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Prevalence of antibiotic self-medication and knowledge of antimicrobial resistance among community members in Neno District rural Malawi: A cross-sectional study

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ABSTRACT

Objectives: Despite global efforts to address antibiotic self-medication, it is still significantly prevalent. This study aimed to investigate the prevalence of antibiotic self-medication and assess knowledge of antibiotic resistance among community members in Neno District, rural Malawi.

Methods: A cross-sectional, community-based study was conducted from September to November 2023, using simple random sampling across 169 villages. Participants from two households per village were surveyed using a “drug bag” method, focusing on those who had taken antibiotics within the preceding 6 months. In addition, drug retailers were selected via snowball sampling for interviews.

Results: Of the 531 participants and 39 drug retailers, 71.1% reported antibiotic use, with 69.5% self-medicating in the past 6 months, with convenience (31.5%) and confidence (26.7%) being the reasons. Common symptoms prompting self-medication included cough (29.9%), sore throat (28.6%), and aches and pain (28.6%). Amoxicillin (61.1%) and cotrimoxazole (29.6%) were the most used antibiotics. More than half (53.1%) reused leftover antibiotics from health facilities, with employed participants significantly more likely to self-medicate. Awareness of antibiotic resistance was low (16.1%), mainly learned from hospitals. Unlawful antibiotic sales by drug retailers (46.2%) were noted.

Conclusions: The study highlights the urgent need for government-led efforts to regulate antibiotic use and increase public awareness to mitigate the impact on public health.

Introduction

Antibiotics have been widely hailed as one of the greatest medical breakthroughs of the twentieth century for their ability to treat bacterial-related illnesses on a global scale [1,2]. However, the improper use of antibiotics has led to a rise in antibiotic resistance [3]. This improper use includes practices such as self-medication, misdiagnosis, excessive dosages, prolonged use, incorrect drug selection, inappropriate dispensing of antibiotics without a prescription, using partial doses of antibiotics, and dependence or abuse [3,4].

The overuse of antibiotics through self-medication and overdosing is a significant contributing factor to the crisis of antibiotic resistance [5,6]. The rise of more resistant infections, in turn, has resulted in extended hospital stays, elevated medical expenses, and a rise in mortality rates [4–6]. Sub-Saharan Africa faces a more severe situation con-

cerning antimicrobial resistance (AMR), as estimated in 2019, with the region recording the highest mortality rate (23.5 deaths per 100,000) attributed to AMR compared with other regions [7]. The significant implications of this situation extend to the health, economic, and social welfare of individuals in numerous lower- and middle-income countries [8].

The rise in AMR is linked to self-medication, premature discontinuation of treatments, inconsistent use, and overuse of antibiotics. In sub-Saharan Africa, self-medication is notably prevalent. A systematic review of 34 studies in low- and middle-income countries reported a pooled self-medication prevalence of 38.8% (95% confidence interval: 29.5–48.1) [3]. The review also identified factors associated with self-medication, including limited access to recognized health care facilities, improper advertising, medical knowledge, and illnesses; inadequate health care personnel; insufficient drug supplies; and the proximity

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of uncertified drug retail shops to one's home [3]. Furthermore, self-medication practices have been associated with socio-demographic factors, particularly, among educated adult females with an income [9–11]. Malawi, a low-income country in southern Africa, has been affected by antibiotic self-medication and AMR [12–21]. We conducted this study to fill the knowledge gap regarding antibiotic self-medication and AMR in the communities of Neno District in rural Malawi. Most existing research has primarily focused on urban areas or health care settings in urban areas [16,18,20,22]. Although previous studies on rural communities have primarily focused on subsistence farmers and health care facility settings, our research takes a broader approach by encompassing the entire community without specifically targeting a particular group or population [23,24]. This study aimed to evaluate antibiotic utilization, identify associated socio-demographic and cultural factors, and assess the level of knowledge about AMR among community members in Neno District in rural Malawi.

Materials and methods

A cross-sectional study utilizing quantitative survey data collection was used. The study was done in the Neno, a rural, mountainous, and hard-to-reach district situated in the southwestern part of the country. Neno residents are subsistence farmers and over 94% of households are engaged in farming activities and mainly depend on rain-fed agriculture [25]. The district has a total of 15 health facilities that offer primary and secondary care services to its 150,000 residents [26,27]. Neno is the last district in the country without a tarmac road leading to its district hospital, and it has an overall poor road network, making it difficult for residents to access health care facilities.

Between August and November 2023, we interviewed community members from two randomly selected households, ensuring that each household in the 169 villages of Neno District had an equal chance of being selected. This approach was most appropriate for capturing a representative sample of the community, allowing generalizable findings about antibiotic self-medication and AMR awareness among the broader population. We included individuals above the age of 18 years and excluded those under 18 years, as well as individuals with hearing, speech, or mental disabilities and those who had lived in Neno for less than a year. Four trained research assistants conducted interviews with 531 study participants. The sample size was calculated using the Cochran cross-sectional survey formula, based on the previous antibiotic use prevalence in a study done in Blantyre, Malawi [16,28]. A structured questionnaire was used, which was translated into Chichewa. We further used a “drug bag” method, aided by visual aids, to assist participants in recalling their antibiotic use [29]. In addition to household interviews, we interviewed 39 community members who ran drug retail shops or other businesses involving the buying and selling of drugs. These individuals were selected using a snowball sampling technique, wherein initial participants referred others, creating a network of participants. This method was suitable for identifying and including drug retailers who may not be easily accessible or known through traditional sampling methods. This ensured that the study captured a comprehensive view of antibiotic dispensing practices in the district. Combining these sampling strategies provided a balanced and thorough understanding of the antibiotic use landscape in the Neno District.

Data collection

Based on a thorough literature review, we developed household and drug retailer questionnaires on self-medication, antibiotic use, and knowledge of AMR [12–14,16–19,22]. A comprehensive literature review was conducted using databases such as PubMed and Google Scholar, focusing on terms such as “antibiotic self-medication,” “AMR awareness,” and “Malawi.” These tools were in English, translated into Chichewa (Malawi's official local language) and then back-translated

into English to ensure accuracy in the translation process. The questionnaires were programmed into the CommCare application and uploaded onto smartphone tablets. Both questionnaires were pretested to assess their acceptability, comprehension, usability, and feasibility. The pretest was conducted in four randomly selected villages. The study team and experts analyzed the results, and adjustments were made to improve the questionnaires.

The research assistants conducted face-to-face interviews with the study participants, aiming to clarify the questions. They followed all COVID-19 precautionary measures. In addition, we collected global positioning system coordinates by enabling the location feature on smartphone tablets for all surveyed village households.

Statistical analysis

The collected data were extracted from CommCare into an Excel sheet where it was cleaned. Statistical analysis was done using R Software, version 4.3.3. Descriptive statistics including counts and percentages for all categorical variables and median and interquartile range for all continuous variables were calculated. Furthermore, we calculated the prevalence rates per 1000 population and used the chi-square to test the association between self-medication and socio-demographic characteristics.

Binary and multivariate logistic regression were also fitted to find factors associated with self-medication. For knowledge of AMR, each question in the survey was assigned a value based on the correctness of the response. A correct answer was awarded one point, whereas an incorrect or “don't know” response received zero points. The total score was the sum of the points from all questions, reflecting the participant's level of knowledge on AMR.

A $P < 0.05$ was selected as the threshold for statistical significance in all tests. This value was chosen because it indicates the presence of significant relationships, which is crucial for guiding public health interventions. In addition, using this standard ensures consistency with previous research, enabling comparisons and the development of a comprehensive knowledge base.

Results

A total of 531 participants responded to our household questionnaires and they were composed of 288 (54.2%) females and 243 (45.8%) males, with a majority below the age of 50 years (347 [65.4%]) and a mean age of 36.3 years. Of the participants, 372 (70.0%) were married, 351 (66.1%) were self-employed, and 311 (58.6%) had completed primary school education (Table 1).

We interviewed 39 drug retailers and the majority were male (25 [64.1%]); most of them were aged below 30 years (35.9%), with primary school level education (23 [59%]). None had a pharmacy-related qualification. Of the drug retailers interviewed, 28 (71.8%) were groceries/kiosks, four (10.3%) were private clinics and drug stores, and three (7.7%) were vendors (Table 1).

Using the survey to better understand participants' knowledge about antibiotics, we found that 311 (58.6%) participants had heard about antibiotics. When shown during the survey, participants who knew antibiotics were able to recognize a median of three antibiotics (interquartile range 1–3). Amoxicillin (190 [61.1%]) and cotrimoxazole (110 [35.4%]) were the most recognized antibiotics. Of all participants, 221 (71.2%) reported having self-medicated with antibiotics in the past 6 months and 261 (69.5%) of them had self-medicated at least twice. Cough (93 [29.9%]), sore throat (90 [28.9%]), and aches and pain (89 [28.6%]) were the most common symptoms people self-medicate for (Figure 1).

Most study participants mentioned experience (98 [31.5%]) and convenience (83 [26.7%]) as the most common reasons why they self-medicated with antibiotics. Of these reporting self-medication, 153 (49.2%) used experience as a guide for antibiotic selection and

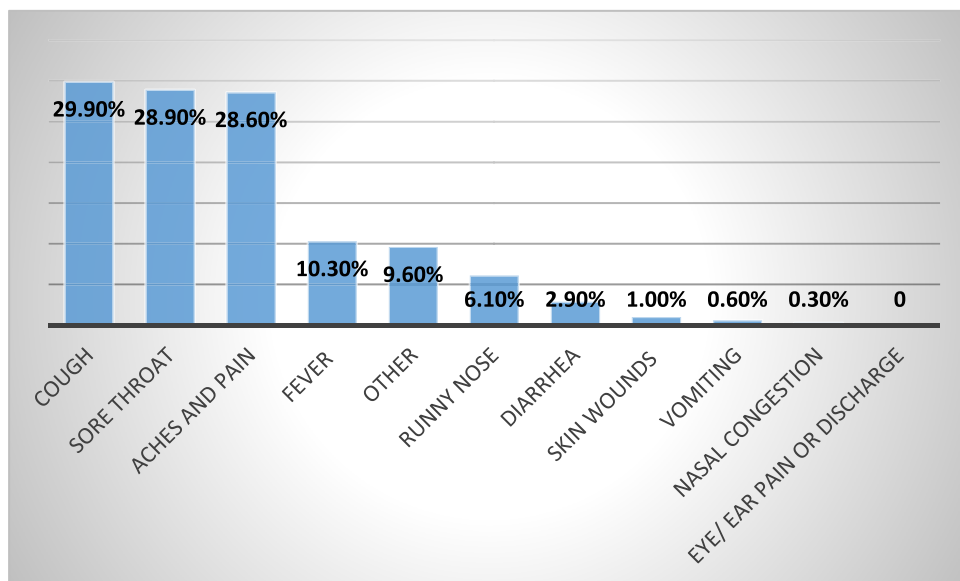


Figure 1. Symptoms leading to antibiotic self-medication.

Table 1 Demographic characteristics of study participants.

Variable	Frequency (Proportions) Household interviews (n = 531)	Frequency (Proportions) Drug retailer interviews (n = 39)
Gender		
Male	243 (45.8%)	25 (64.1%)
Female	288 (54.2%)	14 (35.9%)
Age category		
<20	45 (8.5%)	1 (2.6%)
20-29	171 (32.2%)	14 (35.9%)
30-39	131 (24.7%)	11 (28.2%)
40-49	90 (16.9%)	6 (15.4%)
50-59	47 (8.9%)	5 (12.8%)
≥60	47 (8.9%)	2 (5.1%)
Marital status		
Single	87 (16.4%)	7 (17.9%)
Married	372 (24.7%)	32 (82.1%)
Divorced	53 (10%)	0
Widowed	19 (3.6%)	0
Employment status		
Not employed	143 (26.9%)	N/A ^a
Self-employed	351 (66.1%)	N/A ^a
Government	7 (1.3%)	N/A ^a
Private	12 (2.3%)	N/A ^a
Student	18 (3.4%)	N/A ^a
Education		
No education	55 (10.4%)	2 (5.1%)
Primary	311 (58.6%)	23 (59.0%)
Secondary	159 (29.9%)	8 (20.5%)
Tertiary	6 (1.1%)	6 (15.4%)

^a Not explored because the participants sell drugs as their job.

dosage determination. Over half (15 [57.7%]) of participants who self-medicated antibiotics did not complete the dosage of antibiotics during the treatment when their signs and symptoms improved.

Within participants' self-medicating, 165 (53.1%) reported that they initially were prescribed medication from a health facility, kept some medication, and would later reuse the leftover antibiotics to self-medicate, whereas 60 (21.2%) got them from a vendor. Most of the study participants recognized it is not good to self-medicate (292 [93.9%]), identifying that this can lead to taking the wrong drug (245 [78%]) or taking the wrong medication dosage (17 [55%]). However, of the participants, 50 (16.1%) reported they knew about AMR and most received this information from the hospital (37 [74.0%]) (Figure 2).

When we analyzed the relationship between antibiotic self-medication and knowledge of antibiotic resistance with socio-demographic characteristics, we noted that employed participants were more likely to self-medicate with antibiotics ($P = 0.000$, 95% confidence interval: 4.546-14.738) (Tables 2 and 3). Knowledge of antibiotic resistance was low across all participants.

Of drug retailers, 18 (46.2%) of them revealed that they stock antibiotics, with amoxicillin as the most commonly stocked antibiotic (22 [56.4%]). Most drug retailers (nine [60%]) reported that customers preemptively ask for particular antibiotics and these are sold without a prescription. Most of the drug retailers declined to reveal the source of their antibiotics (24 [61.5%]). Almost all recognize that it is illegal to stock and sell antibiotics without a prescription (37 [97.4%]). Only five (12.8%) knew about AMR and got this information from hospitals or health care workers 20 (51.3%).

Discussion

Our study, which examined antibiotic self-medication and awareness of AMR among locals, revealed an alarming prevalence of self-medication and a significant lack of knowledge regarding AMR. The World Health Organization (WHO) underscores the necessity for diverse interventions to combat AMR, including public awareness campaigns, improved healthcare practices, robust government policies, stringent pharmaceutical oversight, and the regulation of non-human antibiotic usage [30].

In this study, most demographic factors did not significantly influence antibiotic self-medication, except employment status. Employed in-

Table 2 Bivariate analysis of the prevalence of antibiotic self-medication and knowledge of antibiotic resistance against socio-demographic characteristics of our study participants.

Variable	Antibiotic self-medication		Knowledge of antimicrobial resistance	
	Chi ²	P-value	Chi ²	P-value
Age	17.664	0.003	3.933	0.559
Sex	0.856	0.355	0.007	0.932
Marital status	1.776	0.620	1.811	0.613
Employment	60.402	0.000	17.573	0.001
Education	0.205	0.977	6.553	0.088

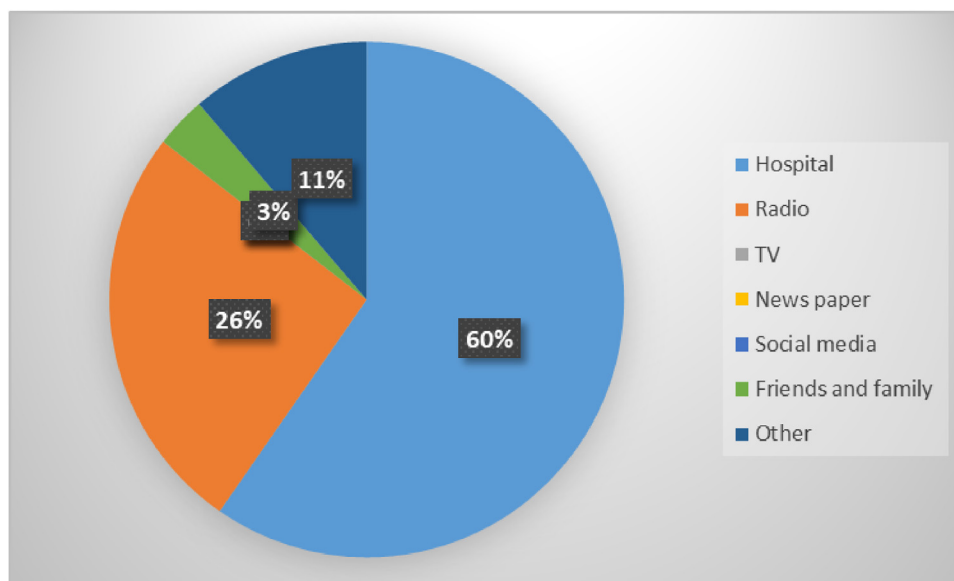


Figure 2. Sources of information on antimicrobial resistance.

Table 3

Multivariate analysis of the prevalence of antibiotic self-medication and knowledge of antibiotic resistance against socio-demographic characteristics of our study participants.

Variable		Antibiotic self-medication			Knowledge of antibiotic resistance		
		OR	P-value	95% CI	OR	P-value	95% CI
Age	≥40	1.449	0.222	0.799-2.627	1.311	0.405	0.693-2.483
	<40	Ref	Ref	Ref	Ref	Ref	Ref
Sex	Male	0.878	0.661	0.410-1.573	0.9981	0.975	0.523-1.874
	Female	Ref	Ref	Ref	Ref	Ref	Ref
Marital status	Married	0.680	0.236	0.359-1.287	0.812	0.545	0.414-1.592
	Unmarried	Ref	Ref	Ref	Ref	Ref	Ref
Employment status	Employed	8.185	0.000	4.546-14.738	0.802	0.526	0.405-1.586
	Unemployed	Ref	Ref	Ref	Ref	Ref	Ref
Any Education	Yes	0.707	0.444	0.290-1.719	2.729	0.116	0.782-9.530
	No	Ref	Ref	Ref	Ref	Ref	Ref

CI, confidence interval; OR, odds ratio; Re, reference.

individuals were more likely to self-medicate with antibiotics ($P = 0.000$). In addition, the low knowledge of AMR (16.1%) was not influenced by any demographic variables. This finding contrasts with other studies in low- and middle-income countries, where factors such as sex have been statistically significant in influencing self-medication behaviors [31]. Local studies have indicated that socio-demographic factors, such as age, sex, educational status, and employment status, can play a role in antibiotic use and awareness, suggesting that our findings may reflect unique regional or cultural dynamics in Neno District, rural Malawi [16–20]. Notably, employed study participants were more inclined to self-medicate with antibiotics, likely due to their financial capability to access health care services or purchase antibiotics from drug retailers.

Among the various presenting complaints that prompt self-medication behavior, cough, sore throat, and aches and pain emerged as the predominant reasons reported by community members and retailer participants. Notably, amoxicillin and cotrimoxazole were the most frequently used antibiotics, typically obtained from health care facilities and, often, left over from a previous course of treatment. These findings were also observed in other studies conducted in Malawi, Mozambique, Tanzania, Kenya, Uganda, Ethiopia, Nigeria, and Zimbabwe [11,16–19,22,31,32]. These antibiotics are categorized as “access” on the WHO’s Access, Watch, Reserve list, indicating they should be readily available at health facilities [33]. However, numerous studies on AMR have highlighted the widespread resistance to these commonly used antibiotics, raising concerns about their continued efficacy [7,34,35].

Based on our findings, it is common for individuals to stop taking antibiotics before completing the full course of treatment once their symptoms start to improve. As a result, many people then turn to left-over medication for self-medication purposes. These findings are consistent with studies conducted in Malawi, Mozambique, Tanzania, Kenya, Uganda, Ethiopia, Nigeria, and Zimbabwe [11,15,17,19,22,31,32]. This misuse and incomplete adherence to prescribed regimens signify critical challenges in antibiotic stewardship, emphasizing the imperative need for comprehensive interventions to mitigate AMR [36,37].

The study further revealed that antibiotics can be easily sourced from retail settings such as drug stores (retail shops that provide prescription drugs among other products), groceries (stores that sell food and small things), kiosks (small shops in a public place, i.e. a street), and vendors (persons offering something for sale) [38]. Contrary to regulations stipulated by the Malawi Pharmacy, Medicines and Regulatory Authority, which restricts antibiotic stocking to licensed pharmacies, our investigation demonstrated a concerning antibiotic source trend that is commonly known and previously shown: retail stores were found to illegally stock and dispense antibiotics, exacerbating the prevalence of self-medication practices [8,11,16,22,39]. This disregard for regulatory measures highlights systemic loopholes and poor enforcement that must be addressed to curtail the illegal distribution of antibiotics outside authorized channels, thereby safeguarding public health.

A widespread lack of awareness regarding AMR was noted, with only a minority informed about its implications, a finding consistent with other studies across the WHO Africa region (Algeria, Benin, Burk-

ina Faso, Cameroon, Democratic Republic of Congo, Djibouti, Ethiopia, Egypt, Libya, Morocco, Gabon, Ghana, Guinea Bissau, the Gambia, Cote d'Ivoire, Madagascar, Malawi, Mozambique, Niger, Nigeria, Sao Tome and Principe, Sudan, Tunisia, United Republic of Tanzania, Namibia, Rwanda, South Africa, Uganda, and Zimbabwe) [7,30,35]. Notably, most individuals who were aware of AMR had acquired this knowledge from health care professionals at medical facilities. This highlights the untapped potential of using diverse community structures and initiatives for public education. Promising avenues, such as workplaces, schools, religious congregations, and community health care workers, can be identified to share information and raise awareness about AMR. By doing so, communities can be empowered to adopt responsible antibiotic use practices and decrease the spread of AMR.

Encouragingly, almost all the participants (>97%) displayed an awareness that self-medication is not advisable. They acknowledged the importance of seeking guidance from health care professionals when ill. This recognition underscores a positive inclination toward responsible health practices and highlights the pivotal role of health care professionals in guiding individuals toward appropriate medical interventions. Such attitudes signify a promising foundation for fostering a culture of informed health care decision-making and collaborative patient-provider relationships, ultimately contributing to improved health outcomes and reduced risks associated with self-medication [40]. Effectively addressing this multifaceted challenge demands a comprehensive strategy that integrates public education initiatives, stringent regulatory enforcement, and seamless collaboration across health care sectors [41–44].

Several limitations were encountered during our study. Recall bias was evident, with some participants struggling to recall antibiotic names or instances of self-medication, potentially skewing the prevalence of self-medication. In addition, there might have been a tendency among participants to provide socially desirable responses. To address these challenges, we employed a drug bag approach supplemented with visual aids to aid participant recall and meticulously trained field interviewers. However, as a cross-sectional study, causality could not be inferred and conclusions were drawn based on observed associations from self-reported practices. Furthermore, the study design did not allow a longitudinal assessment of changes in antibiotic use within the communities over time, highlighting a need for further research to elucidate trends and patterns.

Conclusion

Despite efforts to regulate antibiotic availability and raise awareness, self-medication with antibiotics remains common in the rural Neno District of Malawi. These findings indicate that several factors contribute to this problem, including socio-demographic influences, weak enforcement of regulations, and limited knowledge about AMR. Addressing this issue is complex and requires comprehensive strategies to tackle the challenges and promote responsible antibiotic use.

By implementing targeted awareness campaigns and improving access to quality health care services, we can actively combat the spread of AMR and ensure the long-term effectiveness of antibiotics. This collective effort is crucial for protecting public health and preserving our antimicrobial resources in the face of evolving health threats.

Declarations of competing interest

The authors declare that there are no conflicts of interest related to this study. The research was conducted independently, and there are no financial, personal, or professional affiliations or relationships that could be perceived as influencing the research findings or interpretations. All authors have reviewed and approved the manuscript and agree with its submission to the International Journal of Infectious Diseases.

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Ethical clearance

Ethical clearance was obtained from the Neno District Health Research Committee and the Institutional Review Board of Malawi National Health Science Research Committee. The study's protocol number is #23/04/4140.

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Author contributions

Conceptualization, G.D.L, M.B.A and H.P; methodology, G.D.L, M.B.A and H.P; software, G.D.L, M.B.A and K.P; validation, G.D.L, M.B.A, H.P and S.C; formal analysis, G.D.L, M.B.A and K.P; investigation, G.D.L, M.B.A and K.P; resources, G.D.L, M.B.A, K.P and S.C; data curation, G.D.L, M.B.A, H.P, K.P and S.C; writing—original draft preparation, G.D.L, M.B.A and H.P; writing—review and editing, G.D.L, M.B.A, H.P, S.C and C.W; visualization, G.D.L, M.B.A, H.P, K.P and C.W; supervision, S.C, C.B, E.N, C.W and E.C; project administration, G.D.L, M.B.A, S.C, C.B, E.N, C.W and E.C; funding acquisition, G.D.L and M.B.A. All authors have read and agreed to the published version of the manuscript.

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