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Comparing pharmacy practice in health facilities with and without pharmaceutically trained dispensers: a post intervention study in Tanzania

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ABSTRACT

Background: The critical shortage of comprehensively trained healthcare staff in Tanzania affects the capacity to deliver essential health services, attain universal health coverage and compromises health outcomes. There is a specific lack of suitably trained pharmaceutical professionals, thus, an increase in the use of unqualified or poorly trained staff. Following the introduction of a one-year pharmacy dispenser course intervention, this study explored the impact that the new cadre of graduates had on pharmacy practice compared to healthcare facilities with non-pharmacy trained dispensers (NPTDs).

Methods: A post intervention assessment was conducted in 2021 using questionnaires formulated to measure indicators of Good Pharmacy Practice, comparing 29 public health facilities employing pharmacy-trained dispensers (PTD) with 32 public health facilities with NPTDs in Dodoma, Shinyanga and Morogoro regions of Tanzania. Data were collected by experienced pharmacists or pharmaceutical technicians and subsequently aggregated and statistically analysed.

Results: The dispensing times for medicines were found to be the same for PTDs and the NPTDs (2 min). There were no statistically significant differences in the adequacy of labelling elements between PTDs and NPTDs. Patients' level of knowledge of the medicines dispensed to them, from both PTDs and NPTDs, showed no difference. Moreover, no differences were observed in storage practice and documentation performance, records of dispensed medicines, handling of medicines and the dispensing area cleanliness between both groups. Overall, facilities with PTDs averaged a higher availability of tracer medicines (77%) than those with NPTDs (70%), however, availability of health commodities in all health facilities in the three regions was low and there was no statistically significant difference between both groups.

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Conclusion: The study showed no significant difference in performance of pharmacy practice between PTDs and NPTDs despite the former undertaking a one-year training course intended to improve knowledge and skills. Practice application not only depends on effective training but on the working environment. Clear job descriptions, appropriate tools and references to guide, Standard Operating Procedures, acceptance by management of the training undertaken to actively encourage recruits to apply these new skills could improve PTDs performance. Training and knowledge alone do not seem to lead to better practice and performance.

Abbreviations: ADDO: accredited drug dispensing outlet; HPSS: health promotion and system strengthening project; ILS: integrated logistics system; MSD: medical stores department; MSH: management sciences for health; NPTD: non-pharmacy trained dispensers; PTD: pharmacy trained dispenser; SOP: Standard operating procedure; UHC: Universal healthcare.

KEYWORDS Pharmaceutical education; pharmacy practice; performance; impact of training; Tanzania

Background

Access to essential medicines and to suitably trained, motivated and productive health care professionals to manage, prescribe and dispense them is fundamental to a well-functioning healthcare service that can promote the rational use of medicines (Ofori-Asenso et al., 2016; Trap et al., 2016; World Health Organization, 2002; 2022a). Good pharmaceutical practice requires the proper interpretation and dispensing of prescriptions, diligent administration, patient counselling, medicine storage and maintenance of required records with the objective of continually optimising patient safety and quality of services (Tiyyagura et al., 2014; World Health Organization, 1996). Furthermore, responsible dispensing of medicines implies patients being fully informed by healthcare professionals on their use and advice in the event of potential adverse reactions (World Health Organization, 1996). The use of unqualified or poorly trained pharmacy staff increases the chances of substandard or falsified medicines being used, poor handling/storage of medicines and dispensing errors and thus can ultimately have a detrimental effect on the health service, the community and patient health outcomes (Africa Press, 2020).

However, persistent health workforce shortages limit the capacity to deliver essential health services globally and risk a country's ability to attain health-related sustainable development goals and universal health coverage (UHC), none more so than in the World Health Organization's (WHO) Africa and South-East Asia regions (Ahmat et al., 2022; World Health Organization, 2021; World Health Organization, 2022a; 2022b). In 2014, WHO and the Global Health Workforce Alliance reported on the global deficit of healthcare workers and predicted that the shortage would increase

from 7.2 million to 18 million by 2030; a 6.1 million shortage was forecast for Africa alone (World Health Organization, 2020). The WHO African Region bears one of the largest disease burdens in the world but paradoxically the lowest density of healthcare workers globally (Vos et al., 2016). In Tanzania, like in most low- and middle-income countries (LMIC), the ratios of physicians, nurses, midwives and pharmaceutical staff to 10,000 population are critically low (World Health Organization, 2022c; World Health Organization, 2015) this is especially so in remote and rural areas (Kwesigabo et al., 2012). In addition to the unequal distribution of healthcare workers countrywide, healthcare staff are often poorly paid, inadequately trained, supported and equipped, which is not only discouraging for the staff themselves but also for the public confidence in the healthcare system (Chen et al., 2004; Munga & Mwangu, 2013; Speybroeck et al., 2006; Wiedenmayer et al., 2015).

The severe shortage of pharmacists in Tanzania significantly increased from 0.072 per 10 000 population in 2012 to 0.33 per 10 000 population in 2018; in comparison the approximate ratio of pharmacists per 10 000 in various European countries ranges between 6 and 12 and between 0.31 and 1 per 10,000 in Ghana, Rwanda and Côte d'Ivoire (World Health Organization, 2022c). One cross sectional study in 2011 found that almost 96% of staff providing pharmaceutical services in public health facilities in Dodoma, Tanzania, had no pharmaceutical training. Of those that had, 2% were pharmacists holding a bachelor degree after 4 years training, 2.8% were pharmacy technicians with a diploma in pharmaceutical sciences after 3 years training and 0.8% were pharmacy assistants with a certificate in pharmaceutical sciences after 2 years of training (Wiedenmayer et al., 2015).

Prior to these findings in the year 2000, the Tanzanian Government in collaboration with Management Sciences for Health (MSH), carried out an assessment of the Tanzanian pharmaceutical sector (Mbwasi & Mlaki, 2008). They established that the country lacked trained dispensers working in drug outlets; that most dispensers working in public health facilities had no formal pharmacy training; that poor drug management contributed to stock-outs and furthermore, that poor dispensing practices and patient counselling resulted in irrational medicine use. In response, MSH, successfully piloted and rolled out the Accredited Drug Dispensing Outlet (ADDO) programme in 2003, its purpose was intended to improve the quality of medicines and services in remote and rural settings. The programme addressed the basic components of quality pharmaceutical services and combined owner and dispenser training over a six-week period. The high demand for ADDOs and the very short training period raised concerns within the government and the pharmaceutical profession (Accredited Drug Dispensing Outlets (ADDO) 2003).

In 2011, the Health Promotion and System Strengthening Project (HPSS) began supporting the Tanzanian Government in strengthening the national

health system in pursuit of UHC and the Tanzania's development vision 2025 (Kuwawenaruwa et al., 2020; Swiss Tropical and Public Health Institute, 2020; Wiedenmayer et al., 2019, 2021). The Pharmacy Council in collaboration with National Council for Technical Education and supported by HPSS initiated a new training programme. In 2016, St. John's University in Tanzania responded to the needs of the Pharmacy Council to establish a new two-semester modernised training programme – The Basic Technician Certificate course in Pharmaceutical Sciences. The objective of the course was to produce adequately trained technicians in good pharmacy practice that would work in various accredited health facilities (predominantly lower primary health facilities) as dispensers with basic knowledge of medicines management and their rational use. The course curriculum included a module on good dispensing practice focusing on the competence of providing patient instructions and medication counselling.

In 2018, an evaluation of the course was conducted to ascertain whether the initial aims and objectives, related to curriculum content and methodology, had been achieved. The current study assessed whether the intervention with a new training programme had a positive effect on improving pharmaceutical services. The objective of the study was to evaluate the impact the new cadre of graduates has had on pharmacy practice compared to healthcare facilities with non-pharmacy trained dispensers (NPTDs).

Methods

A comparative, post intervention study was conducted between 8th and 25th October 2020. Both prospective and retrospective aspects of pharmacy practice were measured using adapted patient care indicators and health facility indicators to assess public healthcare facilities deploying pharmacy-trained dispensing staff (PTDs) from the one-year basic technician course and public health facilities deploying NPTDs not attending the course. The presented study took place across three Tanzanian regions, namely, Dodoma, Shinyanga and Morogoro and included 20 councils.

Study site selection

Since there were very few primary health facilities with PTDs from the one-year basic technician course, the selection of health facilities for the study was based on convenience sampling and the availability of primary healthcare facilities with a trained dispenser. Primary healthcare facilities with a PTD, certified from the basic technician course, were identified in all districts of the respective regions, and an equivalent number of primary health facilities with NPTDs were selected in the same district and included in the study.

In total, 29 health facilities with PTDs and 32 health facilities with NPTDs were selected and included in the study.

Questionnaire survey

The study was conducted using questionnaires that were formulated to collect and measure different indicators under Good Pharmacy Practice to determine the impact of PTDs on the quality of pharmacy services rendered at public primary health facilities. A comparison was made with health facilities with NPTDs. The questionnaires were based on recommended tools by WHO and included four different patient care forms adapted to the context and study questions (World Health Organization, 1993). Data were collected by a group of trained data collectors who were also experienced pharmacists or pharmaceutical technicians. They recorded information from prescriptions in Patient Care Form I (the last 5–10 prescriptions from a total of 415 dispensed, composed of 218 prescriptions from health facilities with PTDs and 197 from health facilities with NPTDs) and made observations during dispensing. Data collectors noted the following information: (a) number of drugs prescribed and actually dispensed; (b) diagnosis or disease code written; (c) signature, name or initial of the prescriber and dispenser; and (d) dispensing time (i.e. from receiving the prescription to providing the patient with a labelled package and full verbal instruction).

In Patient Care Form II, data collectors recorded the labelling on packaging given to exiting patients, documenting a total of 397 medicine packages dispensed (198 from health facilities with PTDs and 199 from health facilities with NPTDs). The labelling information included the full name of the patient (child/adult), the full generic name of the medicine and strength, dosage instruction, duration of treatment, name of health facility and date dispensed. Patients were randomly selected as they exited the facility, and after positive patient consent, they were asked to show all medicines just received from the pharmacy. The data collector then randomly picked one medicine from the medicine packages that the patient had shown and recorded the information on it. Only one package was selected from each patient. The number of patients randomly picked for an interview was between 5–10 per day of activity, depending on patient availability.

Data collectors used the Patient Care Form III to assess the patient's knowledge regarding how she/he was going to use the medicine. Continuing with the same patient as selected for Patient Care Form II, the patient was further asked to respond to the following issues pertaining to the respective medicine: did the patient receive any verbal instruction on how to take the medicine, how much to take, at what frequency and for how long. The time taken from the patient's home to the health facility and the level of satisfaction with the quality of dispensing services was also recorded.

In addition to the information captured by the Patient Care Forms, storage and documentation practices and processes and related observations were recorded, such as the regularity with which the temperature chart was logged, storage of medicines (i.e. how and where), any signs of pests in the area, cleanliness of storage area, status of physical and documented stocks, placement of bin cards (used to account for stock and help track inventory process) when available, status of request and report forms and the documentation status of sales vouchers and delivery notes. Observations were also made and recorded with regards to dispensing practice and the process of documentation, the general cleanliness of the dispensing area and practice of dispensing, especially the handling of medicines.

The national Integrated Logistics System (ILS) form was used as a tool to evaluate the availability of selected core health commodities and record keeping of health commodities.

Data handling and analysis

Data were collected using paper forms; they were subsequently scanned and a PDF copy of the filled form with the raw data was sent by the data collectors to the supervisor the same day to check for accuracy and reliability before being aggregated. Analysis was done using Microsoft Excel (2016) and SPSS (version 25).

Results

A total of 61 health facilities were visited, which included 60 primary health facilities (22 health centres, 37 dispensaries and 1 hospital) and one district hospital. In Dodoma region, 27 dispensers in as many health facilities were visited – 12 were PTDs and 15 NPTDs. Of the 21 health facilities and the representing dispensers visited in the Morogoro region, 11 were PTDs and 10 NPTDs. Finally, the 13 health facilities and the representing dispensers visited in the Shinyanga region included 6 PTDs and 7 NPTDs.

Twenty-nine facilities visited (47.5%) had a least one PTD, while the remaining 32 facilities (52.5%) had other cadres (nurse, medical attendant and/or a clinical officer) to provide pharmaceutical services, including the dispensing of medicines (see Appendix Tables S1–S3 for a more detailed analysis).

Dispensing time, number of medicines per prescription and labelling of medicines

An average of two medicines were prescribed per prescription for both groups while the average number of medicines dispensed per prescription

was 1.7. The majority of prescriptions were filled (84%). The average dispensing time ranged from 1.9 to 2 min with no statistically significant difference in dispensing time between the PTDs (2 min) and the NPTDs (1.9 min).

Both PTDs and NPTDs also performed similarly in the adequate labelling of dispensed medicines (85–90%), regarding the name of the medicine and the dosage on the dispensed packages. Of all encountered labels, 10–15% did not have the medicine name or dosage listed. With regards to all other elements, the performance of both groups was again similar and mostly low (Table 1). For instance, only 25% of labels were completed according to good dispensing practice. In terms of proper labelling, there was no statistically significant difference found, between the two groups of dispensers, in any of the elements assessed (Table 1).

Patient knowledge on dispensed medicines

Patients' knowledge of medicines dispensed to them, from both PTDs and NPTDs, was explored upon exiting the health facility (Table 2). Patients from both groups had sufficient knowledge on how to take the medicines (96–99%), how much to take (96–99%) and how often to take them (85–87%). However, the patient's knowledge on the duration of treatment did not fare so well. Approximately half of all patients with medicines dispensed from PTDs (50%) and NPTDs (54%) were aware of why they were taking the medicines. Patients were also ill equipped with information on the possible adverse reactions to medicines and what to do if they occur, with only 28% of patients from PTDs being informed and 15% of patients from NPTDs. Patients with medicines dispensed from PTDs were also better informed

Table 1. Labelling of dispensed medicines as recorded in Patient Care Form II.

		Regional performance (%)			
Measures	PTD or NPTD	Dodoma	Morogoro	Shinyanga	Overall av.
Availability of dispensing bag	PTD	29.00	50.00	66.67	48.56
	NPTD	24.44	40.00	85.71	50.05
Drug name	PTD	74.81	100.00	80.56	85.12
	NPTD	78.47	96.00	85.71	86.73
Strength	PTD	7.50	43.00	33.33	27.94
	NPTD	10.63	30.00	14.29	18.31
Quantity	PTD	12.35	40.00	16.67	23.00
	NPTD	1.11	40.00	42.86	27.99
Date	PTD	8.33	26.00	33.33	22.55
	NPTD	4.44	33.33	57.14	31.64
Dose	PTD	89.09	100.00	83.33	90.81
	NPTD	81.80	90.00	85.71	85.84
Patient name	PTD	8.33	50.00	50.00	36.11
	NPTD	4.44	30.00	28.57	21.01
Facility name	PTD	16.67	20	16.67	17.78
	NPTD	11.11	20	47.62	26.24

NPTD, non-pharmacy trained dispenser; PTD, pharmacy trained dispenser.

Table 2. Patients' knowledge of dispensed medicines as recorded in Patient Care III Form.

Knowledge area	PTD or NPTD	Regional performance (%)			
		Dodoma	Morogoro	Shinyanga	Overall av.
Was the patient given instructions on how to take the medicine	PTD	88.13	100.00	100.00	96.04
	NPTD	100.00	100.00	96.43	98.81
Dosage: how many/much to take	PTD	88.13	100.00	100.00	96.04
	NPTD	100.00	100.00	97.96	99.32
Frequency: how often to take	PTD	86.46	93.33	83.33	87.71
	NPTD	94.89	100.00	58.52	84.47
Duration: how long to take medication	PTD	30.59	88.15	56.34	58.36
	NPTD	23.11	52.38	41.79	39.09
Does patient know why treatment is given	PTD	12.50	42.22	94.44	49.72
	NPTD	20.00	40.95	100.00	53.65
Other information given: adverse reactions	PTD	6.67	22.22	56.35	28.41
	NPTD	0.00	24.29	21.43	15.24

NPTD: non-pharmacy trained dispenser; PTD: pharmacy trained dispenser.

(58%) about the duration of their treatment compared with 39% of patients with medicines dispensed from NPTDs. Nevertheless, statistical analysis showed that there was no significant difference in performance between the two groups.

Storage practice and documentation

Regarding good storage practice and the in-store documentation process, averages aggregated per region showed that both groups in the Dodoma region performed similarly with 79% for PTDs and 78% for NPTDs. In Morogoro, the PTDs scored a 72% aggregate and the NPTDs 85%, indicating that the facilities with NPTDs performed better than those with PTDs. In Shinyanga region, however, facilities with PTDs performed better (82%) than those with NPTDs (68%). The averages based on the performance of all three regions combined were.

78% for PTDs and 77% for NPTDs. Statistical analysis with a t-test confirmed the insignificance in performance between both groups. A few trends were observed at the level of individual measures. PTDs in comparison with NPTDs showed a higher performance regarding the storage of some medicines directly on the floor (50% vs 24%) and in the documentation of expired products (70% vs 59%). NPTDs, however, performed better in keeping ledgers up to date and complete (72% for NPTDs vs 62% for PTDs) (Table 3).

Evaluating the records of dispensed medicines, handling of medicines and the dispensing area cleanliness, the average performance for all regions combined, showed only a slight difference between PTDs (84%) and NPTDs (76%). Aggregating the average performance for each region, the difference in

Table 3. Dispensers' performance on storage practices and documentation.

Measures	PTD or NPTD	Regional performance (%)			
		Dodoma	Morogoro	Shinyanga	Overall av.
Temperature chart for medicine storage area is regularly logged	PTD	0	14.29	33.33	15.87
	NPTD	20	0.00	16.67	12.22
Some medicines are stored directly on the floor	PTD	25	57.14	66.67	49.6
	NPTD	26.67	30.00	16.67	24.45
Medicines are stored in a systematic way (e.g. alphabetical, pharmacological)	PTD	100	71.42	50.00	73.81
	NPTD	100	90.00	33.33	74.44
Medicines are stored first expiry, first out.	PTD	100	85.71	66.67	84.13
	NPTD	93.33	100.00	66.67	86.67
No evidence of pests in the area	PTD	91.67	100.00	100.00	97.22
	NPTD	93.33	100.00	100.00	97.78
The storage area is clean and hygienic	PTD	91.67	71.43	100.00	87.7
	NPTD	86.67	100.00	83.33	90.00
Ledgers are up to date and complete	PTD	58.33	42.86	83.33	61.51
	NPTD	66.67	100.00	50.00	72.22
Bin cards are up to date and complete	PTD	91.67	42.86	83.33	72.62
	NPTD	66.67	90.00	66.67	74.45
Bin cards are stored with their respective medicine or filed correctly	PTD	91.67	57.14	66.67	71.83
	NPTD	73.33	90.00	50.00	71.11
Report and request forms are correctly logged, digital and hard copies	PTD	91.67	100.00	100.00	97.22
	NPTD	100.00	100.00	100.00	100.00
Expired products (Unserviceable goods) well documented	PTD	83.33	42.86	83.33	69.84
	NPTD	46.67	80.00	50.00	58.89
Issue vouchers are available and used*	PTD	100.00	100.00	100.00	100.00
	NPTD	100.00	100.00	100.00	100.00
MSD sales invoices are available and well kept	PTD	91.67	100.00	100.00	97.22
	NPTD	100.00	100.00	100.00	100.00
MSD delivery note is available and well kept	PTD	83.33	100.00	100.00	94.44
	NPTD	93.33	100.00	100.00	97.78
Prime vendor invoices are available and well kept	PTD	91.67	100.00	100.00	97.22
	NPTD	100.00	100.00	83.33	94.44

MSD: Medical Stores Department; NPTD: non-pharmacy trained dispenser; PTD: pharmacy trained dispenser; *distributed medicine is recorded on a voucher providing a trail of accountability.

performance between PTDs and NPTDs remained small in Dodoma (86.1% vs 84.1%), and Morogoro (76.7% vs 80%), while for Shinyanga region PTDs performed better (89%) than NPTDs (64%). For individual measures there was a trend of higher performance among PTDs in four of six measures, including in the appropriate arrangement of medicines and supplies and the handling of medicines using clean tools (Table 4).

Assessing the availability of medicines, facilities with PTDs averaged overall a higher availability of tracer medicines (77%) than those with NPTDs (70%). This was also the case for each region with PTDs in Dodoma, Morogoro and Shinyanga averaging 82%, 78% and 70%, respectively. In contrast, the availability of tracer medicines in health facilities with NPTDs in Dodoma, Morogoro and Shinyanga averaged 74%, 68% and 67%, respectively. However, in general, the availability of health commodities in all health facilities in the three regions was low, with average availability

Table 4. Overall performance on dispensing documentation, handling and cleanliness.

Measures	PTD or NPTD	Regional performance (%)			
		Dodoma	Morogoro	Shinyanga	Overall av.
Prescription forms documented	PTD	41.67	40.00	67.00	49.45
	NPTD	60.00	50.00	28.57	46.19
Records of dispensing register up to date	PTD	100.00	90.00	100.00	96.67
	NPTD	100.00	80.00	85.71	88.57
Medicines and supplies well arranged	PTD	91.67	80.00	83.33	85.00
	NPTD	66.67	90.00	57.14	71.27
Dispensing area clean and tidy	PTD	91.67	90.00	100.00	93.89
	NPTD	100.00	90.00	71.43	87.14
Handling medicine using clean tools	PTD	91.67	80.00	83.33	85.00
	NPTD	100.00	70.00	43.00	70.95
No evidence of pests	PTD	100.00	80.00	100.00	93.33
	NPTD	80.00	100.00	100.00	93.33

NPTD, non-pharmacy trained dispenser; PTD, pharmacy trained dispenser.

below 50% for Benzylpenicillin injections, ferrous salts and folic acid and Bendrofluazide tablets (Table 5).

With regards to the record keeping of stock, both groups had deficiencies. For example, all PTDs records were incomplete in that they had more physical stock than recorded in their ledgers. This shows that the ledgers were not updated periodically as they received commodities. In contrast, NPTDs had more stock in their records than what they had physically in the store. This could indicate their books were not updated as they issued the commodities

Table 5. Availability of health commodities in health facilities with PTDs and NPTDs, per region.

Measures	PTD or NPTD	Regional performance (%)			
		Dodoma	Morogoro	Shinyanga	Av. (%)
Amoxicillin or Cotrimoxazole syrup or DT	PTD	50.00	100.00	50.00	66.67
	NPTD	33.33	70.00	57.14	53.49
Benzylpenicillin 5MU injection	PTD	33.33	71.43	16.67	40.48
	NPTD	20.00	30.00	42.86	30.95
Chlorpheniramine tablets	PTD	100.00	71.43	33.33	68.25
	NPTD	100.00	60.00	28.57	62.86
Griseofulvin or Cotrimoxazole cream	PTD	75.00	57.14	50.00	60.71
	NPTD	73.33	50.00	42.86	55.40
Metronidazole tablets	PTD	66.67	57.14	83.33	69.05
	NPTD	46.67	40.00	85.71	57.46
Paracetamol 500 mg tablets	PTD	75	85.71	66.67	75.79
	NPTD	60.00	40.00	28.57	42.86
Ferrous salt and folic acid	PTD	50.00	14.29	50.00	38.10
	NPTD	46.67	0.00	28.57	25.08
Bendrofluazide tablets	PTD	66.67	57.14	33.33	52.38
	NPTD	66.67	50.00	14.29	43.65
Glibenclamide or Metformin	PTD	83.33	57.14	50.00	63.49
	NPTD	46.67	40.00	28.57	38.41
Sulfadoxine Pyrimethamine	PTD	66.67	28.57	83.33	59.52
	NPTD	66.67	40.00	71.43	59.37

DT: dispersible tablets; NPTD: non-pharmacy trained dispenser; PTD: pharmacy trained dispenser.

or they were not accounted for in general. In Dodoma, PTDs record keeping of stock averaged 93%, with more physical stock on the shelves than in the ledgers or on the bin cards, as opposed to NPTDs with an average of 104%, with more stock recorded in the ledgers or bin cards than there was. In Morogoro, PTDs averaged 116% (as with PTDs in Dodoma, there was more physical stock on the shelves than in the ledgers or on the bin cards) whereas NPTDs averaged 103% with more stock recorded in the ledgers or bin cards than there actually was. In Shinyanga, PTDs averaged 99% with more physical stock on the shelves than in the ledgers or on the bin cards and NPTDs averaged 103% with more stock recorded in the ledgers or bin cards than actually existed.

Discussion

This study assessed pharmacy practice in health facilities across three regions of Tanzania and compared health facilities with PTDs and NPTDs. The findings indicate that there was no substantial pharmaceutical services improvement in health facilities with PTDs over health facilities with NPTDs. Nevertheless, the study does reveal some trends across and within the study regions that may be related to the training and it also offers some insights on the performance of the Tanzanian pharmaceutical services regionally and internationally.

The average dispensing times of ~2 min reported in this study were two-thirds of the WHO suggested three-minute minimum dispensing time. This raises concerns, owing to the importance of this indicator for good dispensing practice and patient care affecting the level of a patient's comprehension towards the method to which the medication should be administered and the duration of the treatment (Sisay et al., 2017a). It is well-established that shorter dispensing times negatively affects a patient's understanding of following correct treatment plans (Sisay et al., 2017a; World Health Organization, 1993). However, dispensing times recorded in this study were consistent with findings in various studies carried out in Ethiopia, Nigeria and Zimbabwe ranging from an average of approximately 1 min to 3.20 min (Alkot et al., 2011; Dilbato et al., 1998; Gidebo et al., 2016; Sisay et al., 2017a; Tamuno, 2011). It has also previously been shown that the length of dispensing time was not directly linked to a longer patient consultation period with the dispenser, but rather on the comprehension of the prescription, especially when the handwriting was difficult to understand and the labelling poor. This was found to be common in facilities where there were no standard packaging bags; facilities with standard packaging bags, however, actually spent less time dispensing compared to those without them (World Health Organization, 1993). Adequate labelling in terms of drug name and dosage was high for both groups in all facilities included in this study (74%–100%) with a regional average between 85 and 87%. Albeit performance from

both groups in these categories were high, it is concerning that 10–15% of dispensed medicines encountered were missing those two vital elements of labelling. When all elements of good labelling were taken into account, the regional averages were approximately 43% for PTDs and 42% for NPTDs, indicating a similarly low performance for both groups measured by the WHO standard (100%). Nevertheless, these averages were higher compared with some other regional and international studies, e.g. in eastern Ethiopia where only 3.3% were adequately labelled in one study and 11% in another (Sisay et al., 2017a; 2017b), in Sudan (30.4%) (Rabie & Kheder, 2020) and in a study in West Bengal India where 0% of medicines were adequately labelled (Bandyopadhyay et al., 2017). Overall labelling performance of all elements taken together for individual regions in the present study showed some appreciable variation for the different groups. In Dodoma PTDs averaged 49% as opposed to 45% scored by NPTDs, in Morogoro PTDs averaged 36% against 31% scored by NPTDs and in Shinyanga PTDs performed poorer (46%) than NPTDs averaging 52%. Attempts to compare good labelling performance with the availability of standard dispensing bags did not provide a clear correlation. For example, although Shinyanga health facilities had the highest availability of dispensing bags (76%), it did not perform any better than Morogoro (45%) and Dodoma (27%), especially in the case of PTDs. Differences in training background also did not yield convincing performance differences between the two groups. In terms of good labelling performance, individual attitude, time pressures and long-term experience might have played a greater role leading to the unclear performance differences observed under this indicator.

Several factors can have a significant influence on patient knowledge of dispensed medicines, be they healthcare professional related (e.g. staff workload and/or lack of time), patient related (e.g. illiteracy, age and education of patient) or system related (e.g. availability of essential drugs, availability of STGs and formularies) (Saqib et al., 2018). Patient knowledge of administering the correct dosage (96% PTDs, 99% NPTDs) and frequency (88% PTDs, 84% NPTDs) of medicines was high; this could indicate that both groups of dispensers considered this information vital. It is possible, then, that the remaining percentages that fall short of the 100% scores in these categories of patient knowledge could be due to patient-related influences. However, when considering comprehensive patient knowledge covering all elements of the knowledge criteria on the medicines that they were dispensed, the average percentage falls to 69% for the patients of PTDs and 65% for patients of NPTDs. Further analysis shows that knowledge of the duration of medicinal treatment was poorer among patients of NTPDs (39%) than those of PTDs (58%) but patients of PTDs were less well informed as to why they were taking the medicines (50%) as opposed to patients of NPTDs (54%). Almost double the average percentage of patients of PTDs had knowledge of

information such as adverse reactions and what to do in the event that they occur (28%) compared to the patients of NPTDs (15%). However, both groups of patients performed poorly in the knowledge of duration category, the knowledge of why they were getting the treatment category and knowledge of information in the event of adverse reactions category compared to the first three categories (were instructions given, the dosage and the frequency).

A combination of factors could have influenced the positive outcomes in the first three categories such as the low number of drugs dispensed (average 2) makes it easier for a patient to remember the 'vital information' on how to take it, the frequency of taking the medicine and how much to take. Another factor could be the opinion of the dispenser believing that these categories were the most vital pieces of information to provide to the patient. However, patients' low knowledge of other information such as the duration of treatment, why they are taking the medicines and adverse reaction information is very dependent on the knowledge and skills, time and attitude of the dispensers from both groups. This could explain why patients of PTDs had a better level of knowledge of the other further information than those from NPTDs, indicating that more dispensers from the PTDs remembered to provide this information to patients. Patients' knowledge of medicines dispensed to them has been a subject widely studied under rational medicines use and patient care. The results from this study fall within the ranges observed in various research findings (Bandyopadhyay et al., 2017; Chima et al., 2012; Rabie & Kheder, 2020; Sisay et al., 2017a, 2017b), where the average percentage of patient knowledge was found to be between 27% and 92%. However, a detailed review of these studies shows that not all reported on comprehensive knowledge regarding the dispensed medicines, some considered dosage only and the dosage scheme, in which case the knowledge level was very high, but if all elements were considered together the averages were between 50−80%, which is within the averages found in this study.

Good storage practice depends on a number of factors, some of which do not directly depend on the knowledge of the dispenser alone. However, when looking at the different elements considered in the presented study under the subheading, 'storage practice and documentation,' almost all depended on the performance of the person responsible for the storekeeping if all necessary tools and a good storage environment were in place and conducive. Although the analysed results based on the individual regions showed some variations between the two groups, it was not sufficient to conclude that PTDs had a better performance than the NPTDs. During the study, it was observed that none of the health facilities visited had any form of SOPs at the various work places to guide the dispensers in different processes. Based on the results one would suggest that the performance observed in both groups more or less depended on the individual attitude rather than

the basic training alone. Self-initiative appeared to be more of a determining factor in the two groups leading to the performances observed regardless of the basic type of training dispensers had.

Documentation of dispensed medicines, handling of medicines and dispensing area cleanliness produced mixed and unclear results. This seems to be typical, especially when performing activities, which not only depend on training background but also on the attitude of the individual person towards accomplishing his or her job. With the exception of Shinyanga region, where the difference in performance between PTDs (82%) and NPTDs (68%) was clearly in favour of PTDs, the other two regions painted a different picture with NPTDs in Morogoro performing better (85%) than PTDs (72%) and both groups in Dodoma performed almost equally. Assuming that both groups were trained in storekeeping either on the job or theoretically in school, then the application of their knowledge and skills gained depended much more on their individual attitude and possibly the working context rather than performing according to what they were taught.

Although availability of medicines does not depend on the performance of the dispenser or store keeper alone, a dispenser responsible for stock management can cause stock outs if he/she fails to submit orders to the district pharmacists in time or orders medicines from the Prime Vendor if Medical Stores Department (MSD) does not have the ordered medicines. Other factors that may influence availability are financial capability of the facility, burden of debts with MSD, availability of medicines from supplier, efficiency of transport system and current inventory control system in practice. The role of dispensers in this indicator was limited to a few performance areas, such as submitting the orders within their supply schedule and lodging reorders to the Prime Vendor as soon as response of non-availability of a commodity ordered from MSD was received. In the presented study, there was a slight tendency in all regions that facilities with PTDs managing the store had better availability of health commodities than those with NPTDs. Assuming that all conditions were the same in both groups of facilities regarding other factors, then the differences in performance observed, higher availability was possibly contributed to by a better performance of the PTDs with timely processing orders and reordering from Prime Vendors where necessary. Nevertheless, when looking at the availability of general health commodities (tracer medicines) in health facilities in all regions, the overall average is still low, 76% from health facilities managed by PTDs and 70% managed by NPTDs with an overall average of only 73% for the three regions. One can only conclude that the availability of health commodities overall in this study was not affected by the performance of the individual dispensers alone, but other factors as listed above. The availability of health commodities has been widely studied and various influencing factors identified. Although according to WHO and Tanzanian national policy the optimal

level of availability for essential health commodities should be 100%, this is rarely achieved in many low-income countries. The results of this study fall within a level of availability similar to other findings (Bandyopadhyay et al., 2017; Hettihewa et al., 2013; Rabie & Kheder, 2020; Sisay et al., 2017a, 2017b).

Both PTDs and NPTDs had problems keeping their stock records updated, they either had more physical stock on shelves than was recorded in their books or vice versa. Assuming that both groups of dispensers were trained or instructed on how to routinely keep and update their records, then the only driving force to maintain accurate records would be the attitude of the individuals. The unclear link between PTDs and NPTDs performances in this indicator suggests that individual attitude was more of a determinant than their basic training. In addition to training and attitude, working conditions such as time pressure, task shifting, supervision by CHMT and the facility in charge, incentives, leadership and role models could have an important influence on performance.

The Tanzanian Pharmacy Council supported Dispenser Certificate Course is considered relevant and useful to close the gap of pharmaceutical cadres especially at primary health facilities. However, graduates face a lack of recognition in terms of remuneration and job description in the workforce, areas that need to be addressed accordingly.

The course curriculum is comprehensive and intends to provide skills and competence for students. Albeit well appreciated it will need to be reviewed and adapted to lessons learnt and inputs from students, graduates, tutors and employers. In addition, working conditions require more attention and must complement training efforts for better impact on pharmaceutical services.

Study limitation

The main limitation of the presented study is that it did not explore the level, scope, extent and type of the job training the NPTDs had received which could have led to minor differences between the two groups observed. An additional limitation may have been the workload of PTDs in some facilities, leading to limited effort and performance in dispensing or storage activities. Although inherently possible, reflexivity of the data collectors could influence research. However, the stringent protocol mitigated the influence of personal judgments regarding professional practices during the research process.

Conclusion

This study revealed that the one-year basic pharmaceutical services and supply chain management course did not substantially improve the

performance of pharmaceutical dispensers in three selected regions of Tanzania. These outcomes are a stark reminder that training alone does not necessarily lead to better practice and performance among health care workers and encourages a broader integrated systems approach. Improving the working environment by (i) providing the appropriate tools and SOPs; (ii) receiving acknowledgement and recognition of the training undertaken by the facility management and team; and (iii) establishing clear job descriptions, could potentially increase performance indicators and actively encourage dispensers to apply these new skills. Ultimately, a more integrated approach to dispenser training may contribute to increased dispensing quality and better performance in supply chain management.

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Availability of data and materials

The data sets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The ethical clearance for the study was given in writing by the Ethical Clearance Committee of St. John's University of Tanzania.

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