Antibiotic prescribing practice and adherence to IMCI guidelines among CNPs in children younger than 5 years with respiratory tract infections at Crossroads clinic, Cape Town, South Africa: retrospective audit

Name: Baba Machina (bmach99@yahoo.com)
Student number: MCHBAB001
MMed (Family Medicine)
Supervisor: Dr Abdul Isaacs (abdul.isaacs@uct.ac.za)

A research report submitted to the Faculty of Heath Sciences, University of Cape Town,
in partial fulfillment of the requirements for the degree of
Master of Medicine in Family Medicine

Plagiarism Declaration

"This thesis/dissertation has been submitted to the Turnitin module (or equivalent similarity and originality checking software) and I confirm that my supervisor has seen my report and any concerns revealed by such have been resolved with my supervisor."

Name: Baba Machina

Student number: MCHBAB001

Signature: Signed by candidate

Date: 02/12/2022

TABLE OF CONTENTS

DECLARATION

I, Baba Machina, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university. I empower the university to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

Signature: Signed by candidate

Date: 02/12/2022

ACKNOWLEDGEMENT

I would like to take this opportunity to thank all who gave me support during the course of my studies.
I am grateful to my beloved parents for their love, encouragement, excellent moral teachings and continuous prayers throughout my life.
A special thank you goes to my supervisor and mentor, Dr Abdul Isaacs, for his inspiration, support and guidance on this thesis and throughout my studies.

LIST OF ABBREVIATIONS/ACRONYMS

AMR - Antimicrobial Resistance
CNPs - Clinical Nurse Practitioners
IMCI - Integrated Management of Childhood Illnesses
RTIs - Respiratory Tract Infections
WHO - World Health Organization
CHC - Community Health Centre
PHC – Primary Health Care
CDC – Community Day Clinic
MDT - Multidisciplinary Team
ASP - Antibiotic Stewardship Programme
U5 - Under 5
LMICs - Low and Middle Income Countries
SA - South Africa
SSA - Sub-Saharan Africa
HCWs - Healthcare workers

Word count: 8650
Number of pages: 25
Tables: 10
Figures: 7

ABSTRACT

Background. Antibiotic use is especially high among children globally. In South Africa (SA), children under 5 years (U5) are typically prescribed an appreciable number of antibiotics in primary health care (PHC). There have been several published studies on antibiotic prescribing practice among Health Care Workers (HCWs) in PHC in low-resource setting. However, no published study has been reported on antibiotic prescribing practice among clinical nurse practitioners (CNPs) in PHC low-resource setting in Cape Town. Antimicrobial Stewardship Programme (ASP) in PHC has strengthened the use of evidence-based guidelines to support appropriate antimicrobial prescribing; however, adherence to these guidelines seems to be low.

Objective. To assess antibiotic prescribing practices amongst CNPs and adherence to Integrated Management of Childhood Illnesses (IMCI) guidelines for U5 children with respiratory tract infections (RTIs), as well as to make recommendations with the aim to promote appropriate antibiotic prescribing at PHC Level.

Methods. This is a retrospective audit that included folder review of children U5 with RTIs for which antibiotic was prescribed by CNPs for the period July 2021 to December 2021 at Crossroads community day clinic (CDC). Data was obtained on site by sequential non-random sampling of patient folders from medical records in the baby clinic admission book, with a total sample size of 120. This study determined the appropriateness or otherwise of antibiotics prescribed to U5 children by CNPs, and additionally makes recommendations to mitigate the effect of rising prevalence of antimicrobial resistance (AMR) in PHC setting.

Results. A total of 120 folders included in this study were audited. Of the 120 folders analyzed, (60%) (n=72) did not adhere to guidelines. Guidelines were adhered to in only (40%) (n=48). Of those non adherent to the guidelines, (18.05%) (13/72) had no diagnosis documented in patient folder, (31.94%) (23/72) had incorrect dose prescribed, (40.27%) (29/72) had no weight documented, (18.05%) (13/72) had no allergies documented; duration of antibiotic prescribed not documented in (9.72%) (7/72), the antibiotic prescribed was different from what was recommended in the IMCI guidelines in (6.94%) (5/72) and only (6.94%) (5/72) were non adherent owing to frequency of antibiotic prescribed per day not documented. Adherence variation was observed between the 3 antibiotics, with significantly higher adherence to guidelines for prescriptions containing Amoxicillin (53.53%) (53/99) than other antibiotics. Adherence to guidelines also differed by diagnosis, prescriptions for pneumonia was more likely to adhere to guideline (55.00%) (33/60) than other RTIs. A strong association was observed between weight documented and adherence to guidelines. 51.64% (47/91) of the prescriptions in which weight was done adhered to guidelines. When weight was done, the prescriptions were more likely to be correct, Fishers exact test = 0.000 ($P<0.05$).

Conclusions. In a resource-limited environment, CNPs play a pivotal role in order to meet community healthcare needs. This study gives insight into antibiotic prescribing practices amongst CNPs and it demonstrated low adherence to IMCI guidelines. Focus should be directed towards CNPs prescribing adherence with aim of improving appropriate antibiotic use and the fight against AMR in PHC in low-resource setting in Cape Town. Future clinical research in this setting should explore qualitative research approach including interviewing both CNPs and caregivers to assess their knowledge and understanding of prescribing guidelines and antibiotic use respectively. The views and expertise of stakeholders should be incorporated to shape policies in the fight against AMR in PHC.

Introduction

A new era in medical practice was marked by the discovery of antimicrobials by Sir Alexander Fleming in 1928, since then antibiotics has transformed modern medicine and saved millions of lives globally[1,2,3]. In developing countries where sanitation may still be poor, antibiotics decrease the morbidity and mortality caused by food borne and other poverty related infections[4]. However, as early as 1945, Sir Alexander Fleming warned that public demand for antibiotics would lead to antibiotic abuses and resistance[5,6]. Despite success recorded in treating infections, up to 50% of all antibiotics prescribed are either unnecessary or inappropriate leading to side effects and resistance[7,8,9]. Recent reports suggests that absolute numbers of infections due to resistant microbes are increasing globally[10,11], this implies that antibiotic overuse drives the evolution of resistance. Despite warnings regarding overuse, antibiotics are overprescribed worldwide[12]. AMR is increasing especially in low and middle income countries (LMICs) where burden of AMR and infectious disease is greatest[13]. There are particular concerns in SA where there is increasing incidence of "super bugs"[14], and in some African countries, antibiotics are unregulated and available over the counter without prescription. Many studies conducted on antibiotic resistance in SA have shown that the sheer number of antibiotics prescribed indicates that a lot of work must be done to reduce the unnecessary use of these medications[12,15,16].

It has been estimated that >700,000 deaths occur globally every year due to AMR, and if left unabated, it could account for 10million deaths annually by 2050[17] with SA being among the affected countries. The hammer blow will fall hardest on Africa and Asia accounting for 4.1 million and 4.7 million deaths respectively and the world economy will lose more than 7% of its Gross domestic product (GDP) (US Dollars 210Trillion) by 2050[18]. To save antibiotics and the future of modern medicine, we must adopt a quote by Mahatma Gandhi "You must be the change you wish to see in the world". Prescribers need to understand the gravity of the situation and put a stop to inappropriate antibiotic prescribing, because in post-antibiotics era, infections may become untreatable. Other than the increased risk of morbidity and mortality, the increasing costs of antibiotic prescription threatens a fragile healthcare system[19]. Even in developed countries such as the USA, antibiotic resistant infections are a substantial health and economic burden to its healthcare system as well as to patients and their families[20], it adds considerable costs to the nations already overburdened healthcare system and patients with resistant infections suffer longer hospital stays, more doctors' visit, lengthier recuperations and increased incidence of long term disability[20]. Similarly, in developing countries, patients infected with resistance organisms not only have increased risk of poor clinical outcomes including death but also consume lean health care resources[8]. SA already has a healthcare system struggling to cope with the burden of disease related to trauma, communicable and non-communicable diseases, and the extra burden of diseases related to patients infected with resistance organisms threatened to overwhelm the healthcare service.

To mitigate the effect of AMR, the WHO Assembly in 2015 adopted a Global Action Plan (GAP) on AMR with five key objectives[21]: Improve awareness and understanding of antimicrobial resistance through effective communication, education and training; strengthen the knowledge and evidence base through surveillance and research; reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures; Optimise the use of antimicrobial medicines in human and animal health and finally to develop the economic case for sustainable investment that takes account of the needs of all countries and to increase investment in new medicines, diagnostic tools, vaccines and other interventions. In line with the WHO Assembly recommendations, many countries across the world including SA introduced ASP across public and private healthcare facilities to mitigate the effect of AMR. The following section will review the current knowledge and implementation of ASP and in some African countries with focus on SA.

ASP is a coordinated programme that promotes the appropriate use of antimicrobials which improves patient outcome, reduces microbial resistance, and decreases the spread of infections caused by multi drug-resistant (MDR) organisms[22]. While the concept has been established in developed countries and shown a lot of

benefits[23,24], ASP is yet to gain traction in Sub-Saharan Africa (SSA) except for SA where it has been implemented and shown remarkable results[25]. Measures to prevent the misuse and overuse of antibiotics to deter resistance came into professional focus in SA with the establishment of the Federation of Infectious Disease Societies of Southern Africa (FIDSSA) in 2005 and the South African Antibiotic Stewardship Program (SAASP) in 2011[26]. In 2014 a multidisciplinary and inter sectorial ministerial advisory committee (MAC) was established to inform a national AMR strategy framework[27]. A study on the implementation of a pharmacist driven prospective audit and feedback strategy in 47 South African Hospitals, showed an 18% reduction in mean antibiotic Daily Defined Doses (DDD) which suggests improvement in antibiotic prescription[25]. ASP has also been shown to modify future antimicrobial prescription patterns especially in children[13]. Another study has shown that ASP in SA has led to fall in total antibiotic consumption, effects of comprehensive ASP on medical inpatient at a public sector hospital in SA were durable over 4years leading to a reduction in total antibiotic consumption without adverse effects[19], when increased laboratory cost were offset, there was a net cost saving of 2.8 million ZAR[19].

As previously stated, an important aspect of ASP is the creation and use of evidence-based guidelines to support antimicrobial use as well as appropriate prescription practice. Antibiotic prescription practices may be improved by revisiting knowledge of pharmacology, reviewing causal organisms and surveillance of local resistance patterns, and ASP aim to do this by means of a multifaceted approach, including audit and education on policies and guidelines[28]. ASP ensures that inappropriate antibiotic prescription is minimized in PHC setting and healthcare professionals adhere to guidelines. It has also led to positive outcome in PHC setting especially those with limited infectious disease resources[25]. In SA, majority of patients are seen and treated in public sector, about 80% of population including children are seen in PHC setting[16,29]. Antibiotic prescription is common among children (between birth and 5years of age) and they are typically prescribed an appreciable number of antibiotics in SA and other developing countries[30,31]. Since this age group receives significant proportion of antibiotics, interventions should be targeted at improving antibiotic prescription among them. They are important target groups for efforts aimed at reducing unnecessary antibiotic use.

Similar to other African countries, antibiotics are prescribed by both doctors and nurses in PHC settings in SA, in order to meet community healthcare needs, CNPs with prescribing license prescribe antibiotic to children in PHC in low-resource setting in SA[32]. Data on antibiotic prescribing practice among these CNPs seems to be limited[8], and since they also prescribe antibiotic in PHC settings, assessing their prescribing practice is imperative to improve future antibiotic use and reduce AMR[30] especially among children. Incorrectly prescribed antibiotics have questionable therapeutic benefit and expose patients including children to potential complications of antibiotic therapy[33] including resistance[33] as HCWs prescribing practices has been shown to affect the population level of AMR[7]. Adherence to evidence-based guidelines in PHC has been shown to vary significantly depending on the condition treated and despite availability of published national guideline; adherence is low in Cape Town Metro District[8]. Poor adherence was especially seen for respiratory problems[8], this may be attributed to the fact that antibiotic treatment may not be necessary in RTIs as majority of RTIs are viral and self limiting.

This research is undertaken with the aim of assessing the antibiotic prescribing practice among CNPs to see the extent of adherence to IMCI guidelines in U5 children presenting with RTIs in PHC setting, and to make comprehensive recommendations to improve appropriate antibiotic use as defined in the IMCI guidelines. There have been a number of published research and evaluation of antimicrobial prescribing in PHC setting in SA, however, no published study has been reported on antibiotic prescribing practice among CNPs in U5 children with RTIs in PHC setting in Cape Town. Gasson et al[8] concur with above statement as stated in their article "Knowledge of antibiotic prescribing among CNPs is limited in South Africa"[8]. Farley et al[34] also mentioned in their article, many studies have been done in SA on antibiotic prescribing practice in PHC setting but none looked at nurses' prescription[34]. Furthermore, antibiotic prescribing audit and feedback has been shown to be one of the interventions that improve antibiotic prescribing practices in healthcare settings[35]. This study is also in line with recommendations from some studies that there is urgent need to improve antibiotic prescribing practice in PHC in Cape Town Metro District[8,35].

Methods

Study design

This was a retrospective clinical audit which involved retrospective folder review of U5 children seen by CNPs from July 2021 to December 2021 at Crossroads CDC. Data was obtained on site by the researcher using an established data collection tool (appendix A).

Study site

The study site was Crossroads CDC, situated on Govan Mbeki Road, Gwayi Street, Cape Town SA. The facility was selected purposefully for convenience and in collaboration with the Family Physician. It is an eight hour facility that is committed to improving the delivery of health care services to patients in surrounding community. The clinic operates in the Mitchells Plain Sub District of the metro region of Cape Town and operates from Monday to Friday; 7:30am - 4:30pm. It has baby clinic managed by CNPs (medical officer consult when the need arises) with patient turnover of between 30-45 patients per day.

Population and sampling

Folders for children both males and females age 2 months to 5 years diagnosed with respiratory infections: otitis media, pharyngitis, tonsillitis, pneumonia, common cold and acute bronchitis[36] seen by CNPs and for which antibiotics was prescribed were included in this study. 1 month was spent in the facility for data collection. Data was obtained on site by sequential non-random sampling of folders from medical records as it appears in the baby clinic admission book from July 2021 to December 2021, and electronic audit tool was used for data collection. In an ideal world, all the folders for children with URTIs seen by CNPs for which antibiotics was prescribed over the 6 months period (July 2021 – December 2021) would be audited. However, the number of folders was too large and due to pragmatic issues around data collection (i.e, time, access to data, and cost) it became realistically impossible to audit all the folders within the time period. Therefore, a sample of folders which represents the overall population within the time period was selected and audited. To avoid bias in selecting folders from a particular team that worked at a certain period, twenty folders were selected sequentially from each month within the study period, which resulted in total sample size of 120. Data recorded included a timestamp, folder number, weight, diagnosis, allergies, and details about any antibiotics prescribed i.e., name, route of administration, dose, duration, frequency, and script validation. All the above data collected are crucial in assessing appropriateness of antibiotic prescribing[8]. All folders audited met the inclusion and exclusion criteria as specified in this study. These criteria included; inclusion: folders of children being age 2 months - 5 years with RTIs for which antibiotics was prescribed by CNPs; exclusion: prescriptions not containing antibiotics, folders of children 2 months- 5 years with underlying medical conditions e.g., immunosuppression, prophylactic antibiotics that are part of standard treatment for patients with immunosuppression, children 2 months - 5 years not seen by CNPs and children above 5 years. Children less than 2 months were excluded because they were seen by doctors in this facility.

Data collection and analysis

Data collection tool was developed that met the objectives of this study, and each patient folder was reviewed and data extracted by the researcher using an Excel spread sheet and transferred to Epidata for analysis. Personal information of patients and CNPs were not collected in the data collection tool. Data were entered and stored digitally into a password-protected laptop which was only accessible to the researcher. Data was analyzed using frequency tables, graphs and percentages. Also, Pearson chi2 test was used for independence and Fisher's exact test were used to assess association between weight recorded and adherence to guideline. All data on antibiotics prescribed were compared with the management advised in the 2019 IMCI guidelines[37]; this minimized subjective interpretation of appropriateness.

Ethical considerations

The study was approved by the Faculty of Heath Sciences' Human Research Ethics Committee at the University of Cape Town (ref. no. 405/2022). Approval to access the clinical records was obtained from the Provincial Research Committee of the Western Cape Department of Health and the Facility Manager of Crossroads CDC. For the purpose of the folder review, informed consent from patient was not required by the approval committees, as folder review was retrospective and there was no direct patient contact. To ensure confidentiality, all data were anonymised before being entered into the study data spread sheet, and stored digitally on a password-protected laptop that was only accessible to the researcher.

RESULTS

A total of 120 folders that met the inclusion criteria as specified in this study were audited and analyzed. The majority of folders analyzed were female 62.5% (75/120), only 37.5% (45/120) were male. The gender characteristics of the study sample are shown in Table 1.

Table 1. Socio-demographic (gender) characteristics of study sample

Total sample N=120		
Gender	N	Percent (%)
Male	45	37.5
Female	75	62.5

Of the 120 patient folders analyzed, weight was recorded in 75.8% (n=91) as shown in Figure 1. The minimum weight was 6kg and maximum weight was 22kg, with a mean of 12.47143 and standard deviation (SD) of 3.91417 (Table 2)

Table 2. Summary statistics on weight (in kg)

Variable	N	Min	P25	Mean	P50	P75	Max	SD	IQR
Weight (kg)	91	6	10	12.47143	12	15	22	3.91417	5

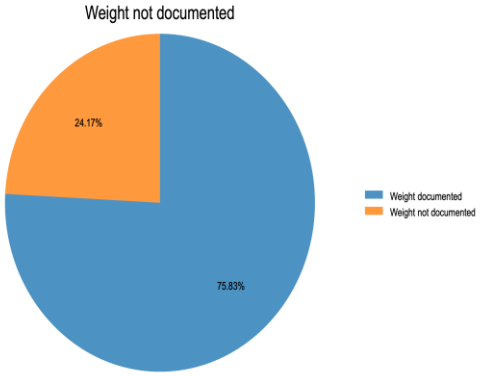

Fig. 1. Chart showing weight (Blue =weight documented and Orange= weight not documented)

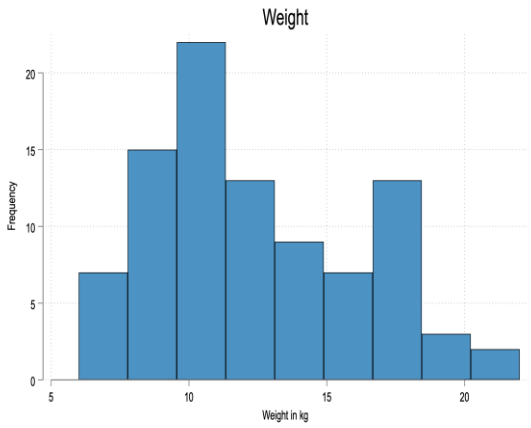

Fig. 2. A histogram of weight showing frequency on weight (kg) documented

As depicted in Table 3, majority of the diagnosis documented in the patient folder was for Pneumonia (50%) (n=60) and only 4.17% (n=5) was for Pharyngitis. No diagnosis had been documented in patient folder in 10.83% (n=13).

Comparing the top 3 antibiotics prescribed, Amoxicillin formed majority of the antibiotics prescribed 82.50% (n=99) Table 4. Appreciable number of prescriptions contained Azithromycin 13.33% (n=16), however no (penicillin) allergy was documented in all the patient folders containing Azithromycin.

Table 3. Frequency counts on Diagnosis

Diagnosis	Freq.	Percent (%)	Cum.
Acute Otitis Media	9	7.50	7.50
Influenza	9	7.50	15.00
Pharyngitis	5	4.17	19.17
Pneumonia	60	50.00	69.17
Tonsilitis	15	12.50	81.67.
URTI	9	7.50	89.17
Not documented	13	10.83	100.00
Total	120	100.00	

Table 4. Frequency counts on Antibiotic prescribed

Antibiotic Prescribed	Freq.	Percent (%)	Cum.
Amoxicillin	99	82.50	82.50
Augmentin	5	4.17	86.67
Azithromycin	16	13.33	100.00

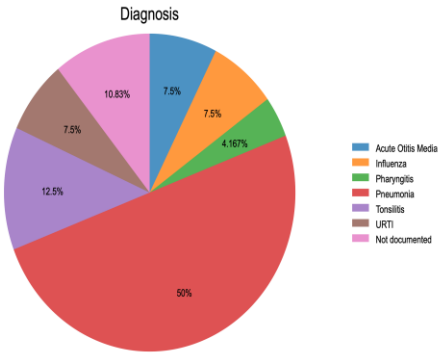

Fig. 3. Graph showing distribution on diagnosis documented

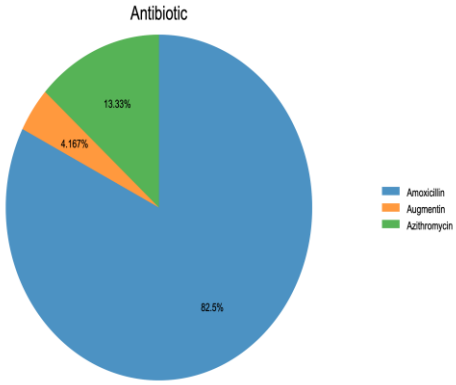

Fig. 4. Graph showing distribution on antibiotic prescribed

As shown in Fig. 5, majority of the prescriptions analyzed did not adhere to the IMCI guidelines[37] 60% (n=72), while guideline was adhered to in only 40% (n=48). All measures had to be met for these prescriptions to be considered as correct, i.e., the 'all-or-none concept'. Of those non adherent to the guideline (Table 5), no diagnosis was captured in patient folder in 18.05% (13/72), incorrect dose was prescribed in 31.94% (23/72), weight was not documented in 40.27% (29/72), 18.05% (13/72) of the prescriptions had no allergies documented, duration of prescription was not documented in 9.72% (7/72), the antibiotics prescribed was different from what was recommended in the IMCI guideline[37] in 6.94% (5/72), and only 6.94% (5/72) were non adherent owing to frequency of prescription per day not documented. The overall reasons for non-adherence to guideline are depicted in Table 5.

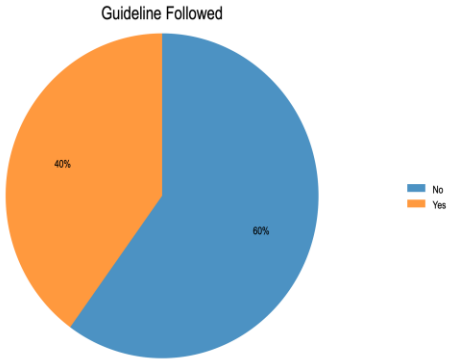

Fig. 5. Graph showing distribution on adherence to IMCI guidelines

Table 5. Multiple responses on reasons for guidelines not followed (based on prescriptions where guidelines were not followed n=72)

Reason	Freq.	Percent (%)
Incorrect dose	23	31.94
Duration not documented	7	9.72
Frequency not documented	5	6.94
Weight not documented	29	40.27
Allergies not documented	13	18.05
Diagnosis not documented	13	18.05
Incorrect antibiotic prescribed	5	6.94

Analysis of the prescriptions revealed that adherence to guidelines differed between the different types of antibiotics used. Comparing the three antibiotics prescribed, prescriptions involving Amoxicillin 53.53% (53/99) were more likely to adhere to guidelines than prescriptions for other antibiotics (Table 6). Adherence to guidelines also differed by diagnosis: prescriptions for pneumonia were more likely to adhere to guideline 55.00% (33/60) than other RTIs (Table 7).

Table 6. Frequency counts for adherence to IMCI guidelines and antibiotic prescribed

	Antibiotic prescribed		
	Amoxicillin	Augmentin	Azithromycin
Total	99 (100%)	5 (100%)	16 (100%)
Guideline followed	53 (53.53%)	0 (0.00%)	2 (12.5%)

Table 7. Frequency counts for adherence to IMCI guidelines and diagnosis

	Diagnosis						
	Acute otitis media	Influenza	Not documented	Pharyngitis	Pneumonia	Tonsillitis	URTI
Total	9 (100%)	9 (100%)	13 (100%)	5 (100%)	60 (100%)	15 (100%)	9(100%)
Guideline followed	3(33.33%)	4 (44.44%)	0 (0.00%)	2 (40%)	33 (55%)	4 (26.66%)	2(22.22)

Results of this study have shown that documenting weight in patient folder is an important factor associated with whether IMCI guidelines were adhered to or not. Weight was documented in 75.83% of prescriptions (91/120) and majority adhered to the IMCI guidelines (51.64%) (47/91). As shown in Table 8, there was a strong association between the missing weight indicator and the non adherence to IMCI guidelines indicator such that: weight was not documented in 24.16% (29/120) of prescriptions and none (0.00%) (0/29) adhered to the guidelines, Fishers exact test p= 0.000 ($p<0.05$), Cramer's V= .4212.

Table 8. Frequency for adherence to IMCI guidelines and weight (with test for association and independence).

	Weight	
	Documented	Not documented
Total	91 (100%)	29 (100%)
Guideline followed	47 (51.64)	0 (0.00%)

Pearson chi2 (1) = 21.2884 Pr = 0.000
Fisher's exact p= 0.000

As shown in Table 9, allergies were documented in only 17.5% (21/120) of the prescriptions. In terms of script validation, only 2.5% (3/120) of the prescriptions were invalid (Table 10)

Table 9. Frequency counts on allergies

Allergies	Freq.	Percent (%)
Documented	21	17.5
None documented	99	82.5
Total	120	100

Table 10. Frequency counts on script validation

Script validation	Freq.	Percent (%)
Invalid	3	2.5%
Valid	117	97.5%
Total	120	100.00

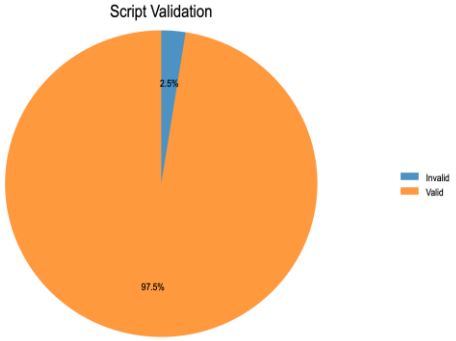

Fig. 6. Graph showing distribution on script validation

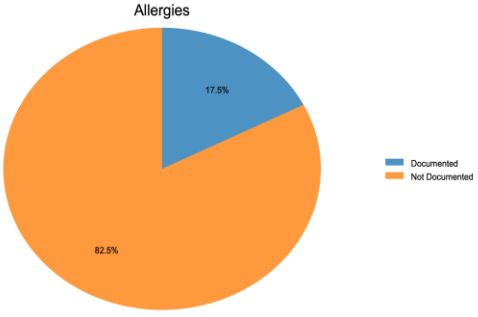

Fig. 7. Graph showing distribution on allergies

Discussion

In Cape Town SA, antibiotic prescribing practice among CNPs in U5 children with RTIs has not been reported[34], with more focus on doctors in PHC setting[8]. This study presents the results of prescribing practice in PHC setting in Cape Town. The results of this study demonstrated the importance of assessing the antibiotic prescribing practice among CNPs in PHC settings. Unlike in resource-abundant developed countries, CNPs are crucial and a growing body of prescribers which should be targeted for interventions in improving appropriate antibiotic use and prescribing adherence in PHC in low-resource setting in SA.

This study illustrated low antibiotic prescribing adherence among CNPs in PHC with more than 50% of prescriptions being non adherent to guidelines. This low adherence to guidelines can easily contribute to the increasing prevalence of antibiotic resistance in PHC in SA. This suggests the importance of interventions and re-audit of the prescribing practices among this group of HCWs in order to mitigate the effect of antibiotic resistance and emergence of "superbugs". Studies from other African countries showed similar results; a retrospective study done in PHC facilities in Ghana showed low prescribing adherence among nurses when compared to physicians [42]. Similar findings were also seen in a recent survey of antibiotic prescribing practices in the Cape Town metropole which confirmed 55% non-adherence to the standard treatment guidelines (STG) and Essential Medicines List (EML) for SA[8]. In stark contrast, a study done in UK suggests that nurse practitioners follow best practices and adhere to guidelines[42.] Interestingly, one study showed no significant difference in prescribing adherence between nurses and doctors[44].

This study revealed strong association between the recording of weight and adherence to guidelines, Fishers exact test p= 0.000 ($p<0.05$). There was prescribing non-adherence in prescriptions that contained undocumented weight while high adherence was seen in prescriptions in which weight was documented. Quite an appreciable number of those non-adherent prescriptions was as a result of patients missing weight or not correctly documented (40.27%) (29/120) and none of these prescriptions adhered to the guidelines (0.00%) (0/29). On the other hand, weight was correctly documented in 75.83% (91/120) of prescriptions and majority of these prescriptions adhered to the IMCI guidelines (51.64%) (47/91). This is not surprising because unlike adults, children are prescribed antibiotic according to their weight. This also implies that weight documentation is key in improving prescribing adherence. Other factors that contributed to low adherence are: undocumented diagnosis (18.05) (13/72), incorrect dose (31.94) (23/72), undocumented allergies (18.05%) (13/72), undocumented duration of prescription (9.72%) (7/72), incorrect antibiotic (6.94%) (5/72) and undocumented frequency of prescription per day (6.25%) (5/72). Similar findings were also seen in some studies done in Cape Town [8,44].

Similar to findings in other studies[42,44], the most common antibiotic prescribed in RTIs in PHC was Amoxicillin, (82.5%) (99/120). Furthermore, prescribing adherence was significantly higher in prescriptions that contained Amoxicillin, (53.53%) (53/99). This indicated that Amoxicillin is the most common antibiotic used in PHC setting. However, no penicillin allergy was documented in majority of the prescriptions in this study (82.5%) (99/120) including those containing Azithromycin - therefore giving no indication as to why a macrolide was prescribed in the first place. This may be due to patient being allergic to penicillin but none documented; recording allergies is a pivotal measure in medicine safety and also when linking antibiotic prescription to patient safety. Documenting allergies is another enabler for change and prescribing adherence.

Prescribing adherence differences were found when comparing diagnosis, with prescribing most adherent to guidelines in Pneumonia cases i.e., (55%) (33/60). Poor adherence was seen in respect to the other RTIs. On the other hand, some of the prescriptions containing antibiotics had no diagnosis documented. This may be attributed to perceived patient and parental/guardian pressures[5,34].

The strength of this study is that the items audited were obtained from medical records and compared to objective targets from current guidelines. This study is also the first description of antibiotic prescribing practice among CNPs in PHC setting in Cape Town, SA. It demonstrated that adherence to guidelines was low and regular audit and feedback to CNPs is paramount in promoting appropriate antibiotic use in PHC in this facility.

This study provided important insight that showed CNPs represent a crucial group of HCWs and the need for interventions to be targeted at them.

There were several limitations to this study. A key limitation is that this study did not implement an intervention which is pivotal in bringing about change in antibiotic prescribing practices. Intervention and re-audit would have added value in improving appropriate antibiotic prescribing among CNPs. Nevertheless, feedback was given to the facility on the outcome of this audit and far reaching comprehensive recommendations were made for future audits of this kind. A full sample size couldn't be reached due to lack of resources, cost, time and target date for audit completion. Also, this study did not seek the views of CNPs regarding their prescribing practice. Crucial gaps in knowledge and poor understanding of antibiotic use were recently demonstrated in multisite survey in SA[34,38]. The nature of clinical audits is that they are site-specific and cannot be extrapolated to the general population. However, it provides insight into HCWs prescribing practices.

Recommendations

Improving appropriate antibiotic prescribing practices and adherence to guidelines requires a multifaceted approach. Intervention and post intervention re-audit with regular feedback should be provided during weekly audit meetings; share successes, brainstorm on ideas to overcome obstacles to adherence and encourage the team to offer suggestions on ways to improve prescribing adherence. A systematic review[41] showed that audit and feedback have small to moderate but important effects on health professionals prescribing practice.

Prescribing adherence can also be improved by targeted management of all acute respiratory infections and active HCWs education in variety of formats that include using posters and printed pamphlets of guidelines in consulting rooms.

Regular MDT meetings including pharmacist, doctors, nurses and clinical managers should be held. Pharmacists to monitor and function as gate keepers to ensure all prescriptions strictly adhere to guidelines before dispensing antibiotics and they should provide regular feedback to the team.

Forming, strengthening and formalizing an antimicrobial stewardship team comprising of doctors, nurses and pharmacist that will be headed by the Family physician, and ensure that regular folder peer review audits take place. Implementing a peer review approach will increase ownership of the process by the facility and embed it in local quality improvement process. Shared decision-making between prescriber and client should be encouraged. This has been shown to reduce antibiotic prescribing for acute respiratory infections in general practice[39].

Finally, future clinical audit in this setting should explore qualitative research approach including interviewing both CNPs and caregivers to assess their knowledge and understanding of guidelines and antibiotic use respectively. The views and expertise of stakeholders should be incorporated to shape policies in the fight against AMR in PHC.

Conclusion

In a resource-limited environment, CNPs play a pivotal role in order to meet community healthcare needs. This study gives insight into antibiotic prescribing practices among CNPs and it demonstrated that adherence to IMCI guidelines was low. Therefore, regular audit and feedback to CNPs is paramount in promoting appropriate antibiotic use in PHC in this facility. Focus should also be directed towards assessing CNPs prescribing adherence with aim of improving appropriate antibiotic use and the fight against AMR in PHC in low-resource setting in Cape Town SA.

Declaration. None.

Acknowledgements. None.

Author contributions.

Funding. None.

Conflicts of interest. None.

REFERENCES

1. Sengupta S, Chattopadhyay MK, Grossart HP. The multifaceted roles of antibiotic and antibiotic resistance in nature fromt. Microbial. 2013; 4; 47

2. Piddock LJ. The crisis of no new antibiotics - what is the way forward? Lancet Infect Dis. 2012; 12(3): 249-253

3. Gould IM, Bal AM. New antibiotic agents in the pipeline and how they can overcome microbial resistance. Virulence. 2013; 4(2); 185-191

4. Rossohni GM, Arena F, Pecile P, Pollini S. Update on the antibiotic resistance crisis . Clint Opin Pharmacol 2014; 18:56-60 (Pubmed)

5. Ventola CL. The antibiotic resistance crisis: part 1: causes and threats. P T. 2015; 40(4):227-83

6. Brink A. Antimicrobial stewardship in the community. Clin Pulm Med 2016; 23(1): 1–10. https://doi.org/10.1097/cpm.0000000000000107

7. World Health Organisation. Antimicrobial resistance, global report on surveillance: Summary. 2014 http://apps.who.int/iris/bitstream/10665/112647/1/WHO_HSE_PED_ALP_2014.2_eng.pdf?au=1

8. Gasson J, Block man M, Willems B. Antibiotic prescribing practice and adherence to guidelines in primary care in the Cape Town Metro District, South Africa. SAMJ S. Afr Med. J vol.108 n.4 Pretoria Apr. 2018

9. Hersh AL, Jackson MA, Hicks LA. Principles of judicious antibiotic prescribing for upper respiratory tract infections in paediatrics. Paediatrics 2013; 132(6): 1146-1154

10. Public Health England. English Surveillance programme for antimicrobial utilisation and resistance (ESPAUR); 2014. p.1-143

11. Centre for disease control and prevention. Antibiotic resistance threats in the US, 2013. Current. 2013: 1-114

12. The antibiotic alarm. Nature. 2013; 495(7440):141

13. Godman B, Egwuenu A, Hague M, Malande OO, Schellack N, Kumar S et al. Strategies to improve antimicrobial utilisation with a special focus on developing countries. Life (Basel), 11(2021) P.528

14. Lowe M, Kock MM, Coetzee J, Hoosien E, Peirano G, Strydom KA et al. Klebsiella Pneumoniae ST 307 with blaOXA -181, SA, 2014-2016. Emerg Infect Dis, 25(2019), PP. 739-747.

15. Crowther-Gipson P, Govender N, Lewis DA, Bamford CM, Brink A, von Gottberg A, et al. Part IV: Human infections and antibiotics resistance. S.Afr Med. J. 101(8):567-578

16. Global antibiotic resistance partnership. situation analysis: antibiotic use and resistance in South Africa. South African Medical Journal. August 2011; Vol101 no.8

17. O'Neil J. Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations. review on antimicrobial resistance. Initial steps. (Internet) 2015 (updated) 2015 February, cited 2016 October 15) http://amr-review.org/sites/default/files/Report-52.15.pdf

18. Review of antimicrobial resistance. December 2014 http://amr-review.org (accessed 2 January 2015)

19. Mendelson M, Whitelaw A, Nicol M, Brink A. Wake up, South Africa! The antimicrobial 'horse' has bolted. S Afr Med J. 2012; 102(7): 607 – 608. https://doi.org/10.7196/samj.5759

20. Golkar Z, Bagazra O, Pace DG. Bacteriophage therapy: a potential solution for the antibiotic resistance crisis. J Infect Dis 2014; 8(2): 129-136.13

21. WHO. Global Action Plan on antimicrobial resistance. 2015. report No.: ISBN 978 92 4 1509763

22. https://apic.org/professional-practice/practice-resources/antimicrobial-stewardship (accessed 6 June 2017)

23. Core Elements of Hospital Antibiotic Stewardship Programs: Centre for Disease Control, available: https://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html (accessed 27 June 2017)

24. Ruttimann S, Keck B, Hartmeier C, Maetzel A, Bucher HC. Long-term antibiotic cost savings from a comprehensive intervention program in a medical department of a university-affilated teaching hospital. Clinical Infectious Diseases. 2004; 38(3): 348-56.

25. Brink AJ, Messina AP, Feldman C, Richards GA, Becker PJ, Goff DA, et al. Antimicrobial stewardship across 47 South African hospitals: an implementation study. The Lancet Infectious Diseases. 2016; 16(9):1017-25.

26. Manderson L. Prescribing, care and resistance: antibiotic use in urban South Africa. Humanities and Social Sciences Communications

27. Mendelson M, Matsoso MP. The South African antimicrobial resistance strategy framework. Ministry of Health Pretoria, South Africa. 2015

28. MacDougall C, Polk RE. Antimicrobial stewardship programs in health care systems. Clin Microbiol Rev. 2005;18:638-656. https://doi.org/10.1128/cmr.18.4.638-656.2005

29. Meyer JC, Schellack, Stokes J, Lancaster R, Zeeman H, Defty D et al. Ongoing initiatives to improve the quality and efficiency of medicine use within primary health care system in South Africa: a preliminary study. Front Pharmacy. 8 (2017), P.751

30. Skosana PP, Meyer JC. A national, multicenter, web-based point of prevalence survey of antimicrobial use and quality indices among hospitalised paediatric patients across South Africa Dec 2021. Journal of Global Antimicrobial Resistance

31. Fink G, D'Acremont V, Leslie HH, Cohen J. Antibiotic exposure among children younger than 5 years in low-income and middle-income countries: a cross-sectional study of nationally representative facility-based and household-based surveys. Lancet infect Dis 2020 PP 179-187

32. Mathibe LJ, Zwane NP. Unnecessary antibiotic prescribing for upper respiratory tract infections in children in Pietermaritzburg, South Africa. Ari. Health Sci 2020; 20(3): 1133-1142

33. Lushrick BD. Antibiotic resistance: a primary healthcare crisis. Public Health Rep. 2014;129(4):314-316

34. Farley E, Stewart A, Davies MA, Govind M, Berg vanden D, Boyles TH. Antibiotics use and resistance: Knowledge, Attitude and Practices among primary care prescribers in South Africa.S Afri. Med Journal 108 (9). 2018

35. Dietrich K, Maker JF. What interventions improve antibiotic prescribing practice in the hospital? Evidence based practice 23(8); 46-47. 2020

36. National institute for health and clinical excellence. Prescribing of antibiotics for self-limiting respiratory tract infections in adults and children in primary care. Clinical guidance CG69, July 2008. Available from http://www.nice.org.uk/guidance/cg69/full-guideline-196853293 (accessed 25 January 2016)Respiratory tract infect.
37. Handbook IMCI: Integrated Management of Childhood Illness. World Health Organisation. Department of Child, Adolescent Health. 2019
38. Wasserman S, Potgieter S, Shoul E, et al. South African medical students' perceptions and knowledge about antibiotic resistance and appropriate prescribing: Are we providing adequate training to future prescribers? S Afr Med J2017;107(5):405-410. https://doi.org/10.7196/samj.2017.v107i5.12370
39. Tonkin-Crine S, Tan p, van Hecke O, et al. Clinician-targeted interventions to influence antibiotic prescribing behavior for acute respiratory infections in primary care: An overview of systematic reviews. Cochr Datab Syst Rev 2017;(9)CD012252. https://doi.org/10.1002/14651858.CD012252.pub2
40. Meeker D, Linder JA, Fox CR, et al. Effect of behavioral interventions on inappropriate antibiotic prescribing among primary care practices: a randomized clinical trial. JAMA 2016; 315(6):562-570. https://doi.org/10.1001/jama.2016.0275
41. Isaacs AA, Manga N, le Grange C, Hellenberg DA, Titus V, Sayed R. a snapshot of noncommunicable disease profiles and their prescription costs at ten primary healthcare facilities in the western half of the Cape town Metropole. S afr Fam pract 2014;56(1):43-49. https://doi.org/10.1080/20786204.2014.10844582
42. Mary-Anne A, Britt P, Richard B, Bygbjerg C, Pascal M. A retrospective audit of antibiotic prescriptions in primary health– care facilities in Eastern Region, Ghana. Health Policy and Planning, March 2016; 31(3), 250-258
43. Valerie A, William M, Guy Mc G, Jacqui R. Growth in nurse prescribing of antibiotics: the Scottish experience. Journal of Antimicrobial Chemotherapy, Dec 2015; 70(12), 3384-3389
44. de Vries E, Johnson Y, Willems B, bedeker W, Ras T, Coetzee R, Tembo Y, Brink A. Improving primary care antimicrobial stewardship by implementing a peer audit and feedback intervention in Cape Town community healthcare centers. SAMJ Oct 2022; 112(10), 812-818

Appendix A. Data collection tool

Timestamp	Folder no.	Weight (kg)	Diagnosis	Antibiotic Prescribed	Route	Dose	Frequency	Duration	According to guideline (Y/N)	Script Validation	Allergies	Not according to Guideline (Reasons)
09/7/2021 09:10am	167961580	17	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
09/7/2021 No time	176871622	11	Pneumonia	Amoxicillin	Oral	200mg	8hrly	5 days	No	Valid	Not documented	**Incorrect Dose**
09/7/2021 No time	163257959	18	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	No	Valid	Not documented	**Incorrect Dose**
16/7/2021 12:13pm	169611969	14	Tonsillitis	Amoxicillin	Oral	250mg	12hrly	10 days	No	Valid	Not documented	**Incorrect Dose**
22/7/2021 11:38am	182507202	6	Pneumonia	Amoxicillin	Oral	125mg	8 hrly	5 days	Yes	Valid	Not documented	
5/8/2021 9:00am	183208024	12	Acute Otitis Media	Amoxicillin	Oral	540mg	12hrly	10 days	Yes	Valid	Not documented	
5/8/2021 9:19am	175919992	11	Pneumonia	Amoxicillin	Oral	375mg	8hrly	Not documented	No	Valid	Not documented	**Duration not documented**
18/8/2021 11:00am	170128219	22	Pneumonia	Amoxicillin	Oral	500mg	8hrly	5 days	Yes	Valid	Not documented	
20/8/2021 10:06am	183631142	10	Pneumonia	Amoxicillin	Oral	250mg	Not documented	Not documented	No	Valid	Not documented	**Frequency not documented** **Duration not documented**
20/8/2021 9:18am	182340869	6,9	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
1/9/2021 8:59am	182111997	8,3	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	No	Valid	Not documented	**Incorrect Dose**
7/9/2021 No time	175465871	13	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
15/9/2021 11:57am	182069013	7,8	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
23/9/2021 10:06am	177531266	14	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
28/9/2021 10:31am	153502174	18	Tonsillitis	Amoxicillin	Oral	800mg	12hrly	10 days	Yes	Valid	Not documented	
4/10/2021 11:11am	175376094	Not documented	URTI	Azithromycin	Oral	100mg	Daily	3 days	No	Valid	Not documented	**Weight not documented** **Allergies not documented**
4/10/2021 12:00pm	159824358	17,5	Not documented	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Diagnosis not documented**
4/10/2021 9:50am	178787016	Not documented	Pneumonia	Amoxicillin	Oral	125mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
19/10/2021 No time	175733567	Not documented	Acute Otits Media	Azithromycin	Oral	160mg	Daily	5 days	No	Valid	Not documented	**Weight not documented** **Allergies not documented**
22/10/2021 10:28am	167513639	13	URTI	Azithromycin	Oral	200mg	Daily	3 days	Yes	Valid	Not documented	
10/11/2021 No time	163847585	Not documented	Not documented	Azithromycin	Oral	200mg	Daily	3 days	No	Invalid	Not documented	**Weight not documented** **Diagnosis not documented** **Allergies not documented**
12/11/2021 9:11am	167280528	Not documented	Not documented	Azithromycin	Oral	200mg	Daily	3 days	No	Valid	Not documented	**Weight not documented** **Diagnosis not documented** **Allergies not documented**
17/11/2021 11:00am	176855757	10	Pharyngitis	Amoxicillin	Oral	450mg	12hrly	10 days	Yes	Valid	Not documented	
24/11/2021 11:18am	182709584	Not documented	URTI	Azithromycin	Oral	100mg	Daily	5 days	No	Valid	Not documented	**Weight not documented** **Allergies not documented**
29/11/2021 11:00am	171887383	12	Influenza	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
2/12/2021 8:45am	183469865	Not documented	Influenza	Azithromycin	Oral	400mg	Daily	3 days	No	Valid	Not documented	**Weight not documented** **Allergies not documented**
7/12/2021 10:18am	155056872	17,5	Not documented	Amoxicillin	Oral	500mg	8hrly	5 days	No	Valid	Not documented	**Diagnosis not documented**
7/12/2021 No time	156270456	17	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
13/12/2021 12:06pm	172270480	11	Pneumonia	Augmentin	Oral	250mg/62,5mg	8hrly	5 days	No	Valid	Not documented	**Incorrect Antibiotic prescribed**
14/12/2021 12:14pm	170209324	14,5	Tonsillitis	Amoxicillin	Oral	650mg	12hrly	10 days	Yes	Valid	Not documented	
2/7/2021 8:25am	153629167	11	Pneumonia	Amoxicillin	Oral	150mg	8hrly	5 days	No	Valid	Not documented	**Incorrect dose**
2/7/2021 8:39	163584683	6	Pneumonia	Amoxicillin	Oral	150mg	8hrly	5 days	Yes	Valid	Not documented	**Duration not documented**
2/7/2021 8:39am	179217641	17	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not Documented	**Incorrect dose**
2/7/2021 8:45am	153516471	11	Pneumonia	Amoxicillin	Oral	125mg	8hrly	5 days	No	Valid	Documented	**Incorrect dose**

5/7/2021 No time	162580146	8	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
5/7/2021 9:40am	159702281	13	Pneumonia	Amoxicillin	Oral	150mg	8hrly	5 days	No	InValid	Not documented	**Incorrect dose**
5/7/2021 10:13	169930773	20	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Incorrect dose**
5/7/2021 10:15	144449592	10	Pneumonia	Amoxicillin	Oral	250mg	Not documented	Not documented	No	Valid	Documented	**Frequency not documented** **Duration not documented**
5/7/2021 12:10pm	162386296	8	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
5/7/2021 12:29pm	169921111	6,9	Pneumonia	Amoxicillin	Oral	220mg	8hrly	5 days	Yes	Valid	Documented	
10/7/2021 No time	180867855	Not documented	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
10/7/2021 2:15pm	159346824	10	Pneumonia	Amoxicillin	Oral	125mg	8hrly	5 days	No	Valid	Not documented	**Incorrect dose**
14/7/2021 11:11am	124805250	13	Pneumonia	Amoxicillin	Oral	125mg	8hrly	5 days	No	Valid	Documented	**Incorrect dose**
16/7/2021 1:18pm	158152603	14,5	Pneumonia	Amoxicillin	Oral	350mg	8hrly	5 days	Yes	Valid	Documented	
16/7/2021 No time	160510871	18	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Incorrect dose**
19/7/2021 9:00am	151047388	12,5	Influenza	Amoxicillin	Oral	375mg	Not documented	Not documented	No	Valid	Not documented	**Frequency not documented** **Duration not documented**
19/7/2021 10:18am	1834698650	Not documented	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
3/8/2021 8:22am	177287471	10	Pneumonia	Amoxicillin	Oral	125mg	8hrly	5 days	No	Valid	Documented	**Incorrect dose**
5/8/2021 8:25am	175733567	17,5	Pneumonia	Amoxicillin	Oral	400mg	8hrly	5 days	Yes	Valid	Not documented	
5/8/2021 9:44am	137205936	10,3	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
9/8/2021 9:44am	160077228	Not documented	URTI	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
10/8/2021 9:48am	163983786	11	Pharyngitis	Amoxicillin	Oral	375mg	12hrly	10 days	No	Valid	Not documented	**Incorrect dose**
10/8/2021 9:50am	164712515	18	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Incorrect dose**
12/8/2021 8:06am	174830141	6	Pneumonia	Amoxicillin	Oral	150mg	8hrly	5 days	Yes	Valid	Not documented	
16/8/2021 9:00am	178787016	14	Not documented	Amoxicillin	Oral	150mg	8hrly	5 days	No	Valid	Documented	**Diagnosis not documented**
16/8/2021 9:10am	176852002	20	Pneumonia	Amoxicillin	Oral	480mg	8hrly	5 days	Yes	Valid	Not documented	
16/8/2021 12:01pm	158202887	Not documented	URTI	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
23/8/2021 10:11am	160663035	11	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
23/8/2021 10:29am	166970402	17	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Documented	**Incorrect dose**
25/8/2021 No time	158202887	14	Pneumonia	Amoxicillin	Oral	350mg	8hrly	5 days	Yes	Valid	Not documented	
25/8/2021 2:18pm	179425343	Not documented	Influenza	Amoxicillin	Oral	400mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
27/8/2021 11:36am	179425343	10	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
27/8/2021 2:14pm	165065285	11	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
27/8/2021 3:00pm	184992797	22	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Documented	**Incorrect dose**
1/9/2021 10:56am	183507508	Not documented	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
1/9/2021 11:11am	182670315	Not documented	Pneumonia	Amoxicillin	Oral	150mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
2/9/2021 8:18am	184363877	7,8	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
6/9/2021 9:38am	157168790	13	Pneumonia	Amoxicillin	Oral	375mg	8hrly	Not documented	No	Valid	Documented	**Duration not documented**
6/9/2021 11:59am	163609217	8,6	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
7/9/2021 2:09pm	184241230	6,7	Pneumonia	Amoxicillin	Oral	150mg	8hrly	5 days	Yes	Valid	Documented	
7/9/2021 2:15pm	177264330	18	Pneumonia	Amoxicillin	Oral	400mg	8hrly	5 days	Yes	Valid	Not documented	
9/9/2021 8:11am	167849371	13	Pneumonia	Augmentin	Oral	250mg/62,5mg	8hrly	5 days	No	Valid	Not documented	**Incorrect Antibiotic prescribed**
9/9/2021 8:13am	185652666	10	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Documented	
13/9/2021 9:58am	184026706	12	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
15/9/2021 No time	165021247	10,8	Tonsillitis	Amoxicillin	Oral	500mg	12hrly	10 days	Yes	Valid	Not documented	
23/9/2021 No time	158667352	12,2	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	No	Invalid	Documented	**Incorrect dose**
27/9/2021 8:44am	165021247	Not documented	Acute Otitis media	Amoxicillin	Oral	375mg	12hrly	10 days	No	Valid	Not documented	**Weight not documented**
27/9/2021 10:28am	169513991	9	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
27/9/2021 3:01pm	151271533	13,5	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
8/10/2021 9:10am	155722150	6	Pneumonia	Amoxicillin	Oral	150mg	8hrly	5 days	Yes	Valid	Not documented	
8/10/2021 10:10am	162822514	16	Not documented	Amoxicillin	Oral	375mg	8hrly	5 days	No	Valid	Not documented	**Diagnosis not documented**

8/10/2021 No time	131643751	11	URTI	Augmentin	Oral	250mg/62 ,5mg	8hrly	5 days	No	Valid	Not documented	**Incorrect Antibiotic prescribed**
11/10/2021 8:15am	190913620	8	Tonsillitis	Amoxicillin	Oral	350mg	Not documented	Not documented	No	Valid	Not documented	**Frequency not documented** **Duration not documented**
11/10/2021 11:28am	165891011	16	Not documented	Amoxicillin	Oral	375mg	8hrly	5 days	No	Valid	Not documented	**Diagnosis not documented**
13/10/2021 11:00am	160268413	Not documented	URTI	Amoxicillin	Oral	500mg	8hrly	5 days	No	Valid	Not documented	**Weight not documented**
13/10/2021 11:23am	184212348	8,5	Tonsillitis	Augmentin	Oral	250mg/62 ,5mg	8hrly	5 days	No	Valid	Not documented	**Incorrect Antibiotic prescribed**
15/10/2021 10:09am	175370683	Not documented	Acute Otitis media	Amoxicillin	Oral	450mg	12hrly	10 days	No	Valid	Not documented	**Weight not documented**
18/10/2021 9:00am	148467194	11	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Documented	
19/10/2021 8:12am	183301431	9	Pneumonia	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
20/10/2021 11:23am	152709069	15	Pneumonia	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Documented	
22/10/2021 10:46am	162724959	Not documented	Tonsillitis	Amoxicillin	Oral	650mg	12hrly	10 days	No	Valid	Not documented	**Weight not documented**
22/10/2021 11:59am	143458123	11	Tonsillitis	Amoxicillin	Oral	375mg	12hrly	10 days	No	Valid	Not documented	**Incorrect dose**
25/10/2021 10:17am	156444952	16	Tonsillitis	Amoxicillin	Oral	450mg	12hrly	10 days	No	Valid	Not documented	**Incorrect dose**
27/10/2021 8:47am	160637195	Not documented	Tonsillitis	Amoxicillin	Oral	350mg	12hrly	10 days	No	Valid	Not documented	**Weight not documented**
3/11/2021 8:18am	122629207	10	Tonsillitis	Amoxicillin	Oral	250mg	12hrly	10 days	No	Valid	Not documented	**Incorrect dose**
3/11/2021 8:44am	160659504	8,3	Tonsillitis	Amoxicillin	Oral	250mg	12hrly	10 days	No	Valid	Not documented	**Incorrect dose**
3/11/2021 2:38pm	165236860	Not documented	Tonsillitis	Amoxicillin	Oral	650mg	12hrly	10 days	No	Valid	Not documented	**Weight not documented**
3/11/2021 No time	156314213	Not documented	Tonsillitis	Amoxicillin	Oral	500mg	12hrly	10 days	No	Valid	Documented	**Weight not documented**
5/11/2021 No time	165033499	14	Tonsillitis	Amoxicillin	Oral	700mg	12hrly	10 days	Yes	Valid	Not documented	
5/11/2021 9:16am	149208902	9,5	Influenza	Amoxicillin	Oral	250mg	8hrly	5 days	Yes	Valid	Not documented	
8/11/2021 11:27am	159234970	Not documented	Not documented	Azithromycin	Oral	250mg	Daily	3 days	No	Valid	Documented	**Weight not documented** **Diagnosis not documented** **Allergies not documented**
9/11/2021 8:13am	139225346	Not documented	Not documented	Azithromycin	Oral	250mg	Daily	3 days	No	Valid	Not documented	**Weight not documented** **Diagnosis not documented** **Allergies not documented**
9/11/2021 10:10am	117492785	20	Not documented	Azithromycin	Oral	500mg	Daily	3 days	No	Valid	Not documented	**Diagnosis not documented** **Allergies not documented**
19/11/2021 8:19am	159234970	7,8	Not documented	Amoxicillin	Oral	250mg	8hrly	5 days	No	Valid	Not documented	**Diagnosis not documented**
22/11/2021 8:38am	165657560	12	Not documented	Amoxicillin	Oral	375mg	8hrly	5 days	No	Valid	Not documented	**Diagnosis not documented**
22/11/2021 8:45am	133138487	Not documented	Not documented	Azithromycin	Oral	250mg	Daily	3 days	No	Valid	Not documented	**Weight not documented** **Diagnosis not documented**
22/11/2021 No time	166250472	Not documented	Acute Otits Media	Azithromycin	Oral	160mg	Daily	5 days	No	Valid	Not documented	**Weight not documented** **Allergies not documented**
23/11/2021 11:00am	161996137	12	Acute Otitis Media	Amoxicillin	Oral	540mg	12hrly	5 days	No	Valid	Not documented	**Incorrect duration**
26/11/2021 10:24am	140965286	15	Acute Otitis Media	Amoxicillin	Oral	650mg	12hrly	10 days	Yes	Valid	Not documented	
2/12/2021 8:19am	183231729	18	Acute Otitis Media	Amoxicillin	Oral	800mg	12hrly	10 days	Yes	Valid	Documented	
2/12/2021 10:12am	152595351	10	Acute Otitis Media	Amoxicillin	Oral	450mg	Not documented	10 days	No	Valid	Not documented	**Frequency not documented**
3/12/2021 9:59am	168308328	Not documented	Influenza	Amoxicillin	Oral	300mg	8hrly	5 days	Yes	Valid	Not documented	**Weight not documented**
3/12/2021 3:12pm	144294527	16	Influenza	Amoxicillin	Oral	375mg	8hrly	5 days	Yes	Valid	Not documented	
6/12/2021 12:12pm	163583693	Not documented	Influenza	Azithromycin	Oral	250mg	Daily	3 days	No	Valid	Documented	**Weight not documented** **Allergies not documented**
8/12/2021 11:00am	182745984	15	URTI	Azithromycin	Oral	200mg	Daily	3 days	Yes	Valid	Not documented	
10/12/2021 No time	155342884	Not documented	URTI	Azithromycin	Oral	500mg	Daily	3 days	No	Valid	Not documented	**Weight not documented** **Allergies not documented**

10/12/2021 11:14am	131410227	Not documented	Influenza	Azithromycin	Oral	200mg	Daily	3 days	No	Valid	Documented	**Weight not documented** **Allergies not documented**
13/12/2021 12:56pm	162163711	9,5	Pharyngitis	Augmentin	Oral	250mg/62,5mg	12hrly	10 days	No	Valid	Documented	**Incorrect antibiotic prescribed**
15/12/2021 9:12am	160780565	14	Pharyngitis	Amoxicillin	Oral	350mg	12hrly	10 days	No	Valid	Not documented	**Incorrect dose**
20/12/2021 9:39am	131748881	9.5	Pharyngitis	Amoxicillin	Oral	450mg	12hrly	10 days	Yes	Valid	Not documented	

Appendix B. Request for permission to access patient record

18th April 2022

The Facility Manager,
Crossroads Day Clinic,
Gwayi Street
Cape Town

RE: REQUEST FOR PERMISSION TO ACCESS PATIENT FOLDER

Dear Sir

I kindly write to seek your permission to carry out my MMed (Family Medicine) research project on: ANTIBIOTIC PRESCRIBING PRACTICE AND ADHERENCE TO IMCI GUIDELINES AMONG CNPs IN CHILDREN YOUNGER THAN 5 YEARS WITH URTIs AT CROSSROADS CLINIC, CAPE TOWN, SOUTH AFRICA: RETROSPECTIVE AUDIT.

This is a retrospective clinical audit which involves reviewing medical records of patient between the period July to December 2021.

The research will be conducted in full conformity with the regulations of Health Research Ethics Committee (HREC)

I am looking forward to your kind consideration, please.

Thank you.

Signed Signed by candidate

DR BABA MACHINA
Division of Family Medicine
University of Cape Town.