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Availability of essential maternal, neonatal and child health medicines and associated factors to their availability at selected high-volume public health facilities in Kampala city, Uganda: a cross-sectional study

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Availability of essential maternal, neonatal and child health medicines and associated factors to their availability at selected high-volume public health facilities in Kampala city, Uganda: a cross-sectional study.

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ABSTRACT

Background: Several interventions have been implemented in Uganda to improve the availability of essential Maternal, Neonatal and Child Health (MNCH) medicines. Despite these efforts, the country still faces a 42% unavailability level of MNCH medicine. We determined the factors associated with the availability of essential MNCH medicines at selected health facilities in Kampala City, Uganda.

Methodology: This was a mixed-methods health facility-based cross-sectional study at 12 selected health facilities in Kampala City. We directly observed up-to-date medicines using a WHO checklist to establish their availability at different health facility levels. For the qualitative study, in-charges/hospital administrators were interviewed using a semi-structured key informant interview guide. Qualitative data were analysed using Crewell's guidelines, while quantitative data were analysed using SPSS version 22.

Results: The study findings indicated that the level of availability of essential MNCH medicines was 73.6%. Availability of maternal health medicines and Neonatal & Child health medicines was 75.7% and 70.8% respectively. Medicine availability stood at 78% in health centre III level, 75% in health centre IVs, 60.4% in general hospitals, and 70.8% in referral hospitals. The average stock-out duration ranged from 30-90 days. The availability and use of guidelines and monthly stock-taking and updating were positive factors in the availability of essential maternal, newborn, and child health medicine. Insufficient funding, delayed delivery, lack of knowledge of supply chain management, low staffing and inadequate support supervision were negative factors.

Conclusion: The availability of essential MNCH medicines was lower than the WHO's recommended level of 80%. The availability of maternal health medicines was slightly higher than the availability of neonatal and child health medicines. Lower health facilities had better medicine availability than higher-level health facilities. Stock-out duration was long. We recommend that the government of Uganda support and build

capacity for conducting monthly stock-taking and updating, and ensure adequate staffing, training and support supervision to ensure informed decisions on the supply chain management of medicines.

Keywords: Essential, Maternal Newborn and Child Health Medicines, Kampala, Uganda.

Background.

The global maternal mortality rate in 2020 was 223 out of every 100,000 live births, translating to 800 daily deaths among pregnant women due to pregnancy and childbirth-related causes (1) This is far from the Sustainable Development Goal (SDG) target of less than 70 deaths for every 100,000 live births by 2030 (2). On the other hand, the under-five mortality rate in 2021 was 38 deaths for every 1000 live births, which translates to 27 children dying before reaching the age of five (3). This also falls significantly above the SDG target of less than 25 deaths per 1000 live births (2). It has been reported that 95% of these deaths take place in low- and middle-income countries, with the Sub-Saharan Africa region contributing up to 87% of such deaths (1). Most maternal and child health deaths are preventable through several cost-effective interventions, including improving access to essential medicines (4). For example, making fundamental maternal health drugs accessible to each woman when she gives birth would save the lives of 1.4 million women within the next 10 years (5).

The availability, accessibility, acceptability, and affordability of health products of assured quality need to be addressed to achieve the Sustainable Development Goals, in particular, Goal 3, Target 3.8.1, which seeks to improve coverage for essential health services, including Reproductive Maternal Newborn and Child Health (RMNCH) (2). Every disease management strategy, therefore, requires access to health products for prevention, diagnosis, treatment, palliative care and rehabilitation (6). Despite the benefits of essential Maternal, Newborn and Child Health (MNCH) medicines, the lack of access to essential medicines for MNCH remains a significant challenge in many developing countries, where more than half of the populations lack access to essential medicines (6,7). Findings of a readiness assessment on the availability of essential medicines for women and children threaten progress towards SDG 3 in Africa, indicating a mean availability of 12 priority essential medicines for women ranged from 22% to 40% while the availability of 12 priority medicines for children ranged from 28% to 57% (4).

In Uganda, several interventions have been implemented in the last decade across all levels of health care to improve the availability of essential medicines. The focus has been on several processes and functions such as infrastructure, equipment, human resources, information systems, inventory management, policy development and review and fostering effective collaborations between stakeholders (8–10). Despite these efforts, health facilities nationwide still face many difficulties accessing essential medicines and supplies. In the 2019/2020 financial year, the availability of a basket of 41 tracer commodities was 79% in 3,568 health facilities. This was below the annual target of 90%. Additionally, the proportion of health facilities with over 95% availability of a basket of commodities was 46%, which is far below the desired target of 75% (11).

Shortage of such medicines and the rampant stockouts of Essential Medicines and Health Supplies (EMHS) have been attributed as major contributing factors to the high rate of neonatal deaths, which stood at 19.2/1000 (11). Further still, maternal death stood at 336 per every 100,000 live births and 42.1/1000 under-five deaths in 2020 (12). This situation is even worse in Kampala, where the neonatal death rate is twice the national average, and 9.4% of such deaths are attributed to a lack of essential medicines and supplies. In the stock-out status report for Uganda in September 2022, Kampala experienced approximately 15 % stockout and 33% understocking of RMNCH tracer commodities, respectively. Furthermore, only about 22% of the RMNCH medicines were adequately stocked, while approximately 30% were overstocked (13).

This dark period of unavailability of essential MNCH medicines has had a contributory effect on some of the poor MNCH indicators in Kampala, like the high maternal mortality, which stood at 185 in every 1000 live births in 2020 (14). However, little is known about the availability of essential medicines and factors associated with this availability in Kampala since very few health facilities adequately report drug stockouts in the stock-out status reports. Furthermore, no studies on this subject have been conducted in Kampala

City. We conducted a study to establish the availability of essential RMNCH medicines and the determinants of their availability in selected health facilities in Kampala City, Uganda.

Methods

Study design, study setting and study population.

We employed a mixed-method descriptive cross-sectional study utilising quantitative and qualitative approaches in Kampala City, Uganda. Kampala City is the capital and largest city in Uganda. The city proper has a population of 3,652,000 in an area of 8,451.9 km^2 and is divided into the five political divisions of Kampala Central Division, Kawempe Division, Makindye Division, and Rubaga Division (15). Kampala's metropolitan area comprises the city proper and the neighbouring Wakiso District, Mukono District, Mpigi District, Buikwe District, and Luweero District. The city has 12 high-volume public health facilities that are at the level of Health Centre III (HCIII) and above (15). HCIIIs have a catchment population of at least 20,000 people and provide services such as basic preventive, promotive, and curative care, basic obstetric care, and support supervision at the community and health centre level II. HCIVs have a catchment population of 100,000 and provide curative, preventive, maternity, outpatient and inpatient services. These supervise, coordinate and plan for health Centre levels III and II. General hospitals have a catchment population of 500,000 and provide curative, preventive, maternity, outpatient and inpatient services. They also provide blood transfusion, medical imaging and laboratory services, in-service training, and support community-based programs through consultation and research. Lastly, the referral hospitals have a catchment population of 2,000,000 people and provide comprehensive specialist services, conduct research and training of health workers (16)

Study variables.

The dependent variable was the level of availability of essential MNCH medicines, which was measured at different levels, including the average level of availability of MNCH medicines, comparison of availability of Maternal health and Neonatal & Child health medicines, comparisons of the level of availability of

essential MNCH medicines across four levels of health care and stock out duration of MNCH medicines. On the other hand, the independent variables were categorised into three themes: procurement-related, inventory-related, and human resource-related factors that affect the availability of MNCH medicines in the 12 assessed health facilities. These have been elaborated on in the following paragraphs.

Level of availability of MNCH medicines

We first calculated the level of availability for each medicine across the 12 health facilities using the formula: Availability = number of health facilities that have an individual medicine on the day of data collection divided by the total number of assessed health facilities, all multiplied by 100%. This was followed by calculating the average availability of the medicines using the formula Availability - = Summation of availability for all assessed medicines/total number of assessed medicines (total of 24). We then used the World Health Organization (WHO) availability index to categorise the level of availability, that is: > 80%, which means a high level of availability, and less than 80%, which means a low availability level (17).

Comparison of MNCH medicine availability Versus Neonatal & Child health medicines

We compared the availability of maternal medicines and neonatal and child health medicines across all 12 assessed health facilities. This was done by determining the average availability of each medicine sub-category using the formula: Availability= sum of the percentage availability of medicines in a given category (that is, maternal health medicines and neonatal & child health medicines)/ 12 since each category contained 12 medicines that are: Oxytocin Injectable, Sodium Chloride Injectable, Calcium gluconate injectable, Magnesium Sulfate injectable, Ampicillin Powder, Gentamicin Injectable, Metronidazole Injectable, Misoprostol Capsules, Azithromycin capsules, Cefixime Capsule or tablet, Benzathine benzylpenicillin and Betamethasone injectable for maternal health medicines for maternal health. On the other hand, neonatal and child health medicines included Amoxicillin syrup, Ampicillin syrup, Ceftriaxone powder, Gentamicin injection, Procaine benzylpenicillin, Oral rehydration salts, Zinc tablets, Artemisinin

combination therapy (ACT), Vitamin A capsule, Standard regimen for first-line antiretroviral treatment, Morphine granule injection and Paracetamol.

Comparison of the availability of MNCH essential medicines across different levels of health care

We also assessed the availability of medicines across the different levels of health care: HCIIIs, HCIVs, general hospitals and referral hospitals. This was done by calculating the average percentage availability of essential MNCH medicines at each level of healthcare using the formula: sum of availability of the medicines for health facilities in a given level of care /number of health facilities in a given level of care multiplied by 100.

Stock out duration of essential MNCH medicines at selected health facilities in Kampala, February -June 2023.

Lastly, we assessed the stock-out duration for each medicine that was not available. This was done by identifying the average stockout period for each essential MNCH medicine from the day of data collection.

Independent variables

The independent variables were grouped according to three themes that helped establish the associated factors of the availability of these medicines. These included procurement-related factors such as the availability of functional procurement committees, funding for MNCH-related activities, the timing of the delivery of medicines, and changes in patient demand. It also included inventory-related factors such as availability of guidelines, stock taking and updating, storage facilities, inventory data quality, health information system and inventory security measures. Lastly, it examined human resource management-related factors, including knowledge of supply chain management, training on supply chain management, staffing norms, and support supervision. These were studied qualitatively.

Data collection methods and tools

We used two data collection methods, as discussed below;

Observation method: A direct observation of the in-date medicine and supplies in the facility was done using a checklist. The in-date medicines of priority were based on 24 medicines recommended by WHO; that is, 12 for women and 12 for children (18). These medicines include; Amoxicillin (dispersible, scored tablets 250 mg and 500 mg or equivalent flexible oral solid dosage form, in blister packs of 10), Ampicillin (powder for injection 500 mg and 1g), Ceftriaxone (powder for injection 250 mg and 1 g), Gentamicin (injection 40 mg/ml; 20 mg/ml) and Oxygen (medicinal gas) for treatment and management of Pneumonia and neonatal sepsis; Oral rehydration salts (ORS, five sachets of 200 ml; 500 ml and 1-litre, appropriate flavour), Zinc (20 mg scored dispersible tablet or equivalent flexible oral solid dosage form) for the treatment and management of diarrhoea in children; Artemisinin combination therapy (ACT) and Artesunate (rectal and injection dosage forms 50–200 mg) for treatment and management of malaria; Standard regimen for first-line antiretroviral therapy for the management of HIV; Vitamin A (capsule 100 000 IU strength; 200 000 IU) for managing vitamin A deficiency; and Morphine and paracetamol for palliative care. On the other hand, the medicines for maternal health include Oxytocin injection 10 IU in a 1-ml ampoule, Sodium chloride injectable solution 0.9% isotonic or Sodium lactate compound: injectable solution, Calcium gluconate injection 100 mg/ml in a 10-ml ampoule, Magnesium sulfate: injection 500 mg/ml in 10-ml ampoule, Ampicillin: powder for injection 500 mg; 1g(as sodium salt) in vial, Gentamicin: injection 40 mg/ml in 2-ml vial, Metronidazole: injection 500 mg in100-ml via, Misoprostol tablet 200 micrograms, Azithromycin: capsule 250 mg; 500 mg or oral liquid 200mg/5 ml, Cefixime capsule 400 mg, Benzathine benzylpenicillin powder for injection 900 mg, and Betamethasone: injection 6 mg/ml (3 mg/ml betamethasone sodium phosphate + 3 mg/betamethasone acetate) in an aqueous vehicle. (18).

Key informant Interviews (KIIs): This involved interviewing in-charges/administrators of the health facilities using a key informant interview guide. These were selected for the KIIs since they have in-depth

knowledge of the subject matter. Respondents were interviewed about procurement, inventory management, and human resource management factors affecting essential MNCH medicines' availability.

Data management and analysis

Quantitative data analysis.

Data was analysed using Statistical Package for Social Sciences (SPSS) version 22. We established means, frequencies and percentages of elements related to the availability of essential MNCH medicines. This data was presented using figures and tables.

Qualitative data analysis

Data was analysed under three themes: procurement, inventory management, and human resource-related factors affecting essential MNCH medicines' availability. We used Creswell's (2014) approach, which suggests a linear, hierarchical approach to data analysis, building from bottom to top. Data was digitally recorded during interviews and later transcribed. Notes on key points were also taken during the interview for backup purposes. The recorded files were stored in a personal laptop and secured with a password to protect respondents' identities.

Ethics

Ethical approval for this project was obtained from the Clarke International University Research Ethics Committee (CIU-REC) under registration number CLARKE-2022-413. Permission to collect data was sought from the office of the Directorate of Public Health and Environment of Kampala City Council Authority (KCCA). Informed written consent was sought from respondents. They were informed that their participation was voluntary and that their refusal would not have any negative consequences. To protect the confidentiality of the respondents, each was assigned a unique identifier, which was used instead of their names (19).

Results

Level of availability of the different essential MNCH medicines during a study conducted at selected health facilities in Kampala, February-June 2023

The average level of availability of MNCH medicines was 73.6%. This falls under the low category using the WHO categorisation index.

Regarding individual medicines, none of the maternal health medicines were available in all 12 of the assessed health facilities at the time of data collection. Cefixime Capsule/tablet was available in 11 (91.7%) health facilities, followed by Benzathine benzylpenicillin powder for injection and magnesium sulfate, available in 10 (83.3%) of the assessed health facilities.

Similarly, none of the child health medicines was available in all 12 of the assessed health facilities at the time of data collection. Ceftriaxone powder and Oral Rehydration Solution (ORS) were the most available in 11 (91.7%) assessed health facilities. This was followed by zinc tablets, ACT, and vitamin A capsules, each available in 10 (83.3%) assessed health facilities, as shown in Table 1.

Table 1: Level of availability of the different essential MNCH medicines in 12 high-volume public health facilities in Kampala.

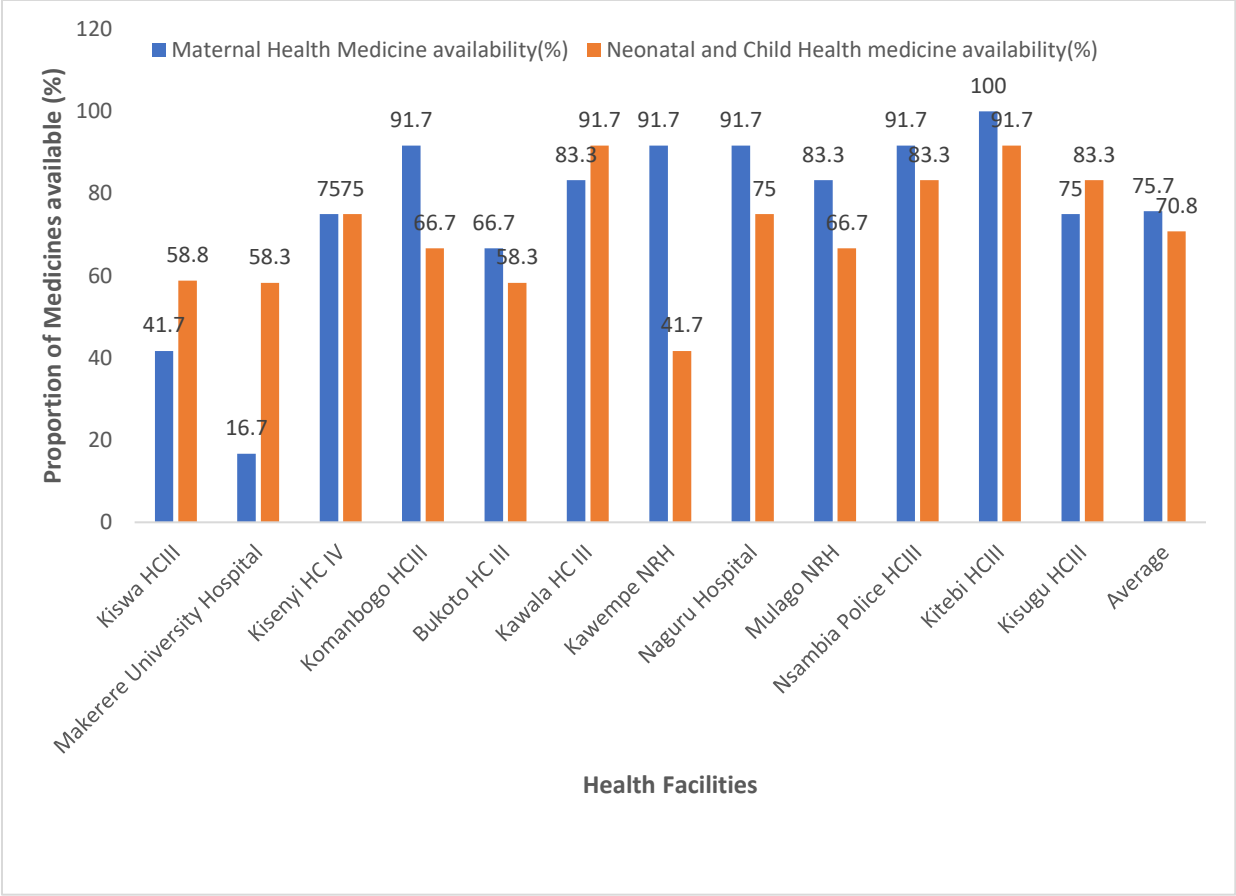
H/F	Kiswa HC III	Makerere University Hospital	Kisenyi HC IV	Komanbogo HC III	Bukoto HC III	Kawaala HC III	Kawempe NRH	Naguru Hospital	Mulago NRH	Nsambia Police HC III	Kitebi HC III	Kisungu HC III	Percentage Availability	WHO Category
Oxytocin Injectable	x	x	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	75	Low
Sodium Chloride Injectable	x	x	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	75	Low
Calcium gluconate injectable	x	x	✓	✓	x	✓	✓	✓	✓	✓	✓	x	66.7	Low
Magnesium Sulfate injectable	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	83.3	High
Ampicillin Powder	x	x	✓	x	✓	✓	✓	✓	✓	✓	✓	x	66.7	Low
Gentamicin Injectable	✓	x	✓	✓	x	x	✓	✓	x	✓	✓	✓	66.7	Low
Metronidazole Injectable	✓	x	x	✓	✓	✓	✓	✓	✓	x	✓	✓	75	Low

Misoprostol Capsules	✓	x	✓	✓	x	✓	✓	✓	✓	✓	✓	x	75	Low
Azithromycin capsules	x	✓	x	✓	✓	✓	✓	✓	x	✓	✓	✓	75	Low
Cefixime Capsule or tablet	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	91.7	High
Benzathine benzylpenicillin	✓	x	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	83.3	High
Betamethasone injectable	✓	x	x	✓	✓	✓	X	✓	✓	✓	✓	✓	75	Low
Amoxicillin syrup	x	x	x	x	✓	✓	X	x	x	✓	✓	✓	41.7	Low
Ampicillin Powder	✓	✓	x		x	✓	X	✓	x	✓	✓	✓	66.7	Low
Ceftriaxone powder	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	91.7	High
Gentamicin Injectable	x	✓	x	✓	x	✓	X	✓	✓	✓	✓	✓	66.7	Low
Procaine Benzyl Penicillin	x	✓	✓	✓	✓	✓	X	x	✓	✓	x	✓	66.7	Low
Oral Rehydration Solution	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	91.7	High
Zinc tablets	✓	x	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	83.3	High
ACT	✓	x	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	83.3	High
Artesunate Rectal/Injectable	x	x	✓	✓	x	✓	✓	x	x	✓	✓	x	50	Low
Vitamin A Capsule	✓	✓	✓	✓	✓	✓	✓	✓	x	x	✓	✓	83.3	High
Morphine granule, Injectable	x	x	✓	x	x	✓	✓	✓	✓	✓	✓	x	58.3	Low
Paracetamol Syrup/ Suspension	✓	✓	✓	x	x	✓	✓	✓	✓	x	✓	✓	75	Low
Percentage availability	**50**	**37.5**	**75**	**83.3**	**62.5**	**87.5**	**66.7**	**83.3**	**75**	**87.5**	**95.8**	**79.2**	**73.6**	Low

✓ **=Available** **x = Un Available**

Availability of essential MNCH medicines by medicine category during a study conducted at selected health facilities in Kampala, February -June 2023

Figure 1 shows medicine availability categorised into maternal medicines and neonatal and child health medicines at the health facilities assessed. The average availability of maternal health medicines was 75.7%, while the average availability of Neonatal and Child health medicines was 70.8%, as shown in Figure 1.



229

230 **Figure 1: Availability of MNCH medicines by medicine category (n=2) at 12 health facilities in**

231 **Kampala, Uganda, February-June 2023**

232

233 **Availability of essential MNCH medicines across different levels of health care during a study**

234 **conducted at selected health facilities in Kampala, February-June 2023.**

235 The level of availability of essential MNCH medicines was higher at the lower health facilities; the HCIIIs

236 had the highest availability level of 78%, followed by a 75% availability level at HCIV, referral hospital

237 had an availability level of 70.8%, and the lowest level of availability was at the general hospital level at

238 60.4%, as shown in Figure 2.

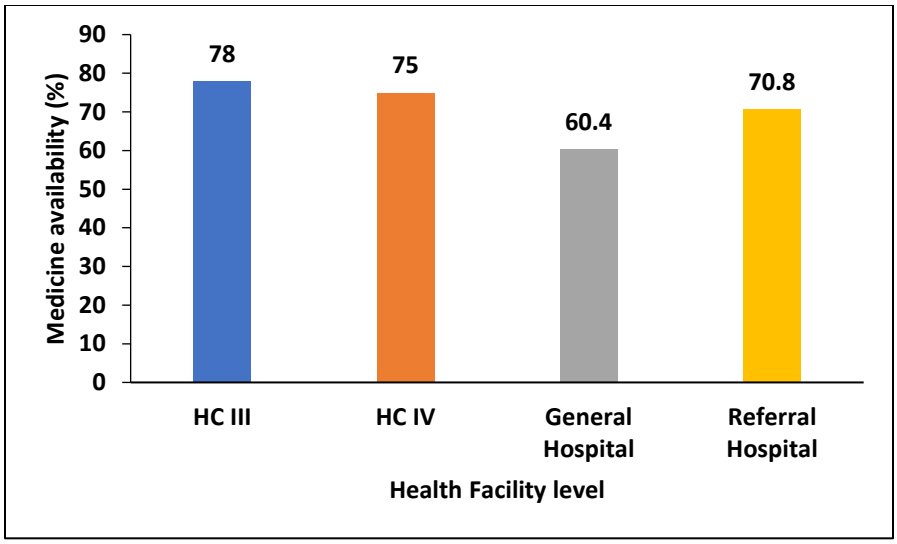


Figure 2: Level of availability of MNCH medicines across four levels of health care during a study conducted at selected health facilities in Kampala, February-June 2023

Average stock-out duration of essential MNCH medicines at selected health facilities in Kampala, February -June 2023.

Figure 3 shows the stockout duration time in days of the medicines assessed at the different health facilities. All the 24 assessed medicines were out of stock in one or more health facilities at the time of data collection. 17 (70.8%) of the medicines had an average stock-out duration of more than 90 days, five (20.8%) of the essential MNCH medicines had an average stock-out duration between 30-90 days, while 2 (8.4%) of the essential MNCH medicines had an average stock-out period between 7 and 30 days, as shown in Figure 3.

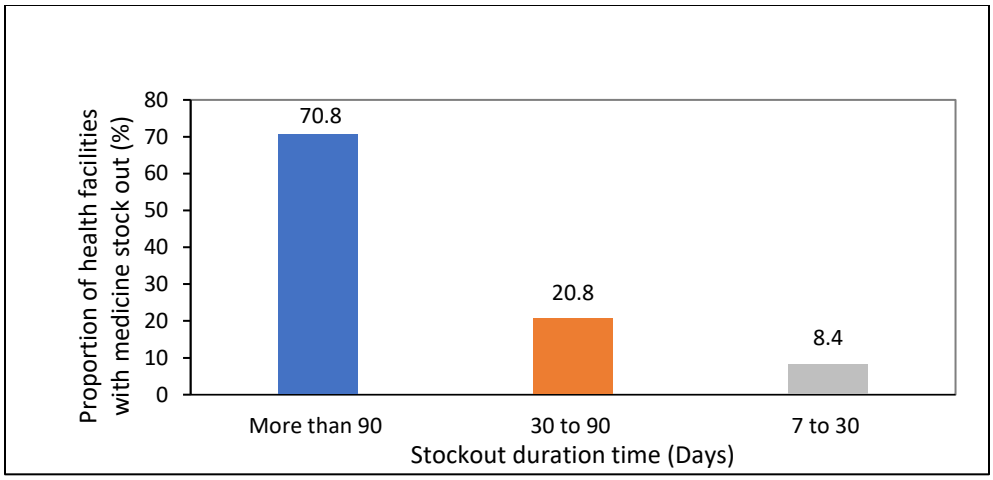


Figure 3: Stock out period for essential MNCH medicines at 12 selected health facilities in Kampala, February-June 2023

Determinants of availability of MNCH medicines in high volume health facilities in Kampala during a study conducted at selected health facilities in Kampala, February-June 2023

Themes

Table 2 summarises the study findings under three major themes. The first theme (Theme 1) presents procurement-related factors of MNCH medicine availability and consists of five sub-themes; the second theme (Theme 2) presents inventory-related factors of MNCH medicine availability and consists of six sub-themes, while the third theme (Theme 3) presents human resource-related factors that affect MNCH medicine availability and consists of five sub-themes.

Table 2: Emergent themes and sub-themes.

Theme	Sub-theme

Procurement-related factors that affect MNCH medicine availability	- Weak procurement system - Inadequate budget allocation - Poor timing in medicine delivery - Patient overload
Inventory management-related factors that affect MNCH medicine availability	- Availability of guidelines - Adequate storage facilities - Poor data quality - Use of paper-based health information system - Poor medicine security
Human resource management-related factors that affect MNCH medicine availability	- Inadequate training on inventory management - Low staffing norm - Inadequate supervision - Poor accountability mechanism

Theme 1: Procurement-related factors of availability of MNCH medicines

Under this theme, four sub-themes emerged among the key informants. These have been presented along with the participants' quotes.

Weak procurement committees

The key informants acknowledged that having functional procurement committees is very important in ensuring the availability of essential medicines since their roles include planning, ordering medicines, medicine quantification and monitoring the usage of medicines. However, most stated that procurement committees were generally weak, with procurement meetings held only once a year in most health facilities. Worse still, a smaller proportion acknowledged that minutes for such meetings existed.

One of the respondents mentioned, "*Although we have a procurement committee, the procurement of medicines is centrally done by the NMS and not according to orders, so I do not find it very effective in ensuring the availability of the required medicines''* (Key informant 1).

Another key informant noted, "*We have a procurement committee which does the procurement plans, but the planning meetings are sometimes irregular, and the procurement minutes are not available to us''* (Key informant 11).

Another key informant mentioned, "*We have a procurement committee, but its functionality is questionable since the members are not well conversant with their roles and they are not even supervised, so they are unable to give adequate guidance about quantities and types of medicines required, and this affects essential MNCH medicines in the health facilities''* (Key informant 8).

Insufficient budget allocation

All the key informants acknowledged the importance of adequate budget allocation to enable the national medical store to supply medicines to the health facilities according to their catchment populations. However, they were not content with the budgets allocated for running health facility activities, including the purchase of essential MNCH medicines.

One key informant mentioned: *''If the government funding for the health sector were adequate, then the health facilities would also have adequate medicines, but due to inadequate funding, we cannot have sufficient stock of essential MNCH medicines''*. (Key informant 7).

Another key informant mentioned: *''*There *is gross underfunding of the health sector by the government, which trickles down to underfunding of health facilities interventions, and that is why you find that at every point in time, essential MNCH medicines are missing at the health facilities''.* (Key informant 3).

Poor timing of medicine delivery

The timing of medicine delivery is a crucial factor in determining MNCH medicine availability; timely delivery ensures access to medicine, whereas late delivery results in prolonged periods without medication. In this study, most respondents reported that this was very poor.

One respondent mentioned, "*Medicines are never supplied on time, and the health facility sometimes has to go without such essential MNCH medicines for several months. As a result, we often do prescriptions and send the mothers and children to buy medicines for their treatment. This greatly affects our relationship with the community since they believe we intentionally don't want to give them the medicines''* (Key informant 5).

Patient overload

Regarding patient load, the key informants thought that changes in demand affected the availability of medicines. One respondent mentioned, *"There are seasons when we receive patients above the projected catchment population, and this causes the delivered medicines to get over faster than expected'* (Key informant 4).

Another respondent mentioned: *"We are a national referral hospital, and sometimes patients don't follow referral pathways, so we get overwhelmed, and medicines get consumed very fast, hence unavailability of medicines many times"* (Key informant 12).

Theme 2: Inventory management determinants of essential MNCH medicines' availability at selected Kampala health facilities, February-June 2023.

Several inventory-related factors have emerged regarding MNCH medicine availability. In the subsequent paragraphs, we present and describe these factors.

Availability of guidelines

Concerning the availability of guidelines, most of the key informants showed satisfaction. One of the respondents mentioned, “I am quite happy with the inventory management in this health facility. We have many of the tools, such as guidelines and registers, *and we also have adequate space”* (Key informant 10).

Similarly, one of the respondents stated, “We have the tools required for managing the supply chain process right from planning, *making requisitions, tracking usage and making reports”* (Key informant 9).

Similarly, one key informant mentioned: *“We have enough guidelines in this health facility which help us ensure the availability and safety of medicines”* (Key informant 6).

Adequate storage facilities

Concerning storage facilities, most respondents from the higher-level health facilities reported having good storage facilities. One key informant stated, *“This health facility has adequate storage facilities such as stores, cabins and refrigerators, and the safety of drugs should not be a problem”* (Key informant 2).

Similarly, another key informant mentioned, *“We have enough infrastructure in this health facility and storage space for medicines is sufficient”* (Key informant 11).

Poor data quality

All the interviewed key informants thought that the quality of MNCH medicine data in the health facility, in terms of accuracy, completeness, and timeliness, was a challenge.

Another key informant stated, "Sometimes the quantification is not well-informed in quality data, and this may result in *wrong decisions on quantities ordered, leading to overstocking or understocking required drugs”.* (Key informant 9).

Use of paper-based health information systems

In this study, most respondents used only paper-based systems, with less usage of computer-based information management systems as the preferred method. However, as reported by health workers, dual systems (computer-based and paper-based systems) accounted for more than one-quarter of inventory data management systems.

One key informant stated, "*Since we embraced computer-based data management for our HMIS, we have reduced mistakes and delays in ordering medicines"* (Key Informant 5).

One key informant mentioned, "*This health facility is busy with only one computer, and when it gets faulty, we are forced to use only the paper-based system, which is tedious and slow"* (Key informant 12).

Insecurity of medicines

Most respondents identified a gap in security measures to safeguard essential MNCH medicines.

One key informant mentioned, "The store cannot be kept under lock and key since we have few staff and cannot have one *fully dedicated to only looking out for medicine security"* (Key informant 2).

Another key informant mentioned, "*Measures on medicine security are weak, so medicines are sometimes stored insecurely"* (Key informant 11).

Theme 3: Human resource factors that affect essential MNCH medicines' availability at selected Kampala health facilities, February -June 2023.

Five sub-themes emerged among human resource-related factors that affect MNCH medicine availability. These have been presented in the subsequent paragraphs.

Low level of knowledge of inventory management

Concerning human resource factors, key informants had varying views on human resource determinants of the availability of essential MNCH medicines.

Supply chain training was an important determinant of essential MNCH medicine availability. However, all of them suggested that training in supply chain management was inadequate. One respondent mentioned, *"If staff could be trained, then we would have the required skills for supply chain management; however, many staff in this facility have never been trained in supply chain management"* (Key informant 5).

Another key informant mentioned, "*The biggest barrier to the availability of essential medicines is the knowledge gap among staff since most of them have never been trained and don't have sufficient knowledge on managing the supply chain process"* (Key informant 9).

Low staffing norms

Most respondents mentioned inadequate staffing, which negatively affects medicine availability due to procurement delays and errors in data quality.

One key informant stated, *"We have less than half of the required human resource gaps for this health facility filled, and these cannot effectively do inventory management since they have other roles too"* (Key informant 6).

Further, another respondent stated, *"Many times, the health facility is seriously understaffed, given that many positions are vacant and the few staff available still have to go for their off-duty as well as annual and study leave"* (Key informant 7).

Another key informant stated, *"This health facility does not have a pharmacist who would have been a significant cadre in planning, ordering, selecting and quantifying MNCH essential medicines. The ones filling the gap are just being trained on the job and cannot do as good work as the person qualified for the position"* (Key Informant 1).

Inadequate Supervision

Concerning supervision, all of the interviewed key informants suggested that monitoring and supervision of the health workers was an important determinant of the availability of essential MNCH medicines**.** They indicated that with adequate supervision, problems can be rectified promptly, thereby reducing mistakes that would lead to stock-outs. However, most agreed that quality support supervision was a big gap.

One key informant stated, *"*If *we could embrace a culture of conducting routine support supervision to our staff, we could easily arrest supply chain-related problems and rectify them early enough"* (Key informant 8).

Another key informant mentioned, '' *Although support supervision would significantly improve medicine availability, it is rarely done, and even when it is done, it is usually inadequate"* (Key informant 10).

Theft and poor accountability mechanisms

Accountability was seen as a barrier to MNCH medicine availability. The respondents suggested that, to some extent, the availability of medicine is attributed to poor accountability mechanisms. Such loopholes lead to MNCH medicines being mismanaged by Health workers.

One respondent mentioned, "A few years ago, this health facility was all over social media for the wrong reasons, *as one of the health workers was caught stealing drugs. This practice contributes to stockouts and the unavailability of MNCH medicines"* (Key informant 2).

One key informant mentioned that *"*Some *of our staff steal these drugs and take them to their drug shops and clinics, and this leads to stockouts in the health facilities"* (Key informant 11).

Discussions

In this study, we used the WHO/HAI criteria, which recommend 80% as the minimum level of availability of essential medicines at health facilities (17). In the current study, the level of availability of essential

MNCH medicines was 73.6%. This finding was lower than the WHO/HAI recommendation of at least 80% for the availability of essential medicines. This level of availability was lower than the level of availability in studies conducted in Malawi and Ethiopia, where the availability of essential medicines stood at 84% and 86.7%, respectively (20,23). This difference could be attributed to the types and numbers of health facilities covered. In the latter studies, private and public health facilities were included, whereas the current study focused solely on public health facilities. Usually, private health facilities may be better stocked than government health facilities, thus improving availability levels, as shown in the former study. The difference in the level of availability of the medicines could also be attributed to the funding sources. In one study (20), it was mentioned that donors funded some of the medicines. In contrast, the current study reported that all medicines were received from the National Medical Stores, a government medical provision facility. Usually, medications supplied by funders other than the government are better stocked.

On the other hand, the findings on the availability of essential MNCH medicines in this study were higher than those of studies conducted in different parts of the world. Notably, the level of availability of essential medicines was 20% to 40% and 43.1%, respectively, in two separate studies (4,21). The former study was conducted in eight different African countries, while the latter was conducted in seventeen countries globally between 2016 and 2020. The difference in availability between the current study and the previous studies could still be attributed to several factors, such as the location of health facilities, the types of health facilities, and the procurement and financing systems used. The current study was conducted in Kampala City and included the national and referral hospitals, which are of priority when allocating medicines. In contrast, regions outside the capital cities were included in the previous studies, which could be less prioritised. Furthermore, since the current study was conducted in the city, the health facilities are closer to the NMS, with possibly minimal challenges in transport. On the other hand, the former studies included even districts up country, which could be more challenging to reach, thus contributing to the higher stock-out levels of essential medicines.

The study findings indicated that lower health facilities had higher levels of availability of essential MNCH medicines compared to the higher-level health facilities. This finding is similar to the findings of other studies conducted in Ethiopia and Uganda (22). The similarity in these study findings could be attributed to the demand for services across the different levels of health care. Indeed, there is usually a higher demand for medicines in the higher levels of health care; thus, there is a greater likelihood of a faster stock-out. Secondly, on many occasions, patients will skip lower-level health facilities and seek treatment in higher-level facilities because they perceive that they will receive better care at these higher-level facilities, which could explain the reason for more stock-outs in the higher facilities in this current study.

Findings indicated that the availability of essential maternal medicines stood at 75.7%. This was slightly higher than the availability of essential neonatal and child health medicines, which stood at 70.8%. The finding did not agree with a study conducted across eight countries (4). The difference in the findings could be attributed to the fact that the consumption of medicines across these categories can differ in different contexts and seasons of the year.

The study findings suggested that most unavailable MNCH medicines (70.8%) had been out of stock for between 30 and 90 days. This means more than a month of no medicines each time a stockout occurred. This finding is similar to a study conducted in Bungoma County, Kenya and the West Wollga Zone of Ethiopia, where the average stock-out duration was 51 and 71 days, respectively (23). However, the findings are lower than those of a study conducted in Ethiopia, where the stock-out duration was 128.9 days (24). The difference in the findings could be attributed to several factors, including procurement processes and staff capacity, as well as weak procurement processes, such as delays in making orders, delays in delivery, and a lack of transport.

The study findings suggested that most health facilities conducted procurement meetings only once a year. These findings are similar to the findings of another study conducted in Uganda, where 55.3% of health workers suggested that they held planning meetings once a year (25). The similarity in these findings could

be attributed to the fact that both studies were conducted in Uganda, implying that the behaviour of health workers and working conditions are similar. The infrequent procurement meetings could lead to inaccurate data and decisions on medicine types and quantities, resulting in unavailability.

The study findings indicated that MOH earmarked inadequate funding for the health sector, which trickles down to the availability of budgets to purchase essential MNCH medicines for health facilities. These findings are similar to the findings of several other studies, including a summative evaluation of the WHO Rapid Access Expansion Initiative, a study conducted in Uganda which suggested that the funding for Uganda's health sector was chronically low, with this sector accounting for 5.1% of the national budget FY 2020/2021, down from 7.9% in FY 2020/2021 and a study conducted in Malawi where inadequate government funding was seen as a significant barrier to the availability of essential medicines in Malawi's public health facility (26,22,20). The similarity in the study findings could be attributed to the fact that all these studies were conducted in African settings, which experience similar financial constraints in funding government programs, including health care.

In this study, findings indicated delayed delivery of medicines by NMS after orders were made. Such untimely delivery of essential MNCH medicines negatively affects the availability of MNCH medicines since the health facilities sometimes face stockouts due to these delays. These findings are similar to the findings of two separate studies conducted in Uganda, where one of the major flaws of the procurement system was the failure to deliver MCH medicines on time, which led to the unavailability of some medicines (22,27).

In this study, patient overload due to changes in demand contributed to the unavailability of essential medicines**.** These findings are similar to the findings of a study conducted in Uganda and Ethiopia (28,29). In the study conducted in North Ethiopia, more drug stock was realised in hospitals (which experienced higher patient load) than in the health facility level at 60% and 20%, respectively. Medicines are often ordered based on past consumption, yet demand and population constantly increase. If the population

increases and medicines are ordered using past consumption methods, then there is a likelihood that health facilities will experience stockouts. Furthermore, it is common for people to opt for higher levels of health care over lower ones, assuming they offer better care and are more accessible.

The study findings indicated that slightly more than half of the health facilities had adequate storage facilities. The findings are lower than the findings of a study conducted in Ethiopia (29) where at least 73.9% of health facilities had good storage facilities. The difference in findings could be attributed to several factors, including the presence of a qualified pharmacist to maintain equipment in good condition and the level of funding, which may have been higher in the former study, allowing for better storage facilities compared to the current study. The findings of the current study are, however, higher than the findings of another study conducted in Ethiopia, where adequate storage facilities were found only in 25% of the health facilities (30). The difference in the findings could be due to several factors, such as supervision, funding, and availability of dedicated store personnel, which could probably be better in the current study.

This study indicated that slightly more than half of health facilities used paper-based systems, with less than 10% using computer-based information management systems as the preferred method. However, dual systems accounted for over one-quarter of inventory data management systems. The low usage of computer-based systems could be attributed to disruptions in power supply, inadequate hardware, and individual factors such as attitude and resistance to change by health workers. These findings are similar to those of studies conducted in Kenya and Uganda, respectively (31). In a study conducted in Kenya, the computer-based system was considered adequate in only 42% of health facilities, with up to 25% having systems unsuitable. Another 25% of facilities, despite having functional systems, used them inconsistently, and worse still, 8% of the facilities did not use computer-based systems at all. In the study conducted in Uganda, although 84% of the 128 public health facilities assessed were using some form of logistics Management

Information System,42% of the health facilities had computer hardware, and only 6% were using electronic systems, while 47% were using both systems. (22)

This study's findings revealed that most health workers had never received any training in supply chain management. It also indicated a positive relationship between training and the availability of MNCH medicines. It further noted that many staff handling supplies were not qualified as pharmacists. The lack of training may indicate a knowledge gap among staff managing the supply chain in health facilities. Lack of knowledge could probably be the biggest challenge facing implementation. These findings are in agreement with the findings of several studies, including studies conducted in Malawi, Kenya, and Uganda, respectively, where inadequate or a lack of training was cited in more than one-half of the interviewed participants (20,32,33) . In Malawi, as a result of inadequate training in supply chain management, most health workers could not even select priority essential medicines from the general essential medicines list (20).

This study indicated that the health facilities had staff positions filled inadequately. These findings align with the 10-year road map 2021/2022-2031/2032 for Uganda, which highlights a significant gap in fulfilling public sector pharmacist and pharmacy technician positions, with less than a 40% staffing rate. It also agrees with the findings of a study done in Ethiopia, which highlighted a shortage of human resource professionals (34,35). When there is inadequate staffing, the few health workers available may not pay much attention to medicine management in procurement and inventory management practices. Instead, they will concentrate on the management of patients. Poor medicine management leads to wastage, theft, and other misuse, resulting in the unavailability of medicine.

Findings indicated that there was inadequate support and supervision of supply chain management, which may have negatively impacted the availability of MNCH medicines. These findings are contrary to findings of a study conducted in Kenya, where support supervision was adequate and led to an increasing trend of indicator achievement, including medicine management that could be translated to medicine availability

(36). It is, however, similar to findings of another study conducted in Kenya, where supervisory visits from management were rare and action plans were irregularly developed and followed up (37).

This study had a fair level of mismanagement/theft of essential medicines. This finding agrees with several evidence on drug theft in health facilities (20,38–41). In Uganda, an article published by The Independent magazine highlighted the concerns of the head of state regarding drug theft. In this article, it was indicated that Ugandan drugs were being sold in the Open markets in the Democratic Republic of Congo and South Sudan (38). Still, The Independent Magazine reported a story of three individuals, including a staff member of the National Medical Stores, who were charged with theft of drugs worth billions of Uganda shillings (39). This finding demonstrates that medicine theft occurs not only at the health facility level but also at higher levels before medicines reach these facilities. This situation is peculiar to Uganda and many other countries where similar findings have been reported. In a study conducted in Malawi, one of the significant barriers to essential medicine availability was drug theft (20). It is estimated that up to 30% of this nation's health supply budget is consumed by medicine theft (40). Similarly, in an article published by a Kenyan newspaper, health workers were charged with stealing government medicines (41). The similarity in these findings could be attributed to the fact that the above findings were generated from African countries with similar governance systems characterised by weak accountability systems and internal control measures that individuals easily surpass. Further, these countries have identical poverty indexes and low pay for health workers who resort to medicine theft to make ends meet.

Strengths and Limitations of the Study.

Our study had some strengths. We used WHO guidelines to develop our questionnaire. Using such a standardised tool ensures our study findings' validity, reliability and objectivity. Secondly, this was the first study on the availability of essential MNCH medicines in Kampala, a capital city and an urban area. It,

544 therefore, provides an opportunity to generalise findings to similar settings. However, our study also had
545 some limitations. A significant limitation of this study was that the quantitative data were based only on the
546 availability of the medicines on the day of the survey. This data may not reflect average monthly or yearly
547 availability. Another limitation is that the quality and amount of information from the key informants might
548 have been subjected to respondent bias; it might depend on their knowledge of Uganda's public health and
549 medicines supply system, and the key informant responses might not capture all the contextual issues that
550 affect the availability of essential medicines in Uganda's public health sector.

551 **Conclusions and recommendations**

552 The study findings indicated that the level of essential MNCH medicine availability was 73.6%. This was
553 lower than the minimum WHO requirement of 80%. Essential maternal and child health medicines were
554 available at 75.7% and 70.8%, respectively. The lower-level health facilities had more medicine availability
555 than the higher-level health facilities. The average stock-out duration ranged from 30 to 90 days.

556 The positive factors of essential MNCH medicine availability included the availability and use of
557 guidelines, as well as monthly stock-taking and updating. On the other hand, insufficient funding for
558 medicine purchases, delayed delivery, lack of supply chain management knowledge, low staffing, and
559 inadequate supervision support were negative factors affecting the availability of essential MNCH
560 medicines.

561 We, therefore, recommend that the government of Uganda support health workers in conducting monthly
562 stock-taking and updating to ensure informed decision-making on matters related to the supply chain
563 management of medicines. The government of Uganda needs to earmark adequate funds for the
564 implementation of health programs since this directly affects the availability of essential medicines. In
565 addition to this, the government of Uganda needs to ensure the timely delivery of medicines to avoid
566 rampant medicine stockouts. Lastly, the government of Uganda needs to improve human resource

indicators, including staffing, training and support supervision, since these have a direct bearing on the availability of essential MNCH medicines.

List of abbreviations

AHSP: Annual Health Sector Performance Report

ART: Antiretroviral Treatment

DHO: District Health Officers

EML: Essential medicines list

HF: Health facility

HSDP: Health Sector Development Plan

HSSP: Health Sector Strategic Plan

LMIC: Low- and Middle-Income Countries

LMIS: Logistics Management Information System

MNCH: Maternal Newborn and Child Health

MoH: Ministry of Health

NMS: National Medical Stores

NRH: National Referral Hospitals

PHC: Primary health care

PMTCT: Prevention of mother-to-child transmission of HIV

PNFP: Private Not For Profit hospitals

SWAP: Sector-Wide Approaches UN - United Nations

RMNCH: Reproductive, Maternal, Neonatal and Child Health Supplies

RMNCH: Reproductive, maternal, newborn, and child health and nutrition

RRH: Regional Referral Hospital

USAID: United States Agency for International Development

WHO: World Health Organization

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Author contributions

IA, IN, and AK conceptualised the study idea. IA, IN, SO, and AK did data analysis, writing, and editing the manuscript. RCN and AK guided the manuscript's writing, data collection, and review. All authors read and approved the final manuscript.

Availability of data and materials

The data set and questionnaires used and/or analysed during the current study will be available on the Mendeley repository.

Conflicts of interest

All authors declared that they have no competing interests.

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608 **Declarations**

609 All the protocols for this project, registration number CLARKE-2022-413, were reviewed and approved by
610 the Clarke International University (CIU) Research Ethics Committee in accordance with the Declaration
611 of Helsinki and CIU research guidelines. Permission to collect data from the health facilities was sought
612 from the office of the Director of Medical Health Services of Kampala City Council. We also sought verbal
613 consent from the participants. They were informed that their participation was voluntary, and their refusal
614 would not result in any negative consequences. To protect the confidentiality of the respondents, each was
615 assigned a unique identifier that was used instead of their names. All methods were carried out in
616 accordance with relevant guidelines and regulations.

617 **Consent for publication**

618 Not applicable.

619 **Competing interests**

620 All authors declared that they have no competing interests

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