

Note: This is Online Supplementary Document 1 of U, Schroeder LF. Providing specimen transport through an online marketplace in the Northern region of Ghana. *Afr J Lab Med.* 2023;12(1), a2062. <https://doi.org/10.4102/ajlm.v12i1.2062>

Supplementary Methods

Pilot study setting

The online marketplace involved a network of stakeholders: health facilities, drivers, and laboratories. The marketplace was piloted between March 2019 and October 2019 at five health facilities in the public health system of the Northern Region in Ghana, including two district hospitals, two health centres, and the Community-Based Health Planning and Services (CHPS) compound. These facilities were selected using convenience sampling to represent a variety of settings. Two laboratories were recruited in the network, Tamale Zonal Public Health Laboratory and the Tamale Central Hospital. Laboratorians and other medical staff were trained on the use of the app and triple-packaging of specimens to ensure biosafety and biosecurity.[20] Taxi drivers in Tamale were recruited and trained on sample triple-packaging procedures and the risks of biohazardous materials. Drivers were trained not to open the packaging under any circumstances and to safely repackage the specimens while using personal protective equipment in instances of unintended opening. The trained drivers were required to pass a test prior to onboarding. The pilot included only biological substance category B specimens (excluding infectious substance category A specimens). Drivers used cars and motorcycles.

In addition to routine clinical and antenatal care (ANC) testing at the health facilities, disease control officers, who are typically responsible for directing specimens to public health laboratories, were recruited. Clinical testing was regarded as any testing for clinical care, excluding ANC screening at initial ANC visits and surveillance for diseases of public health importance. For the duration of the pilot, the study paid drivers per-delivery fees based on distance travelled, supplied mobile phones and data, and paid for testing at the laboratories that were not covered by public health funding.

Review of previous medical records and surveys

In addition to the pilot, medical record review was conducted for the state of test utilisation and TATs at 15 district hospitals and health centres. The sites were distributed across rural and urban settings chosen through convenience sampling. At each facility, laboratory testing data were extracted, including test names, the laboratory performing the test, time stamps, patient demographics, presenting symptoms, and diagnosis, from the 20 most recent medical records that contained any in-house testing at any point in the record and 20 recent records that contained any send-out testing. For TAT calculations, 'request' refers to the time on the provider note that requested a test, 'result' refers to the time the test result was generated by the laboratory, and 'record' refers to the time the test result was recorded. Surveys of patients and healthcare providers (hereafter referred to as providers) were conducted, with selection through convenience sampling, to understand the challenges and preferences for laboratory testing at the pilot sites (see Supplementary Surveys 1 and 2). The survey, which was administered orally by our staff, included multiple-choice and open-ended questions about how often laboratory tests are ordered, barriers to getting tests performed, and availability of specific tests. To characterise the impact of the pilot, a pre/post analysis of medical records at an ANC facility was conducted, including medical records from four months during the pilot (May 2019 through August 2019) and the same four-month period of the prior year (control). Similarly, tuberculosis laboratory records at Tamale Zonal Laboratory were reviewed to identify specimens from Buipe Polyclinic tested between 2009 and 2014. This was done to establish a baseline delivery time from collection to specimen receipt, which could then be compared to delivery times for tuberculosis specimens from the same facility during the pilot.



Supplementary Figure 1. Portion of the existing laboratory network in the Tamale catchment as extracted from medical records in the Northern Region of Ghana with testing dates between March 2014 – December 2018. The thickness of arrow is proportional to number of tests sent to the higher-level laboratory. These data were extracted from medical records and deliveries were ad-hoc (i.e., not performed by the specimen transport pilot). The white cross with a red circle background signifies an ANC public health facility.

Supplementary Survey 1: PATIENT QUESTIONNAIRE

Each of the following are reasons that sometimes prevent the use of laboratory testing. For each reason, rate how often that reason is a problem for you.

- | | | | | | | |
|---|---------|-------|--------|-----------|-------|--------|
| · Too expensive | Answer: | Never | Rarely | Sometimes | Often | Always |
| · Test is not available in the hospital, or equipment is down | Answer: | Never | Rarely | Sometimes | Often | Always |
| · Physician does not order a test | Answer: | Never | Rarely | Sometimes | Often | Always |
| · Other? Please explain | | | | | | |

If laboratory testing is not available at a health facility, sometimes the health care provider refers for testing at a private laboratory. This may be accomplished by collecting a biological sample in the health facility and sending the sample to a private lab, or by having the patient leave the hospital to seek testing at a private lab and then return again to the hospital.

When you need testing not offered in the health facility, which have you experienced? Check one This has

Sample is	Patient is	not sent
	sent Both	occurred
_____	_____	_____

We are developing a service so that we would deliver your sample (blood, urine, etc.) to a high quality laboratory for testing and return the results to you and your provider in the hospital. We expect there to be only a small fee for delivery. Would you be interested in this service? YES NO

Supplementary Survey #2: PROVIDER QUESTIONNAIRE

For tests you order, how often do you receive results in a timely manner so they can aid patient management? Answer: Never Rarely Sometimes Often Always

If a laboratory test is not available *at your* hospital laboratory:

How often do your patients have biological *samples* collected in the hospital with the samples sent from the hospital to an outside laboratory?

Answer: Never Rarely Sometimes Often Always

How often are your patients referred to travel themselves to an outside private laboratory to have samples collected and tested?

Answer: Never Rarely Sometimes Often Always

How often are your patients transferred to a higher tier health care facility that does have testing?

Answer: Never Rarely Sometimes Often Always

Indicate how often you experience these barriers to accessing laboratory tests:

	Never	Rarely	Sometimes	Often	Always
Stock-outs, instrument out-of-service	_____	_____	_____	_____	_____
Availability of collection equipment (e.g., tubes, syringes)	_____	_____	_____	_____	_____
Turn-around time/results not received	_____	_____	_____	_____	_____
Quality (trust in accuracy of results)	_____	_____	_____	_____	_____
Cost	_____	_____	_____	_____	_____
Patient declining testing for other reasons	_____	_____	_____	_____	_____

We are developing an on-demand specimen transport service with an internet and mobile phone app interface. It would be in the model of Uber taxi services in Accra. The app would allow the user to:

- Select a laboratory (with turn-around times and display of which tests are actively offered at each lab)
- Select a driver to pick up pre-packaged specimens from the health facility
- Track the driver en route in real-time within the app
- call or text the driver at any time during the delivery
- Receive confirmation from the laboratory that the specimens were delivered and adequate for testing

Would this service be useful to you at your health facility? YES NO