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Background

Antibiotic resistance (ABR) is a global emerging concerning issue, especially in developing countries. Bangladesh is one of the severe victims of ABR due to the flawed healthcare management system, lack of proper surveillance and misuse and overuse of antibiotics. According to the 2019 ABR threats report, at least 2.86 million people get an ABR infection each year in the US, resulting in the death of 35,900 people [1]. At the global level, this number is exceptionally high. An estimation stated that ABR infections killed approximately 700,000 (low estimate) people yearly. A continued rise in ABR infections would lead to 10 million deaths per year by 2050 [2]. Food animals play a vital role in spreading ABR.

Staphylococcus aureus (**Figure 1**) has a natural ability to become resistant to any antibiotics; therefore, it's rapidly growing up resistance, particularly methicillin-resistant *S. aureus*, contributes to increased health and economic burdens [3]. *S. aureus* has developed resistance to several antimicrobial drugs, including second- and third-line antibiotics. The observed variation in ABR *S. aureus* resistance patterns has been found throughout the world due to its prevalence. As a result, for the clinical management of *S. aureus* infections, constant surveillance of ABR profiles becomes crucial for Bangladesh.
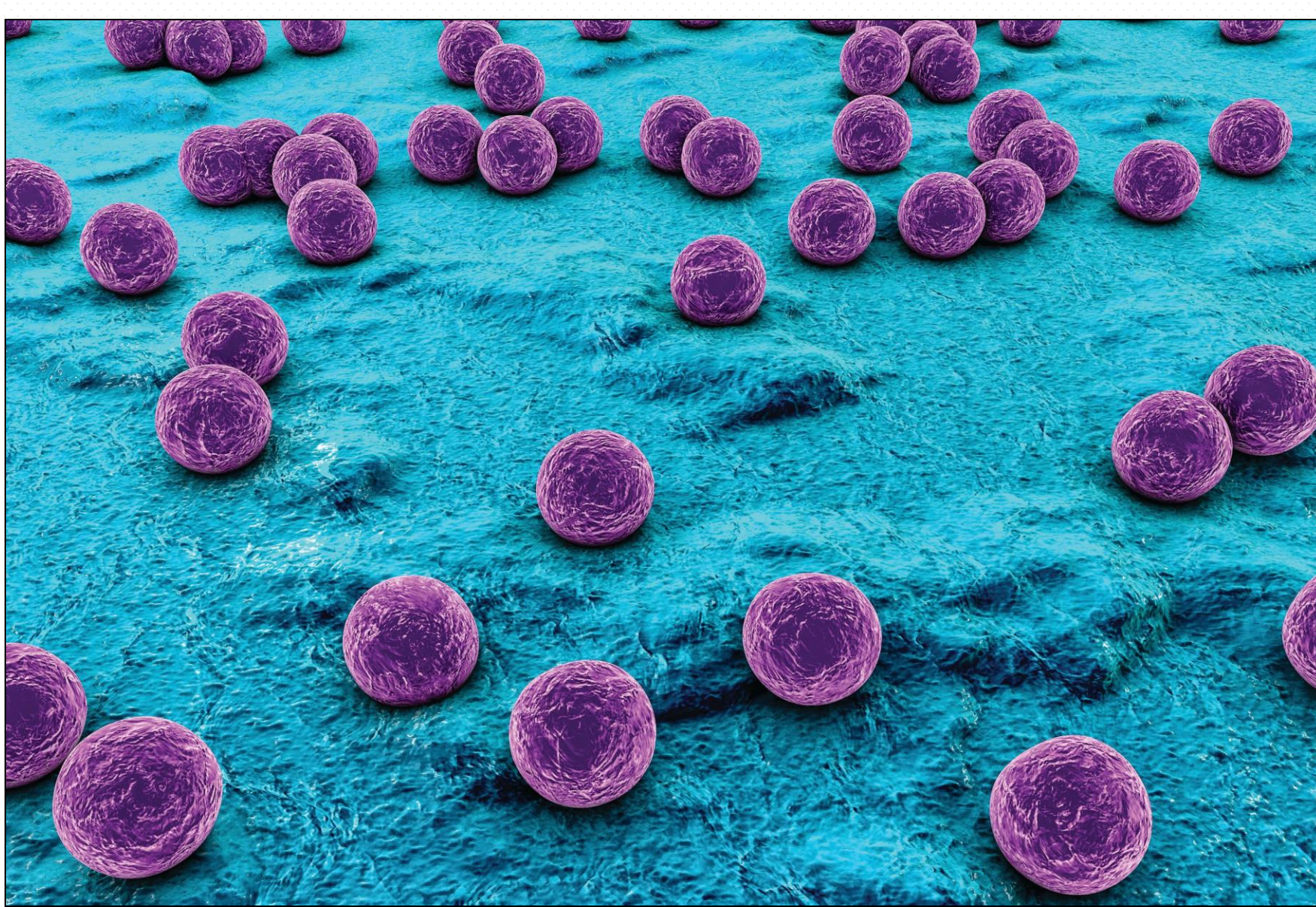

Figure 1. *Staphylococcus aureus* (biomerieux-industry.com/)

Methodology

This study was conducted according to PRISMA guidelines. The following databases were used for literature search:
❑ Scopus
❑ PubMed
❑ Google Scholar
❑ Bangladesh Journal Online
❑ EBSCO databases

Relevant keywords (Antibiotic (also Antimicrobial) AND Resistance (also Susceptibility) AND Staphylococcus aureus AND Bangladesh) were used for literature search. Inclusion or exclusion was based on a predefined set of criteria. Resistance against a given drug was presented as the median resistance and interquartile range.

Results

Thirteen articles were selected for this systematic review. 92.3% studies used Disk Diffusion method for evaluation of antibiotic susceptibility. Specific study times were mentioned in 11 of the 13 papers. The pooled prevalence of ABR *S. aureus* was about 49%. The reported data produced a pooled prevalence of ABR (top ten resistant antibiotics) in *S. aureus* isolates from animal sources (i.e., meat, cow milk, dairy products, eggs, animal feeds and litters) in Bangladesh: streptomycin (IQR, interquartile range: 3.67), vancomycin IQR: 16.50), penicillin (IQR: 23.8), Nalidixic acid (IQR: 33), kanamycin (IQR: 28.9), amoxicillin (IQR: 67.86), tetracycline (IQR: 40.44), oxytetracycline (IQR: 11.64), erythromycin (IQR: 41.97), and methicillin (IQR: 40.5) (**Figure 2**). Ten out of 64 districts were covered in this study. (**Figure 3**).
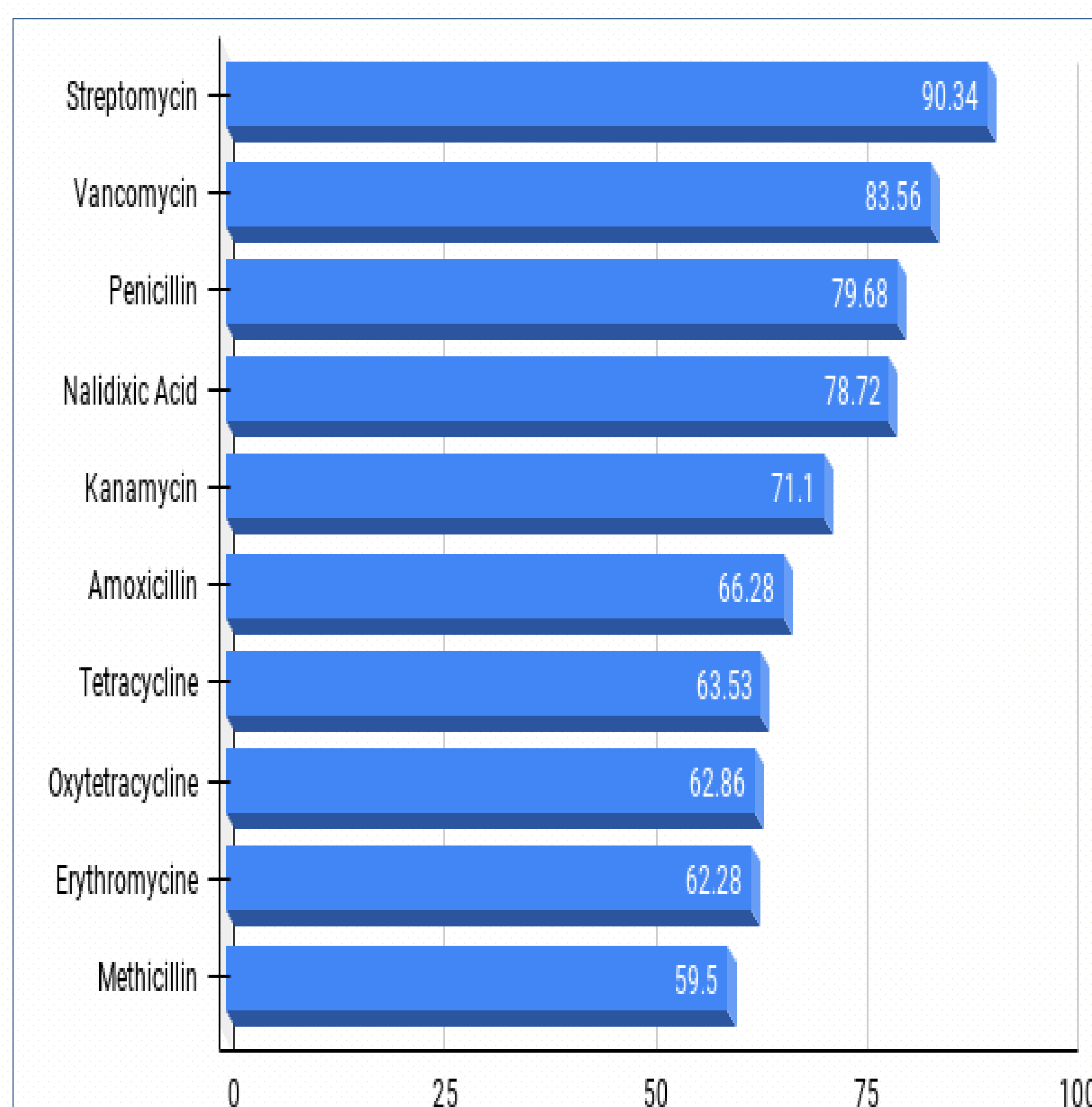

Figure 2. Antibiotic resistance pattern (%) of *S. aureus* in animal sources in Bangladesh.
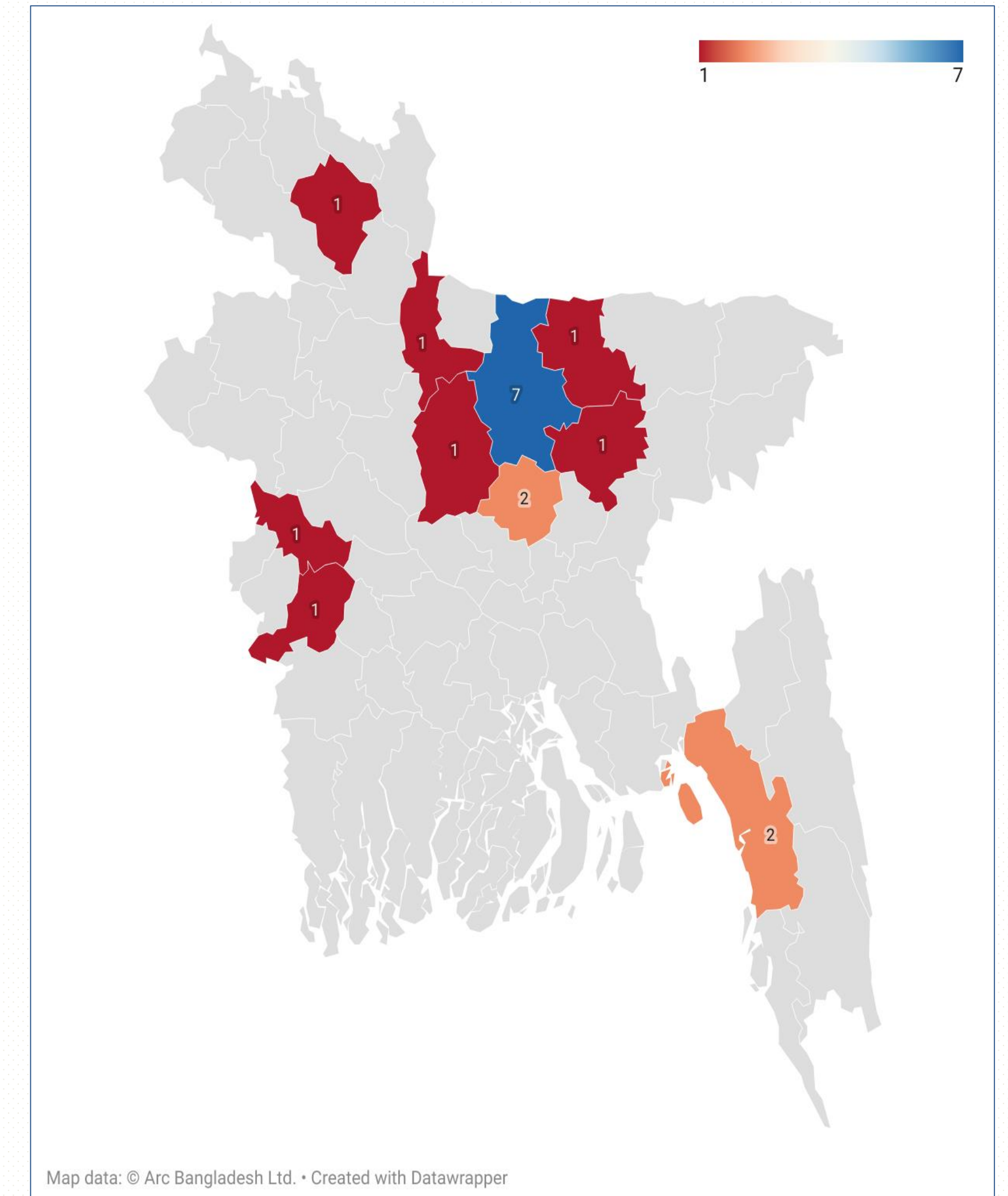
Acknowledgement

Figure 3. Districts covered in this study.

Discussion

Most of the first-line drugs were ineffective against *S. aureus*. The coverage of this study was limited to Bangladesh, but the implications of the findings are global. Food animals plays a vital role in spreading ABR against other animals and to the humans consuming them. Resistant strains are rarely limited to a single location; any area with a high prevalence of resistance can serve as a reservoir from which resistant strains can spread around the world through humans, animals, agricultural products, water, and other means [4] [5]. There is not enough study data for all the regions of Bangladesh. Every districts should be brought under study to have a better view of the ABR scenario of the country. Also, significant surveillance gaps were also observed in this study. Some of the studies didn't mention the methodology and other data properly. These issues should be addressed in future studies on ABR.

Conclusions

A high rate of ABR was observed against most of the studied antibiotics. Misuse and overuse of drugs in poultry and dairy industry play a pivotal role in *S. aureus* resistance. Feeding antibiotics to the food animals should be strictly controlled and monitored. Expanding the *S. aureus* resistance studies to the whole country is necessary to understand the resistance pattern better.

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