Antibiotic resistance situation in Dhaka, Bangladesh: a review

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ABSTRACT
Antibiotic resistance is global trouble and in the megacities, it is causing more rapidly due to the misuse and overuse of antibiotics. This systematic evaluation used to be carried out to summarize the contemporary day kingdom of affairs of antibiotic resistance in Dhaka, to emerge as aware of gaps in close observation, and to prink tips primarily based on honesty and surely on the findings. Google scholar, PubMed, and Bangladeshi journals online have been searched for the use of applicable key phrases to select articles connected to antibiotic resistance in Dhaka, Bangladesh published between 2004 to 2020. The resistance of a bacterium to a given drug was once added as the median resistance and interquartile fluctuate. Forty-one articles have been blanketed in this systematic review. Antimicrobial susceptibility trying out used to be once as quickly as carried out via disk diffusion approach in 97.56% of studies, at the equal time as the clinical and laboratory standards institute suggestions had been accompanied in 92.68%. Data concerning the susceptibility attempting out method and furnish of sickness (hospital/community) had been absent in 12.19%, 10.52%, and 90.24% of the research, respectively. An excessive prevalence of resistance used to be detected in most examined pathogens, and many of the normal first-line pills have been the most importantly ineffective. Resistance to carbapenems was once low in most cases. An excessive incidence of resistance to most antibiotics used to be detected, alongside necessary gaps in surveillance and facts gaps in the methodological data of the show up to be up.

Keywords: Antibiotic resistance, Dhaka, Pathogens, Ineffective, Antibiotic

INTRODUCTION
Antibiotics are indeed considered drugs that saved a lot of lives. At the same time, antibiotic was argued as a medication which is only targeted to certain microbes that causes disease incident.1

Antibiotic resistance (ABR) is a worldwide health problem because of both the use of antibiotics and in terms of their applications not permanently severe in the taint of monitoring practices, nowadays epidemiological distinguishes in various countries. The medical community suspects that the battle in opposition to the infectious diseases are had obtained, unfortunately, the progressive rate of antimicrobial resistance (AMR) produced to a great extent that faith was elusive in the last 30 years.2,3 The option to start antibiotic resistance is attractive for several reasons where one of the most important factors is resistance genes, to inappropriate use of antibiotics.3,4 As a result, AMR increases some factors such as health care cost, morbidity, and fatality not only in developing countries but also in developed countries.5 According to the report of WHO, it is estimated that approximately 45% of death are responsible in both
South Asia and Africa due to multidrug resistance. Bangladesh is a developing country in South Asia where Dhaka is the very fast-growing megacities in the world where the rate of antibiotic resistance is increasing day by day. There is a clear argument that antibiotic physician in Bangladesh prescribes antibiotics to patients based on guesswork.4,7

Current reports estimated that the rate of death will increase 10 million in 2050 and also in world economic output will be lost in case of actual attempts are not built to take on this threat. Current review highlights the percentage of data about antibiotic resistance scenarios in Dhaka that are found by the different published articles in journals. The ultimate goal is to ensure a recommendation for the upcoming workers and also provide direction to the policymakers tend towards with the viewpoint that optimum plan to minimize the rate of antibiotic resistance.9

Protocols to conduct current review article were developed to specify what is the scenario of ABR in Bangladesh, exactly in Dhaka. Current review will meet various research questions such as the emergence of ABR in Dhaka. Multiple search operations have been conducted between 2004 to 2020 to identify ABR in Dhaka-related articles. Searches have been conducted in Google scholar, Pubmed, BioMed, and Banglajol. In this review, various pathogens taken from the article report have been included which are meeting the (WHO) global priority list. A systemic review procedure was followed and a combination of keywords (antibiotics, resistance, Dhaka, Bangladesh,) in the subject area related to each other. By collecting some data from different papers and presented in the table form. Here resistance pattern of the pathogen is also recorded Bacterial resistant pattern of each bacteria has been presented through the table form. Here resistance pattern of the other. By collecting some data from different papers and presented in the table form. Here resistance pattern of the

| Clinical syndrome | Urinary tract infection | Bloodstream infection | Gastroenteritis | Wound infection | Respiratory tract infection | Multiple syndromes | Unavailable |
|-------------------|------------------------|----------------------|----------------|----------------|-----------------------------|------------------|------------|
| N                 | 8                      | 7                    | 7              | 1              | 1                           | 16               | 1          |
| %                 | 19.51%                 | 17.07                | 17.07          | 2.43           | 2.43                        | 39.02            | 2.43       |

Table 1: Summary of studies.

| Publication year | N | %   |
|------------------|---|-----|
| 2004 - 2010      | 7 | 17.07 |
| 2011 - 2014      | 11 | 26.82 |
| 2015 - 2018      | 18 | 43.90 |
| 2019 - 2020      | 5  | 12.20 |

E. coli is the most common bacterium of UTI. In 19 articles, E. coli has been studied to show high resistance against drugs such as ampicillin (MR 92.9, IQR 66-100), amoxicillin (MR 90, IQR 7.7-95), cefixime (MR 65.35, IQR 44.3-73.59), ciprofloxacin (MR 55.67, IQR 35.12-69.5), azithromycin (MR 55.67 IQR 44.25-74.06). Klebsiella spp shows resistance to ceftazidime (MR 60, IQR 50-100), cefuroxime (MR 48.64, IQR 23.79-51), Amoxycylav (MR 48.64, IQR 15.4-58). Pseudomonas spp shows resistance to amikacin (MR 68.7, IQR 50-70), ceftazidime (MR 66.6, IQR 25-95), azithromycin (MR 50.67, IQR 37.5-63.51), ciprofloxacin (MR 50, IQR 40.87-59). Salmonella spp shows resistance to nalidixic acid (MR 52, IQR 40-84.6). Shigella spp shows resistance to ampicillin (MR 53 (30-54.09), nalidixic acid (MR 51, IQR 34-52), chloramphenicol (MR 42, IQR 30.5-45.5). Staphylococcus aureus shows resistance to penicillin (MR 68.61, IQR 62.81-76.5), erythromycin (MR 65, IQR 43.37-82.5), tetracycline (MR 59.3, IQR 35.15-67.15), cefixime (MR 59.3, IQR 58.16-66.75). Streptococcus pneumoniae shows resistance to co-trimoxazole (MR 65.6, IQR 44.5-84.02). Ciprofloxacin (MR 64.6, IQR 46.87 -82.9). Acinetobacter spp. shows
high resistance against penicillin (MR 100, IQR 100-100), cefotaxime (MR 80, IQR 67.25-82.85), azithromycin (MR 79.20, IQR 56.28-100), cefepime (MR 75, IQR 41.5-82.74). Enterococcus spp. shows resistance to ciprofloxacin (MR 66, IQR 66.6-37.84), ceftriaxone (MR 49.32, IQR 42.66-49.66).

**Table 2: Calculated MR and IQR of pathogens.**

| Drug            | Acinetobacter spp MR (IQR) Total sample | Enterococcus spp MR (IQR) Total sample | Escherichia coli MR (IQR) Total sample | Klebsiella spp MR (IQR) Total sample | Pseudomonas spp MR (IQR) Total sample | Salmonella spp MR (IQR) Total sample | Shigella spp MR (IQR) Total sample | Staphylococcus aureus MR (IQR) Total sample | Streptococcus pneumoniae MR (IQR) Total sample |
|-----------------|------------------------------------------|----------------------------------------|----------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------------|---------------------------------------------|
| Amikacin        | 41.65 (24.30-59.97) 200                  | N/A                                    | 11.5 (7.24-29.9) 1576                  | 19.21 (14.97-39.93) 247              | 68.7 (50-70) 517                     | N/A                                  | N/A                                  | N/A                                         | N/A                                         |
| Ampicillin      | N/A                                      | N/A                                    | 92.9 (66-100) 1291                     | N/A                                  | N/A                                  | 30 (28-59.75) 7524                    | 53 (30-54.09) 14348                    | N/A                                         | N/A                                         |
| Amoxicillin     | 100 (100-100) 50 90 (7.7-95) 208         | N/A                                    | 48.68 (39-52.04) 1095                  | 48.64 (15.4-58) 206                  | N/A                                  | N/A                                  | N/A                                  | N/A                                         | N/A                                         |
| Amoxyclov       | N/A                                      | N/A                                    | 55.67 (44.25-74.06) 1426              | N/A                                  | N/A                                  | 50.67 (37.5-63.51) 16                  | 52.05 (40.91-75) 174                  | N/A                                         | N/A                                         |
| Azithromycin    | 79.20 (56.28-100) 55 90 (7.7-95) 208     | N/A                                    | 48.68 (39-52.04) 1095                  | 48.64 (15.4-58) 206                  | N/A                                  | 50.67 (37.5-63.51) 16                  | 52.05 (40.91-75) 174                  | N/A                                         | N/A                                         |
| Aztreonam       | N/A                                      | N/A                                    | 55.67 (44.25-74.06) 1426              | N/A                                  | N/A                                  | 50.67 (37.5-63.51) 16                  | 52.05 (40.91-75) 174                  | N/A                                         | N/A                                         |
| Cephalin        | N/A                                      | N/A                                    | 65.35 (44.3-73.59) 378                 | N/A                                  | N/A                                  | 59.3 (58.16-66.75) 109                 | N/A                                  | N/A                                         | N/A                                         |
| Cefepime        | 75 (41.5-82.74) 49 90 (7.7-95) 208       | N/A                                    | 48.68 (39-52.04) 1095                  | 48.64 (15.4-58) 206                  | N/A                                  | 50.67 (37.5-63.51) 16                  | 52.05 (40.91-75) 174                  | N/A                                         | N/A                                         |
| Cefixime        | N/A                                      | N/A                                    | 48.68 (39-52.04) 1095                  | 48.64 (15.4-58) 206                  | N/A                                  | 50.67 (37.5-63.51) 16                  | 52.05 (40.91-75) 174                  | N/A                                         | N/A                                         |
| Cefotaxime      | 80 (67.25-82.85) 50 90 (7.7-95) 208      | N/A                                    | 65.35 (44.3-73.59) 378                 | N/A                                  | N/A                                  | 59.3 (58.16-66.75) 109                 | N/A                                  | N/A                                         | N/A                                         |
| Ceftazidime     | 61.22 (46.3-67.41) 157 50 (28.77-71.25) 956 | N/A                                    | 50 (28.77-71.25) 956                  | 60 (50-100) 200                      | 66.6 (25-95) 311                     | N/A                                  | N/A                                  | N/A                                         | N/A                                         |
| Ceftriazone     | 50 (43.06-87.55) 123 49.32 (32.35-77.30) 1758 | N/A                                    | 49.32 (32.35-77.30) 1758              | N/A                                  | 3 (1.85-37.48) 1368                   | 51.6 (45.65-62.8) 130                 | N/A                                  | N/A                                         | N/A                                         |
| Cefuroxime      | 56 (41.5-71.5) 53 48.64(2 3.79-51)164 50(48.64-96) 61 | N/A                                    | 48.64(2 3.79-51)164                  | 50(48.64-96) 61                      | N/A                                  | 59.3 (43.15-68.78) 109                 | N/A                                  | N/A                                         | N/A                                         |
| Chloramphenicol | N/A                                      | N/A                                    | 48.64 (2 3.79-51)164                  | 50 (14.5-48.07) 2333                | 42 (30.5-45.5) 3560                   | N/A                                  | N/A                                  | N/A                                         | N/A                                         |

Continued.
| Drug                          | Acinetobacter spp MR (IQR) Total sample | Enterococcus spp MR (IQR) Total sample | Escherichia coli MR (IQR) Total sample | Klebsiella spp MR (IQR) Total sample | Pseudomonas spp MR (IQR) Total sample | Salmonella spp MR (IQR) Total sample | Shigella spp MR (IQR) Total sample | Staphylococcus aureus MR (IQR) Total sample | Streptococcus pneumoniae MR (IQR) Total sample |
|-------------------------------|-----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Ciprofloxacin                | 58.41 (37.84-89.2) 139                  | 66 (66.6-37.84) 68                     | 56.32 (35.12-69.5) 2823                | 37.83 (30-49) 272                      | 50 (40.87-59) 722                     | 18.5 (6.9-38.24) 7359                   | 12 (3-17) 14394                          | 58.06 (36.48-72.35) 197                     | 64.6 (46.87-82.9) 179                      |
| Cloxacillin                  | N/A                                     | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | 50 (49.3-53.7) 126                        | N/A                                           |
| Colistin                     | N/A                                     | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                          | N/A                                           |
| Cotrimoxazole                | 40 (24-75) 82                           | N/A                                    | 48.6 (34.02-65) 2823                   | 33.3 (30.33-45.55) 237                 | 1.9 (0-50) 478                        | 20 (13.63-32) 7477                     | N/A                                    | 43.2 (29.1-50.3) 126                        | 65.6 (44.5-84.02) 179                      |
| Doxycycline                  | N/A                                     | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | 65 (43.37-82.5) 34                        | N/A                                           |
| Erythromycin                 | N/A                                     | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                          | N/A                                           |
| Gentamicin                   | 53.3 (26.99-85.8) 146                    | 25.65 (15.5-37.47) 62                  | N/A                                    | 17 (14.97-39.93) 312                   | 50 (48.64-96) 732                     | N/A                                    | 4 (2.1-37.71) 642                        | 51.07 (72.63-35.11) 176                     | N/A                                           |
| Imipenem                     | 37.45 (22.97-54.45) 92                   | N/A                                    | 7.14 (0.55-93.15) 1639                 | 21.65 (2.5-45.82) 217                  | 50 (7.95-91.05) 708                   | N/A                                    | 10 (7.7-52.2) 119                        | N/A                                          | N/A                                           |
| Levofloxacin                 | N/A                                     | N/A                                    | 40.97 (34.4-41) 801                    | 45.03 (23.9-62.87) 90                  | 7.3 (3.65-8.37) 427                  | N/A                                    | N/A                                    | N/A                                          | N/A                                           |
| Meropenem                    | N/A                                     | N/A                                    | 15 (7-56.99) 884                      | 28.57 (17-33.3) 100                    | N/A                                    | N/A                                    | N/A                                    | N/A                                          | N/A                                           |
| Nalidixic acid               | N/A                                     | N/A                                    | 60 (30.67-71.5) 24                     | N/A                                    | 52 (40-81.6) 7299                    | 51 (34-52) 14614                      | N/A                                    | N/A                                          | N/A                                           |
| Nitrofurantoin               | N/A                                     | N/A                                    | 15 (10-47) 996                        | 33.3 (17-43) 147                      | 25.67 (1.01-62.5) 59                  | N/A                                    | N/A                                    | N/A                                          | N/A                                           |
| Oxacillin                    | N/A                                     | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                          | N/A                                           |
| Penicillin                   | N/A                                     | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | 68.61 (62.81-76.5) 121                     | N/A                                           |
| Tetracycline                 | N/A                                     | N/A                                    | 51.45 (37.75-61.92) 1199               | N/A                                    | N/A                                    | N/A                                    | N/A                                    | 59.3 (35.15-67.15) 110                     | N/A                                           |
| Vancocymycin                 | N/A                                     | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | N/A                                    | 35 (32.35-55.45) 119                      | N/A                                           |
The frequent use of first-line antibiotics towards UTI used to be dissatisfying. A comparable state of affairs was discovered in Africa by contemporary analyses. *E. coli* bacteria are much more resistant against amoxicillin and amoxiclav. Additionally, motels are used to choose tablets like tigecycline, nitrofurantoin, etc., if obligatory. In staphylococcal groups, MRSA is associated with a high risk of mortality, length of hospitalization, and high health care center charges. Vancomycin was once as quickly as determined to be a high pleasant drug in opposition to MRSA in this research. First discovered antibiotic resistance of *Streptococcus pneumonia* used to be negligible, for this motive it stays a preference of treatment for pneumococcal disease. However, extraordinary penalties have been observed in research carried out in Asia. Despite its incidence in many other countries. Searching in this locate out about used to be different, with totally three out of a hundred and forty isolates strains of *Enterococcus spp* set down into vancomycin-resistant (MR 0%). Moreover, a total of three lookups examined vancomycin susceptibility, and a sizeable lookup was required to be done to acquire a definitive insight.

Significant gaps in the surveillance had been added in this research. The search has been carried out in Dhaka which is the capital of Bangladesh. Gaps in the methodological information are additionally identified. In Dhaka, the region antibiotics prescribed to victims no longer normally ever worked, as germs developed antibiotic resistance due to their irrational use, the standard for susceptibility results (26.82%), and (90.24%) of infections in hospital and community center. These markup questions are involving with an extremely good part of their statistics and make it tough to comparisons amongst the pinnacle notch studies. Further work will be done on ABR, to manipulate its issue. However, a giant lookup wishes to be carried out on the pathogens that have been left out due to the reality of an insufficient range of studies, as referred to in the Results section.

There is a scarcity of recent antibiotics, it is of the utmost magnitude that the modern. This can be carried out by way of the use of overall performance of way of implementing stricter insurance plan insurance policies on antibiotic use.

**CONCLUSION**

The effect of antibiotic resistance is much greater in Dhaka, Bangladesh. Highly unwholesome strains of microbial were detected from various hospitals in megacity Dhaka and observed. Antibiotics prescribed in Dhaka hospitals work hard. This observation also implies misuse and overuse of antibiotics. At present, antibiotic resistance is a serious alarming condition for Dhaka residents. The situation in Dhaka is worse than in other districts in Bangladesh in terms of misuse. So, further exploration is very important. Although the current resistance data is not very available, this study has identified resistant bacterial pathogens in Dhaka. Their susceptibility pattern has also been highlighted. Hopefully, this study will help health professionals to make a decision about which antibiotic therapy to use. Moreover, it has been said that the fourth generation of cephalosporin, amoxicillin, tetracycline has become resistant in Dhaka, according to prescription analysis. So, it will help the researchers for the next improvement.

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