

## Short Communication

# Assessment of Essential Medicines Stock-Outs at Health Centers in Burera District in Northern Rwanda

Louis Nditunze<sup>1\*</sup>, Solomon Makuza<sup>2</sup>, Cheryl L Amoroso<sup>2</sup>, Jackline Odhiambo<sup>2</sup>, Elisephan Ntakirutimana<sup>2</sup>, Laura Cedro<sup>2</sup>, Joseph Mushinzimana<sup>3</sup>, Bethany Hedt-Gauthier<sup>2,4</sup>

<sup>1</sup>Ministry of Health, Butaro Hospital, Rwanda

<sup>2</sup>Partners In Health, Rwanda

<sup>3</sup>Ministry of Health, Burera District Pharmacy, Rwanda

<sup>4</sup>Harvard Medical School, Boston, USA

---

### Abstract

One-third of the global population, mostly in sub-Saharan Africa, lacks consistent access to essential medicines. This descriptive study assessed the level of stock-outs and whether distance to district pharmacy, supervision visits or delays in drug delivery from district pharmacy to health centers were associated with stock-outs in 15 rural health centers in northern Rwanda. We extracted data from stock cards, dispensing records and health center registers. One tracer drug, mebendazole, had no stock-outs. Quinine had the most stock-outs, an average of 10.5 months of stock-outs in 10 health centers. No association was found between drug stock-out and distance, supervision visits or delays in drug delivery. We hypothesize that observed stock-outs could be attributed to availability of other dosages of the same medicine, special orders during campaigns, staff turn-over and logistical issues beyond health centers' capacity such as delays in importation. These should be explored more in future studies.

---

**Key words:** essential medicines, stock-outs, pharmacy supply chain management, Rwanda

### Introduction

Majority of the developing countries, mostly in sub-Saharan Africa, lack consistent availability and access to essential health products (Wagenaar *et al*, 2014; Line & Cammack, 2013). Availability, access and affordability of safe drug products must be addressed to facilitate high quality healthcare (Elamin *et al*, 2010). This is challenging in resource-poor settings (Häfele-Abah & Neuhann, 2010). Despite increased affordability of drugs, most countries in sub-Saharan Africa struggle with pharmacy supply chain management (Sekabembe, 2009). Specific challenges include high and increasing outpatient attendance, geographical distance from central stores to local pharmacies, and challenges in importing drugs from outside countries (Edmund & Reuben, 2013; Hayford, 2011).

In Rwanda, the majority of health care delivery happens at the health center level, with more complicated cases referred to district hospitals. Each health center has a pharmacy to support healthcare delivery. Stock-outs at these pharmacies could limit the effectiveness of care offered. Few studies have assessed essential medicine

stock-outs in rural pharmacies in sub-Saharan Africa (Wagenaar *et al*, 2014; Wild & Cammack, 2013) and to our knowledge, none has been conducted in Rwanda.

To understand the level of stock-outs of essential medicines in rural health facilities in Rwanda, this study examined the proportion of drug stock-out and factors related to stock-out for ten tracer drugs in 15 health centers in rural Rwanda. Our study received technical review from Partners In Health (PIH) Research Committee and the Rwanda National Health Research Committee. Because we used routinely collected program data, we received an ethical review exemption from the Rwanda National Ethics Committee.

### Methods

This descriptive study was conducted in 15 health centers in Burera District, a rural district in northern Rwanda, between January 1 and December 31, 2013. The health services in Burera District are led by the Ministry of Health and supported by PIH, a non-governmental organization. The Rwanda Biomedical Center (RBC) and BUFMAR (a faith-based organization) purchase and distribute medicines to district pharmacies. In case

---

\*Corresponding author: ndilouis@gmail.com

of lack of pharmaceutical products in the public sector, with the authorization of the Minister of Health, district pharmacies can purchase medicines from private medical stores or receive donations from non-governmental organizations.

Health center pharmacies are supplied by the district pharmacy. A nurse assigned to the health center pharmacy records stock transactions, monitors the stock levels and uses recent consumption data to place the monthly order to the district pharmacy through paper-based stock management cards. If stock levels drop below predetermined buffer levels, the nurse may place an emergency order to the district pharmacy. Monthly reports on stock level are sent to the district pharmacy which are then aggregated and sent to the central level.

A quick survey of stock records at Burera District Hospital was conducted to determine the ten commonly used medicines that were also in the essential list of medicine. Data was collected on the ten tracer drugs selected by the study investigators based on the consumption patterns. These drugs represent a cross section of drug types that are used for common illnesses in Burera District: Amoxicillin 250mg capsule, Penicillin V 250mg tablet, Paracetamol 500mg tablet, Quinine 300mg tablet, Ibuprofen 200mg tablet, Cotrimoxazole 480mg tablet, Mebendazole 500mg tablet, Chlorpheniramine 4mg tablet, Promethazine 250mg tablet and Oral Rehydration Salt sachets. For each drug, the number of days of stock-out was collected for each month. We assessed health facilities with any stock-

out, the average number of months with any stock-out and the average number of days of stock-out per month.

For each health center, the average monthly proportion of drugs with any stock-out, distance from health center to the district pharmacy, number of months with any supervision visits (from health center register), average number of days between order to delivery (from purchase orders and delivery notes) and availability of motorcycle or vehicle for transportation (as reported by health center leaders) were recorded. The health centers were further classified as low level stock-outs (0-5% of drugs stocked out per month), medium level stock-outs (>5-10% of drugs stocked out per month) and high level stock-outs (>10% of drugs stocked out per month) based on observed stock-outs and compared with potential factors related to stock-outs. We performed univariate analysis, reporting means and proportions and also used a graphical bivariate analysis assessing the relationship between stock-outs level and the factors hypothesized.

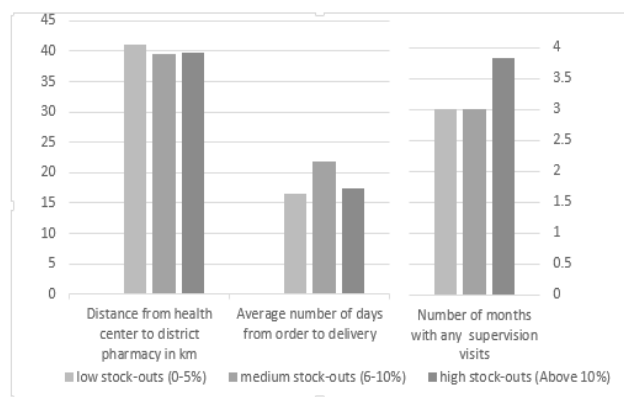
## Results

For the ten tracer drugs assessed, only one tracer drug, mebendazole, had no recorded stock-outs in any health center in 2013 (Table 1). Quinine had the most stock-outs, with 10 health centers (66.6%) experiencing an average of 10.5 months of stock-outs, often lasting for the entire month. For each of the remaining eight drugs, at least one and as many as six health facilities experienced stock-outs, and the number of months with stock-out for each drug ranged from 1.0-3.5 months.

**Table 1. Drug stock-outs for 10 tracer drugs at 15 health centers in rural Rwanda**

Drug name	Average number of months of data collection	Number of health centers with any stock-out	If any stock-out, average number of months of stock-outs	If stock-out, average number of days of stock-out per month
Mebendazole 500mg	12.0	0		
Promethazine 25mg	11.5	1	2	27
Oral Rehydration Salt (ORS)	11.2	2	1	7
Amoxicillin 250mg	12.0	2	1.5	7
Cotrimoxazole 480mg	11.9	3	1.7	13.9
Paracetamol 500mg	12.0	4	1.5	9.2
Chlorpheniramine 4mg	12.0	4	2	10
Penicillin V 250mg	12.0	4	3.5	15.9
Ibuprofen 200mg	11.2	6	3	14.9
Quinine 300mg	12.0	10	10.5	30.4

The classification of stock-out levels was based on the range of stock-out levels seen that was between 0.0-24.2%. Six health centers (40%) were classified as having high levels of drug stock-out, five health centers (33.3%) as medium levels and four health centers (26.7%) as low levels or no stock-outs (Figure 1).



**Figure 1. Comparing factors related to stock-outs in health centers with low, middle and high levels of drug stock-outs**

The distance between health centers and district pharmacy ranged from 1-82 km. The number of supervision visits per facility ranged from 0-7 during the year, with two health centers (13.3%) not receiving any supervisory visits. The average days between order and delivery ranged from 12-38 days. All health centers had access to a motorcycle or vehicle for transportation. Upon further analysis, there was no relationship between level of stock-out and distance from health center to district pharmacy, supervision visits and days between order and delivery.

## Discussion

The present study found out that there was a variation in the presence and level of stock-outs of the different drugs. Mebendazole was the only drug without any documented stock-outs while quinine had high levels of stock-outs with 66% of the facilities experiencing at least one stock-out over the study period. Reasons for these extremes should be studied to improve supply chain management for health center pharmacies in the future. For amoxicillin, ibuprofen and cotrimoxazole, our study included the lower dosage medicines that are commonly prescribed to children. In some cases, higher dosages were available during stock-outs of the lower dosages but would require that tablets be broken to achieve appropriate dosing for children. For drugs such as promethazine and chlorpheniramine, stock outs could be due to low or irregular consumption, as observed in other studies (Robertson, 2009).

The study results showed no trend between drug stock-out and the factors we originally hypothesized. In Rwanda, health center pharmacies are managed by staff with limited pharmaceutical technical and supply chain management capacity (Ministry of Health, 2012). This situation has been associated with inability to quantify medical supplies appropriately and in timely fashion at health facility level resulting in imprecise forecasting of pharmaceutical requirements by the Medical Procurement and Distribution Department (MPDD) (Ministry of Health, 2012). In response to that, however, the Rwandan government in its third Health Sector Strategic Plan for 2012-2018 (HSSP-III) set a target of raising the level of health facility staff skills in pharmaceutical supply management (Ministry of Health, 2012).

In Rwanda, the Logistic Management Information System (LMIS) has been paper-based, although the rolling out of electronic LMIS is in progress (Ministry of Health, 2012). The use of paper-based LMIS at the time of the present study may have contributed to some observed stockouts, as reported elsewhere (Desale, Taye, Belay, & Nigatu, 2013; USAID | DELIVER PROJECT, 2012). Further, the ongoing deployment of electronic LMIS to replace one which is paper-based will require harmonization of tools used by all partners engaged in the procurement and supply chain management (Ministry of Health, 2012), and the impact of this harmonization on drug stock-outs should be studied. Finally, other studies on drug stock-outs in health centers have identified a weak supply chain management system, staff motivation, poor stock records and budget allocation as contributing factors (Wagenaar *et al*, 2014; Penfold *et al*, 2013). Future studies should assess these factors' contributions to drug stock-outs in Rwanda.

## Study limitations

There are a few limitations to our study. We only assessed one rural district, Burera. However, since most district in rural areas tend to experience almost similar challenges, the results of this study might serve as a useful resource to other health managers. Likewise, the use of secondary data gathered in routine execution of logistic activities left many questions unanswered, and will in future require specially designed questionnaire to seek for the answers.

## Conclusion

Up to 73% of health facilities faced a challenge of medium to high levels of stock outs. Limited capacity of staff managing logistics and supplies at health facilities could be contributing to the observed stockouts, a situation also identified by government of Rwanda and

plans for capacity building are underway. Future research to assess the role of electronic Logistic Management Information System in the availability of drugs at health facilities as well as research on the effect of pharmacy staff qualifications and turn-over on stock-outs will go a long way to identifying other factors that might contribute drug stock-outs.

### Acknowledgements and Funding

We are grateful to Tharcisse Tuyizigire, Jean Bosco Turinimana, Rita Uwingabiye, Jean Paul Ndicunguye, Lievin Cedric Bayahunde, Pascal Nkezabera and Michel Nshimiyimana for their support in data collection. The authors also acknowledge support and thank the Ministry of Health, the administration of Butaro Hospital, leaders of all health facilities in Burera District and the managers of health center pharmacies. This study was developed under the Partners In Health/ IMB Intermediate Operational Research Training Program and facilitated by Bethany Hedt-Gauthier and Cheryl Amoroso. We acknowledge Partners In Health/Inshuti Mu Buzima and IMB Innovation Grants for the support of this work.

### Conflict of interests

All authors declare that they have no competing interests.

### Author Contributions:

LN and SM led study conception, design, analysis, interpretation of results, and manuscript writing. BHG and CA served as research mentors, offered support in conception, design, analysis, interpretation of results, and manuscript writing. JO and JM supported analysis, interpretation of results and manuscript writing. EN support conception, design and paper writing. LC supported design and paper writing.

### References

Desale, A., Taye, B., Belay, G., & Nigatu, A. (2013). Assessment of laboratory logistics management information system practice for HIV/AIDS and tuberculosis laboratory commodities in selected public health facilities in Addis Ababa, Ethiopia. *Pan African Medical Journal*, 15, 1–8. doi:10.11604/pamj.2013.15.46.1969

- Edmund, M.N., & Reuben, K.E. (2013). Essential medicines availability and affordability: A case study of the top ten registered diseases in Builsa district of Ghana. *International journal of scientific & technology research*, 2(8), 208-219.
- Elamin, E.I., Ibrahim, M.I.M., & Yousif, M.A.E. (2010). Availability of Essential Medicine in Sudan? *Sudanese Journal of Public Health*, 5(1), 32-37.
- Häfele-Abah, C., & Neuhann, F. (2010). Improving high quality low- cost essential medicines in Tanzania – Assessing an NGO’s Contribution. Available from: <http://www.medicusmundi.org/en/contributions/reports/2010/improving-access-to-high-quality-low-cost-essential-medicines-in-tanzania-assessing-an-ngos-contribution>
- Hayford, K., Privor-Dumm, L., & Levine, O. (2011). Improving Access to Essential Medicines through Public- Private Partnerships. *International Vaccines Access*.
- Ministry of Health (2012). Rwanda Health Sector Strategic Plan 2012-2018 (HSSP III). Available from: [http://www.moh.gov.rw/fileadmin/templates/Docs/HSSP\\_III\\_FINAL\\_VERSION.pdf](http://www.moh.gov.rw/fileadmin/templates/Docs/HSSP_III_FINAL_VERSION.pdf)
- Penfold, S., Shamba, D., Hanson, C., Jaribu, J., Manzi, F., Marchant, T, et al. (2013). Staff experiences of providing maternity services in rural southern Tanzania : a focus on equipment, drug and supply issues. *BMC Health Services Research* 13 :61.
- Robertson, J., Gilles, F., Trapsida, J.M., & Suzanne, H. (2009). What essential medicines for children are on the shelf? *The Bulletin of the World Health Organization*, 87(3), 2310237.
- Sekabembe, L. (2009). Factors contributing to persistent stock outs of essential medicines and health supplies at lower level health facilities in Wakiso District. Makerere University [Dissertation], Available from: <http://docs.mak.ac.ug/sites/default/files/L%20Sekabembe%20Dissertation%2009.pdf>
- USAID/DELIVER PROJECT,T. O. 4. (2012). Computerizing Logistics Management Information Systems: A Program Manager’s Guide. John Snow, Inc. 1616 Fort Myer Drive, 16th Floor Arlington,VA 22209 USA: USAID | DELIVER PROJECT, TASK Order 4. Retrieved from [http://www.villagereach.org/wp-content/uploads/2013/07/CompLMIS\\_PMG-1.pdf](http://www.villagereach.org/wp-content/uploads/2013/07/CompLMIS_PMG-1.pdf)
- Wagenaar, B.H., Gimbel, S., Hoek, R., Pfeiffer, J., Michel, C., Manuel, J.L., et al. (2014). Stock-outs of essential health products in Mozambique – longitudinal analyses from 2011-2013. *Tropical Medicine and International Health*,19(7), 791-801.
- Wild, L & Cammack D. (2012). The supply and distribution of essential medicines in Malawi. Overseas Development Institute. London