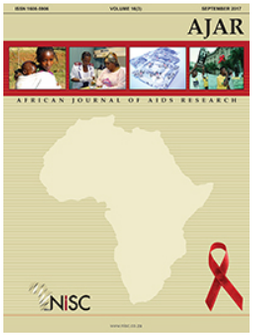

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HIV antiretroviral medication stock-outs in Ghana: contributors and consequences

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Drug stock-outs are an unfortunate yet common reality for patients living in low and middle income countries, particularly in sub-Saharan Africa where trouble with consistent stock of antiretroviral medications (ARVs) continues. Our study takes a snapshot of this problem in Ghana. Although the country launched its antiretroviral therapy (ART) programme in 2003, progress toward realising the full benefit of ART for treated individuals has been limited, in part, because of stock-outs. In Ghana's Greater Accra region, we conducted semi-structured interviews with 40 women living with HIV (WLHIV) and 15 individuals with a history of HIV-related work in government or non-governmental organisations, or healthcare facilities. We used repeated review with coding and mapping techniques to analyse the transcripts and identify common themes. Stock-outs of ARVs result in inconsistent administration of therapy, increased indirect medical costs for WLHIV, and negative labelling of patients. Inefficiencies in drug supply, poor coordination with port authorities, inadequate government funding and dependence on international aid contribute to the stock-outs experienced in Ghana. Although using ARVs produced in-country could reduce supply problems, the domestically-manufactured product currently does not meet World Health Organization (WHO) standards. We recommend focused efforts to produce WHO standard ARVs in Ghana, and a review of current supply chain management to identify and mend pitfalls in the system.

Keywords: antiretroviral therapy, healthcare funding, HIV/AIDS, pharmaceutical supply, reagent shortage, West Africa

Introduction

This research began as a qualitative study exploring HIV status disclosure among women living with HIV in Ghana (see Poku, Owusu, Mullen, Markham, & McCurdy, 2017), as women report more HIV-related stigma experiences and negative consequences of disclosure than men (Afranie, Boafo, & Oppong Asante, 2012; Asiedu & Myers-Bowman, 2014). However, difficulty with acquiring antiretroviral medications (ARVs) due to stock-outs was repeatedly mentioned in our interviews. This paper explores this theme separately, and includes descriptions from government reports and other sources to elaborate on the interview data. Continuous access to the correct line of combination antiretroviral therapy (ART) optimises drug-taking practices. The avoidance of stock-outs is imperative to promoting patient adherence and better outcomes overall, realising the benefits of ART (WHO, 2013). These benefits include decreased HIV transmission rates (Fang et al., 2004), delayed progression from HIV infection to AIDS (Detels et al., 1998), decreased AIDS-related deaths (Palella Jr., et al., 2006), and prevention of drug resistance (Bangsberg, 2008). These benefits accrue, even in low-resource countries (Abbas, Anderson, & Mellors, 2006). Scaling up ART programmes is also associated with decreased HIV-related stigma (Chan, Tsai, & Siedner, 2015).

There is ample evidence that HIV-positive persons in many low resource countries, including Ghana, have inadequate access to ART when they need it (Maddison & Schlech, 2010; Ministry of Health, 2015; WHO, 2014). Explanatory factors for this include ARV stock-outs (UNAIDS, 2012). Thus, this paper is of prime importance not only to Ghana but also to the rest of Africa and other low- and middle-income countries, as they bear a disproportionate measure of the global HIV/AIDS burden (Kharsany & Karim, 2016; Maddison & Schlech, 2010; Ramjee & Daniels, 2013).

Advocates have helped increase the supply of first- and second-line ARVs through manufacturers in Brazil and South Africa (Biehl, 2007; Hörbst & Wolf, 2014). India and China are now major suppliers of ARVs to countries in Asia and sub-Saharan Africa (dos Santos Pinheiro, Brüning, Macedo, & Siani, 2014), and Uganda and Kenya also produce ARVs. Additionally, the medication is available to many countries through programmes such as The Global Fund to Fight AIDS, Tuberculosis and Malaria (The Global Fund) and The US President's Emergency Fund for AIDS Relief (PEPFAR) (Biehl, 2007; Hörbst & Wolf, 2014; UNAIDS, 2012).

Despite these advances, however, inadequate and inconsistent stocks of both first- and second-line ARVs are ongoing problems for many developing countries (UNAIDS, 2012), leading to periods of unavailability, or drug stock-outs. Mori and Owenya (2014), for example, found that weak forecasting of pharmaceutical needs and problems with coordination within the Medical Stores Department

encouraged ARV stock-outs in Tanzania. Although five African countries (Democratic Republic of Congo, Ghana, Nigeria, Tanzania, and Zambia) each have at least one pharmaceutical company in-country producing ARVs, these products do not meet WHO pharmaceutical standards and cannot be purchased for use in Global Fund-sponsored programmes (Pinheiro et al., 2014). Even in areas where WHO standard ARVs are manufactured in-country, mismanagement of the supply chain fosters stock-outs at the depot and health facility levels (Bateman, 2013). Decreased availability of treatment leads to changes in ART regimen for patients in different countries (Mori & Owenya, 2014; Pasquet et al., 2010). Tenuous drug supplies contribute to people living with HIV (PLHIV) having limited access to the drugs they need, and their mistrust of biomedicine, the state, and international donors (Obadare & Okeke, 2011 ; Renne, 2006). Limited ARV access also decreases the interest of PLHIV in pursuing treatment (Muhamadi et al., 2010). All these circumstances threaten the ability and desire of PLHIV to adhere to ART (Pasquet, et al., 2010; Schouten et al., 2011).

Although ARV stock-outs have been discussed in the context of several sub-Saharan African countries including Cameroon, South Africa, Zimbabwe, Botswana and Nigeria (Boyer et al., 2011; Ojikutu, Makadzange, & Gaolathe, 2008; Uzochukwu et al., 2009), to the best of our knowledge no current published literature exists that investigates ARV acquisition problems in Ghana. This paper provides insights into components that contribute to ARV stock-outs in Ghana and the ramifications of this problem.

ARV management within Ghana's healthcare system

Ghana began receiving grants to cover ARVs in 2003 (Felling et al. 2003). Global Fund grants covered ARVs and other clinical assessment needs, such as reagents for assessing CD4 and viral load counts. Between 2005 and 2010, donor funding accounted for 75% of the HIV/AIDS-related spending in Ghana (PEPFAR, 2013). In 2011, by the expiration of the original Global Fund grant period, Ghana's income status was upgraded from a low-income to a lower middle-income country (World Bank, 2011), due in part to the discovery of oil off the western coast in 2008 (World Bank, 2011). In the same year the Ghanaian government committed to providing 150 million[1] Ghana cedis (GHS) (approximately US$98.8 million in June 2011) to continue HIV-related programmes including ARV procurement over the following 5 years (Ghana News Agency, 2012; PEPFAR, 2014). The government did not, however, make the necessary provisions to ensure a steady ARV supply. According to PEPFAR (2014), as of January 2014, only 17 million GHS (approximately US$7.4 million)[2] had been released.

The Global Fund extended its grant, ultimately through the end of 2014, providing only enough funds to cover the original cohort of 49 007 PLHIV already under care (The Global Fund, 2013). Thus, when WHO updated the international ART initiation recommendations in 2010 from CD4 ≤ 200 cells/mm^3 to ≤ 350 cells/mm^3, and then to ≤ 500 cells/mm^3 in 2013 (WHO, 2010, 2013), an estimated 118 574 HIV-positive adults were eligible for treatment in 2013 — a nearly 2.5-fold increase from the original cohort (GAC, 2015). This number far surpassed the capacity of Ghana's Global Fund budget for ART. Emergency shipments of ARVs were partially covered by the US government and others (PEPFAR, 2013); eventually, approximately 76 000 of the 118 574 eligible PLHIV received ART in 2013 (GAC, 2015).

Ghana's HIV programmes are executed by the Ministry of Health through the Ghana Health Service's National AIDS/STI Control Programme (NACP) (PEPFAR, 2013). The Ghana AIDS Commission is a separate agency under the Office of the President responsible for coordinating policy recommendations, monitoring and evaluating programmes, and coordinating finances (GAC, 2013). The Ministry of Health imports most of the medications for their ART programme from India (Food and Drugs Authority Ghana, 2016) and controls the distribution to healthcare facilities contracted to prescribe and/or dispense the medications (Felling et al., 2003; National HIV/AIDS/STI Control Programme, Ministry of Health, & Ghana Health Service, 2010; PEPFAR, 2013).

Until 2013, PLHIV were charged GHS 5 (approximately $2.18 in January 2014, at the time of our study), for a 1-month supply of ART. This fee was removed in late 2013 for those enrolled in the National Health Insurance Scheme (NHIS). However, nationally, only about 38% of Ghanaian citizens were active NHIS members in 2013 (NHIA, 2014). In some areas, including the Greater Accra region where our study was conducted, NHIS coverage was less than 32%. To make matters worse, on 13 January 2015 a fire destroyed the Central Medical Store (CMS) in Tema, a large port city in the Greater Accra region, destroying a substantial part of the ARV supply (Bediako, 2015; Owusu-Sekyere, Yakubu Adjuik, & Wedam, 2017). The above-stated pitfalls in the ART programme in Ghana underscore the timely need for our examination of contributors and consequences to ARV stock-outs.

Methods

We conducted semi-structured, one on one in-person interviews with 40 women living with HIV (WLHIV) in the Greater Accra region and 15 individuals involved in HIV-related projects in government organisations and non-governmental organisations (NGOs) between January and March 2014. Several authors (see, for example, Poku et al., 2017; Tenkorang, Owusu, & Laar, 2017) note the very high stigmatisation, abuse and dehumanisation associated with being HIV-positive in Ghana that lead some HIV-positive persons hiding their sources of health care (Owusu, Tenkorang, & Laar, n.d.). In this paper, we consciously conceal the identity of both the respondents and HIV service-provision agencies we worked with in an effort to protect their identities.

Sampling

Given that women in sub-Saharan Africa, including Ghana, bear the brunt of HIV/AIDS infection in number, experienced stigma, and negative disclosure experiences (Afranie, Boafo, & Oppong Asante, 2012; GAC, 2015; Ramjee & Daniels, 2013; UNAIDS, 2012, 2013; Wright & Mwinituo, 2010), our original study focused on HIV-status disclosure among women. Eligible women 18 years of age or older were recruited from an NGO involved in advocacy and support

(Organisation A), and a healthcare facility (Organisation B). We primarily focused on these agencies for two reasons. First, WLHIV in the study region routinely frequent these places to find assistance. Second, and most importantly, since WLHIV constitute a hard-to-reach population, facility-based sampling at establishments frequently patronised by hard-to-reach populations has been recommended by previous authors (see Magnani, Sabin, Saidel, & Heckathorn, 2005). To enhance the privacy of potentially eligible women, we did not contact women directly and used facility-based convenience sampling. Participating women were recruited by phone with the assistance of the officials of Organisation A, and at the end of clinic visits by staff at Organisation B. Oral, rather than written consent, was obtained to minimise traceable personal information gathered from participants and enhance privacy.

All WLHIV were on ART at the time of the interview. Most had children (27/40), and more than half had ever been married (31/40). Time from diagnosis ranged from 6 months to 24 years; the median was 8 years. Of the 19 who gave their age, the range was 32– 60 years (Table 1).

Organisation representatives had to be at least 18 years of age. They were also recruited using convenience sampling, based on recommendations from other stakeholders and HIV researchers, and by direct contact with well-known government organisations, healthcare facilities and NGOs. Of the 10 organisations that we approached, 7 were represented by 15 interviewees who were available during the interview period. Most of our organisation representatives (11/15) were affiliated with NGOs; 3 others worked for a private healthcare facility, and 1 worked for a government organisation (Table 2).

Organisation representatives provided written consent before interviewing commenced. We used semi-structured, mostly open-ended data collection tools, which were reviewed and revised by experts in qualitative research and research in Ghana before finalisation. Different interviewing tools were used for the two groups of respondents, based on the objectives of the study.

Interviews with organisation representatives took place in offices at each organisation. Interviews with WLHIV took place in offices of the organisations they were affiliated with. WLHIV received a snack and GHS 10 (approximately $4.36 in January 2014) to compensate for their transportation costs. Interviews for WLHIV were conducted in English, as it is the national language (Embassy of Ghana, 2015), or Akan, the most commonly spoken native language in the region, based on participants' preference. Interviews with organisation staff were all conducted in English. We digitally audio-recorded each interview, which participants consented to before participation, and transcribed the interviews verbatim. The interviews in Akan were translated into English during transcription and cross-checked for authenticity of the translation by two native Akan speakers.

Before the study began, we received ethics approval for our research from the University of Texas Health Science Center at Houston Committee for the Protection of Human Subjects and the University of Ghana Noguchi Memorial Institute for Medical Research Institutional Review Board.

Analysis

We used ATLAS.ti version 7 software to organise the transcripts; we analysed the data through repeated review of the transcripts and note-taking to better evaluate the WLHIV and stakeholder interviews. We developed codes for the WLHIV interviews during transcript review; cross-referencing between interviews was done to summarise common experiences and identify themes. We created codes for stakeholder interviews from available literature and during transcript review. We used mapping techniques and linked themes identified between both groups to complete our analysis. This paper focuses on our findings related to drug stock-outs.

Table 1: WLHIV demographics

	n	%
Age		
30–39	6	15.0
40–49	7	17.5
50–59	5	12.5
60+	1	2.5
Unknown	21	52.5
Marital status		
Married	11	27.5
Remarried (widowed, divorced)	5	12.5
Separated	1	2.5
Divorced (not remarried)	7	17.5
Widowed	7	17.5
Unmarried	7	17.5
Unknown	2	5.0
Years from diagnosis		
≤5	11	27.5
6–10	12	30.0
11–15	9	22.5
>15	4	10.0
Unknown	4	10.0
Number of children		
4 or more	6	15.0
2 to 3	16	40.0
1	5	12.5
0	5	12.5
Unknown	8	20.0
Employment		
Petty trader	22	55.0
No official employment	7	17.5
Hairdresser/salon work	4	10.0
Employment not stated	4	10.0
Food service	1	2.5
Laundry service	1	2.5
Seamstress	1	2.5

Table 2: Demographics — organisation representatives

Organisation type	*n*	%
NGO	11	73
Healthcare facility	3	20
Government organisation	1	7
Sex		
Male	6	40
Female	9	60

Results

The WLHIV and the organisation representatives adamantly described "drug stock-out" as an ongoing problem that had gained national attention. This problem became particularly acute after the 2011 expiration of the original Global Fund grant that had been used to procure ARVs. During stock-outs, PLHIV were often sent away from healthcare facilities or pharmacies with partially filled prescriptions and told to return another day to retrieve the remainder of their ARVs; some were sent home without any medication. This increased the number of healthcare visits and subsequently overall healthcare costs. For some patients, once ARVs became available, return visits were not possible mainly because they were out of transportation money. Patients were left without medication for days or weeks. As one woman stated: *"And I usually hear that there is shortage of the drug at Korle-Bu* [Ghana's premier teaching hospital] *on radio. When I hear that I panic"* (married woman, age 38, diagnosed 2 years prior).

Whether for the previously-mentioned access problems, side effects, or other issues, the term "defaulter" was used by organisation representatives, WLHIV, government officials and others to describe someone who stops taking his/her medication, or someone who is "not adherent" to their treatment regimen. One organisation representative explained how the stock-out problems affected peoples' ability to take their medications:

> *That is the challenges [sic] that we are facing now… so sometimes stock-out brings a lot of defaulter [sic]… if I come today and there is no drug for me, I won't come tomorrow. If I come tomorrow, there is no drug, I won't come the following day* (OR09).

As noted in the introduction, Ghana became ineligible for its former magnitude of aid in 2011 due to its upgraded lower middle-income status achieved in 2010 (World Bank, 2011). Several of our respondents spoke about the funding problem but were unaware of the reason for the change:

> *In the HIV support group… four years ago, we were having Global Fund supporting… people living with HIV in Ghana. So, by the time we go to our support group's monthly meetings, we got [money for transportation to/from the meetings], we got snack money, and part to go pay for our drugs. But now it's no more. There's nothing like that… So, still, the support groups is [sic] there, but it's not. It was Global Fund that was funding us but, they stopped. We don't know why they stopped. Yes, if Global Fund will listen to our cry and will come back to our aid, it will help- because it was helping…* (married woman diagnosed 13 years prior).
>
> *And during that time, people that are doing well, they can come for their medicines for like 3 months at a time. Only when they are not feeling well they will come. But then, you take your medicine, 3 months you have your work to do, you go. But then lately, because they took the Global Fund away- I don't know, I don't deal with why they took it away, but I KNOW [she emphasised in a raised voice], they took it away, and uh because of that, sometimes we have shortages in the medication. Because we have a few patients on second line-drugs and (hits desk lightly) uh, sometimes we have to ration, the medicines. And that's very nerve-racking because you are thinking, what if we don't get it on time… Or, if they come next week and we don't have the medicine, then that means they are going to default. Now this second line- in Ghana after second line we don't have any more to give* (OR4).

One organisation representative explained the problem in this manner:

> *There was no substantial fund through… [Ghana's] National AIDS Control Programme… as challenges too in that sector, is [sic] the issue with drugs. The ARV drugs. The shortage. As I said, there are [sic] some attribute to the Global Fund… around aid that Ghana couldn't access… HIV test kits, also, there was a shortage in the system. Currently, CD4 count [test]… it's not free, you pay something…* (OR03).

As described by this organisation representative who worked regularly in HIV testing and counselling in a local hospital, stocks of reagents for CD4 and viral load testing were also sporadic. PLHIV were forced to pay directly for treatment response tests, which could cost over GHS 100 (approximately $43.55 in January 2014) according to organisation representatives, or continue ART without response measurements.

> *But the reagent, they, they need to get more. So when, [addressing the interviewer], when you have to, let it reach the authorities that in Ghana, we are having problems with the reagent, for the CD4 count… It's supposed to be done every 6 months. And viral load. Here they don't do it* (divorced woman, age 40, diagnosed 7 years prior).

Per the organisation representatives and some WLHIV, government officials and health agencies were well aware of the inconsistent availability of ARVs and laboratory assessment supplies. Our participants indicated that the drug stock-out was caused not only by limited funding, but also by problems related to "efficiency", as the organisation representative who worked for a government agency stated:

> *If we are talking about shortage — these are things which embarrass us, a lot. When, there is a news item that... there [are] people living with HIV going to the hospital, there are [no] drugs… condoms are not there or bad condoms have been imported, and all that... It's true, money brings all those things in but, there are also issues of inefficiency* (OR15).

Commentary from our organisation representatives supports other documents, suggesting that problems with inefficiency caused ARVs to be wasted while PLHIV went without medication. As reported by Ghana's CMS, according to a 2012 Global Fund report, 78% of all expired medications removed from CMS stock between 2003 and 2008 were ARVs.

Without a system to adequately determine how much medication is needed in each facility, drug stock-outs may continue to occur. System problems involve not only health facility and CMS communication, but also interaction between health agencies and port authorities. Delays in the retrieval of shipped medication from the port added to the stock-outs, *"Because, when they procure from outside,*

normally from India, it takes so many days on the seas, so many months in the port. And people are suffering and walking around without drugs" (OR03).

Organisation representatives in NGOs and the healthcare facility expressed a meagre hope that circumstances will change to allow PLHIV to receive medications in a timely manner. The lack of ARV supply was not only frustrating, but also taxing for patients:

> *…we should start to make our own, we should put our own structures in place so that we can, you know, make sure we can have access to medications, reagents, and all of that… it's really something that bothers me a lot. I mean, I can imagine what it does to them. People who are HIV-positive come here and sometimes we tell you "well, we don't have medicine so we have to just give you [supply for] one week." It bothers them because you know this is like, their life. And, going to sleep and thinking, "if I go the next month or next week will I get my medicines?" You know it's- it's not the best* (OR06).

The representative from a government organisation stated that a future goal is the establishment of a fund for ART that would secure the consistent acquisition of medications for citizens.

One pharmaceutical company in Ghana is currently producing ARVs. However, the products do not meet WHO standards as required for Global Fund-sponsored ART programmes, making the company ineligible to compete for procurement contracts. The company's medications are sold separately from the vast majority of ARVs given to patients through the government treatment programme (*The Ghanaian Times*, 2013). As another organisation representative stated:

> *…the one and only source we have in Ghana here, each and every day, news here and there, that it's not WHO standard. So, you cannot buy it from there… but I say 'no! Why don't you make him, help the man, the guy, to make his drug to WHO standard?' So Ghana can buy from there… so that there will not be shortage in the country… if you do that it's a [sic] sustainability for the HIV program in Ghana!* (OR03).

The Ghana AIDS Commission also recognises this position and states the benefits of pursuing in-country production (GAC 2013). Given that a small proportion of the ARVs used by citizens is produced in-country, pharmaceutical companies were encouraged to consider ARV production by the then Vice President of Ghana on World AIDS Day 2013 (Ghana News Agency, 2013). His statement, however, did not mention the important need for these products to meet WHO standards.

Overwhelmingly, the organisation representatives spoke about the past overreliance on the Global Fund and the need for Ghana to take steps to secure medication, rather than outside funding or assistance, to reduce the current inconsistency in ARV stocks. They also called for better measures overall to curb the lack of laboratory reagents and other materials necessary for clinical care and HIV prevention measures. One organisation representative summarised the problem and her frustration with the Ghanaian government:

> *They will pledge to give a hundred and fifty million — is it, what, Ghana cedis or dollars, I'm not even sure. They said that on the World AIDS Day. But we don't see this money coming… and, everything is Global Fund, Global Fund. Global Fund too has told us, "this is the need; this is what we have. Ghana is now [sic] middle-income country…" So they are also cutting back… I mean, sometimes I don't want to talk but I always say what will the Global Fund, you know, feel like when they get to know that all the CD4 count machines that they went and bought with their money and, we had to fight for like three years before they gave us one. Finally we got one and now, for about, almost eight months now the machine has just been sitting in there because, no reagent* (OR06).

Without reagents to measure CD4 counts and viral loads, healthcare providers had to use clinical judgment alone to determine if an HIV-positive patient should start ART, and engage in the same process to estimate responses to treatment.

Discussion

The problems with drug procurement and funding of ART in Ghana are troubling. Likewise, the problems discussed regarding clinical supplies, such as reagents for CD4 and viral load measurements, suggest that similar deficits exist in related areas of the healthcare system. Shortages of non-ARV medications have also been observed in Ghana and other countries in sub-Saharan Africa (see, for example, Davis et al., 2013; Masters et al., 2014). The absence of a fund for HIV-related treatment and care may mirror the situation for other diseases, implying that health budgets and various aspects of the healthcare system have been inadequate. The public discourse of politicians indicates Ghanaian leaders are aware of the need to mitigate ARV supply deficits by encouraging local production, but this is a complicated and complex proposal. Development of standards and procedures for the production and regulation of domestically-produced ARVs must meet WHO standards if the local formulations are to be used by PLHIV accessing medication through the government programme. Encouraging ARV production without addressing the complex host of factors entailed in meeting WHO standards is an exercise in futility. Developing WHO-approved ARVs will take time, funds, a mix of scientific and business skills in the pharmaceutical industry, strong leadership, and political will.

Creating linkages with successful pharmaceutical programmes in Botswana, Kenya, and Uganda can provide insights into how those nations successfully implemented their WHO-approved ARV production. Lessons learned about quality standards for pharmaceutical production must be addressed. Businesses, international NGOs and domestic community-based organisations can partner to work on the ARV production issue. By developing industry and civil service partnerships, entrepreneurs and activists can bypass dependency on the government for solutions.

The removal of the GHS 5 service fee helps the few insured PLHIV, but it will not help the majority, who are

without national health insurance. Unfortunately, as noted earlier, only 38% of the Ghanaian population was insured in 2013 (NHIA, 2014); the number of PLHIV unable to access free ART is substantial. However, removal of the service fee may lead more PLHIV, with the financial wherewithal, to enrol or re-enrol in NHIS, providing them with enhanced access to other medications and services. Likewise, the removal of the ART fee for NHIS members does not mitigate the cost for other services, such as CD4 and viral load counts, and out-of-pocket costs for these services are significant. The NHIS system essentially creates a two-tiered system that leaves most of the poorer PLHIV with even more reduced access to ART. This system needs to be re-evaluated and adjusted if more people are to successfully access ART.

Similar to the findings of Mori and Owenya (2014), we found that these stock-out issues increased out-of-pocket costs for PLHIV, as repeated returns to healthcare facilities were required to complete one prescription. Given that the mean gross annual household income in Ghana is GHS 16 644.6 (Ghana Statistical Service, 2014) (approximately $7 249 in 2014), such costs, coupled with transportation and other out-of-pocket expenditures for healthcare visits, can be burdensome for patients and their families (Asante, Poku, Owusu, & Zekeng, 2014).

Labelling PLHIV who are unable to take ART consistently due to stock problems as defaulters highlights the tendency for blame to be shifted to the victim rather than the larger political and health system deficiencies that cause problems with service delivery and treatment. Though the label was used by WLHIV and organisation representatives alike, both groups identified the source of the problem as poor health system management. Healthcare providers said they detested needing to require PLHIV to continuously return for drug pickup at shorter than normal intervals due to the rationing of ARVs. Providers recognised that dispensing limited amounts of ARV raised the indirect costs of treatment, particularly transportation costs for PLHIV, and also increases the likelihood that PLHIV would discontinue ART. The removal of the GHS 5 charge for ART may increase access for the minority 38% of Ghanaian citizens who have the money to purchase insurance, but the problems with stock-outs may prevent the benefits of increased access, including decreased HIV-related morbidity and mortality, from being fully realised nationally, even among the insured PLHIV.

Continuous and reliable stocks of first- and second-line ARVs, laboratory reagents, and other materials necessary for the continuum of care for HIV-positive patients are immediately necessary in Ghana. The current absence of reagents for CD4 (GhanaWeb, 2017) and viral load assessments produces a situation where patients who need treatment may be inadvertently omitted from ART initiation, or unnecessarily started on therapy. Similarly, patients who are not responding to their ART regimen may not be changed to new therapy until physical manifestations of treatment failure arise. In these situations, lack of funding and inefficiency work in tandem creating a potentially dangerous situation for patients and healthcare providers alike, and may also have national impact. Without a change, increased viral load and decreased response to ART could result, increasing the country's illness burden and the risk of HIV transmission within the population.

The January 2015 CMS fire was a devastating event that further burdened the already strained resources to procure and distribute ARVs. Local production of ARVs meeting WHO standards could increase the availability of medication at times of normal demand, and possibly supply ARVs in emergency situations quickly. It can also reduce the possible waste/expiration of ARVs, as local production will eliminate the long processes related to shipment from distant India and bottlenecks at Ghana's international harbour, as mentioned by our respondents. Partnerships working to develop ARVs should also explore developing reagents for testing services domestically. Local production of laboratory reagents could also improve the speed at which Ghanaians begin ART, and improve the precision of follow-up care. In formulating a solution, consideration of a multifaceted system repair is necessary. Research in Ethiopia indicates that enhanced supply reporting systems are incapable of preventing stock-outs of HIV and TB-related laboratory supplies without proper execution of methods and consideration of the challenges related to introducing new requirements to burdened health facility staff (Tilahun, Geleta, Abeshu, Geleta, & Taye, 2016).

Our study focused on the experiences of WLHIV and our organisation representatives were mainly from NGOs or a healthcare background. Consequently, we have limited data from individuals from government agencies and/or groups directly involved in procurement and distribution of medications. This study did not deeply examine the mechanisms of ordering ARVs and monitoring drug stock in healthcare facilities. Such investigations, similar to the disaster response study focusing on the 2015 CMS fire conducted by Owusu-Sekyere et al. (2017), are needed to examine the pitfalls in the current system and make recommendations for improvement.

Because we focused our research on the Greater Accra region of Ghana, the study is limited in describing stock-out problems in other regions, specifically those that are largely rural. However, our review of Global Fund and other reports indicated that stock-outs occurred widely in Ghana and other African nations (Bateman, 2013; Muhamadi et al., 2010, The Global Fund, 2012). Ghanaian national survey data report more frequent stock-outs of anti-malarial drugs in rural regions than urban areas (Davis et al., 2013; Ghana Statistical Service, 2014), which suggests that the availability of ARVs in rural regions is likely worse than in urban areas. In Ghana, access to healthcare is more problematic in the rural areas than in urban ones (Ghana Health Service, 2009; Ghana Statistical Service, Ghana Health Service & ICF International, 2015; ISSER, 2014).

Our study population did not include HIV-positive men. However, women in Ghana have higher HIV rates (GAC, 2015), as is common in developing countries. This is mostly the result of women's higher socio-economic vulnerability in these parts of the world, compared to men (Anarfi & Owusu, 2011; Kimani, Ettarh, Ziraba, & Yatich, 2013; Poulin & Muula, 2011). Consequently, focusing on women provides the perspective of individuals who make up most HIV-positive patients in Ghana. Similarly, though WLHIV provided a patient perspective for our study and we did not

focus on men, stock-outs occurred at the location level, rather than as a gender-specific phenomenon. However, other results of stock-outs, such as increased frequency of travel for medication retrieval, may affect men and women differently. For example, married men may be in a better financial position to return for medication than women, given that married women generally earn less than their husbands and may not have equal influence in decisions regarding household spending and their health (Ghana Statistical Service et al., 2015).

Conclusion

Our study reinforces findings from other research in sub-Saharan Africa. Funding deficits within the government have been a major contributor to the stock-outs, but system problems such as unsatisfactory practices in storage locations fuel the stock-outs. Drug stock-outs threaten the ability of PLHIV to adhere to their ART regimens. Likewise, shortages of reagents for CD4 and viral load testing limit the ability of healthcare providers to complete important clinical assessments to initiate treatment and monitor the progress of their HIV-positive patients. These pose a threat to well-being at micro, meso and macro levels as it has the tendency to worsen the HIV burden at all levels. The Government of Ghana has made some effort to decrease the burden of obtaining ART by removing the GHS 5 service fee for the 38% of Ghanaians who can afford national health insurance (and have deemed it desirable). Most Ghanaians, who lack health insurance, still have to pay GHS 5. The government has created a two-tiered ARV system that, in essence, penalises the poor and those with money who failed to enrol in NHIS. This system should be dismantled and reconfigured in a just and equitable manner. Finally, while politicians have publicly called for domestic pharmaceutical companies to begin in-country production of ARVs, these words must be backed by financial and political initiatives that will foster improvements in the manufacturing process of in-country supplies to meet WHO standards.

Our first recommendation is to promote business and civil service partnerships and invest in relationships and mentoring from at least one of the pharmaceutical companies already successfully producing WHO-approved ARVs in Botswana, Kenya, or other sub-Saharan African countries. This will provide the insights and tools required to align pharmaceutical companies in Ghana with WHO standards for manufacturing, including a review of potentially innovative methods of meeting WHO standards, and encouragement of companies to produce ARVs in-country. This process would not only improve the procurement of ARVs for PLHIV in Ghana, but also provide the country with a possible avenue to improve its pharmaceutical production overall and become a contributor to the regional or global pharmaceutical market. Such opportunities could have a positive impact on the Ghanaian economy and provide the much-needed increase in access to medications for Ghanaians.

Our second recommendation is to restructure the fee system so that the poor have equal access to ARV treatment. An insurance scheme that benefits the elite fails to meet the needs of the nation. HIV/AIDS treatment and prevention must evenly cut cross class and urban–rural distinctions if the health of all is to be realised.

Our third recommendation is to conduct a review of the procurement and distribution of ARVs. This may aid in identifying pitfalls in current supply chain management, and transfer to improvements in medication distribution for other essential medications in the general health system. These improvements would also result in optimised procurement of reagents and other supplies necessary for clinical assessments, and reduce waste and deficits.

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Notes

1. Currency exchange information was obtained from XE Currency and Historical Rates Table, http://www.xe.com/currencytables/, using 10 June 2011 and exchange rate 1.5174999237.
2. Unless otherwise stated, all remaining currency exchange information was obtained from the Bank of Ghana website, www.bog.gov.gh, using the study's start date, 21 January 2014, and exchange rate 2.2961.

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