

Supplementary Table 3. Geographical distribution, species, clones, and resistance mechanisms of antibiotic-resistant Gram-positive bacteria isolated from the environment in Africa from 2007-2019.

Country (n) ¹	Year	Organism/ Species (n) ²	Specimen Sources (n) ³	Sample size (Resistant isolates)	Clones (n) ⁴	Resistance genes/ mechanisms (n) ⁵	Antibiotic resistance phenotype (n) ⁶	MGEs(n) ⁷	Reference
Algeria	2018	<i>S.aureus</i> (33), CONS(18)	creamy cake (14), pizza (10), beef meat (10) and sausages (5)	51	ND	tetM(38), tetK(17), ermC(3), aacA-aphD(9), blaZ(25), mecA(25)	PEN(48), FOX(5), OXA(5), ERY(8), KAN(7), TET(25), VAN(1), CLI(8)	SCCmec(25)	1
Angola	2015	<i>E. faecium</i> (5)	Chicken farm facility (4), water from hospital and community (1)	5(4)	ST245(1), ST650(2)	tet(M)(4), erm(B)(4), tetL(2)	TET(4), ERY(4), STR(4), NIT(2), Q/D	ND	2 4
Egypt	2016	<i>S. aureus</i> (23)	Food sample (23)	23(NS)	ST689(1)	mecA(3), van A(1), vanB(1)	VAN(NS), CIP(NS), GEN(NS), SXT(NS), OXA(NS), ERY(NS)	SCCmec(3)	3
Ghana	2018	<i>S.aureus</i> (5)	Ward (5)	(5)	ST15(4), ST508(1)	BlaZ(5), dfrG(2)	PEN(5)	ND	4
Nigeria (1)	2017	<i>E. faecium</i> (100)	Vegetables soil, farm, Cloacal swabs (25), Manure (8), Rectal swabs (2)	(100)	ND	aac(6')-le- aph(2')-la(35), aph(2')-1c(31), ,aph(3')-lla(32), ant(4')-la(14)	AMP (63), GEN(37)	ND	5

¹ Total number of studies per country

² Total number of isolates

³ Total number of specimen source

⁴ Total number of resistant clones

⁵ Total number of resistant clones

⁶ Number of different antibiotics any one isolate is resistant to

⁷ Total number of mobile genetic elements : plasmids,transposons, integrons

South Africa (4)	2019	<i>E.faecalis</i> (65), <i>E.faecium</i> (45)	Sewage water (56), treated effluent (19), hospital waste (32)	110	<i>E. faecium</i> ST25, ST23, <i>E.faecalis</i> ST23, ST25,ST780	<i>ermB</i> (48), <i>tetM</i> (47), <i>tetL</i> (44), <i>vanC</i> (9), <i>aph</i> (3") -IIIa(47), <i>aac</i> (6')- Ie- <i>aph</i> (2")- la(27),	ERY(48), TET(47), VAN(9)	ND	6
	2019	<i>E.faecium</i> (38), <i>E.faecalis</i> (17)	Ground and surface water (56)	56	ND	<i>VanA</i> (9), <i>vanB</i> (2)	VAN(44), STR(17), CHL(17), AMP(25), TET(28), GEN(9) SMX(9)	ND	7
	2017	<i>S. aureus</i> (30)	Recreational waters and beach sand (30)	(30)	ND	<i>mecA</i> (5), <i>femA</i> (16). <i>rpoB</i> (11), <i>blaZ</i> (16), <i>e</i> <i>rmB</i> (15), <i>tet</i> (M)(8)	AMP (29), PEN (29), RIF(24), CLI(24), OXA (22), ERY(21), VAN(15), TET(13), SXT(13), CIP(10), GEN(1)	SCCmec(5)	8
	2016	<i>E. faecium</i> (30), <i>E. faecalis</i> (37) <i>E. mundtii</i> (36), <i>E. casseliflavus</i> (14), <i>E. gallinarum</i> (5), <i>E. hirae</i> (1), <i>E. sulfurens</i> (1)	Surface water(124)	124(86)	ND	<i>tet</i> (L)(17), <i>msrC</i> (9)	AMP(59), AMX(53), PEN(87), STR(8), VAN(86), CHL(23), CIP(47), ERY(68), TET(59)	ND	9
	2015	<i>E. faecium</i> (30), <i>E. durans.</i> (15)	waste water (32) and effluent (32)	(45)	ND	<i>erm</i> (B) (40), <i>vanB</i> , (42), <i>vanC1</i> (42), <i>van</i> C2/3 (42)	PEN (38), ERY(40), CTX(43), GEN(28), IPM(43), TET(45), KAN(43), CIP(43), VAN(29), CLI(45)	ND	10

	2017	<i>S. aureus</i> (12)	Wastewater	12	ST3245 (7), ST15 (1)	<i>blaZ</i> (7), <i>msrA</i> (7), <i>tet(K)</i> (1)	PEN(12), ERY(7), TET(1), CLI(1)	ND	12
	2017	<i>E. faecalis</i> (2), <i>E. faecium</i> (NS), <i>Enterococcus</i> <i>spp</i> (NS)	Urban wastewater (5)	5(2)	ST86(2)	<i>optrA</i> (2), <i>erm</i> (A), <i>erm</i> (B), <i>tet(M)</i> (1), <i>tet(L)</i> (1), <i>aac</i> (6')- <i>aph</i> (2'')	CHL(2), CIP(2), ERY(2), TET(1), GEN(1), STR(2)	ND	13
Tunisia (7)	2016	<i>E. faecium</i> (86), <i>E. faecalis</i> (8), <i>E. casseliflavus</i> (6)	Hands (50), inanimate such as beds, treatment tables, toilets, faucets, wrists, sinks (250)	(100)	ST910 (13), ST80 (1)	<i>erm</i> (B) (71), <i>tet(M)</i> (18), <i>aph</i> (3')- <i>IIIa</i> (27), <i>ant</i> (6)- <i>la</i> (15), <i>cat(A)</i> (4), <i>vanC2</i> (6)	ERY(73), TET(20), STR(27) and KAN(28), VAN(14), CHL(10), SXT(100), CIP(48), PRI(18)	<i>IS16</i> (14)	14
	2016	<i>S. saprophyticus</i> (30), <i>S. haemolyticus</i> (38), <i>S. epidermidis</i> (NS), <i>S. cohnii</i> (NS), <i>S. warneri</i> (NS), <i>S. sciuri</i> (NS), <i>S. simulans</i> (NS), <i>S. pasteurii</i> (NS), <i>S. arlettae</i> (NS) and <i>S. xylosus</i> (NS)	Inanimate surfaces (83)	83 (32)	ND	<i>mecA</i> (20), <i>msr(A)</i> (32), <i>erm</i> (C)(8), <i>tet(K)</i> and/or <i>tet(M)</i> (21), <i>aac</i> (6')- <i>le-</i> <i>aph</i> (2'')- <i>la</i> (16), <i>(aph</i> (3')- <i>IIIa</i> (19), <i>ant</i> (4')- <i>la</i> (14), <i>ant</i> (6')- <i>la</i> (3)	ERY(32), TET(23), GEN(16), TOB(14), STR(3), Pen(39), OXA(20), FOX(20), KAN(27), SXT(17), CLI(14), CIP(18), FUS(26), STR(11)	SCC <i>mec</i> (20)	15
	2015	<i>E. faecium</i> (34), <i>E. hirae</i> (23), <i>E. faecalis</i> (4), and <i>E. casseliflavus</i> (4)	Vegetable food (34), soil and irrigation water (27)	65 (40)	ST2 (5), ST16 (2), ST528 (2), ST56 (1), ST885 (1), ST886 (1)	<i>erm</i> (B) (12), <i>tet(M)-</i> <i>tet(L)</i> (10), <i>aph</i> (3')- <i>III</i> , (10) <i>ant</i> (6) (2), <i>vanC2</i> (4)	CIP(42), ERY(12), TET(10), KAN(10), CHL(5), STR(2), and GEN(5), VAN(4)	ND	16

	2015	<i>E. faecium</i> (54), <i>E. faecalis</i> (17), <i>E. hirae</i> (8), <i>E. casseliflavus</i> (4), <i>E. durans</i> (2)	waste and surface water (114)	(85)	ST480 (1), ST531 (1), ST55 (1), ST532(1), ST202 (1), ST314(1), ST985(1), ST30 (1), ST986 (1), ST12 (1), ST296 (1), ST327(1)	aph(3')-Ila (22), ant(6)-la (4), erm(B) (34), tet(M) (13), tet(L)(8), aac(6')-Ie-aph(2')(15)	GEN(22), KAN(22), STR(7), ERY(36), TET(13), SXT(79), CIP(6),	ND	17
	2015	<i>S. aureus</i> (12)	Hospital environment (12)	12(6)	ST247(2)	blaZ(12), erm(A), tet(M)(2), aac(6')-aph(2')(2), mecA(2)	STR(2), KAN(2), ERY(2), CLI(2), TET(2), FUS(2), TOB(2), GEN(2), AMK(2), OXA(6), PEN(12), FOX(2)	SCCmec(2)	18
	2014	<i>E. faecium</i> (5), <i>E. casseliflavus</i> (7)	Hospital environment ((beds, treatment table, toilet, faucet, wrist and sink) (100)	(12)	ST80 (1)	vanA(5), vanC2(7), ermB(12), tetM(5), aph(3')-Ila(5), aac(6')-aph(2") (5)	VAN (12), AMP(5), CIP(12), ERY(12), TET(8), STR(6), KAN(80, SXT(11), GEN(3), TEC(5)	IS16(1)	19
	2014	<i>S. aureus</i> (10)	Refrigerator, floor, desk, sink, tray surface (10)	10(5)	ND	BlaZ(5), tetK(5), tetM(2),	SXT(5)	ND	20
Zambia									

References

1. Achek R, Hotzel H, Cantekin Z, Nabi I, Hamdi TM, Neubauer H, E.-A. H. Emerging of antimicrobial resistance in staphylococci isolated from clinical and food samples in Algeria. *BMC Res. Notes* **11(1)**, 663. (2018).

2. Martins E, Novais C, Freitas AR, Dias AR, Ribeiro TG, Antunes P, P. L. Filling the map for antimicrobial resistance in sub-Saharan Africa: ampicillin-resistant Enterococcus from non-clinical sources in Angola. *J. Antimicrob. Chemother.* **70**, 2914–6.
3. Bendary MM, Solyman SM, Azab MM, Mahmoud NF, H. A. Genetic diversity of multidrug resistant *Staphylococcus aureus* isolated from clinical and non clinical samples in Egypt. *Cell Mol Biol* **62(10)**, 55-61. (2016).
4. Donkor ES, Jamrozy D, Mills RO, Dankwah T, Amoo PK, Egyir B, Badoe EV, Twasam J, B. S. A genomic infection control study for *Staphylococcus aureus* in two Ghanaian hospitals. *Infect. Drug Resist.* **11**, 1757. (2018).
5. Ngbede EO, Raji MA, Kwanashie CN, Kwaga JK, Adikwu AA, Maurice NA, A. A. Characterization of high level ampicillin-and aminoglycoside-resistant enterococci isolated from non-hospital sources. *J. Med. Microbiol.* **10;66(7)**, 1027–32 (2017).
6. Hamiwe T, Kock MM, Magwira CA, Antiabong JF, E. M. Occurrence of enterococci harbouring clinically important antibiotic resistance genes in the aquatic environment in Gauteng, South Africa. *Environ. pollution.* **245**, 1041–9. (2019).
7. Matlou DP, Bissong ME, Tchatchouang CD, Adem MR, Foka FE, Kumar A, A. C. Virulence profiles of vancomycin-resistant enterococci isolated from surface and ground water utilized by humans in the North West Province, South Africa: a public health perspective. *Environ. Sci. Pollut. Res.* **26(15)**, 15105–14 (2019).
8. Akanbi OE, Njom HA, Fri J, Otigbu AC, C. A. Antimicrobial Susceptibility of *Staphylococcus aureus* Isolated from Recreational Waters and Beach Sand in Eastern Cape Province of South Africa. *Int. J. Environ. Res. public Heal.* 1001. (2017).
9. Molale LG, B. C. Antibiotic resistance, efflux pump genes and virulence determinants in *Enterococcus* spp. from surface water systems. *Environ. Sci. Pollut. Res.* . **23**, 21501–10
10. Iweriebor, Benson Chuks, Sisipho Gaqavu, Larry Chikwelu Obi, Uchechukwu U. Nwodo, and A. I. O. ‘Antibiotic susceptibilities of *Enterococcus* species isolated from hospital and domestic wastewater effluents in Alice, eastern Cape Province of South Africa.’ 4231-4246. *Int. J. Environ. Res. Public Health* **12**, no. 4,
11. Ateba CN, Lekoma KP, K. D. ‘Detection of vanA and vanB genes in vancomycin-resistant enterococci (VRE) from groundwater using multiplex PCR analysis.’ *J. Water Health* **11.4**, 684-691. (2013).
12. Said MB, Abbassi MS, Gómez P, Ruiz-Ripa L, Sghaier S, Ibrahim C, Torres C, H. A. *Staphylococcus aureus* isolated from wastewater treatment plants in Tunisia: occurrence of human and animal associated lineages. *J. water Heal.* **15(4)**, 638–43 (2017).
13. Freitas AR, Elghaieb H, León-Sampedro R, Abbassi MS, Novais C, Coque TM, Hassen A, P. L. Detection of optrA in the African continent (Tunisia) within a mosaic *Enterococcus faecalis* plasmid from urban wastewaters. *J. Antimicrob. Chemother.* **72(12)**, 3245–51. (2017).
14. Dziri R, Lozano C, Said LB, Bellaaj R, Boudabous A, Slama KB, Torres C, K. N. Multidrug-resistant enterococci in the hospital environment:

- detection of novel vancomycin-resistant *E. faecium* clone ST910. *J. Infect. Dev. Countries.* **10(08):**, 799-806. (2016).
- 15. Dziri, R. *et al.* High prevalence of *Staphylococcus haemolyticus* and *Staphylococcus sapro- phyticus* in environmental samples of a Tunisian hospital. *Diagn. Microbiol. Infect. Dis.* **85.2**, 136-140. (2016).
 - 16. Ben Said L, Klibi N, Dziri R, Borgo F, Boudabous A, Ben Slama K, T. C. 'Prevalence, antimicrobial resistance and genetic lineages of Enterococcus spp. from vegetable food, soil and irrigation water in farm environments in Tunisia.' *J. Sci. Food Agric.* **96(5):**, 1627–33. (2016).
 - 17. Said LB, Klibi N, Lozano C, Dziri R, Slama KB, Boudabous A, T. C. 'Diversity of enterococcal species and characterization of high-level aminoglycoside resistant enterococci of samples of wastewater and surface water in Tunisia.' *Sci. Total Environ.* **530**, 11–17 (2015).
 - 18. Gharsa H, Dziri R, Klibi N, Chairat S, Lozano C, Torres C, Bellaaj R, S. K. Environmental *Staphylococcus aureus* contamination in a Tunisian hospital. *J. Chemother.* **28**, 506–9. (2016).
 - 19. Elhani D, Klibi N, Dziri R, Hassan MB, Mohamed SA, Said LB, Mahjoub A, Slama KB, Jemli B, Bellaj R, B. F. 'vanA-containing *E. faecium* isolates of clonal complex CC17 in clinical and environmental samples in a Tunisian hospital.' *Diagn. Microbiol. Infect. Dis.* **79**, no. 1, 60-63. (2014).
 - 20. Youn JH, Park YH, Hang'ombe B, S. C. Prevalence and characterization of *Staphylococcus aureus* and *Staphylococcus pseudintermedius* isolated from companion animals and environment in the veterinary teaching hospital in Zambia, Africa. *Comp. Immunol. Microbiol. Infect. Dis.* **37(2)**, 123–30. (2014).