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General Practitioners' Awareness, Attitudes, and Practices Regarding Antibiotic Resistance and Antimicrobial Management Programs

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Abstract: To evaluate healthcare providers' Knowledge, Attitudes, and Practices (KAP) regarding antimicrobials and antimicrobial resistance (AMR) within a Chinese hospital setting, to direct the creation of customized learning initiatives, a cross-sectional study was conducted from June 2021 to July 2022 at the People's Hospital of Simao District, Yunnan Province, China. It involved 31 healthcare professionals who completed a 15-question survey on antibiotic knowledge, attitudes, and practices. The data were analyzed using the Cronbach's alpha coefficient and Pearson chi-squared test. With a 96.77% response rate, the study revealed strong knowledge in certain aspects of antibiotic use but identified gaps in critical AMR areas. Attitudes towards antibiotic usage were generally positive, and clinical practices indicated a sound understanding of antibiotic limitations and applications among participants. The study highlighted a good overall understanding of antibiotic resistance, but also revealed crucial gaps in AMR knowledge and practices. These findings emphasize the need for comprehensive AMR education programs in healthcare settings, especially in academic hospital environments. Future research should focus on regular knowledge assessments to address these gaps effectively.

1. Introduction

The advent of antimicrobials in the previous century marked a pivotal advancement in medical practices. Augmented by enhanced sanitation measures and structured immunization programs across various nations, these developments significantly curtailed infection-related mortalities. However, the indiscriminate utilization of antibiotics has precipitated formidable challenges[1]. It is crucial to acknowledge that the surge in the development of novel antimicrobial agents plateaued by 2003, leaving the medical field grappling with resistant microbial strains unresponsive to existing antimicrobials[2]. The pervasive prescription of antibiotics has accelerated the emergence of drug-resistant pathogens[3]. Reports from the World Health Organization (WHO) indicate a growing prevalence of infections unresponsive to treatment due to antimicrobial resistance (AMR)[4]. Annually, AMR-associated mortalities in Europe are estimated at 25,000, incurring a financial burden

of approximately 1.5 billion Euros[5]， In China, the societal economic burden caused by antimicrobial resistance was estimated at $77 billion in 2017, accounting for 0.37% of the gross domestic product, with $57 billion associated with multi-drug resistance [6].This global health and economic crisis, stemming from escalating AMR rates, necessitates urgent attention.

Understanding the activity spectrum of antimicrobials and their resistance patterns is vital for devising effective antibiotic usage programs. The deceleration in new antibiotic introduction, coupled with the rise of highly resistant microorganisms over the past three decades, underscores the imperative need for strategic antibiotic application methodologies. Antimicrobial Stewardship Programs (ASPs) epitomize this strategy[7]. These programs, demonstrating economic benefits in hospital settings, balance patient outcomes with antibiotic costs. ASPs focus on optimizing antibiotic selection, dosage, and treatment duration to enhance patient outcomes while reducing toxicities and expenses[8]. Effective antibiotic selection hinges on clinicians' comprehensive understanding of pharmacological and microbial characteristics. Thus, enhancing knowledge and educational initiatives forms the cornerstone of ASPs. Despite challenges, educational interventions have shown promising results in altering physicians' practices[9]. Knowledge, Attitude, and Practice (KAP) studies are instrumental in evaluating specific populations' understanding and approach towards particular issues[10]. These studies can identify knowledge gaps and inform targeted educational interventions. AMR poses a significant threat globally, especially in low to middle income countries with limited resources to combat resistance. This cross-sectional study aims to thoroughly assess healthcare providers' KAP towards antimicrobials to guide the development of tailored educational programs.

2. Materials and Methods

2.1 Study Population

This study was carried out from June 2021 to July 2022 in the Department of General Practice at People's Hospital of Simao District, Pu'er City, Yunnan Province, China. The participants included all prescribing physicians (a total of 5 physicians) and nurses (a total of 8 nurses) from the Department of General Practice, as well as 6 physicians and 12 nurses from the Emergency Department; a total of 11 physicians and 20 nurses.

Inclusion criteria were Physicians and nurses who have been working in the department for more than 3 months. Exclusion criteria included those employed for less than 3 months, physicians without prescribing rights, and Physicians or nurses who were in rotation or internship.

2.2 Study Design

A prospective cross-sectional study was conducted using an anonymous self-administered questionnaire to assess the Knowledge, Attitude, and Practice (KAP) of the healthcare staff. The questionnaire comprised multiple-choice questions derived from relevant previously published articles, revised and amended as necessary. Initially, 20 questions were chosen to evaluate their validity and reliability. Each question was assessed for simplicity, clarity, and understandability by content experts using the Content Validity Index (CVI). Based on this assessment, 5 questions were excluded due to complexity, and 1 question was simplified and modified for better comprehension. The final questionnaire included 15 questions, with responses scored on a Likert scale ranging from "strongly agree" to "strongly disagree". Responses of "partly agree" and "very agree" were considered positive, while "partly disagree" and "very disagree" were considered negative responses to the corresponding questions.

2.3 Statistical Analysis

The internal consistency, or reliability, of the questionnaire was assessed using the Cronbach's alpha coefficient, with a value above 0.7 indicating reliability. Upon collection and completeness verification of the data, all data were systematically organized and categorized based on the educational background of the participants. Statistical analyses were conducted using R software version 4.3. Results were compared against standard benchmarks and presented using tables, charts, and graphs. Differences among participants' professions and educational levels (physicians or non-physicians) were examined using the Pearson chi-squared test.

2.3.1 Responses were categorized as follows:

(1)Knowledge section:
①Good knowledge was defined as having over 65% affirmative responses to the topic.
②Poor knowledge was considered when unanimous responses were below 65%.
(2)Attitude section:
①A positive attitude was identified as more than 75% agreement on the issue.
②A negative attitude was indicated by less than 75% unanimous responses on the topic.
(3)Practice section:
①More than 70% unanimous positive responses were considered as good practice.
②Less than 70% positive responses were categorized as poor practice[11].

3. Result

A total of 31 questionnaires were distributed, with 30 completed and returned, yielding an overall retrieval rate of 96.77%.Survey sections 1-5 assessed antibiotic knowledge, 6-10 gauged attitudes toward antibiotic usage, and 11-15 evaluated clinical antibiotic practices. Participants showed a strong understanding in areas covered by questions 1, 2, and 5. However, questions 3 and 4 revealed gaps in essential AMR knowledge. Attitudes were positive across questions 6 to 9, with a consensus exceeding 75%(Figure 1). Question 10, however, reflected a less affirmative attitude, with no significant disparity between physicians and nurses($p>0.05$) (Table 1). In practice, the preponderance of participants disagreed with the statement that patient care would suffer from antibiotic use limitation, indicating sound clinical practice. Both physicians and nurses showed equivalent proficiency in antibiotic practice, as demonstrated by the lack of significant variance in their responses($p>0.05$).

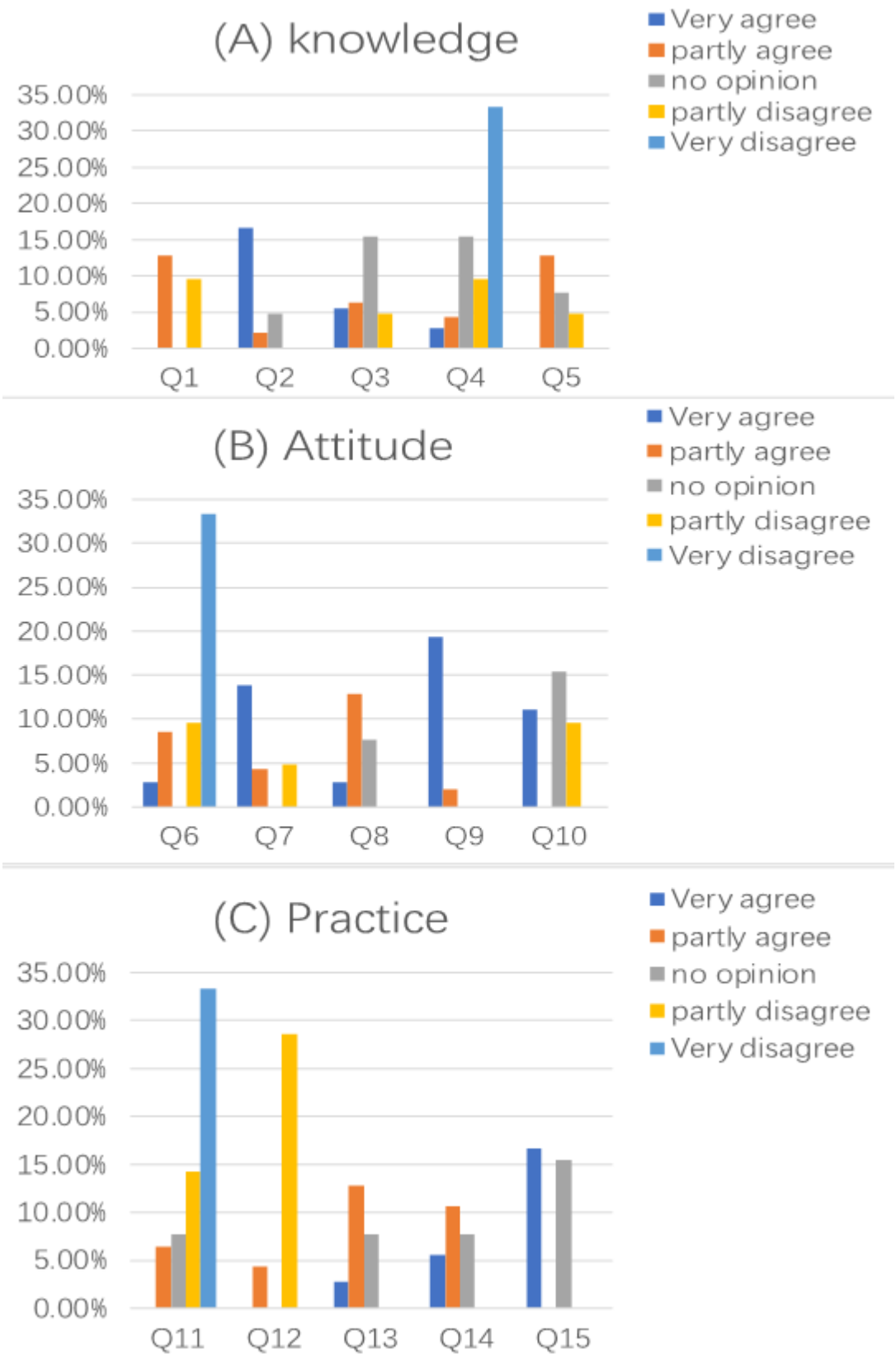

Figure l: Distribution of responses tot the study subjects on antibiotic knowledge, attitudes, and clinical practices (A: Antibiotic Knowledge, B: Antibiotic Attitudes, C: Antibiotic Practices)

Table 1: Comparative Analysis of Questionnaire Responses Between Physicians and Nurses (n=31)

Questions	occupation	Very agree(%)	partly agree (%)	no opinion (%)	partly disagree (%)	Very disagree (%)	*p*
Q1:Newer, costlier antibiotics typically exhibit better clinical outcomes.	doctor	15.0	75.0	0	0	0	0.17
	nurse	0	33.3	0	66.7	0	
Q2:Bacterial culture and susceptibility testing are mandatory before initiating antibiotic treatment.	doctor	60.0	20.0	0	20	0	0.357
	nurse	75	15	0	0	0	
Q3:Antibiotic-resistant microorganisms can potentially regain sensitivity	doctor	20.0	40.0	20.0	20.0	0	0.25
	nurse	33.3	33.3	33.4	0	0	
Q4:Combination antibiotic therapy may prevent the emergence of antimicrobial resistance	doctor	0	33.3	16.7	33.3	16.7	0.107
	nurse	50	25	25	0	0	
Q5:Pharmacists may dispense OTC antibiotics for minor infections without a prescription	doctor	0	83.3	16.7	0	0	0.214
	nurse	0	50	25	25	0	
Q6:Antibiotic cost should be considered before prescribing	doctor	0	60.0	0	40.0	0	0.357
	nurse	33.3	33.3	0	0	33.4	
Q7:Poor hand hygiene in clinical settings can induce antimicrobial drug resistance	doctor	60.0	20.0	0	20.0	0	0.214
	nurse	66.7	33.3	0	0	0	
Q8:Development of new antibiotics can keep pace with current resistance trends	doctor	0	83.3	16.7	0	0	0.375
	nurse	50	50	0	0	0	
Q9:Understanding the correct use of antibiotics can mitigate antimicrobial resistance (AMR)	doctor	100	0	0	0	0	0.286
	nurse	66.7	33.3	0	0	0	
Q10:Local antibiotic guidelines may offer more relevance than global directives for local antibiotic use	doctor	60.0	0	20.0	20.0	0	0.214
	nurse	33.3	0	33.3	33.4	0	
Q11:Restricting antibiotic usage could compromise quality patient care	doctor	0	20.0	20.0	60.0	0	0.357
	nurse	0	66.7	0	0	33.3	
Q12:Broad-spectrum antibiotics should be preferred despite the efficacy of narrow-spectrum agents	doctor	0	40.0	0	60.0	0	0.464
	nurse	0	0	0	100	0	
Q13:I am consistently confident in my chosen antibiotic combination therapy	doctor	20.0	60.0	20.0	0	0	0.429
	nurse	0	100	0	0	0	
Q14:Certain antibiotic approval processes limit my antibiotic choices, necessitating alternatives	doctor	33.3	50.0	16.7	0	0	0.536
	nurse	0	100	0	0	0	
Q15:Intravenous antibiotics should be switched to oral forms after 3 days if clinically appropriate	doctor	80.0	0	20.0	0	0	0.067
	nurse	66.7	0	33.3	0	0	

Note: Using Fisher's exact test.

4. Conclusion

Antimicrobial resistance (AMR), a significant concern both nationally and globally, imposes substantial health and economic burdens. Comprehensive knowledge of antibiotic spectra and their resistance patterns is critical for healthcare professionals to use antibiotics effectively and reduce AMR. Low- and middle-income countries, with limited antibiotic literacy, large populations, and suboptimal infection control, bear a heavier burden. Education in antibiotic use and resistance can globally decelerate this issue. Despite educational initiatives in healthcare systems, gaps in knowledge and improper practices persist. Research targeting healthcare providers and physicians, the main prescribers of antimicrobials, can facilitate a better understanding of knowledge deficits. Therefore, in this cross-sectional study, we assessed healthcare workers' Knowledge, Attitude, and Practice (KAP) regarding antibiotic use and general Antimicrobial Stewardship Programs (ASPs).

In studies like Garcia et al[12], AMR is viewed as a more significant threat in community medicine than in hospitals. The demand for antibiotics in communities is a primary concern. In socio-economically disadvantaged hospital settings, the urgent demand for antibiotics is reported but less prevalent than in community settings. In our study, 25% disagreed with pharmacists dispensing non-prescription antibiotics in the community, and 51.7% were unsure (Table 1). We attribute the high community demand for antibiotics to both the general public and community physicians' limited AMR knowledge, emphasizing the urgency and necessity of antibiotic education. Over half of the healthcare workers in our study agreed on considering the cost of antibiotics before prescribing, contrasting Tegagn et al[11].'s study, where half didn't deem cost consideration necessary.

In our research, all healthcare workers believed that poor hand hygiene leads to AMR, contrasting with Pulcini et al.'s French study, where less than half concurred, considering hand hygiene less significant in resistance development.

As mentioned earlier, all physicians and 66.7% of nurses in our study completely agreed that enhancing knowledge about antimicrobial use can help prevent AMR, in line with similar studies validating the effectiveness of training in this domain. Srinivasan et al[13].'s study also observed that participants who recognized the significance of AMR were more eager to learn and had greater insight into the issue, confirming the necessity of ongoing education for proper antibiotic use and further resistance prevention. Cotta et al.'s Australian study concurred that improving antimicrobial prescriptions could help reduce resistance, with half of the physicians willing to participate in ASPs.

In our study, over half (60%) of the physicians agreed that local antibiotic guidelines are more beneficial for local antibiotic use, while only 33.3% of nurses concurred; over half (53.3%) of healthcare workers were unsure.

Regarding the preference for narrow-spectrum over broad-spectrum antibiotics (Q12), 40% of physicians agreed to prioritize broad-spectrum antibiotics, while all nurses disagreed with using broad-spectrum antibiotics.

In our study, 20% of physicians were completely confident in their antibiotic use, and 60% were somewhat confident. This reflects the effectiveness of substantial hospital antibiotic training and learning investments in our country. In Srinivasan et al[12].'s study, only 21% of participants were completely confident in their antibiotic choice for ICU patients, and 25% were confident in their antibiotic selection for non-ICU settings. Another study reported that 75% of its participants were confident in their antibiotic choice, with fewer (7.5%) very sure of their choice. In a similar study conducted in Africa, most respondents (74.8%) felt somewhat confident in their antibiotic selection, with fewer (16.8%) very confident. Another study indicated that resident physicians were less confident in their antibiotic selection than their attending physicians[11,12].

Previous studies have varied in perspectives on considering antibiotic approval protocols as a limiting factor for prescribing physicians. In our study, 83.3% of physicians felt restricted in their use

of antibiotics due to the need for approval, with 33.3% very agree. Similar findings were reported in a related study in Australia[13],where limiting antibiotic prescription through an approval process was the least approved intervention.

As in our study, Tegagn[11] and Dena Firouzabadi[14] reported that over half of the researchers believed that intravenous antibiotics must be switched to oral if patients' medical conditions improve.

In our study, the differences in responses between physicians and nurses were evaluated. In the knowledge and attitude sections, there were no statistically significant differences (P>0.05). However, in the practice section, question 15 is also no statistical significance (P=0.067), with 20% of physicians and 33.3% of nurses indicating they were unsure. This was not surprising, as some respondents in our study were emergency department physicians who more frequently handle critical and emergency cases.

In summary, our study results indicate a good overall understanding of antibiotic resistance at our hospital; however, there are evident knowledge gaps in several areas: ①the combined use of multiple antibiotics can somewhat reduce antimicrobial resistance (AMR), ② proper implementation of Antimicrobial Stewardship Programs (ASPs) can resensitize resistant microorganisms, ③ local antimicrobial spectrums are more suitable for local antibiotic selection (related studies in China are rare and not widely promoted for application). These findings underscore the need for more in-depth educational programs in the AMR field at our hospital. Considering that our study results come from a teaching comprehensive hospital, the outcomes are more closely aligned with clinical reality in non-academic health research institutions. Implementing ASPs, including the formulation of local antimicrobial guidelines[15], continuous education, and feedback to medical personnel, is essential to improve outcomes in combating antibiotic resistance.

Future research suggestions include conducting regular and long-term knowledge assessments following education. By conducting such studies, knowledge gaps leading to resistance in antibiotic use can be identified, and educational programs can be directed towards each gap area.

5. Limitation

This study has certain limitations, including a small sample size and potential selection bias due to the nature of KAP studies, as well as voluntary participation in responding to questions. A limitation of KAP studies is that participants may provide socially desirable answers rather than their actual beliefs. Studies conducted in teaching hospitals may be more prone to this limitation; however, we assured participants that their responses were confidential and anonymous. Since this study was conducted in a teaching hospital, it may not be possible to generalize our findings to all hospitals and healthcare systems; therefore, the results may not be fully applicable to non-teaching hospitals.

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