

## Access and affordability of extemporaneously compounded essential medicines in some tertiary health facilities in Nigeria

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### ABSTRACT

**Background:** Some essential medicines are not readily available in the required dosage forms. The availability of extemporaneous preparations is crucial in the provision of medical care to patients, especially the geriatrics and paediatrics.

**Objectives:** The objective of the study was to evaluate the prevalence of extemporaneous compounding of medicines and the factors affecting patients' access to extemporaneously compounded essential medicines in some tertiary hospitals in Nigeria.

**Methods:** A retrospective survey was carried out at three different tertiary health facilities, Jos University Teaching Hospital (JUTH), Bingham University Teaching Hospital (BHUTH) Jos, and University of Nigeria Teaching Hospital, Enugu. Medicines for oral use compounded from January 2019 to December 2021 were extracted from pharmacy records using a semi-structured questionnaire and the data was analyzed using Microsoft Excel 2013, IBM SPSS version 21.

**Results:** About 1,140 of the extemporaneous products, were in liquid dosage form made with trituration using crushed tablets. The most frequent preparations were hydroxyurea (34.39 %), Frusemide (8.86%), lamotrigene (7.54 %), phenobarbitone (6.14 %), clonazepam (5.61 %), spironolactone (5.96%). The most compounded therapeutic class was Antihypertensives, anticonvulsants, vitamins/minerals and least was antihistamines. The value for affordability of the compounded medicines in UNTH, JUTH and BhUTH was less than 1.0, which implies that all the compounded medicines were affordable.

**Conclusion:** Extemporaneous compounding is a common practice in the health facilities under consideration. Patients' access to these medicines is affected by the price of the preparations. A higher price reduces accessibility.

**Keywords:** Compounding, extemporaneous medicines, essential medicines, packaging, dosage forms.

## Accès et accessibilité financière des médicaments essentiels préparés de manière extemporanée dans certains établissements de santé tertiaires au Nigéria

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### RÉSUMÉ

**Contexte:** Certains médicaments essentiels ne sont pas facilement disponibles dans les formes posologiques requises. La disponibilité de préparations extemporanées est cruciale dans la fourniture de soins médicaux aux patients, en particulier aux personnes âgées et aux enfants. Cette étude vise à déterminer l'accès aux médicaments essentiels préparés extemporanément / préparations extemporanées de médicaments essentiels dans certains établissements de santé tertiaires au Nigéria.

**Objectif:** L'objectif de cette étude était d'évaluer l'accès aux médicaments essentiels extemporanés ou composés dans certains hôpitaux tertiaires au Nigéria.

**Méthodes:** Une enquête rétrospective a été menée dans trois établissements de santé tertiaires différents : le centre hospitalier universitaire de Jos (JUTH), l'hôpital universitaire de Bingham (BHUTH) Jos et le centre hospitalier d'Enugu au Nigéria. Les médicaments à usage oral composés utilisés de janvier 2019 à décembre 2021 ont été extraits des dossiers de la pharmacie à l'aide d'un questionnaire semi-structuré et les données ont été analysées à l'aide de Microsoft Excel 2013, IBM SPSS version 21.

**Résultats:** Environ 1140 des produits extemporanés étaient sous forme de dosage liquide fabriqué par trituration à partir de comprimés écrasés. Les préparations les plus fréquentes étaient l'hydroxyurée (34,39%), le furosémide (8,86%), la lamotrigine (7,54%), le phénobarbital (6,14%), le clonazépam (5,61%), la spironolactone (5,96%). La classe thérapeutique la plus composée était celle des antihypertenseurs, des anticonvulsivants, des vitamines/minéraux et la moins composée était les antihistaminiques. La valeur de l'accessibilité financière des médicaments composés à UNTH, JUTH et BHUTH était inférieure à 1,0, ce qui implique que tous les médicaments composés étaient abordables.

**Conclusion:** Les préparations magistrales extemporanées sont une pratique courante dans les établissements de santé étudiés. L'accès des patients à ces médicaments est influencé par le prix des préparations. Un prix élevé réduit l'accessibilité.

**Mots-clés:** Préparations magistrales ; médicaments extemporanés, médicaments essentiels, conditionnement, formes posologiques.

## INTRODUCTION

Extemporaneous medicines are produced to address the challenge of non-availability of required dosage forms of essential medicines.<sup>1,2</sup> The need for individualized therapy also necessitates the use of extemporaneous compounding for patients.<sup>3</sup> The use of extemporaneous preparations also stems from the refusal of the pharmaceutical industries to invest in comparatively small markets that extemporaneous medications provide.<sup>4</sup> In most instances, it consists of oral liquid preparations needed by paediatric and geriatric patients.<sup>5,6</sup> Other preparations that can be made extemporaneously include topical preparations such as creams, gels, lotions etc. Extemporaneous compounding of medicines has been the traditional practice before the advent of pharmaceutical industries.<sup>7</sup> The pharmacists are the only skilled and knowledgeable health professionals entrusted with the role of preparing extemporaneous medications.<sup>8</sup> The active principle in the extemporaneous preparation may be obtained from commercially available drugs or it may be a pure chemical or Active Pharmaceutical Ingredients (APIs).<sup>9</sup> Extemporaneous preparations are made in a suitable medium referred to as excipients or inactive pharmaceutical ingredients.<sup>10</sup> The preparations are usually tailored to the specific requirements of each patient. It is worth noting that the medicaments and the excipients must be compatible so that the product made will have assured stability and efficacy.

Millions of children under the age of 5 years die each year from diseases that are treatable and for which extemporaneous medicines can be prepared. Such diseases include malaria, pneumonia, diarrhea and sepsis. Majority of these deaths occur in resource limited countries such as Nigeria where access to extemporaneous preparations is limited.<sup>11</sup> The non-availability of child friendly dosage forms and strengths of medications is a great challenge in the health system.<sup>12</sup> The same situation applies to geriatric patients that require extemporaneous medications. Addressing this challenge will go a long way in providing quality health care services to the patients in society. It is worth noting, however, that the use of extemporaneous preparations should be a last resort because of the inherent risks involved. The associated risks affect both the patients and the pharmacists that prepare the medications.<sup>4</sup> Some of the challenges include calculation errors, instability of the medicaments, infertility, and miscarriage in extemporaneous preparation of cytotoxic drugs by pharmacists.<sup>4</sup> In Nigeria, lack of information on

standards for making extemporaneous preparations is also a great challenge.<sup>13</sup>

In this study, we evaluated the prevalence of extemporaneous compounding of medicines and the factors affecting patients' access to extemporaneously compounded essential medicines in some tertiary hospitals in Nigeria.

## METHODS

The study was a retrospective descriptive survey to identify access to compounded products and practices in Jos University Teaching Hospital (JUTH), Bingham University Teaching Hospital Jos (BhUTH) and University of Nigeria Teaching Hospital Enugu (UNTH). Data was analyzed using Microsoft Excel 2013 and presented in terms of descriptive statistics-percentages.

- Presence of a children's unit (out-patient, in-patient or emergency wards),
- Record of compounding,
- Presence of qualified pharmacists.

The hospitals were also selected to ensure wide coverage. In each of the samples, the hospitals chosen were either among the foremost, or had large patient turnouts, or was a Paediatric specialist hospital. Researchers' work experience with several of these hospitals also influenced the choice.

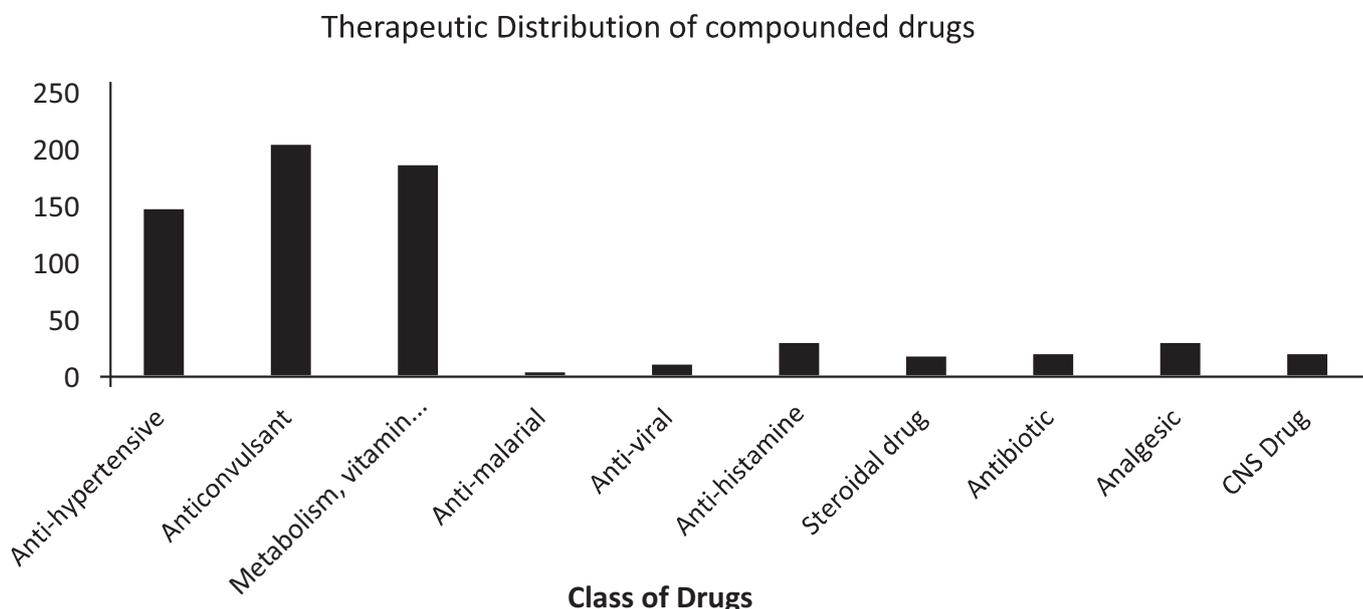
Medicines for oral use compounded from January 2019 to December 2021 were extracted from pharmacy records using a semi-structured questionnaire summarized in Table 1. The questionnaire design was based on elements adapted from a similar questionnaire for African countries used by the Commonwealth Pharmacists Association (unpublished). This questionnaire was vetted by a consultant pharmacist with considerable practice experience and was piloted in one of the locations for validation. Questionnaires were mostly completed by the researchers (in the locations) from records in the 'Compounding Book' of the hospitals. In some locations, they were completed by the responsible pharmacists in charge of compounding. Characteristics of medicines compounded: active pharmaceutical ingredient (API), starting material, final dosage form, compounding or suspending vehicle, and reasons for compounding were noted.

Information was then entered into a Microsoft Excel database to aid analysis. Data was collected in June 2021.

Data was analysed using Microsoft Excel 2013 and presented in terms of descriptive statistics-percentages.

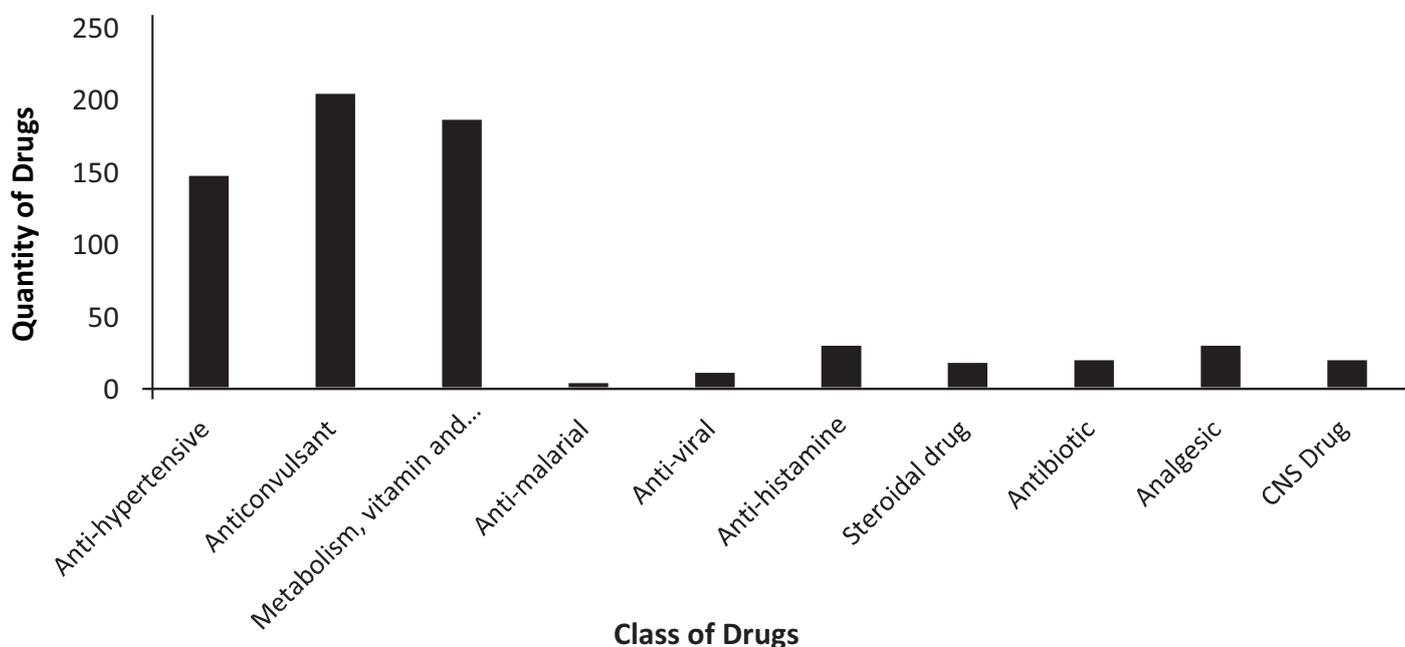
**RESULTS**

The total number of preparations compounded extemporaneously in 2019, 2020 and 2021 was 637, 673 and 370 respectively.



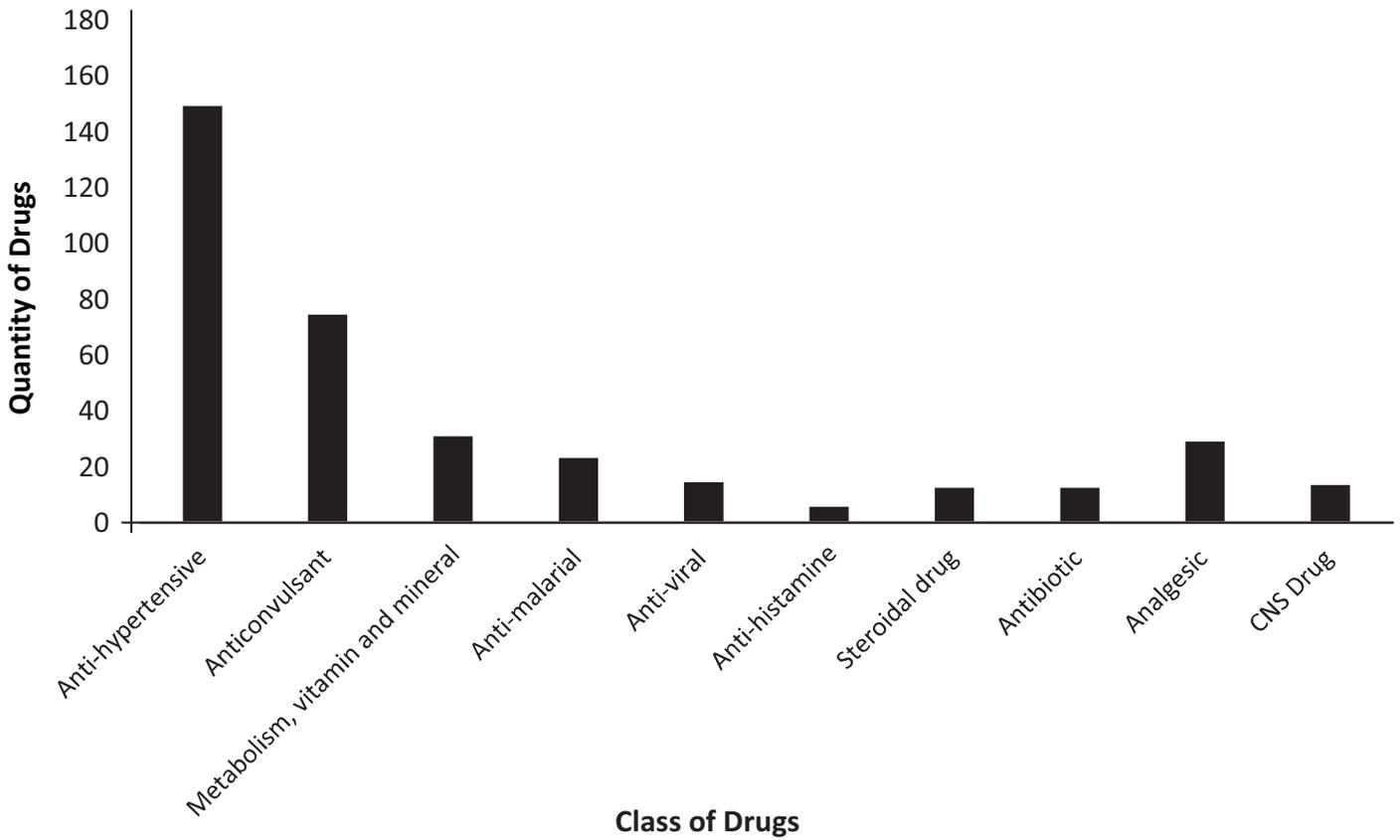
**Figure 1:** Therapeutic distribution of compounded drugs in 2019.

As can be seen from figure 1, in 2019, the most frequently prepared therapeutic category of drugs was anti-convulsants (35.5 %) while the least was anti-malarial drugs (0.47 %).



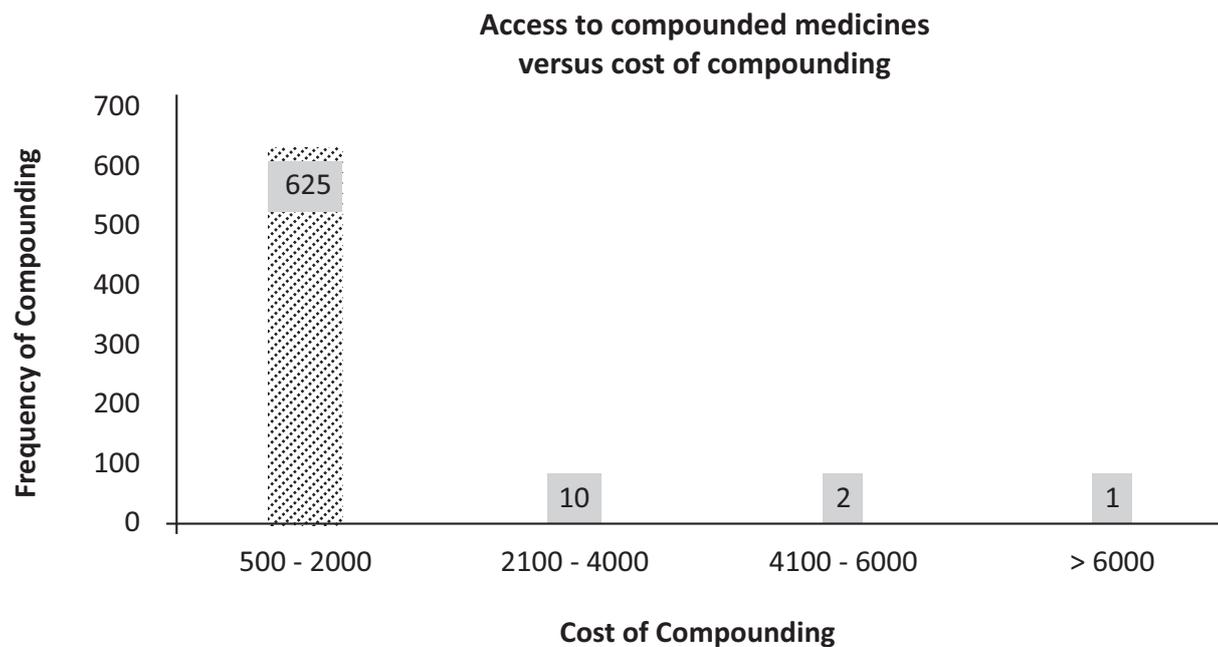
**Figure 2:** Therapeutic distribution of compounded for 2020.

Figure 2 also shows that anti-hypertensive (30.23 %) were the drugs compounded most in 2020 while antihistamines (0.59 %) were the least compounded class of drugs during the period.



**Figure 3:** Therapeutic distribution of compounded for 2021.

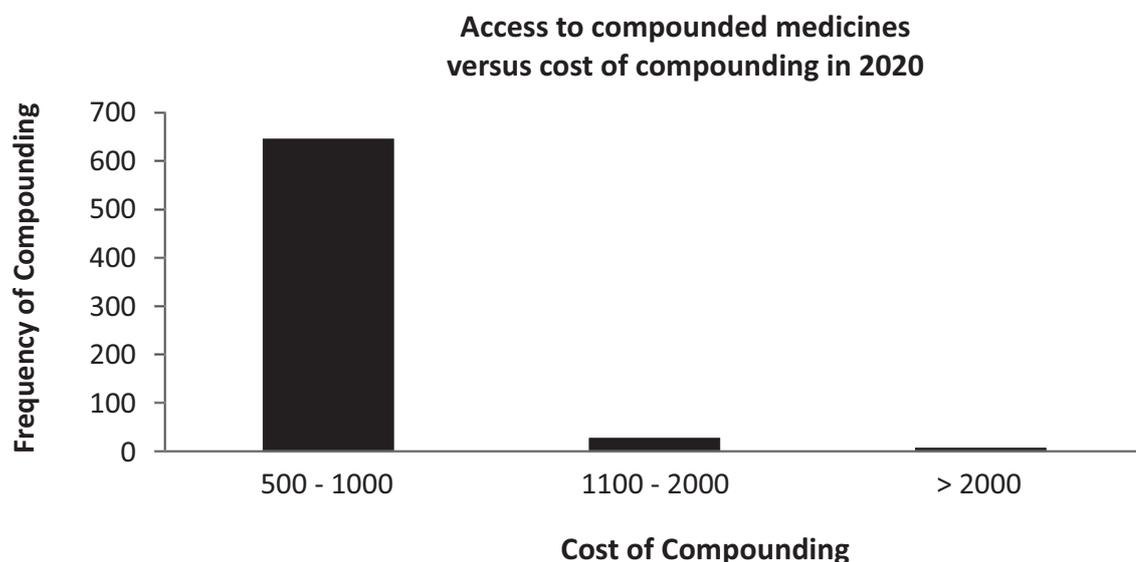
However, in 2021, Anti-hypertensives (40.74 %) were the most frequently prepared drugs, while the least were the anti-histamines (1.58 %).



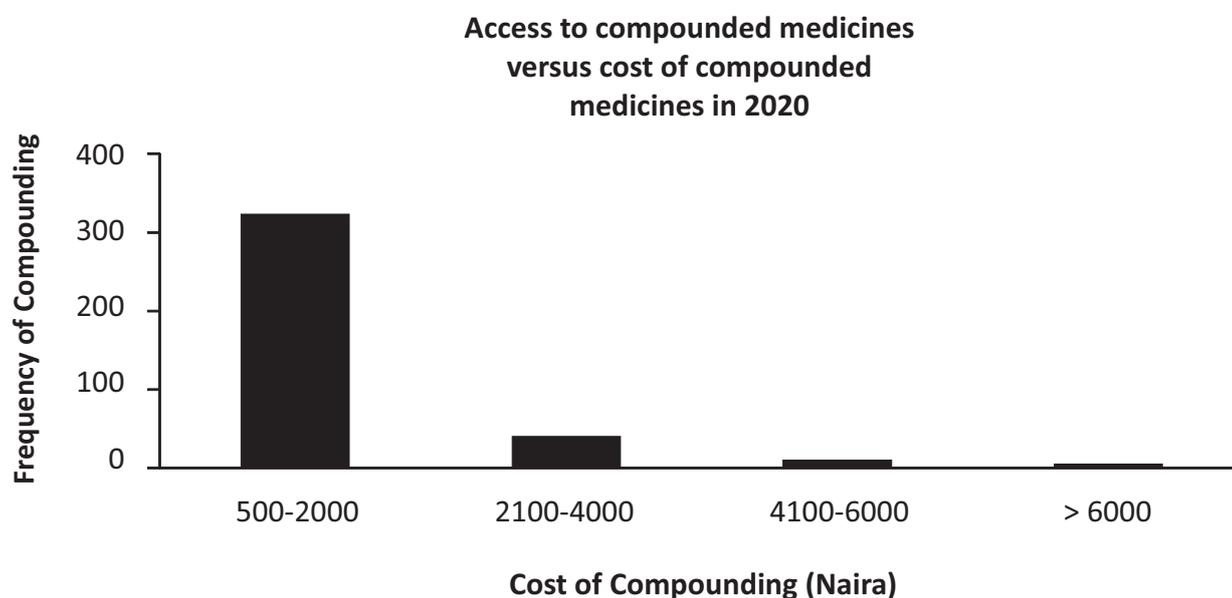
**Figure 4:** The Relationship between the Levels of access and the cost of commercial compounding for 2019

Figure 4 shows that in 2019, an inverse relationship existed between the cost of making extemporaneous preparation and the access to compounded medicines. This implies the population under consideration is poor and as the cost of preparing the drugs increase, affordability became a challenge. Majority of the population can only afford extemporaneous preparations if the cost is lower or equal to two thousand naira.

Affordability was also inversely proportional to cost of compounding extemporaneous preparations in 2020 and 2021, Figures 5 and 6



**Figure 5:** The Relationship between the Levels of access and the cost of commercial compounding for 2020



**Figure 6:** The Relationship between the Levels of access and the cost of commercial compounding for 2021.

## DISCUSSION

The therapeutic arsenal in the health system is made up of largely solid dosage forms, such as capsules and tablets for the use of the patients. However, elderly and paediatric patients may not be able to swallow solid dosage forms and therefore the need for liquid dosage forms.<sup>14</sup> The need for extemporaneous preparations still remain largely unaddressed and many patients are yearning for a solution to this problem.<sup>15</sup> Extemporaneous compounding is an indispensable tool in the management of many health conditions.<sup>16</sup> This study reveals that an increase in the cost of making extemporaneous preparations reduces the affordability and accessibility of the medications to the patients. This finding is similar to that from a study that showed reduced availability of medications to vulnerable groups of patients as the price increases.<sup>17</sup> The compounded medicines in this study are commercially available ready for use in all dosage forms in developed countries<sup>13</sup> while they require extemporaneous compounding in developing countries.

The drugs that were most frequently compounded extemporaneously in this study were antihypertensive and anticonvulsant medications. This is in contrast to a study in Ireland that showed that dermatological preparations were the drugs most commonly compounded.<sup>18</sup> This may be due to the reality of the prevailing diseases in the different communities under study.

This study also reveals that the pharmacists in the tertiary hospitals have the competencies to undertake small scale manufacturing of pharmaceutical preparations. Similar studies revealed that pharmacists are the only competent health professionals entrusted with the task of extemporaneous compounding.<sup>19</sup> However, the ready availability of pharmacists in remote communities where patients need the extemporaneous preparations most cannot be guaranteed. To enhance the availability of medicines that are not commercially available except through extemporaneous compounding, government needs to facilitate the importation and the registration of the commercially produced dosage forms of these drugs.

Some of the challenges with extemporaneous preparations include the risk of microbial contamination, patients' acceptance (with respect to odour, taste, colour and palatability), formulation failure and calculation errors.<sup>6</sup>

## CONCLUSION

Extemporaneous compounding of medicines is a common practice in the health facilities under consideration. Patients' access to these medicines is affected by the price of the preparations. A higher price reduces accessibility.

## REFERENCES

1. Belayneh A, Tessema ZA (2021) Systematic Review of the Stability of Extemporaneous Pediatric Oral Formulations. *Scientific World Journal*. doi:10.1155/2021/8523091.
2. Kiseļova O, Mauriņa B, Šidlovska V, Zvejnieks J. (2019) The extent of extemporaneous preparation and regulatory framework of extemporaneous compounding in Latvia. *Medicine*. 55 (9):531
3. Assefa D, Paulos G, Kebebe D, Alemu S, Reta W, Mulugeta T, *et al.* (2022) Investigating the knowledge, perception, and practice of healthcare practitioners toward rational use of compounded medications and its contribution to antimicrobial resistance: a cross-sectional study. *BMC Health Service Research*. doi.org/10.1186/s12913-022-07649-4.
4. Brion F, Nunn AJ, Rieutord A. (2003) Extemporaneous (magistral) preparation of oral medicines for children in European hospitals. *Acta Paediatr International Journal Paediatrics*. 92(4):486-90.
5. Gruchlik A, Smolik S. (2018) Preparation of extemporaneous oral liquid medications in children's hospital pharmacies. *Farm Policy*. 74(4):260-64
6. da Silva MRM, Dysars LP, Dos Santos EP, Ricci Júnior E. (2020) Preparation of extemporaneous oral liquid in the hospital pharmacy. *Brazilian Journal of Pharmaceutical Sciences*. doi.org/10.1590/s2175-9790201900418358.
7. Alkhatib HS, Jalouqa S, Maraqa N, Ratka A, Elayeh E, Al Muhaissen S. (2019) Prevalence, determinants, and characteristics of extemporaneous compounding in Jordanian pharmacies. *BMC Health Services Research*. 8;19(1):816
8. Mohiuddin A. (2020) Extemporaneous compounding: Cautions, controversies and convenience. *IP International Journal Comparative Advanced Pharmacology*. doi.org/10.1823/249542.2018.0028
9. Falconer JR, Steadman KJ. (2017) Extemporaneously compounded medicines. *Australian Prescriber*. 40(1):5-8

10. Nahata MC, Allen LV. (2008) Extemporaneous drug formulations. *Clinical Therapeutics*. 30;(11):2112-19
11. Robertson J, Forte G, Trapsida JM, Hill S. (2009) What essential medicines for children are on the shelf? *Bull World Health Organ*. 87(3):231-37
12. Andersson ÅC, Eksborg S, Förberg U, Nydert P, Lindemalm S. (2023) Frequency of paediatric patients administered extemporaneous preparations at a Swedish university hospital: A registry-based study comparing two study-years, 10 years apart. *European Journal Hospital Pharmacy*. 8:ejhpharm-2023-003804
13. Orubu ESF, Okwelogu C, Opanuga O, Nunn T, Tuleu C. (2017) Access to age-appropriate essential medicines: A retrospective survey of compounding of medicines for children in hospitals in Nigeria and implications for policy development. *Health Policy Planning*. 1;32(2):225-35
14. Haywood A, Glass BD. (2013) Liquid dosage forms extemporaneously prepared from commercially available products - Considering new evidence on stability. *Journal of Pharmacy and Pharmaceutical Sciences*. 16(3):441-55
15. Giam JA, McLachlan AJ. (2010) Extemporaneous product use in paediatric patients: a systematic review. *International Journal Pharmacy Practice*. 16(1):3-10
16. Freitas Santana DG, Toma MM, Nadai TRDE, Jrl B, (2021) Carvalho Mastroianni DP. Adverse drug events related to extemporaneous compounding medicines. *Rev Ia*. doi.org/10.4321/s1699-714x2023000200008
17. Alpern JD, Song J, Stauffer WM. (2016) Essential Medicines in the United States - Why Access Is Diminishing. *New England Journal Medicine*. 19;374(20):1904-7
18. Ramtoola Z, Catibusic A, Ameen H, Cullen S, Barlow JW. (2023) Evaluation of the type and frequency of extemporaneous formulations dispensed in hospital and community pharmacies. *Exploratory Research Clinical Social Pharmacy*. 28;12:100380
19. Mohiuddin A. (2019) Extemporaneous Compounding: Selective Pharmacists with Separate Skill. *Inovative Pharmacy*. 31;10(4):10.24926/iip.v