GERMS

SOUTH AFRICA

# Annual Report 2017

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES

Division of the National Health Laboratory Service

**The GERMS-SA Annual Report 2017 was compiled by the National Institute for Communicable Diseases, a division of the National Health Laboratory Service, Johannesburg, South Africa.**


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## Introduction

NICD reference laboratories report their GERMS-SA surveillance findings for 2017.

Surveillance continues to be useful in reporting trends in pathogen-specific data however the number of isolates received by NICD reference laboratories continues to decrease with worsening viability of isolates. This means that we have fewer isolates for antimicrobial susceptibility testing and serotyping/ serogrouping. We urge all microbiology laboratories, in their challenged capacities, to continue participating in laboratory surveillance so monitoring can continue and relevant, evidence-based policies can be made. The 2017 report also includes all NICD projects using our GERMS-SA platform. These include STI, HIV drug resistance, rotavirus/diarrhoeal aetiological surveillance and zoonosis surveillance. These projects differ from the laboratory-based surveillance in that some are syndromic surveillance and specimens are taken from patients.

We encourage all laboratory staff to continue participating in the NICD surveillance programmes. We thank you for your ongoing service to the health of all South Africans.

**GERMS-SA Field Project Coordinator meeting 15 March 2017**

# Laboratory-based surveillance

## Methods

In 2017, diseases under surveillance included:

1. Opportunistic infections associated with HIV, e.g. cryptococcosis, invasive pneumococcal disease (IPD) and rifampicin-resistant and –susceptible *Mycobacterium tuberculosis*
2. Epidemic-prone diseases, e.g. *Neisseria meningitidis*, *Salmonella enterica* serotype Typhi, *Shigella* species, *Vibrio cholera,* diarrhoeagenic *Escherichia coli* and listeriosis
3. Vaccine-preventable diseases, e.g. *Haemophilus influenzae* type b (Hib), *Streptococcus pneumoniae* and rotavirus
4. Hospital infections, e.g. *Staphylococcus aureus*, Carbapenem resistant Enterobacteriaceae and *Candida* species

The methods utilised by the GERMS-SA surveillance programme have been previously described in detail (1).
In brief, approximately 222 South African clinical microbiology laboratories participated in the surveillance programme in 2017. The population under surveillance in 2017 was estimated at 56, 5 million (Table 1). Diagnostic laboratories reported case patients to the National Institute for Communicable Diseases (NICD) using laboratory case report forms, according to standard case definitions. If available, isolates from case patients were submitted on Dorset transport media to the NICD for further phenotypic and genotypic characterisation. From 1 July 2008 to 31 December 2013, surveillance methodology for the cryptococcal project was changed, so that only enhanced surveillance sites (ESS) (29 hospitals in 9 provinces), NHLS laboratories in KZN, and laboratories in the private, mining, and military sectors were required to directly report case patients to NICD. In 2015 and 2016, no laboratories were required to directly report case patients or send isolates to NICD. For these

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cases of cryptococcosis, data were obtained directly from the NHLS Corporate Data Warehouse (CDW), which stores information from Disa*Lab and TrakCare laboratory information systems. Cryptococcal isolates, obtained from patients at ESS, continued to be characterised by phenotypic and genotypic tests through 2013. From July 2010 through August 2012, 7 sentinel sites reported cases of *S. aureus* bacteraemia to GERMS-SA. From September 2012 through 2013, laboratory-based bacteraemic *S. aureus* surveillance continued at 3 Gauteng sites only, and in 2014 to 2017, 2 additional sites in the Western Cape were included. From January 2012, 7 sentinel sites in Gauteng and Western Cape provinces reported cases of candidaemia to GERMS-SA, increasing to 12 sites in 2013. Candidaemia surveillance changed to 18 new sites in the remaining seven provinces in 2014, with an additional 2 in 2015. All laboratories were asked to send candidaemia isolates in 2016 and 2017. Carbapenam Resistant Enterobacteriaceae (CRE) surveillance started in July 2015 in four provinces and these organisms were requested to be sent: *Klebsiella* spp., *Enterobacter* spp., *Citrobacter* spp., *Serratia* spp., *E. coli*., *Providentia* spp., *Proteus* spp., *Salmonella* spp., *Morganella* spp. and *Acinetobacter baumannii.*

Enhanced surveillance was not conducted on any of the enteric pathogens in 2015 but restarted for *Salmonella* Typhi only in 2016. At ESS, surveillance officers completed clinical case report forms electronically using the Mobenzi application on mobile phones/ tablets for patients with eight laboratory-confirmed diseases (cryptococcosis [for January through March only and for 2017 included September to December], candidaemia, invasive pneumococcal disease, invasive meningococcal disease, invasive *Haemophilus influenzae* disease, invasive *Salmonella* Typhi disease, bacteraemic *S. aureus* disease [at 5 sites], rifampicin-resistant tuberculosis [at 8 sites] and rifampicin-susceptible TB [3 sites]), by case patient interview or hospital medical record review, to obtain additional clinical details, including antimicrobial use, vaccination history, HIV status, and patient outcome. Case patients were followed up only for the duration of the hospital admission. Data management was centralised at the NICD. Laboratory, clinical and demographic data from case patients were recorded on a Microsoft Access database. A surveillance audit was performed for NHLS laboratories in all provinces using the NHLS CDW. For all diseases under surveillance, except cryptococcosis, the audit was designed to obtain basic demographic and laboratory data from additional case patients with laboratory-confirmed disease not already reported to GERMS-SA by participating laboratories. For cryptococcosis, the audit was designed to obtain data from cases that were no longer reported by NHLS laboratories. Data from case patients, detected by audit, were included on the surveillance database, and have been included in this report; Incidence was calculated using mid-year population estimates for 2016 and 2017 from Statistics South Africa (Table 1) (2). Incidence in the HIV-infected and AIDS populations was calculated for 2016 and 2017, using the Thembisa model (Table 1) (3). All reported incidence is expressed as cases per 100,000 population, unless otherwise stated. Reported p-values were calculated using the Mantel-Haenszel chi-squared test and p values <0.05 were considered significant throughout. Ethics approval for the on-going activities of the surveillance programme was obtained from the Human Research Ethics Committee (Medical), University of Witwatersrand (clearance number M140159 (previously M08-11-17) and from relevant University and Provincial Ethics Committees for other enhanced surveillance sites. Surveillance activities were funded by the NICD/NHLS.

**Table 1. Population denominators used to calculate incidence rates, South Africa, 2016 and 2017**

| Province | General population* | | HIV-infected population** | |
|---|---|---|---|---|
| | 2016 | **2017** | 2016 | **2017** |
| Eastern Cape | 7,061,717 | **6,498,683** | 770,704 | **785,266** |
| Free State | 2,861,618 | **2,866,678** | 365,137 | **368,972** |
| Gauteng | 13,498,151 | **14,278,669** | 1,805,817 | **1,852,088** |
| KwaZulu-Natal | 11,079,717 | **11,074,784** | 1,938,323 | **1,967,748** |
| Limpopo | 5,803,941 | **5,778,442** | 445,097 | **453,531** |
| Mpumalanga | 4,328,256 | **4,444,212** | 665,041 | **682,723** |
| Northern Cape | 1,191,651 | **1,213,996** | 79,657 | **80,762** |
| North West | 3,790,614 | **3,856,174** | 474,748 | **482,017** |
| Western Cape | 6,293,200 | **6,510,312** | 421,751 | **436,771** |
| **South Africa** | 55,908,865 | **56,521,948** | 6,966,275 | **7,109,879** |

Data source: *Statistics South Africa, **Thembisa Model

## Operational Report

**Site visits**

In 2017, NICD staff members did 85 site visits to feedback, train and trouble-shoot at laboratories, hospitals and clinics linked to GERMS surveillance (Table 2). Feedback is important to maintain or improve surveillance participation.

**Coordination of meetings**

Field Project Coordinators' (FPC) meeting, 14-17 March 2017: FPCs learned how to do power point presentation and to set performance objectives for 2017 for both FPCs, Community Surveillance Assistants (CSA) and Surveillance Officers (SO)

FPC meeting , 07 June 2017: aims were to improve FPC's report writing skills.

GERMS-SA NICD Surveillance Review: held at the NICD on 8-9 June 2017. This year we included additional NICD functions in our presentations (Emergency Operations Centre, National Cancer Registry and Notifiable Medical Conditions) along with GERMS-SA work. It was attended by all coordinators from all provinces and most sites, DoH and CDC USA collaborators.

FPC and team leaders meeting, 8-10 November 2017: information for action, discussed GEDI logs, disciplinary and data quality.

**Surveillance audit**

A total of 19,510 surveillance cases were detected by GERMS-SA in 2017. Excluding the cases of cryptococcosis (n=6,636) which are all detected by audit as isolates are no longer required to be sent to the NICD, and cases of rifampicin-resistant TB (n=1,234), for which no audits are performed, 4,148/11,640 (36%) of cases were not reported to the NICD by the clinical microbiology laboratories, but were detected by audit of the NHLS Corporate Data Warehouse (Table 3). GERMS-SA constantly strives to reduce the number of cases detected on audit by raising awareness of the surveillance programme; this is important because GERMS-SA is unable to perform additional microbiological characterisation of isolates detected only through audit.

**Enhanced surveillance site performance indicators**

The proportion of completed CRFs in 2017 was a little lower than that in 2016 . This was due in part to difficulties in finding TB patients (for interview and sputum collection) (Tables 4 and 5): 5,233/ 5,720 (91%) of cases had a case report form (CRF) completed (target = 90%). The interview rate was poorer than previous years partly due to the hospital setting challenges and the changes around SOs doing telephonic interviews [3,683 (70%) of the CRFs were completed by patient interview (target=70%)]. Since 2007, enhanced surveillance site operational reports (ESSOR) have been provided to the site coordinators, laboratory staff and surveillance officers to enable the site team to regularly review site performance, in comparison with set targets. The main objective of these reports is to provide information regarding the overall functioning of the surveillance site, by providing indicators of laboratory participation (submission of isolates), and indicators of surveillance officer performance (completion of CRFs). By reviewing these indicators, problems with data collection can be targeted, and recommendations are provided to improve the site performance. In 2017, these reports were provided quarterly.

**Enhanced surveillance site quality monitoring**

In 2017, surveillance officers (SOs) were audited in terms of quality of work. CRFs from a fixed time period were randomly selected for each surveillance officer so that there were 7 CRFs (one for each organism) to audit per SO. The medical record files were drawn and the GERMS-coordinating staff filled in a modified clean CRF from the original source data and compared their CRF with the original SO CRF. A scoring system was set up and, although the scores varied widely amongst SOs, many of the errors were ones of omission and overlooking information rather than entry of incorrect data. Data training was done regularly to overcome these errors.

**Table 2. GERMS-SA surveillance laboratory, hospital, clinic site visits and DOH meetings between January and December 2017**

| Date | Province | Laboratory (NHLS or private) | Clinics | Hospital | Database training |
|---|---|---|---|---|---|
| 09 January | Gauteng | Steve Biko NHLS | - | Steve Biko | - |
| 11 January | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 12 January | Gauteng | Dr. George Mukhari NHLS | - | - | SOs |
| 12 January | Gauteng | - | - | Rahima Moosa | - |
| 17 January | Mpumalanga | Rob Ferreira NHLS | - | Rob Ferreira | - |
| 18 January | Mpumalanga | - | Hluvukani CHC/ Tintswalo Hospital | - | - |
| 19 January | Mpumalanga | - | Kabokweni CHC | - | - |
| 19 January | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 20 January | Mpumalanga | Themba NHLS | - | Themba | - |

**SOs = surveillance officers**

| Date | Province | Laboratory (NHLS or private) | Clinics | Hospital | Database training |
|---|---|---|---|---|---|
| 20 January | Gauteng | Steve Biko NHLS | - | Steve Biko | - |
| 24 January | Mpumalanga | Rob Ferreira NHLS | Kabokweni CHC | Rob Ferreira | - |
| 26 - 27 January | Limpopo | Polokwane NHLS | - | Polokwane | - |
| 27 January | Gauteng | Chris Hani Baragwanath NHLS | - | - | SOs |
| 27 - 28 January | Eastern Cape | Port Elizabeth Provincial NHLS | Zwide CHC | - | - |
| 29 January | KwaZulu-Natal | Northdale NHLS | Eastboom CHC | - | - |
| 01 February | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 02 February | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 03 February | Gauteng | Steve Biko/ Dr George Mukhari NHLS | - | Steve Biko/ Dr George Mukhari | - |
| 03 February | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 04 February | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 04 February | KwaZulu-Natal | Northdale NHLS | Eastboom Clinic | - | - |
| 09 February | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 8 - 10 February | Eastern Cape | Port Elizabeth Provincial NHLS | Zwide Clinic | - | - |
| 15 - 17 February | Eastern Cape | Port Elizabeth Provincial NHLS | - | Port Elizabeth | - |
| 21 February | Gauteng | - | Chiawelo CHC | - | - |
| 22 February | Gauteng | Steve Biko NHLS | - | Steve Biko | - |
| 24 February | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 24 February | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 28 February - 2 March | Limpopo | Mankweng/Seshego/Polokwane NHLS | - | Mankweng/Seshego/ Polokwane | - |
| 02 March | Western Cape | Tygerberg NHLS | - | Tygerberg | - |
| 03 March | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 09 March | Western Cape | Groote Schuur NHLS | - | Groote Schuur | - |
| 27 March and 03 April | Gauteng | Lancet Richmond | - | - | - |
| 03 April | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 05 April | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | |
| 5 - 7 April | North West | Klerksdorp/Tshepong NHLS | - | Klerksdorp/Tshepong | - |
| 13 April | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |

**SOs = surveillance officers**

| Date | Province | Laboratory (NHLS or private) | Clinics | Hospital | Database training |
|---|---|---|---|---|---|
| 21 April | Gauteng | Steve Biko NHLS | - | CHBAH | - |
| 21 April | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 24 April | Free State | Universitas/ Pelonomi NHLS | - | Universitas/ Pelonomi | - |
| 08 May | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 8 - 9 May | Northern Cape | Kimberley NHLS | - | Kimberley | - |
| 10 - 12 May | Free State | Universitas/Pelonomi NHLS | - | Universitas/ Pelonomi | - |
| 11 - 12 May | Limpopo | Polokwane NHLS | - | Polokwane | - |
| 19 May | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 23 May | North West | Tshepong NHLS | Jouberton CHC | Tshepong | - |
| 24 May | Northern Cape | Kimberley NHLS | - | Kimberley | - |
| 25 May | Gauteng | Chris Hani Baragwanath NHLS | - | CHBAH | - |
| 26 May | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 26 May | Western Cape | Tygerberg NHLS | - | Tygerberg | - |
| 29 May | Free State | Universitas/ Pelonomi NHLS | - | Universitas | - |
| 31 May | Western Cape | Red Cross Hospital | - | Red Cross | - |
| 01 - 02 June | Eastern Cape | Port Elizabeth Provincial NHLS | Zwide CHC | - | - |
| 02 June | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 05 June | Mpumalanga | Themba/ Rob Ferreira NHLS | Kabokweni CHC | Themba/ Rob Ferreira | - |
| 15 June | Gauteng | Rahima Moosa Hospital | - | Rahima Moosa | - |
| 19 - 20 June | Free State | Universitas/ Pelonomi NHLS | - | Universitas/ Pelonomi | - |
| 20 - 21 June | North West | Tshepong/ Klerksdorp NHLS | - | Tshepong/ Klerksdorp | - |
| 20 - 21 June | KwaZulu-Natal | RK Khan, King Edward, Prince Mshiyeni and Inkosi Albert Luthuli NHLS | Phoenix CHC | RK Khan/KEH/IALH - | - |
| 21 - 22 June | Northern Cape | Kimberley NHLS | - | Kimberley | - |
| 21-22 June | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 23 June | Free State | Universitas NHLS | - | Universitas | - |
| 23 June | KwaZulu-Natal | King Edward NHLS | - | King Edward | SOs |
| 24 June | KwaZulu-Natal | Inkosi Albert Luthuli NHLS | - | Inkosi Albert | SOs |

**SOs = surveillance officers**

| Date | Province | Laboratory (NHLS or private) | Clinics | Hospital | Database training |
|---|---|---|---|---|---|
| 27 - 28 June | Northern Cape | Kimberley NHLS | - | Kimberley | - |
| 05 July | North West | Tshepong NHLS | - | Tshepong | - |
| 16 -1 7 August | KwaZulu-Natal | Edendale NHLS | Eastboom CHC | Edendale | - |
| 17 - 19 August | KwaZulu-Natal | King Edward NHLS | Phoenix CHC | King Edward | - |
| 17- 18 August | Free State | Pelonomi NHLS | - | Pelonomi | - |
| 25 August | Northern Cape | Kimberley NHLS | - | Kimberley | - |
| 29 August | KwaZulu-Natal | RK Khan NHLS | Phoenix CHC | RK Khan | - |
| 07 September | North West | Tshepong NHLS | Jouberton CHC | Tshepong | - |
| 18 - 21 September | Northern Cape | Kimberley NHLS | - | Kimberley | - |
| 05 October | Gauteng | Helen Joseph NHLS | - | Helen Joseph | - |
| 05 October | Free State | Kimberley NHLS | - | Kimberley | - |
| 16 October | Free State | Pelonomi NHLS | - | Pelonomi | - |
| 31 October | Free State | Kimberley NHLS | - | Kimberley | - |
| 17 - 19 October | Free State | Kimberley NHLS | - | Kimberley | - |
| 21 - 24 October | Eastern Cape | Port Elizabeth Provincial NHLS | Zwide Clinic | Port Elizabeth | - |
| 25 - 26 October | KwaZulu-Natal | Addington NHLS | - | Addington | SOs |
| 26 October | KwaZulu-Natal | RK Khan NHLS | - | RK Khan | SOs |
| 15 November | Northern Cape | Kimberley NHLS | - | Kimberley | - |
| 23 November | Free State | Universitas/ Pelonomi NHLS | - | Universitas/ Pelonomi | - |
| 24 November | North West | Tshepong/ Klerksdorp NHLS | Jouberton CHC | Tshepong/ Klerksdorp | - |
| 20 December | Free State | Universitas/Pelonomi NHLS | - | Universitas/ Pelonomi | - |

**SOs = surveillance officers**

**Table 3. Cases detected by surveillance audit by province, 2017**

| Surveillance case | | Percentage of cases detected by audit* $n_1/n_2$ (%) | Number of cases detected by audit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | EC | FS | GA | KZ | LP | MP | NC | NW | WC | SA |
| Invasive | Cryptococcosis** | 6,636/6,636 (100%) | 789 | 239 | 1,859 | 1,899 | 404 | 500 | 46 | 493 | 407 | 6,636 |
| | Candidaemia | 287/2,058 (14%) | 27 | 5 | 204 | 17 | 10 | 3 | 3 | 3 | 15 | 287 |
| | *Salmonella Typhi* | 3/92 (3%) | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 3 |
| | Non-typhoidal salmonellosis† | 448/555 (81%) | 39 | 9 | 182 | 59 | 17 | 13 | 7 | 11 | 111 | 448 |
| | Shigellosis | 40/51 (78%) | 4 | 0 | 7 | 2 | 0 | 0 | 2 | 9 | 16 | 40 |
| | Listeriosis | 302/748 (40%) | 16 | 15 | 181 | 29 | 13 | 17 | 2 | 7 | 22 | 302 |
| | Meningococcal disease | 9/136 (7%) | 1 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 2 | 9 |
| | *Haemophilus influenzae* disease | 103/313 (33%) | 18 | 2 | 38 | 20 | 2 | 6 | 0 | 1 | 16 | 103 |
| | Pneumococcal disease | 535/2,441 (22%) | 85 | 34 | 206 | 127 | 10 | 15 | 2 | 25 | 31 | 535 |
| | *Staphylococcus aureus* disease (BC only) | 108/1,001 (11%) | N/A | N/A | 81 | N/A | N/A | N/A | N/A | N/A | 27 | 108 |
| | Carbapenem re-sistant Enterobac-teriaceae (BC only) | 142/483 (29%) | N/A | N/A | 122 | 18 | N/A | N/A | N/A | N/A | 2 | 142 |
| | *Acinetobacter baumannii* (BC only) | 812/1,330 (61%) | N/A | 46 | 625 | 98 | N/A | N/A | N/A | N/A | 42 | 812 |
| Non-invasive | *Salmonella Typhi* | 1/17 (6%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | Non-typhoidal salmonellosis† | 770/1,658 (46%) | 134 | 27 | 182 | 143 | 45 | 46 | 10 | 34 | 149 | 770 |
| | Shigellosis | 588/757 (78%) | 77 | 16 | 123 | 101 | 13 | 10 | 3 | 33 | 212 | 588 |
| | Cholera†† | 0/0 (N/A) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Rifampicin-resistant tubercu-losis*** | NA/1,234 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Total (excluding crypto and RSTB)** | | **4,148/11,640 (36%)** | | | | | | | | | | |

*Percentage of cases detected by audit = number of cases detected on audit (n1)/total number of cases detected by GERMS-SA (n2) x 100; **All cryptococcal cases are detected on audit and no isolates are received, therefore this organism is excluded from the total; ***Audits are not performed on TB cases, therefore this organism is excluded from the total; †Excluding Salmonella enterica serotype Paratyphi; ††Only Vibrio cholerae O1; EC: Eastern Cape; FS: Free State; GA: Gauteng; KZ: KwaZulu-Natal; LP: Limpopo; MP: Mpumalanga; NC: Northern Cape; NW: North West; WC: Western Cape; SA: South Africa; BC: Blood culture.

## Enhanced surveillance site project

In 2017, 5,720 surveillance case patients were diagnosed at enhanced surveillance sites (Table 4). Of case patients with recorded HIV status, 61% (2,275/3,742) were HIV-infected (Table 5). The proportion of case patients with confirmed HIV infection varied by surveillance disease: unsurprisingly, a very high proportion of patients with AIDS-defining infections like cryptococcosis (96%), RRTB (75%) were HIV-infected. *S.* Typhi HIV infections was high (83%) although numbers of *S.* Typhi were small; HIV infection amongst patients with invasive pneumococcal disease, for which HIV is a known risk factor, was 64%.

**Table 4. Enhanced surveillance site performance indicators, 2017**

| Enhanced surveillance site | Case patients, n | Completed case report forms*, n (%)** | | Case report forms completed by interview, n (%)*** | |
|---|---|---|---|---|---|
| Addington [1] | 41 | 36 | (88) | 30 | (83) |
| Charlotte Maxeke Johannesburg Academic [1,2,4] | 649 | 638 | (98) | 439 | (69) |
| Chris Hani Baragwanath/ Zola-Jabulani District [1,3,4] | 852 | 704 | (83) | 388 | (55) |
| Dr George Mukhari [1,4] | 156 | 146 | (94) | 80 | (55) |
| Edendale/ Greys'/ Northdale [1,3,4] | 307 | 302 | (98) | 289 | (96) |
| Groote Schuur/ Red Cross [2,4] | 347 | 319 | (92) | 202 | (63) |
| Helen Joseph/ Rahima Moosa Mother & Child [2,4] | 462 | 434 | (94) | 343 | (79) |
| Kimberley [1,3] | 151 | 141 | (93) | 93 | (66) |
| King Edward VIII/ Inkosi Albert Luthuli Central Hospital [1,4] | 103 | 91 | (88) | 71 | (78) |
| Klerksdorp/ Tshepong [1,3] | 213 | 206 | (97) | 146 | (71) |
| Mankweng/ Polokwane/ Seshego [1,3] | 125 | 106 | (85) | 69 | (65) |
| Netcare Milpark, Pretoria East, Sunninghill[1] | 173 | 152 | (88) | 55 | (36) |
| Pelonomi/ Universitas [1,3,4] | 249 | 238 | (96) | 153 | (64) |
| Port Elizabeth/ Dora Nginza/ Livingstone [1,3] | 743 | 604 | (81) | 517 | (86) |
| RK Khan [1,4] | 114 | 102 | (89) | 84 | (82) |
| Rob Ferreira/ Themba [1,3] | 202 | 190 | (94) | 160 | (84) |
| Steve Biko Pretoria Academic/ Tshwane District [1,2,4] | 438 | 431 | (98) | 321 | (74) |
| Tygerberg [1,2,4] | 395 | 393 | (99) | 243 | (62) |
| **TOTAL** | **5,720** | **5,233** | **(91)** | **3,683** | **(70)** |

Note - The percentage (in brackets) in each cell was calculated using the numerator from that cell and the corresponding denominator from the cell to the left; Cryptococcal surveillance was only enhanced for Q1 and 4 of 2017 (there were an additional 794 cases from Q2 and 3 where no CRFs were asked for); *Low case report form completion rates at certain sites are due to challenges in completing CRFs for certain pathogens; **Target = 90%; ***Target = 70%; [1]Sites doing candidaemia surveillance; [2]Sites doing *S. aureus* enhanced surveillance (bacteraemia only); [3]Sites doing rifampicin-resistant TB surveillance, [4]sites doing CRE surveillance.

**Table 5. Numbers and percentage* of patients diagnosed with laboratory-confirmed invasive disease at GERMS-SA enhanced surveillance sites, with confirmed HIV-1 infection **, South Africa, 2017**

| Pathogen | Case patients, n | Case patients with completed case report forms, n (%)* | | Case patients with known HIV status, n (%) | | Case patients with confirmed HIV infection, n (%)** | |
|---|---|---|---|---|---|---|---|
| *Cryptococcus* species† | 1,604 | 777 | (48) | 739 | (95) | 711 | (96) |
| *Candida* species | 1,140 | 1056 | (93) | 471 | (45) | 134 | (28) |
| *Neisseria meningitidis* | 39 | 39 | (100) | 29 | (74) | 8 | (28) |
| *Streptococcus pneumoniae* | 952 | 871 | (91) | 681 | (78) | 437 | (64) |
| *Haemophilus influenzae* | 149 | 129 | (87) | 92 | (71) | 30 | (33) |
| *Salmonella* Typhi | 31 | 23 | (74) | 23 | (100) | 19 | (83) |
| *Staphylococcus aureus* | 1,001 | 992 | (99) | 536 | (54) | 186 | (35) |
| CRE | 483 | 456 | (94) | 292 | (64) | 93 | (32) |
| Rifampicin-resistant TB | 1234 | 970 | (79) | 879 | (91) | 657 | (75) |
| **TOTAL** | 6,633 | 5,313 | (80) | 3,742 | (70) | 2,275 | (61) |

*The percentage (in brackets) in each cell was calculated using the numerator from that cell and the corresponding denominator from the cell to the left. **HIV infection was confirmed by an age-appropriate, laboratory test and recorded by surveillance officers at enhanced surveillance sites. †For cryptococcal disease, case report forms were completed for the first and last quarter of 2017 at all GERMS enhanced surveillance sites.

## *Cryptococcus* species

**Results**

During 2017, 6,636 case patients with laboratory-confirmed incident cryptococcal disease (including meningitis, fungaemia and culture-positive disease at other sites but excluding cryptococcal antigenaemia) were reported (Table 6). A total of 3,196 cases of cryptococcal antigenaemia (with no concurrent recorded cryptococcal meningitis or fungaemia) were detected at NHLS microbiology laboratories. After excluding the latter cases, the incidence remained stable in all but one province between 2016 and 2017 (overlapping 95% confidence intervals). The incidence in Mpumalanga and the national incidence decreased. In 2016, the highest incidence was recorded among males aged 40-44 years; the peak incidence among females was in the group aged 30-34 years (Figure 1). 137 children younger than 15 years had laboratory-confirmed cryptococcosis; 63 (46%) were younger than 5 years of age. Most patients (95%) with incident disease were diagnosed with meningitis (laboratory tests on cerebrospinal fluid positive for *Cryptococcus* species) and 3% with fungaemia (Table 7). In 2017, 104 patients were diagnosed by culture of urine, sputum, pleural fluid and other specimen types. Clinical case data were collected from patients at ESS for the first quarter of 2016 and for the first/ last quarter of 2017. For these 2 years, completed case report forms were available for 9% (1,194/13,776) of patients. Of 1,166 patients with known HIV status, 1,124 (96%) were HIV-infected. Of 1,085 HIV-infected patients with known antiretroviral treatment (ART) status, 656 (60%) were on ART at the time of diagnosis of cryptococcal disease or had previously received ART. Among 913 HIV-infected patients who had a CD4+ T-lymphocyte (CD4) count test result recorded close to the time of diagnosis, 840 (92%) had a CD4 count <200 cells/µl; the median CD4 count was 37 cells/µl (interquartile range, 14 – 85). The in-hospital case-fatality ratio for patients at ESS with a first episode of cryptococcal disease was 36% (279/782), with no significant difference between 2016 and 2017 (p=0.44).

**Discussion**

In October 2016, national reflex CrAg screening was implemented at all NHLS CD4 laboratories; however, these cases are tracked through a separate surveillance system (NICD CrAg dashboard). For this reason, cases of cryptococcal antigenaemia diagnosed by provider-initiated screening were excluded from this report. The epidemiology of cryptococcal meningitis or culture-confirmed cryptococcal disease remained unchanged between 2016 and 2017. With earlier diagnosis of cryptococcal disease, we expected to see a decline in the in-hospital case-fatality ratio but this has remained stable.

**Table 6. Number of cases and incidence of cryptococcal meningitis or culture-positive cryptococcal disease detected by GERMS-SA by province, South Africa, 2016-2017, n=13776**

| Province | 2016 | | 2017 | |
|---|---|---|---|---|
| | n* | Incidence (95% CI)† | n* | Incidence (95% CI)† |
| Eastern Cape | 813 | 105 (98-113) | 789 | 100 (93-107) |
| Free State | 242 | 66 (58-75) | 239 | 65 (57-73) |
| Gauteng | 2,070 | 115 (110-120) | 1859 | 100 (96-105) |
| KwaZulu-Natal | 2,034 | 105 (100-109) | 1899 | 97 (92-101) |
| Limpopo | 438 | 98 (89-108) | 404 | 89 (80-98) |
| Mpumalanga | 599 | 90 (83-97) | 500 | 73 (67-80) |
| Northern Cape | 48 | 60 (43-77) | 46 | 57 (40-73) |
| North West | 499 | 105 (96-114) | 493 | 102 (93-111) |
| Western Cape | 397 | 94 (85-103) | 407 | 93 (84-102) |
| **South Africa** | **7,140** | **102 (100-105)** | **6,636** | **93 (91-96)** |

*These case numbers exclude patients who tested positive for cryptococcal antigenaemia. †Incidence was calculated using mid-year population denominators determined by the Thembisa model and is expressed as cases per 100,000 HIV-infected persons (refer to Table 1).

**Figure 1. Number of cases and incidence of cryptococcal meningitis or culture-positive cryptococcal disease detected by GERMS-SA , by gender and age group, South Africa, 2017, n=6,236**

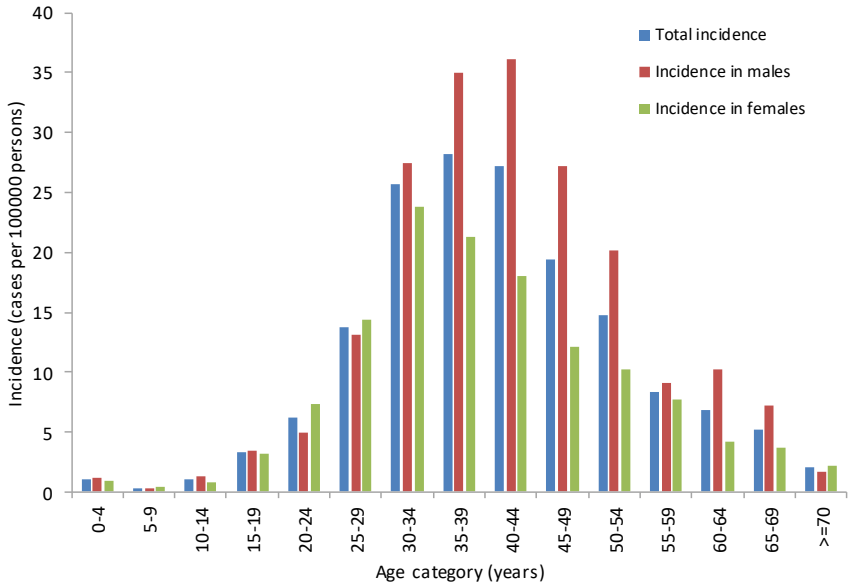



**Table 7. Number and percentage of cases of cryptococcal meningitis or culture-positive cryptococcal disease reported to GERMS-SA by specimen type, South Africa, 2016-2017, n=13,540**

| Site of specimen | 2016 | | 2017 | |
|---|---|---|---|---|
| | n* | % | n* | % |
| Cerebrospinal fluid | 6,583 | 92 | 6,294 | 95 |
| Blood | 314 | 5 | 238 | 3 |
| Other | 243 | 3 | 104 | 2 |
| **Total** | 6,576 | | 6,964 | |

*These case numbers exclude patients who tested positive for cryptococcal antigenaemia.

## National and enhanced sentinel surveillance for candidaemia

**Results**

Over the 2 years, 3,817 cases of candidaemia were detected, 2,517 (66%) of which were diagnosed in Gauteng province. Of all cases, 1,033 (27%) were reported from the private sector. The age of cases was significantly lower in the public- vs. the private sector (median, 4.5 years [IQR, 1 month to 46 years] vs. median, 56 years [IQR, 37 to 68 years]; p<0.001). Where sex was known, 54% (2,054/3,766) of patients were male. Clinical case report forms were completed for 2,035 (53%) patients, including 228 cases at 3 private hospitals in Gauteng province. The overall crude case-fatality ratio was high (608/1,420; 43%) and varied significantly by species (*Candida albicans*, 50%; *Candida parapsilosis*, 32%; *Candida glabrata*, 51%; *Candida tropicalis*, 49% and *Candida auris*, 46%; p<0.001) and age category (infants <1 year, 36%; children 1-17 years, 24%; adults 18-44 years, 50%; adults 45-64 years, 58% and adults ≥65 years, 66%; p<0.001). HIV infection is not an independent risk factor for candidaemia; however, 26% (262/1,015) of patients were HIV-seropositive, all but 17 in the public-sector. A significantly higher proportion of patients was admitted to an intensive care unit in the private- vs. public-sector (213/223 [96%] vs. 1,315/1,737 [76%]; p<0.001). At least one viable isolate was identified to species level for 3,008 (79%) cases of candidaemia. Overall, *C. parapsilosis* was the most common species followed by *C. albicans;* the species distribution differed significantly by sector (p<0.001) (Table 8; Figure 2). Of particular concern, *C. auris* accounted for 11% (316/3,008) of cases and was the second commonest species in the private-sector and the fourth commonest in the public-sector. All *Candida* isolates had an amphotericin B minimum inhibitory concentration (MIC) ≤ 2 µg/ml (apart from 4 *C. krusei*, 3 *C. parapsilosis*, 1 *C. glabrata* and 1 *C. albicans* isolate). Of concern, 16 (5%) *C. auris* isolates had an amphotericin B MIC ≥2 µg/ml which may indicate resistance.

Susceptibility results for five commonest *Candida* species, including *C. auris*, and three antifungal agents are summarised in Table 9; anidulafungin MICs are a proxy for susceptibility to the entire echinocandin class.

**Discussion**

The epidemiology of culture-confirmed candidaemia over the 2-year surveillance period is similar to what was reported in the last GERMS-SA report. There were striking differences in epidemiology between the public- and private-sector, with variation by province. Candidaemia was diagnosed far more commonly among young children, predominantly neonates, in the public sector and among older adults in the private sector. Overall more than a third of patients with candidaemia, many of whom were critically ill, died in hospital. A large majority of bloodstream *C. parapsilosis* isolates were resistant to fluconazole. *C. auris*, an emerging pathogen, is also fluconazole resistant, with very few exceptions. Azole-resistant strains of *C. parapsilosis* and *C. auris* now dominate in the private sector, particularly in Gauteng province. Early treatment with fluconazole should be avoided in this setting. Knowledge of local epidemiology will guide empiric choices. Conventional amphotericin B is the empiric agent of choice for the public-sector. Susceptibility of *C. auris* to amphotericin B needs to be monitored carefully. Caspofungin, micafungin or anidulafungin are good choices for empiric treatment, where available.

**Table 8. *Candida* species distribution for cases of candidaemia with a viable bloodstream isolate by health sector and province, 2016-2017, n=2,988***

| Species | n (%): | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | EC | FS | GA | KZ | LP | MP | NC | NW | WC | Overall |
| ***Public-sector facilities*** | | | | | | | | | | |
| *Candida albicans* | 37 (39) | 57 (33) | 349 (31) | 88 (36) | 23 (49) | 19 (66) | 10 (40) | 13 (34) | 114 (44) | 710 (35) |
| *Candida parapsilosis* | 24 (25) | 78 (45) | 438 (39) | 85 (34) | 7 (15) | 6 (21) | 8 (32) | 18 (47) | 56 (21) | 720 (35) |
| *Candida auris* | 0 (0) | 0 (0) | 108 (10) | 1 (1) | 3 (7) | 0 (0) | 0 (0) | 0 (0) | 1 (1) | 113 (6) |
| *Candida glabrata* | 20 (21) | 21 (12) | 118 (11) | 32 (13) | 7 (15) | 2 (7) | 6 (24) | 6 (16) | 54 (21) | 266 (13) |
| *Candida tropicalis* | 4 (4) | 2 (1) | 28 (2) | 18 (7) | 0 (0) | 1 (3) | 0 (0) | 1 (3) | 13 (5) | 67 (3) |
| Other *Candida* species | 11 (11) | 15 (9) | 86 (13) | 23 (9) | 7 (15) | 1 (3) | 1 (4) | 0 (0) | 24 (9) | 168 (2) |
| Sub-total | 96 | 173 | 1,127 | 247 | 47 | 29 | 25 | 38 | 262 | 2,044* |
| ***Private-sector facilities*** | | | | | | | | | | |
| *Candida albicans* | 0 (0) | 0 (0) | 107 (13) | 3 (21) | 1 (100) | 7 (21) | 0 (0) | 5 (50) | 18 (24) | 141 (15) |
| *Candida parapsilosis* | 1 (33) | 0 (0) | 414 (52) | 9 (64) | 0 (0) | 15 (45) | 0 (0) | 1 (10) | 36 (48) | 476 (51) |
| *Candida auris* | 0 (0) | 1 (100) | 188 (24) | 2 (14) | 0 (0) | 7 (21) | 0 (0) | 0 (0) | 1 (1) | 199 (21) |
| *Candida glabrata* | 2 (67) | 0 (0) | 65 (8) | 0 (0) | 0 (0) | 2 (6) | 0 (0) | 4 (40) | 12 (16) | 85 (9) |
| *Candida tropicalis* | 0 (0) | 0 (0) | 12 (2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 2 (3) | 14 (1) |
| Other *Candida* species | 0 (0) | 0 (0) | 19 (2) | 0 (0) | 0 (0) | 2 (1) | 0 (0) | 1 (0) | 7 (9) | 29 (3) |
| Sub-total | 3 | 1 | 805 | 14 | 1 | 33 | 0 | 11 | 76 | 944 |
| **Total** | **99** | **174** | **1,932** | **261** | **48** | **62** | **25** | **49** | **338** | **2,988** |

**EC**: Eastern Cape, **FS**: Free State, **GA**: Gauteng, **KZ**: KwaZulu-Natal, **LP**: Limpopo, **MP**: Mpumalanga, **NC**: Northern Cape, **NW**: North West

**Figure 2. Species distribution for cases of candidaemia with a viable bloodstream isolate by health sector, South Africa, 2016-2017, n=3,008**

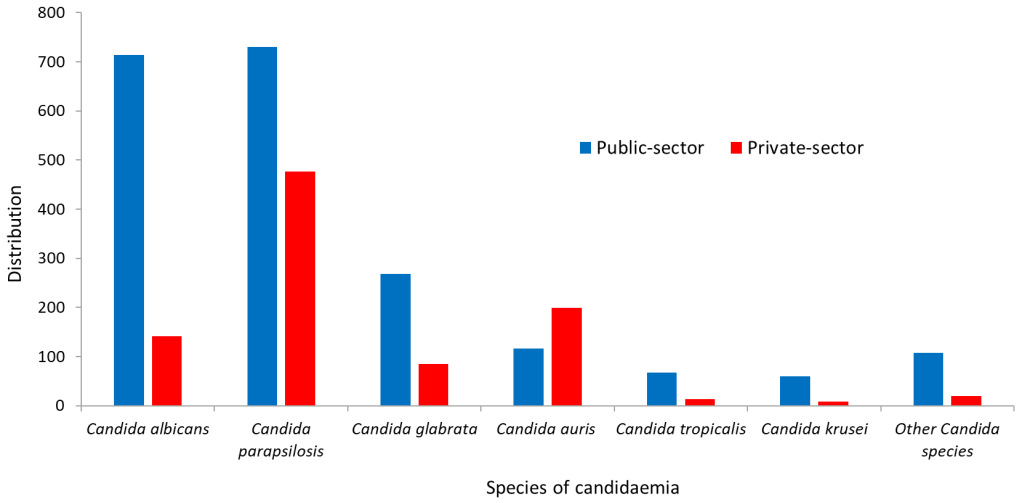



**Table 9. Number and percentage of *Candida* bloodstream isolates (five commonest species only) susceptible[a] to fluconazole, voriconazole and anidulafungin by sector, 2016-2017, n=2,800**

| Antifungal agent | Number (%) of isolates susceptible to: | | | | |
|---|---|---|---|---|---|
| | ***C. albicans*** | ***C. parapsilosis*** | ***C. glabrata*** | ***C. tropicalis*** | ***C. auris*** |
| ***Public-sector facilities*** | n=710 | n=726 | n=268 | n=67 | n=116 |
| Fluconazole | 699 (98) | 232 (32) | 0 (0) | 60 (89) | No breakpoints or ECV[b] |
| Voriconazole | 704 (99) | 374 (52) | No breakpoints | 57 (85) | No breakpoints or ECV[c] |
| Anidulafungin | 710 (100) | 726 (100) | 266 (99) | 67 (100) | No breakpoints or ECV[d] |
| ***Private-sector facilities*** | n=141 | n=475 | n=85 | n=14 | n=198 |
| Fluconazole | 141 (100) | 65 (14) | 0 (0) | 14 (100) | No breakpoints or ECV[b] |
| Voriconazole | 141 (100) | 140 (29) | No breakpoints | 14 (100) | No breakpoints or ECV[c] |
| Anidulafungin | 141 (100) | 475 (100) | 85 (100) | 14 (100) | No breakpoints or ECV[d] |

[a]Based on CLSI M60 species-specific breakpoints for susceptibility; [b]88% of isolates with an MIC ≥32 mg/L; [c]fluconazole MIC may be a surrogate for susceptibility to other azoles; [d]No isolates with an MIC ≥4 mg/L; ECV: epidemiologic cut-off value

## Enhanced sentinel surveillance for *S. aureus* bacteraemia in Gauteng and the Western Cape

**Results**

In 2017, 1,001 cases of *S. aureus* bacteraemia were detected (Table 10). The majority of cases were detected from sentinel sites in Johannesburg and Pretoria (604; 60%). Among all cases, 609 (61%) patients were male, with a median age of 33 years (IQR: 10-52). The largest proportion of case patients were ≥60 years (178, 18%) followed by patients 30-39 years (164, 16%). Ten per cent (103) of case patients were neonates (Figure 3). The median length of hospital stay was 21 days (IQR: 9-40). Among 959 case patients with outcome data available, 324 died in hospital (crude case fatality ratio 34%).

*S. aureus* isolates were available for 80% (797/1,001) of case patients. The proportion of MRSA cases remained stable as 25% (188/746) in 2016 and 24% (189/797) in 2017 (Figure 4). Among 189 MRSA case patients, 24% (44/183) had prior hospitalisation in the preceding year and 6% (11/185) had prior documented MRSA infection. Seventeen per cent (33/96) had known HIV infection.

SCC*mec* typing was performed for 184 *mec*A-positive *S. aureus* isolates in 2017 on almost the same number as in 2016. There was a predominance of type III SCC*mec* in Gauteng (66/184; 36%) and type IV in the Western Cape (40/184; 22%) (Figure 5). Among 797 viable *S. aureus* isolates, 199 (25%) were non-susceptible to clindamycin. All isolates were susceptible to vancomycin and daptomycin (except two non-susceptible isolates) in 2017. A total of 778 (98%) isolates were susceptible to mupirocin (Table 11 and Figure 4). Among 955 patients, 273 (29%) died. From 536 patients with known HIV status 35% are positive (Table 5).

**Discussion**

The proportion of cases of MRSA bacteraemia in 2017, compared to 2016 remained stable. Overall, SCC*mec* type III predominated and was more common in Gauteng; type IV was dominant in the Western Cape. A similar proportion of isolates was resistant to clindamycin and oxacillin. As expected, no vancomycin or daptomycin non-susceptible isolates were identified. Other than a reduction in MRSA cases, there was no change in the susceptibility pattern of bloodstream *S. aureus* isolates over the reporting period.

**Table 10. Number and percentages of cases of *Staphylococcus aureus* bacteraemia reported to GERMS-SA sentinel sites by province, South Africa, 2016 (n=955) and 2017 (n=1,001) (including audit cases)**

| Province | 2016 | | 2017 | | Total | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Gauteng | 560 | 59 | 604 | 60 | 1,164 | 60 |
| Western Cape | 395 | 41 | 397 | 40 | 792 | 40 |
| **Total** | **955** | **100** | **1,001** | **100** | **1,956** | **100** |

**Figure 3. Cases of laboratory-confirmed *Staphylococcus aureus* bacteraemia, by age group and methicillin susceptibility status**

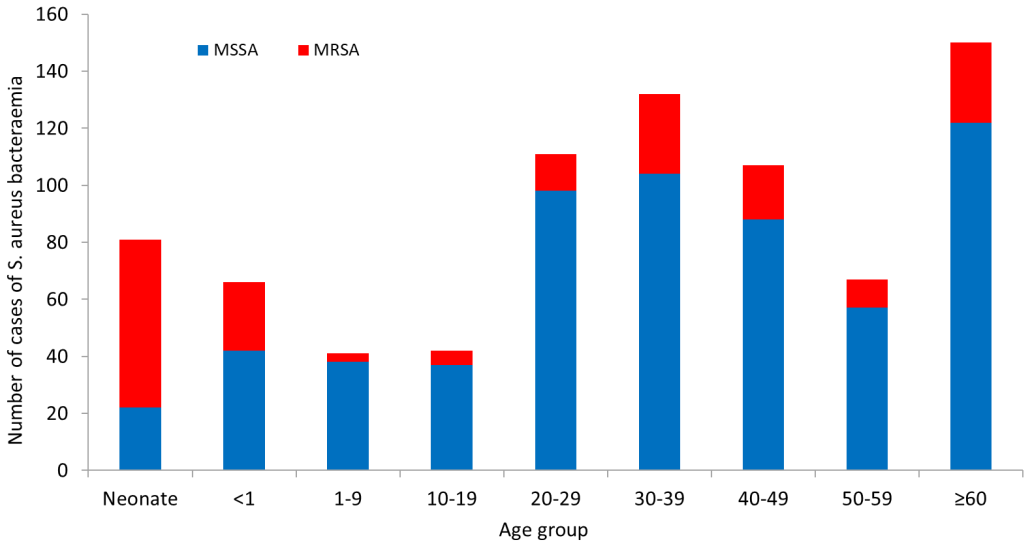


**Figure 4. Proportion of cases of laboratory-confirmed *Staphylococcus aureus* bacteraemia with isolates susceptible to various antimicrobial agents reported to GERMS-SA in Gauteng and Western Cape, 2016 and 2017, n=1,543**

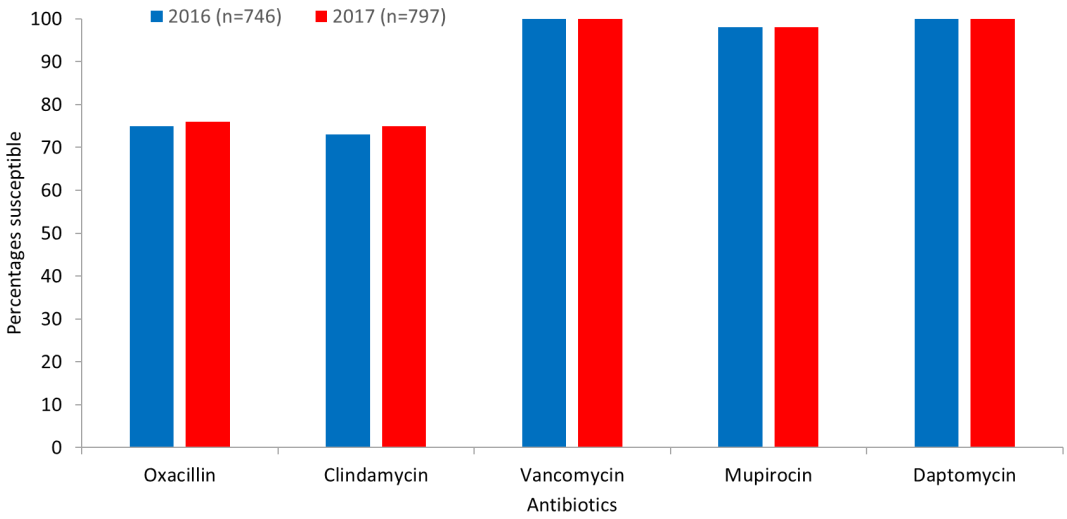



**Figure 5. SCCmec distribution for laboratory-confirmed cases of *Staphylococcus aureus* bacteraemia reported to GERMS-SA by two provinces, 2016 and 2017, n=373**

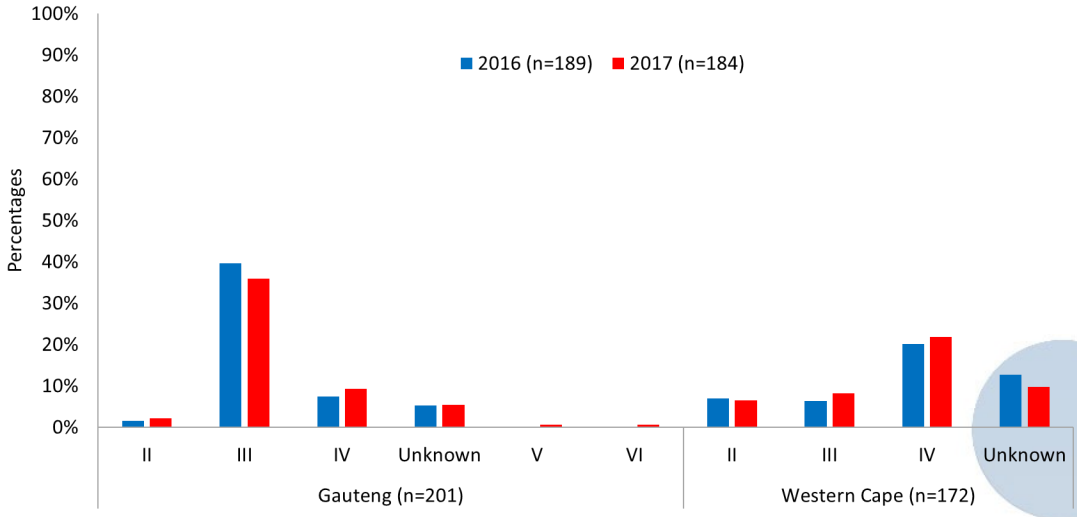



**Table 11. Number and percentage of viable *Staphylococcus aureus* isolates susceptible to various antimicrobial agents, n=797**

| Province | Oxacillin | Clindamycin | Vancomycin | Mupirocin | Daptomycin | Linezolid | Trimethoprim/ Sulfamethoxa-zole |
|---|---|---|---|---|---|---|---|
| | n=797 | n=797 | n=795 | n=797 | n=795 | n=797 | n=797 |
| Gauteng | 336 (77) | 325 (75) | 434 (100) | 427 (98) | 435 (100) | 435 (100) | 335 (77) |
| Western Cape | 277 (77) | 274 (76) | 361 (100) | 351 (97) | 360 (100) | 362 (100) | 314 (87%) |
| **Total susceptible** | **613 (77)** | **599 (75)** | **795 (100)** | **778 (98)** | **795 (100)** | **797 (100)** | **649 (81%)** |

## Enhanced sentinel surveillance for CRE bacteraemia in four provinces

**Results**

There were 923 cases of CRE bacteraemia (as detected by a diagnostic laboratory) reported to GERMS-SA from July 2015 through to December 2017 (Table 12). The proportion of males (505, 55%) was significantly higher than females (416, 45%); p=0.04. Twenty-one percent (197) of cases were aged less than one year old and an increase was noted for cases aged 65-74 in 2017; p=0.04 (Figure 6). The majority of cases were detected from sentinel sites in Gauteng (673; 73%) followed by KwaZulu-Natal (181; 20%) (Table 12). CRE isolates were available for 63% (581/923) of patients and submitted to NICD for antimicrobial susceptibility testing. *Klebsiella pneumoniae* was the predominant organism (457; 79%) followed by *Enterobacter cloacae* (49; 9%), *Serratia marcescens* (30; 5%) and *Escherichia coli* (19; 3%) (Figure 7). Among all isolates, 86% (499) were non-susceptible to ertapenem, 54% (168) non-susceptible to imipenem, 54% (315) non-susceptible to meropenem 53% (311) and doripenem 52% (305) (Figure 8). We confirmed carbapenemase genes in 84% (487/581) of isolates including NDM (212/581; 36%) and OXA-48 or variants (252/581; 43%) as the highest amongst all genes (Figure 9).

A number of 46 (8%) isolates were susceptible to ertapenem with an MIC ≤ 0.5 mg/L but were OXA-48 positive over the time of surveillance. Over the surveillance period, there was a shift towards CRE mediated by OXA-48 & variants (Figure 9). Among viable isolates, 460 (79%) were susceptible to tigecycline. Of all patients with CRE bacteraemia with known outcome, 322/872 (37%) died. Among 292 patients with known status, 32% were positive (Table 5).

**Discussion**

The number of CRE bacteraemia cases detected over the surveillance period is relatively small. However, there has been an increase in 2017 of these highly-resistant organisms which has an impact on the public-sector health system in terms of patient outcomes and healthcare costs. Most cases were detected in Gauteng and KwaZulu-Natal. We noted a shift to CPE mediated by OXA-48 & variants; these enzymes are not easily detected in the laboratory. In addition, the OXA genes are located on a very efficient transposon with the potential for point mutations, which would render them even more difficult to detect.

**Table 12. Number of cases of carbapenem-resistant Enterobacteriaceae (CRE) bacteraemia reported to GERMS-SA by province, July 2015 to December 2017, n=923 (including audit cases)**

| Province | 2015 | | 2016 | | 2017 | | Total | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % |
| Free State | 1 | 1 | 3 | 1 | 11 | 2 | 15 | 2 |
| Gauteng | 80 | 68 | 218 | 67 | 375 | 78 | 673 | 73 |
| KwaZulu-Natal | 32 | 27 | 73 | 23 | 76 | 16 | 181 | 20 |
| Western Cape | 4 | 4 | 29 | 9 | 21 | 4 | 54 | 6 |
| **Total** | **117** | **100** | **323** | **100** | **483** | **100** | **923** | **100** |

**Figure 6. Distribution of cases of CRE bacteraemia by age category, n=923**

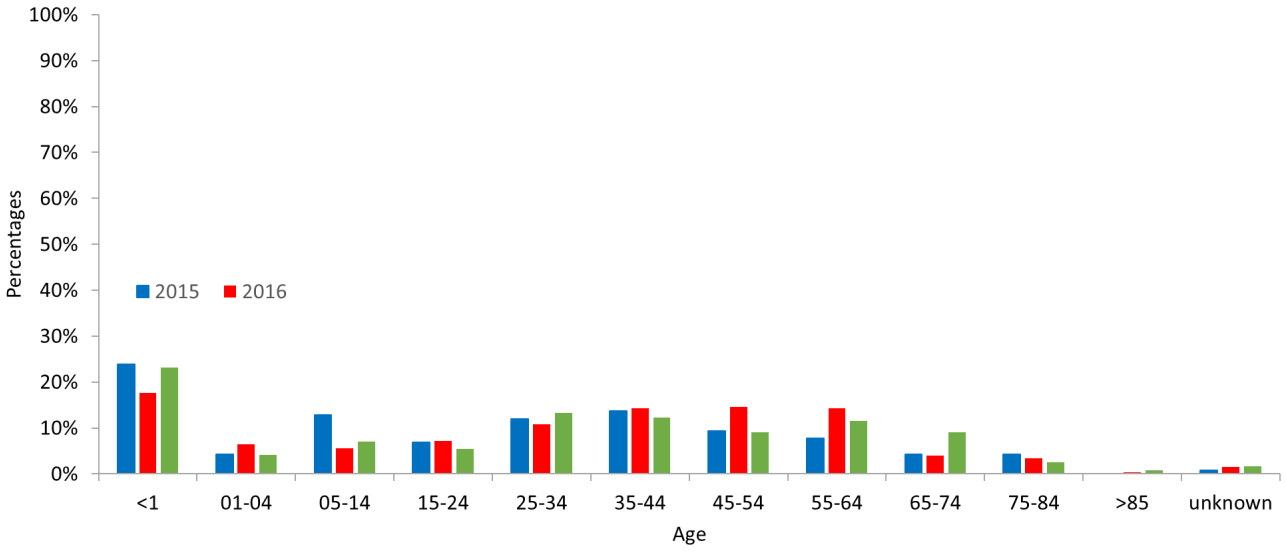


**Figure 7. Species distribution of Enterobacteriaceae submitted for CRE bacteraemia surveillance to GERMS-SA, n=581**

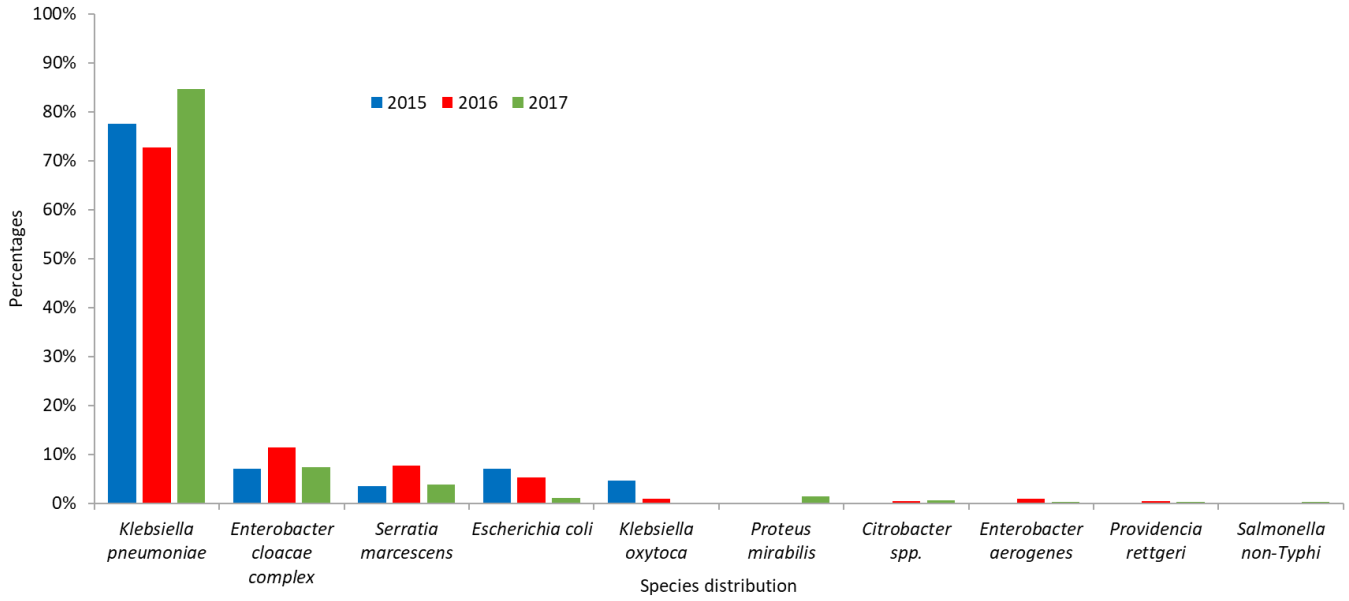
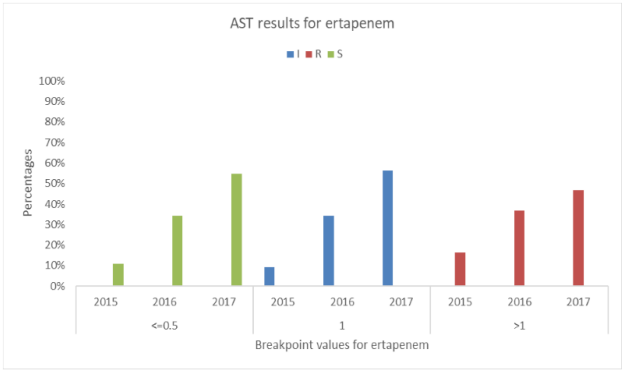
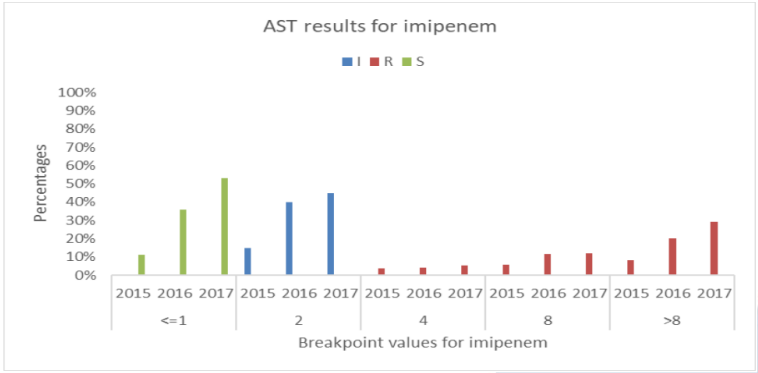
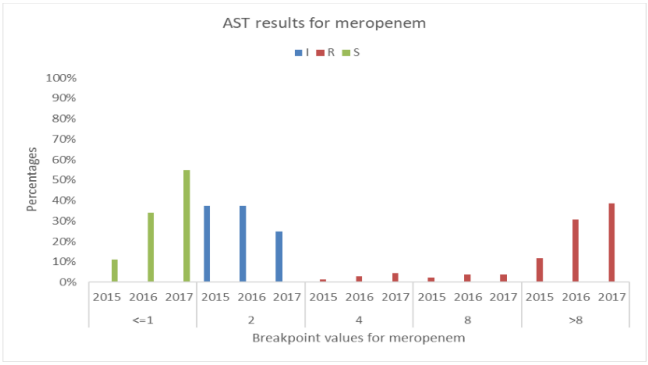



**Figure 8. Carbapenems AST results**



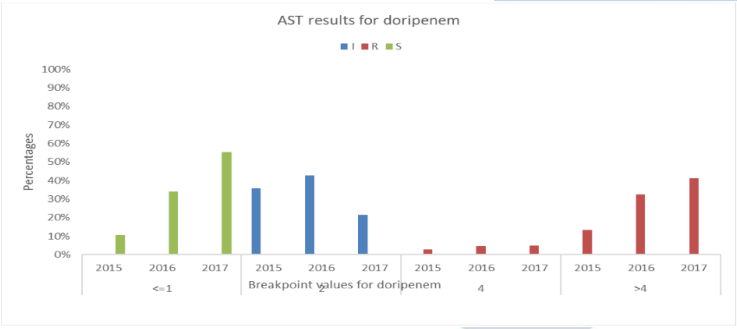
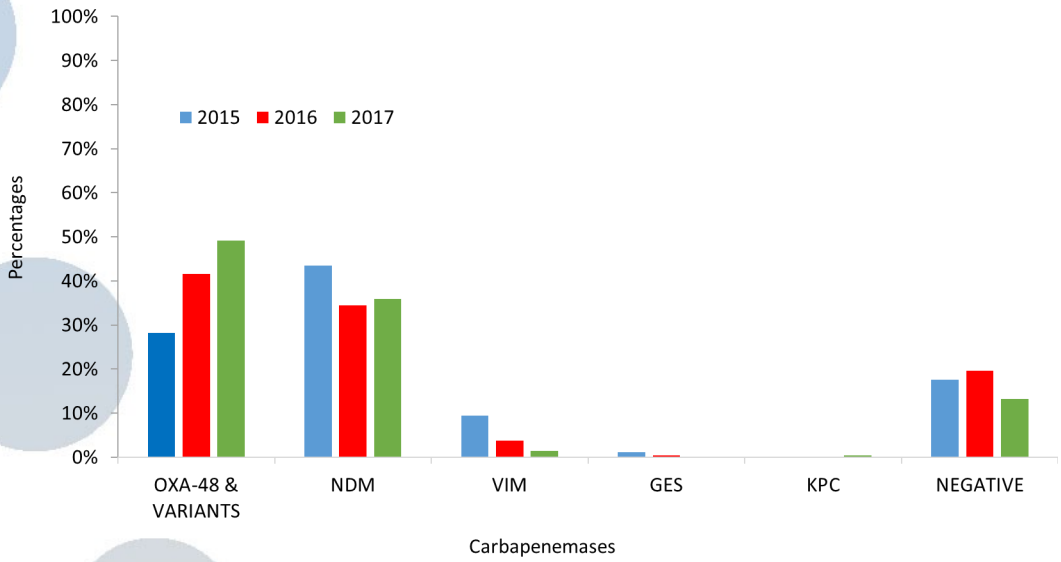



**Figure 9. Carbapenemase gene detection in 487 (84%) of 581 Enterobacteriaceae bloodstream isolates**




## Laboratory-based sentinel surveillance for *Acinetobacter baumannii* bacteraemia in Gauteng, Free State, KwaZulu-Natal and the Western Cape

**Results**

The number of cases of AB bacteraemia in four provinces were 1,328 of which 62% (826) were identified by audit (Table 13).

As we introduced surveillance in the April 2017, colistin susceptibility was not performed for this report. The AST profile to other agents is shown in Figure 10.

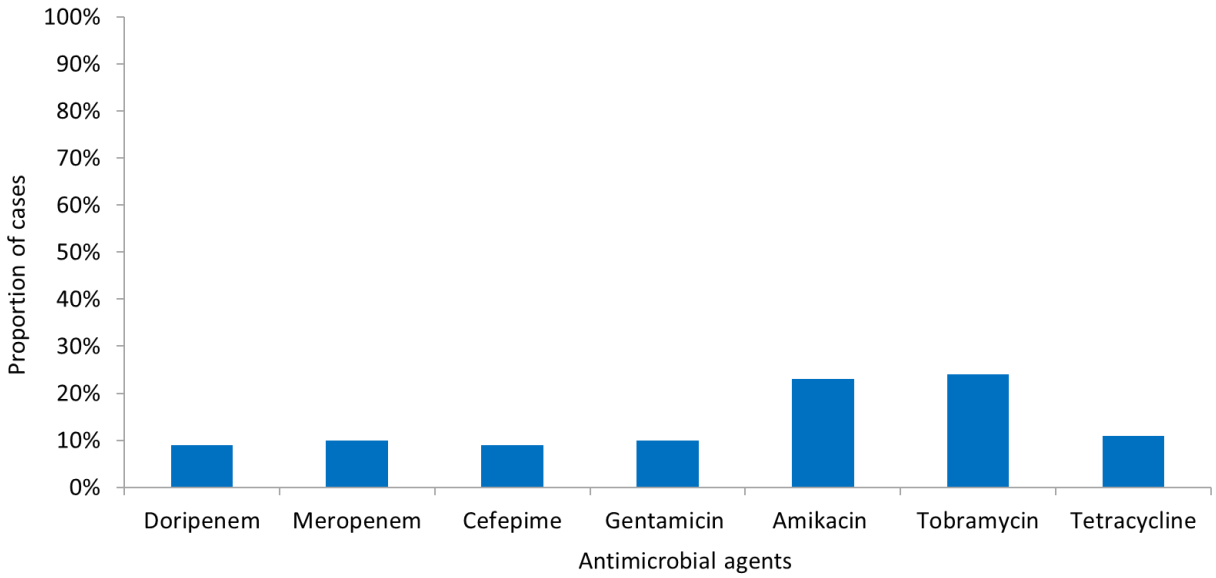
**Discussion**

The susceptibility to different classes of antibiotics is critically low; assessing clinical significance of the organism per individual case is required to be able to optimize patient management. For the optimization of antibiotic treatment and assessment of significance of the organism causing severe infection, enhanced surveillance will be introduced in mid 2018.

**Table 13: Number and percentages of cases of *Acinetobacter baumannii* bacteraemia reported to GERMS-SA sentinel sites by province, South Africa, 2017 (n=1,328) (including audit cases)**

| Province | 2017 | |
|---|---|---|
| | n | % |
| Gauteng | 899 | 70 |
| Western Cape | 124 | 9 |
| KwaZulu-Natal | 159 | 10 |
| Free State | 146 | 11 |
| **Total** | **1,328** | **100** |

**Figure 10. Proportion of cases of laboratory-confirmed *Acinetobacter baumannii* bacteraemia with isolates susceptible to various antimicrobial agents reported to GERMS-SA in 2017, n=502**




**Mpumalanga site visit, June 2017, left to right: Dr Vanessa Quan (GERMS-SA head), Sr Lesley Ingle (MP SO), Dr Olivia Almendares (CDC, USA ), Ms Ncqobile Mtshali (CSA) and Mr Sunnieboy Njikho (FPC)**

## *Neisseria meningitidis*

**Results**

In 2017, 136 cases of laboratory-confirmed invasive meningococcal disease (IMD) were identified through the surveillance system, of which 70 (51%) viable isolates were received and 9 (7%) cases were detected on audit (Table 3). The overall disease incidence was 0.24 cases per 100,000 population, similar to that in 2016 (0.23/100,000). Incidence was highest in the Western Cape Province (0.75/100,000) followed by Gauteng (0.29/100,000), Eastern Cape (0.29/100,000) and Free State provinces (0.21/100,000) (Table 14). Disease peaked in the winter to spring months (June to October) with a further peak in December (Figure 11). No outbreaks of meningococcal disease were detected in 2017. Cerebrospinal fluid was the most common specimen from which meningococci were identified (94/136, 69%) (Table 15). Serogroup B (45/108, 42%) was the most common serogroup causing disease, followed by W (27/108, 25%) and Y (21/108, 19%) (Table 16). IMD occurred more frequently in males (73/133, 55%) than females. Incidence was highest in children <5 years with a small increase in the 15-24 year age category. Infants had the highest incidence of IMD for all serogroups (Figure 12). Of the viable isolates tested for antimicrobial susceptibility, 6% (4/70) were non-susceptible to penicillin with minimum inhibitory concentrations (MICs) >0.06µg/ml, all were susceptible to 3rd generation cephalosporin and ciprofloxacin.

Thirty-nine (29%) IMD patients presented to our enhanced surveillance sites and 35/39 (90%) had additional clinical information available. The median time for each admission was 7 days (interquartile range 5-10 days). Case-fatality ratio was 17% (6/35); half of the patients died on the day of admission, 2 died after 6 days and 1 after 8 days. Twenty-eight percent of patients with HIV status available were HIV-coinfected (8/29). For those who survived to discharge from hospital, 6/29 (21%) suffered sequelae following IMD. These included 1 patient requiring amputation of the toes, 1 with skin scarring following necrotic lesions, 1 developed hydrocephalus, 2 with new onset of seizures, and 1 with loss of vision and new onset seizures.

**Discussion**

IMD incidence remains low for 2017. Serogroup B predominates once again, particularly in the Western Cape Province, driving up the incidence in that province. Penicillin non-susceptibility was below 10%, justifying the continued recommendation of high-dose penicillin as first-line therapy for confirmed IMD. Although uncommon, meningococcal disease in South Africa is a devastating illness largely affecting young children and has an in-hospital case fatality of 17%, with 21% of patients suffering sequelae post discharge from hospital.

**Table 14. Number of cases and incidence rates of meningococcal disease reported to GERMS-SA by province, South Africa, 2016 and 2017, n=267 (including audit cases)**

| Province | 2016 | | 2017 | |
|---|---|---|---|---|
| | n | Incidence rate* | N | Incidence rate* |
| Eastern Cape | 15 | 0.21 | 19 | 0.29 |
| Free State | 2 | 0.07 | 6 | 0.21 |
| Gauteng | 36 | 0.27 | 41 | 0.29 |
| KwaZulu-Natal | 11 | 0.10 | 8 | 0.07 |
| Limpopo | 1 | 0.02 | 3 | 0.05 |
| Mpumalanga | 5 | 0.12 | 4 | 0.09 |
| Northern Cape | 2 | 0.17 | 1 | 0.08 |
| North West | 5 | 0.13 | 5 | 0.13 |
| Western Cape | 54 | 0.86 | 49 | 0.75 |
| **South Africa** | **131** | **0.23** | **136** | 0.24 |

*Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population.

**Figure 11. Number of laboratory-confirmed, invasive, meningococcal cases, reported to GERMS-SA, by month and year, South Africa, 2016-2017, n=267**

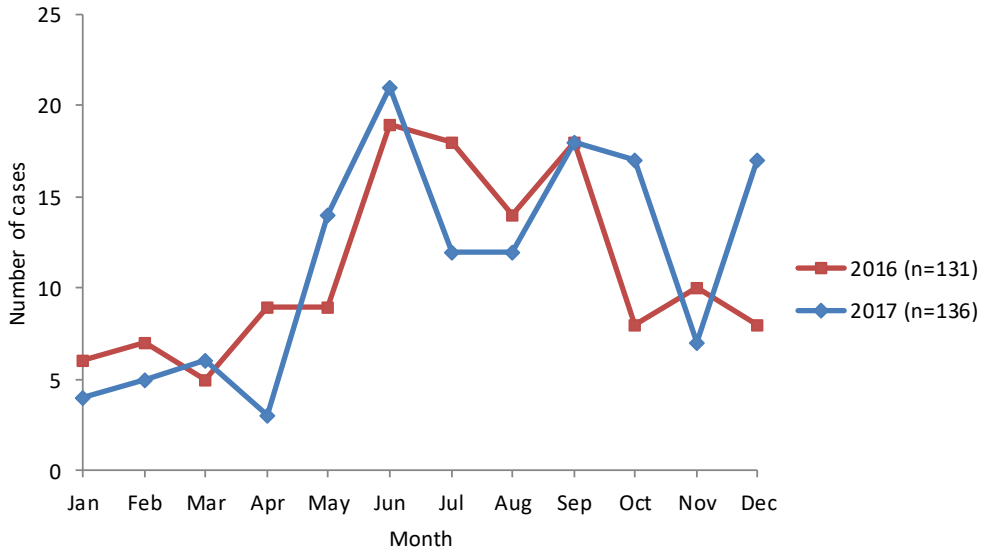



**Table 15. Number and percentage of cases of meningococcal disease reported to GERMS-SA by specimen type, South Africa, 2016 and 2017, n=267**

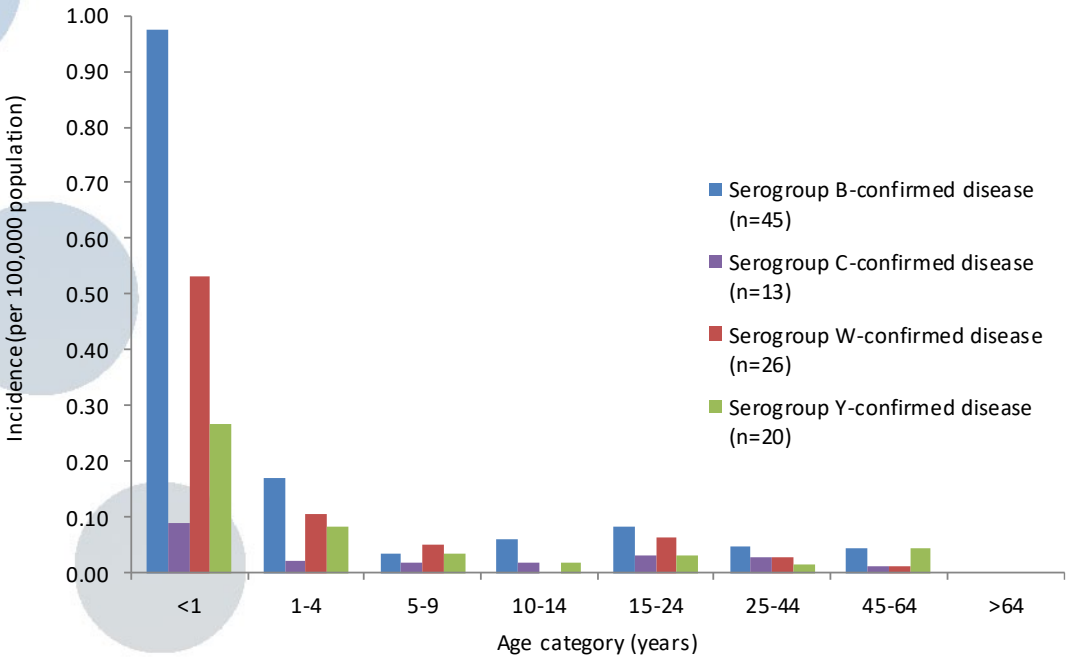
| Site of specimen | 2016 | | 2017 | |
|---|---|---|---|---|
| | n | % | n | % |
| Cerebrospinal fluid | 92 | 70 | 94 | 69 |
| Blood | 38 | 29 | 42 | 31 |
| Other | 1 | 1 | 0 | 0 |
| **Total** | **131** | | **136** | |

**Table 16. Number of cases of invasive meningococcal disease reported to GERMS-SA by serogroup and province, South Africa, 2017, n=136***

| Province | Serogroup | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Serogroup not available | A | B | C | W | Y | Z | NG** | Total |
| Eastern Cape | 2 | 0 | 6 | 5 | 3 | 3 | 0 | 0 | 19 |
| Free State | 0 | 0 | 3 | | 2 | 1 | 0 | 0 | 6 |
| Gauteng | 7 | 0 | 11 | 6 | 8 | 9 | 0 | 0 | 41 |
| KwaZulu-Natal | 3 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 8 |
| Limpopo | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Mpumalanga | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 |
| Northern Cape | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| North West | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 5 |
| Western Cape | 5 | 0 | 22 | 2 | 13 | 6 | 0 | 1 | 49 |
| **South Africa** | **28** | **0** | **45** | **14** | **27** | **21** | **0** | **1** | **136** |

*108 (79%) with viable isolates or specimens available for serogrouping/genogrouping; ** NG: Non-groupable (including 1 that was negative for genogroups A, B, C, W, Y, X by polymerase chain reaction)

**Figure 12. Age-specific incidence rates* for laboratory-confirmed, invasive, meningococcal cases, by serogroup B, C, W and Y, South Africa, 2017, n=136** (**age unknown for n=3; specimens or viable isolates unavailable for serogrouping n=28; one Non-groupable specimen)**




*Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population.

## *Haemophilus influenzae*

**Results**

There were 313 cases of invasive *Haemophilus influenzae* (HI) disease identified through the surveillance programme in 2017, 33% (103) were detected on audit; and 59% (184) had either viable isolates (118) or specimens (66) available for serotyping (Table 17). Ten cases were co-infected with invasive *Streptococcus pneumoniae.* Western Cape Province (112/313, 36%) had the highest number of cases reported, followed by Gauteng Province (84/313, 27%) (Table 17). Twenty-two percent of cases (41/184) were serotype b (Hib) and non-typeable (HNT) disease was found in 64% (118/184) (Table 17). Most cases were isolated from blood, however Hib isolates were more likely than HNT isolates to be found in CSF (19/41, 46% versus 11/118, 9%, p<0.001) (Table 18). Children <5 years had the highest burden of all types of invasive HI, followed by a second peak in the 25-44 year age group (Figure 13). Incidence of Hib in infants is 1.6 per 100 000, decreasing to 0.08 per 100,000 in 1-4 year olds, this is similar to that of 2016 (Figure 14 and 15). HNT incidence is also highest in infants (2.3 per 100,000) and peaks again in 45-64 year age group (0.3 per 100,000). Since 2010, Hib incidence in children <1 year has decreased significantly from 5.2 to 1.6 cases per 100 000 (p<0.001); and remained below 0.3 per 100,000 in 1-4 year olds, since 2012. (Figure 15).

Seventeen percent (4/23) of Hib isolates and 7% (5/76) of HNT isolates were non-susceptible to ampicillin (MIC>1mg/L). Twenty-four cases of Hib disease occurred in children <15 years of age and vaccine history was available for 54% (13/24). Thirty-eight percent (5/13) of these children with invasive Hib had received appropriate doses of Hib vaccine for their age, and were possible vaccine failures. Whilst 54% (7/13) had not received appropriate Hib vaccine doses for their age. The remaining child only had a verbal history of having received childhood vaccinations.

Clinical information was available for 87% (129/149) of cases presenting to the enhanced surveillance sites (ESS). Patients were admitted for a median of 9 days (interquartile range (IQR) 2-21). Case fatality was 29% (36/126) and median time to death was within one day of admission (IQR 0-9). Case fatality was lower amongst those with Hib than with HNT disease, but this did not reach statistical significance (13% (2/15) vs. 29% (14/49), p=0.3). Amongst those with known HIV status, 33% (30/92) were HIV infected. Conditions other than HIV predisposing to HI disease were reported in 71/129 (55%) patients – the most common conditions included chronic lung disease, underlying cardiac disease, malignancy, prematurity and history of smoking. Of 20 patients at ESS with HI on CSF: 25% (4/20) died during their hospitalization, and 25% (4/16) who survived to discharge suffered sequelae – these included 2 with new onset seizures, 1 with hydrocephalus and 1 with weakness of the limbs.

**Discussion**

Overall incidence of HI remains low and HNT accounts for the majority of cases. Highest rates of disease are seen in infants for both Hib and HNT, with HNT incidence increasing with age. Case-fatality ratios are high (29%) and long-term sequelae following meningitis occurred in 25% of cases. Majority of children, <15 years of age with Hib had not been fully vaccinated, highlighting the importance of Hib vaccinations in children under 2 years.

**Table 17. Number of cases of invasive *Haemophilus influenzae* disease reported to GERMS-SA by serotype and province, South Africa, 2017, n=313***

| Province | Serotype | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Serotype not available | a | b | c | d | e | f | Non-typeable | Total |
| Eastern Cape | 20 | 1 | 2 | 0 | 0 | 0 | 2 | 8 | 33 |
| Free State | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 13 |
| Gauteng | 45 | 1 | 15 | 0 | 0 | 1 | 2 | 20 | 84 |
| KwaZulu-Natal | 22 | 1 | 3 | 1 | 1 | 0 | 2 | 11 | 41 |
| Limpopo | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 1 | 9 |
| Mpumalanga | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 8 |
| Northern Cape | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 |
| North West | 4 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 8 |
| Western Cape | 24 | 5 | 14 | 2 | 0 | 0 | 3 | 64 | 112 |
| **South Africa** | **129** | **9** | **41** | **4** | **1** | **1** | **10** | **118** | **313** |

*184 (59%) with specimens or viable isolates available for serotyping.

**Table 18. Number and percentage of cases of invasive *Haemophilus influenzae* disease reported to GERMS-SA by specimen type, South Africa, 2017, n=313**

| Site of specimen | No serotype available | | Serotype b | | Serotypes a, c, d, e, f | | Non-typeable | |
|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % |
| Cerebrospinal fluid | 28 | 22 | 19 | 46 | 9 | 36 | 11 | 9 |
| Blood | 62 | 48 | 21 | 51 | 15 | 60 | 72 | 61 |
| Other | 39 | 30 | 1 | 2 | 1 | 4 | 35 | 30 |
| **Total** | **129** | | **41** | | **25** | | **118** | |

**Figure 13. Number of laboratory-confirmed, invasive, *Haemophilus influenzae* cases, reported to GERMS-SA, by serotype and age group, South Africa, 2017, n=313 (age unknown for n=7; specimens or viable isolates unavailable for serotyping for n=129)**

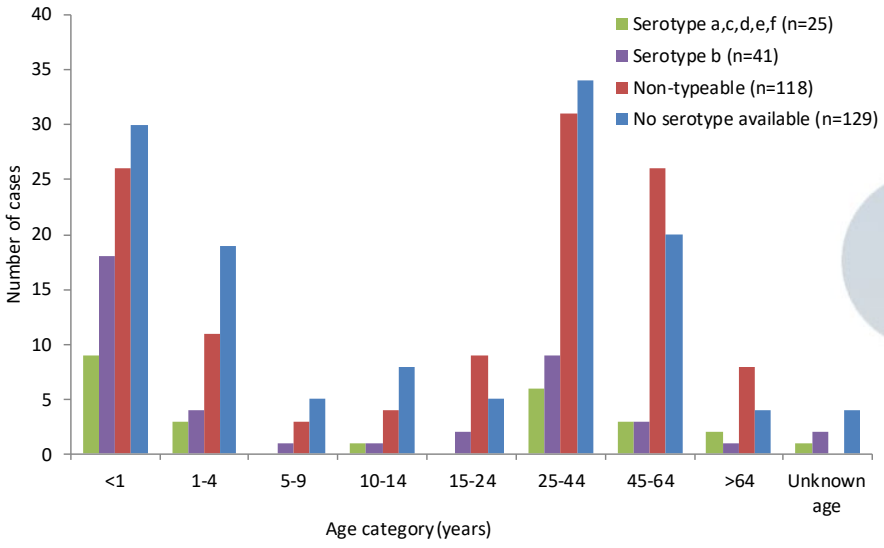
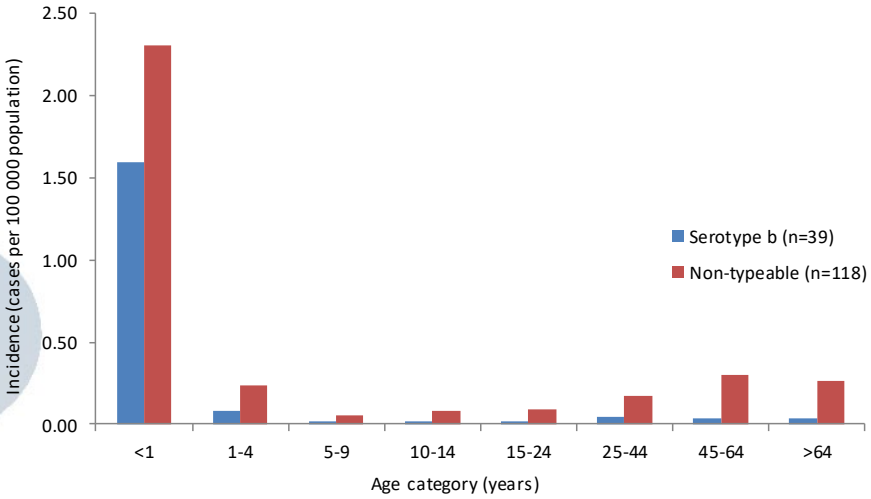
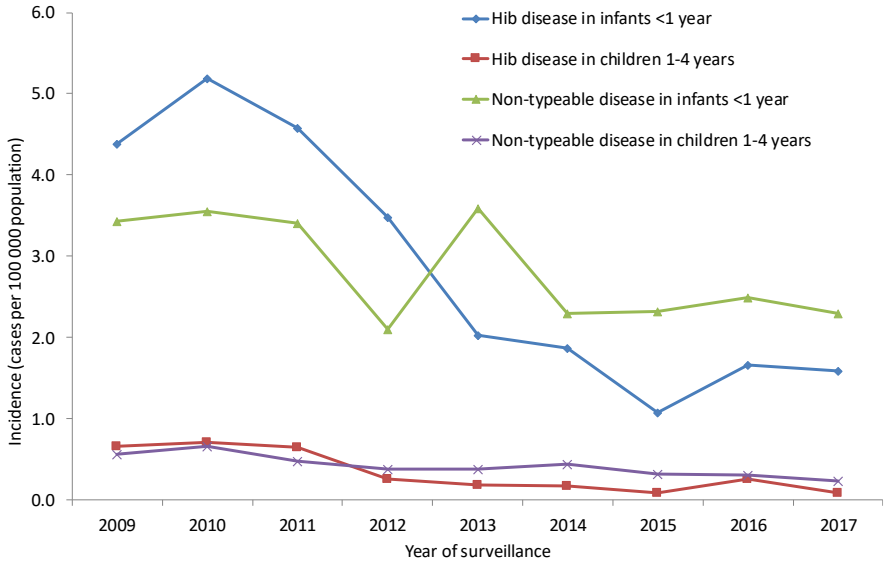


**Figure 14. Age-specific incidence rates* for laboratory-confirmed, invasive *Haemophilus influenzae* disease, reported to GERMS-SA, by serotype b and non-typeable, South Africa, 2017, n=313 (age unknown, n=3; viable isolates unavailable for serotyping, n=129; other serotypes from cases with known age, n=24)**




*Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population.

**Figure 15. Incidence rates* of laboratory-confirmed, *Haemophilus influenzae* serotype b disease, reported to GERMS-SA, in children <5 years old, South Africa, 2009-2017**




*Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population.

## *Streptococcus pneumoniae*

**Results**

Incidence of invasive pneumococcal disease in 2017 was similar to that in 2016 (4.3 vs 4.4 per 100,000 population, p=0.9) (Table 19). IPD incidence varied by province with the highest incidence seen in the Western Cape (10.4 per 100,000 population) followed by Gauteng Province (6.1 per 100,000 population) (Table 19). Since the introduction of the pneumococcal conjugate vaccine (PCV-7) into the Expanded Programme on Immunisation (EPI) in 2009, and the replacement of PCV-7 with PCV-13 in 2011, there was a 79% reduction in IPD in children <5 years (from 30 per 100,000 population in 2005 to 6 per 100,000 population in 2017, p<0.001). There was also a 46% reduction in IPD in those aged five years and older (from 7 per 100,000 population in 2005 to 4 per 100,000 per population in 2017).

In 2017, the highest burden of IPD was still in infants (20 per 100,000 population), followed by the 45-64 year age group (7 per 100,000 population) (Figure 16). Ten patients with IPD were co-infected with invasive *Haemophilus influenzae*. The majority of cases were isolated from blood culture specimens (61%, 1,480/2,441) (Table 20). Penicillin non-susceptibility (minimum inhibitory concentration (MIC) >0.06µg/ml) was detected in 29% (439/1531) of IPD isolates, the highest proportion was in children 1-4 years of age (44%) (Figure 17). Ceftriaxone non-susceptibility (MIC >0.5µg/ml) was detected amongst 7% (114/1,531) of isolates from all specimens, and amongst 5% (19/388) of IPD isolated from CSF. Serotypes 8, 12F, 19A, 3 and 19F were the most predominant serotypes causing IPD in 2017. Amongst children <5 years, serotype 8 (35/201) caused the majority of disease followed by serotypes 15A (14/201) and 19A (13/201) (Figure 18). Unfortunately only 55% (207/374) of IPD isolates from children <5 years-of-age were sent to the NICD for serotyping (Figure 19). Of these, 20% (41/207) were serotypes contained in PCV-13 (Table 22). Thirty-nine percent (952/2,441) of IPD patients presented to our enhanced surveillance sites (ESS), and 871/952 (91%) had additional clinical information available (Table 5). Patients were admitted for a median hospital stay of 8 days (interquartile range (IQR) 2-15) and most deaths occurred within 2 days of admission (IQR 1-7). Overall case fatality was 32% (274/846). HIV-coinfection was present in 64% (437/681) of IPD patients, and 37% (29/78) of infants, with maternal HIV-status available, were HIV exposed (6 HIV-infected and 23 HIV-uninfected infants). Forty-nine percent (406/825) of patients had an underlying medical condition (excluding HIV infection) predisposing them to IPD. Of 236 patients at ESS with pneumococcus on CSF: 40% (94/236) died during their hospitalization, and 33% (47/142) who survived to discharge suffered at least one sequelae – these included new onset seizures (15), limb weakness/paralysis (12), hearing loss (10), hydrocephalus (5), and loss of vision (4). Twenty-four episodes of IPD caused by serotypes present in the PCV-13 vaccine occurred in children <10 years-of-age at ESS. Vaccine history was available for 67% (16/24). Eighty-one percent (13/16) of these children had not received adequate PCV-13 doses for their age and 2 neonates were too young to receive vaccine. Only one child who received 3 PCV-13 doses would possibly be considered a vaccine failure.

**Discussion**

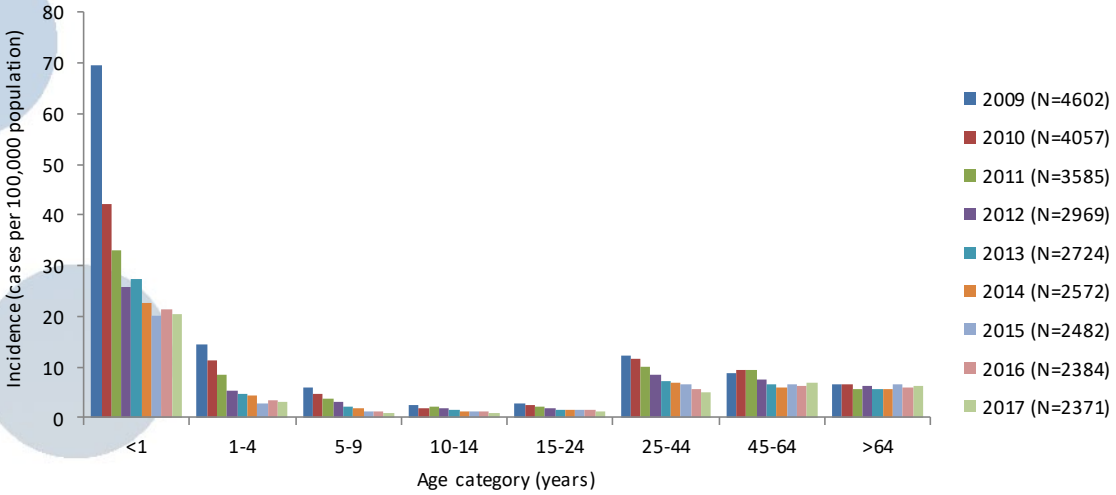
IPD incidence remains low for 2017, with marked reductions seen amongst all age categories post introduction of PCV into the EPI. Children <1 year-of-age had the highest incidence of disease followed by a peak in the 45-64 year age category (a shift from the 25-44 year age category peak that has been seen in previous years). Penicillin and ceftriaxone susceptibility of IPD isolates remain unchanged. HIV infection and infant HIV exposure remain risk factors for disease. Pneumococcal meningitis has high mortality and morbidity. Residual disease in children <5 years is largely due to non-vaccine serotypes, and the majority of vaccine-type disease occurs in children who have not received adequate doses of PCV-13. Clinicians should ensure that all children (and adults with risk factors for IPD) receive adequate vaccine doses to protect them from this serious illness. The number of viable isolates submitted to the NICD for serotyping is still low, and we urge laboratories to remember to forward pneumococci from normally sterile sites to the NICD.

**Table 19. Number of cases and incidence rates of invasive pneumococcal disease reported to GERMS-SA by province, South Africa, 2016 and 2017, n=4,873 (including audit cases)**

| Province | 2016 | | 2017 | |
|---|---|---|---|---|
| | n | Incidence rate* | n | Incidence rate* |
| Eastern Cape | 208 | 2.95 | 208 | 3.20 |
| Free State | 147 | 5.14 | 117 | 4.08 |
| Gauteng | 854 | 6.33 | 868 | 6.08 |
| KwaZulu-Natal | 320 | 2.89 | 269 | 2.43 |
| Limpopo | 84 | 1.45 | 74 | 1.28 |
| Mpumalanga | 102 | 2.36 | 105 | 2.36 |
| Northern Cape | 42 | 3.52 | 53 | 4.37 |
| North West | 73 | 1.93 | 72 | 1.87 |
| Western Cape | 602 | 9.57 | 675 | 10.37 |
| **South Africa** | 2,432 | 4.35 | 2,441 | 4.32 |

*Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population.

**Figure 16. Age-specific incidence rates* for laboratory-confirmed, invasive pneumococcal disease, reported to GERMS-SA, South Africa, 2009 through 2017**




2009: N=4,762, age unknown for n=161; 2010: N=4,197, age unknown for n=141; 2011: N=3,804, age unknown for n=218; 2012: N=3,223, age unknown for n=248; 2013: N=2,866, age unknown for n=138; 2014: N=2,732, age unknown for n=165; 2015: N=2,638, age unknown for n=157; 2016: N=2,432, age unknown for n=48; 2017: N=2,441, age unknown for n=70.
*Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population.

**Table 20. Number and percentage of cases of invasive pneumococcal disease reported to GERMS-SA by specimen type, South Africa, 2016 and 2017, n=4,873**

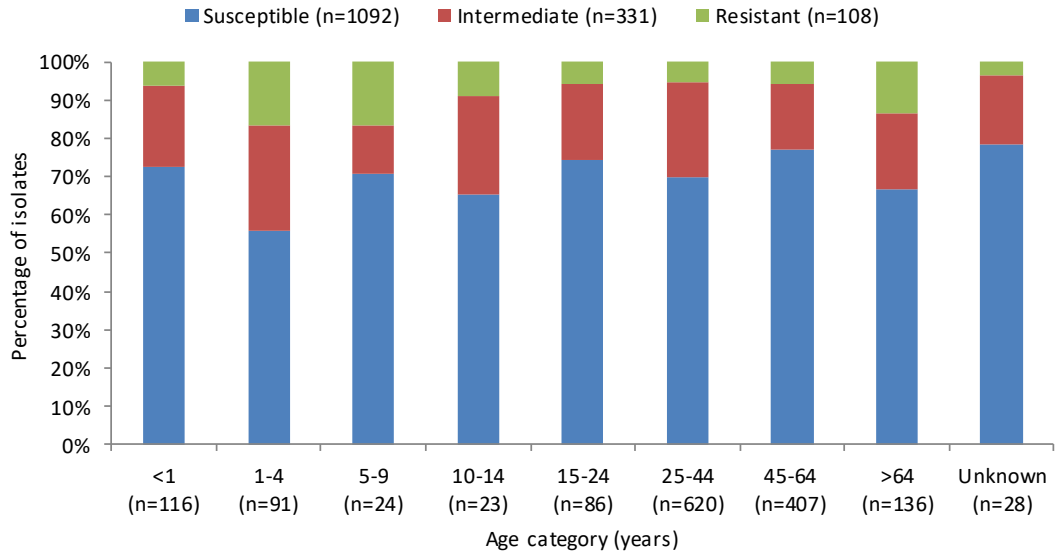
| Site of specimen | 2016 | | 2017 | |
|---|---|---|---|---|
| | n | % | n | % |
| Cerebrospinal fluid | 859 | 35 | 792 | 32 |
| Blood | 1379 | 57 | 1480 | 61 |
| Other | 194 | 8 | 169 | 7 |
| **Total** | **2,432** | | **2,441** | |

**Table 21. Number and percentage of penicillin susceptible and non-susceptible isolates from invasive pneumococcal disease cases reported to GERMS-SA by province, South Africa, 2017, n=2,441**

| Province | Isolate not available | Susceptible* | | Intermediate* | | Resistant* | |
|---|---|---|---|---|---|---|---|
| | n | n | % | n | % | n | % |
| Eastern Cape | 115 | 70 | 75 | 17 | 18 | 6 | 6 |
| Free State | 45 | 52 | 72 | 18 | 25 | 2 | 3 |
| Gauteng | 363 | 358 | 71 | 107 | 21 | 40 | 8 |
| KwaZulu-Natal | 152 | 70 | 60 | 38 | 32 | 9 | 8 |
| Limpopo | 32 | 31 | 74 | 10 | 24 | 1 | 2 |
| Mpumalanga | 40 | 39 | 60 | 20 | 31 | 6 | 9 |
| Northern Cape | 12 | 31 | 76 | 7 | 17 | 3 | 7 |
| North West | 37 | 28 | 80 | 5 | 14 | 2 | 6 |
| Western Cape | 114 | 413 | 74 | 109 | 19 | 39 | 7 |
| **South Africa** | **910** | **1,092** | 71 | **331** | 22 | **108** | 7 |

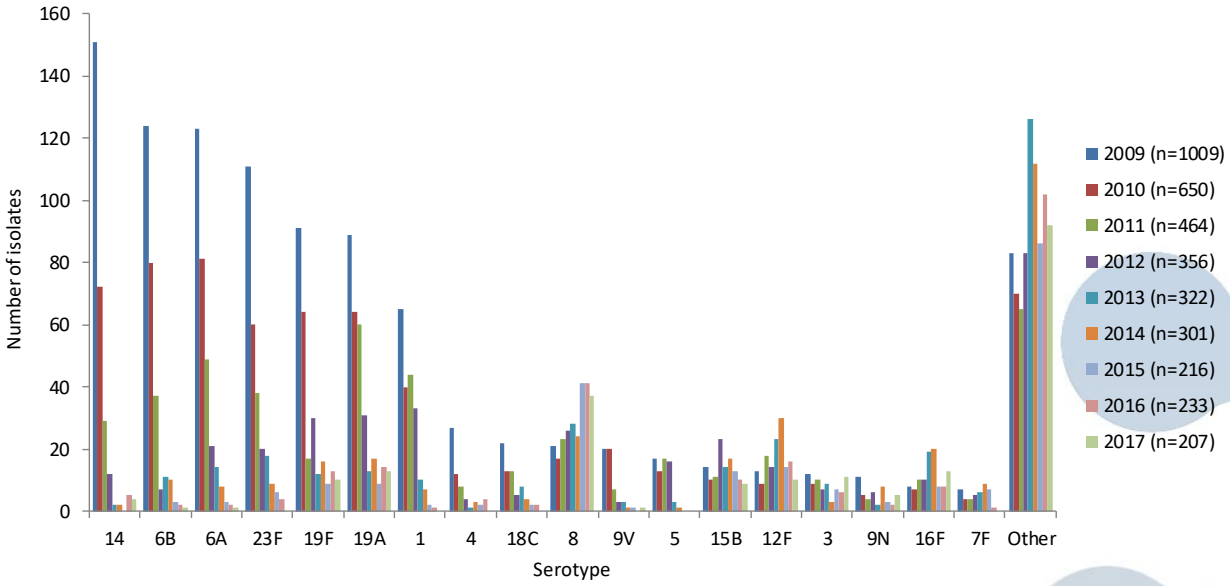
*2016 CLSI breakpoints for penicillin (oral penicillin V) were used: susceptible, ≤0.06mg/L; intermediately resistant, 0.12-1mg/L; resistant, ≥2mg/L.

**Figure 17. Number of laboratory-confirmed, invasive pneumococcal disease cases, reported to GERMS-SA, by age group and penicillin susceptibility, South Africa, 2017, n=2,441 (n=1,531 with viable isolates)**



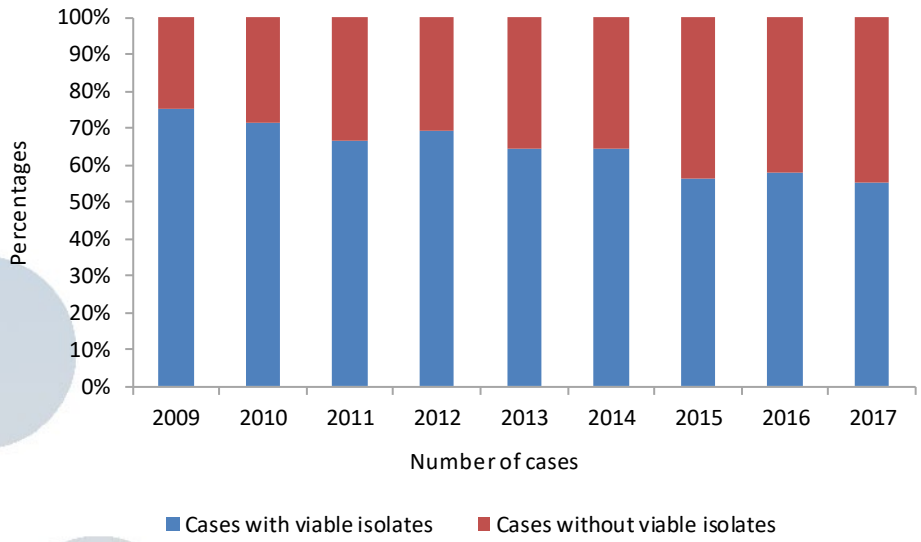

2016 CLSI breakpoints for penicillin (oral penicillin V) were used: susceptible, ≤0.06mg/L; intermediately resistant, 0.12-1mg/L; resistant, ≥2mg/L.

**Figure 18. Most common pneumococcal serotypes causing laboratory-confirmed, invasive pneumococcal disease, reported to GERMS-SA, in children <5 years, South Africa, 2009-2017**




2009: N=1,336, n=327 without viable isolates; 2010: N=910; n=260 without viable isolates; 2011: N=695, n=231 without viable isolates; 2012: N=512, n=156 without viable isolates; 2013: N=498, n=176 without viable isolates; 2014: N=465, n=164 without viable isolates; 2015: N=382, n=166 without viable isolates; 2016: N=401, n=168 without viable isolates; 2017: N=374, n=167 without viable isolates.

**Figure 19. Percentage invasive pneumococcal disease cases with viable isolates reported to GERMS-SA, in children <5 years, South Africa, 2009-2017**




2009: N=1,336, n=327 without viable isolates; 2010: N=910; n=260 without viable isolates; 2011: N=695, n=231 without viable isolates; 2012: N=512, n=156 without viable isolates; 2013: N=498, n=176 without viable isolates; 2014: N=465, n=164 without viable isolates; 2015: N=382, n=166 without viable isolates; 2016: N=401, n=168 without viable isolates; 2017: N=374, n=167 without viable isolates.

**Table 22. Number and percentage of invasive pneumococcal cases reported amongst children less than 5 years of age caused by the serotypes contained in the 7-valent, 10-valent and 13-valent pneumococcal conjugate vaccines, South Africa, 2017, n=374 (n=207 with viable isolates)**

| Province | Total isolates available for serotyping | 7-valent serotypes* | | Serotype 6A# | | 10-valent serotypes** | | 13-valent serotypes*** | |
|---|---|---|---|---|---|---|---|---|---|
| | | n | % | n | % | n | % | n | % |
| Eastern Cape | 7 | 2 | 29 | 0 | 0 | 2 | 29 | 2 | 29 |
| Free State | 7 | 1 | 14 | 0 | 0 | 1 | 14 | 5 | 71 |
| Gauteng | 91 | 6 | 7 | 0 | 0 | 6 | 7 | 15 | 16 |
| KwaZulu-Natal | 15 | 2 | 13 | 1 | 7 | 2 | 13 | 5 | 33 |
| Limpopo | 11 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| Mpumalanga | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 43 |
| Northern Cape | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| North West | 5 | 1 | 20 | 0 | 0 | 1 | 20 | 2 | 40 |
| Western Cape | 63 | 4 | 6 | 0 | 0 | 4 | 6 | 9 | 14 |
| **South Africa** | **207** | **16** | **8** | **1** | **0.5** | **16** | **8** | **41** | **20** |

All serotypes included in each of the categories:

7-valent serotypes*: 4, 6B, 9V, 14, 18C, 19F, 23F

10-valent serotypes**: 4, 6B, 9V, 14, 18C, 19F, 23F, 1, 5, 7F

13-valent serotypes***: 4, 6B, 9V, 14, 18C, 19F, 23F, 1, 5, 7F, 19A, 3, 6A

# Cross-protection with 6B has been demonstrated

## *Salmonella enterica* serotype Typhi and *S. enterica* serotypes Paratyphi A, Paratyphi B and Paratyphi C

**Results**

Typhoid fever cases with *Salmonella* Typhi isolates from all sample sites (therefore indicative of both invasive and non-invasive disease) are reported in Table 23. Cases of enteric fever (including *Salmonella* Typhi and *S. enterica* serotypes Paratyphi A, Paratyphi B and Paratyphi C) were highest in January, although there was no marked seasonality (Figure 20). The number of isolates within each age group is reported in Table 24, indicating that most isolates are from patients in the 5 to 14 year and 25 to 34 year age groups, although infection is seen in both older and younger age groups, including younger children (less than five years). Ciprofloxacin resistance is problematic, although azithromycin remains susceptible (Table 25), following CLSI guidelines. Six isolates of *Salmonella* Paratyphi A, one isolate of *Salmonella* Paratyphi B and three isolates of of *Salmonella* Paratyphi C isolates were identified. No antimicrobial susceptibility testing was conducted on *S. enterica* serotypes Paratyphi A, Paratyphi B and Paratyphi C isolates.

**Discussion**

*Salmonella* Typhi isolates from both invasive and non-invasive sites are included in these analyses, as both add to burden of infection in South Africa and thus represent a public health risk. The diagnosis of typhoid fever remains challenging; clinical index of suspicion and appropriate laboratory tests are critical in identifying cases. Given the limitations of serological testing, culture (and more recently, PCR) remains the gold standard for confirmation of disease. Therefore, the prevailing specimen collection practices heavily influence the likelihood of detecting typhoid and enteric fever cases. Although this data may not reflect actual burden of disease, numbers were comparable with previous non-outbreak years. Although strict seasonality is not observed, the greatest number of cases were seen during January. Greater numbers reported from Gauteng and Western Cape provinces may reflect healthcare seeking behavior and specimen collection practices. The number of reported *Salmonella* Typhi isolates is regarded as an underestimate and thus incidence rates were not calculated. Susceptibility testing was undertaken against limited numbers of antimicrobials due to resource constraints. *Salmonella* Typhi should routinely be tested against azithromycin, which is an alternative treatment option, as ciprofloxacin resistance emerges. Continual monitoring of resistance to these two antimicrobials has become mandatory. Ceftriaxone may also be used as an alternative therapy. Paratyphoid fever remains rare in South Africa, accounting for 8% (10/119) enteric fever cases overall.

**Table 23. Number of invasive and non-invasive *Salmonella* Typhi cases reported to GERMS-SA, South Africa, 2017, n=109 (including audit reports, missing isolates, mixed and contaminated cultures)**

| Province | Non-invasive *Salmonella* Typhi | Invasive *Salmonella* Typhi |
|---|---|---|
| Eastern Cape | 0 | 1 |
| Free State | 0 | 0 |
| Gauteng | 6 | 38 |
| KwaZulu-Natal | 1 | 5 |
| Limpopo | 1 | 15 |
| Mpumalanga | 0 | 1 |
| Northern Cape | 1 | 0 |
| North West | 2 | 0 |
| Western Cape | 6 | 32 |
| **South Africa** | 17 | 92 |

**Figure 20. Number of non-invasive and invasive cases of *Salmonella* Typhi (n=109) and Paratyphi (n=10) reported to GERMS-SA, by month of specimen collection, South Africa, 2017 (including audit reports)**

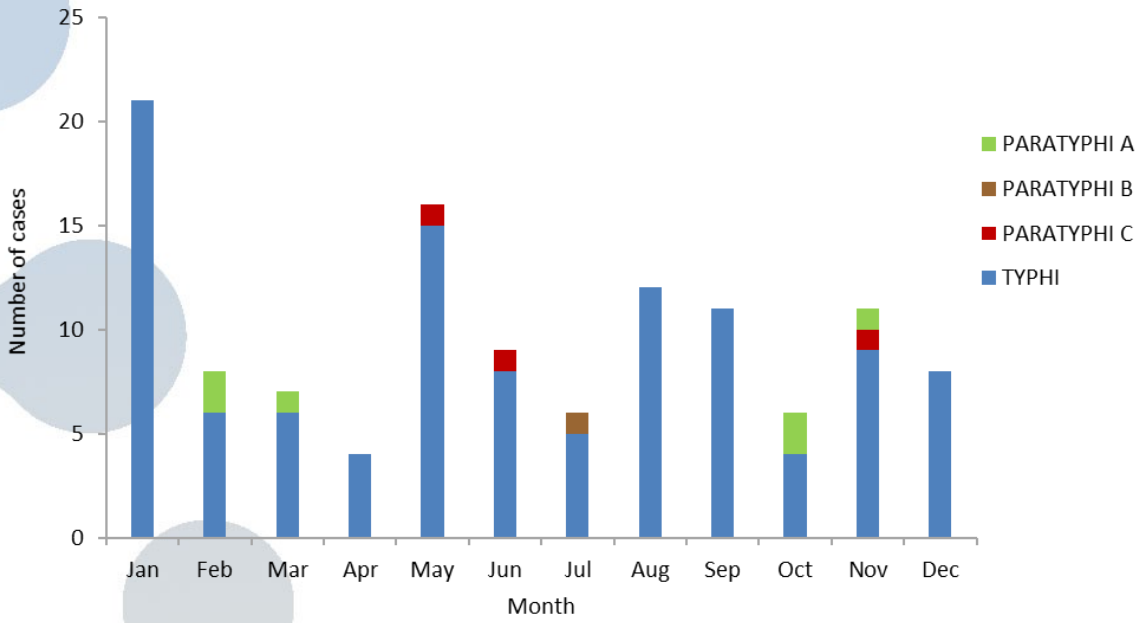



**Table 24. Number of *Salmonella* Typhi cases reported to GERMS-SA by age category, South Africa, 2017, n=109 (including audit reports, missing isolates, mixed and contaminated cultures)**

| Age category (years) | *Salmonella* Typhi cases |
|---|---|
| 0 - 4 | 22 |
| 5 - 14 | 28 |
| 15 - 24 | 11 |
| 25 - 34 | 24 |
| 35 - 44 | 12 |
| 45 - 54 | 6 |
| 55 - 64 | 2 |
| ≥ 65 | 2 |
| Unknown | 2 |
| **Total** | 109 |

**Table 25. Antimicrobial susceptibility test results for all *Salmonella* Typhi isolates received by GERMS-SA, South Africa, 2017, ciprofloxacin, n=91 and azithromycin, n=87 (excluding audit reports, missing isolates, mixed and contaminated cultures)**

| Antimicrobial agent | Susceptible (%) | Resistant (%) |
|---|---|---|
| Ciprofloxacin (n=91) | 78 (86%) | 13 (14%) |
| Azithromycin (n=87) | 112 (100%) | 0 (0%) |

## Non-typhoidal *Salmonella enterica* (NTS)

**Results**

Invasive disease does not appear to have a seasonal prevalence; increased numbers of non-invasive disease in the earlier months of the year and a lower incidence in the winter months reflect seasonality (Figure 21). The number of cases of invasive and non-invasive disease by province is stated in Table 26. The number of cases of invasive and non-invasive disease, by age group, is shown in Table 27; non-invasive disease was highest in children under five years of age, whilst invasive disease was most common in adults aged 35 – 44 years. Most invasive isolates were identified from blood cultures (90%, 498/555), although isolates were frequently identified from both blood culture and another site, including stool and other normally-sterile sites (Table 28). Serotyping and antimicrobial susceptibility testing of referred isolates was undertaken only by request, or when associated with an outbreak.

**Discussion**

Non-typhoidal salmonellosis may be foodborne, in which case patients normally present with gastroenteritis, or may be associated with HIV-infection, in which case the organism frequently becomes invasive. Invasive *Salmonella* Typhimurium ST313, has been documented to occur in South Africa in association with HIV. As in previous years, seasonal prevalence was noted in 2017 for non-invasive disease.

**Figure 21. Number of non-invasive (n=1,103) and invasive (n=555) cases of non-typhoidal *Salmonella* reported to GERMS-SA, by month of specimen collection, South Africa, 2017 (including audit reports)**

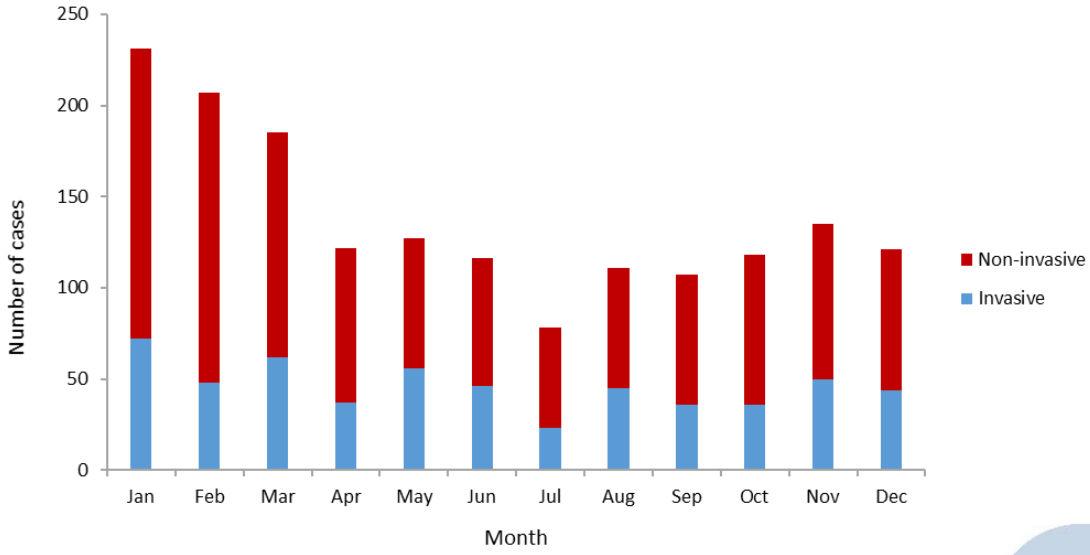



**Table 26. Number of invasive and non-invasive non-typhoidal *Salmonella* cases reported to GERMS-SA, by province, South Africa, 2017, n= 1 ,658 (including audit reports, missing isolates, mixed and contaminated cultures)**

| Province | Non-invasive, non-typhoidal *Salmonella cases* | Invasive non-typhoidal *Salmonella cases* |
|---|---|---|
| Eastern Cape | 176 | 49 |
| Free State | 33 | 13 |
| Gauteng | 361 | 226 |
| KwaZulu-Natal | 157 | 62 |
| Limpopo | 57 | 26 |
| Mpumalanga | 74 | 22 |
| Northern Cape | 19 | 12 |
| North West | 53 | 16 |
| Western Cape | 172 | 129 |
| Unknown | 1 | 0 |
| **South Africa** | **1,103** | **555** |

**Table 27. Number* of cases of invasive and non-invasive non-typhoidal *Salmonella* reported to GERMS-SA by age category, South Africa, 2017, n=1,658 (including audit reports, missing isolates, mixed and contaminated cultures)**

| Age Category (years) | Cases | |
|---|---|---|
| | Non-invasive | Invasive |
| 0 - 4 | 255 | 90 |
| 5 - 14 | 97 | 29 |
| 15 - 24 | 77 | 37 |
| 25 - 34 | 172 | 103 |
| 35 - 44 | 157 | 113 |
| 45 - 54 | 129 | 78 |
| 55 - 64 | 94 | 49 |
| ≥ 65 | 77 | 30 |
| Unknown | 45 | 26 |
| **Total** | **1,103** | **555** |

*Incidence rates were not calculated because specimens are not routinely submitted for culture from all patients with gastroenteritis.

**Table 28. Number of non-typhoidal *Salmonella* cases reported to GERMS-SA by primary anatomical site of isolation*, South Africa, 2017, n=1,658 (including audit reports, missing, mixed and contaminated cultures)**

| Specimen | n | % |
|---|---|---|
| CSF | 10 | 0.6 |
| Blood culture | 498 | 30 |
| Stool | 805 | 48.5 |
| Other | 345 | 20.9 |
| **Total** | **1,658** | **100** |

*Many cases had multiple isolates of the same serotype, including those with isolates from an invasive site of origin and a second isolate from stool, or isolates from two different normally-sterile sites.

## *Shigella* species

**Results**

The highest number of shigellosis cases for 2017 occurred in January and February (Figure 22). which is in contrast with 2016 when case numbers were highest from March through May. However, this pattern is in keeping with previous years (2008 – 2015) when increased cases during summer months suggested seasonality. The primary manifestation of disease due to *Shigella* is non-invasive dysentery or diarrhoea, although invasive disease cases continue to occur (Table 29). The predominant burden of disease, including both invasive and non-invasive shigellosis, is in the under-five-year age group (Table 30). Serotyping and antimicrobial susceptibility testing of referred isolates was undertaken only by request, or when associated with an outbreak.

**Discussion**

Although *Shigella* infection has been associated with waterborne outbreaks in South Africa, person-to-person transmission also plays an important role. Invasive disease appears to be decreasing.

**Figure 22. Number of non-invasive and invasive *Shigella* cases reported to GERMS-SA, by month of specimen collection, South Africa, 2017, n=808 (including audit reports)**

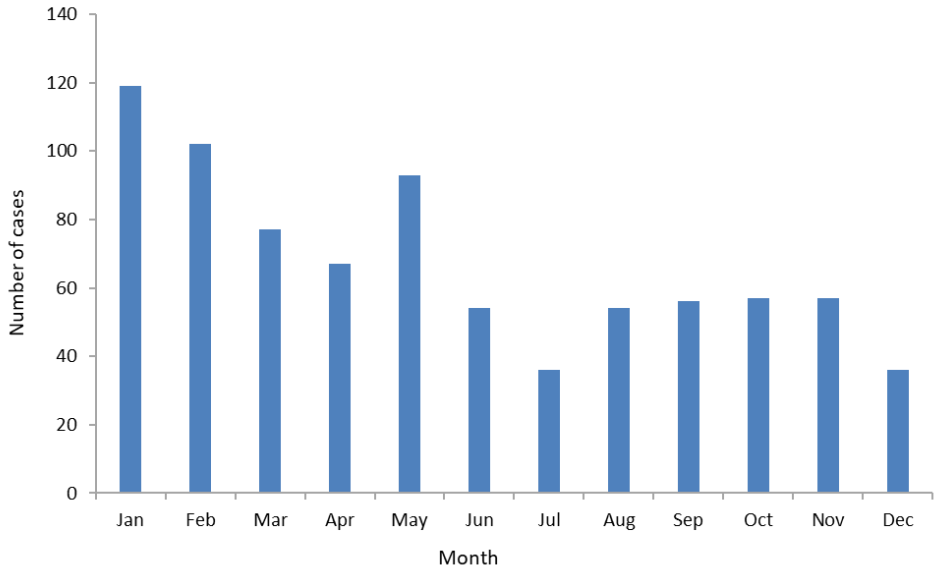



**Table 29. Number of invasive and non-invasive *Shigella* isolates reported to GERMS-SA by province, South Africa, 2017, n=808 (including audit reports, missing isolates, mixed and contaminated cultures)**

| Province | Non-invasive *Shigella* | Invasive *Shigella* |
|---|---|---|
| Eastern Cape | 120 | 5 |
| Free State | 19 | 0 |
| Gauteng | 169 | 8 |
| KwaZulu-Natal | 117 | 6 |
| Limpopo | 16 | 1 |
| Mpumalanga | 17 | 0 |
| Northern Cape | 3 | 2 |
| North West | 39 | 9 |
| Western Cape | 257 | 20 |
| **South Africa** | 757 | 51 |

**Table 30. Number* of invasive and non-invasive *Shigella* cases reported to GERMS-SA by age category, South Africa, 2017, n=808 (including audit reports, missing isolates, mixed and contaminated cultures)**

| Age Category (years) | Cases | |
|---|---|---|
| | Non-invasive | Invasive |
| 0 - 4 | 345 | 16 |
| 5 - 14 | 118 | 1 |
| 15 - 24 | 34 | 3 |
| 25 - 34 | 65 | 9 |
| 35 - 44 | 52 | 11 |
| 45 - 54 | 40 | 6 |
| 55 - 64 | 45 | 2 |
| ≥ 65 | 39 | 2 |
| Unknown | 19 | 1 |
| **Total** | 757 | 51 |

*Incidence rates were not calculated because specimens are not routinely submitted for culture from all patients with gastroenteritis.

## *Vibrio cholerae* O1

**Results**

No cases of *Vibrio cholerae* O1 were identified in 2017.

**Discussion**

The lack of outbreaks of cholera in 2017 supports the importance of heightened awareness and rapid responses in years past in the event of disease being identified.

## *Listeria monocytogenes*

The listeriosis outbreak which began during 2017 provided an ideal opportunity to institute laboratory-based surveillance for *Listeria monocytogenes.* Prior to this, listeriosis had not been a priority communicable disease and no data was available; listeriosis was officially declared a Notifiable Medical Condition by the Minister of Health on 15 December 2017. Collection and analysis of retrospective laboratory data from NHLS and private sector laboratories was crucial in establishing background rates of listeriosis against which to monitor trends in outbreak-associated cases.

Once the outbreak was confirmed, GERMS-SA provided instrumental and critical support to outbreak investigation activities. This included use of the GERMS-SA database for listeriosis laboratory and case report form data; support for data collection and management from GERMS-SA staff; and interview of case-patients with completion of case report forms by surveillance officers.

**Results**

The highest case numbers occurred in October through December 2017, when the outbreak peaked (Figure 23).

A record number of 150 cases occurred during the month of October. Table 31 shows the provincial distribution of cases. Although cases occurred in all provinces, 79% were reported from three provinces: Gauteng (444/758, 59%), Western Cape (93/758, 12%) and KwaZulu-Natal (55/758, 7%). Neonates ≤28 days accounted for 39% (295/748) cases, and 32% (238/748) cases were adults aged 15 -49 years (Figure 24). All laboratory-confirmed cases were classified as listeriosis, regardless of primary anatomical site of isolation (Table 32). *L. monocytogenes* was most commonly isolated from blood culture (72%) followed by CSF (23%).

**Discussion**

GERMS-SA played a vital role in supporting the listeriosis outbreak investigation during 2017. Now that listeriosis is a notifiable medical condition, routine surveillance will assist in detecting unusual trends in case numbers which may indicate outbreaks, to allow for rapid investigation and response.

**Figure 23. Number of listeriosis cases reported to GERMS-SA, by month of specimen collection and province, South Africa, 2017, n=748 (including audit reports)**

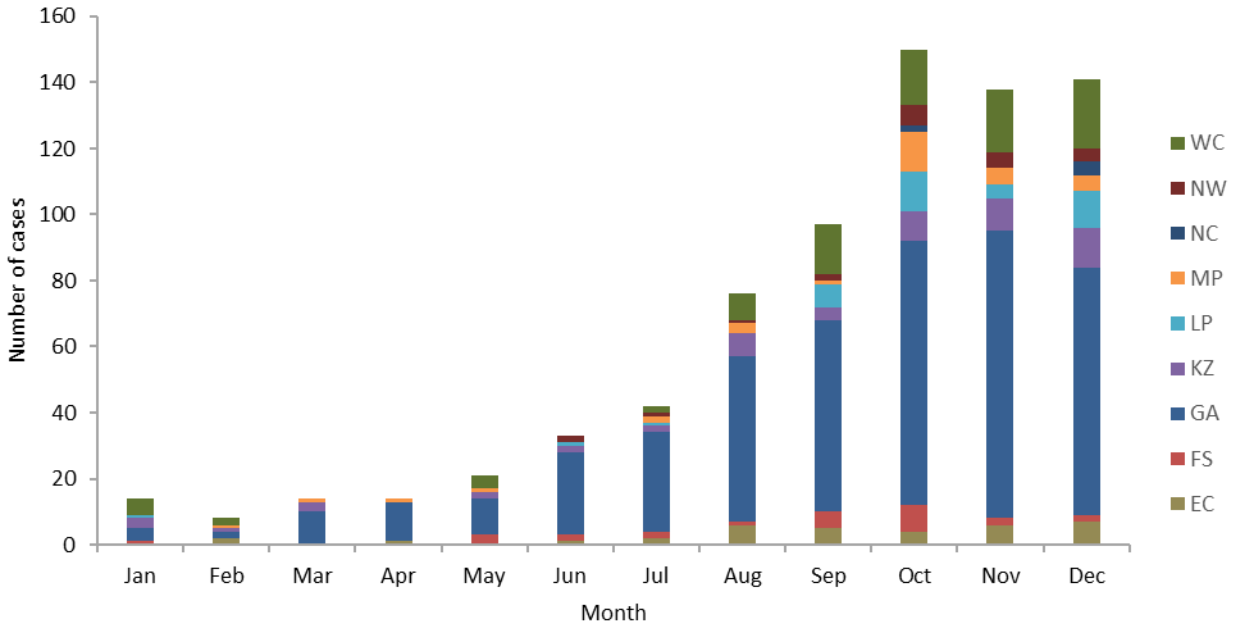


**Table 31. Number of listeriosis cases reported to GERMS-SA, by province, South Africa, 2017, n=748 (including audit reports, missing isolates, mixed and contaminated cultures)**

| Province | Listeriosis cases |
|---|---|
| Eastern Cape | 34 |
| Free State | 26 |
| Gauteng | 444 |
| KwaZulu-Natal | 55 |
| Limpopo | 37 |
| Mpumalanga | 32 |
| Northern Cape | 6 |
| North West | 21 |
| Western Cape | 93 |
| Unknown | 0 |
| **South Africa** | 748 |

**Figure 24. Number of listeriosis cases reported to GERMS-SA, by age group and gender, South Africa, 2017, n=748 (including audit reports)**

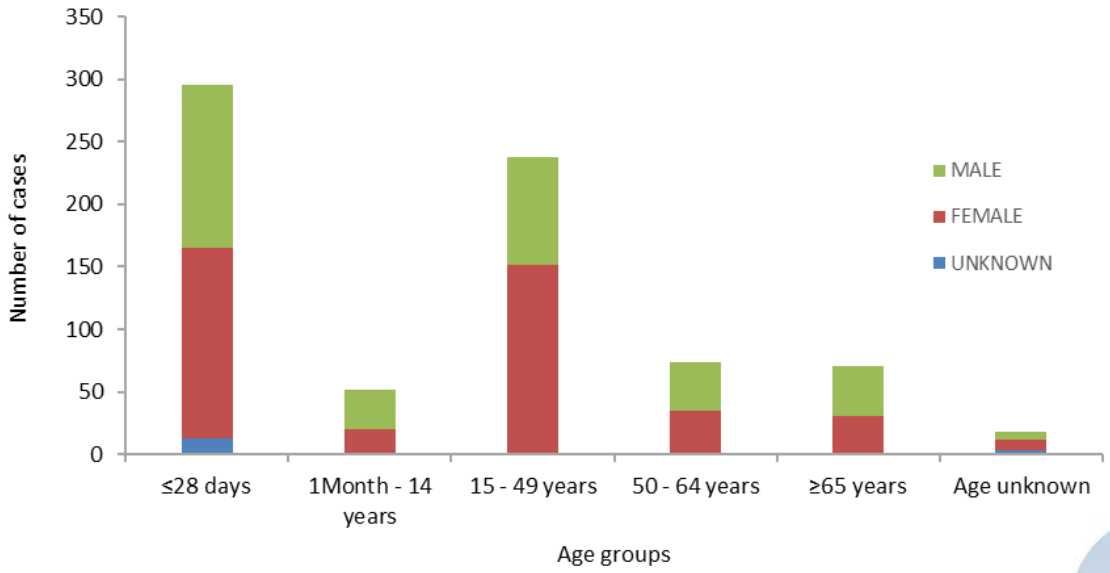



**Table 32. Number of listeriosis cases reported to GERMS-SA by primary anatomical site of isolation*, South Africa, 2017, n=748 (including audit reports, missing, mixed and contaminated cultures)**

| Specimen | n | % |
|---|---|---|
| CSF | 177 | 23 |
| Blood culture | 549 | 72 |
| Stool | 3 | 0.4 |
| Other | 36 | 5 |
| **Total** | 765 | 100 |

*Many cases had multiple isolates from different body sites.

## Rifampicin-resistant Tuberculosis

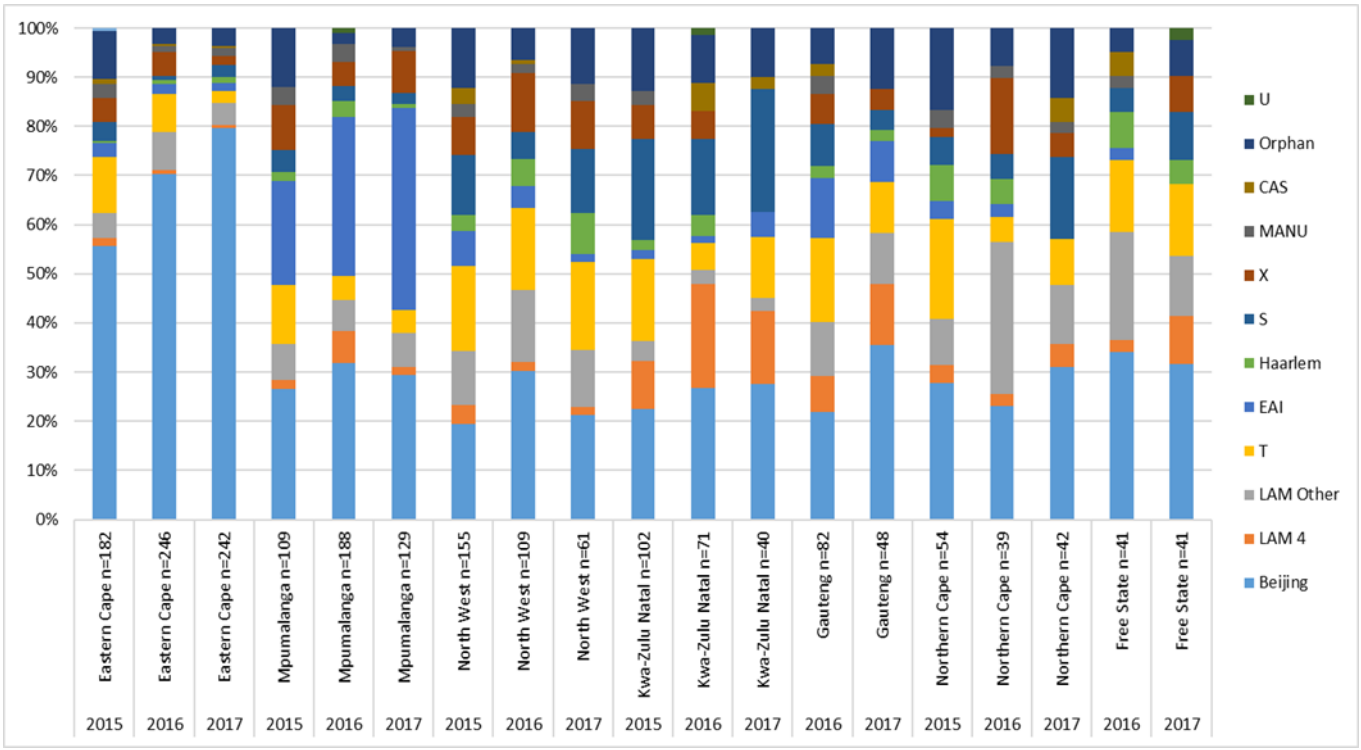
**Results**

In 2017, 603 Rifampicin resistant (RIF-R) isolates collected from seven provinces were successfully typed. The patients enrolled in the surveillance included 53.9% males and 42% females, while the gender of 3.5% of the patients was not available. The patients' median age was 35 years, ranging from 1 to 89 years. The majority of samples processed were smear positive (75.9%). Susceptibility testing results were available for 99% (597/603) of the samples. Over half of the isolates were MDR-TB isolates, mostly being detected from Eastern Cape and Mpumalanga. Eastern Cape had the highest proportion (78%) of the XDR-TB cases. Based on the spoligotyping results, 10 distinct families of TB were identified with Beijing family being the predominant family 49%, followed by 10.8% LAM, 10.6% EAI, 7.1% T, 6.6% S and 4.6% X. Forty (6.6%) isolates typed had no lineage assigned. The distribution of different families varied by province over a three-year period is shown in Figure 25. There was no significant association between the genotypes and age, gender, or specific drug susceptibility patterns.

**Discussion**

The surveillance data showed that RIF-R cases in the seven provinces is caused by a wide diversity of genotypes with predominance of Beijing family in the six provinces. In the Eastern Cape region, the Beijing genotype represented 80% of the isolates. There was more than 20% increase in the number of Beijing isolates from 2015 to 2017 (Figure 25). Although the reason for this increase in Beijing strains in Eastern Cape is not clearly understood, it is possible that transmission could be the driving cause of the epidemic. In Mpumalanga, unlike the rest of the provinces, the EAI family was the predominant genotype. There was also a progressive increase in number of EAI genotype from 2015 to 2017. This is of concern and needs careful monitoring of trends. The rest of the provinces had high level of diversity of genotypes suggesting that the transmission of TB in these settings is not caused by the clonal spread of a specific drug resistant strain. T, LAM, and S families were among the major genotypes identified in most of the provinces. The prevalence of S family was higher in KZN compared to other provinces. The number of S genotypes increased between 2016 and 2017 in KZN, Northern Cape and Free State. Interventions that decrease transmission in community settings are needed especially in Eastern Cape and Mpumalanga.

**Figure 25. Tuberculosis spoligotypes of culture positive specimens by province (South Africa) for 2015 to 2017**



## Rifampicin-susceptible Tuberculosis

**Results**

In 2017, 231 enrolled rifampicin susceptible cases had a case report form completed and sputum sample processed. Data from four provinces (Mpumalanga, Gauteng, KZN and North West) were analyzed. Almost 80% of the patients were HIV positive. The North West Province had the highest proportion of TB/HIV co-infection cases (83%), followed by Gauteng (81%), KZN (71%) and Mpumalanga (67%). Just over half (51%) were on ART. North West had the highest proportion of previously treated TB cases (38%). Smoking (64%) was more prevalent among patients in Mpumalanga, whereas alcohol (28%) use was more prevalent among patients in the KZN. Close to 40% of patients from Mpumalanga reported to have someone in the household diagnosed with TB in the last two years. Seven percent of HIV positive patients reported to have been on IPT, most from Mpumalanga (11%) followed by North West (9%) and Gauteng (7%). Table 33 shows the comparison of factors by province. Sixty-three percent (146/231) of cases were smear positive. Cultures were negative in 13% (31/231) and 6% (15/231) were contaminated, precluding further analysis. Drug susceptibility results were successfully performed for 179 samples. Majority were from Gauteng (36%), followed by North West (28%), Kwa-Zulu Natal (24%) and Mpumalanga (12%). Fourteen of these were isoniazid mono resistant (IMR), with the majority from North West (7/14), followed by Gauteng (5/14) and Kwa-Zulu Natal (2/14). Nine (64%) of the mono resistant cases were smear positive. The overall IMR prevalence was 8% and for North West was 14%. Only one participant from the North West who was IMR reported to taking INH prophylactic therapy.

**Discussion**

The majority of TB cases were co-infected with HIV highlighting its continued importance in controlling the TB epidemic. Antiretroviral treatment has been previously shown to reduce TB incidence and having only 51% of TB patients on ART highlights an important gap that needs to be addressed. The policy recommending test and treat for HIV will likely change this over time. Previous treatment exposure was low in Gauteng compared to the other provinces and is suggestive of primary transmission rather than reactivation. The overall prevalence of IMR (8%) is in keeping with what was found in the TB drug resistant survey. It is also interesting to note the high smear positivity rate of IMR cases which is indicative of transmission, particularly in the North West province. Previous household contact with a TB patient was high in Mpumalanga, close to half having been exposed emphasizing the need for improved contact management of index cases. The high prevalence of smoking, which is a known risk factor for TB is an important health issue that is often overlooked leading to poor lung health and increased long term susceptibility to TB and other infections. Alcohol use which can impact on treatment adherence and drug levels was also observed to be relatively common and should be taken into consideration when managing patients. The findings of this surveillance has important public health importance however as the surveillance was conducted only at a few sites the generalizability of these findings is limited.

**Table 33. Risk factors by province in patients with Rifampicin susceptible TB**

| Risk Factor | MPU=28 | GP=80 | KZN=57 | NW=66 | TOTAL=231 |
|---|---|---|---|---|---|
| *Previous treatment for TB* | | | | | |
| unknown | 2 | 3 | 2 | 3 | 10 |
| no | 19 | 62 | 42 | 38 | 161 |
| yes | 7 | 15 | 13 | 25 | 60 |
| **Proportion with previous TB treatment exposure** | **25%** | **19%** | **23%** | **38%** | **26%** |
| *Household contact previously diagnosed with TB in the past 2 years* | | | | | |
| unknown | 0 | 6 | 11 | 6 | 23 |
| no | 19 | 60 | 42 | 50 | 171 |
| yes | 9 | 14 | 4 | 10 | 37 |
| **Proportion with a previous household TB contact** | **32%** | **18%** | **7%** | **15%** | **16%** |
| *Highest level of education completed* | | | | | |
| unknown | 0 | 2 | 2 | 2 | 6 |
| no formal | 3 | 0 | 1 | 4 | 8 |
| primary | 14 | 13 | 11 | 17 | 55 |
| secondary | 10 | 62 | 39 | 40 | 151 |
| tertiary | 1 | 3 | 4 | 3 | 11 |
| **Proportion who have completed secondary education among positive respondents** | **36%** | **78%** | **68%** | **61%** | **65%** |

| Risk Factor | MPU=28 | GP=80 | KZN=57 | NW=66 | TOTAL=231 |
|---|---|---|---|---|---|
| *History of Imprisonment* | | | | | |
| unknown | 0 | 0 | 2 | 2 | 4 |
| no | 26 | 77 | 53 | 56 | 212 |
| yes | 2 | 3 | 2 | 8 | 15 |
| **Proportion who have been previously imprisoned** | **7%** | **4%** | **4%** | **12%** | **6%** |
| *Alcohol history* | | | | | |
| unknown | 0 | 3 | 1 | 2 | 6 |
| no | 22 | 66 | 40 | 56 | 184 |
| yes | 6 | 11 | 16 | 8 | 41 |
| **Proportion who have used alcohol** | **21%** | **14%** | **28%** | **12%** | **18%** |
| *Previous work at a mine* | | | | | |
| unknown | 0 | 7 | 0 | 1 | 8 |
| no | 28 | 73 | 57 | 58 | 216 |
| yes | 0 | 0 | 0 | 7 | 7 |
| **Proportion with prior mining work exposure** | **0%** | **0%** | **0%** | **11%** | **3%** |
| *Previous hospital admissions in the past year* | | | | | |
| unknown | 0 | 5 | 4 | 2 | 11 |
| no | 23 | 68 | 50 | 52 | 193 |
| yes | 5 | 7 | 3 | 12 | 27 |
| **Proportion who have previously been admitted to hospital** | **18%** | **9%** | **5%** | **18%** | **12%** |
| *Smoking history* | | | | | |
| unknown | 0 | 0 | 1 | 0 | 1 |
| no | 10 | 45 | 38 | 27 | 120 |
| yes | 18 | 35 | 18 | 39 | 110 |
| **Proportion with a positive smoking history** | **64%** | **44%** | **32%** | **59%** | **48%** |
| *HIV status* | | | | | |
| unknown | 1 | 6 | 5 | 1 | 13 |
| negative | 9 | 14 | 15 | 11 | 49 |
| positive | 18 | 60 | 37 | 54 | 169 |
| **Proportion with HIV among those with a known status** | **67%** | **81%** | **71%** | **83%** | **78%** |
| *History of IPT exposure among HIV positive patients* | | | | | |
| unknown | 2 | 5 | 4 | 6 | 17 |
| Not applicable | 9 | 12 | 15 | 10 | 46 |
| no | 15 | 59 | 38 | 45 | 157 |
| yes | 2 | 4 | 0 | 5 | 11 |
| **Proportion of HIV positive patients who have received IPT treatment** | **11%** | **7%** | **0%** | **9%** | **7%** |
| *History of prior anti-retroviral treatment among HIV positive patients* | | | | | |
| no | 10 | 26 | 27 | 18 | 81 |
| screened for initiation | 0 | 0 | 2 | 0 | 2 |
| yes | 8 | 34 | 8 | 36 | 86 |
| **Proportion of HIV positive patients who have had prior ART exposure** | **44%** | **57%** | **22%** | **67%** | **51%** |

## References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# Clinic/ syndromic surveillance

## Diarrhoeal surveillance

**Introduction**

Sustainable development goal (SDG) 3 talks to ending preventable deaths of new-borns and children <5 years by 2030 and sets limits on these indicators of <12 neonatal deaths per 1,000 live births and <25 children <5 deaths per 1,000 live births. While South Africa has made tremendous strides in reducing the <5 mortality rates from 78.1 per 1,000 live births in 2003 to 37-40 deaths per 1,000 live births in 2015[1], the rates are still above the limit of 25 set in SDG 3. Diarrhoea, pneumonia and HIV infection remain the most important causes of death in children <5 outside the neonatal period despite mortality-declines associated with these syndromes. The rotavirus vaccine, introduced into the Expanded Programme of Immunisation in August 2009, was one of the interventions that contributed to the decline in diarrhoeal mortality. The oral monovalent vaccine was administered to children at 6 and 14 weeks of age to protect against rotavirus, the most important cause of severe diarrhoea and death in children <5 years. Impact studies have shown a decrease in both rotavirus-specific (54-58% reduction in children < 5 years [2] and all-cause diarrhoea (45-65% reduction in children <12 months and 40-50% reduction in children 13-24 months [3] in South Africa. Continuous monitoring of diarrhoea and rotavirus in children <5 years is, however, required to ensure the vaccine formulation and program are functioning properly and to identify rotavirus strains that may escape protection, if any.

**Methods**

In 2017, diarrhoea surveillance was conducted at five sites which included: Chris Hani Baragwanath Academic Hospital (CHBAH, Gauteng Province), Dr George Mukhari Hospital (DGM, Gauteng/North West Province border), Matikwane Hospital (MKH, Mpumalanga Province (MP)), Pelonomi Hospital (PNH, Free State Province) and Dora Nginza Hospital (DNH, Eastern Cape Province). All children <5 years admitted to a sentinel hospital for the treatment of acute diarrhoea (WHO definition; seven days or less) were approached for enrolment. Enrolment was conducted systematically from Monday to Friday (8am-5pm), after informed consent was obtained from a parent or guardian, and demographic, clinical and outcome data were collected in a structured questionnaire by dedicated surveillance officers.

Stool specimens were collected for rotavirus and enteric pathogen screening. Specimens were screened at the MRC-Diarrhoeal Pathogens Research Unit laboratory at Sefako Makgatho Health Sciences University or at the Centre for Enteric Diseases, NICD for rotavirus (commercial EIA and standardized characterization protocols) and other enteric viruses. The start of the rotavirus season was defined as a rotavirus detection rate of above 20% for two consecutive weeks. The end of the season was defined as a rotavirus detection rate of below 20% for two consecutive weeks.

**Results**

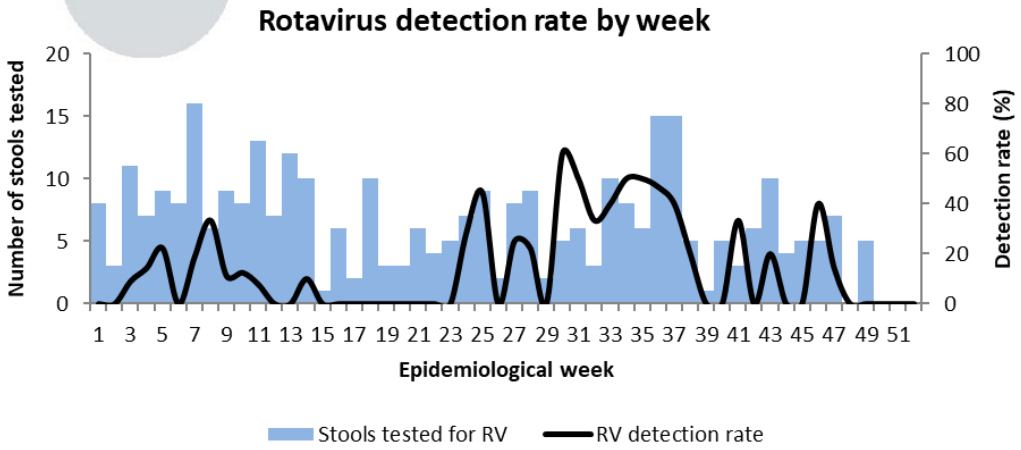
A total of 324 stool specimens were screened in 2017 (Table 34) with 19% (61/324) positive for rotavirus. The rotavirus season began in week 24 (12 June) and ended in week 38 (24 September; Figure 26). The maximum detection rate (60%; 3/5) was in week 30 (24 July; Figure 26). A total of 28 rotavirus positive strains were genotyped with G8P[4] (36%; 10/28) and G2P[4] (29%; 8) predominant and other strains detected at lower levels (G3P[4], G3P[8], G9P[8], and mixed strain infections).

A total of 237 specimens were also screened for other enteric viruses. A total of 12% (29/237) were positive for adenovirus, 8% (n=20) for norovirus GII, 4% (n=10) for astrovirus, 3% (n=7) for sapovirus and <1% (n=1) for norovirus GI.

**Table 34. A summary of the stool specimens collected per site per month in 2017 and the number and percentage of specimens positive for rotavirus**

| Site | CHBAH | MKH | DGM | PNH | DNH | Total |
|---|---|---|---|---|---|---|
| **January** | 4 | 3 | 8 | 17 | 1 | 33 |
| **February** | 5 | 10 | 6 | 12 | 2 | 35 |
| **March** | 9 | 5 | 13 | 16 | 0 | 43 |
| **April** | 6 | 1 | 5 | 9 | 0 | 21 |
| **May** | 5 | 3 | 10 | 7 | 0 | 25 |
| **June** | 3 | 3 | 7 | 4 | 7 | 24 |
| **July** | 11 | 1 | 4 | 4 | 5 | 25 |
| **August** | 9 | 0 | 5 | 9 | 8 | 31 |
| **September** | 6 | 2 | 17 | 6 | 6 | 37 |
| **October** | 5 | 1 | 8 | 10 | 2 | 26 |
| **November** | 0 | 8 | 4 | 7 | 0 | 19 |
| **December** | 0 | 4 | 1 | 0 | 0 | 5 |
| **Total screened** | 63 | 41 | 88 | 101 | 31 | 324 |
| **Rotavirus positive** | 14 | 8 | 16 | 17 | 6 | 61 |
| **Percentage rotavirus positive** | 22 | 20 | 18 | 17 | 19 | 19 |

**Figure 26. Number of stool specimens and percentage rotavirus positive per week in 2017**




**Discussion**

The rotavirus detection rate (19%) was higher than the 17% noted in 2016 but lower than levels seen in the pre-vaccine era. In addition, the rotavirus season was longer in 2017 (15 weeks) compared to 2016 (9 weeks). The predominant G8P[4] strains identified were uncommon but have previously been detected in South Africa in 2010. The G2P[4] strains detected were more frequent in 2012-2014 but reduced to low levels in 2015 and 2016. However, no rotavirus genotype has been associated with increased severity and genotype frequency distribution simply reflects the changing and unpredictable nature of rotavirus genotype circulation globally.

The limited number of specimens screened for enteric viruses as well as the limited sites surveyed makes it difficult to draw any conclusions regarding the prevalence of the other enteric viruses detected. However, decreases were noted in adenovirus detection in 2017 compared to 2016 (12% compared to 16%), in norovirus GII detection (8% compared to 10%) and in sapovirus detection (3% compared to 7%). An increase in astrovirus detection was noted in 2017 compared to 2016 (4% compared to 1%).

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## Prospective Sentinel Surveillance of Human Immunodeficiency Virus in South Africa and Related Drug Resistance

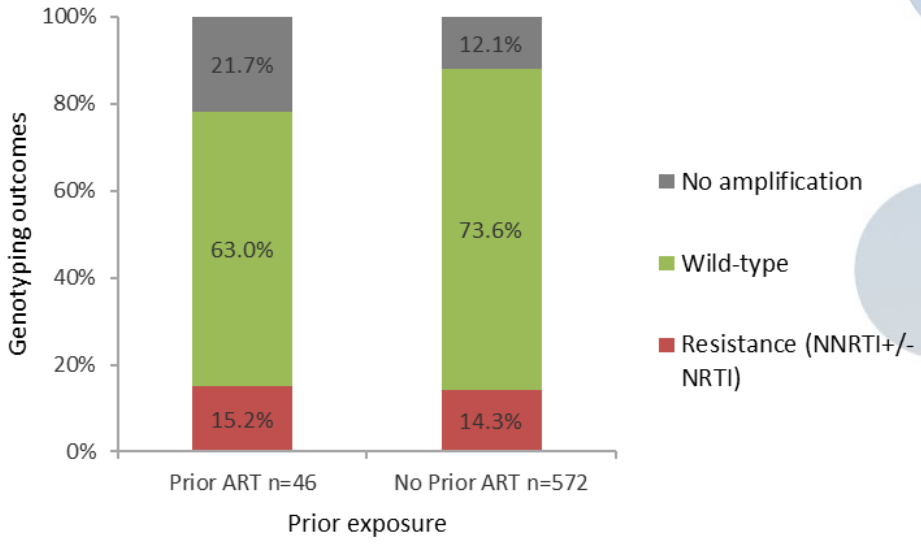
**Introduction**

South Africa (SA) is afflicted with dual epidemics of Tuberculosis (TB) and Human Immunodeficiency Virus (HIV). The country has the world's largest antiretroviral (ARV) program, with approximately 3.5 million people ever started ARV therapy (ART) by 2016. First line combination ART (cART) consists of tenofovir (TDF) / zidovudine (AZT) plas lamivudine (3TC) / emitricitabine (FTC) with efavirenz (EFV) / nevirapine (NVP). As of September 2016, all HIV-infected patients are eligible for life-long ART. Clinical and laboratory monitoring recommends that CD4 and HIV viral load testing be performed at 6 and 12 months, and viral loads repeated every 12 months thereafter. Routine testing for HIV drug resistance (HIVDR) is not performed at ART initiation or NNRTI-based regimen failure - patients failing on these regimens are switched to a standardised protease inhibitor-containing 2$^{nd}$ line regimen after intensified adherence counselling. HIVDR testing is available for PI regimen failure and is a prerequisite for access to 3$^{rd}$-line regimen selection. The NICD Centre for HIV and STIs established an integrated TB-HIV surveillance study in 2014/15 by building on the GERMS-SA hospital-based enhanced surveillance platform. The study introduced surveillance for rifampicin and other drug-resistance in persons initiating TB treatment and /or HIVDR surveillance in persons initiating ART in the same clinic. A single primary health clinic in each province has been selected on the basis of convenience from clinics with high TB and HIV case loads. By 2017, enrolment had completed in the Eastern Cape (EC, Feb 2015) and North West (NW, Jan 2015) Provinces; continued in Mpumulanga (MP, Oct 2014) and Gauteng (GP, February 2016) and started in KwaZulu-Natal (KZN, Feb 2017) and Free State (FS, Sept 2017) Provinces. At each clinic, a dedicated surveillance officer (SO) identifies and enrols eligible patients (i.e. patients initiating TB therapy or ART according to routine clinic procedures). Where consent is obtained, SOs interview the participants using a standard questionnaire and available medical records to collect relevant clinical and epidemiological data, and collect sputum or whole blood specimens from the participants. Here, we report on HIVDR data in patients initiating ART and enrolled in the GERMS HIVDR surveillance study during 2017. All sites keep enrolling until a pre-defined sample size has been achieved.

**Results**

During 2017, 618 specimens were collected for HIVDR testing, 74 (12%) from GP, 343 (56%) from KZN, 100 (16%) from FS and 100 (16%) from MP, all from clinics located in urban/peri-urban areas. Sixty five percent of all enrolled participants were female, and the average age was 35 years (IQR 29-42 years). Half of enrolled participants were unemployed and 19% are smokers. Six percent (6%) had received a tertiary education, and 72% had completed secondary school. Median CD4 count at time of enrolment was generally not available, due to uptake of test-and-treat policies. Eleven percent have ever been diagnosed with TB. Six percent of participants were currently experiencing clinical markers – a notable decrease from two thirds of participants recruited during 2015/6. Prior exposure to ART (as PMTCT and/or previous ART) was reported in 46 (7%) participants: 32 of these reported receiving PMTCT (as single-dose nevirapine, Option A or Option B), 10 had previously received combination ART for clinical management and 4 reported receiving post-exposure prophylaxis. HIVDR testing was successful in 86% of specimens, with amplification failure primarily due low viral loads. NNRTI resistance was detected in 15% of specimens, of which 2% harboured dual NRTI/NNRTI drug resistance. The K103N mutation, which confers high-level resistance to efavirenz and nevirapine, was most commonly detected. When analysed according to prior ART exposure, HIVDR was present in 15% of participants with any prior ART vs 14% of those with no reported prior ART (Figure 27.)

**Figure 27. HIV drug-resistance genotyping outcomes amongst 618 participants enrolled in NICD HIVDR surveillance during 2017, according to participants' prior exposure to antiretroviral therapy**



**Conclusion**

The data show high proportions of patients are initiating ART with resistance to NNRTI (15%), which may compromise the effectiveness of the NNRTI drug in the standardised first line regimens. Sentinel site surveillance, while not population-based and therefore not necessarily generalizable to all clinics, does provide good assessments of prevalence and trend data. In addition, prior exposure to ART recording may not be accurate, due to recall bias and absence of data in medical files. The extent to which the facilities surveyed herein are similar to facilities elsewhere and to what extent the patients enrolled are similar to those in the national program needs to be determined in order to ascertain the representivity of this data. However, surveillance through the GERMS platform allows for valuable, consistent and intensified data collection over longer periods of time.

## Aetiological surveillance of Sexually Transmitted Infection Syndromes at sentinel sites: GERMS SA 2017

**Executive Summary**

Sentinel aetiological surveillance of STI syndromes was conducted at primary healthcare facilities in four South African provinces in the period 2017. *Neisseria gonorrhoeae* was the predominant cause of MUS; and syndromic management with dual antimicrobial therapy, which also covers *Chlamydia trachomatis*, the second most common pathogen, is rational. Herpes simplex virus was the commonest detectable cause of genital ulceration, supporting the continued use of acyclovir in syndromic management. The syndromic management of VDS remains complex: the commonest causes, bacterial vaginosis and candidiasis, are not considered as STIs; however, a significant proportion of patients with either condition were co-infected with STI pathogens. The HIV seroprevalence among STI patients was high, underlining the importance of linkage to universal HIV counselling and testing in primary healthcare settings.

**Background**

In South Africa, STIs are managed principally at primary healthcare facilities (PHCs) using standard syndromic management guidelines.[1] National clinical STI syndrome surveillance is conducted by NDoH at 270 surveillance sites across the country. Clinical surveillance data on the distribution of STI syndromes in Gauteng Province PHCs (2000 – 2007) have revealed that male urethritis syndrome (MUS), vaginal discharge syndrome (VDS) and genital ulcer syndrome (GUS) together comprise nearly 80% of all syndromes seen.[2]

Periodic aetiological surveillance of the three main STI syndromes is critical in validating the existing treatment algorithms. In 2017 STI aetiological surveillance was conducted in the following provinces: Gauteng (Alexandra Health Centre); Western Cape (Khayelitsha Clinics); Eastern Cape (Zwide Clinic); and Free State (Heidedal Clinic).

**Objectives**

The primary objectives of surveillance were to determine the aetiologies of the three major STI syndromes (MUS, GUS, VDS) and the susceptibility profiles of *Neisseria gonorrhoeae* isolates. Secondary objectives were to determine co-infections (e.g. HIV) among patients presenting with STI Syndromes.

**Methods**

Consecutive consenting patients presenting with MUS, VDS or GUS at the selected PHCs between January and December 2017 (and up to 31 March 2018 for Heidedal Clinic) were included in the surveillance. Inclusion criteria were STI patients aged 18 years and above with a new episode of clinically confirmed MUS, VDS and/ or GUS. The target sample size per site was as follows: 100 cases each of MUS and GUS and approximately 150 -200 cases of MUS (in order to obtain at least 100 viable gonococcal isolates from each site). Following eligibility and informed consent procedures, a nurse-administered questionnaire was used to document demographic and clinical information. Swabs were used for the sampling of genital discharge (vaginal, endocervical, urethral) and genital ulcers. Additionally, a 10ml specimen of venous blood was collected from each participant.

**Results**

**Patient demographic and clinical characteristics**

Of 1,054 participants, 559 (53.0%) were male (Table 35). Median age of participants was 26 years (IQR 23-32 years) and the majority were of black African ethnicity (99.6%) and of self-reported heterosexual orientation (99.5%). With respect to high risk sexual behaviours: median age at sexual debut was 17 years (IQR 16-18 years), and self-reported condom use at last sexual encounter was low (15.8%). Condom use was significantly lower in the Eastern Cape (0.4%). Almost one-third of participants (28.3%) had been diagnosed with an STI syndrome within the preceding 12-month period; and this proportion was significantly higher for the Eastern Cape at almost 40% ($p < 0.001$).

Over one-third of all patients reported that their most recent sexual encounter was with a non-regular partner. A significantly greater proportion of patients in Gauteng reported having sex with a partner in another province (37%) or country (22.5%) in the preceding 3-month period.

Approximately 80% of patients reported knowledge of their HIV status; knowledge was significantly lower among the Eastern Cape patients (55.0%). Overall 70% of males had been circumcised; this was lowest for Gauteng Province (< 50%).

**Table 35. Demographic and behavioural characteristics of participants with STIs (N=1,054)**

| Variable (n, %) | All N= 1,054 | Alexandra (GP) N=364 | Heidedal (FS) N=181 | Khayelitsha (WC) N=227 | Zwide (EC) N=282 | p-value |
|---|---|---|---|---|---|---|
| Males | 559 (53.0) | 209 (57.2) | 76 (42.0) | 118 (52) | 156 (55.3) | |
| Current age, Median (IQR) | 26 (23- 32) | 28 (25- 33) | 28(23- 35) | 24 (22- 28) | 25 (22- 30) | |
| Black Africans | 1,050 (99.6) | 364 (100) | 179 (98.9) | 227 (100) | 280(99.3) | |
| Age at first sex, Median (IQR) | 17 (16- 18) | 17 (16- 19) | 17 (16-19) | 17 (15- 18) | 17 (16- 18) | |
| Heterosexual orientation | 1,049 (99.5) | 360 (98.9) | 181 (100) | 227 (100) | 281 (99.7) | |
| Condom use at most recent sexual encounter | 166 (15.8) | 111 (30.9) | 20 (11.1) | 34 (15.0) | 1 (0.4) | <0.001 |
| Sex with someone living outside province in the past 3 months | 162 (15.4) | 135 (37.1) | 4 (2.2) | 21 (9.3) | 2 (0.7) | <0.001 |
| Sex with someone living outside the country in the past 3 months | 91 (8.6) | 82 (22.5) | 7(3.9) | 2 (0.9) | 0 (0.0) | <0.001 |
| Most recent sexual encounter with a non-regular sexual partner | 370 (35.1) | 120 (33.0) | 46 (25.4) | 84 (37) | 120 (42.6) | 0.001 |
| STI syndrome diagnosed in the past 12 months | 298 (28.3) | 86 (23.6) | 38 (21.0) | 65(28.3) | 109 (38.7) | <0.001 |
| Know their HIV status | 830 (78.8) | 285 (78.3) | 163 (90.1) | 227 (100) | 155 (55.0) | <0.001 |
| Males ever circumcised* | 392 (70.1) | 102 (48.8) | 39 (51.3) | 107 (90.7) | 144 (94.2) | <0.001 |

*among 559 males

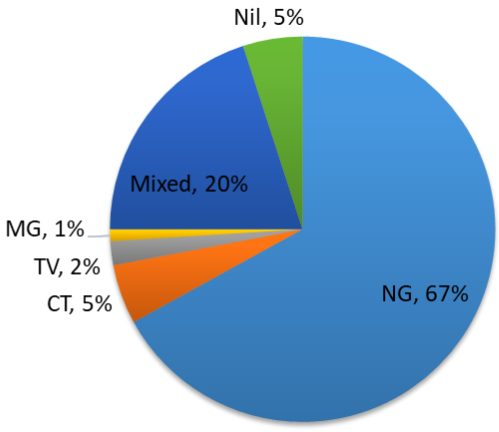
**Laboratory results**

**STI Syndrome aetiologies**

**MUS**

Among 483 patients presenting with MUS, *Neisseria gonorrhoeae* was the commonest cause (414, 85.7%; 95% CI 82.3 – 88.6), followed by *Chlamydia trachomatis* (114, 23.6%; 95% CI 20.0 – 27.6) (Figure 28). The majority of patients (362, 74.9%; 95% CI 70.9 – 78.6) had infections caused by single agents. *Trichomonas vaginalis* and *Mycoplasma genitalium* accounted for less than 5% of MUS. Multiple pathogens were detected in approximately 19.9% (96; 95% CI 16.5 – 23.7): the majority of these mixed infections (93; 96.9%) were caused by *Neisseria gonorrhoeae* together with one or more STI pathogens, mostly *Chlamydia trachomatis* (83; 86.4%). An STI pathogen was detected in approximately 95% of specimens (458; 95%CI 92.4 – 96.5); approximately 5% of specimens (25; 95% CI 3.5 – 7.6) had no identifiable STI aetiology. The STI pathogen yield was significantly higher for the Western Cape site than for sites in other provinces (99.1%; p = 0.001); this is possibly indicative of better specimen quality and adequacy.

**Figure 28. Relative prevalence of STI pathogens in MUS (N = 483)**




**Mixed aetiology (n = 96):**
**Mostly NG + CT (86.5%)**

**Overall prevalence (single + mixed infections)**

- **NG: 86%**
- **CT: 24%**
- **TV: 3%**
- **MG: 3%**

**Key: *Neisseria gonorrhoeae* (NG); *Chlamydia trachomatis* (CT); *Trichomonas vaginalis* (TV); *Mycoplasma genitalium* (MG)**

**VDS**

Among 431 women with VDS (Figure 29), less than 50% had a detectable STI pathogen in single or mixed infections (205; 95% CI 42.9 – 52.3). The commonest STI aetiology was *Chlamydia trachomatis* (96, 22.2%; 95%CI 18.6 – 26.5), followed by *Trichomonas vaginalis* (86, 20.0%; 95% CI 16.4 – 24.0). The relative prevalence of *T. vaginalis* differed significantly by site, ranging from 12% for the Eastern Cape site to 31% for Free State (p = 0.002). *Neisseria gonorrhoeae* accounted for less than 20% (72, 16.7%; 95% CI 13.5 – 20.5) of infections, and *Mycoplasma genitalium* for less than 10%.

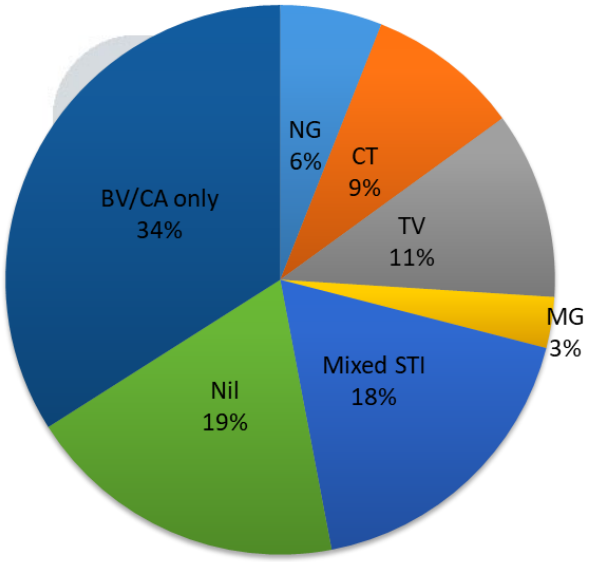
Overall, single STI pathogens were detected in 128 VDS cases (29.7%; 95% CI 25.5 – 34.2); and mixed infections with multiple (two or more) STI pathogens in 77 (17.9%; 95% CI 14.5 – 21.8).

Most VDS cases were attributed to conditions that are not traditionally considered to be STIs: bacterial vaginosis (BV) was identified in 209/752 (48.5%; 95% CI 43.8 – 53.2). Vulvovaginal candidiasis (CA) accounted for 87 (20.2%; 95% CI 16.6 – 24.3). An identifiable pathogen or cause was not found for 78 (18.1%; 95% CI 14.7 – 22.0) of VDS cases.

A significant proportion of VDS patients had co-infection with STI and non-STI aetiologies. Only 18.1% (78/431; 95% CI 14.7 – 22.0) of VDS cases tested for all causes had a sole STI aetiology; whereas 29.5% (127/431; 95% CI 25.2 – 34.0%) had an STI plus BV and/or CA.

Overall 102 VDS cases (23.7%) had BV-STI co-infections, and 34 VDS cases (7.9%) had CA-STI co-infections. Therefore 102/209 patients with BV (48.8%; 95% CI 41.8 – 55.8) and 34/87 patients with CA (39.1%; 95% CI 28.8 – 50.1) had STI co-infections.

**Figure 29. Relative prevalence of VDS aetiologies (N = 431)**




**Any STI pathogen (single/ mixed infections): 48% (205/431)**

**Overall prevalence**

- **NG : 17%**
- **CT : 22%**
- **TV : 20%**
- **MG : 10%**

**STI only: 18.1% (78/431)**

**BV: 49% (209/431)**

- **Overall BV with STI: 23.7% (102/431)**
- **Of those with BV: 49% had STI (102/209)**

**CA: 20% (87/431)**

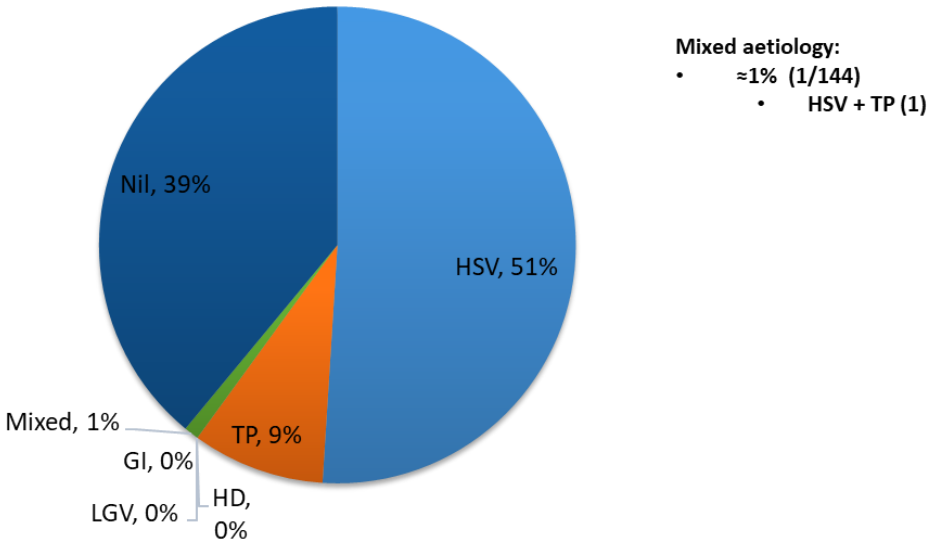
- **Overall CA with STI: 8% (34/431**
- **Of those with CA: 39% had STI (34/87)**

Key: *Neisseria gonorrhoeae* (NG); *Chlamydia trachomatis* (CT); *Trichomonas vaginalis* (TV); *Mycoplasma genitalium* (MG); bacterial vaginosis (BV); vulvovaginal candidiasis (CA)

**GUS**

Among 144 GUS cases (Figure 30), the major cause was herpes simplex virus (HSV) in 51.4% (74; 95% CI 43.2 – 59.5); followed by *Treponema pallidum* (TP) in 10.4% (15/144; 95% CI 6.3 – 16.6). Type-specific PCR revealed that 98.6% (73/74) HSV infections were caused by HSV-2. Most pathogen-detectable cases had a single aetiology (87/144, 60.4%). Only 1 case had mixed aetiology with HSV and TP co-infection. An ulcer-derived pathogen was not identified in 38.9% GUS cases (56; 95% CI 31.2 – 47.2). Statistical analysis to detect significant aetiological differences by site was limited by small sample sizes for GUS.

**Figure 30. Relative prevalence of STI pathogens in GUS (N = 144)**




Key: herpes simplex virus (HSV); *Treponema pallidum* (TP); lymphogranuloma venereum (LGV); granuloma inguinale (GI)

**Serological results**

HIV co-infection rates were as follows: 42.4% (61/143; 95% CI 34.5 – 50.7) in GUS; 29.7% (128/428; 95% CI 25.6 – 34.2) in VDS and 21.3% (103/482; 95% CI 17.9 – 25.2) in MUS. The relative prevalence of HIV co-infection in VDS was significantly higher for the Free State site (46%) than for sites in other provinces ($p < 0.001$). There was a significant association between HIV seropositivity and HSV-associated ulceration ($p = 0.04$).

**Discussion and Conclusions**

This surveillance study provides a snapshot of STI Syndrome aetiologies across several South African provinces in 2017. Overall the study found that the majority of participants enrolled with STI syndromes were young and reported high risk sexual behaviour, such as young age at sexual debut and unprotected sex at last sexual encounter. STI/HIV control interventions, such as knowledge of HIV status, condom use and voluntary male medical circumcision need to be strengthened across all provinces, and especially in the Eastern Cape province.

*Neisseria gonorrhoeae* was the predominant cause of male urethritis syndrome. Based on our data, syndromic management for MUS in the South African public health sector should include cover for the two leading causes, *Neisseria gonorrhoeae* and *Chlamydia trachomatis*.

Bacterial vaginosis was the leading cause of VDS, and prevalent in almost 50% of females. A significant proportion of women with BV were co-infected with one or more STI pathogens. These findings suggest that BV is associated with risk factors for traditional STI infections, and that the management algorithm for VDS should be reconfigured to increase the predictive value of the algorithm for STI pathogens.

Herpes simplex virus-2 remains the leading cause of pathogen-detectable GUD in Gauteng, and this supports the use of antiviral therapy in the syndromic management guidelines

The HIV prevalence among patients presenting with STI syndromes is significantly higher than the UNAIDS 2016 estimated prevalence of 18.9% (95% CI 16.6 – 21.0) for adults aged 15-49 years in the general South African population. This underscores the importance of linkage to universal HIV testing and treatment for STI patients; and support the recently adopted national policy of early ARV initiation for those who are HIV-infected.

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**Data management and statistical analysis**: Tendesayi Kufa-Chakezha, Gloria de Gita, Thabitha Mathega

**Medicines sans Frontiers:** Laura Trivino Duran, Rebecca O'Connell

**References**

[1]National Department of Health, Sexually Transmitted Infections management guidelines 2015. Adapted from: Standard Treatment Guidelines and Essential Drugs List PHC. National Department of Health, Republic of South Africa.

[2]National Department of Health, Epidemiological comments. 2008; 3(3)

## Zoonotic aetiologies in febrile adults in the Mnisi Community, Mpumalanga Province, South Africa, 2017

**Introduction**

The Mnisi area is a malaria endemic area in rural Mpumalanga and is bordered by the Kruger National Park. Contact between wildlife, livestock and humans is frequent. Zoonoses cause infectious diseases in humans who interact with livestock, domestic animals and vectors. A high prevalence of zoonotic infections was observed in a previous study at 3 public health clinics in Mnisi. A single sentinel site was established at the community health clinic in Mnisi for the NICD surveillance programme in 2014.

The goal of the study was to investigate selected zoonotic diseases in an agropastoral rural community in South Africa.

**Methods**

The methodology has remained the same. Consenting adult (≥18 years) volunteers presenting to the clinic with fever (>37.5 °C) or a history of fever, and on whom a malaria rapid test was done, were enrolled and a questionnaire administered. Acute and convalescent blood samples were collected and for 2017 laboratory tests for leptospirosis, Q fever and brucellosis were done (Table 36). In addition, malaria PCR was done on all samples.

**Table 36. Panel of tests performed**

| Test | Test particulars | Samples tested | Interpretation of results |
|---|---|---|---|
| Q fever IgG ELISA* | Panbio® *Coxiella burnetii (Q fever) IgG ELISA (Standard Diagnostics Inc., Republic of Korea)* | Convalescent serum samples, or acute samples where convalescent samples not available | Index values calculated using run-based cut-off values. As per manufacturer's recommendations |
| *Leptospira IgM ELISA* | Panbio® *Leptospira IgM ELISA (Standard Diagnostics Inc., Republic of Korea).* | Convalescent serum samples, or acute samples where convalescent samples not available | Index values calculated using run-based cut-off values. As per manufacturer's recommendations |
| *Brucella IgM and IgG ELISA* | Vircell® Brucella IgM and IgG ELISA (Vircell S.L., Spain) | Convalescent serum samples | Index values calculated using run-based cut-off values. As per manufacturer's recommendations |

*ELISA: enzyme-linked immunosorbent assay

**Results**

Forty three (43) adult patients were enrolled in 2017. 26% (11/43) did not return for follow up blood samples. The median age was 32 years (IQR 25-51 years) and 60% were female. All patients had contact with animals, all with chickens, 86% with dogs, 72% with cattle and goats, 60% with rodents. Forty to fifty percent of patients knew they had been previously bitten by ticks or fleas. Only 7% had ever attended a dip tank. All patients had eaten meat. Seventy-nine percent had slaughtered animals (chickens), 55% had fed animals. Only two patients had consumed raw cow's milk (which they heated), none consumed goat's milk. Only one patient (4%) knew of abortions in her/ her neighbour's animals.

Illness duration ranged from 1-31 days (mean of 3 days). Sixteen percent (7/43) of patients had no systemic symptoms, majority presented with muscle pain (65%) followed by respiratory symptoms (30%) and gastro-intestinal symptoms (28%). Eighty-one percent (35/43) received an antibiotic at the clinic and 7% (3/43) were referred to the hospital.

On laboratory testing, 19% (8/43) of patients showed evidence of a recent or past infection/exposure for at least one of the zoonotic diseases tested for in this study (Table 37). For Brucella, testing of acute samples still needs to be done on those patients who did not come back for convalescent tests. Malaria PCR was positive for one out of 2 patients in whom the rapid test was positive.

**Table 37. Laboratory test results for 2017**

| Laboratory test positive | Number of patients positive / | % positive |
|---|---|---|
| Q fever IgG | 7/43 | 16% |
| *Leptospira IgM* | 2/43 | 5% |
| *Brucella IgM* | 0/33 | 0% |
| *Brucella IgG* | 0/33 | 0% |
| Malaria PCR | 1/43 | 2% |

**Conclusions**

The numbers were small for 2017 (no surveillance nurse for 4 months and drought may have affected vectors), animal contacts are common, majority of patients seek health care early and antibiotic use is high. There were few positive tests on what the laboratory tested for.

## SUMMARY

Trends in pathogen-specific data are reported through laboratory-based surveillance. For enhanced sentinel surveillance, the percentage of case report forms done on interview was 70% (just reaching the target of 70%); the reason for this drop is in part due to our changes with telephonic interviews. Ongoing training and auditing of our surveillance officer data quality is done to continually improve that aspect.

**Opportunistic infections:** The epidemiology of cryptococcal meningitis or culture confirmed cryptococcal disease remains unchanged between 2016 and 2017. *Cryptococcus* spp, incidence remained stable across provinces for 2016 and 2017. The peak incidence in men was in the 40-44 year old age group; in women it was in the 30-34 year old age group. Where we had HIV information, 96% were infected with HIV and only 60% were on ART (either previously or at the time of diagnosis). Patients still come into hospital with a low CD4 count and the in-hospital case fatality rate continues to be high (36%).

Rifampicin-resistant TB surveillance was done in seven provinces. Of 582 cases where gender was known, 56% were male. Median age was 35 years. Three quarters of the samples processed were smear-positive indicating infectiousness and risk of transmission to close contacts. Over half the isolates were MDR TB isolates (mostly EC and MP). Eastern Cape had the highest proportion of XDR-TB cases (78%). Beijing is still the dominant lineage in all provinces but EAI family predominates in MP. Trend monitoring is important and interventions that decrease transmission in community settings are urgently needed especially in EC and MP.

Rifampicin-susceptible TB surveillance looks at risk factors for TB as well as INH mono-resistance. From 4 provinces (n=231) data showed a high rate of HIV infection (80%) and low ART use (51%) and only 7% isoniazid preventive therapy, high smoking and alcohol consumption. INH mono-resistance is <10%.

**Vaccine-preventable diseases:** The 2017 data continues to monitor the trends in vaccine-preventable diseases of IPD and Hib post-EPI vaccine introduction of PCV13 and the Hib booster. Hib disease remains low, infants being the most affected with Hib and non-typeable disease (HNT). Non-typeable disease is highest in all age groups. One third of patients died in hospital and the median time to death was within one day of admission. Fifty five percent of patients had some predisposing condition other than HIV. *Please remember that Hib is a notifiable medical condition.* There is a continued decrease in IPD, incidence peaks in children under one year of age but also now in the older 45-64 year age category (a shift from the 25-44 year age category from previous years). HIV is still an important risk factor for IPD (64%) and 49% of patients had an underlying medical condition (not HIV) predisposing them to IPD. Case fatality rate continues to be high especially with meningitis (40%) and a third of patients who survived to hospital discharge suffered at least on sequelae. Penicillin and ceftriaxone non-susceptibility remains unchanged. Clinicians should remember to check the vaccine status of children and remember to give catch-up doses.

**Epidemic-prone diseases:** The incidence of meningococcal disease remained low for 2017 with no outbreaks detected; WC having the highest rate and serogroup B being the predominant serogroup (45/108; 45%). High-dose penicillin is still being recommended as the drug of choice for therapy for confirmed meningococcal disease, although penicillin non-susceptibility was 6%; all were susceptible to 3rd generation cephalosporin and ciprofloxacin. Case fatality rate was 17% and 21% of patients who survived to discharge from hospital suffered sequelae. The diagnosis of typhoid fever remains challenging and although the data may not reflect actual burden of disease, numbers were comparable to previous non-outbreak years. For *Salmonella* Typhi, azithromycin is an alternative treatment option since the emergence of ciprofloxacin resistance; continual monitoring of resistance to these two antibiotics has become mandatory. Paratyphoid fever remains rare in South Africa. Non-typhoidal salmonellosis may be foodborne or may be associated with HIV-infection. Although *Shigella* infection has been associated with water-borne outbreaks in South Africa, person-to-person transmission also plays and important role. No cases of *Vibrio cholerae* O1 were identified.

**Listeriosis** was declared a Notifiable Medical Condition in December 2017. Almost 80% of cases were reported from three provinces: Gauteng (59%), WC (12%) and KZN (7%). Neonates accounted for 39% of cases, 32% of cases in adults 15-49 years. The situations reports are available on the NICD webpage.

**Healthcare associated infections:** The epidemiology of candidaemia was similar to the 2016 report. Surveillance covered all provinces; one third of cases came from private sector laboratories. The age of patients were significantly lower (predominantly neonates) in public– vs. the private sector (older adults). Overall, more than a third of patients with candidaemia, many of whom were critically ill, died in hospital. A large majority of bloodstream *C. parapsilosis* isolates were resistant to fluconazole. *C. auris*, an emerging pathogen, is also fluconazole resistant, with very few exceptions. Azole-resistant strains of *C. parapsilosis* and *C. auris* now dominate in the private sector, particularly in Gauteng province. Early treatment with fluconazole should be avoided in this setting. Conventional amphotericin B is the empiric agent of choice for the public-sector. Susceptibility of C*. auris* to amphotericin B needs to be monitored carefully. Caspofungin, micafungin or anidulafungin are good choices for empiric treatment, where available.
*Staphylococcus aureus* surveillance is ongoing in Gauteng and the Western Cape, 61% of patients were male. Long hospital stays were common and a crude case fatality rate was 34%. A quarter of cases were MRSA (unchanged from 2016). Overall, SCCmec type III predominated and was more common in Gauteng; type IV was dominant in the Western Cape. A similar proportion of isolates was resistant to clindamycin and oxacillin. As expected, no vancomycin or daptomycin non-susceptible isolates were identified. CRE numbers increased in 2017; a shift to CPE mediated by OXA-48 & variants was noticed. *Acinetobacter baumannii* susceptibility to different antibiotics classes is extremely low.

**Diarrhoeal surveillance:** rotavirus identified in 19% of 324 stool isolates (lower than pre-vaccine era) and the season was longer than in 2016 (15 weeks). The predominant G8P[4] strains identified were uncommon but have previously been detected in South Africa in 2010. The G2P[4] strains detected were more frequent in 2012-2014 but reduced to low levels in 2015 and 2016. However, no rotavirus genotype has been associated with increased severity and genotype frequency distribution simply reflects the changing and unpredictable nature of rotavirus genotype circulation globally. The limited number of specimens screened for enteric viruses as well as the limited sites surveyed makes it difficult to draw any conclusions regarding the prevalence of the other enteric viruses detected. However, decreases were noted in adenovirus detection in 2017 compared to 2016 (12% compared to 16%), in norovirus GII detection (8% compared to 10%) and in sapovirus detection (3% compared to 7%). An increase in astrovirus detection was noted in 2017 compared to 2016 (4% compared to 1%).

**HIV Drug resistance in patients initiating ART**: The data show high proportions of patients are initiating ART with resistance to NNRTI (15%), which may compromise the effectiveness of the NNRTI drug in the standardised first line regimens. Sentinel site surveillance, while not population-based and therefore not necessarily generalizable to all clinics, does provide good assessments of prevalence and trend data. In addition, prior exposure to ART recording may not be accurate, due to recall bias and absence of data in medical files. The extent to which the facilities surveyed herein are similar to facilities elsewhere and to what extent the patients enrolled are similar to those in the national program needs to be determined in order to ascertain the representivity of this data. However, surveillance through the GERMS platform allows for valuable, consistent and intensified data collection over longer periods of time.

**STI aetiological surveillance:** Overall the study found that the majority of participants enrolled with STI syndromes were young and reported high risk sexual behaviour, such as young age at sexual debut and unprotected sex at last sexual encounter. *Neisseria gonorrhoeae* was the predominant cause of male urethritis syndrome. Based on our data, syndromic management for MUS in the South African public health sector should include cover for the two leading causes, *Neisseria gonorrhoeae* and *Chlamydia trachomatis.* Bacterial vaginosis was the leading cause of VDS, and prevalent in almost 50% of females. A significant proportion of women with BV were co-infected with one or more STI pathogens. These findings suggest that BV is associated with risk factors for traditional STI infections, and that the management algorithm for VDS should be reconfigured to increase the predictive value of the algorithm for STI pathogens. Herpes simplex virus-2 remains the leading cause of pathogen-detectable GUD in Gauteng, and this supports the use of antiviral therapy in the syndromic management guidelines. HIV co-infection rates were as follows: 42.4% (61/143; 95% CI 34.5 – 50.7) in GUS; 29.7% (128/428; 95% CI 25.6 – 34.2) in VDS and 21.3% (103/482; 95% CI 17.9 – 25.2) in MUS, significantly higher than the UNAIDS 2016 estimated prevalence of 18.9% (95% CI 16.6 – 21.0) for adults aged 15-49 years. This underscores the importance of linkage to universal HIV testing and treatment for STI patients; and support the recently adopted national policy of early ARV initiation for those who are HIV-infected.

**Zoonotic diseases in acutely febrile paitents**: This study is in acute febrile adults attending one rural Mpumalanga clinic bordered by the Kruger National Park and where the populations of human, livestock, domestic animals and wildlife are in frequent contact. For 2017 laboratory tests for leptospirosis, Q fever and brucellosis and malaria PCR were done on all samples. The numbers were small for 2017, animal contacts are common, majority of patients seek health care early and antibiotic use is high. There were few positive tests (19%) on what the laboratory tested for.

***The GERMS-SA publications and effects on policy are as a result of the isolates that your participating laboratories submit and the work that you at your clinics and hospitals permit. We encourage all laboratory and clinical staff to continue participating in the NICD surveillance programmes. We thank you for your continued support of GERMS-SA and your service to the health of all South Africans.***

## Publications

Peer-reviewed GERMS-SA and GERMS-SA-related publications 2017


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