Original paper

Assessment of Guideline Concordant Antibiotic Prescribing for Patients with Community Acquired Pneumonia at The Kenyatta National Hospital Medical Wards

Rintari PN[1], Oyoo GO[1], Amayo EO[1], Achieng L[1], Kagima J[2]

[1]Department of Clinical Medicine and Therapeutics, School of Medicine, University of Nairobi, P.O. Box 19676-00202, Nairobi, Kenya
[2]Kenyatta National Hospital, Nairobi, Kenya

Address for Correspondence: Dr Pauline N Rintari, Department of Clinical Medicine and Therapeutics, School of Medicine, University of Nairobi, P. O. Box 19676-00202, Nairobi, Kenya. Email: rynkish@ymail.com

Abstract

Background: Pneumonia is a major cause of morbidity and mortality globally. Despite the proven benefits of guideline concordant antibiotic prescribing, research has shown that adherence to clinical guideline recommendations is dismal.

Objectives: The study aims to determine utilization of Kenyatta National Hospital antibiotic guideline titled 'The KNH guide to empiric antimicrobial therapy 2018' in the management of community acquired pneumonia in the Kenyatta National Hospital medical wards and the perceived barriers towards the utilization of this guideline.

Materials and methods: A check list derived from the Kenyatta National Hospital (KNH) guide to empiric antimicrobial therapy 2018 was used to assess guideline concordance based on seven quality indicators: empiric antibiotic, dose and route of administration, switch to oral antibiotics, duration of antibiotics (at least 5 days), collection of microbiological samples before initiating antibiotics, review of antibiotics at 48 hours and once the culture results are out. Online self-administered questionnaires were used to determine attitude and perceived barriers towards utilization of the KNH guideline among the Internal Medicine registrars and medical officers.

Analysis: Descriptive statistics were applied in the representation of each of the seven quality indicators. These were then compared with the guideline recommendations and adherence to the guideline for each parameter was expressed as a percentage of the total number of patients admitted with community acquired pneumonia. These were then graded into the following categories based on the level of concordance: Good >90%, Intermediate 60-90%, poor <60%. Questions on the attitude and the perceived barriers towards KNH guideline utilization were answered using a 5 point Likert scale. Perceived barrier statements that were positively formulated were then recorded so that a lower score meant a lower level of the perceived barriers and vice versa. Percentages were then calculated for the total number of doctors that agreed or strongly agreed that the barrier was applicable. An open ended question on the top three barriers to the KNH guideline utilization was also included in the questionnaire.

Results: For each of the other quality indicators, adherence to the KNH guideline for patients with community acquired pneumonia was as follows: empiric antibiotic choice 48%, collection of samples for culture prior to antibiotic administration 0%, review of antibiotics at 48 hours 26.4%, review of antibiotics with culture results 45.8%, total duration of antibiotics 28.8% and time to switch to oral antibiotics 3.6%. The top three barriers towards guideline utilization among the doctors were: unavailability of drugs (52.7%), inaccessibility of the KNH guideline (45.1%) and lack of or delay of investigations (34.1%).

Conclusion: This study has demonstrated that the level of adherence to the seven quality indicators from the KNH guide is poor with the overall adherence being 35.5%. The recommendation least adhered to was collection of microbiological samples before initiation of empiric antibiotics. The most commonly identified barriers to utilization of the guideline were external and guideline related barriers.

Key words: Guide to empiric antimicrobial therapy 2018, Guideline Concordance antibiotic prescribing, Community acquired pneumonia

Introduction

Pneumonia remains one of the leading causes of hospitalization among adult patients in low and medium income economies despite advancement in the approach to disease prevention and management (1).

The absence of a microbiological aetiology when antibiotics need to be administered, the vast array of available antibiotics and increasing antimicrobial

resistance have led different infectious disease societies to publish antimicrobial guidelines to help in the selection of the appropriate initial antibiotic regimen, taking into account individual patient parameters (2).

Broad-spectrum guideline-concordant empiric therapy increases the possibility of prompt initiation of the appropriate antibiotics and has been shown to be comparable in efficacy to a pathogen-directed approach (3). Adherence to pneumonia treatment guidelines has also been shown to reduce 30 day mortality and length of hospital stay (4). Empiric antimicrobial therapy that is not concordant to pneumonia guidelines has been found to be an independent factor associated with early deaths in patients with severe pneumonia.

Adherence to guidelines for the treatment of pneumonia has been found to be alarmingly low. A study done in Garissa Provincial General Hospital, Kenya, reported 27.7% adherence to the Ministry of Health pneumonia guidelines (5). This is in contrast to studies in other countries that have reported adherence levels of 61- 97% (6).

In line with evidence based practice, the 'Kenyatta National Hospital (KNH) guide to empiric guide to antimicrobial therapy' antibiotic guideline was launched in 2018. Utilization of this guideline in the management of pneumonia is yet to be audited.

Materials and methods

This was a hospital based cross sectional study conducted in six general medical wards at the Kenyatta National Hospital (KNH). The study comprised of two population groups: 250 medical records of patients with a diagnosis of community acquired pneumonia and 91 medical doctors (Internal medicine residents, medical officers and medical officer interns at the KNH).

All the records of patients aged 18 years and above admitted to the six general medical wards in KNH with a working diagnosis of community acquired pneumonia were included in the study. Community acquired pneumonia was defined as a clinical syndrome with at least one of these "major" clinical features: or temperature > 37.8°C, cough, or sputum production, or at least two of the listed "minor" clinical features: dyspnea, deranged mental status, pleuritic chest pain, consolidation on chest examination, or leukocytosis of >12,000mm with chest X-ray showing features suggestive of pneumonia at admission or within 24 hours (7). The exclusion criteria included patients admitted in the specialized medical wards, those aged 80 years and above with multiple comorbidities (category 2 and above in the KNH antimicrobial guideline) and those who tested positive for pulmonary tuberculosis. Data was extracted from the patients' files using the study pro-forma. Information was obtained concerning their age, sex, length of hospital stay, past or current smoking history, comorbidities and hospitalization in the last 90 days. Concordance to the KNH antimicrobial guideline for community acquired pneumonia was assessed using a checklist derived from the guideline. The check list consisted of eight statements derived from the antibiotic prescribing algorithm. The domains that were assessed include: documented evidence of pneumonia, collection of microbiological samples before initiation of antibiotics, guideline concordant choice of antibiotics, review of antibiotics after reviewing results of microscopy, culture and sensitivity, time to switch to oral antibiotics and the total duration of antibiotic administration. Documentation of the evidence of pneumonia diagnosis was confirmed by ticking the positive clinical features and a chest radiograph suggestive of pneumonia. Descriptive statistics were used to represent patient demographics, evidence of pneumonia (expressed as at least two positive clinical features and a chest radiograph suggestive of pneumonia), empiric antibiotic regimen chosen, timing of collection of microbiological samples, dose, time to oral antibiotics and the total duration of antibiotic administration as well as the review of antibiotics at 48 hours and upon receiving culture results. These were then compared with the guideline recommendations. Adherence to the guideline for each parameter was expressed as a percentage of the total number of patients admitted with community acquired pneumonia.

In the second study population, the total sample was taken from the internal medicine registrars, medical officers in casualty and medical officer interns. This was done at a ratio of 7:2:1 based on the expected proportions. Enrollment was by consecutive sampling. Informed consent was sought and validated self-administered questionnaires were filled in soft copy and had a total of 20 questions. The questions assessing attitude and barriers to guideline utilization were answered using a 5 point Likert scale with the options being strongly agree, agree, neutral, disagree and strongly disagree. One open ended question is also included, where the respondents were expected to list their top 3 barriers to utilizing the KNH guideline 2018 in the management of pneumonia. The questionnaire consists of two parts: a general section on the professional characteristics of the doctors which was summarized by descriptive statistics, and a guideline specific part on the attitude towards the guideline and the perceived barriers towards guideline utilization which was answered using a 5 point Likert scale to rate the degree of agreement or vice versa. Perceived barrier statements that were positively formulated

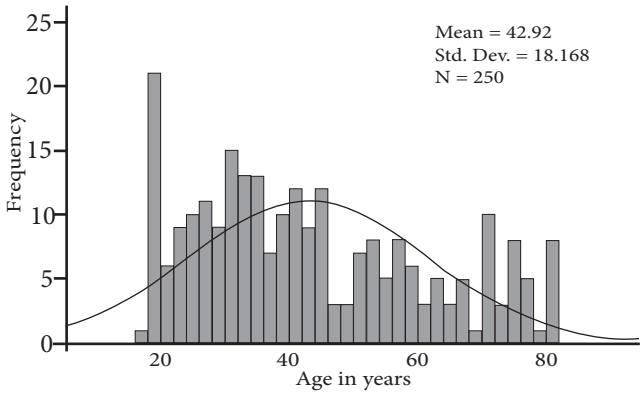
were then recorded so that a higher score meant a greater level of perceived barriers and the reverse also applied. Percentages were then calculated for the total number of doctors that agreed or strongly agreed that the barrier was applicable.

Results

During the study period, January 2020 to April 2020, a total of 282 patients admitted with pneumonia were screened for eligibility and were considered for the study. Six of these patients did not meet the case definition while 26 patients were excluded from the study due to the following reasons: 7 had healthcare associated pneumonia, 2 were treated for aspiration pneumonia, 5 tested positive for pulmonary tuberculosis while 12 patients were over 80 years of age with multiple comorbidities.

The mean age of the study patient population at the time of this study was 42.9 (±18) years. There was a slight male preponderance with male patients being 119 (52.4%). Majority, (78.8%) of the patients, were aged between 18 - 60 years. Extremes of age, represented by patients under 20 years and over 70 years were 21 (8.4%) and 35 (14%) respectively. Notably, patients aged 18 years contributed to the bulk of patients aged under 20 years at 7.2%.

Figure 1: Age distribution among patients with CAP



Past or current smoking history was reported in 55 (22%) of the study participants, predominantly male. Among the smokers, only 17 (6.8%) had a documented duration of cigarette smoking with the total number of sticks per day, giving an average of 12.29 pack years of smoking. Majority, 177 (70.9%) of the patients had at least one concurrent chronic illness. The two commonly reported comorbidities were heart failure 35 (14%) and HIV 30 (12%).

Table 1: Sociodemographic characteristics of patients with CAP (n=250)

Variable	No. (%)
Past or current smoking history	
Yes	57 (22.8)
No	193 (77.2)
Comorbid conditions	
Diabetes	10 (5.9)
HIV	17 (10.1)
Heart failure	20 (11.8)
Asthma	3 (1.8)
COPD	9 (5.3)
Other	56 (33.1)
None	54 (32.0)
Gender	
Male	128 (51.2)
Female	122 (48.8)

The length of hospital stay was defined as the time between admission into the medical ward and documentation of discharge in the patients file. The average length of hospital stay for patients admitted with CAP was 6.5 days. Majority of the patients stayed in hospital for at least 7 days (93.6%) and only 11 patients were discharged within 5 days of hospitalization.

Table 2: Length of hospital stay

Length of hospital stay in days	Number of patients (%)
2	1 (0.4)
3	1 (0.4)
4	2 (0.8)
5	6 (2.4)
6	4 (1.6)
≥ 7	236 (94.4)

Assessment of concordance to the KNH guideline was done using 7 quality indicators namely: Empiric antibiotic choice, dose, route and frequency of administration, collection of blood culture samples before starting antibiotics, review of antibiotics in 48 hours after initiation, review of antibiotics after receiving culture results, total duration of antibiotic use and time to switch to oral antibiotics in days. The degree of concordance was then graded into: Good

>90%, Intermediate 60 – 90% and poor <60%. Each of the quality indicators will be discussed below.

Empiric antibiotic concordance

The choice of antibiotic, route, dose and frequency were taken into account to fully assess the full prescribing criteria. The dose, route and frequency of administration was concordant to the KNH guideline in majority of the patients 241 (96.4%). The main reason for lack of adherence in this indicator was the erroneous dosage of ceftriaxone and ceftazidime in nine patients. Two patients received ceftriaxone 1g OD, 4 received ceftriaxone 2g BD while the remaining 3 got ceftazidime 2g TDS. There was no documented reason for the dose adjustment in these patients.

The KNH antimicrobial therapy (2018) recommends the use of either ceftriaxone, cefuroxime or amoxicillin- clavulanic acid in combination with a macrolide for the management of hospitalized patients with CAP. The empiric antibiotic choice was guideline concordant in 120 (48%) of the patients. These patients received a combination of amoxicillin- clavulanic acid or ceftriaxone with either clarithromycin or azithromycin. The most commonly prescribed empiric antibiotics were ceftriaxone (33.2%) and amoxicillin - clavulanic acid 55.6% either as monotherapy or in combination. Amoxicillin-clavulanic acid and ceftriaxone monotherapy was prescribed in 42.5% and 35.4% respectively, while dual therapy with macrolides was given in 64.4% and 23.3% respectively. Broader spectrum antibiotic use was seen in 9 (3.6%) patients, where ceftazidime, meropenem, and piperacillin tazobactam were used. Besides the combination with macrolides, a number of other antimicrobials were used in a small percentage of patients, with metronidazole being the most common in 12 (4.8%) patients.

Table 3: Antibiotic prescription patterns

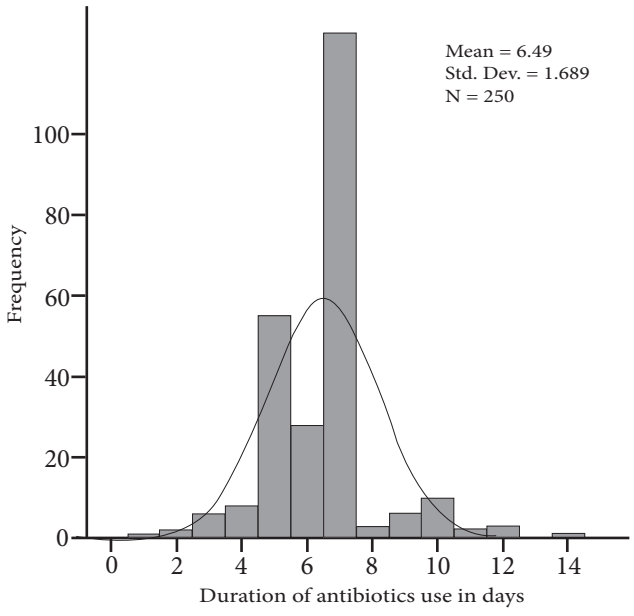
Antibiotics used	No. (%)
Single agent	113 (45.2)
	137 (54.8)
Combination therapy	
Single agent	40 (35.4)
Ceftriaxone	48 (42.5)
Amoxicillin-Clavulanic acid	16 (14.2)
Ceftazidime	3 (2.7)
Cefuroxime	2 (1.8)
Meropenem	4 (3.6)
Piperacillin tazobactam	
Combination therapy	85 (62.0)
Augmentin+Clarithromycin	3 (2.2)
Augmentin+Azithromycin	2 (1.5)
Augmentin+ Metronidazole	1 (0.7)
Augmentin+Ciprofloxacin	3 (2.2)
Ceftazidime+Clarithromycin	7 (5.1)
Ceftriaxone+Azithromycin	25 (18.2)
Ceftriaxone + Clarithromycin	10 (7.3)
Ceftriaxone+ Metronidazole	1 (0.7)
Ceftriaxone+Gentamycin	

Review of antibiotics during the course of admission

Adjustment of antibiotics after 48 hours was done for 66 (26.4%), but only 9 (3.6%) patients were reviewed with the aim of switching to oral antibiotics at 48 hours as recommended by the KNH guideline. Review of antibiotics was done mainly with the aim of adding atypical cover 65 (26.2%), with addition of clarithromycin, azithromycin or metronidazole. Ninety eight (39%) of patients had a complete change of antibiotics, with majority 45 (46%) being changed from ceftriaxone to amoxicillin- clavulanic acid.

During the course of the in-patient stay, 25 (10%) patients received oral antibiotics, with the median time to oral antibiotics being 6 days. Only 9 (3.6%) of these patients received oral antibiotics within 48 hours of admission, in line with the KNH guideline. The average duration of antibiotic administration was 6.5 (1.7) days, longer than the recommended 5 days of treatment. Guideline concordance for duration of antibiotics was only achieved in 28.8% of the study participants. Two hundred and thirty six (93.6%) of the patients received more than 7 days of antibiotics as illustrated in Figure 2. while 118 (47.2%) had comorbidities.

Figure 2: Duration of antibiotics



The KNH antimicrobial guideline recommends the collection of blood culture and sputum for TB analysis (gene Xpert) for all patients admitted with CAP. In the study cohort blood culture and sputum samples for gene Xpert test were collected for 48 (19%) and 96 (38.4%) respectively. Eighty one (32.4%) of the admitted patients presented with dry cough. There was no documentation of any attempt to induce sputum therefore no sputum sample was collected.

However, none of these microbiological samples were collected before the initiation of antibiotics. These samples were collected from day 2 of admission

onwards. Among the samples collected, over 50% of the results were not available in the patients file by day 7 therefore not reviewed. For the individual samples, blood culture results were reviewed for 21 (43.8%) while sputum gene Xpert results were only reviewed for 45 (46.9%) of the patients by day 7. Overall compliance to this quality indicator was 45.8%. The yield from these cultures was low, with 95.2% blood cultures and 93.3% sputum results being reported as negative for TB.

Assessment of attitude and barriers towards implementation of the KNH guideline

A total of 91 doctors took part in the survey. All the participants gave informed consent and proceeded to fill the online questionnaires. Seventy three internal medicine registrars, 18 medical officers and 1 medical officer intern fulfilled the inclusion criteria and proceeded to fill in the online questionnaires. Majority 59 (64.9%) of the internal medicine registrars who took part in the study were in their second and third year of training while the medical officers work in the outpatient department. Over half 48 (52.7%) the respondents reported to have worked for more than five years after graduation and only 7 (7.7%) reported to have been in practice for less than 2 years. Fifty (54.9%) of the respondents reported that they prescribe antibiotics at least once a day while only 1 (1.1%) prescribe antibiotics at least once a week. Table 4 summarizes the sociodemographic characteristics of the doctors.

Table 4: Doctors' sociodemographic characteristics (n=91)

Variable	Frequency (%)
Duration worked after school in years	
1-2	7 (7.7)
3-4	17 (18.7)
4-5	19 (20.9)
Above 5	48 (52.7)
Current position held at KNH	
Internal medicine resident	73 (80.2)
Medical officer	17 (18.7)
Medical officer intern	1 (1.1)
Year of training for Internal Medicine Residents	
Year 1	14 (15.4)
Year 2A	20 (22.0)
Year 2B	39 (42.9)
Not applicable	18 (19.8)
Times prescribed antibiotics in work week	Number (%)
More than once a day	50 (54.9)
Once a day	9 (9.9)
3-5 times per week	23 (25.3)
1-2 times per week	8 (8.8)
Less than once a week	1 (1.1)

Attitude toward the KNH guideline

To assess the attitude of the respondents towards the KNH guide to antimicrobial therapy 2018, four questions with options ranging from strongly agree to disagree were included in the survey as shown in Table 5. Eighty one (89.1%) of the doctors felt that the guideline is evidence based while 1 (1.1%) disagreed with this statement. Seventy four to eighty four percent of the participants find the guideline a useful tool in choosing the initial antibiotic, convenient and easy way to find information required. Three (3.3% of the respondents however, felt that the guideline is not useful in improving the quality of treatment given to patients with community acquired pneumonia.

Table 5: Attitude towards the KNH guideline

Question (N 91)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Guidelines are evidence-based	37 (40.7)	44 (48.4)	9 (9.9)	1 (1.1)	0
Useful and help improve quality of treatment	40 (44.0)	36 (39.6)	11 (12.1)	3 (3.3)	1 (1.1)
Good tool for choosing initial treatment	48 (52.7)	36 (39.6)	7 (7.7)	0	0
Convenient to use and easy to find information	36 (39.6)	38 (41.8)	9 (9.9)	8 (8.8)	0

Barriers towards guideline implementation

The most commonly identified barrier toward implementation of the KNH guideline was lack of medical resources as reported by 56.1% of the respondents. The doctors reported that the guideline is accessible (67.1%), does not reduce their autonomy (61.5%) or limit treatment options (53.9%). Thirty one point nine percent however, felt that the KNH guideline is complicated and difficult to find information.

Table 6: Barriers towards guideline implementation

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Hard to implement in daily practice due to lack of medical resources	19 (20.9)	32 (35.2)	13 (14.3)	24 (26.4)	3 (3.3)
Hard to implement in daily practice due to a lack of resources for patients	17 (18.7)	28 (30.8)	14 (15.4)	29 (31.9)	3 (3.3)
There is no time to search for information	3 (3.3)	16 (17.6)	12 (13.2)	45 (49.5)	15 (16.5)
Treatment guidelines are not accessible	4 (4.4)	15 (16.5)	11 (12.1)	42 (46.2)	19 (20.9)
Too complicated and it is difficult to find the information	5 (5.5)	24 (26.4)	20 (22.0)	35 (38.5)	7 (7.7)
Treatment guidelines reduce doctors' autonomy	3 (3.3)	16 (17.6)	16 (17.6)	49 (53.8)	7 (7.7)
Treatment guidelines limit treatment options	2 (2.2)	23 (25.3)	17 (18.7)	43 (47.3)	6 (6.6)
Treatment guidelines limit flexibility and individual approach	1 (1.1)	2 (2.2)	2 (2.2)	40 (44.0)	46 (50.5)
There is no need for treatment guidelines as treatment routines exist	0	1 (1.1)	12 (13.2)	42 (46.2)	36 (39.6)

Responses to the open ended question

The survey utilized an open ended question asking the respondents to list their top 3 barriers to the utilization of the KNH guideline in treating CAP. The respondents cited unavailability of drugs 48 (52.7%), inaccessibility of the guideline (45.1%) and lack of investigations or delay of results 31 (34.1%) as the most common barriers. Time constrains 8 (8.8%) and exposure to antibiotics prior to admission 7 (7.7%) were also listed among the barriers, albeit in a small percentage of respondents as shown in Table 7.

Table 7: Summary of top 3 barriers (n=91)

Barriers	Frequency (%)
Inaccessibility of guidelines	41 (45.1)
Unavailability of drugs	48 (52.7)
Lack or delay of investigative results	31 (34.1)
Conformity to routine treatment regime	10 (11.0)
Cost to the patients	12 (13.2)
Time constraints	8 (8.8)
Exposure to antibiotics prior to admission	7 (7.7)

Discussion

This audit was looking at the different aspects of adherence to the KNH guide to microbial therapy 2018 in the management of in-patient community acquired pneumonia. The quality indicators studied were: appropriate empiric antibiotic choice taking into account the dose, route, frequency of antibiotic administration, time to change to oral treatment, total duration of antibiotics and the timely collection of microbiological samples. Additionally, the attitude and barriers towards the KNH guideline were investigated.

Overall, adherence to the 7 quality indicators was poor at 35.5%, with only the route, dose and frequency of antibiotic administration achieving good adherence (96.3%).

The KNH guideline recommends the use of amoxicillin-clavulanic acid, cefuroxime or ceftriaxone with a macrolide in admitted patients with community acquired pneumonia. The main reason for discordance in the empiric antibiotic choice was the prescription of ceftriaxone or augmentin as monotherapy. Multiple studies are in favor of combination therapy with macrolides for atypical cover as this regimen has been shown to reduce both length of hospital stay and 30 day mortality of patients admitted with CAP (8). The use of monotherapy may also contribute to the increasing antimicrobial resistance in Africa, with the resistance of *Streptococcus pneumoniae* to penicillin reported at 26.7% by 2017(9).

The adherence to the recommended antibiotic in this audit (48%) was higher than the audit done in Garissa County Hospital in 2014 that revealed adherence of 27.7% to the National Paediatric protocols (5) . This may be attributed to various factors including: the greater availability of antibiotics in a referral facility like KNH compared to a remote county hospital like Garissa, the adult versus paediatric population, retrospective versus prospective study design as well as the extensive continuous medical education on antibiotic stewardship.

Globally, there is a lot of variation in the level of adherence to empiric antibiotics. Our adherence data are in agreement with other studies that investigated compliance to treatment guidelines in patients admitted with pneumonia and reported adherence rates of between 41% and 77% (10). The level of adherence is even lower in African counties with Sudan reporting up to 82% non-adherence to paediatric guidelines (11) while South Africa reported as low as 8% (12).

The study also looked at the full prescribing criteria, and it showed that the route, dose and frequency was appropriate in majority of the patients (96.4%). However, review of intravenous antibiotics at 48 hours with the aim to change to oral treatment was only done for 9 (3.6%) patients. In this audit study, only 10% of the patients received oral antibiotics during their course of hospital admission, with the median time to initiation of oral antibiotics being 6 days. This is despite the fact that the 48-hour review of antimicrobials with the aim to switch to oral treatment is a critical component of antimicrobial stewardship programs to improve judicious antibiotic use and has been shown to reduce both length of hospital stay and health care related costs (13). A study done in Venezuela as part of the CAPO study revealed that switch to oral antibiotics at 48 hours was poorly adhered to at 15% (14). Globally, the recommendation for switch to oral antibiotics is poorly adhered to and some of the reasons that have been cited include: lack of poorly stated recommendations in the clinical practice guidelines, the clinician's perception regarding patient outcome with oral antibiotics and the absence of protocols to monitor switch criteria during daily ward rounds.

The average total duration of antibiotics was 6.5 days (± 1.7) which is above the recommended duration of 5 days. This is likely as a result of the delay in early initiation of oral antibiotics as well as the patients' comorbidities. Studies done globally have shown that patients with CAP are treated with a 10 – 14 day course of antibiotics, inclusive of 6 to 8 days of oral antibiotics (15). Research done has shown that withdrawal of antibiotics after 5 days is not inferior to previously recommended fixed timelines in terms of clinical success (9). Additionally, studies have found that needless prolongation of the duration of antibiotic administration is likely to select for antibiotic resistance (16). With multiple studies favoring short courses of antibiotics for patients with CAP, the thinking is now shifting to "less is more" with regard to in-patient care of pneumonia (17).

In terms of microbiological samples, the KNH guideline recommends that both blood cultures and sputum samples for gene Xpert are taken to rule out tuberculosis due to the high prevalence of mycobacterium tuberculosis in Kenya. Blood cultures were collected for 48 (19.2%) of the patients, while sputum was collected for 96 (38.4%) of the study population. The fact that over one third of the patients with CAP 118 (32.4%) presented with a dry cough contributed to the reduced number of sputum samples collected. There was no documentation of any attempt at sputum induction in the sample population. Studies have shown that sputum induction is safe and increases the yield on sputum specimens by about two fold among HIV infected patients and admitted patients (18). Despite over half of the patients having at least either blood or sputum collected, none of these samples were collected prior to the initiation of empiric antibiotics as recommended by the KNH guideline. A similar finding was reported in a study done between 2013 to 2016 in KNH that found that the median duration of hospital stay before specimen collection for cultures was 4 days (19). The turnaround for culture results was noted to be high with results only (43.8%) and (55.2%) blood culture and sputum gene Xpert respectively available in the file by day 7. This was despite the fact that on average, blood culture results are out in about 48 hours while sputum gene Xpert test takes less than 2 hours. Factors that could explain the delay in getting the results may include a lack of initiative among the staff to follow up results, inertia from many negative blood cultures, large numbers of samples collected in a day in the referral facility leading to a back log of unattended to samples, and logistical factors like lack of reagents to run the tests.

This study also explored the factors affecting the utilization of the KNH guideline, specifically focusing on the attitude and perceived barriers among the doctors who frequently prescribe the antibiotics for patients admitted with CAP in the KNH medical wards. The participants, internal medicine residents (80.2%), medical officers in out-patient (18.7%) and medical officer interns (1.1%) reported that they routinely prescribe antibiotics for pneumonia patients, with 54.9% prescribing antibiotics at least once a day.

Overall, the attitude towards the KNH guideline is good. This was evidenced by the fact that, 89.1% felt that the KNH guideline is evidence based, a good tool for choosing initial treatment (84%) and it is convenient to use and easy to find information (84%). This is similar to what has been found in other studies, as most studies assessing clinical practice guidelines have reported a good attitude among the users (20). The reasons for the positive attitude include: the portability of the KNH guideline, the fact that it captures the commonly encountered infections not forgetting that each infection is summarized in one page for ease of reference.

In line with the overall good attitude towards the KNH guideline, it was noted that external, rather than individual barriers were cited as the main barriers to utilization of the KNH guideline. The top 3 barriers identified were: unavailability of drugs (52.7%), lack of guideline accessibility (45.1%) and lack or delay of investigations (34.1%). Other factors that featured prominently as hindrances to guideline utilization were: conformity to routine (11%), time constraints (8.8%) and previous use of antibiotics (7.7%). The

perceived barriers in our setting were different from those studied in the developed countries as patient and physician factors featured more prominently compared to KNH where external and guideline factors were cited more.

In one study done in the U.S.A, the doctor was likely to disregard the guideline if the patient was severely ill with multi-lobar disease or multiple comorbidities, male, age >65 years. Physician factors that played a key role in non-adherence include: the presence of the primary physician at the emergency department at the time of admission and the physicians level of experience. In the study done on adherence to the national paediatric protocols in Garissa County Hospital, it was reported that the presence of comorbidities did not affect adherence to the guidelines while the disease severity led to greater adherence (9).

The choice of empiric antibiotic and time to de-escalation may have been affected by other factors other than non-adherence to the KNH guideline. These include: type of antibiotic available in the hospital pharmacy, the available investigations and their turn-around time as well as comorbidities and exposure to antibiotics prior to hospital admission.

Poor documentation had direct impact on the information abstracted from patients' files and may have affected the quality of data obtained as anything not documented was considered not done.

The Hawthorne effect (observer bias) was likely to have increased the rate of compliance to the empiric antimicrobial guideline and therefore positively skewed the results.

Due to the large number of patients in KNH medical wards who are elderly and have comorbidities, it was not possible to exclude all of them as required under Category 1 of the guideline, we included only patients with one comorbidity and those over 80 years were excluded from the study.

Conclusion

This study has demonstrated that the level of adherence to the seven quality indicators from the KNH guide is poor with the overall adherence being 35.5%. The recommendation least adhered to was collection of microbiological samples before initiation of empiric antibiotics. The attitude towards the KNH guideline among the doctors was good. The most commonly identified barriers to utilization of the guideline were: unavailability of drugs, inaccessibility of the guideline and lack of or delay of results.

Acknowledgements

The principal author (PNR) would like to appreciate the supervisors and the entire Department of Clinical Medicine and Therapeutics, University of Nairobi, all the staff at Kenyatta National Hospital general medical wards, colleagues and all the medical officers who took part in this study, the statistician Mr. Mutai and all the patients who allowed us to use their medical records.

Disclosure: The authors report no conflict of interest in this work.

References

1. Borgatta B, Rello J. How to approach and treat VAP in ICU patients. *BMC Infect Dis.* 2014; **14**(1):4–7.
2. Dambrava PG, Torres A, Vallès X, Mensa J, Marcos MA, Peñarroja G, *et al*. Adherence to guidelines' empirical antibiotic recommendations and community-acquired pneumonia outcome. *Eur Respir J.* 2008; **32**(4):892–901.
3. Defining community acquired pneumonia severity on presentation to hospital: An international derivation and validation study. *Thorax*. 2003; **58**(5):377–382.
4. Silveira CD, Ferreira CS, Correa RD. Adherence to guidelines and its impact on outcomes in patients hospitalized with community-acquired pneumonia at a university hospital. *J Bras Pneumol.* 2012; **38**(2):148–157.
5. Health C. Adherence to the National Guidelines for management of children with pneumonia at Garissa Provisional General Hospital.
6. Triantafyllidis C, Kapordelis V, Papaetis GS, Orphanidou D, Apostolidou M, Nikolopoulos I, *et al.* Guidelines adherence for patients with community acquired pneumonia in a Greek Hospital. *Eur Rev Med Pharmacol Sci*. 2012; **16**(1):1–9.
7. Luna HIR, Pankey G. The utility of blood culture in patients with community-acquired pneumonia. 2001; **3**(2):85–93.
8. Caballero J, Rello J. Combination antibiotic therapy for community- acquired pneumonia. *Ann Intensive Care* [Internet]. 2011; **1**(1):48. Available from: http://www.annalsofintensivecare.com/content/1/1/48.
9. Tadesse BT, Ashley EA, Ongarello S, Havumaki J, Wijegoonewardena M, González IJ, *et al*. Antimicrobial resistance in Africa: A systematic review. *BMC Infect Dis.* 2017; **17**(1):1–17.
10. Adler NR, Weber HM, Gunadasa I, Hughes AJ, Friedman ND. Clinical medicine insights. *Circ Resp Pulmonary Med*. 2014;17–20.
11. Salih KEM, Bilal JA, Alfadeel MA, Hamid Y, Eldouch W, Elsammani E, *et al.* Poor adherence to the World Health Organization guidelines of treatment of severe pneumonia in children at Khartoum, Sudan. 2014;1–4.

12. K. N, U.G. L. Poor adherence to South African guidelines for the management of community-acquired pneumonia. *South Afr Med J* [Internet]. 2007; **97**(8):601–603. Available from: http://www.embase.com/search/results?subaction = viewrecord&from = export&id = L352645813%5Cnhttp://www.samj.org.za / index.php / samj / article / view / 650 / 147% 5 Cnhttp: // sfx.ub.rug.nl: 9003 / sfx_local ?sid = EMBASE & issn = 02569574&id = doi:&atitle = Poor + adherence + to + South + Africa.
13. Jenkins C, Pharmacy AC, Health D. Downloaded from https: // academic.oup.com / ofid / article-abstract/4/suppl_1/S272/4294658 by guest on 18 April 2020 S272 • OFID 2017 : 4 (Suppl 1) • Poster Abstracts Poster Abstracts • OFID 2017: 4 (Suppl 1) • S273. 2017;4(Suppl 1):272–273.
14. Levy G, Perez M, Rodríguez B, Voth H, Perez J, Gnoni M, *et al*. Adherence with national guidelines in hospitalized patients with community-acquired pneumonia : Results from the CAPO study in Venezuela. 2015; **51**(4):163–168.
15. Aliberti S, Blasi F, Zanaboni AM, Peyrani P, Tarsia P, Gaito S, *et al.* Study population. 2010; **36**(1):128–134.
16. Arch M, Dis C, Med R. A CAP on antibiotic duration. (2):3–5.
17. Pinzone MR, Cacopardo B, Abbo L, Nunnari G. Duration of antimicrobial therapy in community acquired pneumonia : less is more. 2014; 2014.
18. Peter JG, Theron G, Singh N, Singh A, Dheda K, Unit I, *et al*. HHS public access. 2017; **43**(1):185–194.
19. Wangai FK, Masika MM, Maritim MC, Seaton RA. Methicillin-resistant Staphylococcus aureus (MRSA) in East Africa: red alert or red herring ? 2019;1–10.
20. Lugtenberg M, Burgers JS, Besters CF, Han D, Westert GP. Perceived barriers to guideline adherence: A survey among general practitioners. *BMC Fam Pract*. [Internet]. 2011; **12**(1):98. Available from: http://www.biomedcentral.com/1471-2296/12/98.