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Original Article

Antibiotic Prescription in Some Healthcare Facilities in Tripoli, Libya

Emhemed A. Gedara[1], Ahmed Ibrahim Elbousify[2], Hend Mohamed Farhat[3], Arij M. Mousa[3], Alla Esam Abdula[3], Maram Abd Alnasser Laklouk[3], Fatima Ahmed Alsharif[3], Ibrahim Sanousi Elarabi[3], Allaaeddin A. El Salabi[3*]

[1] *Department of Microbiology, Faculty of Veterinary Sciences, University of Al-Jifara, Al-Jifara, Libya*
[2] *Department of Paediatrics, Faculty of Medicine, University of Tripoli, Tripoli, Libya*
[3] *Department of Public Health, Faculty of Medical Technology, University of Tripoli, Tripoli, Libya*

Corresponding author, Allaaeddin A. El Salabi . Email: a.el_salabi@uot.edu.ly

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ABSTRACT

Background: Inappropriate antibiotic prescribing in healthcare settings contributes to antimicrobial resistance (AMR) and healthcare-associated infections, and understanding current practices among healthcare professionals is essential for developing effective stewardship strategies. This study aimed to assess antibiotic prescribing practices, knowledge of AMR, infection control measures, and the use of laboratory tests among healthcare personnel in four of the largest hospitals in Tripoli, Libya **Methods:** A cross-sectional descriptive study was conducted from 20 June to 20 August 2025 among 200 healthcare professionals (50 per hospital) at Tripoli Children Hospital, Tripoli University Hospital, Abu Salim Trauma Hospital, and Tripoli Central Hospital. Data were collected with a structured self-administered questionnaire and analyzed descriptively using IBM SPSS version 26. **Results:** Practices varied between hospitals. Antibiotics were reported to be prescribed against a specific bacterium by 72% of respondents at Abu Salim Trauma Hospital, 66% at Tripoli Children Hospital, 62% at Tripoli University Hospital, and 32% at Tripoli Central Hospital. Tripoli Central Hospital reported the most conservative use of carbapenems, with 86% describing them as a last-resort option. A hospital antibiotic policy was reported by 94% of respondents at Tripoli University Hospital, 90% at Tripoli Central Hospital, and 64% at Abu Salim Trauma Hospital. For methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin was the antibiotic most often reported in three hospitals (56.8% to 58.0% of responses), whereas colistin was most often reported at Tripoli Children Hospital (62.8%). No inferential tests were performed, so between-hospital differences are descriptive. **Conclusion:** The findings indicate a need for standardized antibiotic stewardship programs, wider laboratory-guided prescribing, strict infection control, and consistent MRSA management protocols across hospitals to reduce antimicrobial resistance.

Keywords: Antibiotic prescribing; Antimicrobial resistance; Hospital-acquired infections; Carbapenems; Methicillin-resistant Sta.

Introduction

Antibiotics are used to treat bacterial infections; they are ineffective against viral infections, which makes accurate diagnosis before prescription essential. They act by targeting specific bacterial functions and are selected according to their spectrum of activity.[1] Antibiotics are commonly grouped as broad-spectrum agents, such as amoxicillin and gentamicin, and narrow-spectrum agents, such as penicillin. The World Health Organization (WHO) AWaRe classification, introduced with its 2017 Essential Medicines List, divides antibiotics into Access, Watch, and Reserve groups and encourages countries to keep at least 60% of total antibiotic consumption within the Access group.[2]

Misuse of antibiotics, including overuse, easy availability without prescription, and inappropriate dosing, drives bacterial resistance and contributes to global morbidity and mortality, including an estimated 50,000 neonatal deaths annually in some regions.[3] Resistance arises through enzymatic degradation of antibiotics, target mutations, altered cell permeability, and efflux, and the production of β-lactamases promotes the spread of multidrug-resistant (MDR) strains.[4] Healthcare-associated infections (HAIs), also called nosocomial infections, develop typically 48 hours or more after admission and increase morbidity, mortality, and costs, so infection prevention and control programs are essential.[5]

The ESKAPE pathogens (Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter species) are MDR bacteria that cause severe HAIs, particularly in intensive care units (ICUs),[6] through mechanisms that include β-lactamase and carbapenemase production, target-site mutations, efflux pumps, and biofilm formation.[7] In 2024, WHO updated its Bacterial Priority Pathogens List, grouping pathogens into critical, high, and medium priority according to their burden and resistance.[8] Resistant bacteria are also found in wastewater, pharmaceutical effluents, and agricultural settings; about 46% of bacteria isolated from such sources have been reported to be

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multidrug resistant, which supports a One Health approach.[9,10] The WHO and the European Centre for Disease Prevention and Control have called for antibiotic stewardship, stronger surveillance, and new therapeutic strategies.

Hospital-based studies illustrate the problem. In Ethiopia, 30.2% of 126 bacterial isolates from patients with HAIs were MDR, and 25% of Gram-negative isolates were carbapenem-resistant.[11] In Gaza, 66.9% of isolates from 1,317 samples were reported to be MDR.[12] In Libya, a one-year study in the surgical ICU of Abu Salim Trauma Hospital identified 79 device-associated infections among 363 patients, most often caused by K. pneumoniae, A. baumannii, and P. aeruginosa;[13] 86.7% of healthcare workers sampled in ICUs at Al-Zawia Medical Center had contaminated hands;[14] and a novel metallo-β-lactamase gene (blaTMB-1) was reported from Tripoli Central Hospital.[15] Studies of healthcare professionals in India[16] and sub-Saharan Africa[17] have linked prescribing behavior and knowledge of AMR to training, leadership support, diagnostic capacity, and hospital culture. In Saudi Arabia, 52.7% of clinicians surveyed were unaware of antimicrobial stewardship programs and only 10.9% had formal training.[18] Surveys among students in Libya have also found knowledge gaps about antibiotics and resistance.[19,20]

This study therefore aimed to assess antibiotic prescribing practices, knowledge of AMR, infection control measures, and laboratory test use among healthcare personnel in four large hospitals in Tripoli. It addressed four questions: what is the current knowledge of healthcare workers about antibiotics; whether they follow international prescribing guidelines; how the four hospitals differ in antibiotic use and prescribing; and how healthcare workers manage specific infections. The stated objectives were to analyze factors contributing to bacterial resistance, such as improper practices and misuse by doctors; to determine whether there is a knowledge gap in antibiotic prescription; and to determine whether a system for monitoring resistant infections is needed.

Materials and Methods

Study design, setting, and period

A cross-sectional descriptive study was conducted from 20 June to 20 August 2025 to capture current practices, knowledge, and perceptions about antibiotic use and resistance among healthcare personnel in four hospitals in Tripoli, Libya: Tripoli Children Hospital, Tripoli University Hospital, Abu Salim Trauma Hospital, and Tripoli Central Hospital.

Participants

The study included 200 healthcare professionals (doctors, nurses, and technicians), 50 from each hospital. Age and gender were not collected.

Data collection

Data were collected with a structured, self-administered questionnaire covering professional role, antibiotic prescribing practices, knowledge of antibiotic resistance, infection control measures, and laboratory test use (items are listed in Tables 1 to 5). All questionnaires were completed during the study period.

Statistical analysis

Data were entered into IBM SPSS version 26. Categorical variables were summarized as frequencies and percentages and are presented in tables by hospital. No inferential tests were applied.

Ethical considerations

Informed consent was obtained from all participants, and the confidentiality of responses was maintained

Results

Results are shown by hospital in Tables 1 to 5. Percentages are those reported by the authors. Cells marked † in the tables contain counts and percentages that do not agree (n/50) and are provisional until the authors check them against the SPSS output.

General prescribing practices and laboratory test use

Targeted prescribing, defined as prescribing for an identified bacterium, was reported most often at Abu Salim Trauma Hospital (72%), followed by Tripoli Children Hospital (66%) and Tripoli University Hospital (62%), and least often at Tripoli Central Hospital (32%, with 64% answering “No”) (Table 1). Prescribing without clear need was acknowledged by 14% to 18% of respondents in all hospitals. Most respondents at Tripoli Children and Tripoli University hospitals reported giving antibiotics for the longest duration (72% each), whereas 92% at Abu Salim Trauma Hospital reported adjusting the dose rather than the duration. Laboratory support varied: C-reactive protein testing and bacterial susceptibility testing were reported most often at Abu Salim Trauma Hospital (68% each), and nucleic acid amplification was reported by 88% at Tripoli Central Hospital compared with 18% at Abu Salim Trauma Hospital.

Table 1. General antibiotic prescribing practices and laboratory test use, by hospital (n = 50 per hospital)

Question	Tripoli Children Hospital	Tripoli University Hospital	Abu Salim Trauma Hospital	Tripoli Central Hospital
Antibiotic prescribed targeting specific bacteria?	Yes 33 (66%) No 1 (2%) Suspected 16 (32%)	Yes 31 (62%) No 11 (22%) Suspected 8 (16%)	Yes 36 (72%) No 3 (6%) Suspected 11 (22%)	Yes 16 (32%) No 32 (64%) Suspected 2 (4%)
Antibiotic given according to effectiveness (shortest / dose / longest)?	Shortest 7 (14%) Dose 7 (14%) Longest 36 (72%)	Shortest 12 (24%) Dose 2 (4%) Longest 36 (72%)	Shortest 2 (4%) Dose 46 (92%) Longest 2 (4%)	Shortest 4 (8%) Dose 27 (54%) Longest 19 (38%)

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Ever prescribed antibiotic to patient without clear need?	Not needed 3 (6%) No symptoms 4 (8%) Random 2 (4%) None 41 (82%)	Not needed 3 (6%) No symptoms 3 (6%) Random 1 (2%) None 43 (86%)	Not needed 3 (6%) No symptoms 4 (8%) Random 2 (4%) None 41 (82%)	Not needed 2 (4%) No symptoms 3 (6%) Random 3 (6%) None 42 (84%)
Antibiotics effective vs viral infections?	Yes 9 (18%) No 28 (56%) Sometimes 13 (26%)	Yes 1 (2%) No 33 (66%) Sometimes 16 (32%)	Yes 9 (18%) No 28 (56%) Sometimes 13 (26%)	Yes 1 (2%) No 30 (60%) Sometimes 19 (38%)
Prescribed for sinusitis?	Yes 22 (44%) No 17 (34%) Several 5 (10%) Few 6 (12%)	Yes 16 (36%) No 2 (4%) Several 14 (32%) Few 18 (36%) †	Yes 22 (44%) No 17 (34%) Several 5 (10%) Few 6 (12%)	Yes 23 (46%) No 9 (18%) Several 4 (8%) Few 14 (28%)
CRP testing when using antibiotics?	Yes 20 (44%) No 8 (16%) Sometimes 22 (40%) †	Yes 24 (48%) No 10 (20%) Sometimes 16 (32%)	Yes 34 (68%) No 3 (6%) Sometimes 13 (26%)	Yes 29 (58%) No 7 (14%) Sometimes 14 (28%)
Use immunoassay when using antibiotics?	Yes 20 (44%) No 8 (16%) Sometimes 22 (40%) †	Yes 19 (36%) No 13 (26%) Sometimes 18 (38%) †	Yes 21 (42%) No 19 (38%) Sometimes 10 (20%)	Yes 23 (46%) No 10 (20%) Sometimes 17 (34%)
Bacterial sensitivity testing?	Yes 28 (56%) No 8 (16%) Sometimes 14 (28%)	Yes 28 (56%) No 10 (20%) Sometimes 12 (24%)	Yes 34 (68%) No 5 (10%) Sometimes 11 (22%)	Yes 30 (60%) No 11 (22%) Sometimes 9 (18%)
GDH testing performed?	Yes 19 (44%) No 9 (18%) Sometimes 22 (38%) †	Yes 14 (28%) No 31 (62%) Sometimes 5 (10%)	Yes 6 (12%) No 29 (58%) Sometimes 15 (30%)	Yes 24 (48%) No 19 (38%) Sometimes 7 (14%)
A & B toxin testing?	Yes 24 (36%) No 8 (16%) Sometimes 18 (48%) †	Yes 17 (34%) No 27 (54%) Sometimes 6 (12%)	Yes 8 (16%) No 27 (54%) Sometimes 15 (30%)	Yes 23 (46%) No 20 (40%) Sometimes 7 (14%)
PCR for toxin genes?	Yes 23 (54%) No 27 (46%) †	Yes 18 (36%) No 32 (64%)	Yes 18 (36%) No 32 (64%)	Yes 21 (42%) No 29 (58%)
Nucleic acid amplification (DNA/RNA) testing?	Yes 24 (52%) No 26 (48%) †	Yes 24 (52%) No 26 (48%) †	Yes 9 (18%) No 41 (82%)	Yes 44 (88%) No 6 (12%)

Values are n (%). † Count and percentage do not agree (n/50), or categories do not sum to 100%; original values retained. In several Tripoli Children Hospital cells, the counts for "Yes" and "Sometimes" appear to be interchanged. The percentages for "Antibiotic prescribed targeting specific bacteria?" are for that item only.

Third-generation cephalosporins

Respondents at Tripoli Central (52%) and Tripoli University (48%) hospitals reported treating severe diarrhoea without antibiotics more often than those at Abu Salim Trauma Hospital (42%), where 64% reported using antibiotics for acute otitis media (Table 2). Recognition that third-generation cephalosporins are associated with increased resistance was highest at Tripoli Central (98%) and Tripoli University (96%) hospitals, and lowest at Tripoli Children Hospital (48%). Adherence to the correct duration was highest at Abu Salim Trauma Hospital (80%), and side effects were considered most often at Tripoli University Hospital (74%).

Table 2. Third-generation cephalosporin prescribing practices, by hospital (n = 50 per hospital)

Question	Tripoli Children Hospital	Tripoli University Hospital	Abu Salim Trauma Hospital	Tripoli Central Hospital
Treat severe diarrhea without antibiotics?	Yes 25 (36%) No 7 (14%) Sometimes 18 (50%) †	Yes 24 (48%) No 6 (12%) Sometimes 20 (40%)	Yes 21 (42%) No 13 (26%) Sometimes 16 (32%)	Yes 26 (52%) No 4 (8%) Sometimes 20 (40%)
Acute otitis media treated without antibiotics?	Yes 28 (42%) No 1 (2%) Sometimes 21 (56%) †	Yes 23 (46%) No 10 (20%) Sometimes 17 (34%)	Yes 11 (22%) No 32 (64%) Sometimes 7 (14%)	Yes 29 (58%) No 2 (4%) Sometimes 19 (38%)
Necessity to prescribe for pharyngitis?	Yes 24 (52%) No 26 (48%) †	Yes 24 (52%) No 26 (48%) †	Yes 29 (58%) No 21 (42%)	Yes 33 (66%) No 17 (34%)

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3rd-gen cephalosporins used for bacterial sepsis?	Yes 21 (42%) No 8 (16%) Sometimes 21 (42%)	Yes 30 (60%) No 5 (10%) Sometimes 15 (30%)	Yes 28 (56%) No 6 (12%) Sometimes 16 (32%)	Yes 30 (60%) No 3 (6%) Sometimes 17 (34%)
Side-effects considered when prescribing 3rd-gen?	Yes 19 (46%) No 8 (16%) Sometimes 23 (38%) †	Yes 37 (74%) No 3 (6%) Sometimes 10 (20%)	Yes 34 (68%) No 1 (2%) Sometimes 15 (30%)	Yes 34 (68%) No 3 (6%) Sometimes 13 (26%)
Patients restricted to correct duration (3rd-gen)?	Yes 16 (54%) No 7 (14%) Sometimes 27 (32%) †	Yes 35 (70%) No 3 (6%) Sometimes 12 (24%)	Yes 40 (80%) No 1 (2%) Sometimes 9 (18%)	Yes 34 (68%) No 7 (14%) Sometimes 9 (18%)
Has 3rd-gen caused hypersensitivity?	Yes 15 (30%) No 0 (0%) Few 35 (70%)	Yes 13 (26%) No 20 (40%) Few 17 (34%)	Yes 11 (22%) No 28 (56%) Few 11 (22%)	Yes 15 (30%) No 17 (34%) Few 18 (36%)
3rd-gen co-prescribed with other drugs?	Yes 16 (52%) No 8 (16%) Sometimes 26 (32%) †	Yes 21 (42%) No 12 (24%) Sometimes 17 (34%)	Yes 23 (46%) No 6 (12%) Sometimes 21 (42%)	Yes 23 (46%) No 14 (28%) Sometimes 13 (26%)
3rd-gen associated with increased resistance?	Yes 26 (48%) No 24 (52%) †	Yes 48 (96%) No 2 (4%)	Yes 37 (74%) No 13 (26%)	Yes 49 (98%) No 1 (2%)

Values are n (%). † Count and percentage do not agree; original values retained.

Carbapenem use and prescription

Tripoli Central Hospital showed the most conservative pattern: 86% described carbapenems as a last-resort option, 90% rated them as very effective for severe infections, and 98% supported reconsidering carbapenem strategies (Table 3). Abu Salim Trauma Hospital reported the highest routine prescribing for all bacterial infections (32%, versus 6% to 10% elsewhere). Respondents at Tripoli Children Hospital rated carbapenem effectiveness lowest (52% "very effective") and rarely reported prescribing before the severity of infection was known (2%, versus 32% to 54% elsewhere). Support for more research and development on antibiotic use ranged from 70% to 92%.

Table 3. Carbapenem use and prescription, by hospital (n = 50 per hospital)

Question	Tripoli Children Hospital	Tripoli University Hospital	Abu Salim Trauma Hospital	Tripoli Central Hospital
Are carbapenems prescribed for all bacterial infections?	Yes 3 (6%) No 47 (94%)	Yes 5 (10%) No 45 (90%)	Yes 16 (32%) No 34 (68%)	Yes 5 (10%) No 45 (90%)
Are carbapenems effective for severe infections?	Very 26 (52%) Mild 16 (32%) Not effective 8 (16%)	Very 41 (82%) Mild 9 (18%) Not effective 0 (0%)	Very 29 (58%) Mild 16 (32%) Not effective 5 (10%)	Very 45 (90%) Mild 3 (6%) Not effective 2 (4%)
Carbapenems as last-resort?	Yes 23 (46%) No 9 (18%) Sometimes 18 (36%)	Yes 26 (52%) No 8 (16%) Sometimes 16 (32%)	Yes 31 (62%) No 4 (8%) Sometimes 15 (30%)	Yes 43 (86%) No 2 (4%) Sometimes 5 (10%)
Are carbapenems life-saving?	Yes 27 (54%) No 23 (46%)	Yes 27 (46%) No 23 (54%) †	Yes 38 (76%) No 12 (24%)	Yes 49 (98%) No 1 (2%)
Carbapenems a clear threat for resistance?	Yes 26 (52%) No 9 (18%) Sometimes 15 (30%)	Yes 31 (62%) No 0 (0%) Sometimes 19 (38%)	Yes 27 (54%) No 4 (8%) Sometimes 19 (38%)	Yes 32 (64%) No 4 (8%) Sometimes 14 (28%)
Should strategies for carbapenems be reconsidered?	Yes 43 (86%) No 7 (14%)	Yes 48 (96%) No 2 (4%)	Yes 44 (88%) No 6 (12%)	Yes 49 (98%) No 1 (2%)
Is carbapenem failure due to poor prescribing?	Yes 16 (32%) No 7 (14%) Sometimes 27 (54%)	Yes 16 (32%) No 7 (14%) Sometimes 27 (54%)	Yes 26 (40%) No 4 (8%) Sometimes 20 (52%) †	Yes 23 (46%) No 2 (4%) Sometimes 25 (50%)
Hospital needs R&D on antibiotic use?	Yes 35 (70%) No 15 (30%)	Yes 46 (92%) No 4 (8%)	Yes 43 (86%) No 7 (14%)	Yes 46 (92%) No 4 (8%)
Carbapenems prescribed before knowing severity?	Yes 1 (2%) No 21 (42%)	Yes 26 (52%) No 8 (16%)	Yes 16 (32%) No 21 (42%)	Yes 27 (54%) No 3 (6%)

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	Sometimes 28 (56%)	Sometimes 16 (32%)	Sometimes 13 (26%)	Sometimes 20 (40%)
Carbapenems described as last choice?	Yes 23 (36%) No 9 (18%) Sometimes 18 (46%) †	Yes 34 (68%) No 3 (6%) Sometimes 13 (26%)	Yes 17 (34%) No 13 (26%) Sometimes 20 (40%)	Yes 37 (74%) No 4 (8%) Sometimes 9 (18%)

Values are n (%). † Count and percentage do not agree; original values retained

Administration, monitoring, infection control, and policy

Intravenous administration was the most commonly reported route in all hospitals (Table 4). Correct dosing was reported by 94% to 98% of respondents at the three other hospitals but by 50% at Tripoli Children Hospital, and adherence to label instructions ranged from 50% to 94%. A hospital antibiotic policy was reported by 94% at Tripoli University Hospital, 90% at Tripoli Central Hospital, and 64% at Abu Salim Trauma Hospital; the value for Tripoli Children Hospital is unresolved. Administrative approval of the policy was reported by 84% and 46% of respondents at Tripoli University and Abu Salim Trauma hospitals, respectively. Stopping antibiotics once the patient improves was reported by 8% to 20% of respondents.

Table 4. Administration, monitoring, infection control, and other practices, by hospital (n = 50 per hospital)

Question	Tripoli Children Hospital	Tripoli University Hospital	Abu Salim Trauma Hospital	Tripoli Central Hospital
Carbapenem with enzyme inhibitors?	Yes 19 (46%) No 8 (16%) Sometimes 23 (38%) †	Yes 19 (46%) No 8 (16%) Sometimes 23 (38%) †	Yes 9 (18%) No 18 (36%) Sometimes 23 (46%)	Yes 30 (60%) No 17 (34%) Sometimes 3 (6%)
Patient monitored continuously after carbapenem?	Yes 26 (32%) No 8 (16%) Sometimes 16 (52%) †	Yes 31 (62%) No 6 (12%) Sometimes 13 (26%)	Yes 32 (64%) No 7 (14%) Sometimes 11 (22%)	Yes 30 (60%) No 7 (14%) Sometimes 13 (26%)
Carbapenems given by which route (oral/ IV)?	Oral 14 (28%) IV 36 (72%)	Oral 14 (28%) IV 36 (72%)	Oral 4 (8%) IV 46 (92%)	Oral 4 (8%) IV 46 (92%)
Can carbapenems be given IM?	Yes 30 (60%) No 20 (40%)	Yes 42 (84%) No 8 (16%)	Yes 15 (30%) No 35 (70%)	Yes 46 (92%) No 4 (8%)
Can carbapenems change gut flora / select resistance?	Yes 26 (52%) No 9 (18%) Sometimes 15 (30%)	Yes 31 (62%) No 0 (0%) Sometimes 19 (38%)	Yes 27 (54%) No 4 (8%) Sometimes 19 (38%)	Yes 32 (64%) No 4 (8%) Sometimes 14 (28%)
Labels followed before administration?	Yes 27 (54%) No 23 (46%)	Yes 25 (50%) No 25 (50%)	Yes 41 (82%) No 9 (18%)	Yes 47 (94%) No 3 (6%)
Antibiotic given correctly (correct doses)?	Yes 25 (50%) No 25 (50%)	Yes 49 (98%) No 1 (2%)	Yes 47 (94%) No 3 (6%)	Yes 47 (94%) No 3 (6%)
Many patients acquire nosocomial infections?	Several 23 (46%) Few 27 (54%)	Several 23 (46%) Few 27 (54%)	Several 38 (76%) Few 12 (24%)	Several 22 (44%) Few 28 (56%)
Patient follows correct treatment time?	Yes 15 (30%) No 9 (18%) Sometimes 26 (52%)	Yes 28 (56%) No 0 (0%) Sometimes 22 (44%)	Yes 21 (42%) No 13 (26%) Sometimes 16 (32%)	Yes 35 (70%) No 1 (2%) Sometimes 14 (28%)
Most used route in hospital (oral / IV)?	Oral 14 (28%) IV 36 (72%)	Oral 14 (28%) IV 36 (72%)	Oral 1 (2%) IV 49 (98%)	Oral 19 (38%) IV 31 (62%)
Major challenge in reducing bacterial infections?	Yes 32 (64%) No 18 (36%)	Yes 32 (64%) No 18 (36%)	Yes 42 (84%) No 8 (16%)	Yes 45 (90%) No 5 (10%)
Were most resistant infections treated?	Yes 17 (44%) No 11 (22%) Sometimes 22 (34%) †	Yes 28 (56%) No 3 (6%) Sometimes 19 (38%)	Yes 27 (54%) No 2 (4%) Sometimes 21 (42%)	Yes 28 (56%) No 2 (4%) Sometimes 20 (40%)
Monitor patient if improving without antibiotics?	Yes 15 (30%) No 20 (40%) Sometimes 15 (30%)	Yes 43 (86%) No 1 (2%) Sometimes 6 (12%)	Yes 30 (60%) No 6 (12%) Sometimes 14 (28%)	Yes 42 (84%) No 3 (6%) Sometimes 5 (10%)
Side-effects explained to patient before treatment?	Yes 15 (54%) No 8 (16%) Sometimes 27 (30%) †	Yes 32 (64%) No 0 (0%) Sometimes 18 (36%)	Yes 25 (50%) No 11 (22%) Sometimes 14 (28%)	Yes 34 (68%) No 2 (4%) Sometimes 14 (28%)

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Check for drug interactions before prescribing?	Yes 26 (52%) No 9 (18%) Sometimes 15 (30%)	Yes 41 (82%) No 0 (0%) Sometimes 9 (18%)	Yes 36 (72%) No 3 (6%) Sometimes 11 (22%)	Yes 38 (76%) No 4 (8%) Sometimes 8 (16%)
Do staff handle antibiotic strategies inappropriately?	Yes 14 (28%) No 36 (72%)	Yes 19 (38%) No 31 (62%)	Yes 24 (48%) No 26 (52%)	Yes 14 (28%) No 36 (72%)
Is antibiotic stopped once patient improves?	Yes 4 (8%) No 46 (92%)	Yes 4 (8%) No 46 (92%)	Yes 10 (20%) No 40 (80%)	Yes 4 (8%) No 46 (92%)
Is there a hospital antibiotic policy?	Yes 34 (32%) No 16 (68%) †	Yes 47 (94%) No 3 (6%)	Yes 32 (64%) No 18 (36%)	Yes 45 (90%) No 5 (10%)
If policy exists, is it approved by administration?	Yes 34 (32%) No 16 (68%) †	Yes 42 (84%) No 8 (16%)	Yes 23 (46%) No 27 (54%)	Yes 45 (91.8% of 49) No 4 (8.2% of 49) †

Values are n (%). † Count and percentage do not agree, categories do not sum to 50, or the percentage uses a different denominator; original values retained . Tripoli Children Hospital values for the policy items are given as "32%?/68%?" in the original and are unresolved. The two route-of-administration rows disagree for Abu Salim Trauma and Tripoli Central hospitals, and several Tripoli Children and Tripoli University values are identical.

Management of MRSA

Intravenous antibiotics for MRSA were reported most often at Tripoli Central (68%) and Abu Salim Trauma (62%) hospitals and least often at Tripoli University Hospital (34%) (Table 5). Vancomycin was the antibiotic most often reported at Abu Salim Trauma (57.9%), Tripoli University (56.8%), and Tripoli Central (58.0%) hospitals, whereas colistin was most often reported at Tripoli Children Hospital (62.8%). Ceftriaxone was reported in all four hospitals (16.0% to 31.6% of responses).

Table 5. Antibiotics reported for MRSA, by hospital

Question / antibiotic	Tripoli Children Hospital	Tripoli University Hospital	Abu Salim Trauma Hospital	Tripoli Central Hospital
IV antibiotics given if MRSA isolated?	Yes 17 (52%) No 7 (14%) Sometimes 26 (34%) †	Yes 17 (34%) No 17 (34%) Sometimes 16 (32%)	Yes 31 (62%) No 6 (12%) Sometimes 13 (26%)	Yes 3 (68%) No 3 (6%) Sometimes 13 (26%) †
Vancomycin	8 (18.6%)	25 (56.8%)	22 (57.9%)	29 (58.0%)
Ceftriaxone	8 (18.6%)	12 (27.3%)	12 (31.6%)	8 (16.0%)
Colistin	27 (62.8%)	5 (11.4%)	3 (7.9%)	9 (18.0%)
Bactroban	0 (0%)	2 (4.5%)	1 (2.6%)	4 (8.0%)

Values are n (%). Antibiotic rows show counts and percentages of the responses given; the original notes that each hospital had a different number of respondents for this question, and the counts imply 43, 38, 44, and 50 responses. † The "Yes" and "Sometimes" counts for Tripoli Children Hospital appear interchanged, and the Tripoli Central "Yes" count is given as 3 (68%) in the original and shown here as printed. Column order was changed to match Tables 1 to 4.

Discussion

This survey of 200 healthcare professionals in four large Tripoli hospitals shows differences in self-reported antibiotic prescribing, laboratory support, carbapenem use, and policy availability. Because the analysis was descriptive, the differences cannot be called statistically significant, and the original text's use of "significant variability" has been replaced accordingly.

Targeted prescribing was reported least often at Tripoli Central Hospital, which also reported the most extensive use of nucleic acid amplification testing, suggesting that availability of advanced diagnostics does not by itself lead to targeted therapy. Determinants such as leadership support, diagnostic capacity, and hospital culture have been associated with prescribing behavior in sub-Saharan Africa,[17] but they were not measured here. Awareness that third-generation cephalosporins contribute to resistance was high at three hospitals but low at Tripoli Children Hospital, where the other cephalosporin items also showed lower adherence.

Carbapenem practices were most cautious at Tripoli Central Hospital and least at Abu Salim Trauma Hospital. This is relevant to local resistance patterns, since carbapenem-resistant isolates have been reported in Ethiopia,[11] a high proportion of MDR isolates in the Abu Salim surgical ICU,[13] and a novel metallo-β-lactamase from Tripoli Central Hospital.[15] Some respondents reported oral (8% to 28%) or intramuscular (30% to 92%) administration of carbapenems, which are mainly given intravenously; this may reflect misunderstanding of the questions or knowledge gaps and should be checked.

For MRSA, vancomycin was the most frequently reported agent in three hospitals, whereas the predominance of colistin at Tripoli Children Hospital is unexpected, because colistin is active against Gram-negative rather than Gram-positive bacteria; ceftriaxone, also reported, is generally not active against MRSA. The questionnaire item asked about antibiotics given when MRSA was isolated from the nose of a patient or staff member, which describes colonization rather than

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infection, so these answers should not be read as adherence to treatment guidelines.

Limitations

Responses were self-reported and not checked against prescription records; the sampling method, professional mix, and response rate are not reported; no inferential statistics were used; the questionnaire was not described as validated; and four hospitals in one city limit generalizability.

Conclusion

This survey describes self-reported antibiotic prescribing practices in four large hospitals in Tripoli and shows differences between hospitals in targeted prescribing, adherence to treatment duration, laboratory test use, carbapenem practices, availability of antibiotic policies, and choice of antibiotics for MRSA. These findings point to the need for standardized antibiotic stewardship programs, wider laboratory-guided prescribing, clear carbapenem policies, strict infection control, and consistent MRSA management protocols across hospitals. Larger studies with sampling by profession, a validated questionnaire, inferential analysis, and prescription audit data are needed to confirm these findings.

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Conflict of interest

The authors declare that they have no conflicts of interest related to the research, authorship, or publication of this manuscript.

Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The raw data may be made available for editorial review upon request, subject to applicable ethical approvals and confidentiality requirements.

Authors' contributions

Alla Esam Ahmed Abdulal, Maram Abd Alnasser Laklouk, and Fatima Ahmed Esmail Alsharif contributed to the conception and design of the study, data acquisition, analysis and interpretation of the results, and preparation of the manuscript. All authors participated in the critical revision of the manuscript for important intellectual content, approved the final version for publication, and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the research are appropriately investigated and resolved.

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