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Capacity for optimal performance of healthcare supply chain functions: competency, structural and resource gaps in the Northern Region of Ghana

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Abstract

Purpose – The study drew on capacity framework around the individual, organisational, health system and wider context to explore gaps in health supply chain (HSC) workers capacity and competency to perform supply chain (SC) functions and the lessons for workforce development.

Design/methodology/approach – A mixed-method study was conducted across the Northern Region of Ghana. Qualitative data were collected from in-depth interviews with 34 key SC managers at the regional, district and facility levels. A semi-structured questionnaire was administered through the RedCap mobile app to 233 core HSC workers and non-core workers (clinicians with additional responsibilities in SC). Data were managed and analysed inductively and deductively for themes.

Findings – Weak knowledge and competency in SC functions attributed to poor training exposure and organisational support for capacity building, undermined the capacity to perform basic SC functions, especially by the non-core category. The policy and regulatory environment of the HSC marketplace were described as fluid and with complexity of demands. Both worker categories, therefore, requested functional, technical, managerial and customer care competencies to anticipate and manage complexities. Structural characteristics of the health system giving narrow decision space to HSC workers cascaded the capacity for innovation and initiative and promoted frustrations among mid-level managers. Infrastructural deficits and shortfalls in operational resources scaled back the capacity to efficiently manage inventory and ensure that commodities reach clients in good quality.

Originality/value – Finding suggest that capacity building of HSC workers, strengthening of health institutions structural and resource capacity, and leveraging on technology will enable optimal performance of HSC functions.

Keywords Supply chain worker, Competency, Structural, Resources, Capacity, Ghana

Paper type Research paper

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Introduction

Healthcare supplies and commodities account for about 20–30% of many hospitals' budgets making it the second highest healthcare expenditure next to human resources (Dowling, 2011; Mathew *et al.*, 2013). This high investment has not yielded significant impact, however. Many populations especially the poor and marginalised still lack access to essential health supplies and medicines because of deficits of critical health supply chain (HSC) workforce. Effective and efficient health commodities management is dependent on the availability of well-motivated, competent and well-resourced HSC workforce (Cometto *et al.*, 2014). Supply chain (SC) workforce with the requisite capacity to function can optimally manage commodities by deploying appropriate planning and forecasting techniques to ensure that essential supplies reach the final consumer at the right place and the right time (Brossette *et al.*, 2010).

The need for the deployment and empowerment of human resources with the requisite capacity to manage health SC systems has received significant attention worldwide. Recent developments include collaboration between several global health actors to build capacities in low- and middle-income settings. The people that deliver (PtD) initiative, for example, is a global partnership established with the aim of providing technical and resource support for national and local levels to increase capacity of HSC workforce to be effective in delivering health commodities to the last mile (Brown *et al.*, 2014). This partnership recognises the fact that health workforce functional efficiency is a product of capacity and enabling environment.

Capacity in this context refers to 'the ability of the individual SC worker to perform assigned functions, solve problems and set and achieve defined objectives in a sustainable manner' (UNDP, 2008). Capacity in terms of adequate skill set (e.g. training, knowledge and proficiency in SC functions), resources or inputs and laid down work processes enable HSC workers to; (1) get desired things done rightly; (2) effectively influence change and outcomes and (3) challenge the status quo and execute complex and challenging tasks to meet client needs and institutional goals (Brown and Gilbert, 2014).

One of the underlying factors of frequent shortages of essential medicines in health facilities is health workforce poor capacity for inventory management, procurement, planning and estimation of consumption needs (Brossette *et al.*, 2010). Capacity development is identified as one of the mechanisms of addressing health workforce competency deficits. Capacity development has been typically utilised to improve practice performance among clinicians such as doctors, nurses, midwives and paramedics. However, within the context of HSC, workforce capacity to function and capacity development is still under the radar, especially in poorly resourced settings. This is further exacerbated by poor empirical evidence documenting capacity gaps of SC workers to inform policy and capacity strengthening. This calls for more context based evidence to understand the inherent complexities underpinning the capacity to perform HSC functions as well as determine SC workforce existing and desired capacity needs as basis for policy and capacity building approaches. In addition, understanding how the dynamic interaction between the wider health system environment, organisational and individual level factors shape and determine the capacity to perform SC functions is crucial. Health systems are governed by multiple feedback mechanisms such that organisational and wider environmental bottlenecks can technically constraint or promote individual health worker functional inefficiencies (Bennett *et al.*, 2010).

This paper sought to provide more nuanced evidence by diagnosing the wider environmental, organisational and individual SC worker capacity, competencies, needs and constraints in the Northern Region of Ghana. The region is one of the most impoverished where health, social and economic problems severely constraint development. Historically, inequities of critical health workforce distribution between the deprived north and the prosperous south have persisted for several decades. The Northern Region, one of five

regions of the north has been the most disadvantaged in terms of attraction and retention of critical cadre (Ministry of Health, 2017a). While some scholars have attributed this phenomenon to unfavourable geography and poor micro-economy of the north (Abdulai *et al.*, 2018), a significant others associate it with systematic political neglect combined with the complexities of public sector management (Abdulai, 2014; Abdulai and Hulme, 2015). Further information about the development trajectories of northern Ghana has been documented elsewhere (Abdulai *et al.*, 2018; Kelly and Bening, 2007; Plange, 1979). The constrained socio-economic development space of the north has had cascading effect on health workforce posting and transfer. Critical health workforce cadre are lacking in most parts of the Northern Region as are essential HSC workers such as pharmacists, SC managers, warehouse and procurement workers, clerks and data managers. In 2016, the Northern Region had only 4% of the nation's skilled HSC workers in public health facilities (Ghana Health Service, 2017).

The chronic deficit has produced incentives for task shifting of SC functions to non-traditional cadre such as doctors, nurses, midwives and others whose clinical duties also involve handling health commodities. Not only do the non-traditional cadre have to puzzle out their own mechanisms of executing SC functions in response to client and institutional demands, but also, they struggle to maintain a clear balance between the dual functions of clinical and commodity management. Navigating through complexities of the dual responsibilities lies in being capacitated to confront routine multiple challenges.

With HSC functions performed by both trained and non-trained workers in the field, the need to determine elements of the individual capacity competencies, needs and constraints as well as the wider environmental factors that impinge on the capacity to effectively execute assigned tasks is reinforced. Findings of the study will help define sustainable strategies of building the competencies and skills capacities of HSC workers for optimal performance of SC functions.

Methods

This study reports findings from part of a larger mixed-method research project borne out of a collaboration between the Authors Institution and Chemonics International Inc, Prime Contractor for the USAID Global Health Supply Chain – Procurement and Supply Management (GHSC-PSM). The project sought to determine motivation and capacity gaps of HSC workers in Ghana as a step towards addressing the complex and intractable barriers to delivering high quality SC services within and across health institutions and service delivery points. It was hypothesised that addressing capacity gaps and adequately motivating SC workers will increase their productivity and maximise value for money procurement and management of health commodities.

Prior to the inception of the project, the now Savannah, North East and Northern Region created by a referendum held in December 2018 were one region known as the Northern Region, where this study was conducted. The Northern Region was used as a pilot site in scaling up the research process of the project. Before expanding the project to other regions, this initial study identified a number of insightful capacity and competency deficits worth reporting, so that early systematic approaches can be adopted to maximise labour efforts and productivity in the region and the wider HSC environment. The study was conducted across the strategic, managerial and operational levels of the regional health system using concurrent triangulation of qualitative and quantitative methods.

Qualitative component

Qualitative data were collected from key managers at the regional health directorate (RHD), district health directorate (DHD) and health facilities (teaching hospital, regional hospital,

districts hospitals and health centres). Data were collected through observations and in-depth interviews with 7 managers at the RHD (managers of human resource, procurement, supplies and regional medical stores) and deputy directors; 14 DHD managers and SC workers and 27 key facility managers including heads of pharmacy, procurement, supplies and stores. All participants were sampled purposively because they are either directly or indirectly involved in HSC decision-making, governance and commodity management.

Interviews were conducted by 8 field assistants who were given a day's training on behaviour control, how to pose and probe deeper into questions and recording narratives. Interviews were conducted at participant's places of work except 5 who requested preferred venues. The interviews were audio recorded and lasted between 30 and 50 min. Observational data were collected at facility sites during field monitoring. Attention was paid to competence and resources available to perform SC functions through inspection and interactions.

Semi-structured questionnaire administration

A semi-structured interview tool comprising closed-ended statements and follow-up open-ended questions was used to collect data from HSC workers across the health facilities, RHD and DHD. The instrument was administered to both core workers (professionally trained workers in-charge of SC functions whether of procurement, storage, inventory management and distribution of commodities) and non-core workers (clinicians with additional responsibilities of handling SC functions relating to procurement, storage, inventory management and distribution of commodities). Giving their few numbers in the region in general, and the sampled institutions, all core and non-core workers were recruited into the study.

The tool was administered using the Research Electronic Data Capture (REDCap) mobile app (android and IOS) which facilitated real-time data entry validation. The research team regularly monitored the data synched with the RedCap server and if an error or anomaly was detected, the respective field assistant was prompted to address it. This was done throughout the data collection exercise which lasted for 10 working days. In all, responses were successfully completed for 233 out of the 250 invited respondents, giving a response rate of 93%.

Research tools

The research instruments for both the qualitative and quantitative data were drawn from the conceptual framework illustrated in Figure 1. Variables of the framework were derived from Potters and Brough (2004) hierarchy of capacity indicators which has been widely employed to study strategic capacity options for maximising health workforce motivation and performance (Dieleman *et al.*, 2009; Meyer *et al.*, 2012; Peirson *et al.*, 2012). Potter and Brough (2004) classified capacity needs more broadly into three factors – individual, organisational and the wider context. We theorised that individual's capacity competencies, needs and constraints potentially shape their performance of SC functions. Furthermore, an organisation has an obligation to deploy appropriate mechanisms of providing for and building individuals' capacity to be effective in the discharge of SC functions. On the contrary, individuals might simply be less responsive to capacity building approaches even if they received them, hence the two-way interaction arrows. Both the individual and organisational capacity issues are potentially shaped by the wider context and the health system environment.

Data processing and analysis

Data collected through the RedCap was exported to STATA 14 for descriptive analysis of the closed-ended questions and SPSS 24 for extraction of responses to open-ended questions. The

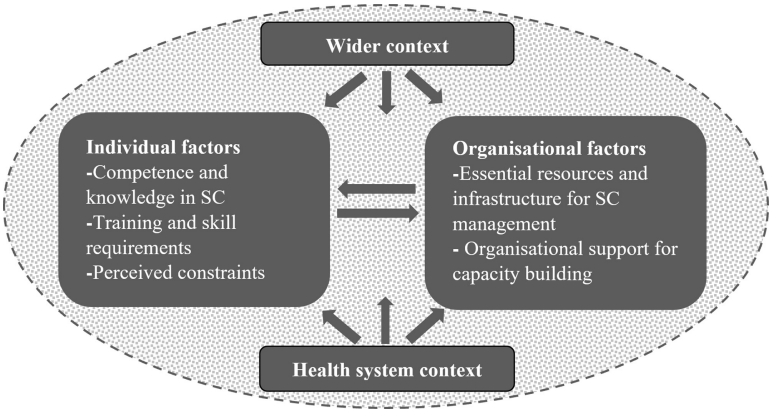

Figure 1.
Framework of SC workforce capacity competencies, needs and constraints

qualitative data was thematically analysed with the aid of Nvivo 11. The themes building process followed inductive and deductive approaches guided by the research tool and framework (Figure 1). We developed a thematic matrix that allowed us to determine association between sub-themes and categories. Where necessary, themes were quantified and inputted into excel and analysed descriptively. Considering the wealth of the qualitative data, this paper largely reports the qualitative findings and triangulated them with some of the quantitative data.

Stakeholder validation forum

A stakeholder validation forum was organised for 35 participants who participated in the qualitative and quantitative studies. The study's objectives and findings were presented in PowerPoint slides after which participants took turns to comment and provide feedback. Issues that were deliberated and considered as isolated cases were subsequently removed from the findings.

Results

Characteristics of respondents

There were more core workers (60.5%) than non-Core workers (39.5%) in the quantitative sample (Figure 2). The mean ages were 37 and 35 years, respectively, for core and non-core workers. As shown in Table 1, most of the core workers (30.5%) and non-workers (17.6%) were holders of Diploma/High National Diploma (HND) and certificate respectively. Both core and non-workers were concentrated in the district and teaching/regional hospitals.

Individual capacity factors

Competency to perform SC functions

There were mixed perceptions about the competency to perform SC functions. About 69% and 49% of the non-core and core workers respectively rated their competence to perform SC functions as insufficient. Most non-core workers also described their knowledge in SC as insufficient (62%). Gaps in competency and knowledge on SC were partly the result of the calibre of workers handling SC duties. Only about 42% of the core workers held a degree or diploma, while none of the non-core had an elevated formal training in SC management.

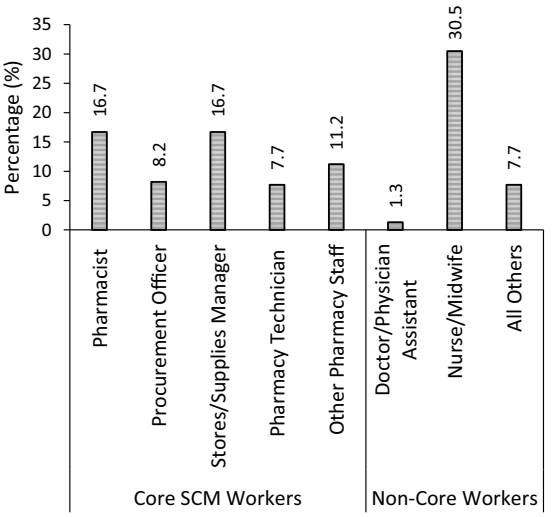

Figure 2.
Proportions of core and non-core workers

Characteristic	Description	Core worker (n = 141) Number	%	Non-core worker (n = 92) Number	%	χ^2	$p<$
Sex	Male	109	46.8	45	19.3	20.2	0.01
	Female	32	13.7	47	20.2		
Education	Certificate	28	12.0	41	17.6	22.6	0.01
	Diploma/HND	71	30.5	30	12.9		
	Professional	6	2.6	2	0.9		
	Degree	27	11.6	13	5.6		
	Masters	9	3.9	6	2.6		
Institution	CHPS	0	0.0	18	7.7	114.3	0.01
	Health centre	4	1.7	41	17.6		
	District hospital	78	33.5	22	9.4		
	Regional/teaching hospital	41	17.6	0	0.0		
	RMS/DHD/RHD	18	7.7	11	4.7		

Table 1.
Demographic characteristics of respondents

For this reason, non-core workers explained that they lack both technical and functional capacity to be effective.

> It is something we are told to do, and we are doing that. I can't say I am competent in the technical aspects of SC. (Midwife, facility)

> We only know what we are supposed to do. But how should it be done better, not sure? (Nurse, facility)

In facilities without core SC workers, quality delivery of SC services was compromised, because, in the words of some core workers, they: (1) lack knowledge on accurate filling of bin cards and store ledgers; (2) have limited understanding of the economic value of inventory and therefore working towards minimising wastage and maximising value for money purchase; (3) could not keep proper records and real-time data on stock, consumption and

inventory; and (4) do not give SC management needed attention as demonstrated in these statements:

> We have many nurses in charge of managing drugs and supplies, something they cannot do but they are forced to. And because it is not their core mandate, they don't take it seriously. (Pharmacist, regional)

> Most of them (non-core workers) don't keep data on consumption level over a period. They don't plan, they don't have worksheet, they just fill anything and bring it as report. It is frustrating. (Supplies Manager, regional)

Competencies requested

Functional competency

In-depth training on SC functions was mentioned repeatedly by a significant number of the participants as a need. Both worker categories suggested the design of standardised refresher training programmes be delivered periodically to enhance their performance. Key among the content of the training highlighted included the capacity to accurately complete bin cards or requisition forms, prepare reports and keeping accurate data on consumption trends. These quotes by regional level participants buttress the criticality of the proposed standard training programme.

> . . . because they lack knowledge in SC function, they will just issue medicines without recording, they don't see accountability as an issue. If there was proper refresher training from time to time, some of these things would be minimised. (Procurement Manager, regional)

> Some of them after closing from work, will not even take stock or quantify items issued. This makes it impossible to plan ahead. They need good training in logistics management to be abreast with issues. (Pharmacist, regional)

Technical competency

Some participants, especially middle-level managers explained that SC is a complex area in Ghana because it lies at the interface between national legal instruments and health system policies. Therefore, they requested to be empowered with the technical skill to understand and appreciate the legal, regulatory and policy aspects of SC in order to properly function in alignment with the provisions of such laws.

> We need in-depth knowledge on the national procurement laws so that we are not caught in the web in the discharge of our duties. (Procurement Officer, facility)

Some participant feared that without adequate knowledge of policies governing procurement, they might violate them inadvertently leading to prejudicial application of sanctions.

> . . . I need knowledge of the procurement laws. Some people have been punished for doing things not intentional. (Procurement Officer, District Health Directorate)

Moreover, the success or otherwise of delivering health commodities depend in part on how well the procurement process is well managed (Ancarani, 2009). It was not surprising, therefore, that the processes involved in commodity procurement from the sourced point to the service delivery point for management and use was mentioned as a technical area that required capacity building by some managers and core workers. The opinion formed was that an understanding of the procurement process will enable effective tracking, reporting on supplier performance and avoidance of undue delays. Others also asked to be given technical

expertise to develop appropriate framework to guide prequalification of potential suppliers, quantification of needs and demand estimation. As said by this participant.

> As it stands now, we procure when there are shortages but if we know the technique for forecasting, we can plan ahead so that no patient will lack medicine. (Pharmacist, facility)

Managerial and customer care competency

The competencies to effectively lead, plan, direct and coordinate teams to deliver SC services were mentioned as a need, as illustrated in "you need what it takes to be a good manager to succeed in SC" and "the skill to manage people is what I need". The managerial skill to see things in perspective, motivate people for better performance, mobilise resources and conduct effective monitoring and supervisions also came up.

> I can call myself a manager but the people are not easy to manage. You need the skill to get them understand you and to galvanise their support for quality performance of SC functions. (Manager, regional)

> This region is too big. How to determine what goes on in every district and plan against wrong doing is what I need. (Deputy Director, regional)

The ability to engage with and communicate to clients with a sense of professionalism was highlighted as a capacity need. According to some participants, clients sometimes develop anxiety and aggression over their inability to obtain prescribed drugs not in stock. Knowledge of the specific mechanisms can be deployed to calm such patients as well as engage with them using other social oriented tools was crucial.

> . . .when they don't get the medicine prescribed for them they will become confrontational thinking that it is deliberate. If you explain they will not listen. So we need customer care training on how to manage such patients. It is important. (Nurse, facility)

Organisational capacity factors

Three themes emerged from the organisational dynamic configuration, namely; operational resources, infrastructure for commodity management and support for capacity building.

Operational resources

> For more than two years now, I have been buying my own stationery. Any time I buy I tell my boss. This chair that I am sitting on, for instance, I bought it with my own money, this printer is mine. (Procurement Officer, regional).

Just like clinical staff, SC workers were expected to be responsive and in devising strategies to improve quality healthcare delivery. However, the size of resources available to keep up with routine responsibilities was inadequate due to funding gaps. This prompted a range of individual coping strategies including self-purchase of office stationery, tools and equipment to address resource gaps. In most of the facilities, SC data were logged and processed with paper-based systems due to lack of computers. This weakened the capacity to generate, store and use real-time data to inform SC decisions. Consequently, as indicative of the quote below, demand quantification, for example, was performed based on naïve extrapolation of previous consumption levels. Frequent depletion of stock was reportedly linked to such unstandardised operational system.

> Assuming you use 30 bottles of paracetamol syrup every month, if you want to reorder for 3 months, you multiply the 30 by 3 and that gives you 90. (Nurse, facility)

Infrastructure for commodity management

Almost all the participants raised concerns about poor essential infrastructure to support inventory management. In more than half of the facilities studied, stores were poorly structured – poor layout, ventilation and spacing to ease navigation and stock taking. As a result, medicines were perceived to be losing potency because they are not stored in appropriate room temperature.

> Medicines are not stored in the right temperature, sometimes you give the drug to the patient and it doesn't work. (Pharmacist, facility)

> When you enter the stores you sweat. It tells you what is happening to the commodities stored inside. (Pharmacist, RMS)

To get around the problem, some participants requested technical support that will enable them leverage on existing structures to better manage inventory in a sustainable manner to avoid medicines fluctuating potency.

> This is what we have. Given the circumstance, we need support to be able to keep drugs by preserving their quality. (Stores Manager, facility)

Institutional support for capacity building

SC workers were perceived to be less prioritised in institutional support mechanisms of capacity building. They also felt not being sufficiently exposed to capacity building opportunities for skill update like the clinical cadre. The average length of engagement in SC functions was 5.9 and 5.6 years, respectively, for core and non-core workers. However, about 51% and 62%, respectively, of the core and non-core workers reported not benefiting from any form of institutional capacity training in SC. For those who participated, pharmacist and nurses/midwives reported the least number of participations in the last five years (Table 2). Participants held mixed views about the sufficiency of such capacity training programmes in terms of their rigour, detail and impact as shown in Box 1. Some core SC workers claimed the limited institutional support for skill upgrade was partly contributing to waning efficiency, effectiveness and performance outcomes.

Table 2. Participation in institutional support capacity building programme in SC

	Ever participated in capacity building training in the last 5 years				No. of participations in SC capacity training if "yes"	
	Yes		No			
Worker category	Number	%	Number	%	Mean	Range
Core workers						
Pharmacist	15	6.7	24	10.8	1.6	0–5
Procurement officer	17	7.6	2	0.9	2.6	1–6
Stores/supplies managers	21	9.4	16	7.2	2.1	0–4
Pharmacy technician	1	0.4	17	7.6	2.0	2–3
Other pharmacy staff	14	6.3	12	5.4	1.6	1–3
Non-core workers						
Doctor/physician assistant	1	0.4	2	0.9	2.3	1–5
Nurse/midwife	28	12.6	42	18.8	1.3	0–4
All others	9	1.3	8	3.6	1.4	0–3
Total	100	44.5	123	55.5	2.4	0–6

Box 1. Perception about the impact and rigour of SC capacity training programmes attended

(1) "I was expecting something that will make is easy for us to do our work without problems, but it didn't turn out that way."
(2) "The training was based on something that we already know."
(3) "I cannot say it has impacted me so much such that I can change things. It is still the same way of doing things."
(4) "It was not practical as I expected. Some people found it difficult relating the theory to practice."

> You can't be effective in confronting challenges if you are not up to date. We have been saying it, we should be supported to go to school and participate in workshops to update our knowledge. (Procurement worker, facility)

Health system and wider contextual factors

Narrow decision space on SC functions

> The SC management system is such that even though you have the knowledge, you do non't have the final authority. There are certain decisions that the superiors or management must take. Because of that, sometimes it gets to a stage and you are in the dark, you are not involved again, you don't know what's happening. (Procurement Officer, regional)

Middle-level SC managers expressed dissatisfaction about narrow decision space to influence choices, procurement decisions and adopt more innovative approaches to improve their functions. This problem boiled down to the structural characteristics of the health system which is designed with limited power and decisional control given to SC workers. Across all regional health systems in Ghana, core SC workers are not part of key administrative decision-making structures (Manso *et al.*, 2013). For this reason, they lack capacity to influence key SC decisions and outcomes. This participant also felt that the health system structural arrangement has systematically cascaded individual confidence, initiative and innovation.

> . . .we know the job, yet we do basic stuff. They think we don't have the capacity to do the work. Because of that have we been reduced to advance storekeepers and that is bad. (Procurement Manager, regional)

Supply of skilled human resources for SC functions

Despite the complexities associated with SC, there are currently a handful of high institutions of learning in Ghana offering certificate, diploma and degree programmes in SC management (Manso *et al.*, 2013). Such programmes, however, are more generic in content. They are not specific and tailor-made to standard operating procedures, job functions and management information system in health SC as noted by this procurement manager:

> Healthcare comprises many areas. A lot goes into drug management alone. Yet we don't have a SC programme specifically devoted to health. Most of the things we do are application. (Procurement Officer, facility)

Apart from the gap in curricular, both private and public organisations compete for the few qualified SC workers from training institutions. This has created chronic scarcity of skilled HSC workers, especially in primary care facilities. All the hospitals studied reported

permanent core SC staff numbers less than the prescribed staffing norms (Ministry of Health, 2017b). Even if the non-core workers were included, almost all the hospitals will still be understaffed as per the staffing norms. For this reason, some participants complained that routine stress caused by mounting workload hampered the capacity to be responsive to job demands, as for example.

> First, I used to kill myself but now I don't. Because I am the only one, the workload is too much. Everyday, you go home very tired, body pains. I can only do my best. (Procurement Officer/Stores Manager, facility)

Matching the competency gaps, skill needs and constraints with SC functions

In the course of interpreting the qualitative findings, we found that some of the themes explaining competency gaps, skill need and constraints fitted with four SC domains: planning and forecasting, procurement, warehouse/stores management and standard reporting (Table 3). While the matrix provides useful direction for capacity building approaches and dealing with 'low hanging fruits' to sustain gains, a change from paper-based to electronic SC management system is crucial. However rigorous the design, execution and receipt of skill training programmes might be, effective results may be inhibited by uncoordinated and silo SC functions performed using paper-based methods which does not foster interaction across a range of operational activities. This was brought to light by some participants.

> Some people keep saying training. That is not bad. But the problem will surface again after the training unless facilities perform SC functions on electronic platforms. (Pharmacist, facility)

> Part of the problem is the manual system. We need an electronic system from top to down so that as you move from one place to another there is standard practice. (Procurement Officer, District Health Directorate)

Discussion

Giving their pivotal roles in improving health outcomes and contributions to the revenue basket of health systems, HSC workers need to be empowered, resourced and provided with the skill set relevant to today's market demands. Unfortunately, too often, HSC workers are poorly recognised and neglected in routine administrative functions of health institutions (Brossette *et al.*, 2010). Individual capacity deficits continue to be a setback to optimal delivery of SC services as well as effective, efficient and sustainable commodity management. This study was conducted with the aim of providing policy makers with options for prioritising capacity building of HSC workers for improved performance of their functions. Capacity was assessed from the individual, organisational and wider perspectives, because of the dynamic interaction between organisations and their employees, both of which are not immune to influences of the broader environment. Strengthening the capacity of individual HSC workers greatly increases health institutions overall capacity to be responsive to counterproductive influences of the wider context.

The literature is inconclusive about the competencies required to deliver optimal SC services. The desired competencies identified: functional, technical, managerial and customer care adds to and align with those from the dominant literature synthesis and reports (Bals *et al.*, 2019; Brossette *et al.*, 2010; Heaslip *et al.*, 2018; Luke and Heyns, 2012). These competencies are foundational assets to the performance of SC functions (Heyns and Carstens, 2012). As noted by Thai (2012), a competent SC worker is one with the capacity to discern and interpret complex information (technical competency), manage by adaption to changing situations (managerial competency) and function in alignment with standard

Table 3.
Matrix of competency gaps, skill needs, constraints and SC functions

SC function	Competency gaps	Skill need	Constraints	Institution
Planning and demand estimation	(1) Knowledge in IT (2) How to predict and estimate consumption trends by month and year	(1) IT training (2) Basic quantitative demand estimation techniques	(1) Inadequate skilled workforce to manage sustainable forecasting (2) Lack of computers (3) Lack of trained IT persons to provide solutions (4) Non-trained SC workers give limited attention to SC functions	CHPS, Health Centres, hospitals, regional medical stores and district health directorate
Procurement	(1) Knowledge of health commodity value chain (2) Effective supplier relationship and negotiation skill	(1) Strategic purchasing techniques (2) Supplier cataloguing and selection techniques (3) Risk reduction techniques	(1) Options for supplier selection is limited by small size of the supplier market in some environments (2) Procurement workers have limited decision space to fully function in achieving desired outcomes	Health Centres and hospitals, regional medical stores
Store/warehouse management	(1) Effective stores and inventory management (2) Correct filling of inventory control tools (3) Sustainable preservation of medicines potency (4) Accurate verification of rolling stock	(1) Medical stores management techniques including hygiene rules (2) Training on formal configuration of medical stores	(1) Lack of cold chain infrastructure (2) Lack of trained medical stores managers for sustainable management of initiatives	Regional medical stores and hospitals
Standard reporting	How to generate, store and manage quality inventory data	(1) Training on data management and reporting techniques (2) Translating data into evidence for decision-making	(1) Manual systems limit quality data generation and use (2) Poor research competencies on translating data into information for use	CHPS, Health Centres, hospitals, regional medical stores and district health directorate

operating procedures (functional competency). Technological and managerial competencies are crucial given the complexities of today's SC marketplace which requires managerial thinking alongside understanding of and adherence to plans, policies, procedures and regulatory mechanisms (Bals *et al.*, 2019). Meanwhile, the functional competences mentioned including knowledge of basic SC practices, IT, reporting standards and demand forecasting ensures flexible and rapid response to challenging work demands.

In line with an earlier study (McKinnon *et al.*, 2017), this study has revealed weaknesses of health institutions capacity to perform SC functions and in strengthening workforce professional capacity to effectively deliver SC services. HSC workers have been less prioritised in institutional capacity building approaches, partly because, attention has traditionally been focused on skill building of clinical oriented workers to respond to more pressing health needs (Kredo *et al.*, 2017; Nancarrow *et al.*, 2014). Moreover, policies on capacity strengthening of HSC workers have been deemphasised in global health human resource strategies (WHO, 2016) and especially in the Ghanaian context where HSC workers have limited access to professional development opportunities and function without clear career path (Frankel and Eomba, 2016). Limited support and exposure to capacity building tend to constraint HSC workers capability to fully utilise technology and adopt more innovative ways of maintaining sustainable inventory management (Prajogo and Sohal, 2013).

Infrastructural gaps and chronic shortfalls of operational resources including human, physical, material and financial resources are increasingly a threat to HSC workers responsiveness, resilience and service optimisation (Bailey *et al.*, 2015; Cometto *et al.*, 2014). This echoed in our findings. Frustrations over a range of poor working conditions relating to scarce administrative resources, poor storage systems, lack of cold chain and unstable funding support for SC scaled back the capacity to manage inventory and ensure that commodities reach end users at the right quality. The concerns about medicines inefficacy owing to fluctuating potency arising from poor storage systems corroborate earlier studies (Bailey *et al.*, 2015; Privett and Gonsalvez, 2014). Overall, it was observed that the resource gaps were further compounded by huge deficits of professionally trained HSC workers, resulting in non-trained cadre managing a portfolio of SC services (Brossette *et al.*, 2010). On the one hand, the deployment of non-trained cadre provided impetus to tackle workload challenges momentarily. On the other hand, however, their deployment was problematic. Because, they lacked foundational knowledge and control over inventory management and ordering procedures and therefore, incapable of minimising wastage and maximising the value of stock (Privett and Gonsalvez, 2014).

As envisaged, the performance of SC functions was affected by the context in which health institutions and HSC workers are nested. Context can significantly enable or undermine health institutions performance and individual workforce ability to properly execute SC functions (Brown and Gilbert, 2014). The dynamic interaction between context and health systems can be understood by viewing capacity as a hierarchy of needs flowing from the broader system to health system administrative machinery and down to the HSC individual worker (Potter and Brough, 2004). The capacity needs of health institutions and their workforce will be met only if the health system and training institutions (in and outside the health system) needs are fulfilled to provide training opportunities for HSC workers and adequately supply professional human resources to mitigate deficits and tasks overload (Brossette *et al.*, 2010; Sankaranarayanan, 2014).

Conclusion

HSC is an integral component of value creation and income generation for quality health delivery and outcomes (Brown and Gilbert, 2014). Human resources with the requisite

capacity to efficiently manage health commodities is needed to ensure that end users benefit from access to quality health supplies. Drawing on Potter and Brough (2004) capacity framework, we found that optimal performance of SC functions was hampered by weak individual and organisational capacity linked in part to the health system environment and the wider context.

Taken together, our findings draw health stakeholders attention to the need to prioritise capacity building of HSC workers. This can take the form of setting up structures to institutionalise capacity building focussing on acquisition of key competencies such as: (1) functional competency: how to manage basic SC functions such as filling of bin card, reporting and keeping accurate up to speed data; (2) technical competency: knowledge of the SC processes including sustainable mechanisms of evaluating supplier selection as well as how to function in conformity with the legal and policy instruments governing SC; and (3) managerial competency: empowering SC workers especially mid-level managers to be self-confident, effective and efficient in executing SC tasks orders.

The need to address gaps in institutional capacity needs by strengthening structures, systems, staffing, infrastructure and resources is key to achieve significant gains in SC management. A more stable resource environment (office supplies, logistics and tools to aid work flow), adequate funding and appropriate staffing mix can catalyse both the individual and organisational capacity to secure equitable and sustainable access to life-saving commodities. Finally, across the individual and organisational levels, capacity strengthening can be achieved by leveraging on technology through application of logistics management information software to improve operational efficiency (Cholette *et al.*, 2019).

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