



Prevalence and associated risk factors of High-Level Vancomycin-resistant *Enterococcus faecium* in well water used for domestic purposes in Ile-Ife, Southwestern Nigeria

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ECA
2025
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Introduction

- Vancomycin-resistant *Enterococcus faecium* (VREfm) is a significant cause of healthcare-associated infections.
- In Nigeria, VREfm prevalence varies geographically, with the western region showing the highest rates (49.6%), nearly triple that of the northern region (14.6%).
- VREfm has also been detected outside of healthcare settings in recent years. This poses a significant challenge to infection control, particularly in resource-limited areas with inadequate healthcare infrastructure.
- Building upon our previous research identifying domestic wells as reservoirs for pathogenic and resistant *E. coli*, this study aimed to: determine the prevalence of VREfm in these wells, investigate the mechanisms of VREfm resistance within well water, identify potential reservoirs for VREfm in the community and analyze factors influencing VREfm presence in well water. This information will guide the development of effective interventions to prevent the spread of VREfm through drinking water sources in the study area.

Methods

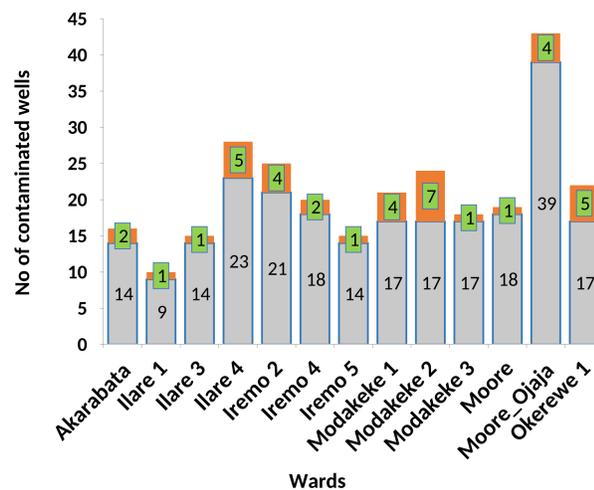
- We assessed 350 wells for VREfm, and questionnaires were administered to obtain information about well characteristics and owners' bio-demographic data.
- Isolates were identified using biochemical and molecular methods.
- The isolates were tested against eight antibiotics using the Kirby-Bauer disc diffusion method and vancomycin minimum inhibitory concentration (MIC) was determined by the agar dilution method.
- The resistance (*vanA*, *vanB*, *msrA/B*, *mefA*, *mph(ABC)*) and virulence (*esp*, *gelE*) genes of VREfm were detected by Polymerase chain reaction.
- Data analysis was done with R statistical software.

Results

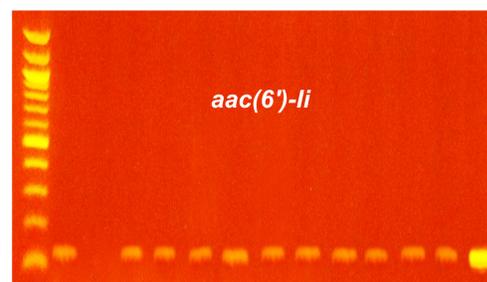
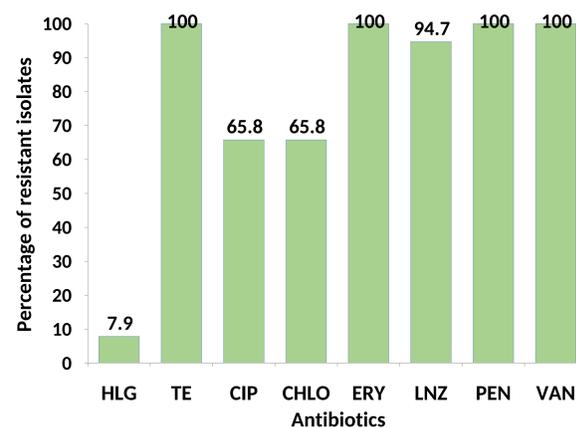
The sampling locations are shown on the map. Thirty-nine samples were obtained from Moore-Ojaja ward, 23 samples from Ilare ward 4, 25 samples from Ilode ward 2, 21 samples from Irewo ward 2, 18 samples from Ilode ward 1, and 17 samples from Modakeke ward 1



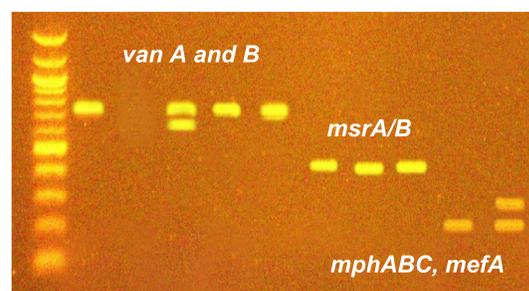
Thirty-eight (10.9%) wells were contaminated by VREfm, with counts ranging from 1×10^2 to 5×10^3 CFU/100mL.



- Wells sited near dumpsites, with ponding within three metres and split water collection, significantly harbored VREfm ($p < 0.05$).
- All isolates (100%) showed resistance to tetracycline, penicillin, erythromycin, and vancomycin. Additionally, 65.8% were resistant to ciprofloxacin and chloramphenicol while 94.7% were resistant to linezolid. The lowest resistance was observed against gentamicin at 7.9%. The MIC values of the isolates ranged from 64 to 512 $\mu\text{g/mL}$, and all exhibited multidrug resistance. The Multiple Antibiotic Resistance (MAR) indices varied between 0.63 and 1.

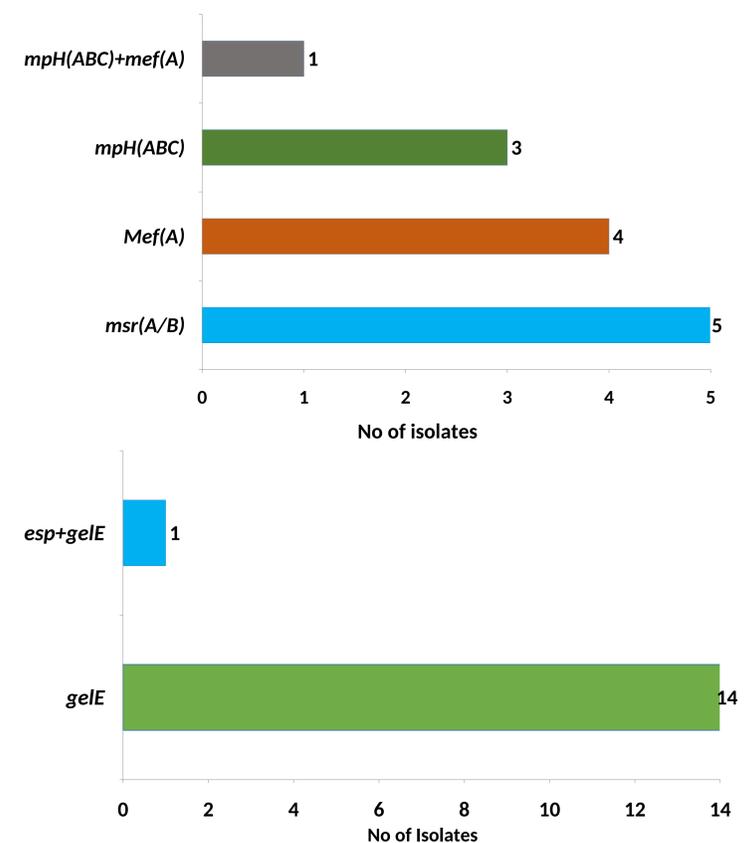
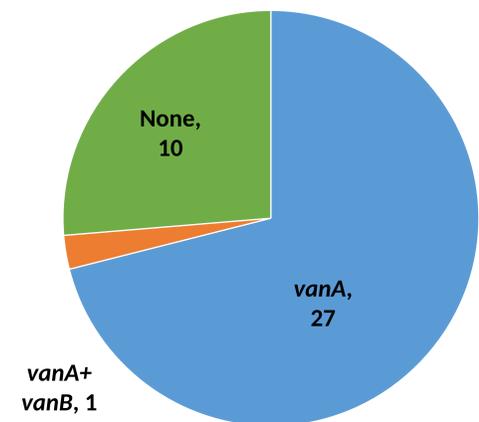


A representative gel image of amplified *aac(6)-li* of *Enterococcus faecium*



A representative gel image of amplified *vanA*, *vanB*, *msrA/B*, *mefA*, *mph(ABC)* of VREfm.

Twenty-seven isolates harboured only the *vanA* gene, while one harboured both the *vanA* and *vanB* genes. Five isolates harboured the *msrA/B* gene, three isolates harbored only the *mph(ABC)* gene, one harbored the *mph(ABC)* and *mefA* genes, and four harbored only the *mefA* gene. Virulence determinants, *esp* and *gelE* were found in 2.6% and 29% of the isolates, respectively.



Conclusion

This study indicates that hand-dug wells may serve as a potential source of VREfm in this environment. The identification of factors such as improper well construction, proximity to pollution sources, and habitation patterns that contribute to contamination underscores the necessity for regular sanitation and inspection of wells for cracks to prevent seepage, runoff, and potential outbreaks of waterborne diseases. It is essential to educate well owners and consumers on the importance of boiling untreated water before use. Regulatory agencies responsible for well construction and water quality must implement measures to ensure proper siting, construction, and maintenance of wells to prevent contamination.

References

- Anyanwu, M., Eze, U., Nnamani, J., Ikenna-Ezeh, N., Akpa, P., Okorie-Kanu, O., Anene, B., 2022. Occurrence, antibiogram, high-level vancomycin and aminoglycosides resistance and potential virulence factors of enterococci in dogs in Nigeria. *Journal of the Hellenic Veterinary Medical Society* 73, 4689-4696.
- Kiruthiga, A., Padmavathy, K., Shabana, P., Naveenkumar, V., Gnanadesikan, S., Malaiyan, J., 2020. Improved detection of *esp*, *hyl*, *asa1*, *gelE*, *cyIA* virulence genes among clinical isolates of *Enterococci*. *BMC research notes* 13, 1-7. *Int. J. Chem. Biochem. Sci* 23, 164-176.
- Economou, V., Gousia, P., 2015. Agriculture and food animals as a source of antimicrobial-resistant bacteria. *Infection and drug resistance* 49-61.
- Enayati, M., Sadeghi, J., Nahaei, M.R., Aghazadeh, M., Pourshafie, M.R., Talebi, M., 2015. Virulence and antimicrobial resistance of *Enterococcus faecium* isolated from water samples. *Lett Appl Microbiol* 61, 339-345. <https://doi.org/10.1111/LAM.12474>

Acknowledgement

We appreciate the well owners for their cooperation. This work was supported by the 2020-2022 merged TETFUND Institutional Based Research grant.

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