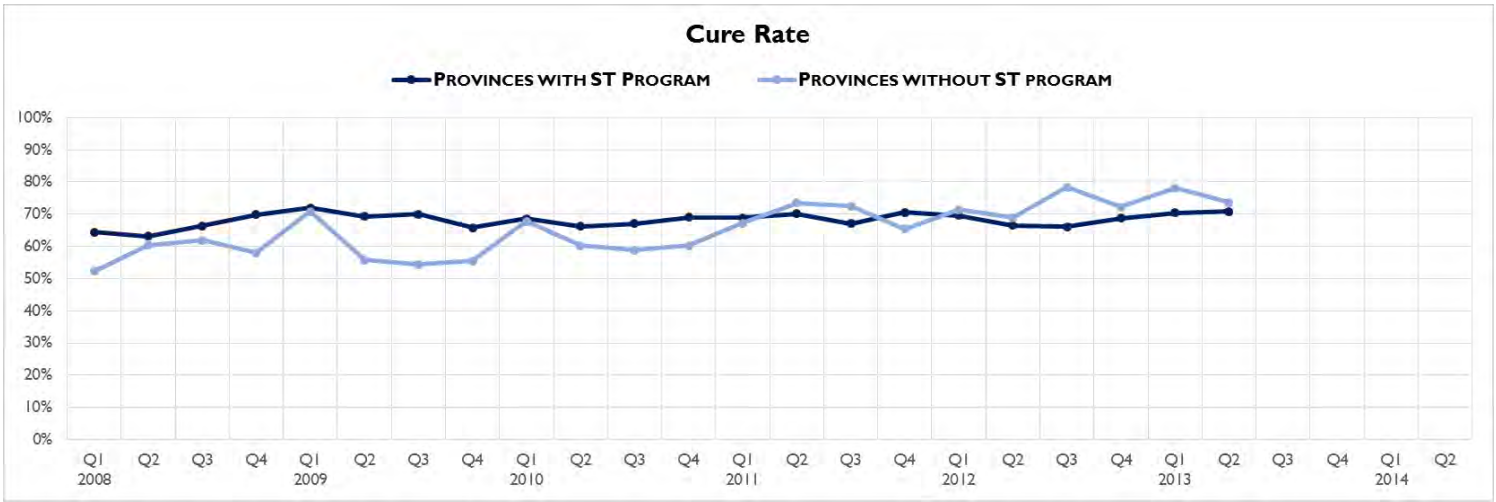


FIGURE 23. CURE RATE (PROVINCES), 2008-2014

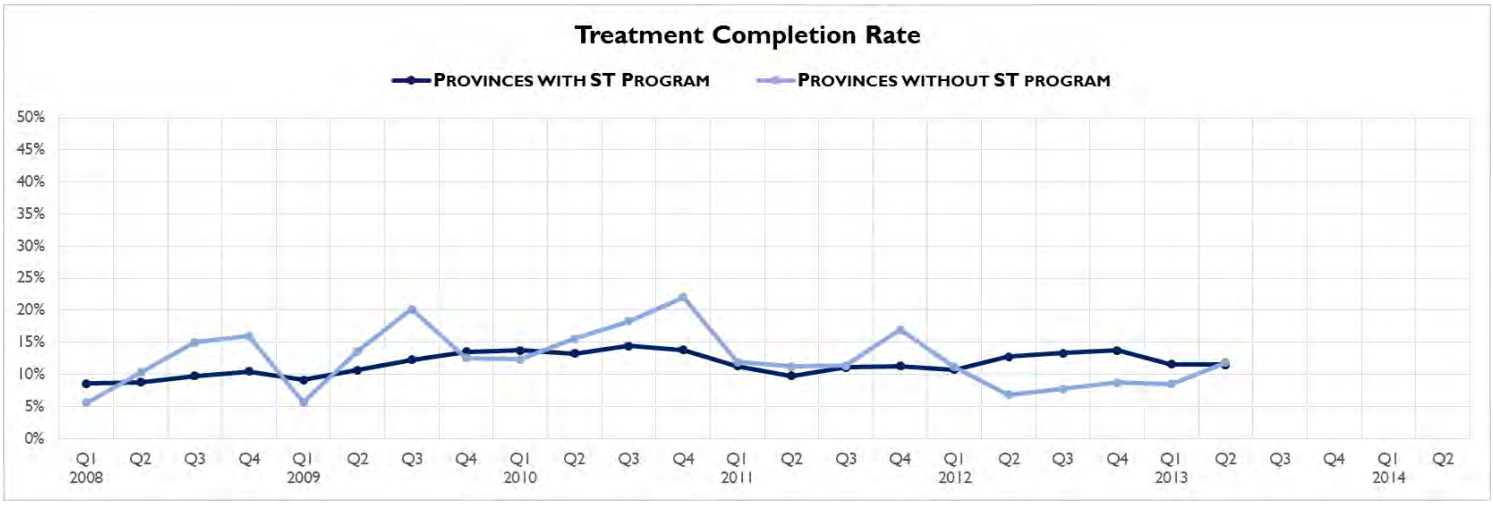


FIGURE 24. TREATMENT COMPLETION RATE (PROVINCES), 2008-2014

CONTEXTUAL FACTORS

The evaluation team also considered contextual factors, external to the ST system or out of the direct control of implementing partners, which nonetheless appear to either facilitate or potentially limit program success. These factors are summarized and described below.

Facilitating Factors
• Integrated diagnosis and treatment services for HIV/AIDS and TB • Introduction of microscopy centers and GeneXpert machines to districts • Diffusion of mobile technology and instant messaging applications to communicate results • Stable drug supply and reduction in stock-outs, national in scale • Health worker trainings as part of TB CARE and other NTP efforts • Community and clinic support (village health workers, DOTS observers)
Limiting Factors

• Lack of written SOP on sputum specimen collection at health facilities, labs, and for couriers
  ○ Inadequate specimen storage capacity
  ○ Misunderstandings about specimen viability
  ○ Improper specimen packaging practices
• Laboratory receiving schedules can sometimes be restrictive
• Occasional stock-out of sputum cups
• Laboratory challenges (workload, electricity, water, personnel, equipment)
• Communication challenges in reaching patients
• Stigma and discrimination in the community
• ST system addresses only a part of the broader TB program "cascade"

FACILITATING FACTORS

Some factors external to the TB CARE ST system have facilitated increases in patient access to TB diagnosis. First, the increase in HIV/TB integrated care, with increased screening for TB in HIV positive patients will have led to an increased number of TB tests done among HIV/AIDS patients in recent years. The results of this are likely at play in many of the quantitative indicators presented above from the NTP databases, as elaborated in greater detail in previous sections.

ST system and microscopy centers are mutually beneficial
"With the courier, we've also been able to take full advantage of the microscopy centers that we have opened, they are now fully utilized."

Secondly, in recent years, an increasing number of microscopy centers have been established at peripheral clinics around the country. At these clinics, a trained microscopist conducts TB testing on site. For these clinics, specimen transport is not necessary and results can be processed as quickly as the same day. However, these microscopy centers also facilitate greater timeliness within the ST system, since the distance between clinics and testing sites is effectively decreased and workload can be shared between district facilities and microscopy sites. For example, in many cases, especially in rural areas, couriers bring sputum specimens to the closest testing site to each clinic. In one district, the evaluation team was told that depending on a clinic's location, it was brought to either the district laboratory, or one of two microscopy sites situated at peripheral facilities. On the other hand, many respondents noted that the ST system facilitated increased utilization of the microscopy centers. One respondent expressed that the microscopy centers could not be used to their fullest capacity before the ST system was put in place. Similarly, the introduction of GeneXpert machines to some districts may also be considered a factor facilitating access to TB diagnosis; these machines provide diagnosis that also includes an assessment of drug susceptibility.

Courier schedules often dictate sample collection schedules at clinics

"We have one courier. Sputum collection is therefore done at the clinics on the day the courier is going to pass through, [because of] the viability of a sputum sample […] at room temperature. Therefore if there is a breakdown, the health facility will probably end up having to discard the samples, and try to recollect them from patients. In those cases, it's really up to the clinician to convince patients to return on a day closer to when the sputum is going to be picked up by the courier."

As described earlier, the use of mobile phones and instant messaging applications to communicate positive results to facilities ahead of the courier visit also contribute to timeliness of diagnostic services. In addition, the improved availability of TB medication and absence of stock-outs in TB drugs over recent years has also facilitated better treatment outcomes, and has allowed the ST system to function effectively with respect to its reliance on equipment and materials such as sputum cups, clinic stationary and lab request forms, and TB medications. Similarly, increased health worker training, as well as the availability of improved decision support tools in clinics, much of which has been supported by the TB CARE program and other NTP efforts, also contribute to improved access to timely diagnosis and better TB treatment. Lastly, community support through village health workers and DOTS observers also helps to facilitate early initiation of TB treatment patients, prevention of loss to follow-up, and retention of patients on treatment. While the ST system does not have the scope to conduct community outreach, community and clinic support contribute to increasing awareness in the community and encouraging individuals to seek early diagnosis for tuberculosis. This is especially relevant in view of the fact that the ST system can only be relevant when there is demand for TB testing in the community.[48]

LIMITING FACTORS

The most prominent factor that limits program success beyond its current levels is the lack of a written standard operating procedure (SOP) on sputum specimen collection procedures that can be used by health facilities, couriers, and laboratories alike. This SOP could address several points which are preventing specimen transport from operating at its full capacity, and therefore potentially limiting further gains in improvements in TB diagnosis, including:

- Inadequate specimen storage capacity,
- Misunderstandings about specimen viability, and
- Improper specimen packaging practices.

Health workers at clinics that do not store sputum specimens instruct patients to bring their specimens back on the day of the next courier pick-up. This affects rural clinics to a greater extent, since the weekly schedule means that patients may have to wait up to seven days to come back. If the patient is unable to return on a designated day, especially in a rural area, they risk missing the next pick-up and then diagnosis will be delayed. This practice is common even among clinics that use makeshift storage (e.g. designated areas of tables, cooler boxes outside the clinic, or cardboard boxes, often outdoors, as seen in Figure 25 and Figure 26), as most expressed a preference not to keep sputum specimens around the clinic, or otherwise expressed some understanding of the need to collect a fresh specimen because of specimen viability. The use of a cardboard box presents a potential biohazard. In one case, health workers reported leaving sputum specimens individually on the ground, just outside of the clinic, each wrapped in a latex glove. In some cases this means that they are unprotected from being disturbed by passersby or being mistaken for waste and discarded.

Many health facilities reported collecting specimens on the day the courier would be coming not just because of storage capacity but also because of their understanding of specimen viability; often the estimate of specimen viability was reported to have come from the laboratory or other health personnel in the district. Respondents of all levels reported substantially different understanding about the periods

[48] While there are several factors that bear on overall TB treatment outcomes related to healthcare quality and TB patient management, as well as adherence, the evaluation team has focused in this report on those that most likely influence treatment through channels of access to and timeliness of diagnosis.

of specimen viability, ranging anywhere from hours to months.[49] There were different opinions on the accepted time a specimen would still be tested after being collected leading to some facilities discarding sputum specimens after a certain number of days.

Improper specimen packaging and labeling contribute to reductions in specimen integrity – i.e. making the specimen prone to leakage or spilling – and increased likelihood of rejection by laboratories. Laboratory standards dictate that specimens are rejected when they are not accompanied by proper laboratory request forms, missing individual information (such as patient name), or when the specimen integrity has been damaged, such as leakage, spilling, or drying out. Laboratories reported receiving many specimens from clinics with consistent errors of this nature. In cases where specimens are rejected, notification is sent back with the courier to the clinics, who are then responsible for contacting patients to ask them to return and provide another specimen. This inconveniences the patient and can potentially decrease trust in the system.

FIGURE 25. CLINICS STORE SPUTUM BOTTLES IN CARDBOARD BOXES OUTDOORS

FIGURE 26. CLINICS STORE SPUTUM BOTTLES IN COOLER BOXES OUTDOORS

Other external limiting factors include practices such as the absence of a specimen receiving schedule in some laboratories, or schedules that are not aligned with the ST system; some reportedly don't accept drop-offs in the early afternoon before couriers are able to deliver the last specimens in a day. Some facilities reported experiencing occasional stock outs of sputum bottles, meaning that during those times they would not be able to collect specimens from patients, and may resort to referring them to the districts, similar to before the program; it is important to note that in some cases, the courier delivers sputum cups to clinics when they run out of stock, which is a useful application of the system. Notably,

[49] In actuality, specimen viability differs depending on whether it is refrigerated or stored at ambient temperature, and whether chemical preservatives are added. Recent studies show that even stored at room temperature, sputum specimens can remain viable for several weeks (Banda et al. 2000).

stock-outs are widely reported to have decreased drastically over the last few years.

Laboratories also face certain challenges which may influence the ability of the ST system to deliver on its intended results. Laboratories cannot process results when they do not have adequate equipment, personnel, electricity, or water. Several laboratories reported occasional challenges with these resources. For example, some do not have generators, which means electricity outages or load-shedding can affect their ability to process specimens and may affect the timeliness of the ST system. More commonly, human resources were mentioned as a constraint, whereby not enough microscopists were available to handle the heavy workload. Many labs did assert that they had adequate resources to manage the volume of specimens that are delivered for testing on a daily basis, and that processing time had not changed very much since the introduction of the ST system, even with increased specimen volumes. Nevertheless, in a small number of cases, the team heard reports that labs had asked sites not to send more than a certain number of specimens per day, to enable them to better manage workloads.

Lastly, communicating with and reaching a patient in the community (especially those residing far away) can sometimes be difficult, leading to delays in treatment initiation. Findings from some of the interviews and focus group discussions indicate that stigma and discrimination in the community can still contribute in some cases to patient reluctance to return to clinics, and discourage presumptive TB patients from completing the TB diagnostic process out of fear of being labeled "TB victims."

INTEGRATION

To what extent is the system integrated with routine health services?

Service integration was defined as: "the management and delivery of health services so that clients receive a continuum of preventive and curative services, according to their needs over time and across different levels of the health system." The evaluation team also examined the program through the lens of **system integration**: alignment of the ST system, operationally, into existing program structures.

Service Integration
• The TB CARE ST system is used reliably to transport other specimens, supplies, and materials • Integrated specimen transport facilitates integrated management of patients • Currently, the system may be underutilized by other health services
System Integration

• The TB CARE ST system is well integrated into existing TB program structures
  ○ Coordination of ST activities, integrated management and supervision at district level
  ○ Couriers as City Council employees in the major urban districts
  ○ Back-up system utilizing existing MOHCC/City Council staff
• The ST system functions as a link between district and peripheral health facilities

SERVICE INTEGRATION

While the ST system was developed to address TB specimen transport, the ST system is being utilized to transport a range of medical specimens, materials, documents, and communications. This means that in addition to supporting the TB program, the ST systems supports other MOHCC programs and health services, and the ST courier serves as a physical link between district and peripheral health facilities.

The ST system is used regularly for transportation of other specimens, facilitating integrated management of patients, especially those co-infected with HIV. These include blood samples, e.g. CD4 count testing for HIV, dried blood spot (DBS) specimens for early infant diagnosis of HIV and other regular and periodic medical specimens including urine, blood, and stool

samples. For example, an HIV infected TB patient can have their immunological and TB specimens collected simultaneously, reducing burden on patients to return to different facilities at different times. This enhances integrated patient management, which is an explicit goals of the MOHCC as well as the TB CARE program.

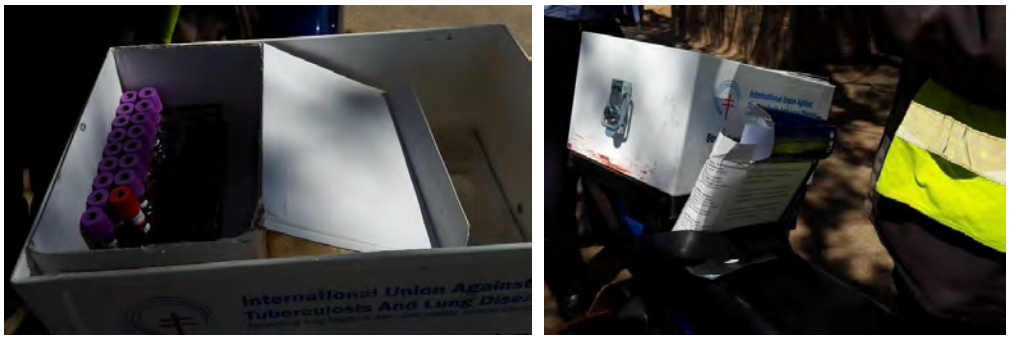


FIGURE 27. COURIERS TRANSPORT OTHER SAMPLES AND MATERIALS BETWEEN FACILITIES

Respondents strongly favor an integrated ST system for the sake of efficiency, and to ensure that all health services are supported by ST services. All respondent types recognized the potential of the ST system to support other health services and strongly recommended that the ST to continue with integrated specimen transportation rather than be restricted to TB sputum specimens, which would necessitate other systems for other specimens. Some also favored an integrated approach based on the concern that maintaining an ST system dedicated to TB only would leave other systems designed for other services unable to support the TB program if donor funding ended.

The ST system has improved the link between district and peripheral health facilities. ST couriers are regularly asked to carry reports, forms, messages, and memos between district facilities and clinics. This function is not, in the majority of districts visited, a peripheral or ad hoc function, but rather is seen as a key advantage of the ST system. The courier is viewed as an important physical link between levels of the health system and is regarded as an important player in the health system by MOHCC colleagues. The TB CARE ST system is thus not viewed as an external structure independent of the national health system, which speaks to the widespread buy-in described above, and contributes to sustainability, described in the following section.

FIGURE 28. COURIERS USE SATCHELS TO CARRY OTHER SPECIMENS

SYSTEM INTEGRATION

The ST system is well integrated into existing TB program structures, particularly at the district level. Health administrators and district TB coordinators are heavily involved in the day to day coordination of the system. As elaborated in *Implementation*, district personnel supervise couriers, and facilitate smooth functioning of the system in the districts. They assist in developing and adjusting courier routes, and when needed, identifying and activating back-up couriers. Courier motorcycles are housed at district hospitals. District facilities are typically where couriers start and end their workday. The use of City Council employees as couriers in Harare, Bulawayo and Chitungwiza and the use of field orderlies or TB coordinators as back-ups in rural districts facilitate structural integration, along with in-kind contributions from the NTP as elaborated in previous sections.

Overall, the ST system is less integrated centrally at the national level. This configuration has brought efficiencies to the program in the initial phases of implementation, and has promoted learning about the system. National stakeholders were consulted about the introduction and design of the program. However, they are not heavily involved in the daily operations and monitoring of the program. Most central communication is conducted by RFH, addressing issues such as major maintenance and servicing, courier training and compensation, and program monitoring. Because of its strong technical expertise and agile program operations, it has been efficient to have RFH, via The Union, serving as the central point of contact as it can prioritize issues and address ST system concerns in a targeted and focused manner. While the evaluation team noted that some respondents preferred a higher degree of central integration, it is acknowledged that the configuration to date has enabled stakeholders to learn about how to implement a strong and reliable specimen transport system.

There appears to be an opportunity for better integration of ST system indicators with NTP data. The RFH ST system has developed a useful set of program indicators that permit regular monitoring of specific program operations. These data are primarily used internally by RFH and as a basis for documenting performance to justify regular budget funds transfers from The Union. The NTP currently does not collect information related to specimen transport, whether through this TB CARE program, existing district structures utilizing MOHCC resources, or through other NGO partner programs. Neither RFH nor the NTP systematically collects information on additional indicators related to ST systems, e.g. turnaround time and specimen rejection rates, as described in previous sections. The partnership with TB CARE may present an opportunity for the NTP, The Union, and RFH to jointly consider how specimen transport indicators could be integrated and included in routine monitoring activities.

SUSTAINABILITY

How can the medical specimen transport system be made more sustainable? What mechanisms have been put in place to ensure an appropriate exit strategy?

To assess sustainability, the evaluation team focused on financial and non-financial (technical, managerial) support coming from different entities including implementing partners, the Government of Zimbabwe, MOHCC/NTP, districts, city councils, and other external partners working with provinces and districts on activities related to specimen transport. The team's objectives were to assess (1) the strategies and mechanisms embedded in the program currently, which may show the potential for the system to be sustained in the absence of USG support, and (2) any adjustments or activities that could be undertaken in the future to work toward such goals.

Summary of Factors Currently Enabling Sustainability

• Strong government commitment and widespread buy-in at all levels of the health system
  ○ Integrated management and oversight of the ST system
  ○ In-kind cost-sharing, including gloves, disinfectant, etc.
• Strong technical partner to support motorcycle maintenance and training

Summary of Factors Currently Inhibiting Sustainability
• Financial contribution to ST system is constrained due to economic environment • Courier role may not be easily transferrable to MOHCC given low staffing levels and high workloads • No explicit exit strategy of donor and partner

One enabling factor for the sustainability of the ST system is strong government commitment along with strong buy-in from all levels of implementation. The ST system is important to the MOHCC since, in the present economic environment and health delivery structure, it is critically important to minimize patient referrals to district facilities. This eases pressure on district facilities and reduces burden on patients caused by care-seeking at distant and congested facilities. The strong buy-in from all levels of the health system, widespread agreement about the reliability and effectiveness of the system, and its responsiveness to local needs, are factors that suggest the potential for sustainability in future years.

Current MOHCC and municipality inputs to the management and oversight of the ST system will assist in ensuring sustainability. The MOHCC and municipalities provide notable in-kind contributions that represent cost-sharing, including gloves, disinfectant, daily supervision, and back-up riders, among others. These contributions further indicate buy-in, effective management, coordination, and oversight of the program, and provide some examples of ways that the MOHCC and implementing partners can continue to work together to find ways to ensure program sustainability through incrementally increased MOHCC/NTP contributions to the program. As described throughout this report, the system is already operating in an integrated way, rather than parallel, with existing TB program structures.

Strong technical partners and support for maintenance of the motorcycle fleet will remain critical for the program in the future. The continued availability of capacity (whether internally or through partners) for rapid and effective support for motorcycle maintenance, courier training, and other key technical aspects of the system will remain a critical factor influencing overall. While supervision and management are currently integrated currently, implementing partners are handling maintenance and the consistent supply of fuel.

Implementing partners have promoted an integrated approach that will contribute to future sustainability
"RFH actually said they want him to be part of the health staff, [that he] should do what the other health staff are already doing."

The main limiting factor to sustainability of the ST system, with respect to financial resources, is the current economic environment, suggesting that a near-future transition to MOHCC would not be feasible. Respondents acknowledged that the government continues to face substantial financial constraints. The health budget has continued to decline, even in light of targets such as the Abuja Declaration benchmark of 15% budget allocation to health. Donor funding, which has complemented health budget funding in Zimbabwe for several years, has also been declining in line with global trends. The sustainability of the ST system cannot be conceptualized outside of Zimbabwe's broad economic context. With the occasional exception, such as municipal governments which may have sufficient budgets to cover more of the ST system costs, respondents noted that the national health budget was likely not adequate to permit absorption of the costs of the ST system in the foreseeable future. With RFH currently covering the majority of courier salaries, plus motorcycle maintenance and rider training and equipment, a full transition to the government may be too substantial to consider in the immediate term. While respondents noted that the ST system is important and should be advocated for to ensure it continues, they also acknowledged that it may be positioned behind other priority health expenditures in line for government financial commitment. As some noted, "As long as there is not enough fuel for an ambulance, there will be no fuel for motorcycles," and "until we get sufficient funds to fix the hospital [equipment], we cannot afford to invest in motorcycle maintenance for ST." In general, this aligns with common health system preferences to allocate money toward patient care and treatment, rather than diffuse system interventions or preventive services.

A key input to consider for future sustainability is the dedicated courier role. The courier function does not seem to be easily transferable to government or municipalities at the current time given low staffing levels and high workloads for existing MOHCC/City Council staff. The cadres which are widely considered to be primarily responsible for specimen transportation in the absence of the program are short-staffed, largely not motorized or adequately fueled, and tend to be overwhelmed with other responsibilities including public health inspection, water and sanitation monitoring, monitoring disease outbreaks, malaria control activities, and others. This leaves them without ample time to allocate to specimen transportation. Therefore, in future phases of the program, courier identification/recruitment and compensation will need to feature prominently in terms of sustainability. Financial considerations and the goal of supporting MOHCC adoption of the program will have to be weighed against the need to maintain the current level of quality and level of effort that couriers are currently able to allocate to specimen transport.

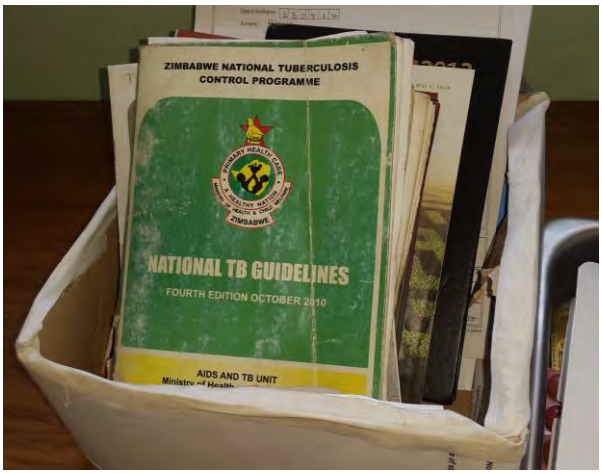


FIGURE 29. NATIONAL TB GUIDELINES

NON-PROGRAM DISTRICTS

The motivation for visiting non-program districts was to collect information relevant to considerations for program expansion. The evaluation team collected information about systems and personnel currently being utilized for specimen transport, notable successes or challenges with existing systems, and how existing systems, if present, are being sustained. Findings from non-program districts visited are presented below. An important caveat for interpretation is that only three non-program districts were visited, including Zvishavane (Midlands province), Tsholotsho (Matabeleland North province), and Makonde (Mashonaland West province); see *Methodology* for more detail. Methodological limitations prevent direct comparisons between program and non-program districts and generalizable conclusions about all non-program districts (especially to provinces without the ST system). Thus, findings below relate only to the areas visited.[50]

Summary of Findings from Non-Program Districts Visited

- There are no systems or personnel that are exclusively dedicated to specimen transport.
  - Current systems include the use of district vehicles, partner (NGO) vehicles, environmental health technicians (EHTs), field orderlies, and others.
- Existing systems are characterized by irregular or infrequent schedules.
- Health facilities are not regularly collecting specimens; patients are usually referred to the district.
- Carrier boxes are not typically used for specimen transport.
- Specimen transport appears to work more effectively (i.e. more regularly and frequently) in areas closer to district hospitals, with better transport networks, and when personnel tasked with ST have better fuel supply, access to vehicles and servicing, and external partners that supplement ST efforts.
- There were some occasions where the team noted unprompted expression of preference for a regular system dedicated to specimen transport that is known to be operating in other districts.

In the non-program districts visited, there are no systems or personnel that are exclusively dedicated to specimen transport. In these areas, specimen transport is usually conducted by a combination of environmental health technicians (EHTs), NGO partners, or health workers themselves. In those areas visited, the team observed no couriers assigned exclusively to ST, as in the TB CARE program.

Personnel or NGO partners assigned to ST usually do not have the time or resources (e.g. vehicles, fuel, maintenance) to carry out ST activities consistently. Personnel and partners assigned to conduct ST are challenged by a number of constraints. For example, EHTs balance multiple important responsibilities competing for priority. Respondents reported that EHTs could not reasonably be expected to implement consistent ST given their other duties. Chronic fuel shortages, and lack of maintenance and servicing means that not all personnel are adequately motorized to carry out ST activities;[51] they also do not have safety and repair kits, as the TB CARE couriers do. NGO partners often contribute to ST efforts, but in all such cases, it is a secondary activity. For example, NGOs working on HIV may want to transport blood samples, and then would be asked to use their vehicles to transport sputum specimens as well. However, NGO vehicles may only visit clinics once or twice per month. Vehicles and motorcycles used by personnel or NGOs for ST are usually not equipped with proper biohazard safety measures; cardboard boxes are usually used, instead of carrier boxes. NGO contributions also often run in parallel to district structures. The evaluation team heard reports of ST coming to a stand-still when partners pulled out of a district.

[50] Making direct comparisons between program and non-program was not the underlying intention, as it was not possible to account for underlying systematic factors that differ between program and non-program areas. For example, one might expect that the readiness of program districts may contribute to success, compared to areas without the program. Alternatively, non-program districts may benefit from other existing programs. Without comprehensive information on such factors, and a larger sample size, generalizable inferences cannot be made for all program versus non-program areas; differences described only apply to the those areas visited by the evaluation team.

[51] Global Fund resources had been used in many cases to purchase motorcycles or fuel; however the evaluation team noted that motorcycles were in frequent disrepair and out of use, which was echoed by respondents, along with reports of chronic fuel shortages.

As a result, existing systems are characterized by irregular and infrequent schedules, and thus patient referrals to district facilities for diagnosis are the norm. The current situation in these districts is described similarly to the way program district respondents describe circumstances prior to the TB CARE ST system. One lab respondent estimated that about half of clinics in the district were continuing to refer clients, rather than sending specimens. A nurse explained that pick-up can be unpredictable, and she makes a habit of calling to verify the timing of the next EHT visit before deciding whether to collect a sputum specimen from a TB suspect on site, versus referring the patient. Others reported collecting sputum specimens only from patients vising the clinic two to three days before an EHT or NGO vehicle is scheduled to arrive.[52] To reduce burden on patients, some health workers use public transport to bring specimens to labs, but complained that they themselves cannot consistently pay for transport. Taking into consideration the challenges described above, ST appears to work more effectively in areas closer to district hospitals, with better transport networks, and when personnel or partners tasked with ST have better fuel supply, access to vehicles, and servicing.

Existing ST systems are sustained by a number of funding sources. Respondents reported a variety of sources of funding that had been used to cover ST expenses, such as fuel, motorcycle maintenance or public transport for nurses or patient referrals. These sources included Community Development Funds, District Hospital Health Services Fund (HSF), RBF Funds from the World Bank, and the Global Fund. At the same time, respondents often pointed out that these funds were either insufficient or too erratic to consistently cover the costs for the ST.

When asked to rate the effectiveness of current ST systems, many respondents reported low levels of satisfaction, based on frustration with the overall lack of reliability, which they felt threatened TB control efforts.[53] As described above, lack of reliable ST prompts health workers to refer patients to district facilities, rather than collecting specimens on site. When ST does occur, it is characterized by delays. Respondents reported that their current ST system negatively impacted the timeliness of TB diagnosis and resulted in long turnaround times, especially for rural patients.[54] As a result, frequent concerns were raised about the delay in initiation of treatment of patients. Some laboratory respondents from non-program districts reported that delays in ST led them to reject specimens frequently, if the integrity of the specimen had degraded. Several respondents felt that the problems with their ST system were stifling case detection and preventing confirmation of cure.

There were occasional unprompted expressions of preference for a regular system dedicated to ST, often-times known to be in operation in other districts.[55] One respondent said: "If you compare our system with the courier system in other districts, we would be better off. It is very convenient." Virtually all respondents were in favor of improving the ST system, not only for TB but also for other services. One administrator pointed out that, "The TB program relies on other programs, it cannot stand on its own. It can continue with support of other programs. It can also help other programs."

[52] There were also occasional reports of stock-outs of reagents and sputum cups. It was not possible to ascertain whether this occurred more commonly than in program districts. However, it is reasonable to assume that the TB CARE ST system provides a platform through which to bring materials to clinics (such as sputum cups) when they are running low. Stock-outs of reagents or medications tend to be more widespread, and thus would not necessarily be expected to affect program and non-program districts very differently.

[53] In some cases, respondents expressed satisfaction toward the beginning of the interview but noted similar challenges as those listed above by the end of the interview.

[54] Delays in TAT relate both to getting specimens to the laboratory as well as in getting results back to clinics, though similarly to program districts, positive results are given priority and respondents say that they are communicated sooner in order to try and reduce the time to treatment initiation for patients with TB.

[55] The team visited non-program districts adjacent to districts with the TB CARE ST system in place, so it is very likely they were intimately aware of systems in the other districts.

4. CONCLUSIONS

IMPLEMENTATION

Overall, the TB CARE ST system has been implemented successfully in both urban and rural areas of Zimbabwe. The Union and RFH are regarded as effective and reliable partners, and buy-in across levels of the health system for the specimen transport system is strong. Challenges related to implementation that are under the control of implementing partners are anticipated to be relatively straightforward to address.

EFFECTIVENESS

The TB CARE medical specimen transport system has strengthened the diagnosis of tuberculosis and other diseases in the supported areas of Zimbabwe by decentralizing diagnostic services from district to peripheral health facilities. This increases access to diagnosis for patients by reducing the burden of traveling to district facilities to receive services. The regular and reliable courier schedule maintains daily turnaround times in urban areas, and weekly turnaround times in rural areas. This empowers health workers to collect sputum specimens regularly instead of referring patients to district facilities, and results in increased patient trust in the health system. The effect of the ST system on TB treatment outcomes is more challenging to isolate from other influences; however, findings support the conclusion that TB treatment is also improved by the ST system, because timely access to TB diagnosis enables faster initiation on treatment, which can lead to better patient outcomes and reduced transmission in the community. Several factors external to the ST system, not under the direct control of implementing partners, were seen to both facilitate and limit program effectiveness.

INTEGRATION

The TB CARE ST system is relatively well integrated with other health services, as it is being used to transport a range of specimens, materials, and communications between peripheral clinics and district facilities. District health executives and health workers are especially keen to use the system for transporting other specimens and materials. Accordingly, as the courier creates a physical link between district and peripheral facilities, the system has the potential to be utilized further by other health services; indeed all stakeholders expressed the need for a specimen transport system that is integrated and not focused too heavily on TB. The ST system is also well integrated with existing TB program management structures at the district and service delivery level. This district level integration has reduced management burden at the central level, and has allowed for flexibility in implementation that has facilitated learning about how to implement a successful ST system.

SUSTAINABILITY

There are several factors embedded in the current system which facilitate long-term sustainability. The program has demonstrated the importance of a courier function that is dedicated solely to specimen transport. There is already a substantial amount of in-kind, cost-sharing by the MOHCC, including back-up couriers, disinfection supplies, district-level management, and provision of safe storage space for motorcycle, as well as a strong degree of buy-in nationally and sub-nationally. The main limiting factor to sustainability of the ST system, with respect to financial resources, is the current economic environment, suggesting that a full transition to MOHCC would not be feasible in the immediate future.

5. RECOMMENDATIONS

The TB CARE specimen transport system is a well-implemented, effective program that has made commendable progress over the past four years, and has achieved a notable degree of integration with existing TB program structures. No extensive changes to project design, implementation, or operations are recommended. Most challenges described in this report are likely to be relatively straightforward for USAID/Zimbabwe and the TB CARE implementing partners, in collaboration with the NTP, to address. The evaluation team has discussed its recommendations with USAID/Zimbabwe, The Union, and RFH during preliminary debriefs in Harare. The team elaborates on these recommendations below, for consideration by program stakeholders in future phases of the program.

TABLE 2. SUMMARY OF RECOMMENDATIONS

Implementation & Effectiveness	Integration	Sustainability	Expansion
R1. Develop a written SOP on specimen collection for use by health facilities, labs, and couriers **R2.** Provide specimen storage capacity at health facilities, in order to mitigate biohazard & facilitate daily collection of sputum specimens by health workers **R3.** Strengthen trainings for couriers on infection control by collaborating with district laboratories **R4.** Strengthen supply arrangements for safety provisions for courier from health facilities and laboratories **R5.** Increase responsiveness to courier requests for support **R6.** Integrate additional ST performance monitoring indicators to better track effectiveness **R7.** Consider distance and terrain in allocation of couriers to districts	**R8.** Maintain streamlined management at national level and integrated approach at district level for system efficiency **R9.** Increasingly orient the system toward an integrated specimen transport system	**R10.** Continue to lobby for increases in national health budget to facilitate financial contribution from the government to the ST system **R11.** Prioritize specimen transport in other health budgets, including Global Fund, Health Transition Fund (HTF), Results-Based Financing (RBF), Health Services Fund (HSF), health center committee fund, among others **R12.** Consider a staggered phase-in for transition of the program into MOHCC management and operation without strict timelines **R13.** Consider expanding field orderly role to assume ST courier duties, so that the program can draw on an existing cadre which can be supported by any health system funding	**R14.** Because of the clear importance of, and need for, a reliable ST system, continue expansion in other districts, considering R1-R13. **R15.** During expansion, prioritize partnership with a strong technical support partner, such as RFH, for motorcycle maintenance and technical support

IMPLEMENTATION & EFFECTIVENESS

R1. DEVELOP A WRITTEN STANDARD OPERATING PROCEDURE (SOP) ON SPECIMEN COLLECTION AND TRANSPORT FOR USE BY HEALTH FACILITIES, LABS, AND COURIERS: There is currently no common documentation that can be referenced by health workers, laboratory staff, and couriers alike, that specifically addresses procedures, best practices, and expectations of roles for specimen collection, handling, and packaging along the entire continuum of specimen collection and transport. The team recommends that a written Standard Operating Procedure (SOP) including collection, packaging, specimen viability, labeling, storage, and transport be developed and distributed widely. This would help to ensure consistent and correct practices are in place across districts, that roles and expectations of each party are clear, and make sure these practices are happening consistently even in the context of turnover in the health system. The SOP might also indicate the role of the courier as a "gate keeper" to assess that proper labeling and packaging of sputum specimens have been done before they are taken to the laboratory. The team suggests that the SOP be a single document covering the responsibilities and best practices for all parties involved, in order to provide a shared understanding between health workers, laboratories, and couriers.

R2. PROVIDE SPECIMEN STORAGE CAPACITY AT HEALTH FACILITIES, IN ORDER TO MITIGATE BIOHAZARD & FACILITATE DAILY COLLECTION OF SPUTUM SPECIMENS BY HEALTH WORKERS: The lack of specimen storage capacity and variable practices of makeshift storage present several challenges for health workers, patients, and couriers. Substandard storage can result in greater biohazard risks for all in the vicinity of the sputum specimens, with health workers and couriers bearing the greatest risk from spillages and leaks. With inadequate storage capacity, health facilities often do not take sputum specimens from patients on any day they happen to visit the clinic; patients may be asked to come back on the day the courier is next scheduled to come back to the clinic. Providing adequate storage for clinics would remove this inconvenience for patients. The recommendation from R1 would also ensure a common understanding of specimen viability, which affects storage practices. While refrigerated storage space is ideal, this may not be feasible in many cases. A space that can keep specimens in a cool, dark place away from heat and people should be prioritized.

R3. STRENGTHEN TRAININGS FOR COURIERS ON INFECTION CONTROL BY COLLABORATING WITH DISTRICT LABORATORIES: Couriers are at an elevated risk for TB infection since they are transporting infectious material between facilities on a daily basis. This is especially relevant in light of the findings that feed into recommendations R1 and R2, where specimens are reportedly not packaged properly in some cases, leading to spillages and leaks. RFH already has a plan in place whereby couriers are trained on infection control by district laboratory staff. The team recommends a review of trainings completed for all couriers in the current system, to ensure that all have received the benefit of this training. The team also recommends considering refresher trainings for couriers. Infection control measures should also be included in the SOP described in R1.

R4. STRENGTHEN SUPPLY ARRANGEMENTS FOR SAFETY PROVISIONS FOR COURIER FROM HEALTH FACILITIES AND LABORATORIES: Safety provisions such as latex gloves and disinfectant are supposed to be provided by district health facilities, clinics, and/or laboratories, according to RFH, though findings indicate this is not occurring as planned in a number of cases. The team recommends revisiting the arrangements with districts to ensure that there is a clear plan in place to provide couriers with the necessary equipment on a regular basis.

R5. INCREASE RESPONSIVENESS TO COURIER REQUESTS FOR SUPPORT: Delays in responding to requests for support by couriers, whether for motorcycle maintenance, documentation, or other concerns, must be minimized in order to keep the system running smoothly. While such cases were usually the exception to the rule, a few instances were described to the team where couriers had issues

that remained unresolved. The team recommends reviewing the system in place for ensuring that couriers have a reliable method of communicating any issues that remain unresolved after a reasonable period of time.

R6. INTEGRATE ADDITIONAL ST PERFORMANCE MONITORING INDICATORS TO BETTER TRACK EFFECTIVENESS: RFH routinely collects numbers of specimens and results ferried, and conducts baselines of each new district where the program expands, along with follow-up data in existing districts. However, the indicators collected tend to focus on process and outputs. The team recommends working to develop a way to track, on a routine basis, indicators that more directly measure effectiveness, prioritizing indicators for access and timeliness; some examples could include turnaround time, specimen rejection rate, and time to treatment. Recognizing that such data are important for the NTP, and that much of this data would come from MOHCC registers, the team suggests collaboration between TB CARE implementing partners and the NTP regarding a way forward to track more, and better, ST performance monitoring indicators in the future.

R7. CONSIDER DISTANCE AND TERRAIN IN ALLOCATION OF COURIERS TO DISTRICTS: Rural districts are potentially under-served because of lower courier numbers, who have to traverse longer distances and more challenging terrain. The team recommends setting lower cost efficiency thresholds (e.g. specimens ferried per courier) in rural areas, and/or considering distance and terrain when allocating courier numbers to each district, in order to lengthen the life of each individual motorcycle, prevent courier burn-out or turnover, and potentially increasing the frequency of courier schedules in rural areas.

INTEGRATION

R8. MAINTAIN STREAMLINED MANAGEMENT AT NATIONAL LEVEL AND INTEGRATED APPROACH AT DISTRICT LEVEL FOR SYSTEM EFFICIENCY: Based on findings about the efficiencies achieved with current program configuration, the team recommends continuing with the same method of integration at the district level, and a leaner management approach at the national/central level.

R9. INCREASINGLY ORIENT THE SYSTEM TOWARD AN INTEGRATED SPECIMEN TRANSPORT SYSTEM: A reliable specimen transport system is an integral part of the health system, and the TB CARE system is already being used for the transport of specimens, materials, and communication outside of the TB program. In recognition of the substantial efficiencies that an integrated system brings, and the widespread preference for an integrated system, the team recommends increasingly orienting the system toward an integrated approach, which may mean making adjustments to ensure that other health programs are aware of, and fully utilizing, the ST system.

SUSTAINABILITY

R10. CONTINUE TO LOBBY FOR INCREASES IN NATIONAL HEALTH BUDGET TO FACILITATE FINANCIAL CONTRIBUTION FROM THE GOVERNMENT TO THE ST SYSTEM: The team notes that financial constraints are the largest impediment to long-term sustainability, in terms of MOHCC adoption of any such program in a scenario when donor funding ceases. The team recognizes the considerable challenges involved in garnering additional financial support from the government. However, stakeholders of the ST system should continue to support efforts to lobby for health budget funding at the national level. In the meantime, efforts taken as part of other recommendations above, such as tracking indicator effectiveness and developing an SOP, may also help in demonstrating the need, importance, and impact of such a program to these ends.

R11. PRIORITIZE SPECIMEN TRANSPORT IN OTHER HEALTH BUDGETS, INCLUDING GLOBAL FUND, HEALTH TRANSITION FUND (HTF), RESULTS-BASED FINANCING (RBF), HEALTH SERVICES FUND (HSF), HEALTH CENTER COMMITTEE FUNDS, AMONG OTHERS: In recognition of the fact that gains in budgetary allocations to health can be a long-term challenge, the team also recommends that ST system stakeholders look to other potential sources of financial support, including other sources of donor funding as well as local sources of support such as health committee funds, which have the benefit of being supported by the communities in which the ST system operates and may contribute to further integration with existing structures. Those listed above are a few that emerged in the course of data collection, but are not necessarily an exhaustive list.

R12. CONSIDER A STAGGERED PHASE-IN FOR TRANSITION OF THE PROGRAM INTO MOHCC MANAGEMENT AND OPERATION WITHOUT STRICT TIMELINES: The evaluation team recognizes that a view toward MOHCC adoption of the ST system may be an ideal future scenario. The team recommends that any approach that might be undertaken in order to transition the ST system to the MOHCC happen over time, perhaps using a phased-in approach, with gradual and reasonably timed adoption of responsibility for discrete components of the program. The financial challenges noted in this report (and cited in R10 and R11), along with other resources constraints, would make it difficult for the MOHCC to adopt the program all at once, especially in the immediate future, while maintaining the high level of quality that has been achieved by the current program.

R13. CONSIDER EXPANDING THE FIELD ORDERLY ROLE TO ASSUME ST COURIER DUTIES, SO THAT THE PROGRAM CAN DRAW ON AN EXISTING CADRE WHICH CAN BE SUPPORTED BY ANY HEALTH SYSTEM FUNDING: One of the most successful aspects of the TB CARE ST system is the fact that a courier is dedicated to specimen transport full-time, and is therefore able to adhere to a set schedule and uphold the system's reliability. However, creating a new cadre in the health system is not necessarily straightforward. One recommendation is to consider expanding the field orderly role to assume ST responsibilities, in such a way that an individual can be hired as a field orderly and be expected to conduct ST activities full-time, or at least near full-time. This position was found to generally be more reliable as a back-up courier and therefore may be the more tenable position for the main courier, assuming a transition to MOHCC.

EXPANSION

R14. BECAUSE OF THE CLEAR IMPORTANCE OF, AND NEED FOR, A RELIABLE ST SYSTEM, CONTINUE EXPANSION AND SCALE-UP INTO OTHER DISTRICTS, WHILE CONSIDERING ALL ISSUES RAISED IN RECOMMENDATIONS R1 THROUGH R13. Based on the findings presented above, expanding and scaling up the program to new districts, and within existing districts not fully covered by the ST system, is likely to add substantial value to existing systems, and contribute to improved TB diagnosis in Zimbabwe.

R15. DURING EXPANSION AND SCALE-UP, PRIORITIZE PARTNERSHIP WITH A STRONG TECHNICAL SUPPORT PARTNER FOR MOTORCYCLE MAINTENANCE AND TECHNICAL SUPPORT. The technical support provided by The Union and RFH as part of the TB CARE ST system is an important factor driving program success. In future phases of the program, a similar level of technical support should be identified to maintain the level of reliability observed in the current program to date.

FIGURE 30. WORD CLOUD, PLENARY FROM EVALUATION CAFÉ WORKSHOP

Note on Figure 30: Word clouds are a visual representation of qualitative data. In the figure above, the size of each word represents the frequency with which it was mentioned and transcribed in the qualitative notes taken by the evaluation team, transcribing and summarizing the plenary discussion during the Evaluation Café participatory workshop (see Methodology for elaboration on the methodology, format, and participant composition).

REFERENCES

Banda HT, Harries AD, Nyiernda TE, Banerjee A, Salaniponi FML. (2000). Viability of Stored Sputum Specimens for Smear Microscopy and Culture. *The International Journal of Tuberculosis and Lung Disease*, 4(3):272-274.

Burke SJ, Lass E, Thistle P, Katumbe L, Jetha A, et al. (2014). Increased Incidence of Tuberculosis in Zimbabwe, in Association with Food Insecurity, and Economic Collapse: An Ecological Analysis. *PLoS ONE*, 9(2): e83387, doi:10.1371/journalpone.0083387.

CORE Group. (2008). The Expansion of Community-Based Tuberculosis Programming: Critical Program Design Issues for New Partners: Critical Program Design Issues for New Partners.

Chadambuka A. (2006). Evaluation of the TB control programme in Gokwe North and South Districts of Midlands Province. *Final Proposal*.

Chadambuka A, Mabaera B, Tshimanga M, Shambira G, Gombe NT, Chimusoro A. (2011). Low tuberculosis case detection in Gokwe North and South, Zimbabwe in 2006. *African Health Sciences*, 11(2):190-196.

Corbett EL, Bandason T, Duong T, Dauya E, Makamure B, Churchyard GJ, Williams BG, Munyati SS, Butterworth AE, Mason PR, Mungofa S, Hayes RJ. (2010). Comparison Of Two Active Case-Finding Strategies For Community-Based Diagnosis Of Symptomatic Smear-Positive Tuberculosis And Control Of Infectious Tuberculosis In Harare, Zimbabwe (DETECTB): A Cluster-Randomised Trial. *Lancet*, 376:1244-53.

Corbett EL, Zezai A, Cheung Y-B, Bandason t, Dauya E, Munyati SS, Butterworth AE, Rusikaniko S, Churchyard GJ, Mungofa S, Hayes RJ, Mason PR. (2010). Provider-initiated symptom screening for tuberculosis in Zimbabwe: diagnostic value and the effect of HIV status. *Bulletin of the World Health Organization*, 88:13-21, doi:10.2471/BLT.08.055467.

Corbett EL, MacPherson P. (2013). Tuberculosis screening in high human immunodeficiency virus prevalence settings: turning promise into reality. *The International Journal of Tuberculosis and Lung Disease*, 17(9):1125-1138, doi:10.5588/ijtld.13.0117.

Corbett EL, Bandason T, Cheung Y-B, Makamure B, Dauya E, Munyati SS, Churchyard GJ, Williams BG, Butterworth AE, Mungofa S, Hayes RJ, Mason PR. (2009). Prevalent infectious tuberculosis in Harare, Zimbabwe: burden, risk factors and implications for control. *The International Journal of Tuberculosis and Lung Disease*, 13(10):1231-1237.

Dimairo M, MacPherson P, Bandason T, Zezai A, Munyati SS, et al. (2010). The Risk and Timing of Tuberculosis Diagnosed in Smear-Negative TB Suspects: A 12 Month Cohort Study in Harare, Zimbabwe. *PLoS ONE*, 5(7): e11849, doi:10.1371/journal.pone.0011849.

Global Laboratory Initiative (gli). (2013). Laboratory Diagnosis of Tuberculosis by Sputum Microscopy: The Handbook, global edition. STOP TB Partnership. SA Pathology: Adelaide, Australia.

Institute for Health Metrics and Evaluation (IHME). (2013). GBD 2010 Profile: Zimbabwe. Retrieved from: http://www.healthdata.org/sites/default/files/files/country_profiles/GBD/ihme_gbd_country_report_zimbabwe.pdf

Mabaera B, Lauritsen JM, Katamba A, Laticevischi D, Naranbat N, Rider HL. (2007). Sputum smear-positive tuberculosis: empiric evidence challenges the need for confirmatory smears. *The International Journal of Tuberculosis and Lung Disease*, 11(9):959-964.

Metcalfe JZ, Makumbirofa S, Makamure B, Sandy C, Bara W, Mungofa S, Hopewell PC, Mason P. (2014). Drug-resistant tuberculosis in high-risk groups, Zimbabwe. *Emerging Infectious Diseases*, 20(1):135-137.

Ministry of Health & Child Care (MOHCC), Department of Epidemiology and Disease Control; National Health Information & Surveillance Unit (NHISU), with the Zimbabwe National Statistics Agency (ZIMSTAT), and Research Triangle Institute (RTI). (2010). Zimbabwe National Health Profile 2010.

Ministry of Health and Child Welfare, Government of the Republic of Zimbabwe. (2010). Zimbabwe National HIV and AIDS Strategic Plan 2011-2015 [ZNASP II], V2 draft. December 10, 2010.

Ministry of Health and Child Welfare, Government of the Republic of Zimbabwe. (n.d.) National Tuberculosis Control Programme, Five Year Strategic Plan 2010-2014.

Mukecheza M, Chimusoro A, Gombe NT, Tshimanga M, Shambira G. (2012). District health executives in Midlands province, Zimbabwe: are they performing as expected? *BMC Health Services Research*, 12:335.

Murimwa TC, Sandy C, Mugurungi O, Edginton ME, Reid T. (2012). What proportion of patients diagnosed with TB and started on treatment in Manicaland Province, Zimbabwe, are registered? *International Health*, 4:320-322.

Nkengasong JN, Nsubuga P, Nwanyanwu O, Gershy-Damet G-M, Roscigno G, Bulterys M, Schoub B, DeCock KM, Birx D. (2010). Laboratory Systems and Services Are Critical in Global Health. *American Journal of Clinical Pathology*, 134:368-373, doi:10.1309/AJCPMPSINQ9BRMU6.

Osika J, Altman D, Ekbladh L, Katz I, Nguyen H, Rosenfeld J, Williamson T, and Tapera S. (2010). Zimbabwe Health System Assessment 2010. Bethesda, MD: Health Systems 20/20 Project, Abt Associates Inc.

Parsons LM, Somoskovi A, Gutierrez C, Lee E, Paramasivan CN, Abimiku A, Spector S, Roscigno G, Nkengasong J. (2011). Laboratory Diagnosis of Tuberculosis in Resource-Poor Countries: Challenges and Opportunities. *Clinical Microbiology Reviews*, 24(2):314-349, doi:10.1128/CMR.00059-10.

Printz N, Alt D, Mudzimu F, and Ndlovu M. (2009). Zimbabwe: Logistics System Designs for Tuberculosis Commodities. Arlington, VA. USAID | DELIVER PROJECT, Task Order 1.

PSI/Zimbabwe (n.d.) TB screening of newly diagnosed PLHIV and linkages to TB diagnostic and treatment services in Zimbabwe. *Presentation*, retrieved from: http://www.aidstar-one.com/sites/default/files/Gudukeya.pdf

Riders for Health (RFH). (2010). Bulawayo Sample Transport Baseline Report.

Riders for Health (RFH). (2012). Rural Sample Transport Baseline Report.

Riders for Health (RFH) Zimbabwe (2011). Sample Transport programme for The International Union against Tuberculosis and Lung Disease, Partner Feedback Report. December 2011.

Riders for Health (RFH) (2011). Evaluation of the Sputum Transport System.

Riders for Health (RFH) (2012). Sputum Transport System: Expansion to Rural Areas, Progress Update. May 4, 2012.

Riders for Health (RFH). (2012). Programme Impact Report 2012, Zimbabwe.

Riders for Health (RFH) (n.d.) Improving Access to Laboratory Sputum Microscopy Services in the Urban Areas of Zimbabwe.

Takarinda K, Harries AD, Srinath S, Mutasa-Apollo T, Sandy C, Mugurungi O. (2012). Treatment outcomes of adult patients with recurrent tuberculosis in relation to HIV status in Zimbabwe: a retrospective record review. *BMC Public Health*, 12:124, doi:10.1186/1471-2458-12-124.

Takarinda KC, Harries AD, Nyathi B, Mkhokheli N, Mutasa-Apollo T, Sandy C. (n.d.) TB treatment delays and associated factors within the Zimbabwe National Tuberculosis programme. Unpublished manuscript (*operational research paper completed as part of TB CARE I program in Zimbabwe*).

The Union. (2014). TB CARE I USG Supported Specimen Transport System, List of Districts/Cities. June 30, 2014.

USAID. (2010). TB CARE I Cooperative Agreement. (*USAID to KNVC Tuberculosis Foundation*). September 29, 2010.

USAID. (2011). TB CARE I, Zimbabwe, Year 1 Annual Report. November 10, 2011.

USAID. (2011). TB CARE I, Program Year 1 First and Second Quarterly Performance Monitoring Report. May 16, 2011.

USAID. (2012). TB CARE I and PEPFAR - Zimbabwe Annual Report (TB CARE, Year 2; PEPFAR Year 1). October 30, 2012.

USAID. (2013). TB CARE I, Zimbabwe, Year 3 Annual Report. October 30, 2013.

USAID and MEASURE Evaluation. (n.d.) Monitoring and Evaluation of Tuberculosis Control Programs. Retrieved from: http://www.cpc.unc.edu/measure/training/materials/m-e-of-tuberculosis-control-programs.

USAID. (n.d.) TB CARE I, Toolbox. Module 5: Collection, transport and receipt of specimens. Retrieved from: http://www.tbcare1.org/publications/toolbox/culture/

USAID. (n.d.) TB CARE I, Zimbabwe. Retrieved from: http://www.tbcare1.org/countries/africa/zim/

USAID | DELIVER PROJECT, Task Order 1. (2008). Logistics Indicators Assessment Tool (LIAT). Arlington, VA: USAID | DELIVER PROJECT, Task Order 1.

USAID | DELIVER PROJECT, Task Order 1. (2009). Logistics System Assessment Tool (LSAT). Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

USAID | DELIVER PROJECT, Task Order 1. (2010). Assessment Tool for Laboratory Services and Supply Chains (ATLAS). Arlington, VA: USAID | DELIVER PROJECT, Task Order 1.

USAID/Zimbabwe. (n.d.). Global Health. Retrieved from: http://photos.state.gov/libraries/zimbabwe/231771/PDFs/USAID_Global_Health_001.pdf

US Centers for Disease Control and Prevention (CDC). (2011). Core Curriculum on Tuberculosis: What the Clinician Should Know. Chapter 4: Diagnosis of Tuberculosis Disease. Retrieved from: http://www.cdc.gov/tb/publications/slidesets/corecurr/chapter4.htm

World Health Organization (WHO). (2004). Compendium of Indicators for Monitoring and Evaluating National Tuberculosis Programs. Stop TB Partnership. WHO/HTM/TB/2004.344. World Health Organization: Geneva, Switzerland.

World Health Organization (WHO). (2009). TB Impact Measurement: Policy and recommendations for how to assess the epidemiological burden of TB and the impact of TB control. STOP TB Policy Paper, No. 2. WHO/HTM/TB/2009.416. World Health Organization: Geneva, Switzerland.

World Health Organization (WHO). (2010). Treatment of Tuberculosis Guidelines, Fourth Edition. WHO/HTM/TB/2009.420.

World Health Organization (WHO). (2012). Electronic Recording and Reporting for Tuberculosis Care and Control. WHO/HTM/TB/2011.22. World Health Organization: Geneva, Switzerland.

World Health Organization (WHO). (2013). Definitions and Reporting Framework for Tuberculosis - 2013 Revision. WHO/HTM/TB/2013.2. World Health Organization: Geneva, Switzerland.

World Health Organization (WHO). (2013). Global Tuberculosis Report 2013. WHO/HTM/TB/2013.11. World Health Organization: Geneva, Switzerland.

World Health Organization (WHO). (2014). Global Tuberculosis Report 2014. WHO/HTM/TB/2014.08. World Health Organization: Geneva, Switzerland.

World Health Organization (WHO). (2014). Understanding and Using Tuberculosis Data. WHO/HTM/TB/2014.09. World Health Organization: Geneva, Switzerland.

World Health Organization (WHO). (2014). Zimbabwe Tuberculosis Profile. Retrieve from: http://www.who.int/tb/country/data/profiles/en/

Zhao Q, Wang L, Tao T, Xu B. (2013). Impacts of the "transport subsidy initiative on poor TB patients" in Rural China: A Patient-Cohort Based Longitudinal Study in Rural China. *PLoS ONE*, 8(11): e82503, doi:10.1371/journal.pone.0082503.

Zimbabwe National Statistics Agency (ZIMSTAT) and ICF International. (2012). Zimbabwe Demographic and Health Survey 2010-11. Calverton, Maryland: ZIMSTAT and ICF International Inc.

Zimbabwe National Tuberculosis Control Programme (NTP). (2010). National TB Guidelines, Fourth Edition.

Zimbabwe National Tuberculosis Programme Reivew, Draft Report – October 2011.

APPENDICES

APPENDIX 1: DETAILED METHODOLOGY

RESULTS FRAMEWORK

The SI evaluation team developed a results framework (RF) summarizing the TB CARE ST system theory of change since implemented began in 2010, prior to the 2011 USAID project design guidance. It was developed using TB CARE program documents and RFH baseline reports. The following results framework describes how objectives of the TB CARE ST system, are expected to be achieved; this framework is summarized in Figure 30 below.

Inputs **–** Riders for Health provides motorcycles and riding gear, as well as fuel, log-books, and carrier boxes and satchel, among other equipment. In some cases, where a rider cannot be identified from exisitng health system employees, RFH employs a rider from the community.

Processes **–** After riders are recruited, they are trained at RFH headquarters in Harare. They are also provided with on-route training by RFH staff, who shadow them through a full run of their routes around their assigned district. They are supervised by a combination of district health administrators and RFH staff, depending on the issue to be addressed (e.g. schedule delays versus fuel needs). Motorcycles are serviced according to a predetermined schedule. Couriers are also trained by district laboratories on specimen packaging, handling, and infection control.

Outputs **–** The expected output of the steps above are the essence of the ST model: a regular and reliable system for specimen collection and results return. In urban districts, specimen collection/results return is conducted on a daily schedule, i.e. clinics receive a visit from a courier each day. During that visit, the courier collects specimens collected in the previous 24 hours, and returns the results for tests done with specimens collected during the last visit (the day before). In rural districts, this schedule is weekly. It is expected that with the regular and reliable system, an increased number of peripheral clinics can be served by specimen transport over time.

Outcomes **–** The outcomes expected to result from a regular and reliable ST system include:

- Increase volume of specimens collected and tested, and results returned
- Increased proportion of suspects examined for TB with Sputum-Smear Microscopy (SSM)[56]
- Reduction in patient travel to district facilities in order to obtain a diagnosis
- Reduction in the number of new pulmonary TB cases with "sputum not done"
- Reduction turnaround time from specimen collection to the return of results
- Increase in number of people receiving their results
- Reduction in specimen rejection at laboratories
- Increased cure rate for new sputum positive TB cases
- Increased case notification rate of new sputum positive cases
- Reduction in treatment completion rate as outcome for new sputum positive TB cases[57]

Impacts **–** The goal of the ST system as a whole is to contribute to longer-term impacts including the TB CARE goal of universal access to TB diagnosis, improved TB patient outcomes (through earlier initiation on treatment, better patient management by health workers, ability to conduct follow-up sputum to confirm treatment outcomes/cure, and reduced lost to follow-up), reduced TB transmission

[56] This means is the proportion of patients who are tested for TB with sputum smear microscopy (laboratory confirmation of TB), out of all patients who are registered as TB suspects in clinic registers. Some documentation referred to "numbers" of patients examined with SSM, but the team retains the term "proportion" here, to account for potential changes in underlying TB burden, and varying burden (denominators) between different districts. Whereas targets are hard to set with absolute numbers, a target of 100% of TB suspects examined with SSM is much more straightforward to interpret.

[57] See *Definitions*; treatment completion is a designation given only when "cured" cannot be confirmed via laboratory testing (sputum smear microscopy).

in the community, and overall strengthening of the NTP.

Assumptions – As with any logic underpinning the implementation of a program, there are assumptions about the conditions that facilitate successful implementation. These assumptions span conditions that are both internal to the program, as well as those that are contextual.

Assumptions include:

- ***Motorcycles are functional and properly maintained throughout the program***: this means that the servicing is at an appropriate frequency, and that it is sufficient to keep motorcycles from having major breakdowns or being off the road for an extended period of time so as to interrupt the reliability of the specimen transport system.
- ***Couriers adhere to schedules***: the reliability of the system is centered on the assumption that courier routes and schedules are appropriately tailored to the terrain and distances specific to each district, such that schedules can be maintained and health workers know when to collect specimens and when to schedule follow-ups with patients.
- ***Clinics maintain a consistent supply of sputum cups***: without a consistent supply of sputum cups/bottles, health workers will not be able to collect specimens from patients, and even in the presence of a reliable transport system, it will not have the intended effects.
- ***Specimens are packed and handled appropriately***: Without proper packaging and handling, specimens may leak or spill, or may otherwise be damaged such that laboratories will reject the specimen when it comes and the patient will have to be re-contacted by health workers in order to produce another specimen, which inconveniences the patient and delays diagnosis
- ***Health staff are willing to collect specimens for testing***: Without an assurance that results will be returned reliability, and on a given schedule, health staff may not be willing to collect specimens or schedule follow-ups with patients for a certain date; or, otherwise refer patients to go to district facilities for TB diagnosis. At first, health workers may decide to test whether the system is truly reliable before being willing to collect specimens on a regular basis.
- ***Patients have faith in the system***: This assumption means that rather than opting to bring themselves to the district facilities for laboratory diagnosis, or visiting another facility, i.e. private or mission hospitals, patients understand that they will reliably receive results on a given schedule, and therefore are willing to attend the nearest clinic to seek TB diagnosis.

This performance evaluation focuses primarily on inputs, outputs, and outcomes, and also examines assumptions underlying the program. Outcomes were assessed when possible but the evaluation team recognizes that all outcomes and impacts are influenced by a number of factors and that specimen transport (ST) is considered a contributing but not sole cause of any changes observed in outcomes and impacts. A cause-and-effect relationship between ST and outcomes cannot be ascertained without a rigorous impact evaluation design.

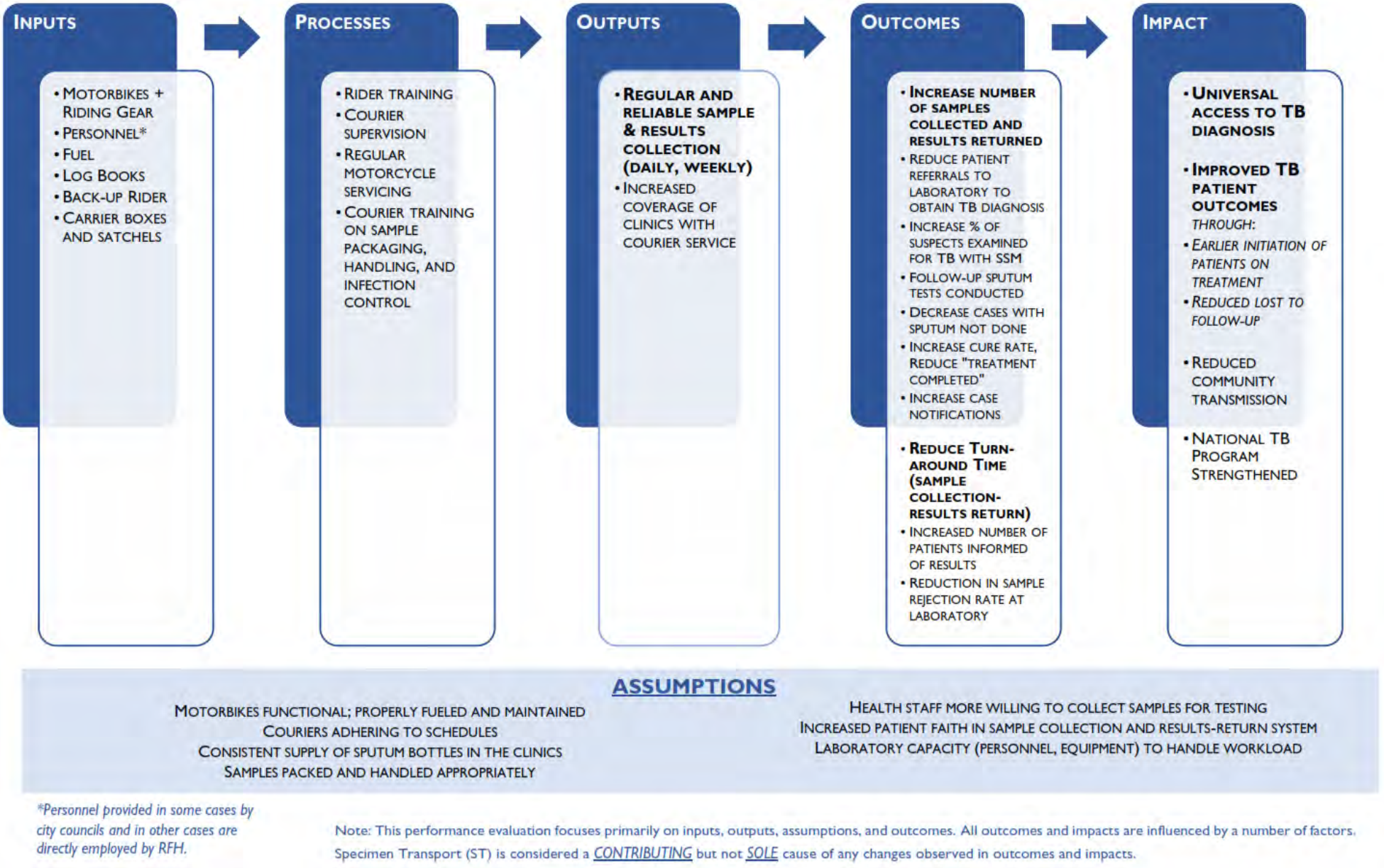


FIGURE 31. RESULTS FRAMEWORK FOR THE ZIMBABWE TB CARE SPECIMEN TRANSPORT (ST) SYSTEM

SAMPLING & DATA COLLECTION

Site Selection: Hospitals, laboratories, and clinics were selected on the basis of criteria applied consistently in each district. District hospitals were visited in order to interview health administrators. District laboratories were purposively sampled since the majority of specimens are processed there. The team conducted visits to up to two clinics in each district, based on the following criteria: (1) refers specimens to laboratory (i.e. no microscopy on site), (2) at least 20km from district laboratory, but within two hours driving time,[58] and (3) priority given to clinics with higher volumes of specimens transported or TB patients.[59] For non-program districts, information on these criteria were unavailable before entering the district. The team discussed criteria with district administrators, who provided the team with information to assist them in selecting up to two clinics to visit.

Respondent Selection: Health administrators and couriers in each district were contacted ahead of time by the evaluation team to secure an interview appointment. Among laboratory staff, microscopists and laboratory managers were prioritized when available. Health workers were approached the same day of each interview, when the team arrived at each clinic; priority was given to TB nurses or TB focal persons at a given facility; community health nurses were also included when available. Focus group participants were recruited through health facilities. The evaluation team made a request prior to the start of each of the clinic SSIs, asking health workers whether they could assemble a group of 5-8 TB patients for a focus group discussion, on one of the two days following the SSI. TB patients were only included if they were on treatment for one month or more, over the age of 18, and when possible, received a diagnosis at the clinic where the FGD was organized. FGD participants were compensated for transport and were provided with refreshments. Evaluation Café participants were selected through communications with district and city council administrators.

TABLE 3. QUALITATIVE DATA COLLECTION SUMMARY

Interview Type*	**Total**
Key Informant Interviews	13
Health Administrators, program **	10+
Health Administrators, non-program	4
Health Facilities, program	14
Health Facilities, non-program	5
Laboratories, program	9
Laboratories, non-program	3
Couriers (program only)	9
FGD, TB patients (program only)	6
Evaluation Café	1
Total data collection events	*74*
Focus groups: 36 total participants *Evaluation Café: 12 participants*	

*Note: SSIs were typically conducted as small group interviews, so the number of respondents exceeds the number of interviews conducted.
**The "+" indicates a number of additional unstructured interviews conducted with others including field orderlies, environmental health technicians, etc. that were otherwise unplanned upon entry into the district.

[58] This was done to ensure clinics were included that had a distinct need for the ST system, while also balancing time constraints of the evaluation team.
[59] Information for these criteria for program districts was obtained through: RFH baseline databases, and RFH routine monitoring database.

APPENDIX 2: DATA APPENDIX

This appendix provides district-specific data corresponding to the aggregate data presented in the main body of the report. The districts for which figures are presented here include the first three urban districts (Harare, Bulawayo, and Chitungwiza), as well as the first five rural districts (Gokwe North, Makoni, Umguza, Umzingwane, and Zaka). The aggregate NTP data presented in the main body of the report includes data from all districts nationally. In this appendix, only the eight districts that have been in the program for the longest amount of time are presented, since it is expected that long-term trends may be better identified in such districts, accounting for seasonal or random variations, and because there is an adequate amount of data available for years following the start of the program.

RFH Data

Figures A1 through A8 present district-level data for the number of sputum specimens and TB results transported by the program, since the start date in each district. Breaks in the trend-lines indicate missing data; at times, data from districts was not available to RFH because of a lag in service due occasional needs to replace a courier. Seasonal trends, as described in the main body of the report, are evident in some of the district graphs. In Makoni, the courier motorcycle was stolen at some point and this affected specimen transportation. This is also a very large district with many health facilities and bad terrain; this district also began with a back-log.

NTP Data

Figures A9 through A16 present district-level data for the four indicators extracted from the NTP databases. Blue lines represent the indicators before the start of the program, and red lines indicate indicator levels after the start of the program, in each district. In these graphs, it is evident that individual events or district level factors can occasionally interrupt a trend. Examples of this include outreach programs in Chitungwiza, such as the known TB REACH program, resulting in a surge of suspects examined with SSM. As in the aggregated versions of these data, trends mostly proceed as expected, though it is not evident that the ST system incited any kind of substantial level or slope change in these districts for the indicators examined. Seasonal patterns are also evident in the district-level data, as described above. For a few districts, trends appear to be noisy or opposite of expected, such as Gokwe North for sputum not done, Zaka for sputum not done and treatment completion rate, and Umguza for treatment completion rate. Breaks in the trend lines indicate that data was missing from the NTP database.

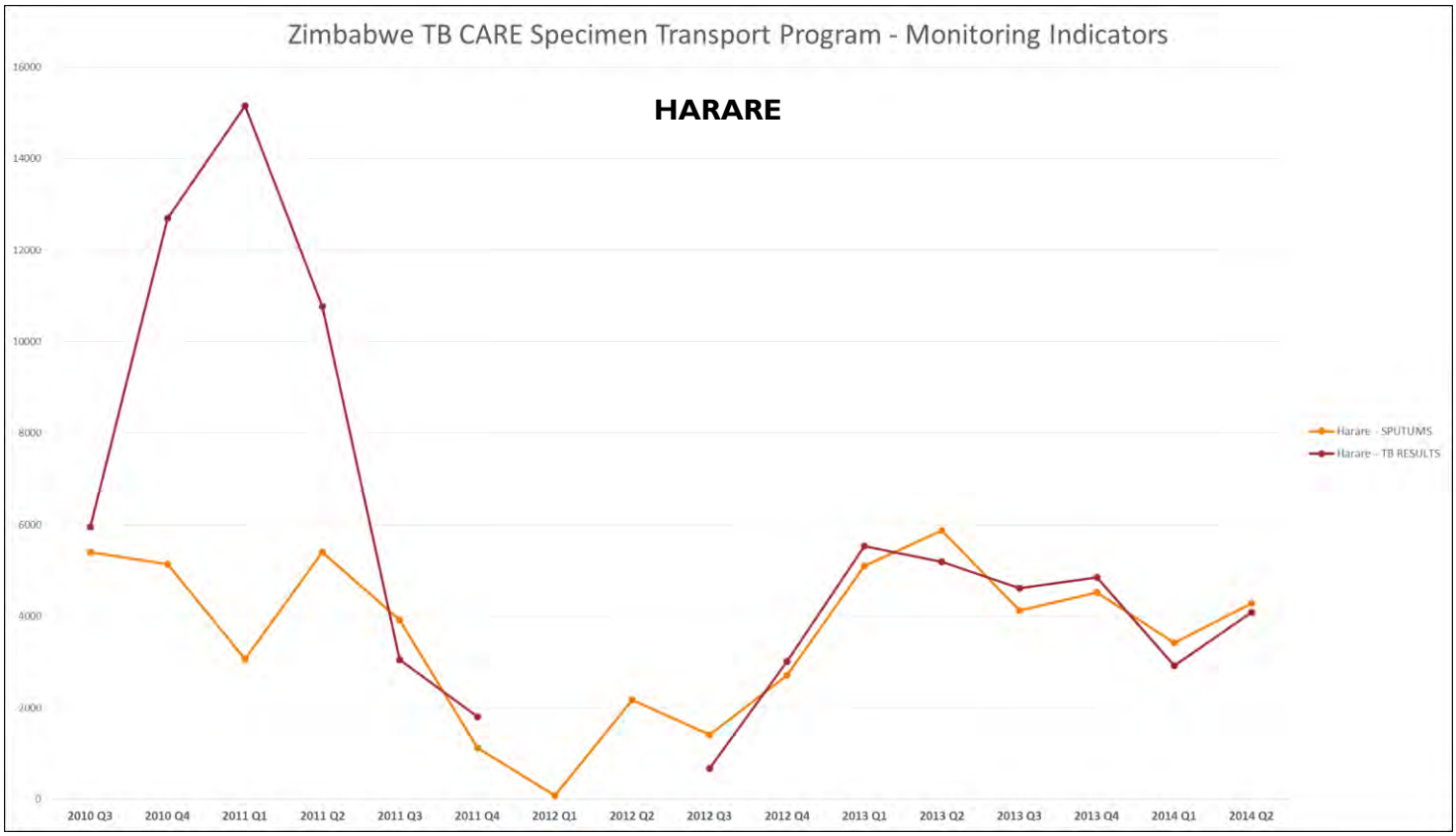


Figure A1. Sputum specimens and TB results transported in Harare

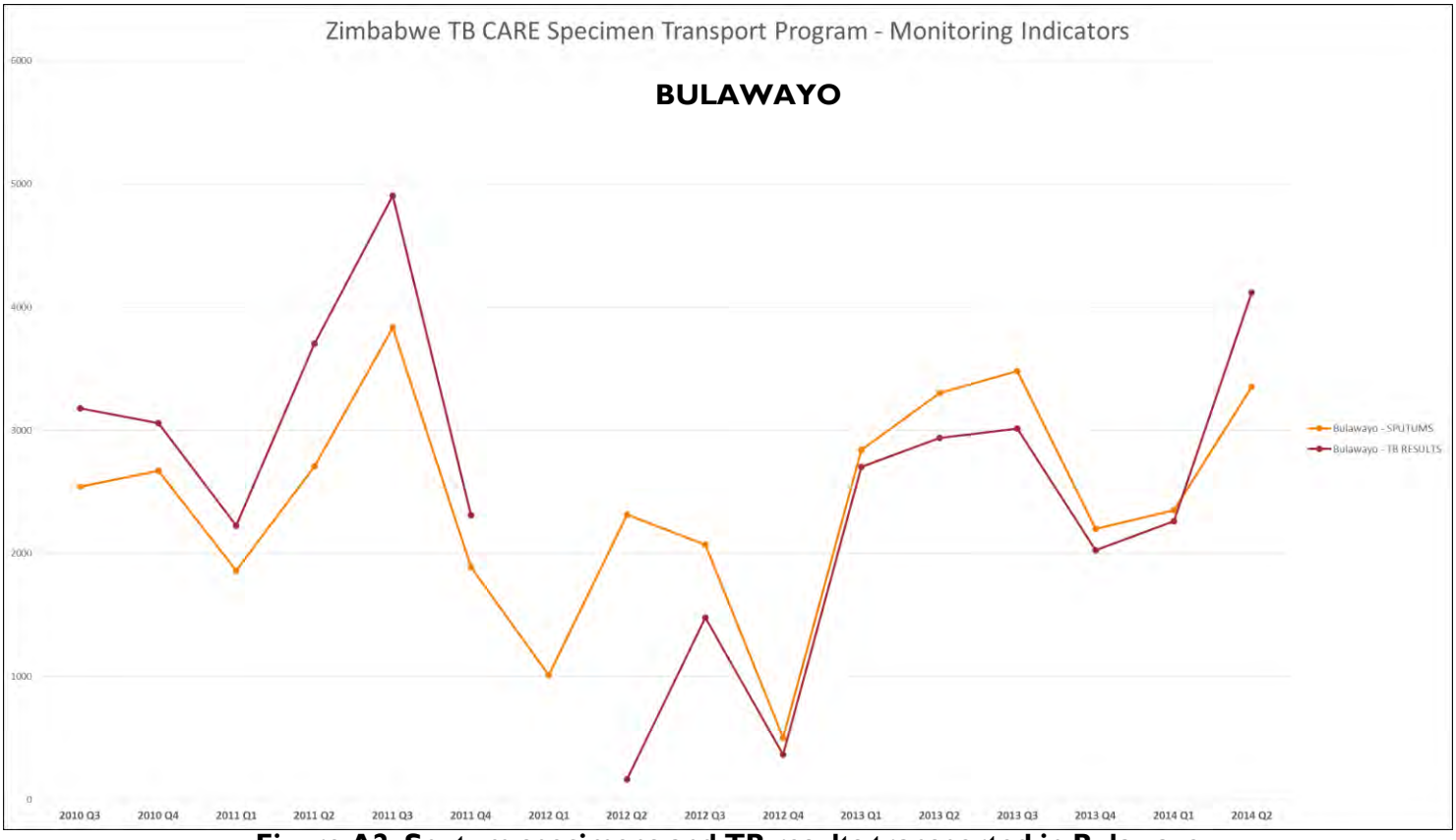


Figure A2. Sputum specimens and TB results transported in Bulawayo

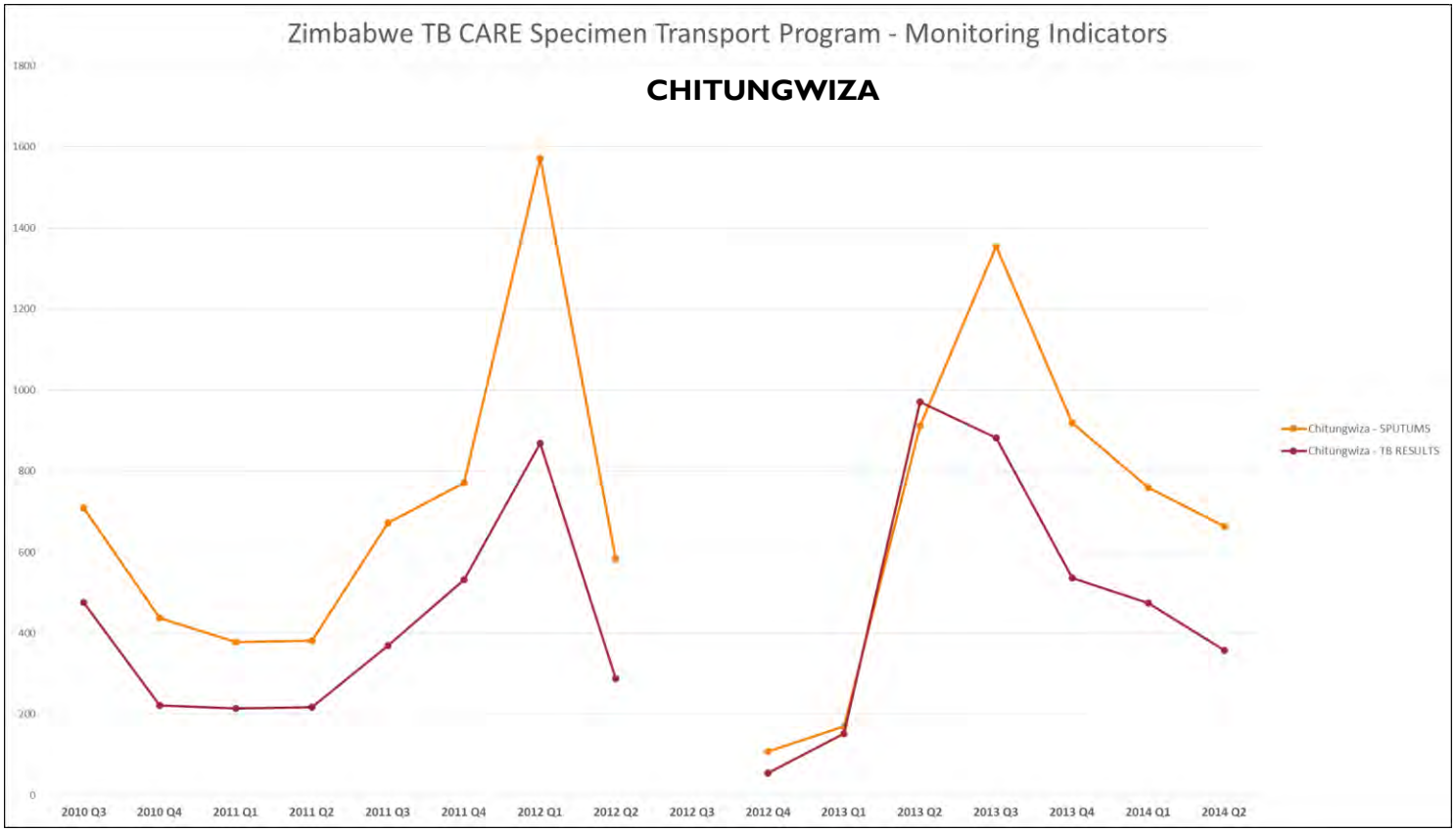


Figure A3. Sputum specimens and TB results transported in Chitungwiza

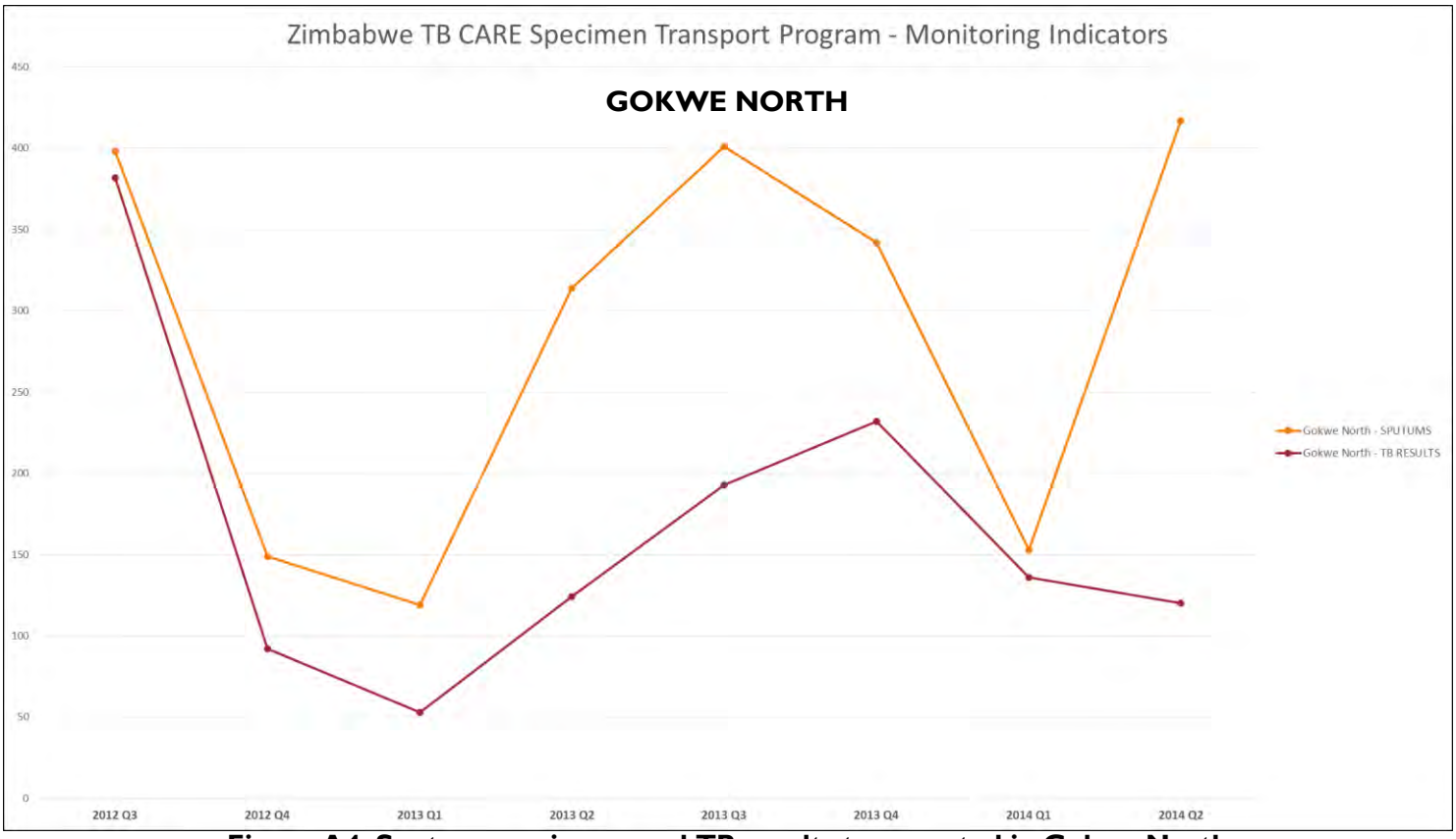


Figure A4. Sputum specimens and TB results transported in Gokwe North

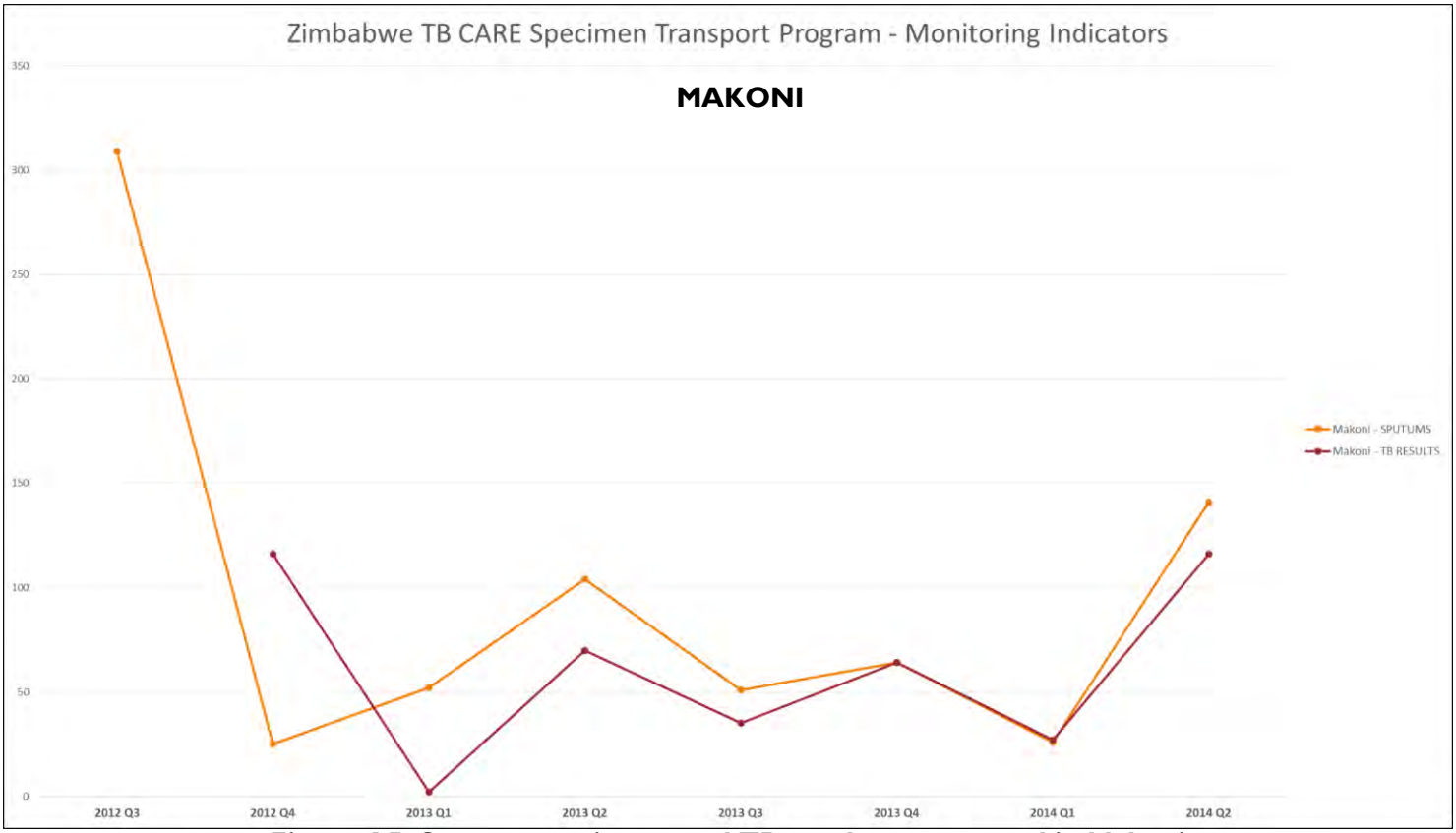


Figure A5. Sputum specimens and TB results transported in Makoni

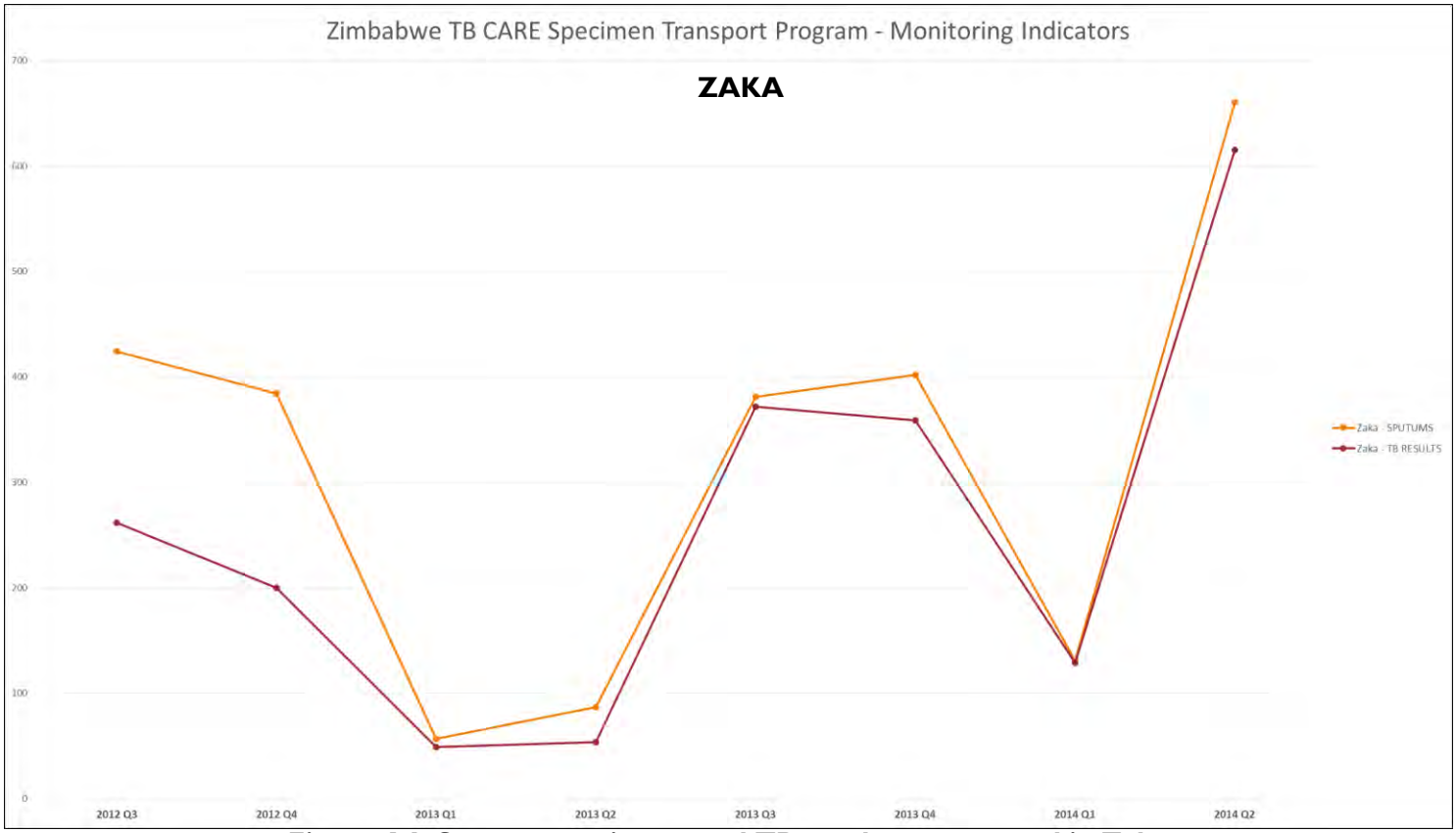


Figure A6. Sputum specimens and TB results transported in Zaka

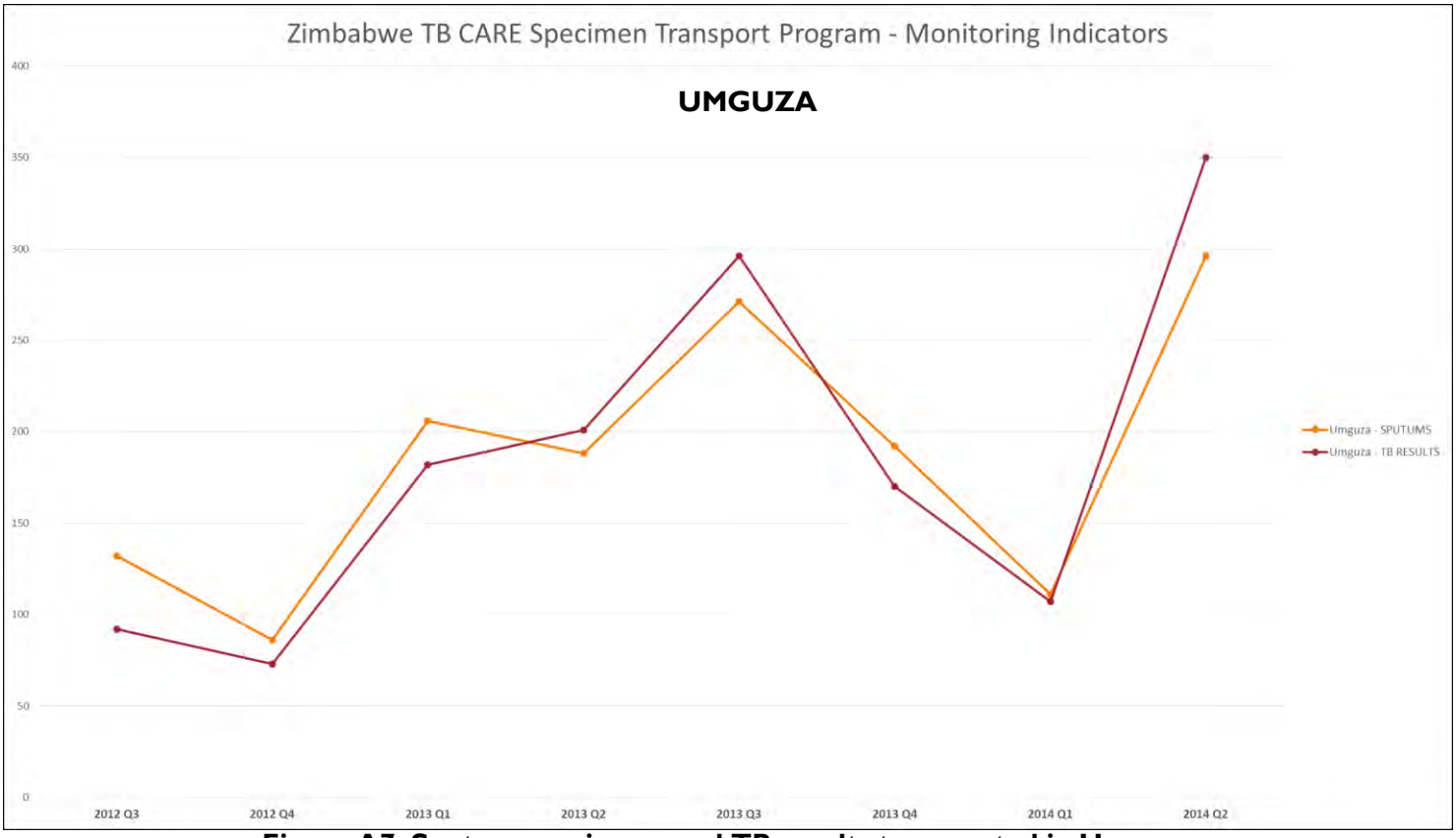


Figure A7. Sputum specimens and TB results transported in Umguza

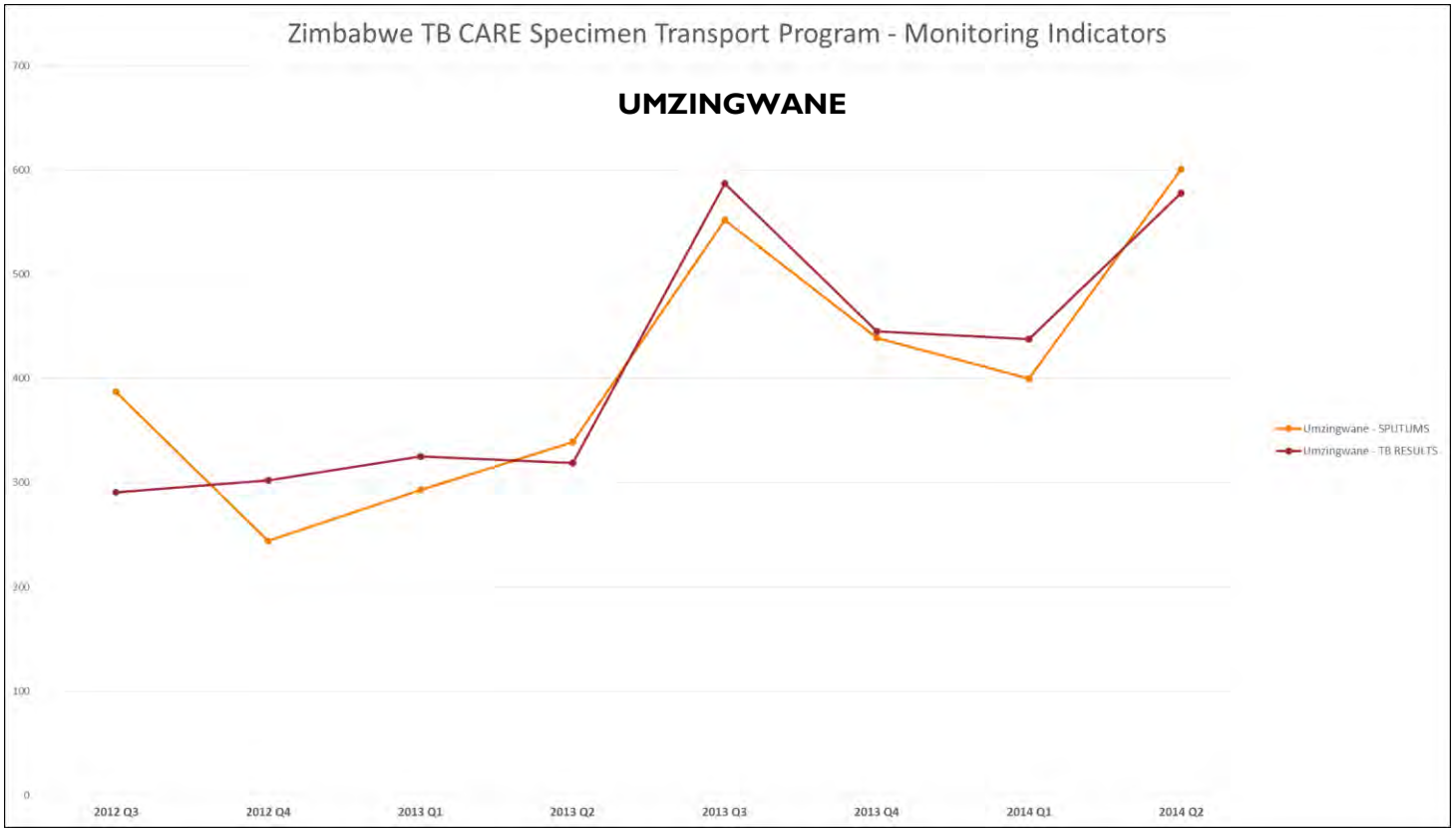


Figure A8. Sputum specimens and TB results transported in Umzingwane

HARARE

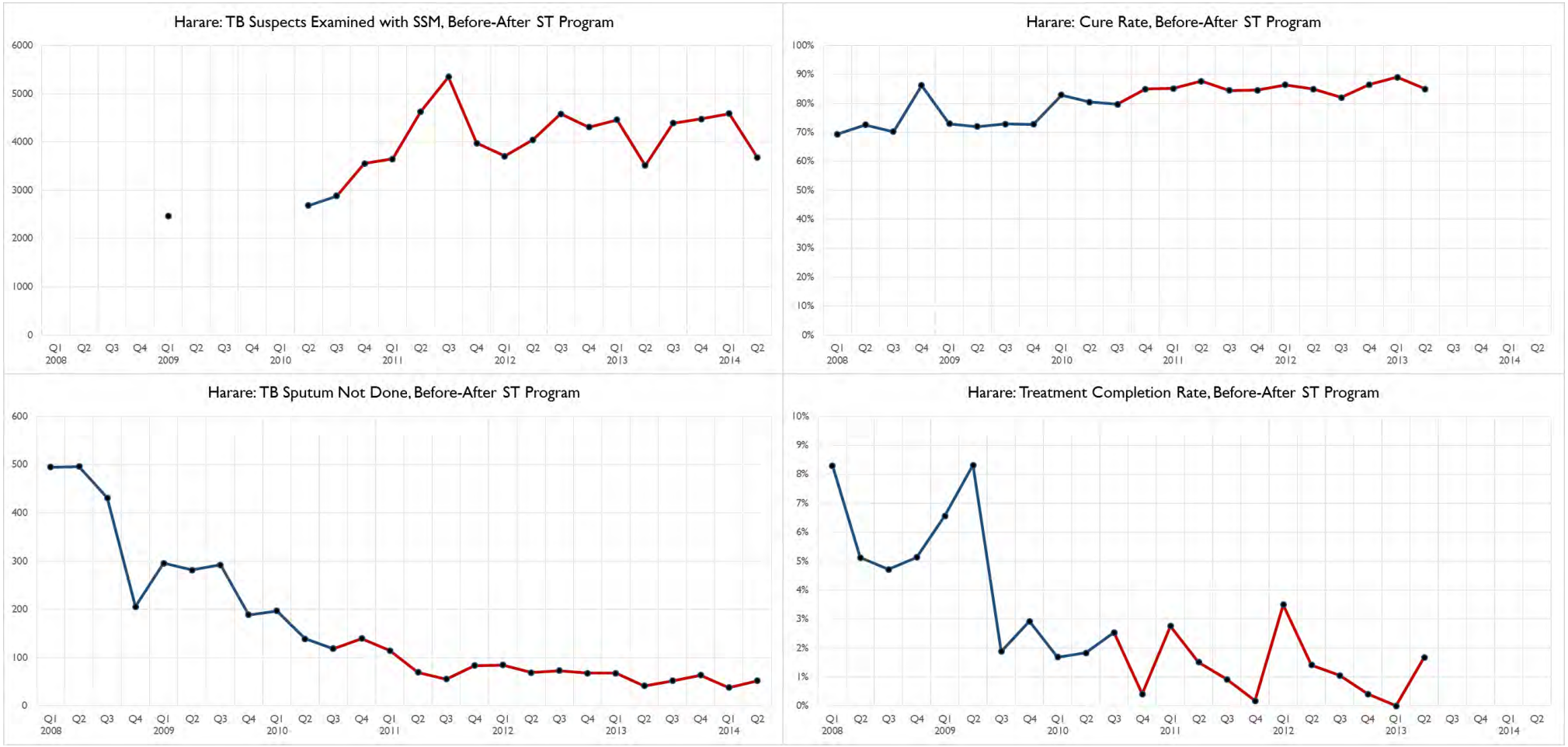


Figure A9. TB access and treatment outcome trends in Harare, 2008-present

BULAWAYO

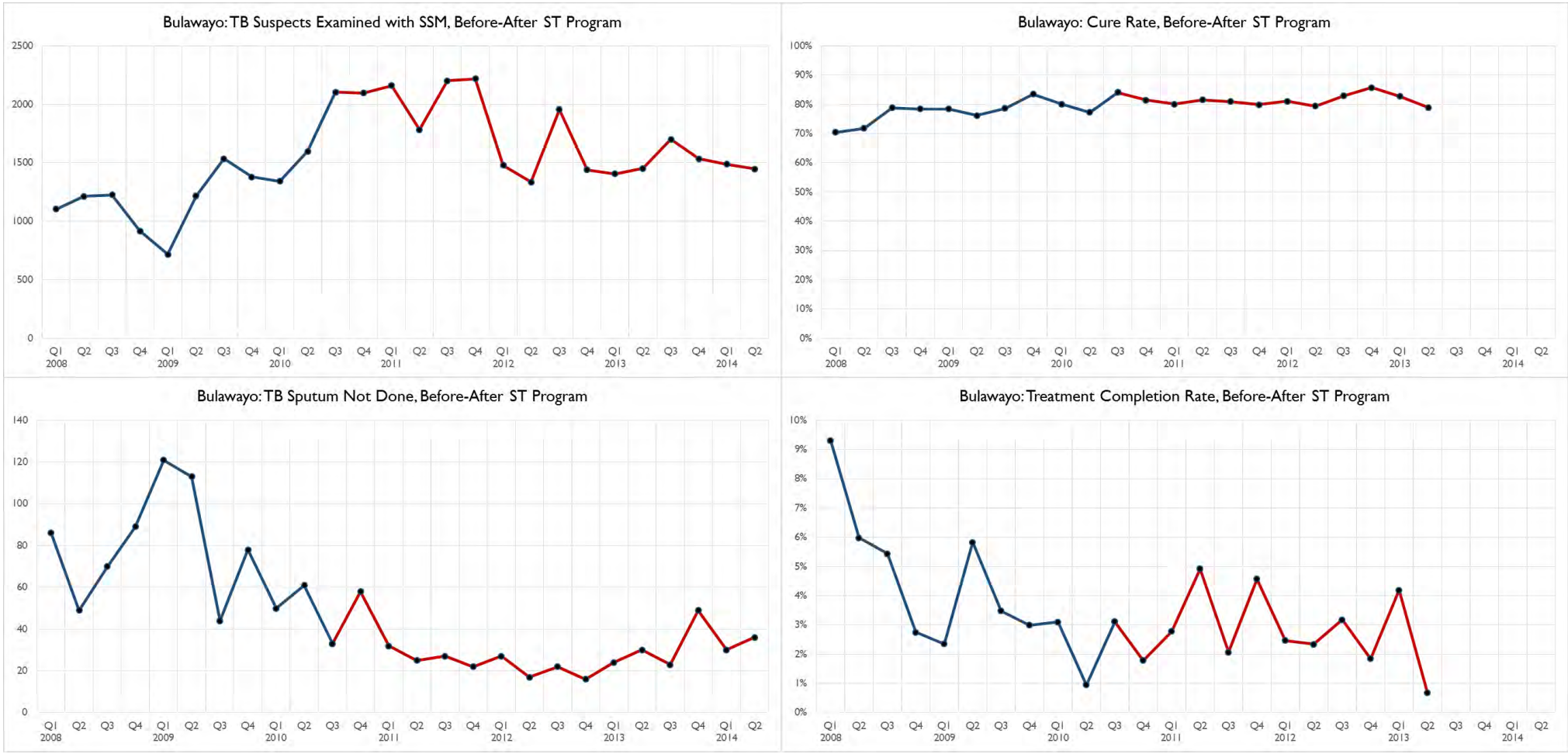


Figure A10. TB access and treatment outcome trends in Bulawayo, 2008-present

CHITUNGWIZA

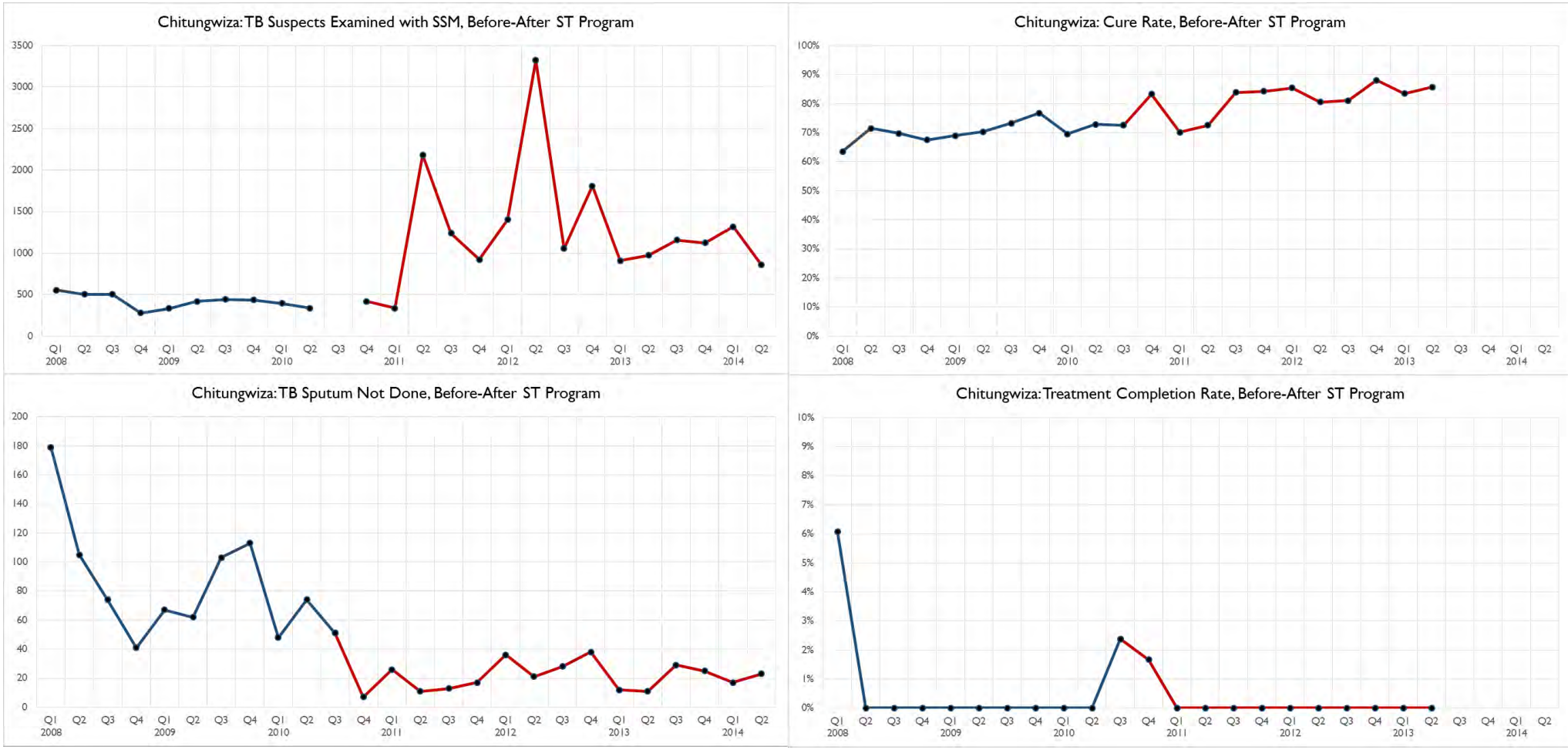


Figure A11. TB access and treatment outcome trends in Chitungwiza, 2008-present

GOKWE NORTH
(Midlands)

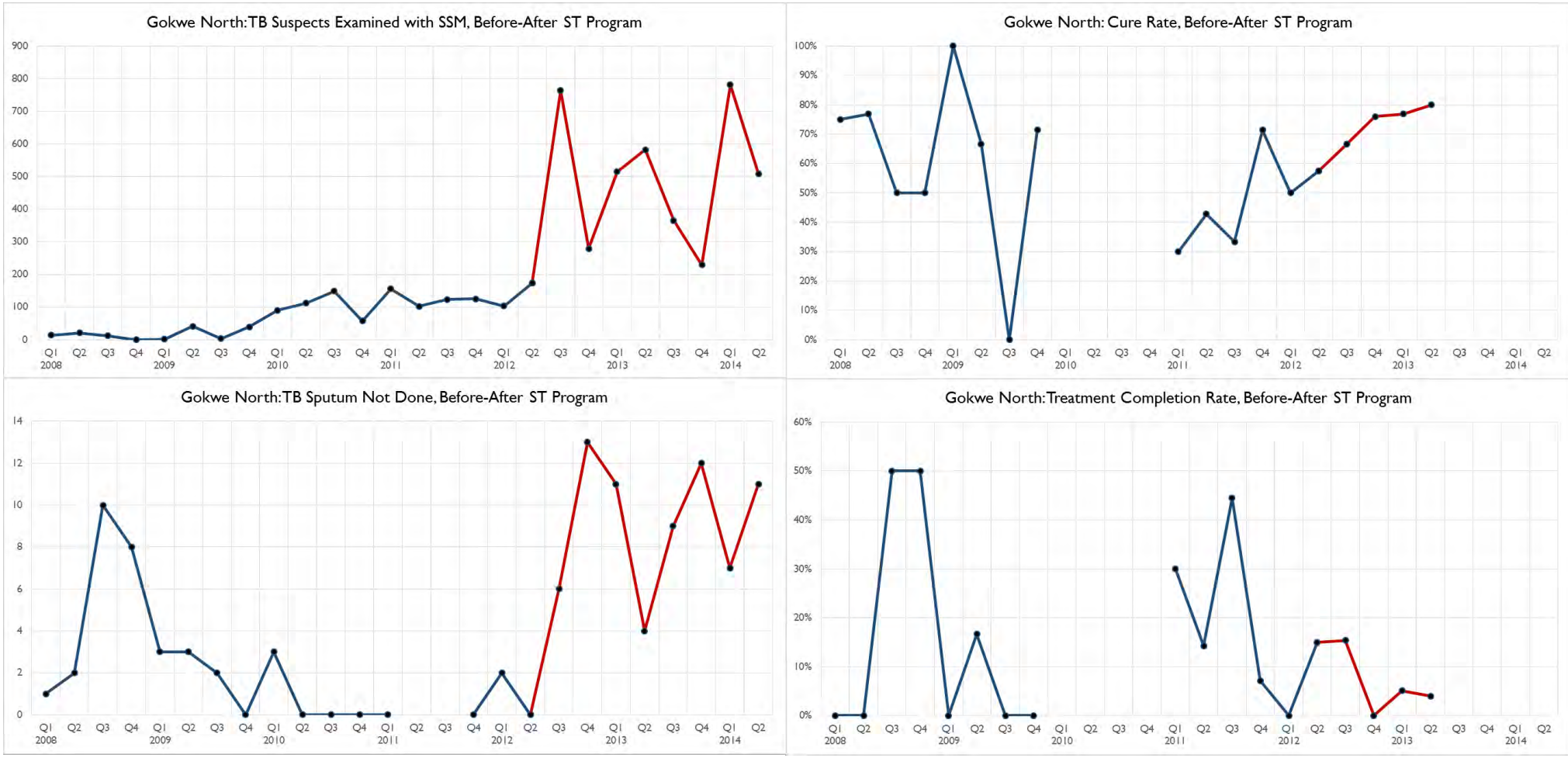


Figure A12. TB access and treatment outcome trends in Gokwe North, 2008-present

MAKONI
(Manicaland)

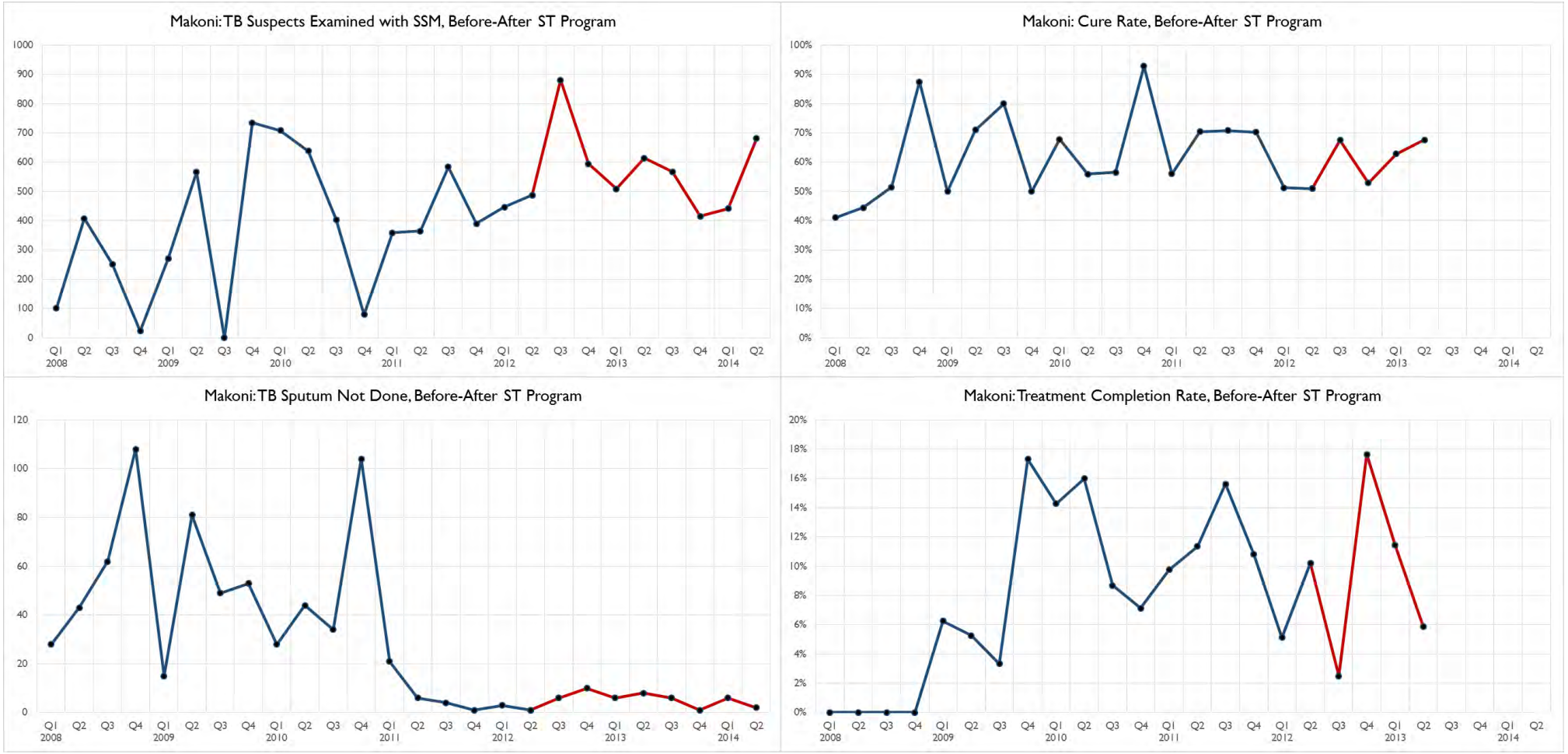


Figure A13. TB access and treatment outcome trends in Makoni, 2008-present

ZAKA
(Masvingo)

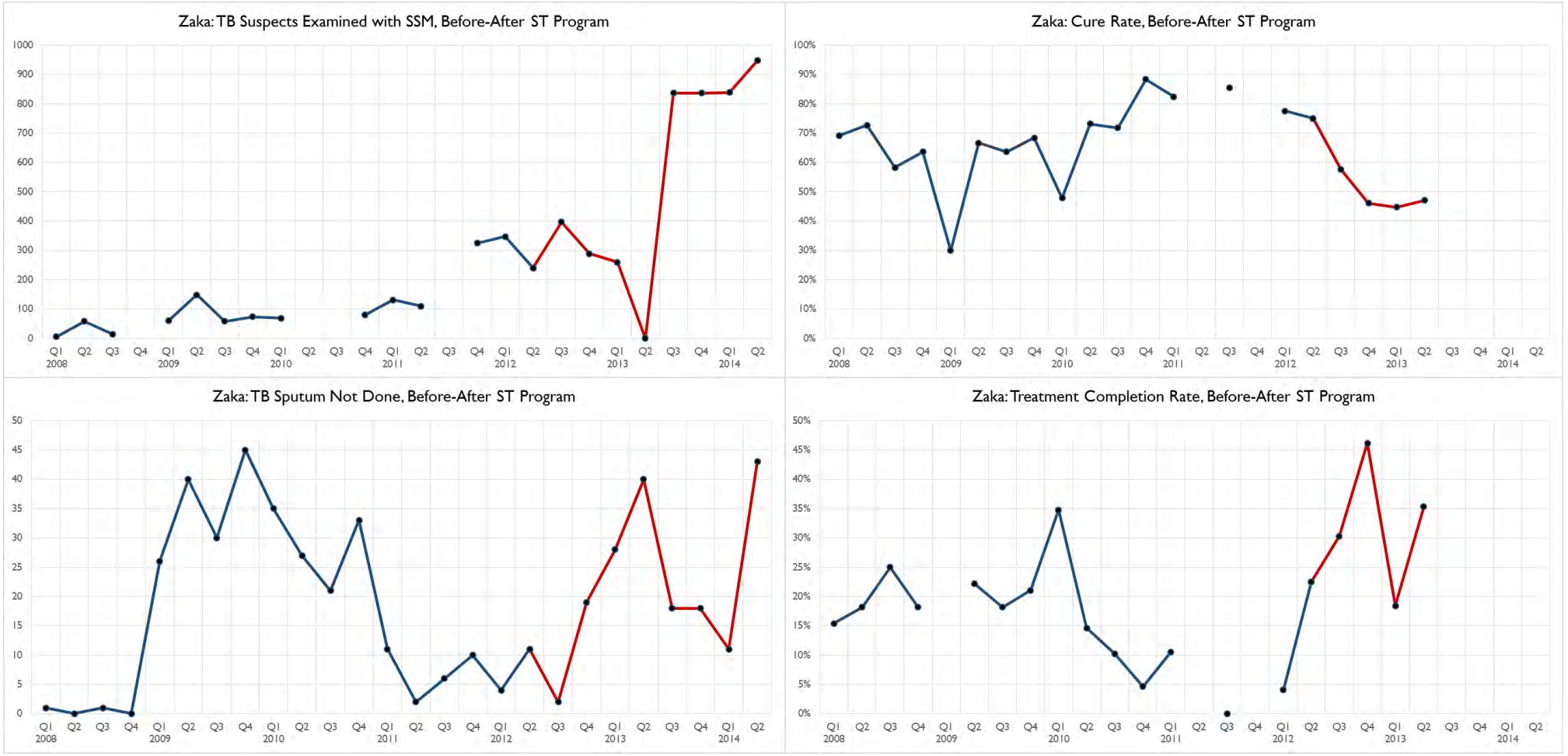


Figure A14. TB access and treatment outcome trends in Zaka, 2008-present

UMGUZA
(Matabeleland North)

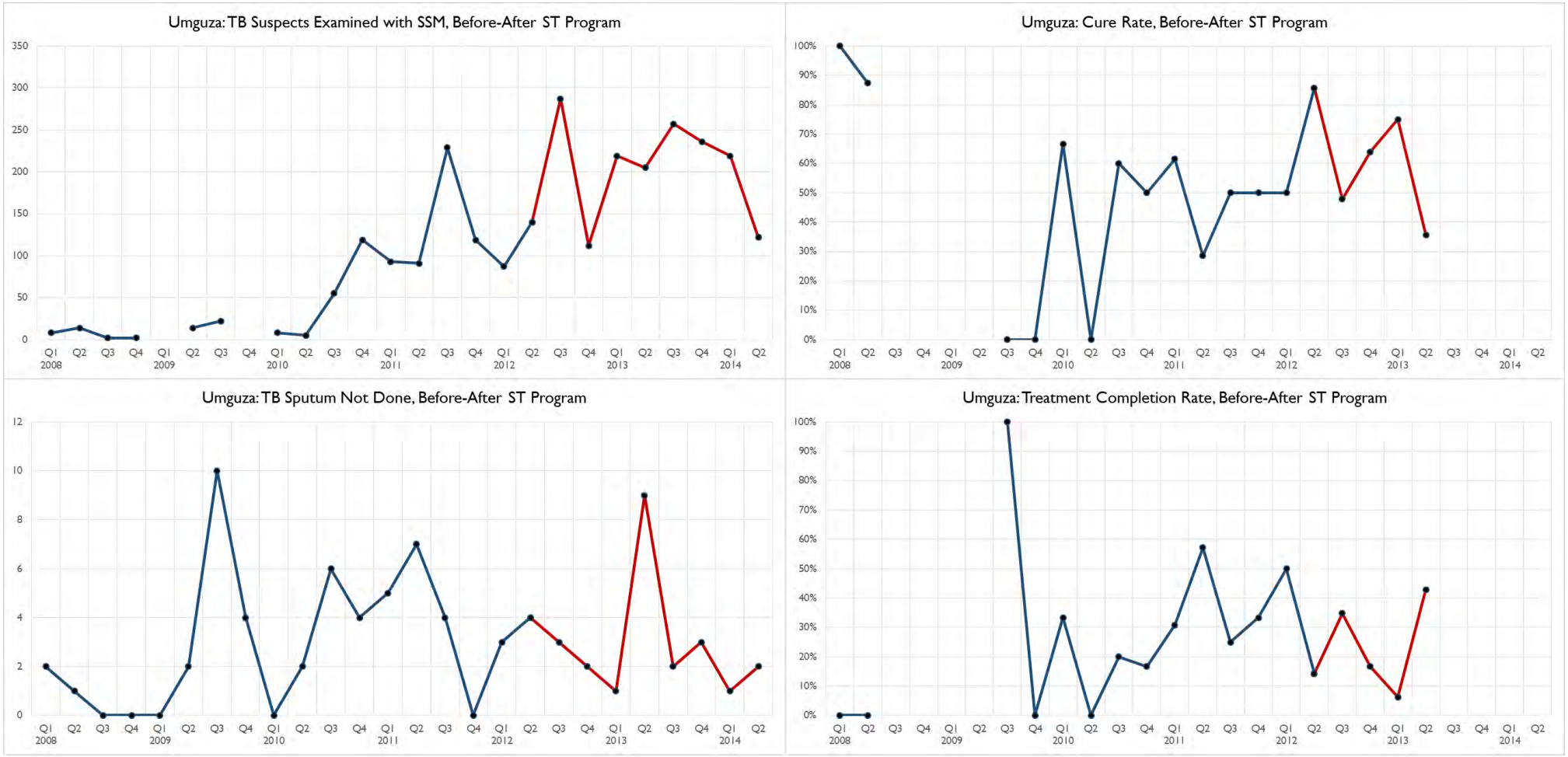


Figure A15. TB access and treatment outcome trends in Umguza, 2008-present

UMZINGWANE
(Matabeleland South)

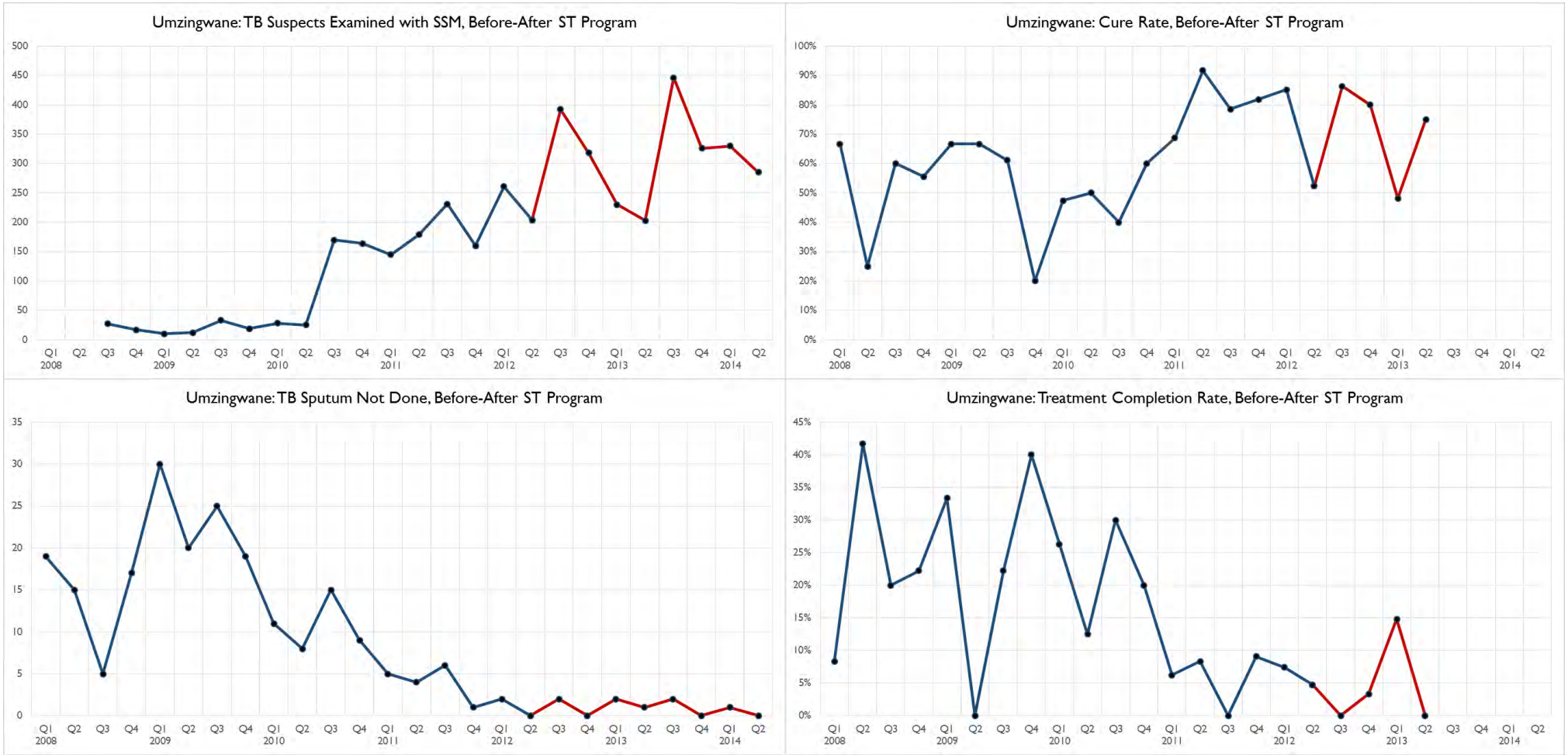


Figure A16. TB access and treatment outcome trends in Umzingwane, 2008-present

APPENDIX 3: RECOMMENDED FOLLOW-ON RESEARCH

The evaluation team recommends the following research be considered as follow-on efforts to this evaluation.

1. **Assessment of quantitative ST indicators, through data abstraction**
   This could include turnaround time (TAT), time to treatment initiation for smear-positive TB patients, and specimen rejection rates at laboratories. Such indicators are not tracked regularly by RFH or the NTP, but would be important to demonstrate program performance and impact. This data abstraction exercise would need to be conducted in a large sample of facilities across the country in order to make statistically robust comparisons over time and between areas. Potential challenges may include varying data completeness in TB registers, and the fact that before the ST system, in places where health facilities were referring patients to the district facilities for diagnosis, TAT would not have been an applicable indicator to track.

2. **Needs assessment (similar to RFH baseline surveys) in districts within provinces not yet reached by the program (Mashonaland Central and East)**
   Since the evaluation team was not able to include districts from these provinces in the district sample for this evaluation, it is possible that important insights from these provinces have been missed, whether related to successes or challenges with existing ST systems in those areas. Assessments similar to RFH baseline surveys or the non-program interviews conducted as part of this evaluation, are likely to yield useful insights from districts in these areas about the current state of ST in those districts and provinces.

3. **Economic analysis to examine relative benefits and costs of the program**
   The team recommends that some form of economic analysis is undertaken to assess the relative benefits and costs of the program. This would assist in tracking the program's performance over time, and will also enable program implementers, with the MOHCC and NTP, to discuss cost efficiency thresholds for different areas, e.g. rural versus urban. One option is cost-effectiveness analysis, with alternative specimen transport systems that may be implemented in other parts of the country where the TB CARE program is not operational, or in areas where current MOHCC staff are enlisted to conduct ST. This would require detailed cost information about the TB CARE program, and analogous information about the comparator programs. It will also require agreement about the appropriate measure of effectiveness to use. Two examples include specimens transported, which is process-based, and the proportion of TB suspects examined with sputum-smear microscopy, which is a more downstream measure of impact. At the very least, a cost-effectiveness threshold would need to be determined. Potential challenges may include the availability of impact-level indicators, and the availability and comparability of cost information between programs.