

Determinants of Clinician and Patient to prescription of antimicrobials: case of Mulanje, Southern Malawi

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1 **Determinants of Clinician and Patient to prescription of antimicrobials: case of Mulanje,**
2 **Southern Malawi**

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19 **Abstract**

20 **Background:** Antimicrobial resistance is an emerging problem in low- and middle-income
21 countries. The problem is exacerbated by inappropriate prescription of antimicrobials. Factors
22 leading to overuse or inappropriate prescription of antimicrobials by the cadre of medical
23 assistants, clinical technicians and clinical officers have received limited attention. This study
24 investigated factors that influence prescription behaviours of antimicrobials among clinical
25 officers in various health facilities in Mulanje district, Southern Malawi.

26 **Methods:** In-depth interviews (n=18) and focus group discussions (n=2) were conducted with
27 COs from four health facilities in Mulanje district. Purposive sampling was done to arrive at a
28 sample size of 30 health cadres.

29 **Results:** Participants pointed out that patient preferences, belief and clinicians' inadequate
30 education on this issue were among the factors that contribute to inappropriate antimicrobial
31 prescription. 75-% of clinicians showed lack of knowledge on the definition of antibiotic and
32 antimicrobial resistance.

33 **Conclusion:** Inappropriate use of antimicrobials is facilitated by prescribing decisions made by
34 clinicians who are greatly influenced by their patients. Interventions aimed at improving
35 antimicrobial prescription should target both clinicians and patients.

36 **Key words:** Antimicrobial resistance, Antibiotics, Clinician, Patient, Prescription.

37

38 **Introduction**

39 Antimicrobial resistance (AMR) is a great public health challenge which is accelerated by
40 inappropriate use of antimicrobials [1]. Overprescribing of antimicrobials is associated with
41 increased risks of prolonged hospital stay, self-medication of self-limiting conditions, amplified
42 frequent admission to hospital and causing severe infections [2]. Globally, at least 700,000
43 people die each year of drug resistance illnesses because of infections such as bacteria, malaria,
44 Tuberculosis and HIV / AIDS [3]. A study conducted in Malawi reported that there is a decrease
45 in bacterial bloodstream infection which has been accompanied by a rise in antimicrobial
46 resistance involving all bacterial bloodstream infection pathogens [4]. A recent study done in
47 Malawi found out that Gram-positive pathogens are resistant to empiric, first-line antimicrobials
48 [5].

49 Patient-pressure and customer-satisfaction are considered to be major factors for inappropriate
50 antibiotic prescription [6]. In hospital settings, the cadre of Clinicians also known as Clinical
51 Officers (COs) is tasked with prescription of medicines to patients. COs are licensed medical
52 practitioners with an initial three-year training and one year internship [7]. According to
53 Mangione (2019), clinicians are more likely to prescribe antibiotics if they perceive that parents
54 who have brought sick children to the hospital want antibiotics if they ask about the treatment
55 plan [6].

56 Much of the global overuse of antimicrobials occurs in low - and middle-income countries
57 (LMICs), topped by the BRICS (Brazil, Russia, India, China and South Africa) nations where
58 there is enormous use in both animal and human sectors [8]. A study conducted in Sudan,
59 Guinea-Bissau, Central African Republic and Democratic Republic of Congo found out that
60 patient demand for antibiotics contributed to antibiotics prescription [9].

61 In Sub-Saharan Africa, one factor contributing to AMR is misuse of antibiotics. However,
62 improvements in malaria diagnostics and the recognition that malaria transmission is decreasing
63 globally have highlighted the lack of tests for other infections and many patients who test
64 negative for malaria are treated with antibiotics indiscriminately [10]. This is where the focus on
65 prescribing habits of clinicians has to be looked at as it may inadvertently contribute to AMR.

66 Some of the barriers to prudent prescribing of antibiotics by general practitioners (GPs) are
67 known, and these are: patients demanding antibiotics, prescribing antibiotics to save time due to
68 the perception that it takes longer to explain why antibiotics are not needed, concerns that the
69 patient may not return for follow up, uncertainty in the diagnosis where antibiotics may be
70 warranted, concerns about possible complications, preservation of the doctor-patient relationship,
71 and knowledge and attitudes to AMR [11].

72 Szymczak explained that clinicians identify patient pressure and demand for antibiotics as a
73 major barrier to more judicious prescribing [12]. Brookes-Howell, et al. described how clinicians
74 spoke of familiarity with the patient, which helped clinicians in their decision on whether or not
75 to prescribe antibiotics [13]. Patient pressure and expectation were cited among the reasons for
76 prescribing antibiotics ‘unnecessarily’, in particular where a shortage of consulting time meant
77 that the doctor felt unable to adequately explain why antibiotics were inappropriate [14].

78 Physicians’ express desire for a quick fix, the problem of diagnostic uncertainty and the fact that
79 explaining why antibiotics are not necessary is too time-consuming and unrewarding [15] were
80 reported as being the basis of antibiotic misuse. Patients’ lack of knowledge also drives their
81 demands for antimicrobials [16].

82 Doctor's communication skills are the core clinical skills in the practice of medicine, with the
83 ultimate goal of achieving the best outcome and patient's satisfaction which are essential for the
84 effective delivery of health care [17].

85 Communication skills and diagnostic uncertainty rank among the principal indirect factors
86 influencing antibiotic prescription [15]. In a study conducted in Malaysia, the majority of the
87 respondents agreed that too many antibiotic prescriptions, using too many broad spectrum
88 antibiotics and excessive use of antibiotics in livestock were leading contributors to AMR. In the
89 same study, another group felt that too long durations of antibiotic treatment, too low dosing of
90 antibiotics, poor hand hygiene and not removing the focus of infection are among the major
91 factors contributing to AMR [18].

92 However, improving clinician's communication skills helps to bridge the gap between
93 physician's and patient's expectations [19].

94 Antimicrobial prescription can also be reduced in settings where there is one-on-one patient-
95 directed education in the workplace [20].

96 The present paper was aimed at identifying determinants of decisions in antimicrobial
97 prescription among clinicians in health care settings. Since a previous study on antimicrobial
98 prescription focused on physicians and Medical doctors, it was necessary to also get views from
99 Clinical Officers, Clinical Technicians and Medical Assistants, particularly in Sub Saharan
100 Africa who are at the frontline in providing health services in primary and secondary health care
101 settings [21].

102 **Methods**

103 **Study Design, Sample size and Recruitment of participants**

104 This was a qualitative study aimed at exploring clinicians' views and experiences about
105 prescribing AMRs. The research question we tackled was: 'What factors determine the
106 Malawian clinician's decision to inappropriately prescribe Antimicrobials?'. We used in-depth
107 interviews and focus group discussions with clinicians working at the district hospital and health
108 centers in Mulanje district, Southern Malawi. In-depth interviews and focus group discussions
109 were chosen because they provide much more detailed information and they allow for a more
110 relaxed atmosphere. They were also chosen because responses can be clarified and expanded
111 upon with probing question and interviewees can react and build upon each other's response to
112 provide information or ideas that, on their own individually, they might not have provided.

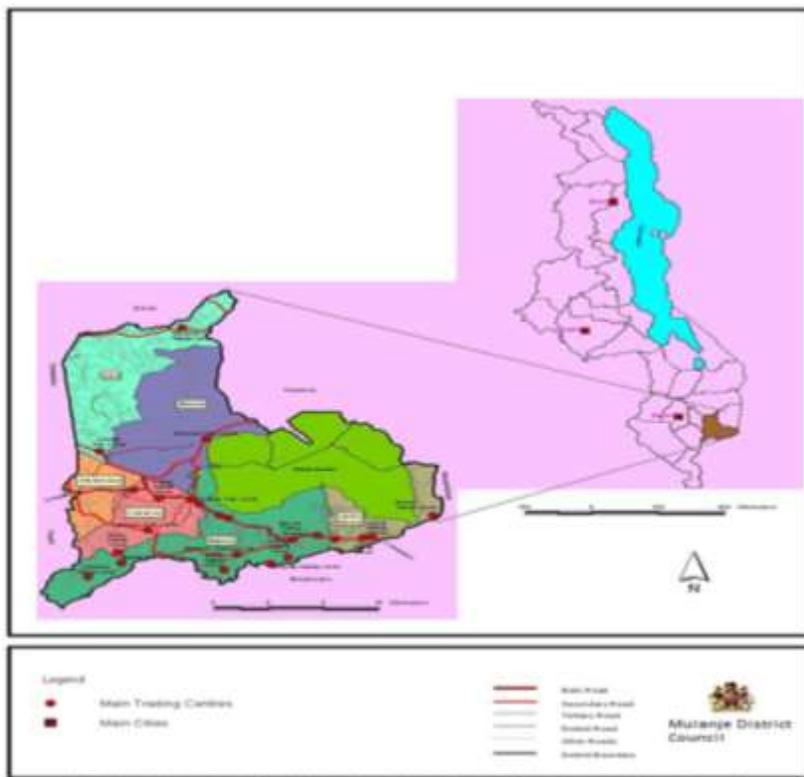
113 Clinicians who completed their internship were selected for inclusion. We recruited clinicians
114 from two hospitals, and two health centers. There were 30 clinicians who took part in the study.
115 Purposive sampling was utilised. This is appropriate in qualitative research, where the aim is not
116 to obtain a statistically representative sample and make statistical inferences from the results, but
117 rather to obtain an information rich sample and make logical inferences from that sample [22].
118 Recruited clinicians were given a consent form to read and sign, once they had agreed to take
119 part in the study.

120 We collected data between May and June 2019. Clinicians' qualifications ranged from
121 Certificate, Diploma to Degree in Clinical Medicine. All participants were assured of privacy
122 and confidentiality, thus, only the team that was involved in data collection had access to the
123 information. Codes were used instead of names. Ethical approval was sought from Malawi
124 College of Medicine Research Ethics Committee and granted with approval number
125 P.04/19/2656. Permission to collect data in the study health facilities was provided by Mulanje

126 District and Mulanje Mission Hospital Directors respectively. Prior to recruitment of clinicians,
127 communication about the study was sent to the health facility Officers-in-charge.

128 **Data collection**

129 Before beginning data collection, we created a semi structured, open – ended interview guide
130 based on literature review on factors that promote inappropriate antimicrobial prescription and
131 piloted with two practicing clinicians. The piloting data was not included in the analysis [23,24].



132

133 **Data analysis**

134 Transcripts were coded using a blend of deductive (codebook based on main interview
135 questions) and inductive coding (emerging from the data). All English transcripts (n=30) were
136 thematically analysed by the primary investigator (MC) and then an independent (CB) researcher
137 with expertise in qualitative research. Analysis began soon after data collection to get
138 familiarization, which involved reading the transcripts repeatedly and noting down ideas.

139 The information which is pertinent to participants' determinants of antimicrobial prescriptions
 140 was identified and coded based on a deductive and inductive approach. These codes were
 141 collected into sub themes and themes. The first author subsequently discussed the coding, sub-
 142 themes and themes with two independent researchers to enhance data reliability. Themes were
 143 reviewed by co-authors (CB and FK). Discrepancies were resolved by reaching a consensus.
 144 The first author then presented the findings to the study participants and obtained their feedback
 145 to ensure that their perspectives were accurately and clearly represented.

146 **Results**

147 **Participants' demographic characteristics**

148 There were 17 male and 13 female participants. Their educational backgrounds ranged from
 149 Medical Assistant (Certificate in Clinical Medicine), Clinical Technician (Diploma in Clinical
 150 Medicine) and Clinical Officer (Degree in Clinical Medicine). All participants (n = 30) reported
 151 that they had prescribed antimicrobials in the previous year.

		Medical assistant (n=11)	Clinical Technicians (n=16)	Clinical Officer (=3)	Overall total (n=30)
Sex	Male	4	12	1	17
	Female	7	4	2	13
Type of facility	MMH		7	2	9
	MJDH	10	10	1	21
Professional qualification		10	16	4	30
Professional experience (years)	< 1	5	2		7
	> 1	6	13	4	23

152 **Main themes**

153 Seven main themes influencing antimicrobial prescribing emerged from the semi-structured
 154 interviews. Quotations from the interviews are included where relevant to illustrate a point.

155 **Theme 1: Patients' Preferences**

156 To explore why clinicians give over their prescribing decision power to patients, the interviewer
157 asked them about determinants of antimicrobial prescription in health care settings. Most
158 clinicians mentioned that some patients force clinicians to prescribe antimicrobials while other
159 patients come with their own diagnosis to the hospital. The clinicians added that a patient's signs
160 and symptoms and a patient's preference for antimicrobials are significant determinants of
161 antimicrobial prescriptions. Most clinicians reported that patients preference on antimicrobials
162 was a factor that contributed to inappropriate prescription of antimicrobials.

163 *“Okay, it’s about the patient preferences, okay, it’s just like there are a lot of antibiotics but*
164 *patients may choose that “I like this antibiotic when I take it I feel good, I recover from my*
165 *complaints and my disease”, could be just patient expectation according to clinical condition of*
166 *her disease” (Clinician # 5).*

167 *“aah sometimes aah patient do have their preferences on which drugs antibiotics to be*
168 *prescribed to them that they feel is best for them not the condition they have, what’s best for*
169 *them” (Clinician # 6).*

170 **Theme 2: Belief about Efficacy**

171 Most patients believe that intramuscular injections, IM and IV antibiotics work better than per os
172 (PO), so, if you give them PO antibiotics, they believe that you have not helped them. They
173 believe that if you give them antibiotics they will dramatically change for the better within two
174 days.

175 *“Patients' understanding of antimicrobials is that the belief that antimicrobials, especially*
176 *injectable heal any form of severe illness. Even if it is not a bacterial infection, they still think*
177 *that if you give them IV [Intravenous] antimicrobials, they are going to recover” (Clinician # 7).*

178 Clinicians also reported that prescribing antibiotics occurs even in suspected cases of viral
179 infections or mere cough because patients and guardians believe their patients will improve only

180 after taking antibiotics and that any form of illness can be cured with antibiotics. Thus, patients
181 show a lack of knowledge on antimicrobials that can be used to treat a bacterial infection or a
182 viral infection.

183 *“I think they feel that for them to get well then they have to take a certain type of antimicrobial.*
184 *Whether you find that the malaria test is negative then they still have the feeling that for them to*
185 *get well they have to take antimalarial, or for them they just have a viral infection like cough or*
186 *whatever or just a flu. They believe that for them to get well they have to take antibiotic like*
187 *amoxicillin” (Clinicians# 12).*

188 Clinicians reported that patients believe that having a cough means one needs antibiotics. This
189 belief prevents proper antimicrobial prescription in a health care setting.

190 **Theme 3: Negative attitude of patients towards clinicians who do not prescribe**
191 **antimicrobials**

192 Most of the clinicians reported that when they refuse to prescribe antimicrobials, patients think
193 that they do not know their work; they are sometimes referred to as not being good doctors
194 because of denying them what they want. In other words, the patients have a negative attitude
195 towards such clinicians.

196 *“Well, when you refuse they think maybe you are not a good clinician. You don’t really know*
197 *your work or else you haven’t helped them. They would prefer to go to another clinician or else*
198 *to go to another hospital where they feel they can be helped. They feel that you haven’t helped*
199 *them” (clinician #12).*

200 Almost all clinicians reported that such patients think of them as being incompetent when they
201 refuse to prescribe antimicrobials to them. What the patients do in such circumstances is to go to
202 another clinician.

203 *“They do just think that am not a medical practitioner, that am not well equipped with*
204 *knowledge and they go for another clinician” (Clinician # 4).*

205 **Theme 4: Educating the patients**

206 As one way of reducing inappropriate antimicrobial prescription, the majority of Clinicians
207 reported the need for patients’ education during patients’ clinic visits. Clinicians suggested that
208 the following should be done during clinician-patient interaction in health care settings:
209 educating patients on the dosage, how to take the drugs and for how long as well as any side
210 effects. This needs to be properly communicated in addition to when to return to the hospital if
211 there is no improvement.

212 *“First, we need to explain why we are giving those drugs, frequency, route, and duration. And*
213 *they should not share with someone else because it's only for him or them that have attended the*
214 *service and the drug is prescribed only for him. I think about the problems people still share*
215 *drugs somewhere behind. You should build a good relationship between you and the patient and*
216 *make sure when you have given the drug they should come back for feedback” (Clinician #11).*

217 Patient education is a factor that can lead to a reduction in unnecessary antimicrobial
218 prescriptions. This important theme of educating the patients is however restricted by the reality
219 on the ground as shown in the next theme.

220 **Theme 5: Limited time /Clinicians being overwhelmed**

221 Clinicians stated that limited consultation time between clinician and patient was one of the
222 factors that lead to inappropriate prescription of antimicrobial. It emerged that there is limited
223 time a clinician can spend with an individual patient because of large numbers of patients
224 visiting a health care setting which is a big challenge that affects clinicians. There is a lack of
225 comprehensive history taking on patients because of having to spend minimal time with each one
226 of them. Some clinicians may see as many as 50 patients per day.

227 *“We can spend 2 minutes with each patient because we have long lines in outpatient*
228 *departments and sometimes there is one clinician or two, so if you take much time with patients,*
229 *they start complaining that you are wasting their time. It affects a lot because we need to have*
230 *more time with our patient and they should talk more of their complaints but with the complaints*
231 *that I said that we are few Clinicians, we spend aah not enough time with the patient, so the*
232 *patient do not share more of their complaints that they have come with on that particular day”*
233 *(Clinician #1).*

234 The underlying factor is handling a long queue of patients in outpatient departments and huge
235 workload. This results in unnecessary antimicrobials prescription in health care settings in order
236 to relieve pressure in the outpatient department.

237 Lack of enough time is a barrier for proper history taking, physical examinations, investigations
238 and counselling. Furthermore, because of having fewer clinicians, antimicrobials are being
239 prescribed in order to see more patients within a short period of time and this results in no
240 explanation to patients on what they are suffering from and the importance of adhering to
241 medications.

242 **Theme 6: Hindrance / Obstacle to antimicrobial prescription**

243 The study also investigated problems of antimicrobial prescription in cases where this is the
244 appropriate decision. Clinicians stated that they do face problems and challenges in prescribing
245 some antimicrobials because of their unavailability in the health care settings. The findings
246 revealed that frequent unavailability, shortages and antibiotics being sold on the open market are
247 problems since people can go and buy without a prescription from a clinician.

248 *“One of the challenges mostly (silence) its aah repetitive usage of single antimicrobial, even in*
249 *the same patients or in most outpatients seen or even inpatients, so it's mostly certain antibiotic*
250 *dominate over other antibiotics, so that's one of the challenges simply because it has developed*
251 *some resistance simply because of overuse and it has caused most of the unfavorable side effects*

252 *and which are most difficult to treat so are some of the challenges we have met so far”*
253 *(Clinician # 7).*

254 Clinicians reported that a shortage of certain antimicrobials makes them prescribe the same
255 antibiotics, even in cases where they believe it is not the best option, not indicated or not the
256 strongest one.

257 *“Your choices may be out of stock in a particular pharmacy and that can affect your prescription*
258 *as well. And the other thing is, you are not quite sure what you are treating. So you just*
259 *prescribe but then you are not really sure like blinded and treating blindly” (Clinician # 12).*

260 **Theme 7: Clinician Lack of Knowledge on antibiotic and antimicrobial resistance**

261 Besides all that, participants showed that they had minimal understanding of antibiotics and
262 antibiotic resistance. Four clinicians correctly defined what antibiotic and antimicrobial
263 resistance is, which represents 13 %. 6.5 % correctly defined antibiotic resistance whilst only 3%
264 correctly defined antimicrobial resistance. Clinicians were also using antibiotics and
265 antimicrobial resistance interchangeably. In this study, clinicians did not define properly what
266 antibiotics are and what antimicrobials are. Below is an illustration.

267 *Definition of Antimicrobial resistance: Antimicrobial resistance means the causative organisms,*
268 *the bacteria have developed a mechanism or a resistance to that antimicrobial which means you*
269 *might give antimicrobial which previously could work or the bacteria could respond or could be*
270 *sensitive to that antimicrobial but now in the later stage or after a certain period of time the*
271 *bacteria will develop another mechanism against that antimicrobial” (Clinician # 7).*

272 **Discussion**

273 Medical Assistants, Clinical Technicians and Clinical officers are an important group in
274 prescribing antimicrobials in Sub Saharan African countries including Malawi. They are
275 frontline health workers in primary and secondary health facilities in Malawi. They are more

276 likely to prevent inappropriate prescription of antimicrobials and educate patients if they have
277 enough knowledge and are aware of antimicrobial resistance. This study yields important
278 findings regarding factors influencing clinicians to give over their prescribing decision power to
279 patients during consultation. The allocation of more health workers and providing patient
280 education during consultation is crucial and paramount to improve antimicrobial prescription.

281 The study identifies an important area that needs to be addressed when developing education
282 interventions regarding interactions between clinician and patients. The study has demonstrated
283 that only few clinicians were aware on the definition of antibiotic and antimicrobial resistance.

284 The majority asserted that some factors influence clinicians to give over their prescribing
285 decision power to patients. Key among the factors are preferences, beliefs and efficacy of
286 antimicrobials, negative attitude of patients towards clinicians, limited time /Clinician being
287 overwhelmed as well as hindrance / obstacle to antimicrobial prescription.

288 However there is a significant gap on the definition of antibiotic and antimicrobial resistance
289 among Clinicians which needs to be bridged, and that can result into appropriate antimicrobial
290 prescription.

291 **Preference**

292 The present study confirmed that patient preference is a factor that influences clinicians to give
293 over their prescribing decision power to patients and it determines inappropriate antimicrobial
294 prescription in health care settings. These findings are supported by several studies in developed
295 countries [11,25–28]. In the USA, a similar study to the current one found out that parental
296 pressure was influencing clinicians to prescribe antibiotics [12]. This is also reflected in a similar
297 study, in which, one of the reasons for the prescription of antimicrobials is patient demands or

298 attitude [29]. A study done in Egypt also reported that preferences of caregivers and patients
299 were among of the factors that contribute to antibiotics prescriptions [28].

300 **Belief about efficacy**

301 Our study also found out that belief about efficacy among patients in antimicrobials is
302 contributing to inappropriate prescriptions in health care settings. These findings corroborate the
303 findings from other studies.

304 It is reported that patients have a belief in certain antimicrobials over others when they visit
305 health care settings. Clinicians in this study cited that patients' demands and preferences for
306 injectable or intravenous antimicrobials over oral ones contribute to inappropriate prescription.
307 Similar findings from developed countries also reported that patients believe in antimicrobials
308 when they visit health care settings, and even when they have a viral infection, they will demand
309 antibiotics to avoid repeated consultations [30–33].

310 The current findings are also supported by another study which found out that patients come to a
311 hospital with common cold and then demand intravenous antibiotics [34]. The current study
312 findings also corroborate other studies which reported that there is belief that intravascular
313 antibiotics are better than oral antibiotics and that, both doctors and patients encourage
314 prescription of intravenous antibiotics [28,29,33–35].

315 **Negative attitude of patients towards clinicians**

316 Our findings about negative attitude of patients towards clinicians who refuse to prescribe
317 antimicrobials is similar to other study findings which found out that clinicians were prescribing
318 antibiotics in fear of losing patients' trust [36]. The results also show that patients would change
319 physicians when antibiotics are not prescribed. This is also reflected in similar studies that

320 reported that even when patients do not need medication, doctors prescribe antibiotics to
321 maintain a good patient-doctor relationship [37–39].

322 A study done in Malaysia found out that a few participants indicated that they would make their
323 expectations explicit and request antibiotics from their physician even when they had viral
324 infections, as they believe the medicine promotes rapid recovery. They also said they would
325 consult another physician if their request was not granted [40].

326 **Educating patients**

327 This study also revealed that clinicians were influenced to prescribe antimicrobials because of
328 patients' lack of education on medications. In general, the health systems in Malawi are
329 considered inadequate to meet the ever increasing health demanding population in health care
330 settings as health care and clinician-patient ratios still need to improve. Clinicians reported that
331 they do not have enough time to counsel and educate patients during consultations because of
332 demands on their time due to large patient numbers.

333 In a review conducted by Ayukekbong et al.[41], it was found out that, because of high patient-
334 doctor ratio in most developing countries, doctors are overwhelmed and, as a result, there is often
335 inadequate time for meaningful education and communication with the patient on drug adherence
336 guidelines and consequences of poor or non-adherence to the guidelines.

337 The current results corroborate a study done in North Carolina that revealed that clinicians
338 should provide information in a manner that is easy for patients to understand as to why an
339 antibiotic is not needed to treat a particular illness as well as how to appropriately use antibiotics
340 in their treatment as and when they are prescribed [42].

341 Providing education at all levels, that is, community, healthcare setting and individual, is
342 essential to ensuring rational use of antibiotics and suppressing inappropriate use.

343 Public education campaigns are effective in changing attitudes and knowledge regarding
344 antibiotic use and resistance. Fletcher-Lartey and Machowska [22,39] found out that consumer
345 education, such as discussion and explanation, was the common strategy reported by participants
346 to manage patients' expectations and demand for antibiotics.

347 Findings in this study are all consistent with other studies done in Belgium, England and France
348 which reported that mass media interventions such as national TV campaigns and campaigns
349 through other forms of mass media have been shown to reduce antibiotic prescribing for Acute
350 Respiratory Tract Infection but argued that this strategy works best when targeting both
351 healthcare professionals and the public [43]. It is recommended that care providers, dispensers
352 and patients need to be educated on how the use and misuse of antimicrobials may contribute to
353 the development of resistance [41]. It is cited that lack of communication skills is a factor that
354 promotes unnecessary antimicrobial prescription [44].

355 **Limited -Time /Clinician being overwhelmed**

356 The findings also reveal that limited time act as a barrier to proper antimicrobial prescriptions.
357 Clinicians reported that they prescribe antimicrobials in order to handle long queues in the
358 outpatient department. Several studies support the fact that clinicians spend less time with
359 patients because of work overload.

360 It is reported that clinicians prescribe medications in order to end the consultation and the
361 clinicians themselves also reported that they prescribe under pressure when factors other than

362 clinical presentation pushed them into prescribing even when they believe antibiotics are not
363 needed [32].

364 In a study conducted in Karnataka state in South India, physicians agreed that they have too
365 much work because of staff shortages and nearly half of them said that their patients ask them to
366 prescribe antibiotics [48].

367 In this current study, clinicians **do not perceive that limited time** and inadequate number of
368 clinicians is a facilitator for inappropriate prescription of antimicrobials.

369

370 **Hindrance / Obstacle to antimicrobial prescription**

371 Several factors exist such as unavailability of antimicrobials or their shortage, as well as
372 antibiotics being sold on the open markets all of which are barriers to proper antimicrobial
373 prescriptions since people can go and buy antimicrobials from pharmacies and open markets
374 without a prescription from a clinician. One of the barriers to appropriate antibiotic prescriptions
375 is inappropriate antibiotic use which has resulted from lack of access to and affordability of
376 antibiotics due to inadequate government funding in developing countries [50].

377 In another study, it is also reported that those who were on medical aid were more likely to
378 receive an antibiotic than those not on medical aid [46].

379 A study done by Baubie, et al. [51] also reported that high physician workload and high
380 antibiotic use in the community were major barriers to antimicrobial stewardship implementation
381 and lack of patient or client understanding of antibiotics, and difficulty in making diagnoses were
382 barriers to proper antimicrobial prescription [52].

383 The current study is also supported by another study done in India which shows that selection of
384 particular antibiotics also depends on their availability at the public health center and this is a
385 barrier to prescribers [48]. The above study findings also corroborate other results, which report
386 that clinicians felt that some antibiotics available in their hospital are of poor quality and less
387 effective or that the required ones are not available and the patient gets antibiotics directly from
388 shopkeepers without prescriptions [24]. Similarly, a study done in South Asia reveal that
389 common challenges to proper antimicrobials prescription were poor dispensing, poor quality
390 antibiotics, less effective ones in hospital, insufficient history taking and sale of antibiotics that
391 have no proper dosage or are clinically inappropriate [53].

392 In fact, a study done in India found out that one of the obstacles to the appropriate use of
393 antibiotics is poor quality of antibiotics and less effective ones in hospitals [24].

394

395 **Clinician Lack of Knowledge on antibiotic and antimicrobial resistance**

396 Furthermore, we need to educate clinicians on antibiotic and antimicrobial resistance. Overall,
397 participants had minimal understanding of antibiotics and antimicrobials resistance. In this study,
398 clinicians pointed out that overuse, poor adherence, and self-medication were causes of antibiotic
399 resistance. In a study done in France and Scotland, the clinicians had knowledge of antibiotics
400 resistance [54].

401 But, overall, in the current study, clinicians knew the causes of antimicrobial resistance and had
402 knowledge which is similar to the findings of a study done in Saud Arabia on rural and urban
403 physicians which pointed out that inadequate prescription, use of antimicrobials without
404 prescription and noncompliance of patients are the most important factors contributing to the

405 development of bacterial resistance to antibiotics [54,55]. Studies done in Sudan and Ghana also
406 found out that a number of factors were mostly perceived by the majority of physicians as very
407 important causes of antibiotic resistance such as overuse in the population and hospitals, self-
408 medication, uncompleted antibiotics therapy, inappropriate empiric choice and low antibiotics
409 dosage use in animals as well [56,57].

410 Nicholson et al. [58] similarly reported that factors contributing to antibiotic resistance are: wide
411 spread use of antibiotics, overuse of a broad-spectrum of antibiotics, inappropriate use,
412 inadequate hand washing and use of antibiotics in animals.

413 In a similar study done in Ghana among prescribers, causes of antibiotics resistance identified
414 include antibiotics over-prescription, irrational prescription of antibiotics and patients'
415 noncompliance to medications [59].

416 **Strength and Limitation of the study**

417 This is the first study done in Malawi among clinical officers on antimicrobial prescription. The
418 study managed to capture a wide range of determinants of inappropriate antimicrobial
419 prescription. Sample size in qualitative research is determined by data saturation and it is a gold
420 standard in a qualitative study however (n=30) were all interviewed. The study had high levels of
421 participation which might show that research participants were interested in antimicrobial
422 resistance and they were willing to participate in the study. This study was only done in one
423 district, Mulanje, Southern Malawi, so it is a snapshot of Mulanje district as such the result
424 cannot be generalized. Another limitation is non-random sampling. Finally, private clinicians
425 were not interviewed which is also one of the limitations of the study.

426 **Conclusion**

427 This study sought to assess determinants of antimicrobial prescription among clinicians in
428 Mulanje, Malawi. Based on the findings in this study, **the following** are key conclusions that
429 contribute to the evidence of determinants of antimicrobial prescription. This is one of the first
430 few studies in southern Malawi and will contribute to evidence based targeted interventions to
431 address the problem of inappropriate antimicrobial prescription in health care settings.

432 Although clinicians were aware of the causes of antimicrobial resistance, they showed lack of
433 knowledge on antimicrobial resistance. Lack of patient education, limited time and work
434 overload are among the factors that promote inappropriate prescription of antimicrobials.

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436 **Supplementary information**

437

438 **Author Contributions:**

439 MC, CB and FK wrote the Manuscript, MC, CB and FK design the research and finally MC, CB
440 and FK analyses the data.

441

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447

448 **Disclosure**

449 The authors report no conflicts of interest in this work.

450 **Ethics approval Ethics**

451 Ethics approval was obtained from the Malawi College of Medicine Research Ethics Committee
452 under approval number (ID P.04/19/2656).

453

454 **Availability of data and materials**

455 The datasets used and analyzed during the current study are available from the corresponding
456 author on reasonable request.

457 **Consent for publication**

458 Not applicable

459 **Abbreviations**

460 AMR: Antimicrobial resistant; ABR: Antibiotic resistant; LMICs: Low Middle Income
461 Countries; BRICS: Brazil, Russia, India, China and South Africa, SDM: Shared Decision
462 Making.

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