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FOREWORD

In this issue the recent incidences of Crimean-Congo haemorrhagic fever (CCHF) and tick-bite fever in South Africa are described. It is highly likely that infections in all cases were acquired from the bites of either *Hyalomma* or *Amblyomma* ticks. In general, human infection with CCHF virus is uncommon in South Africa, and incidences of both diseases are most closely associated with hunting and livestock farming.

Also in this issue is the GERMS-SA report for 2013. This report contains summaries of national surveillance data by disease including data collected from the enhanced surveillance sites that cover all nine of South Africa's provinces. The GERMS surveillance system is now in its 11th year and continues to monitor the impact of programmes, including the Expanded Programme on Immunisations and the Comprehensive Care, Management and Treatment Programme for HIV/AIDS, on the South African population. 2013 saw various changes to the GERMS surveillance platform. In particular, rifampicin -resistant TB surveillance was rolled out to four additional sites, identification of *Staphylococcus aureus* bacteraemic cases was limited to three Gauteng sites and electronic capture on mobile phones of enhanced surveillance case report forms by surveillance officers was initiated for cryptococcosis. Importantly, the total number of cases matching the GERMS definitions dropped from over 17,000 in 2012 to approximately 12,000 cases in 2013. Other notable surveillance indicators for 2013 include the decrease in cryptococcosis incidence nationally, the stabilizing of meningococcal disease incidence since 2012, the continued low prevalence of non-susceptibility of *Neisseria meningitidis* isolates to penicillin, reductions in the incidence of invasive *Haemophilus influenzae* and *Streptococcus pneumoniae* disease, and a significant decline in methicillin resistance amongst *Staphylococcus aureus* isolates.

All participating laboratories and contributors to these reports are thanked for their inputs, especially Vanessa Quan and Penny Crowther-Gibson who co-edited the GERMS-SA report.

Basil Brooke, Editor

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CRIMEAN-CONGO HAEMORRHAGIC FEVER AND TICK-BITE FEVER IN SOUTH AFRICA, 2012 - 2014

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Introduction

Crimean-Congo haemorrhagic fever (CCHF) virus (*Bunyaviridae: Nairovirus*) and *Rickettsia africae* (*Rickettsiales: Ricketsiaceae*), the aetiological agent of African tick-bite fever (TBF), are medically important, endemic tick-borne pathogens in South Africa.

Crimean-Congo haemorrhagic fever virus is typically transmitted by the so-called "bont poot" ticks, *Hyalomma rufipes* and *H. truncatum*, while TBF is transmitted by "bont ticks", *Amblyomma variegatum* and *A. hebraeum*.[1] Ticks become infected by feeding on the blood of a viraemic or rickettsaemic vertebrate animal. Infection in these tick species is chronic and spans the lifetime of the vector, and ticks appear to be both vector and reservoir for these pathogens.

Although the two pathogens should be considered in the differential diagnosis of tick-acquired fevers, they are geographically aligned to the distribution of their tick vectors. The *Hyalomma* species, and therefore CCHF virus, occur in the more arid parts of South Africa, particularly on the inland plateau. On the other hand, the *Amblyomma* species and *R. africae* tend to be associated with the subtropical region of the Lowveld, below the Drakensberg Escarpment. Exposure to CCHF virus or *R. africae* may also occur outside of the endemic regions when tick vectors have been introduced through the movement of cattle and sheep, or the translocation of wildlife. These ticks tend to be two- and three-host ticks, where the larval, nymphal and adult stages feed on different hosts. Humans tend to be targeted by the immature tick stages. However, where tick specimens associated with CCHF cases have been submitted for testing, these have usually been adult male hyalommas.

The natural cycle of CCHF virus includes transovarial, trans-stadial and non-viraemic transmission among ticks, and a tick-vertebrate-tick cycle involving a variety of wild and domestic animals. Transovarial transmission occurs through the infection of tick eggs, allowing the virus or rickettsia to be transmitted to the next generation without the necessity of blood-feeding. Trans-stadial transmission involves survival of the pathogen from larval to nymphal to adult stage ticks as each stage moults into the next. "Non-viraemic" transmission occurs between infected and uninfected ticks during co-feeding on the same host.[2]

Hyalomma ticks feed on a variety of domestic ruminants (sheep, goats, and cattle) as well as wild herbivores, hares, hedgehogs and certain rodents. Although CCHF virus infection in animals is generally subclinical, it generates viraemia levels capable of supporting virus transmission to uninfected ticks.[3] Many birds are resistant to infection, and ostriches appear to be the most susceptible of the birds.[3] Results from serological surveys conducted in Africa and Eurasia indicate extensive circulation of the virus in livestock and wild vertebrates.[4]

The natural transmission cycle of *R. africae* is less well understood, apart from the tick-human link. *Amblyomma* ticks are also ectoparasitic on a wide variety of domestic and wild mammals (both large and small) and are also more likely to parasitize ground-frequenting birds than *Hyalomma* species. Although these hosts may not serve as reservoirs for *R. africae*, they do still represent a source of tick vectors.

Rickettsia conorii is an introduced tick-borne pathogen that is typically confined to urban areas. This rickettsial organism is responsible for causing the classical Mediterranean spotted fever (fièvre boutonneuse) and is transmitted by the kennel (brown dog) tick, *Rhipicephalus sanguineus,* to dogs and humans. It is believed to have been introduced to southern Africa from North Africa and the Mediterranean Region.[5]

Epidemiology of tick-bite infections

Transmission to humans

Humans acquire CCHF virus infection from tick bites, squashing of infected ticks or from contact with infected blood or other tissues of livestock or human patients. The initial fever develops into severe disease, frequently followed by a haemorrhagic state with necrotic hepatitis resulting in a mortality rate of up to 30%.[6,7] CCHF virus transmission is rare in the general human population and transmission by ticks most frequently occurs among farmers or field workers. Human-to-human transmission and outbreaks of CCHF can also occur through close physical contact with highly viraemic people (nosocomial transmission). The risk of transmission of rickettsial infection from human and animal hosts is reduced owing to low-level rickettsaemia that only lasts for a short period, especially in human hosts. [6] The tick-to-human transmission of rickettsiae is common in areas such as the Kruger National Park, where people are exposed at a young age as a consequence of outdoor activities.

Prevalence in humans

The rates of tick-bite and CCHF infections in humans are highly influenced by the prevalence of tick vectors. *Amblyomma, Hyalomma* and *Rhipicephalus* ticks are common in livestock areas. *Amblyomma variegatum* and *A. hebraeum* feed readily on humans[8,9] and are commonly infected with *R. africae* (16%–75%) in widely separated regions of Africa.[10-12] For example, *Rickettsia* species were detected by polymerase-chain-reaction (PCR) in 12.5% (17/136) of ticks from cattle and in 3.1% (22/700) of ticks from the vegetation in a survey in Nigeria. In this study the estimated infection rate of cattle in positive herds ranged from 15.4% to 50%, with an average of 20.6%.[13] Sero-surveys conducted on humans in areas of endemicity have shown up to 100% antibody prevalence.[6, 14-16]

Serological evidence of human infection with CCHF is uncommon, despite the widespread and high prevalence of CCHF virus antibodies amongst sheep, cattle and hares throughout South Africa. A serosurveillance study conducted in the 1980s found high antibody prevalence to CCHF virus in cattle herds in the interior of the country, with over 90% in some herds, while the seroprevalence was less than 4% in cattle in the coastal region between Cape Town and East London. Only 17/1109 (1.5%) of human residents on 55 farms had antibodies to CCHF, while no veterinary staff engaged in farm animal practice were CCHF seropositive.[17] Other rural studies in South Africa revealed that human infection with CCHF virus is uncommon (12.6/1,000, 1.3%). 12.7% of young animals on farms with human cases were antibody positive compared with 5.8% on those farms with no known human cases.[18]

A more recent survey to establish the seroprevalence of CCHF virus in the North West Province was carried out on 109 extensive cattle farms in 2002. A total of 8 505 cattle sera were collected from these farms and tested by means of an IgG sandwich ELISA. All 109 farms tested positive for the presence of antibodies to CCHF virus. Individual herd antibody prevalence ranged from 31.9% to 100% of tested animals (mean=80%). No linear relationship between dipping frequency and herd prevalence could be established (unpublished data). The North West Province, South Africa, has produced eighteen laboratory confirmed human cases of CCHF since 1981, and ranks third following the Northern Cape and Free State Provinces.

CCHF and TBF cases confirmed for the period 2012-2014 in South Africa

The Centre for Emerging and Zoonotic Diseases (CEZD) of the National Institute for Communicable Diseases (NICD) functions as a national reference laboratory for the diagnosis of arboviruses and bacterial and viral haemorrhagic fevers (BHFs and VHFs), including CCHF, the most significant VHF in South Africa, and the rickettsioses, as part of the differential diagnosis of VHFs. Rickettsia tests are also provided by a number of private laboratories in the country.

The CCHF figures reported here represent the national figures available for South Africa. Twenty-one VHF cases were investigated for CCHF by CEZD during 2012. No CCHF cases were confirmed, but three cases had serological evidence of recent or current rickettsial infection. In 2013, five cases of CCHF and two cases of TBF were diagnosed out of thirty-five tick-bite disease-associated cases from South Africa. In the first half of 2014, one CCHF and five TBF cases have been confirmed out of eighteen cases investigated (figure 1).

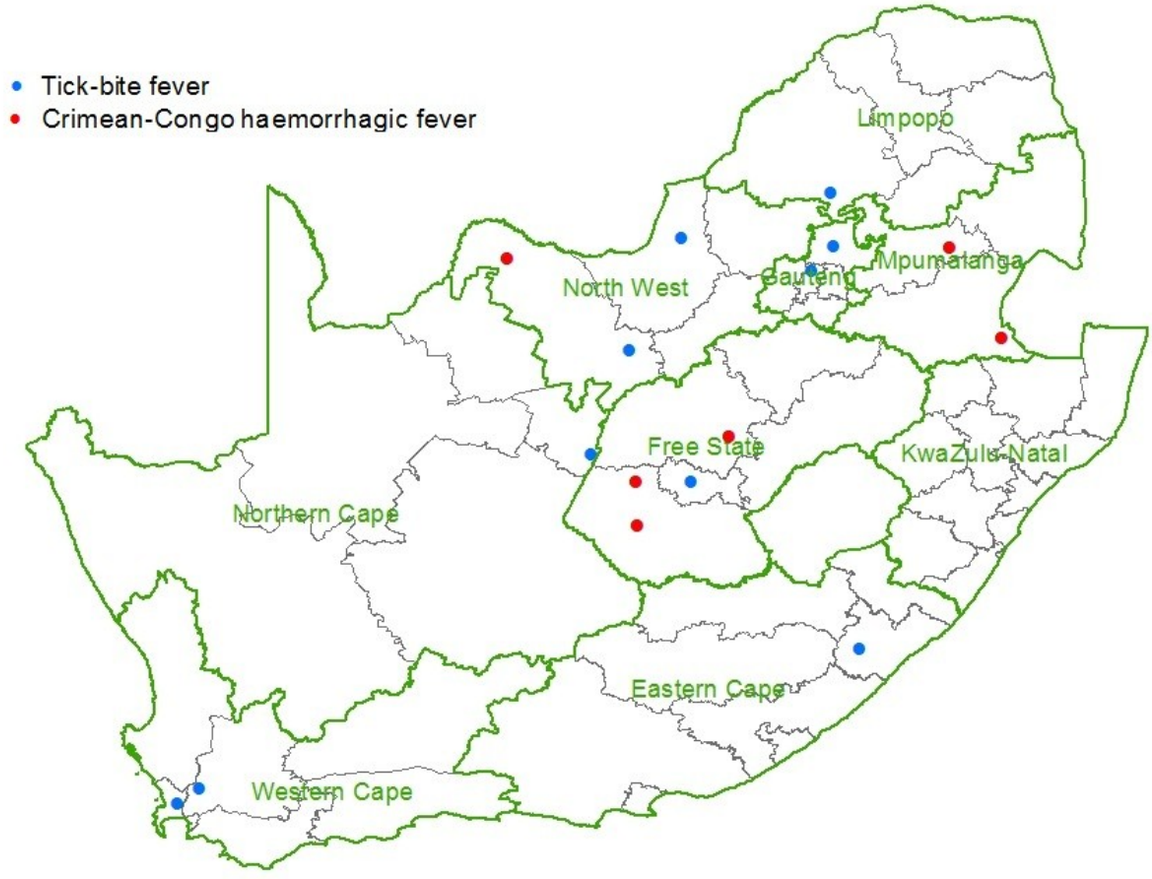

Figure 1: Geographical localities of confirmed Crimean-Congo haemorrhagic fever (CCHF) and tick-bite fever (TBF) cases in South Africa, 2012-2014.

During the 2012 to 2014 period, the six confirmed CCHF cases originated in the Free State (n=3), North-West (n=1) and Mpumalanga (n=2) Provinces. The ten TBF cases originated from seven out of nine SA provinces: Free State (n=1), North-West (n=2), Northern Cape (n=1), Eastern Cape (n=1), Western Cape (n=2), Limpopo (n=1) and Gauteng (n=2).

Table 1: Characteristics Crimean-Congo haemorrhagic fever (CCHF) or African tick-bite fever (ATBF) cases from South Africa, 2012-2014.

Variable	Patients with CCHF (N=6)	Patients with ATBF (N=10)	Patients without CCHF, ATBF (N=58)	Relative Risk for patients with 1) CCHF, 2) ATBF versus without CCHF, ATBF		
					RR (95% CI)	P-value
Mean age, years (range)	43 (36-47)	49 (23-75)	42(3-79)	1) 2)	N/A N/A	
Male	83% (5/6)	50% (5/10)	66% (38/58)	1) 2)	1.27(0.85-1.90) 0.76(0.40-1.46)	0.7 0.5
Tick bite/eschar	67% (4/6)	88% (7/8)	27% (11/41)	1) 2)	2.48(1.16-5.31) 3.26(1.85-5.76)	0.07 0.002*
Farming/Hunting	100% (6/6)	63% (5/8)	39% (16/41)	1) 2)	2.56(1.75-3.76) 1.60(0.83-3.10)	0.007* 0.3
Fatal outcome	0/6	40% (4/10)	24% (12/50)**	1) 2)	N/A 1.67(0.67-4.12)	 0.4

*RR significant at $p<0.05$ by Fisher's exact 2-tailed test.
**Low rate of follow-up for an ill patient without confirmed CCHF or TBF

Amongst the few cases where case histories were obtainable, tick bite was commonly reported for CCHF cases (67%, 4/6), as was eschar in TBF cases (88%, 7/8) (table 1). All suspected cases associated with working with animals or living on a farm tested positive for exposure to CCHF virus. Persons with CCHF infection were more likely to have farming or hunting occupations than suspected patients without laboratory confirmation of CCHF or TBF (RR: 2.56, p=0.007).

The severity and mortality rate of TBF cases varies greatly according to the tick vector and the geographic area. African tick bite fever in Sub-Saharan Africa is a relatively mild infection with a documented case fatality rate of 3%.[19] CCHF has a higher case-fatality rate (CFR) because the disease does not resolve easily and carries a greater risk of complications if not diagnosed and treated timeously.[20] In South Africa, CCHF CFR is 24% as estimated from 194 cases confirmed since 1981. Mortality is higher during nosocomial outbreaks. Patient survival is improved after an illness lasting more than 5 days. No case-fatalities were reported amongst the six CCHF cases documented for the 2012-2014 period. However, four of the TBF cases in 2014 were fatal.

Clinical diagnosis and treatment of tick-bite infections

Ticks may attach to numerous parts of the human body but are most frequently found in hidden areas around the head and neck and in the groin. Tick bites usually do not cause pain and immature stages are frequently not detected because of their small size. Tick-bite marks are difficult to find; inoculation eschars and regional lymphadenitis on medical examination of patients are usually the first indicators of exposure to CCHF or rickettsioses.[14,21] Rickettsial diseases share symptoms with a broad range of febrile illnesses including fever, myalgia and headache, and thus clinical diagnosis can be difficult. Some African tick bite fever cases present with a distinct vesicular cutaneous rash, but this is not a general feature of *R. africae* infection.[14,21] Many people who experience flu-like symptoms will not present for medical evaluation, which suggests that tick-bite fever is underreported. CCHF may be easier to diagnose

clinically, especially if a patient reaches the haemorrhagic phase. Late-phase infection manifests as a petechial or purpural rash, with extensive subcutaneous bleeding or other bleeding of the gastro-intestinal tract, uterus, urinary tract, and respiratory mucosae (table 2).

The fever preceding this phase is usually more elevated and other flulike symptoms - myalgia, dizziness, diarrhoea, vomiting, nausea and conjunctivitis - are more severe.[20] The incubation period for CCHF ranges from 3-7 days and for TBF from 6-7 days.[20, 22]

The rickettsiae are amenable to treatment with doxycycline, preferably administered as soon as symptoms (fever and sensitive, swollen lymph node/s) appear. The CCHF patient may respond to supportive clinical management and antiviral treatment with ribavirin when administered shortly after exposure to the virus.

Table 2: Clinical features reported of confirmed Crimean-Congo haemorrhagic fever (CCHF) and African Tick bite fever (ATBF) cases from South Africa, 2012-2014.

Tick bite infection symptoms	CCHF (6)	ATBF (10)	Tick bite infection symptoms	CCHF (6)	ATBF (10)
Signs Symptoms documented	**6**	**9**	**Signs Symptoms documented**	**6**	**9**
Fever	6	5	Venipuncture bleeding	1	1
Thrombocytopenia	5	6	Nausea		1
Elevated hepatic transaminases	4	4	Vomiting		1
Headache	3	5	Malaise		1
Myalgia	3	3	Arthralgia		1
Petechial rash	3		Weakness		1
Non-specified rash	2	2	Maculopapular rash		2
Haematemesis	2	1	Jaundice/hepatitis		2
Leukopenia	2	1	Encephalopathy		2
Epistaxis	1		Raised C-reactive protein		2
Gum bleeding	1		Intracranial haemorrhage		1
Conjunctivitis	1		Leucocytosis		2
Sore throat/pharyngitis	1				

Laboratory diagnosis of tick-bite infections

Serological testing remains the most commonly used diagnostic technique for rickettsial infections in Africa. The NICD performs immuno-fluorescent assays because of better sensitivity and specificity compared to the outdated Weil and Felix test. However, cross-reactions between anti-*connorii* and anti-*africae* antibodies are common. The NICD is also equipped for molecular detection and identification by polymerase chain reaction (PCR). Bio-security measures are in place to do isolation and cell culture and these remain the gold standard in the diagnosis of rickettsias. Early TBF diagnosis is often based solely on symptoms and case history. This is because laboratory confirmation in the first week of illness is challenging due to low sensitivity of both PCR and serology.

The management of CCHF cases crucially depends on rapid diagnosis and isolation of the patient. Reverse transcription polymerase chain reaction (RT-PCR) and

serological testing by either IFA or ELISA provide rapid results. Patients with fatal disease, as well as patients in the first few days of illness, do not usually develop a measurable antibody response and so diagnosis in these individuals is achieved by virus isolation or RNA detection in blood samples. Virus isolation by cell culture is the gold standard. Tests on patient samples present a high biohazard risk and are only conducted in the high biocontainment facility of the CEZD.

Conclusion

Limited epidemiological data exists on tick-borne infections in South Africa. The data presented here are therefore a retrospective analysis of suspected cases for which specimens were submitted for laboratory testing. More integrated surveillance studies should be conducted in human, animal and tick populations to identify risk factors for these diseases, so as to provide information on the proportion of people that previously have been infected with CCHF or TBF, and to indicate the range of symptomatic responses these infections can cause in disease endemic areas and in groups potentially at risk of infection.

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Introduction

The GERMS-SA 2013 Annual Report summarises the findings from national surveillance, including the 31 enhanced surveillance (ESS) hospital sites in all 9 of South Africa's provinces. Due to changes in the surveillance system - ie: not all sites were enhanced for all organisms, changeover of sites in certain provinces, addition of sites within certain provinces and rollout of rifampicin-resistant TB surveillance - this report is not easily comparable to the previous annual reports. Laboratory information systems continued to change in 2013 (from DISA*Lab to TrakCare Lab) and challenges with mapping of data onto the Corporate Data Warehouse added to the difficulties with audits. As this is a laboratory-based surveillance system, it is completely dependent on the public and private laboratories submitting isolates to the NICD for serotyping/serogrouping, antimicrobial susceptibility testing and molecular testing. The GERMS surveillance system (now in its 11th year) continues to monitor the impact of programmes, including the Expanded Programme on Immunisations and the Comprehensive Care, Management and Treatment Programme for HIV/AIDS, on the South African population.

Methods

In 2013, diseases under surveillance included:

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

The methods utilised by the GERMS-SA surveillance programme have been previously described in detail.[1]

In brief, approximately 213 South African clinical microbiology laboratories participated in the surveillance programme in 2013. The population under surveillance was estimated at 52.9 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 2011, surveillance methodology for the cryptococcal project was changed, so that only enhanced surveillance sites (ESS) (25 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. From 2012, only ESS (31 hospitals in 9 provinces) were required to directly report cryptococcosis case patients to NICD.

For other cases of cryptococcosis, data were obtained directly from the NHLS Corporate Data Warehouse (CDW), which obtains 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. From July 2010 through August 2012, 7 sentinel sites reported cases of *S. aureus* bacteraemia to GERMS-SA, and from September 2012 through 2013, laboratory-based bacteraemic *S. aureus* surveillance continued at 3 Gauteng sites only. From January 2012, 7 sentinel sites reported cases of candidaemia to GERMS-SA. At ESS, surveillance officers completed clinical case report forms for patients with nine laboratory-confirmed diseases (invasive salmonellosis, invasive shigellosis, cryptococcosis, candidaemia, invasive pneumococcal disease, invasive meningococcal disease, invasive *Haemophilus influenzae* disease, bacteraemic *S. aureus* disease [at 3

sites] and rifampicin-resistant tuberculosis [at 4 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 for the duration of the hospital admission only. 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 using the NHLS CDW for NHLS laboratories in all provinces. 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. However, an NHLS change-over from the DISA*lab to TrakCare Lab has proved difficult for auditing purposes and all case numbers may not be reflected. Incidence was calculated using mid-year population estimates for 2012 and 2013 from Statistics South Africa (table 1).[2] Incidence in the HIV-infected and AIDS populations was calculated for 2012 and 2013 using estimated population denominators from the Actuarial Society of South Africa (ASSA) 2008 model (table 1), assuming that the HIV/AIDS prevalence amongst cases with known status was similar to those with unknown status.[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 the Witwatersrand (clearance number M08-11-17) and from relevant University and Provincial Ethics Committees for other enhanced surveillance sites. Surveillance activities were funded by the NICD/NHLS, and ESS activities continued to be funded by a CDC-NICD Cooperative Agreement (5U2GPS001328).

Table 1: Population denominators used to calculate disease incidence rates for 2012 and 2013.

Province	General population*		HIV-infected population**		AIDS population**	
	2012	2013	2012	2013	2012	2013
Eastern Cape	6,586,307	**6,620,137**	736,404	**756,979**	64,849	**69,948**
Free State	2,748,506	**2,753,142**	355,466	**359,406**	36,010	**37,490**
Gauteng	12,463,886	**12,728,438**	1,222,605	**1,227,020**	132,375	**139,348**
KwaZulu-Natal	10,345,539	**10,456,907**	1,602,236	**1,628,536**	158,413	**168,173**
Limpopo	5,452,206	**5,517,968**	423,400	**436,918**	36,035	**39,672**
Mpumalanga	4,074,763	**4,127,970**	492,287	**502,186**	46,712	**49,513**
Northern Cape	1,153,090	**1,162,914**	78,711	**80,225**	7,617	**8,293**
North West	3,546,631	**3,597,589**	436,670	**441,816**	45,384	**47,342**
Western Cape	5,904,017	**6,016,926**	278,889	**283,550**	27,595	**30,323**
South Africa	**52,274,945**	**52,981,991**	5,685,424	**5,786,603**	553,253	**591,116**

Data source: *Statistics South Africa; **Actuarial Society of South Africa (ASSA 2008).

Operational Report

Site visits

In 2013, NICD staff members made 45 visits (table 2) to participating laboratories and hospitals to offer feedback on GERMS-SA surveillance data as well as to obtain buy-in from surrounding clinics to do rifampicin-resistant TB surveillance. These visits were used to improve participation in the surveillance programme. Additional visits to surveillance officers (SOs) for training and audits were made throughout the year (not included in table).

Coordination of meetings

Surveillance officer (SO) meeting, 7-8 March 2013: This meeting, convened at the Genesis Suites and Conferencing in Johannesburg, was attended by all surveillance officers from 9 provinces. The meeting focused on feedback from the project leads, challenges that the SOs experienced on the ground and the introduction of future projects.

Surveillance officer meeting, 29-30 August 2013: This meeting was convened in Johannesburg and the main focus was to re-train the SOs on the surveillance system and the surveillance organisms. The majority of talks were done by the SOs themselves which gave them an opportunity to research their selected organism, make a presentation and present it in a meeting forum. It was also an opportunity to train the SOs on the updated case report forms (CRFs) as well as to update them on ethics.

Surveillance officer meeting, 2-3 December 2013: This subsequent meeting was held in Johannesburg to further train the SOs on the new projects and to deal with problems they encountered on the CRFs.

Principal Investigator (PI) meeting, 13-14 November 2013: Convened at the NICD, this meeting was attended by over 50 local, national and international delegates, including representatives from the Department of Health and Centers for Disease Control and Prevention. Plans for the expanded GERMS-SA platform were discussed, bringing on board the following clinic surveillance activities: Integrated TB/HIV surveillance (including drug resistance), STI surveillance and zoonosis surveillance. Current surveillance and research activities were reviewed including presentations from the enhanced surveillance sites.

Surveillance audit

Of the 11,380 surveillance cases on the GERMS-SA database (excluding rifampicin-resistant TB cases), 1,397 (12%) were detected by audit of the NHLS CDW (table 3). This percentage is not a true reflection of audit cases because isolates of cryptococcosis are no longer requested from non-enhanced sites and case numbers are obtained from the Corporate Data Warehouse. If the *Cryptococcus* sp. cases are excluded, 14% (1,261/9,171) of the total GERMS-SA cases were true audit cases (not reported to the NICD by the clinical microbiology laboratories). 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

Surveillance organisms and sites changed in 2013 making this report less comparable to those of previous years. Table 4 includes the new *Cryptococcus* antigen surveillance roll-out sites, the change of the North West province site from Rustenburg to Klerksdorp/ Tshepong, and rifampicin-resistant TB cases. The proportion of completed CRFs was similar to that in 2012: 85%

(4,617/5,441) of cases had a case report form completed (target = 90%). The addition of pathogens that cause more severe illness (candidaemia and *S. aureus*) made patient follow-up more difficult (tables 4 and 5): The interview rate has continued to improve over the years [3,515 (76%) of the CRFs were completed by patient interview (target = 60%)]. 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 2013, these reports were provided quarterly.

Enhanced surveillance site quality monitoring

In 2013, surveillance officers (SO) 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 5 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 of omission and the overlooking of information rather than entry of incorrect data. In future, this process will be done at least twice per year.

Table 2: GERMS-SA surveillance site visits between 1 January and 31 December, 2013.

Date	Province	Laboratory (NHLS or Private)	Hospital/ Clinic
14-15 February	EC	NHLS Mthatha & SOs	Surrounding clinics
4 March	GA	NHLS Chris Hani Baragwanath & SOs	-
12 March	NC	NHLS Kimberley & SO	Kimberley Hospital & surrounding clinics
14 March	MP	NHLS Rob Ferreira & SO	Rob Ferreira Hospital & surrounding clinics
25 March	GA	NHLS Chris Hani Baragwanath & SOs	-
12 April	GA	NHLS Tambo Memorial	Tambo Memorial Hospital
17 April	GA	NHLS Charlotte Maxeke Johannesburg	Charlotte Maxeke Johannesburg Academic Hospital
17 April	GA	NHLS Helen Joseph	Helen Joseph Hospital
06 May	KZ	NHLS Stanger	-
06 May	KZ	NHLS Eshowe	-
06 May	KZ	NHLS Ngwelezane	-
07 May	KZ	NHLS Prince Mshiyeni	-
07 May	KZ	NHLS Mahatma Gandhi	-
08 May	KZ	NHLS Northdale	-
08 May	KZ	NHLS Inkosi Albert Luthuli	-
09 May	KZ	NHLS Ladysmith	-
09 May	KZ	NHLS Madadeni	-
10 May	KZ	NHLS Port Shepstone	-
21 May	GA	-	Chris Hani Baragwanath Hospital & Soweto clinics
10 June	NW	NHLS Klerksdorp / Tshepong	Klerksdorp / Tshepong Hospital & surrounding clinics
20 June	LP	NHLS Mankweng	Mankweng Hospital
20 June	LP	NHLS Polokwane	Polokwane Hospital & surrounding clinics
04 July	NW	NHLS Tshepong	Tshepong Hospital
22 July	FS	NHLS Welkom	-
23 July	FS	NHLS Kroonstad	Kroonstad Hospital
23 July	GA	NHLS Sebokeng	Sebokeng Hospital
24 July	FS	NHLS Universitas	Universitas Hospital
25 July	NC	NHLS Kimberley	Kimberley Hospital
05 August	GA	NHLS Dr George Mukhari	-
07 August	GA	NHLS Charlotte Maxeke Johannesburg	-
22 August	WC	Ampath	-
04 September	KZ	NHLS Ngwelezane	Ngwelezane Hospital & surrounding clinics
09 September	WC	NHLS Karl Bremer	-
12 September	WC	NHLS Groote Schuur	Groote Schuur Hospital
27 September	GA	-	Steve Biko Pretoria Academic Hospital
30 September	LP	NHLS Mankweng	Mankweng Hospital
22 October	EC	NHLS Zithulele	Zithulele Hospital
30 October	MP	NHLS Mapulaneng	Mapulaneng Hospital
30 October	MP	-	Matikwane Hospital
30 October	MP	-	Hluvukani Clinic
30 October	GA	-	Alexander Clinic
20 November	KZ	NHLS King Edward VIII & SOs	King Edward VIII Hospital
21 November	KZ	NHLS RK Khan & SOs	RK Khan Hospital
21 November	KZ	NHLS Addington & SOs	Addington Hospital
28 November	NW	NHLS Rustenburg	-

SOs = Surveillance Officers;
Provinces: EC = Eastern Cape, GA = Gauteng, NC = Northern Cape, MP = Mpumalanga, KZ = KwaZulu-Natal, NW = North West, LP = Limpopo, FS = Free State, WC = Western Cape.

Table 3: Invasive and non-invasive disease cases detected by surveillance audit by province, 2013.

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	Typhoid**	1/54 (2%)	0	0	1	0	0	0	0	0	0	**1**
	Non-typhoidal salmonellosis†	82/697 (12%)	7	4	33	25	0	11	0	1	1	**82**
	Shigellosis	12/45 (27%)	0	1	4	3	1	1	0	0	2	**12**
	Cryptococcosis†††	136/2209 (6%)	18	3	71	5	2	17	1	12	7	**136**
	Candidaemia	18/547 (3%)	N/A	N/A	15	N/A	N/A	N/A	N/A	N/A	3	**18**
	Meningococcal disease	28/233 (12%)	2	5	7	13	0	0	0	1	0	**28**
	Haemophilus influenzae disease	86/333 (26%)	7	9	29	18	0	8	1	1	13	**86**
	Pneumococcal disease	580/2866 (20%)	65	63	137	170	7	50	9	56	23	**580**
	Staphylococcus aureus disease (BC only)	33/378 (9%)	N/A	N/A	33	N/A	N/A	N/A	N/A	N/A	N/A	**33**
Non-invasive	*Salmonella* Typhi**	1/10 (10%)	0	0	0	1	0	0	0	0	0	**1**
	Non-typhoidal salmonellosis†	239/2298 (10%)	26	14	62	70	4	22	9	9	23	**239**
	Shigellosis	181/1709 (11%)	7	9	31	54	9	8	6	11	46	**181**
	Cholera††	0/1 (0%)	0	0	0	0	0	0	0	0	0	**0**
Total		**1397/11380 (12%)**	**132**	**108**	**423**	**359**	**23**	**117**	**26**	**91**	**118**	**1397**

*Percentage of cases detected by audit = number of cases detected on audit (n_1)/total number of cases detected by GERMS-SA (n_2) x 100;
**Only *Salmonella enterica* serotype Typhi; †Including *Salmonella enterica* serotype Paratyphi;
††Only *Vibrio cholerae* O1;
†††Only for enhanced surveillance sites that reported cases and submitted isolates;
Provinces: 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.

Table 4: Enhanced surveillance site performance indicators by hospital, 2013.

Enhanced surveillance site*	Case patients, n	Completed case report forms**, n (%)***	Case report forms completed by interview, n (%)†
Addington [5]	162	151 (93)	109 (72)
Bertha Gxowa [3]	6	2 (33)	2 (100)
Charlotte Maxeke Johannesburg Academic [1,2,5]	669	626 (94)	530 (85)
Chris Hani Baragwanath [1,4,5]	1,190	1016 (85)	649 (64)
Dr George Mukhari [5]	283	218 (77)	189 (87)
Donald Gordon Medical Centre [1]	11	4 (36)	4 (100)
Edendale/ Greys/ Northdale [5,6]	339	330 (97)	294 (89)
Groote Schuur/ Red Cross/ Victoria [1,5,6]	330	295 (89)	227 (77)
Helen Joseph/ Rahima Moosa Mother & Child [1,2,5]	318	281 (88)	231 (82)
Kalafong [5]	6	6 (100)	6 (100)
Kimberley [4,5]	168	139 (83)	103 (74)
King Edward VIII [5]	143	82 (57)	62 (76)
Klerksdorp/ Tshepong [4,5,8]	188	132 (70)	93 (70)
Mankweng/ Polokwane/ Seshego [4,5]	100	67 (67)	61 (91)
Natalspruit [3,5]	58	53 (91)	22 (42)
Nelson Mandela Academic Complex [4,5]	260	189 (73)	125 (66)
Pelonomi/ Universitas [5]	113	86 (76)	67 (78)
Pholosong [3]	11	9 (82)	5 (56)
RK Khan [5]	177	157 (89)	141 (90)
Rob Ferreira/ Themba [4,5]	361	276 (76)	204 (74)
Rustenburg [5,7]	26	20 (77)	14 (70)
Steve Biko Pretoria Academic/ Tshwane District [1,2,5]	294	264 (90)	226 (86)
Tambo Memorial [3]	52	47 (90)	32 (68)
Tygerberg [1,5]	176	167 (95)	119 (71)
TOTAL	**5,441**	**4,617 (85)**	**3,515 (76)**

Note - The percentage (in parentheses) in each cell was calculated using the numerator from that cell and the corresponding denominator from the cell to the left; For *Salmonella* and *Shigella*, only invasive isolates are included;
*There were 6 surveillance officers at Chris Hani Baragwanath and 3.5 at Charlotte Maxeke Johannesburg Academic, 1.5 at Helen Joseph/Rahima Moosa Mother and Child Hospital, 3 at Groote Schuur/Red Cross/Victoria, 2 at Tygerberg, 1.5 at Dr George Mukhari, Steve Biko Academic Hospital and Edendale/Greys; one surveillance officer was present at all other sites;
**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 only cryptococcal surveillance; [4]Sites doing rifampicin-resistant TB surveillance (Chris Hani Baragwanath for all of 2013, Nelson Mandela Academic Complex from 1 March 2013, Kimberley and Rob Ferreira/ Themba from 1 April 2013, Mankweng/ Polokwane/ Seshego and Klerksdorp/ Tshepong from 1 July 2013); [5]IPD case-control study sites; [6]Greys and Victoria were only enhanced for the first quarter of 2013; [7]Rustenburg was only enhanced until 30 April 2013; [8]Klerksdorp only became enhanced on 1 July 2013.

SURVEILLANCE REPORTS

ENHANCED SURVEILLANCE SITE PROJECT

In 2013, of 12,055 surveillance case patients detected by GERMS-SA, 5,484 (45%) were diagnosed at enhanced surveillance sites. Of case patients with recorded HIV status, 74% (2,967/4,012) 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 (97%) and rifampicin-resistant TB (86%) were HIV-infected. HIV infection amongst patients with invasive pneumococcal disease and non-typhoidal salmonellosis, for which HIV is a known risk factor, were 62% and 60%, respectively, and less than one quarter (17%) of patients with invasive meningococcal disease were HIV-infected.

Table 5: Numbers and percentages* of patients, diagnosed with laboratory-confirmed invasive disease at GERMS-SA enhanced surveillance sites, with confirmed HIV-1 infection**, South Africa, 2013.

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	2,209	1,920	(87)	1,805	(94)	1,758	(97)
Candida species	547	484	(88)	326	(67)	77	(24)
Neisseria meningitidis	65	58	(89)	48	(83)	8	(17)
Streptococcus pneumoniae	1,067	952	(89)	822	(86)	507	(62)
Haemophilus influenzae	157	135	(86)	106	(79)	47	(44)
Salmonella species	364	302	(83)	262	(87)	156	(60)
Shigella species	22	13	(59)	10	(77)	6	(60)
Staphylococcus aureus	378	342	(90)	233	(68)	64	(27)
Rifampicin-resistant TB†	675	417	(62)	400	(96)	344	(86)
Total	**5,484**	**4,623**	**(84)**	**4,012**	**(87)**	**2,967**	**(74)**

*The percentage (in parentheses) 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.
† Includes 43 additional cases identified prior to the official start of TB surveillance at sites.

SALMONELLA ENTERICA SEROTYPE TYPHI AND S. *ENTERICA* SEROTYPES PARATYPHI A, PARATYPHI B AND PARATYPHI C

Results

Salmonella Typhi isolates from both invasive and non-invasive sites are reported in table 6. Cases of enteric fever were highest in January, although there was an unusual peak in July (figure 1). The number of isolates within each age group is reported in table 7, indicating that most isolates were from patients in the 5-34 year age group, although infection was seen in both older

and younger age groups, including younger children (less than five years). Ciprofloxacin resistance remained a problem, but azithromycin resistance was not recorded (table 8), following EUCAST guidelines.[4] One isolate each of *Salmonella* Paratyphi A, Paratyphi B var Java and Paratyphi C were identified from Gauteng, and one each of *Salmonella* Paratyphi B var Java and Paratyphi B (non-Java variant) from the Eastern Cape. The two *Salmonella* Paratyphi B var Java were isolated from an abscess in an adult (Eastern Cape) and a stool culture from a 25 day old infant (Gauteng). The non-Java *Salmonella* Paratyphi B was isolated from the stool of a 5 month old infant. The *Salmonella* Paratyphi A was isolated from the blood culture of a 4 month old child and the *Salmonella* Paratyphi C from a tissue specimen in an adult. All the *Salmonella* Paratyphi isolates were susceptible to first and second line antibiotics.

Discussion

Salmonella Typhi isolates from both invasive and non-invasive sites were included in these analyses, as both add to burden of infection in South Africa and thus represent a public health risk, although data may not reflect actual burden of disease. This is compounded by the challenges of alternative diagnostic methods for typhoid fever, including both clinical and serological. These data thus exclude those patients in whom alternative methods were used, without culture confirmation. Strict seasonality was not observed, although a greater number of cases were seen between January and April, with numbers rising in July and again in December. The greater numbers reported from Gauteng and the Western Cape may reflect healthcare-seeking behavior. The number of reported *Salmonella* Typhi isolates was regarded as an underestimate and thus incidence rates were not calculated. EUCAST guidelines for *Salmonella* Typhi provide break points for azithromycin, which is an alternative treatment option, as ciprofloxacin resistance emerges.[4] Ceftriaxone may also be used as an alternative therapy in these cases. All isolates tested were fully susceptible to ceftriaxone.

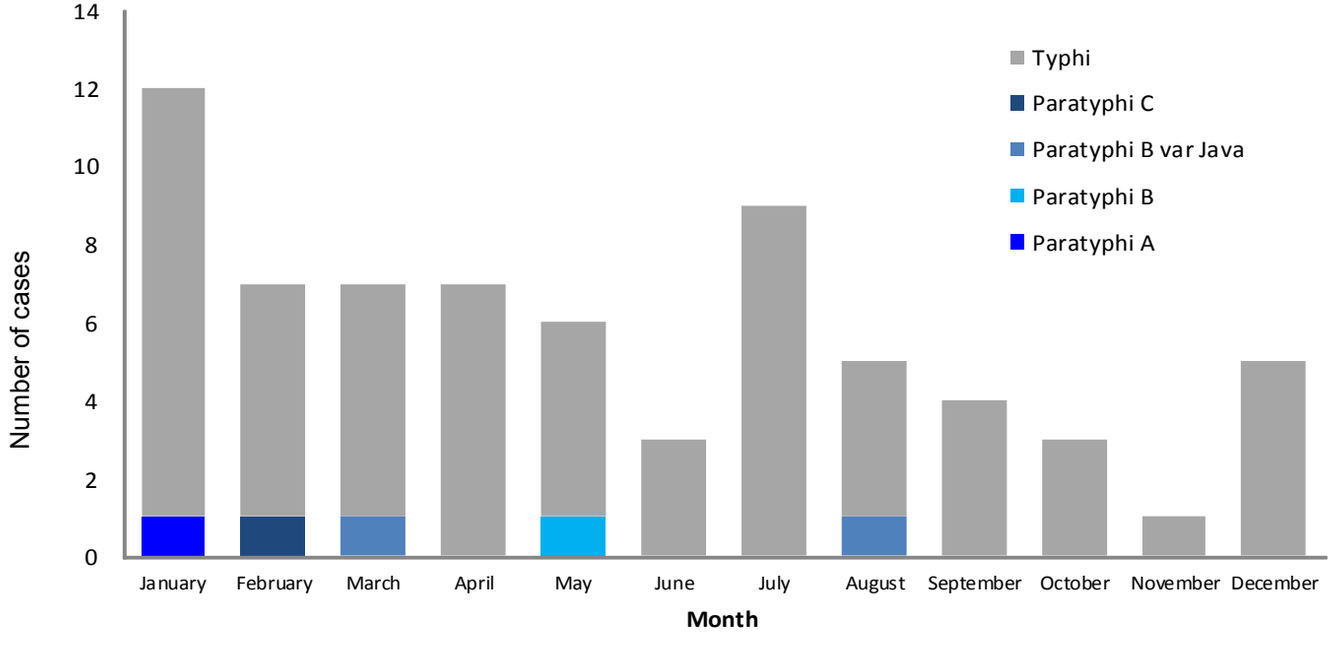


Figure 1: Numbers of non-invasive and invasive cases of *Salmonella* Typhi (n=64) and Paratyphi (n=5) reported to GERMS-SA by month of specimen collection, South Africa, 2013 (including audit reports).

Table 6: Numbers of invasive and non-invasive *Salmonella* Typhi cases reported to GERMS-SA by province, South Africa, 2013. n=64 (including audit reports, missing isolates, mixed and contaminated cultures).

Province	Non-invasive *Salmonella* Typhi	Invasive *Salmonella* Typhi
Eastern Cape	0	1
Free State	0	2
Gauteng	1	23
KwaZulu-Natal	5	6
Limpopo	0	0
Mpumalanga	3	8
Northern Cape	0	0
North West	0	1
Western Cape	1	13
South Africa	**10**	**54**

Table 7: Numbers of *Salmonella* Typhi isolates reported to GERMS-SA by age category, South Africa, 2013. n=64 (including audit reports, missing isolates, mixed and contaminated cultures).

Age category (years)	*Salmonella* Typhi isolates
0 - 4	10
5 - 14	16
15 - 24	8
25 - 34	14
35 - 44	6
45 - 54	2
55 - 64	0
≥ 65	0
Unknown	8
Total	**64**

Table 8: Antimicrobial susceptibility test results for all *Salmonella* Typhi isolates received by GERMS-SA, South Africa, 2013. n=60 (excluding audit reports, missing isolates, mixed and contaminated cultures). Clinically relevant antimicrobials are listed.[4]

Antimicrobial agent	Susceptible (%)		Resistant (%)	
Ampicillin	38	(63)	22	(37)
Chloramphenicol	37	(62)	23	(38)
Ciprofloxacin	54	(90)	6	(10)
Imipenem	60	(100)	0	(0)
Ceftriaxone	60	(100)	0	(0)
Azithromycin	60	(100)	0	(0)

NON-TYPHOIDAL *SALMONELLA ENTERICA* (NTS)

Results

Invasive disease did not appear to have a seasonal prevalence. Increased numbers of non-invasive disease due to NTS in the earlier months of the year and in October through December reflect seasonality. A lower incidence was observed in the winter months (figure 2). The numbers of cases of invasive and non-invasive disease by province, reported to GERMS-SA, are given in table 9. The numbers of cases of invasive and non-invasive disease, by age group, are shown in table 10. Most invasive isolates were identified from blood cultures (20.8%), although isolates were frequently identified from both blood culture and another site, including stool and other normally-sterile sites (table 11). Resistance to first-line antimicrobial agents and the fluoroquinolones was noted (table 12), as was Extended-Spectrum Beta-lactamase production (ESBL): 88/2,607 (3.4%) of all NTS.[4] *Salmonella Enteritidis* was the commonest NTS isolated (table 13). Most of these isolates were from stool specimens (data not shown).

Discussion

Non-typhoidal salmonellosis may be a food-borne disease, for which data are poorly captured in South Africa, and where the patients normally present with gastroenteritis, or may be an AIDS-defining illness, in which case the organism frequently becomes invasive. Seasonal prevalence was noted in 2013 for non-invasive disease. Incidence rates have only been calculated for invasive NTS, due to differences in stool-taking practices in adult and paediatric medical care and between different medical facilities. Antimicrobial resistance remains a cause for concern in invasive and non-invasive cases, although as case numbers of invasive disease decreased, the prevalence of ESBL production decreased. *Salmonella Enteritidis* has replaced *Salmonella Typhimurium* as the commonest serotype, as noted in 2011 and 2012.[5,6]

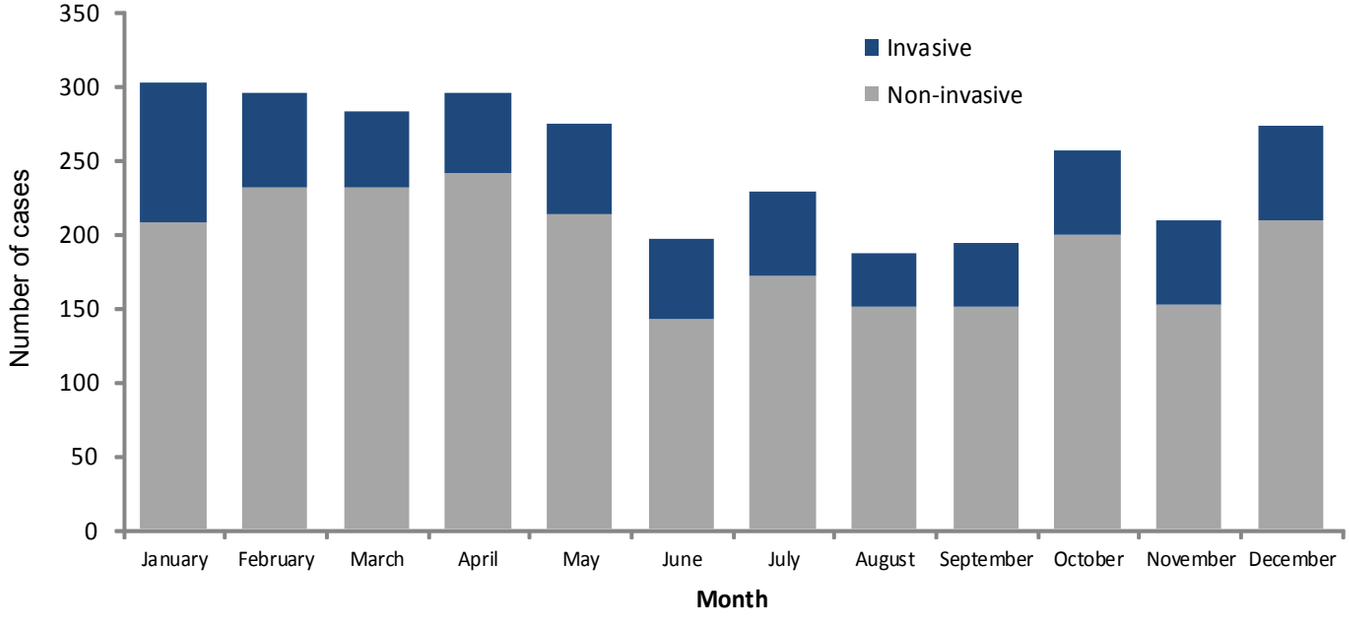


Figure 2: Numbers of non-invasive (n=2,298) and invasive (n=697), non-typhoidal *Salmonella* (NTS) cases, reported to GERMS-SA by month of specimen collection, South Africa, 2013 (including audit reports).

Table 9: Numbers* of invasive and non-invasive non-typhoidal *Salmonella* cases reported to GERMS-SA by province, South Africa, 2013. n=2,995 (including audit reports, missing isolates, mixed and contaminated cultures).

Province	Non-invasive, non-typhoidal *Salmonella* isolates	Invasive, non-typhoidal *Salmonella* isolates
Eastern Cape	198	44
Free State	72	19
Gauteng	992	315
KwaZulu-Natal	305	121
Limpopo	18	7
Mpumalanga	128	42
Northern Cape	15	5
North West	58	6
Western Cape	512	138
South Africa	**2,298**	**697**

*Incidence rates were not calculated as there may have been regional differences in specimen collection practices.

Table 10: Numbers of cases and incidence rates for invasive and non-invasive* non-typhoidal *Salmonella* reported to GERMS-SA by age category, South Africa, 2013. n=2,995 (including audit reports, missing isolates, mixed and contaminated cultures).

Age Category (years)	Cases		Incidence rate for invasive disease**
	Non-invasive	Invasive	
0 - 4	860	160	3.0
5 - 14	221	16	0.2
15 - 24	140	38	0.4
25 - 34	209	128	1.4
35 - 44	266	131	1.8
45 - 54	197	82	1.7
55 - 64	136	51	1.6
≥ 65	143	40	1.5
Unknown	126	51	-
Total	**2,298**	**697**	**1.3**

*Incidence rates for non-invasive non-typhoidal *Salmonella* were not calculated because specimens may not have been submitted for culture from all patients with gastroenteritis due to non-typhoidal *Salmonella* in clinical practice;
**Incidence rates are expressed as cases per 100,000 population.

Table 11: Numbers of non-typhoidal *Salmonella* cases reported to GERMS-SA by primary anatomical site of isolation*, South Africa, 2013. n=3,000 (including audit reports, missing, mixed and contaminated cultures).

Specimen	n	%
CSF	14	0.5
Blood culture	623	20.8
Stool	2,014	67.2
Other	344	11.5
Total	**2,995**	**100**

*Certain 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.

Table 12: Antimicrobial susceptibility test results for all non-typhoidal *Salmonella* isolates received by GERMS-SA, South Africa, 2013. n=2,607 (excluding audit reports, missing isolates, mixed and contaminated cultures). Clinically relevant antimicrobials for non-invasive and invasive strains are listed.[4]

Antimicrobial agent	Susceptible (%)		Resistant (%)	
Ampicillin	2,371	(90.9)	236	(9.1)
Trimethoprim- Sulphamethoxazole	2,377	(91.2)	230	(8.8)
Chloramphenicol	2,402	(92.1)	205	(7.9)
Ciprofloxacin	2,491	(95.6)	116	(4.4)
Imipenem	2,607	(100.0)	0	(0.0)
Ceftriaxone	2,519	(96.6)	88	(3.4)

Table 13: Commonest invasive and non-invasive non-typhoidal *Salmonella* serotypes reported to GERMS-SA by province, South Africa, 2013. n=1,890 (excluding audit reports, missing isolates, mixed and contaminated cultures).

Province	Serotype				
	Diarizonae	Enteritidis	Heidelberg	Infantis	Typhimurium
Eastern Cape	2	45	4	0	85
Free State	3	20	0	1	31
Gauteng	34	594	24	24	193
KwaZulu-Natal	15	115	4	7	66
Limpopo	2	7	0	0	2
Mpumalanga	1	68	3	3	23
Northern Cape	1	0	0	0	4
North West	1	15	3	1	18
Western Cape	6	333	11	14	107
South Africa	**65**	**1,197**	**49**	**50**	**529**

SHIGELLA SPECIES

Results

Slightly increased numbers from January through March and October through December 2013, suggest seasonality (figure 3). The primary burden of disease due to *Shigella* was non-invasive dysentery or diarrhoea (table 14). The predominant burden of disease, including both invasive and non-invasive shigellosis, was in the under-five-year age group (table 15). Quinolone resistance remained low, but fluoroquinolone resistance appeared to be emerging (table 16). ESBL-production is rarely documented, but remains important. Four (0.28%) of 1433 *Shigella* isolates were ESBL-producers.[4] All were isolated from stool cultures. Predominant serotypes confirm that *Shigella flexneri* 2a remains the commonest cause of shigellosis in South Africa (table 17). *Shigella dysenteriae* type 1 was not isolated in 2013 (data not shown).

Discussion

Shigella infection is associated with water-borne outbreaks in South Africa, although person-to-person transmission plays an important role. Invasive disease appears to be decreasing.[5-7] Resistance to fluoroquinolones remains low, but should be continually monitored. ESBL-production is rarely documented. *Shigella dysenteriae* type 1 isolates were not reported and appear to be rare as there were no isolates in South Africa in 2013 or in preceding years.[5,6]

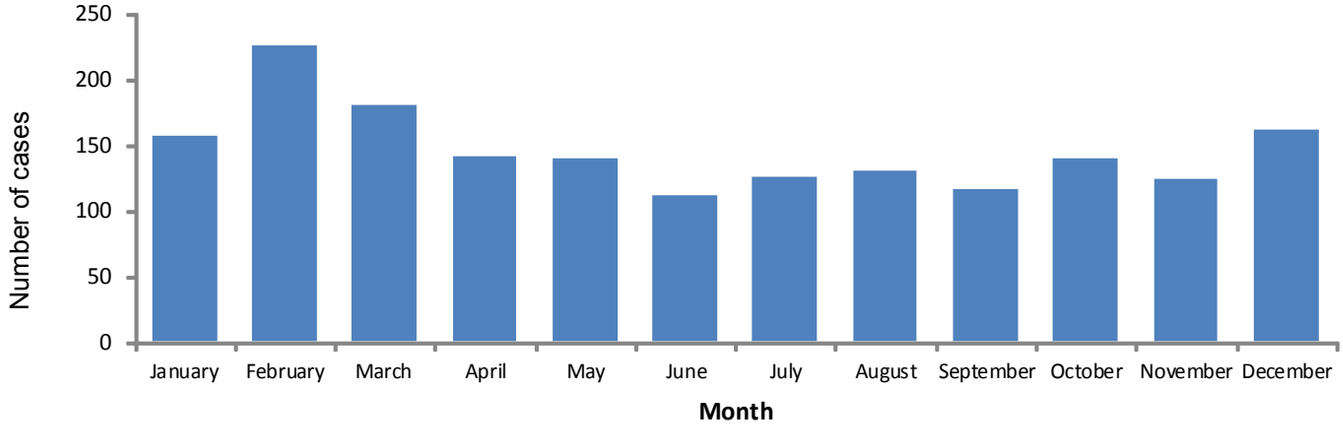


Figure 3: Numbers of non-invasive and invasive *Shigella* isolates, reported to GERMS-SA by month of specimen collection, South Africa, 2013. n=1,754 (including audit reports).

Table 14: Numbers of invasive and non-invasive *Shigella* isolates reported to GERMS-SA by province, South Africa, 2013. n=1,754 (including audit reports, missing isolates, mixed and contaminated cultures).

Province	Non-invasive *Shigella*	Invasive *Shigella*
Eastern Cape	259	2
Free State	87	1
Gauteng	664	14
KwaZulu-Natal	280	9
Limpopo	13	1
Mpumalanga	60	4
Northern Cape	16	0
North West	29	1
Western Cape	301	13
South Africa	**1,709**	**45**

Table 15: Numbers of cases and incidence rates for invasive and non-invasive* *Shigella* reported to GERMS-SA by age category, South Africa, 2013. n=1,754 (including audit reports, missing isolates, mixed and contaminated cultures).

Age Category (years)	Cases		Incidence rate for invasive disease**
	Non-invasive	Invasive	
0 - 4	845	24	0.45
5 - 14	240	4	0.04
15 - 24	61	1	0.01
25 - 34	148	6	0.07
35 - 44	120	6	0.08
45 - 54	67	0	0.00
55 - 64	62	2	0.06
≥ 65	73	1	0.04
Unknown	93	1	-
Total	**1,709**	**45**	**0.08**

*Incidence rates for non-invasive non-typhoidal *Shigella* were not calculated because specimens may not have been submitted for culture from all patients with gastroenteritis in clinical practice; **Incidence rates are expressed as cases per 100,000 population.

Table 16: Antimicrobial susceptibility test results for *Shigella* isolates received by GERMS-SA, South Africa, 2013. n=1,529 (excluding audit reports, missing isolates, mixed and contaminated cultures). Clinically relevant antimicrobials for non-invasive and invasive strains are reported.[4]

Antimicrobial agent	Susceptible (%)	Resistant (%)
Ampicillin	890 (58.2)	639 (41.8)
Trimethoprim-Sulphamethoxazole	371 (24.3)	1,158 (75.7)
Chloramphenicol	1,043 (68.2)	486 (31.8)
Ciprofloxacin	1,527 (99.9)	2 (0.1)
Imipenem	1,529 (100.0)	0 (0.0)
Ceftriaxone	1,523 (99.6)	6 (0.4)

Table 17: Commonest invasive and non-invasive *Shigella* serotypes reported to GERMS-SA by province, South Africa, 2013. n=1,370 (excluding audit reports, missing isolates, mixed and contaminated cultures).

Province	*S. flexneri type 1b*	*S. flexneri type 2a*	*S. flexneri type 3a*	*S. flexneri type 6*	*S. sonnei*
Eastern Cape	35	85	22	31	52
Free State	2	28	14	6	19
Gauteng	14	164	74	85	239
KwaZulu-Natal	12	75	30	22	52
Limpopo	1	0	1	1	2
Mpumalanga	2	16	8	4	17
Northern Cape	0	7	0	1	4
North West	1	4	4	1	5
Western Cape	25	108	29	34	34
South Africa	**92**	**487**	**182**	**185**	**424**

DIARRHOEAGENIC *ESCHERICHIA COLI* (DEC)

Results

Decreased numbers of cases were observed in July and August, with the highest numbers of cases being observed in February through May, and November and December 2013 (figure 4). Enteropathogenic *Escherichia coli* (EPEC) remained the commonest cause of diarrhoea in South Africa (table 18). Most cases were identified in children less than 5 years of age (table 19).

Discussion

Despite the low numbers of isolates received, there is a suggestion of seasonality, with a predominance of disease occurring in summer. The predominance of cases in younger children under five years of age may reflect, in part, specimen-taking practices, as well as the burden of diarrhoeal disease in this age group. Incidence rates were not calculated as numbers were likely not fully representative. Actual burden of disease due to diarrhoeagenic *E. coli* is probably greatly

underestimated in South Africa, as management is primarily syndromic and centres on rehydration. As a result, clinicians are unlikely to prioritise stool-taking in uncomplicated cases of diarrhoea. Disease in the past appears to have been primarily associated with water-borne outbreaks, due to high levels of faecal contamination in water sources, and this trend appears to be continuing. Identification of EHEC/STEC was primarily incidental, as there are currently no useful biochemical markers in sorbitol-positive isolates.[8]

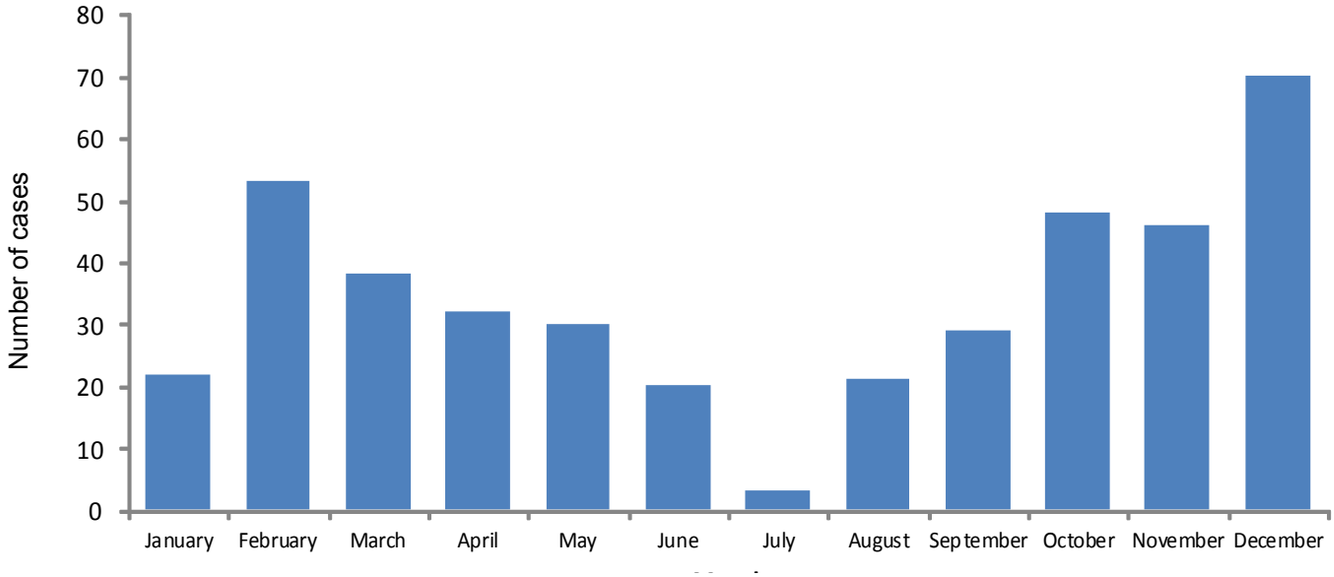


Figure 4: Numbers of diarrhoeagenic *Escherichia coli* isolates, reported to GERMS-SA by month of specimen collection, South Africa, 2013. n=342.

Table 18. Numbers of diarrhoeagenic *Escherichia coli* isolates reported to GERMS-SA by province, South Africa, 2013. n=342.

Province	DAEC	EAggEC	EHEC/ STEC	EIEC	EPEC	ETEC	Mixed pathotype*
Eastern Cape	3	1	0	0	6	0	0
Free State	0	0	0	0	7	0	1
Gauteng	11	10	6	2	211	1	1
Kwazulu-Natal	0	1	6	0	9	1	0
Limpopo	0	0	0	0	0	0	0
Mpumalanga	19	4	2	1	26	4	1
Northern Cape	0	1	0	0	0	0	0
North West	1	0	0	0	8	0	0
Western Cape	0	0	0	0	2	0	0
South Africa	**34**	**17**	**10**	**3**	**269**	**6**	**3**

DAEC = diffusely-adherent *E. coli*; EAggEC = enteroaggregative *E. coli*; STEC/EHEC = Shiga-toxigenic *E. coli* or enterohaemorrhagic *E. coli*; EIEC = enteroinvasive *E. coli*; EPEC = enteropathogenic *E. coli*; ETEC = enterotoxigenic *E. coli.*
*Mixed pathotype: virulence genes from more than one pathotype detected

Table 19. Numbers of diarrhoeagenic *Escherichia coli* isolates reported to GERMS-SA by age category, South Africa, 2013. n=342.

Age category (years)	DAEC	EAggEC	EHEC/ STEC	EIEC	EPEC	ETEC	Mixed pathotype*
0 - 4	21	14	9	1	259	6	3
5 - 14	2	0	0	1	1	0	0
15 - 24	0	0	0	0	0	0	0
25 - 34	2	0	0	0	3	0	0
35 - 44	2	0	0	1	2	0	0
45 - 54	3	0	0	0	2	0	0
55 - 64	0	1	0	0	0	0	0
≥ 65	1	0	0	0	0	0	0
Unknown	3	2	1	0	2	0	0
Total	34	17	10	3	269	6	3

DAEC = diffusely-adherent *E. coli*; EAggEC = enteroaggregative *E. coli*; STEC/EHEC = Shiga-toxigenic *E. coli* or enterohaemorrhagic *E. coli*; EIEC = enteroinvasive *E. coli*; EPEC = enteropathogenic *E. coli*; ETEC = enterotoxigenic *E. coli.*
*Mixed pathotype: virulence genes from more than one pathotype detected

VIBRIO CHOLERAE O1

Results

A single case of *Vibrio cholerae* O1 El Tor Inaba from an adult male was reported in Limpopo province in March 2013 (data not shown).

Discussion

This case was probably imported (acquired outside of South Africa). The lack of outbreaks of cholera in 2013 supports the importance of heightened awareness and a rapid response in the event of disease being identified.

CRYPTOCOCCUS SPECIES

Results

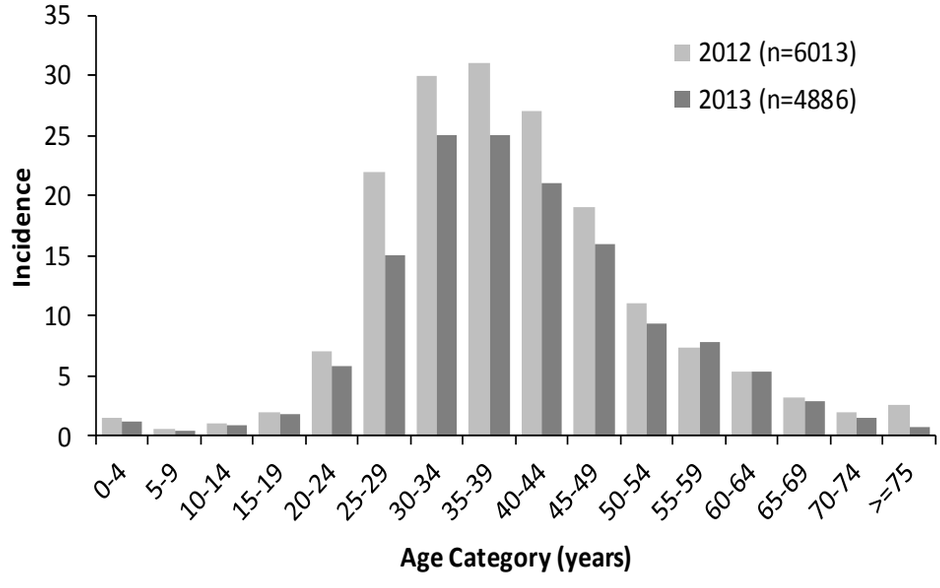
During 2013, 6,273 case patients with laboratory-confirmed, incident cryptococcal disease were reported. The incidence of cryptococcal disease in the HIV-infected population decreased in all provinces except Mpumalanga where the incidence remained stable, and in Gauteng and Western Cape provinces where the incidence increased (table 20). When cases of antigenaemia (with no laboratory evidence of meningitis or fungaemia) were excluded, the incidence still increased from 157 to 163 cases per 100,000 HIV-infected persons in Gauteng and from 198 to 209 cases per 100,000 HIV-infected persons in the Western Cape. The highest incidence was recorded among patients aged 35-39 years (figure 5). One hundred and twenty three children younger than 15 years had laboratory-confirmed cryptococcosis of which 59 (48%) were younger than 5 years of age. Where gender was known, 56% (3,456/6,181) of patients were male. Most patients (88%) were diagnosed with meningitis (laboratory tests on cerebrospinal fluid positive for *Cryptococcus* species), and 11% were diagnosed with fungaemia/ antigenaemia (table 21). Sixty four patients were diagnosed by culture of urine, sputum, pleural fluid

and other specimen types. Viable isolates were received from 1,320 patients diagnosed at enhanced surveillance sites. Isolates were speciated from all these cases: 1,237 (93%) were identified as *Cryptococcus neoformans* and 83 (6%) were identified as *C. gattii*. Cases of *C. gattii* disease were diagnosed in all provinces except the Northern Cape. Among 1,342 patients who had a test result recorded close to the time of diagnosis, 1,198 (90%) had a $CD4_+$ T-lymphocyte (CD4) count <200 cells/µl. The median CD4 count was 45 cells/µl (range, 1 – 2,488). Just under half of patients with known antiretroviral treatment (ART) status (901/1,988; 45%) were currently on ART at the time of diagnosis of cryptococcal disease or had previously received ART. The in-hospital case-fatality ratio for patients at enhanced surveillance sites did not change significantly between 2012 and 2013 [531/1,646 (32%) vs. 673/1,985 (34%); p=0.3].

Discussion

The burden of laboratory-confirmed cryptococcal disease decreased in 2013 with an overall incidence of 108 cases per 100,000 HIV-infected persons. Since 2012, the GERMS-SA programme has undertaken audits of public-sector laboratories nationally. The incidence increased in Gauteng and the Western Cape. Since the case numbers included patients with cryptococcal antigenaemia diagnosed at NHLS microbiology laboratories (i.e. through provider-initiated screening of cryptococcal disease), this may reflect improved case detection in these two provinces.[9] Given the large proportion of patients who were on concurrent ART or had previously received ART, more cases may have been diagnosed among ART-experienced persons who had discontinued or failed ART.[10] Although age-specific incidence was under-estimated for both years of surveillance and especially for 2013 where age data were unavailable for many cases detected by audit, the peak incidence still occurred in the 35-39 year age category. Most patients continued to be diagnosed with meningitis. The demographic profile of patients with cryptococcosis remained largely unchanged. As expected, *C. neoformans* was the dominant pathogen causing disease and a small number of patients who were infected with *C. gattii* were diagnosed across the country. The in-hospital case-fatality ratio remained high and unchanged.

Figure 5: Incidence* of laboratory-confirmed cryptococcal disease reported to GERMS-SA by age category, South Africa, 2012 and 2013. n=10,899 (age unknown for 795 cases in 2012 and 1,387 cases in 2013).



*Incidence was calculated using population denominators from Statistics South Africa and has been expressed as cases per 100,000 persons in the general population; Note: due to the large number of cases with unknown age in 2013, incidence is under-estimated.

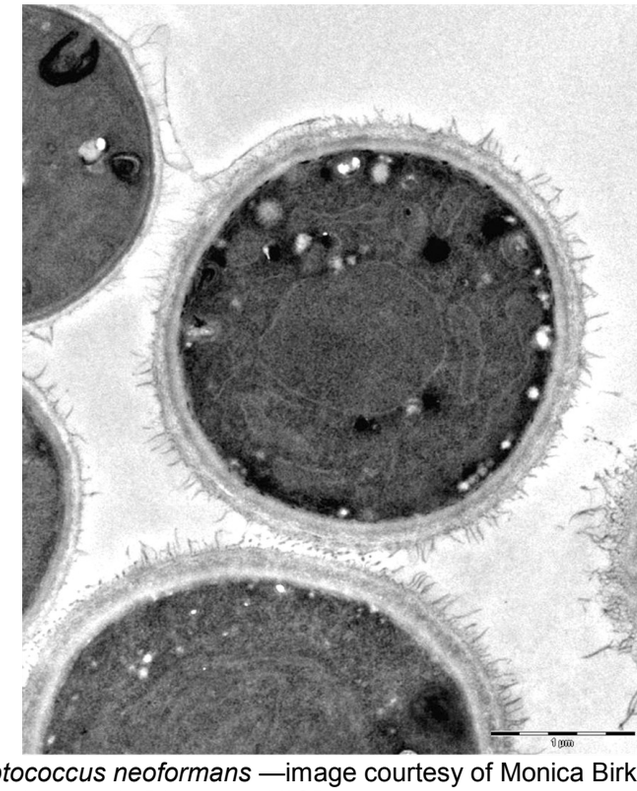
Table 20: Numbers of cases and incidence of cryptococcal disease detected by GERMS-SA by province, South Africa, 2012 and 2013. n=13,081.

Province	2012		2013	
	n*	Incidence**	n*	Incidence**
Eastern Cape	1,109	151	720	95
Free State	315	89	249	69
Gauteng	1,973	161	2,130	174
KwaZulu-Natal	1,905	119	1,706	105
Limpopo	176	42	156	36
Mpumalanga	364	74	372	74
Northern Cape	68	86	54	67
North West	307	70	261	59
Western Cape	591	212	625	220
South Africa	**6,808**	**120**	**6,273**	**108**

*These case numbers include patients who had blood specimens submitted to an NHLS microbiology laboratory for screening of cryptococcal disease and who tested positive for cryptococcal antigenaemia.
**Incidence was calculated using HIV-infected population denominators determined by the Actuarial Society of South Africa model and are expressed as cases per 100,000 population.

Table 21: Numbers and percentages of cryptococcal disease cases reported to GERMS-SA by specimen type, South Africa, 2012 and 2013. n=13,081.

Site of specimen	2012		2013	
	n	(%)	n	(%)
Cerebrospinal fluid	6,090	(89)	5,489	(88)
Blood	622	(9)	720	(11)
Other	96	(2)	64	(1)
Total	**6,808**		**6,273**	



Spores of *Cryptococcus neoformans* —image courtesy of Monica Birkhead, Centre for Emerging and Zoonotic Diseases, NICD

CANDIDA SPECIES

Results

In 2013, 547 cases of candidaemia were detected from nine sentinel hospitals (table 22). The vast majority of cases occurred among children aged 0-4 years and 160 (30%) of all cases occurred among neonates (≤28 days of age) (figure 6). Where gender was known, 53% (286/537) of patients were male. Clinical data were collected for 484 (88%) patients. The overall crude case-fatality ratio remained high (189/454; 42%). Although HIV infection is not an independent risk factor for candidaemia, 23% (77/325) of patients with candidaemia were also HIV-infected. At least one viable isolate was available for 455 (83%) cases of candidaemia. Overall, *Candida albicans* was the most common species followed by *C. parapsilosis* and *C. glabrata*. The species distribution differed between the Gauteng and Western Cape Provinces (table 23). All *Candida* isolates had an amphotericin B minimum inhibitory concentration (MIC) ≤ 1 µg/ml (apart from three *C. krusei* isolates). Susceptibility results for five common *Candida* species and three antifungal agents are summarised in table 24; anidulafungin MICs are presented as a proxy for susceptibility to the echinocandin class. In Gauteng and the Western Cape, the percentage of *C. parapsilosis* isolates that were susceptible to fluconazole ((42/152 (28%) vs. 12/14 (86%); p<0.001)) and voriconazole ((57/152 (38%) vs. 14/14 (100%); p<0.001)) differed significantly between provinces.

Discussion

The clinical epidemiology of culture-confirmed candidaemia diagnosed at eight public-sector hospitals and 1 private-sector hospital in Gauteng and the Western Cape was largely unchanged in 2013. Overall, most cases of candidaemia were diagnosed among young children, predominantly neonates, and almost half of patients died in hospital. The epidemiology of candidaemia remained different between Gauteng and the Western Cape. In Gauteng, *C. albicans* and *C. parapsilosis* were equally commonly detected whereas *C. albicans* and *C. glabrata* were the two commonest species in the Western Cape. Knowledge of local hospital or hospital unit epidemiology should still guide empiric treatment choices. In Gauteng, conventional amphotericin B remains the empiric drug of choice for candidaemia in the public-sector because of the high prevalence of azole-resistant *C. parapsilosis* isolates. In the Western Cape, high-dose fluconazole or amphotericin B are both reasonable choices for empiric treatment in the public-sector. Caspofungin is also a good choice for empiric treatment in all settings where this agent is available.

Table 22: Numbers of candidaemia cases detected by GERMS-SA by enhanced surveillance site, Gauteng and Western Cape Provinces, South Africa, 2012-2013. n=1,074.

Enhanced surveillance site	2012	2013
Charlotte Maxeke Johannesburg Academic	112	116
Chris Hani Baragwanath	216	231
Groote Schuur	39	53
Helen Joseph/ Rahima Moosa	27	34
WITS Donald Gordon Medical Centre	7	11
Red Cross	18	7
Steve Biko Pretoria Academic	64	53
Tygerberg	43	41
Victoria	1	1
Total	**527**	**547**

Table 23: *Candida* species distribution for cases of candidaemia with a viable bloodstream isolate, Gauteng and Western Cape Provinces, South Africa, 2013. n=455.

Species	Gauteng N (%)	Western Cape N (%)	Overall N (%)
Candida albicans	138 (38)	44 (48)	182 (40)
Candida parapsilosis	152 (42)	14 (15)	166 (36)
Candida glabrata	40 (11)	20 (22)	60 (13)
Candida tropicalis	8 (2)	5 (6)	13 (3)
Candida krusei	10 (3)	2 (2)	12 (3)
Other *Candida* species	16 (4)	6 (7)	22 (5)
Total	**364**	**91**	**455**

Table 24: Numbers and percentages of *Candida* bloodstream isolates (five commonest species only) susceptible* to fluconazole, voriconazole and anidulafungin by broth microdilution testing, Gauteng and Western Cape Provinces, South Africa, 2013. n=433.

Susceptible to Antifungal agent	*C. albicans* n/N (%)	*C. parapsilosis* n/N (%)	*C. glabrata* n/N (%)	*C. tropicalis* n/N (%)	*C. krusei* n/N (%)
Fluconazole	180†/182 (99)	54†/166 (33)	N/A**	12/13 (92)	N/A
Voriconazole	181†/182 (99)	71†/166 (43)	N/A	11/13 (85)	12/12 (100)
Anidulafungin	182/182 (100)	166/166 (100)	60/60 (100)	13/13 (100)	12/12 (100)

*Based on CLSI M27-S4 (2013) species-specific breakpoints for full susceptibility; **Only 5 isolates with MICs ≥64 µg/ml (resistant category); †Isolates with MICs in the resistant category confirmed by Etest.

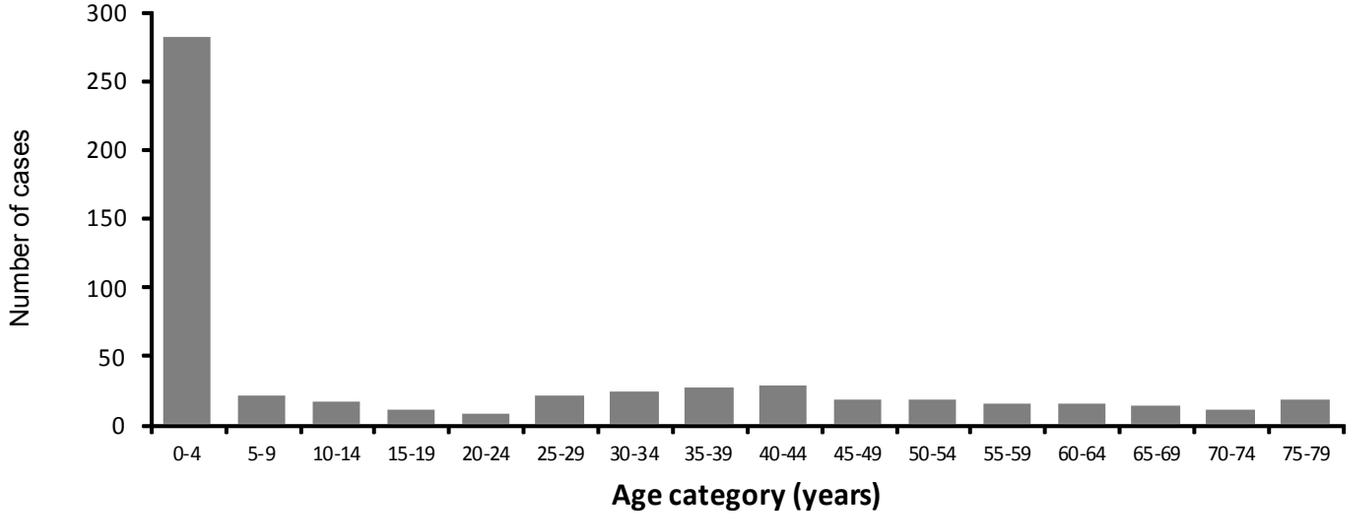


Figure 6: Numbers of cases of laboratory-confirmed candidaemia reported to GERMS-SA by age category, Gauteng and Western Cape Provinces, 2013. n=538 (age unknown for 9 cases).

NEISSERIA MENINGITIDIS

Results

In 2013, 205 cases of meningococcal disease were reported, and an additional 28 cases were identified on audit, giving a total of 233 cases of laboratory-confirmed meningococcal disease identified by the surveillance system during the year (table 25). Overall incidence remained stable from 2012 (0.44 cases per 100,000 population in both years). The number of cases reported was greatest during the winter and spring months (figure 7). Of all cases reported, cerebrospinal fluid (CSF) was the most common specimen yielding meningococci (table 26), and the number of cases diagnosed on blood culture remained similar in 2013 compared to 2012 (p=0.7). Serogroup W was the most predominant in South Africa (97/190, 51%) (table 27), similar to the proportion in 2012 (72/176, 41%; p=0.07). Minor year-on-year fluctuations of disease by province were noted. Rates of disease were highest in the Western and Eastern Cape Provinces (table 25). In Gauteng, the incidence of meningococcal disease was estimated at 0.55/100,000, and most of that disease was due to serogroup W (34/55, 62%). In the Western Cape, serogroup B was the most common meningococcal serogroup (21/48, 44%). Risk of disease was greatest amongst children less than five years of age. Age and serogroup-specific incidence rates show that infants were at greatest risk of disease for the three most common serogroups (figure 8). Preliminary analysis of case-fatality ratios, as calculated at enhanced surveillance sites where in-hospital outcome is specifically recorded, was 8/56 (14%) in 2013, compared to 8/79 (10%) in 2012 (p=0.6). Of the viable isolates tested for antimicrobial resistance, 6% (7/116) of isolates had penicillin minimum inhibitory concentrations (MICs) >0.06µg/ml, and would be considered non-susceptible.

Discussion

Incidence of disease has stabilised since 2012. Serogroup W disease remained the predominant serogroup. Changes in meningococcal disease incidence in provinces may reflect changes in ability to confirm disease in the laboratory and changes in reporting to the surveillance network, or may reflect true changes in incidence. Case-fatality ratios have remained similar compared to previous years. The prevalence of non-susceptibility to penicillin remained low in 2013. The clinical relevance of increased MICs is unclear, and penicillin is, at present, still being recommended as the drug of choice for therapy for confirmed meningococcal disease.

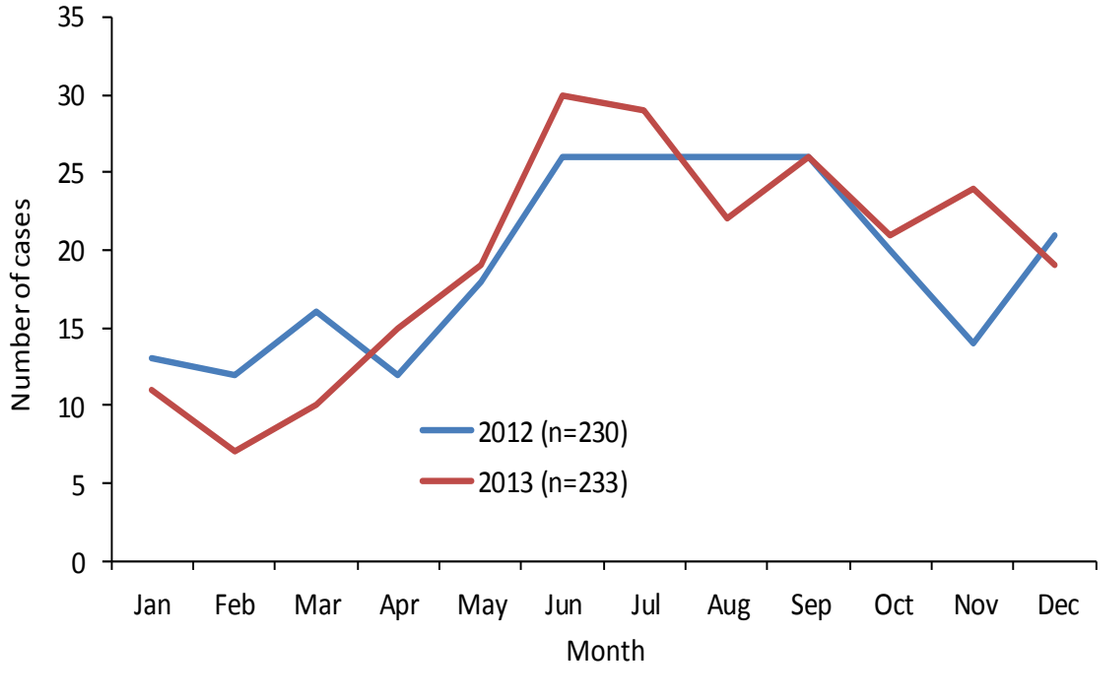
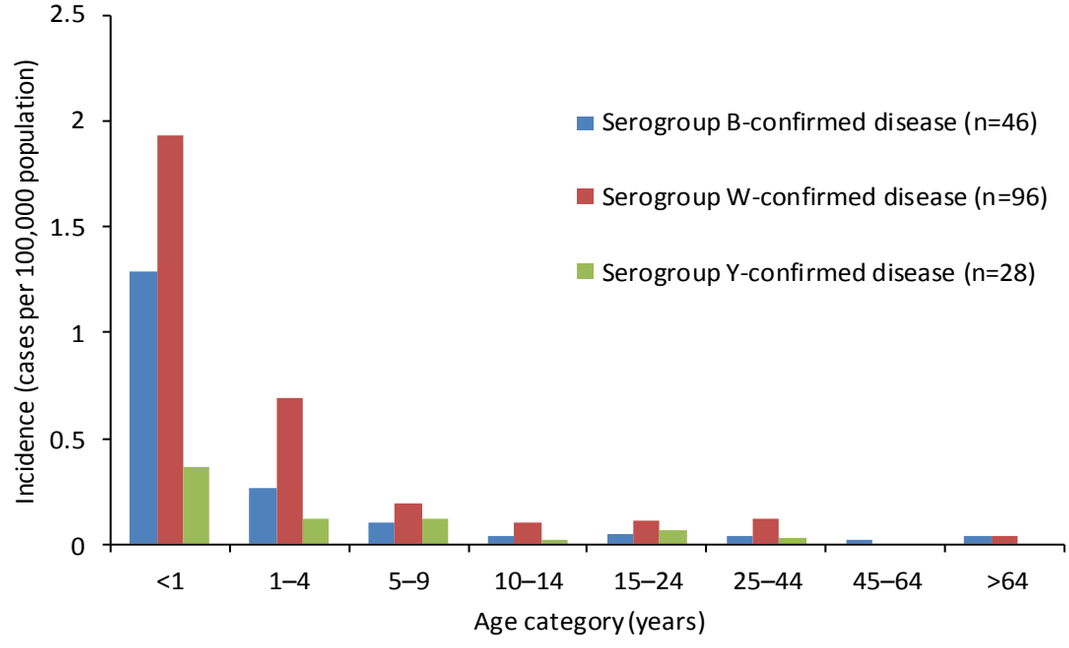


Figure 7: Numbers of laboratory-confirmed, invasive meningococcal cases, reported to GERMS-SA by month and year, South Africa, 2012-2013. n=463.

Figure 8: Age-specific incidence rates* for laboratory-confirmed, invasive meningococcal cases by serogroup B, W and Y**, South Africa, 2013. n=186 (age unknown for n=6; specimens or viable isolates unavailable for serogrouping n=41).



*Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population. **Other serogroups: serogroup C, n=14; non-groupable, n=2.

Table 25: Numbers of cases and incidence rates of meningococcal disease reported to GERMS-SA by province, South Africa, 2012 and 2013. n=463 (including audit cases).

Province	2012		2013	
	n	Incidence rate*	n	Incidence rate*
Eastern Cape	49	0.74	47	0.71
Free State	12	0.44	14	0.51
Gauteng	77	0.62	69	0.55
KwaZulu-Natal	26	0.25	39	0.38
Limpopo	3	0.06	1	0.02
Mpumalanga	6	0.15	4	0.10
Northern Cape	2	0.17	2	0.17
North West	8	0.23	7	0.20
Western Cape	47	0.80	50	0.85
South Africa	**230**	**0.44**	**233**	**0.44**

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

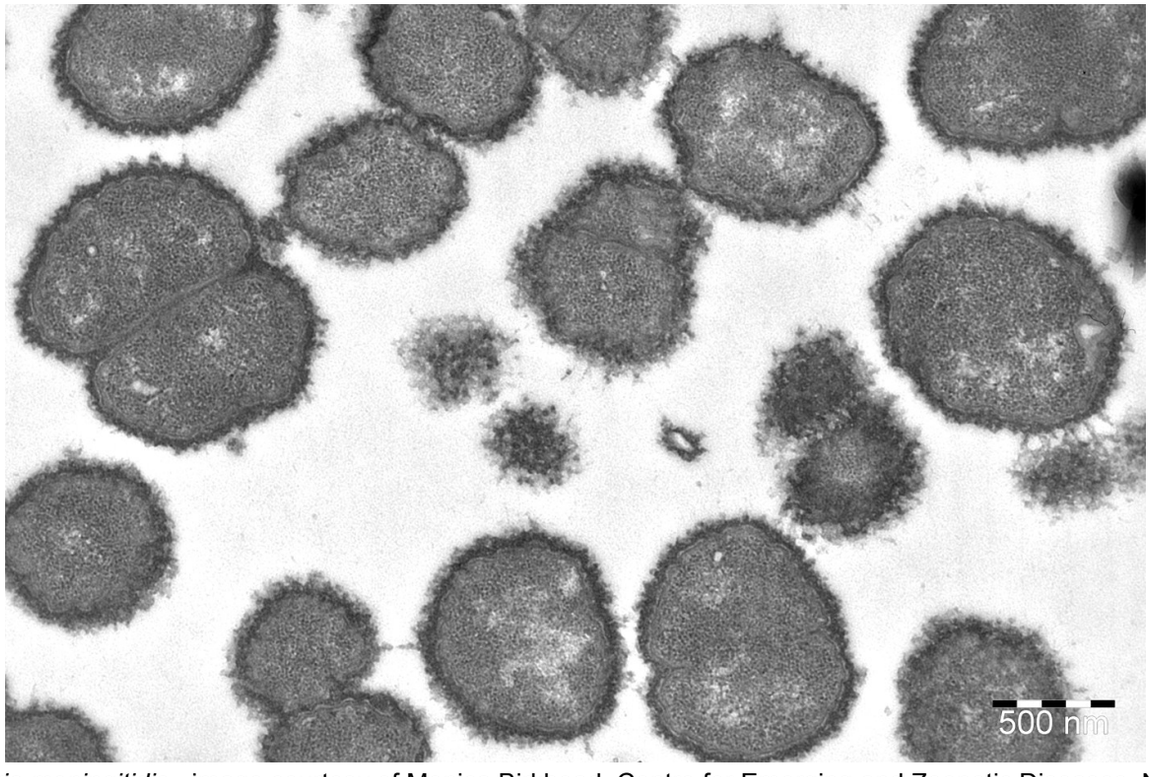
Table 26: Numbers and percentages of cases of meningococcal disease reported to GERMS-SA by specimen type, South Africa, 2012 and 2013. n=463.

Site of specimen	2012		2013	
	n	(%)	n	(%)
CSF	162	(70)	167	(72)
Blood	67	(29)	63	(27)
Other	1	(0.4)	3	(1.3)
Total	**230**		**233**	

Table 27: Numbers of invasive meningococcal disease cases reported to GERMS-SA by serogroup and province, South Africa, 2013. n=233*.

Province	Serogroup							
	Serogroup not available	A	B	C	W	Y	NG**	Total
Eastern Cape	2	0	7	3	27	8	0	47
Free State	6	0	4	0	2	1	1	14
Gauteng	14	0	8	7	34	5	1	69
KwaZulu-Natal	16	0	2	3	13	5	0	39
Limpopo	0	0	0	0	1	0	0	1
Mpumalanga	1	0	1	0	2	0	0	4
Northern Cape	0	0	1	0	1	0	0	2
North West	2	0	3	0	1	1	0	7
Western Cape	2	0	21	2	16	9	0	50
South Africa	**43**	**0**	**47**	**15**	**97**	**29**	**2**	**233**

*190 (82%) with viable isolates or specimens available for serogrouping;
** NG: Non-groupable



Neisseria meningitidis - image courtesy of Monica Birkhead, Centre for Emerging and Zoonotic Diseases, NICD

HAEMOPHILUS INFLUENZAE

Results

The number of cases of *Haemophilus influenzae* invasive disease reported in 2013 was 247, while an additional 86 cases were identified during the national audit (total number of cases available for analysis was 333). Of these, 222 (67%) had isolates or specimens available for serotyping, and 57/222 (26%) were confirmed as serotype b (table 28). Serotype b isolates were more likely to be isolated from CSF than non-typeable *H. influenzae* (33/57, 58% vs. 7/131, 5%, p<0.001) (table 29). In 2013, a total of 30 cases of *H. influenzae* serotype b (Hib) were reported amongst children <5 years (figure 9). Serotype b is no longer the commonest serotype of *H. influenzae* causing disease amongst infants (figure 10). Rates of Hib disease among infants <1 year of age have decreased since 2010 (p<0.001, chi-squared test for trend) (figure 11). Eighteen percent (7/39) of serotype b strains were non-susceptible to ampicillin (MIC>1mg/L, all but one producing beta lactamase), while 14% (14/97) of non-typeable strains were non-susceptible (p=0.8).

Discussion

Since the introduction of the Hib conjugate vaccine into the Expanded Programme on Immunisation (EPI) for South Africa in 1999, there has been a reduction in cases reported due to this serotype.[11] Recognising that the surveillance system underestimates disease, reported cases of Hib disease amongst children <1 year are being carefully monitored. In April 2009, the updated infant vaccination programme in South Africa introduced a booster dose of conjugate Hib vaccine given at 18 months as part of a combination vaccine (Pentaxim: diphtheria-tetanus-acellular pertussis-inactivated poliovirus-*Haemophilus influenzae* type-b conjugate). The first children benefiting from this would have received a dose in November 2010. Rates of Hib in children <1 year and 1-4 years have decreased in the

last 3 years, while non-typeable disease in the same age groups has fluctuated. The booster dose may have improved long-term protection against disease and impacted on ongoing Hib transmission in the community.[12] Other reasons for reductions in disease may be related to interventions such as improved prevention and treatment of HIV in infants, or changes in diagnosis and reporting of cases. More data are needed to evaluate the relative contributions of these factors. Clinical and laboratory staff are urged to continue reporting all cases of *H. influenzae*.

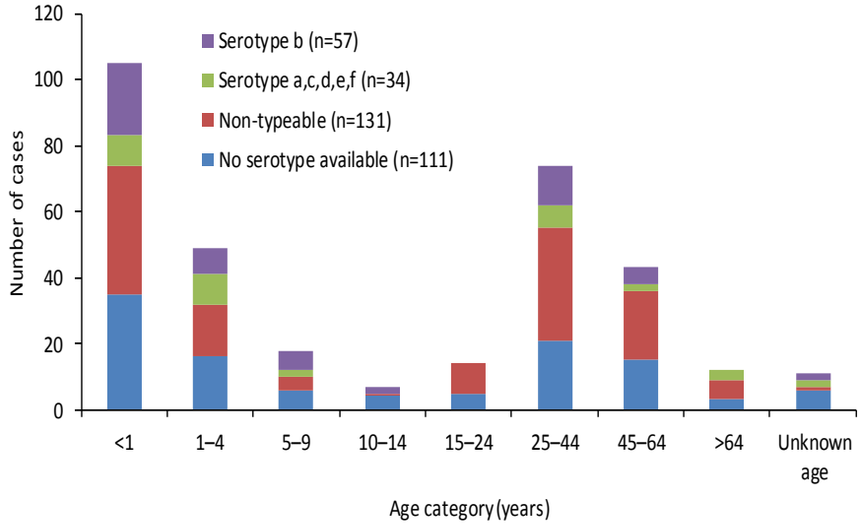
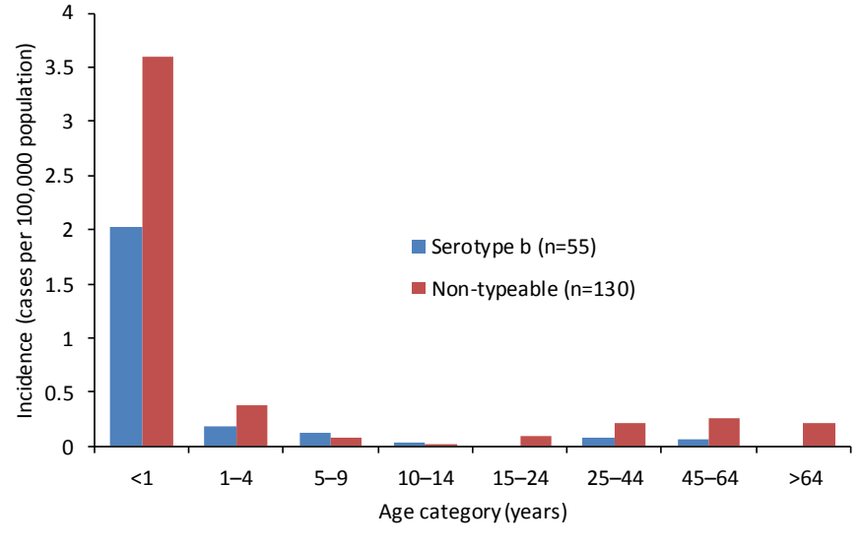


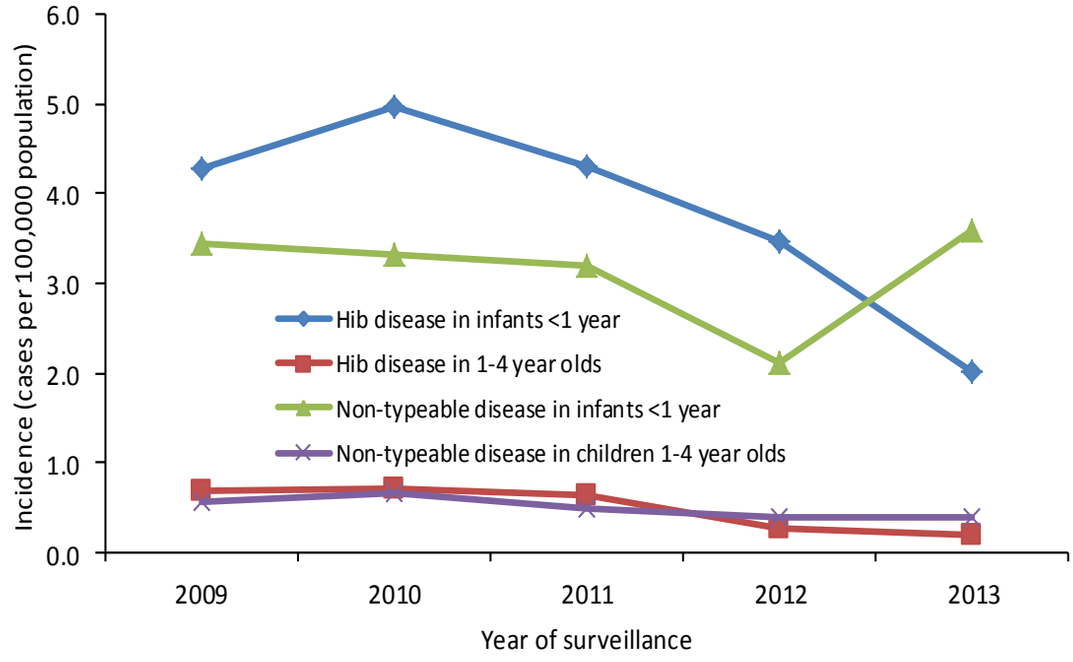
Figure 9: Numbers of laboratory-confirmed, invasive *Haemophilus influenzae* cases reported to GERMS-SA by serotype and age group, South Africa, 2013. n=333 (age unknown for n=11; specimens or viable isolates unavailable for serotyping for n=111).

Figure 10: Age-specific incidence rates* for laboratory-confirmed, invasive *Haemophilus influenzae* disease reported to GERMS-SA by serotype b and non-typeable, South Africa, 2013. n=333 (age unknown, n=11; viable isolates unavailable for serotyping, n=111; other serotypes from cases with known age, n=34).



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

Figure 11: Incidence rates* of laboratory-confirmed *Haemophilus influenzae* serotype b (Hib) and non-typeable disease reported to GERMS-SA in children <5 years old, South Africa, 2009-2013.



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

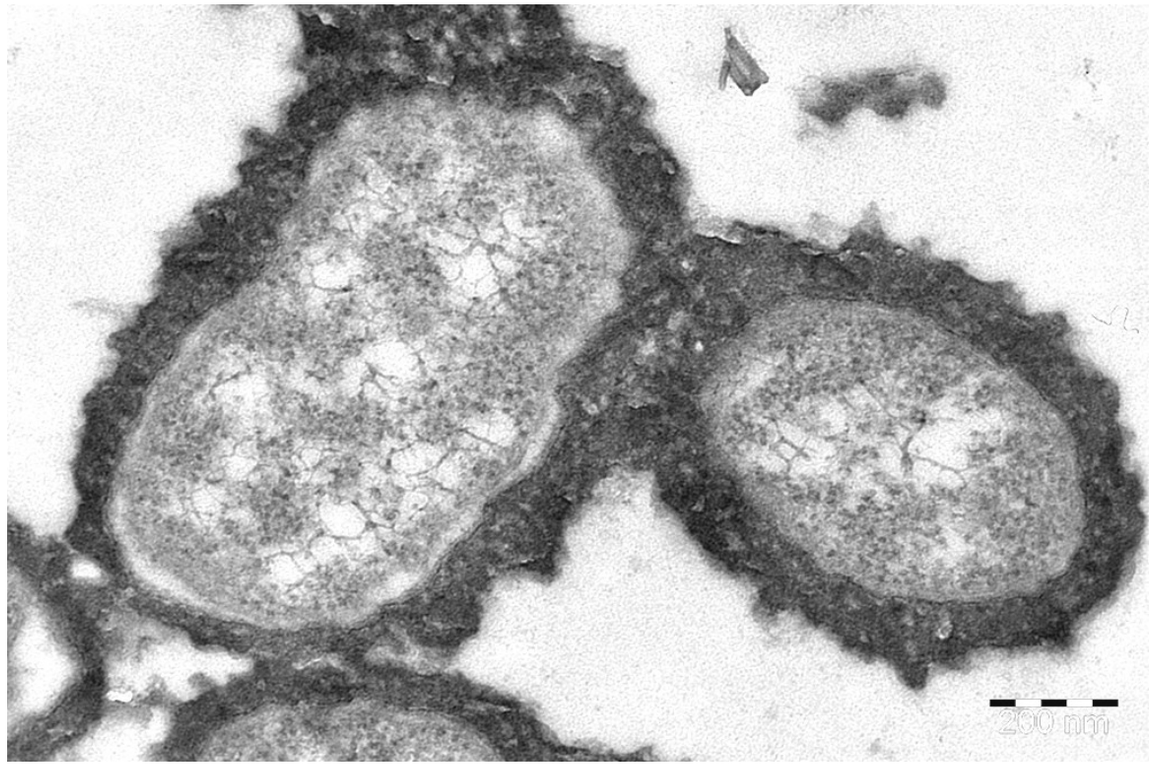
Table 28: Numbers of cases of invasive *Haemophilus influenzae* disease reported to GERMS-SA by serotype and province, South Africa, 2013. n=333*.

Province	Serotype								
	Serotype not available	a	b	c	d	e	f	Non-typeable	Total
Eastern Cape	9	0	11	0	0	0	0	6	26
Free State	9	0	4	0	0	2	0	3	18
Gauteng	39	6	17	1	0	2	2	42	109
KwaZulu-Natal	20	0	9	0	0	1	3	16	49
Limpopo	2	0	0	0	0	0	0	1	3
Mpumalanga	9	0	3	0	1	0	0	2	15
Northern Cape	1	0	1	1	0	0	0	2	5
North West	2	0	0	0	0	0	0	1	3
Western Cape	20	6	12	0	0	2	7	58	105
South Africa	**111**	**12**	**57**	**2**	**1**	**7**	**12**	**131**	**333**

*222 (67%) with specimens or viable isolates available for serotyping.

Table 29: Numbers and percentages of cases of invasive *Haemophilus influenzae* disease reported to GERMS-SA by specimen type, South Africa, 2013. n=333.

Site of specimen	No serotype available		Serotype b		Serotypes a, c, d, e, f		Non-typeable	
	n	(%)	n	(%)	n	(%)	n	(%)
CSF	32	(29)	33	(58)	11	(32)	7	(5)
Blood	57	(51)	21	(37)	20	(59)	93	(71)
Other	22	(20)	3	(5)	3	(9)	31	(24)
Total	**111**		**57**		**34**		**131**	



Cells of *Haemophilus influenzae* type b, stained to highlight the polysaccharide capsules - image courtesy of Monica Birkhead, Centre for Emerging and Zoonotic Diseases, NICD

STREPTOCOCCUS PNEUMONIAE

Results

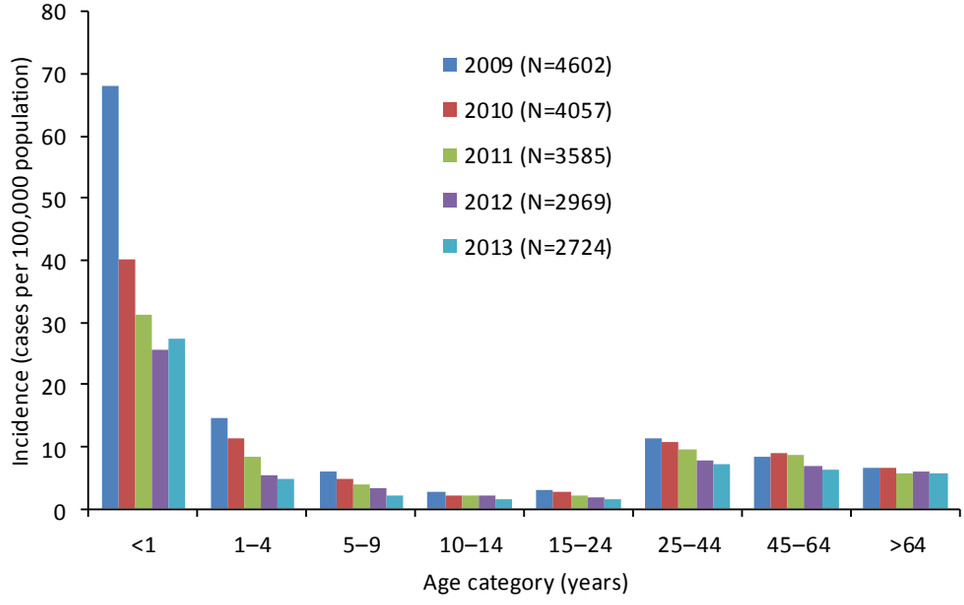
The 7-valent polysaccharide-protein conjugate pneumococcal vaccine (PCV-7) was introduced into the Expanded Programme on Immunisations (EPI) in South Africa from 1 April 2009. In June 2011, this vaccine was replaced by the 13-valent formulation (PCV-13). Incidence of reported invasive pneumococcal disease (IPD) varied widely by province (table 30). The age group at highest risk of disease in South Africa was infants <1 year of age, and disease rates have stabilised from last year (figure 12). The majority of episodes reported to GERMS-SA were diagnosed from positive blood culture specimens (table 31). Prevalence of non-susceptible strains ranged from 25% to 37% in different

provinces (table 32). Penicillin non-susceptible isolates were most common amongst older children (figure 13). Ceftriaxone non-susceptibility was detected amongst 5% (90/1,933) of all IPD cases; and no reduction was seen from 2012 (5%, 117/2,160). Amongst isolates from CSF specimens, 4% (26/679) were non-susceptible. The number of cases among children less than 5 years of age due to common serotypes for the period 2009-2013 are shown in figure 14. The percentages of disease in 2013 amongst children less than 5 years of age due to PCV-7 and newer valency vaccine formulations are shown in table 33. The number of isolates available for serotyping in this age group has decreased in the last five years (1,009/1,337 [75%] in 2009; 649/909 [71%] in 2010; 465/696 [67%] in 2011; 353/509 [69%] in 2012; and 322/498 [65%] in 2013).

Discussion

Differences in IPD incidence by province have been documented for several years, and are partly due to differences in specimen-taking practices and laboratory reporting. However, real differences in disease incidence cannot be excluded. The decreases in incidence of disease in children <5 years of age after the introduction of PCV have been substantial, although rates have stabilised in children <1 year in 2013. In 2013, as vaccine serotypes continue to decrease, increases have been noted in non-vaccine serotypes. When our data are analysed by HIV-coinfection, vaccine and non-vaccine serotypes have decreased in HIV-infected infants, suggesting that HIV prevention and treatment improvements have also impacted on this opportunistic disease. Clinicians are urged to continue taking relevant specimens when pneumococcal disease is suspected and laboratorians should send all pneumococci isolated from normally sterile site specimens. Ongoing surveillance will assist in evaluating pneumococcal disease in South Africa at this time of multiple interventions.

Figure 12: Age-specific incidence rates* for laboratory-confirmed, invasive pneumococcal disease reported to GERMS-SA, South Africa, 2009 through 2013.



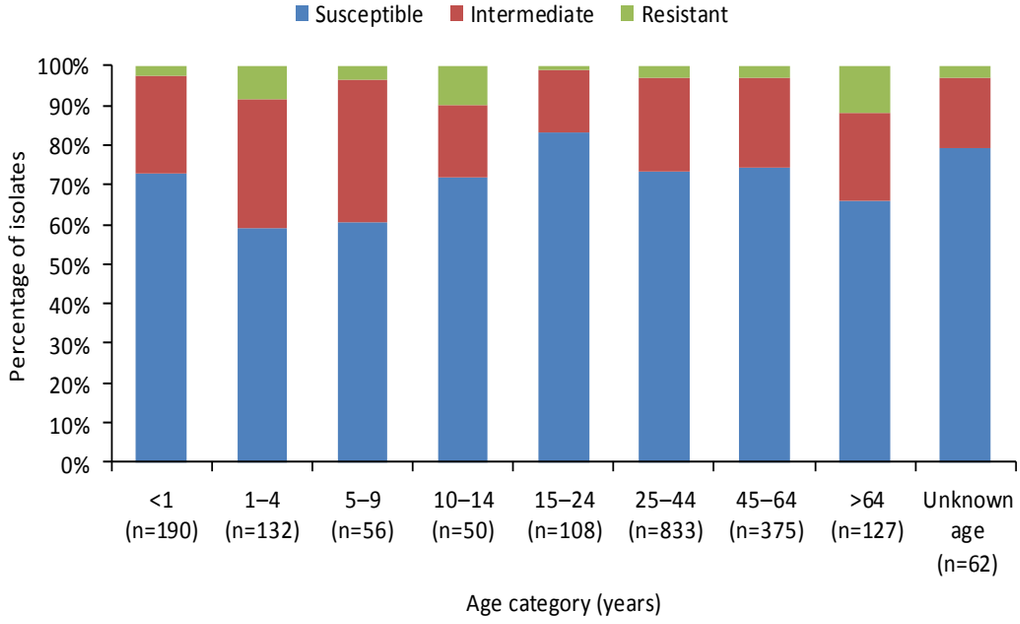
2009: N=4,765; age unknown for n=163; 2010: N=4,199; age unknown for n=142; 2011: N=3,804; age unknown for n=219; 2012: N=3,222, age unknown for n=253; 2013: N=2,866, age unknown for n=142. *Incidence rates were calculated based on population denominators provided by Statistics South Africa, and are expressed as cases per 100,000 population.

Table 30: Numbers of cases and incidence rates of invasive pneumococcal disease reported to GERMS-SA by province, South Africa, 2012 and 2013. n=6,088.

Province	2012		2013	
	n	Incidence rate*	n	Incidence rate*
Eastern Cape	314	4.77	301	4.55
Free State	221	8.04	193	7.01
Gauteng	1266	10.16	976	7.66
KwaZulu-Natal	578	5.59	496	4.74
Limpopo	75	1.38	62	1.12
Mpumalanga	167	4.10	143	3.46
Northern Cape	50	4.34	81	6.97
North West	134	3.78	136	3.78
Western Cape	417	7.06	478	7.94
South Africa	**3222**	**6.16**	**2866**	**5.41**

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

Figure 13: Numbers of laboratory-confirmed, invasive pneumococcal disease cases reported to GERMS-SA by age group and penicillin susceptibility, South Africa, 2013. n=2,866 (n=1,933 with viable isolates).



2013 CLSI breakpoints for penicillin (oral penicillin V) were used: susceptible, ≤0.06mg/L; intermediately resistant, 0.12-1mg/L; resistant, ≥2mg/L.

Table 31: Numbers and percentages of invasive pneumococcal disease cases reported to GERMS-SA by specimen type, South Africa, 2012 and 2013. n=6,088.

Site of specimen	2012		2013	
	n	(%)	n	(%)
CSF	1,385	(43)	1,144	(40)
Blood	1,498	(46)	1,439	(50)
Other	339	(11)	283	(10)
Total	**3,222**		**2,866**	

Table 32: Numbers and percentages of penicillin susceptible and non-susceptible isolates from invasive pneumococcal disease cases reported to GERMS-SA by province, South Africa, 2013. n=2,866.

Province	Isolate not available	Susceptible*		Intermediate*		Resistant*	
	n	n	(%)	n	(%)	n	(%)
Eastern Cape	118	137	(75)	43	(23)	3	(2)
Free State	78	86	(75)	26	(22)	3	(3)
Gauteng	296	512	(75)	137	(20)	31	(5)
KwaZulu-Natal	206	186	(64)	89	(31)	15	(5)
Limpopo	23	29	(74)	10	(26)	0	(0)
Mpumalanga	70	46	(63)	24	(33)	3	(4)
Northern Cape	12	48	(70)	19	(27)	2	(3)
North West	79	43	(75)	14	(25)	0	(0)
Western Cape	51	310	(73)	94	(22)	23	(5)
South Africa	**933**	**1,397**	**(72)**	**456**	**(24)**	**80**	**(4)**

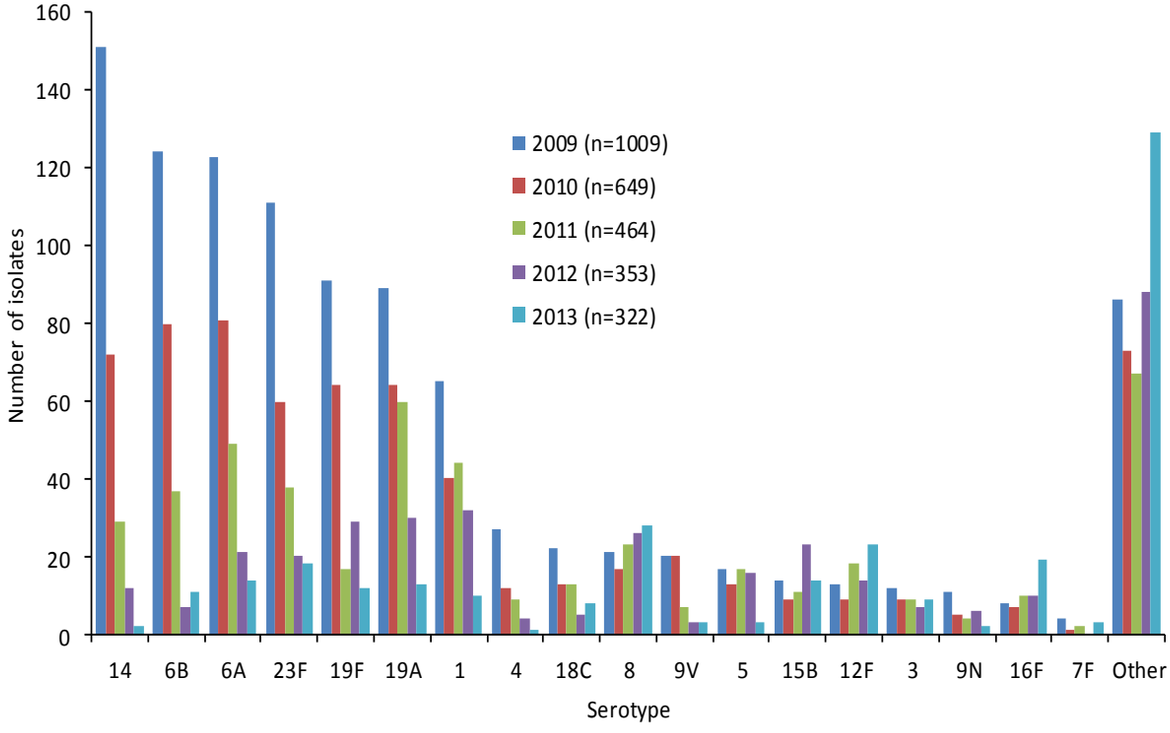
*2013 CLSI breakpoints for penicillin (oral penicillin V) were used: susceptible, ≤0.06mg/L; intermediately resistant, 0.12-1mg/L; resistant, ≥2mg/L.

Table 33: Numbers and percentages 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, 2013. n=498 (n=322 with viable isolates).

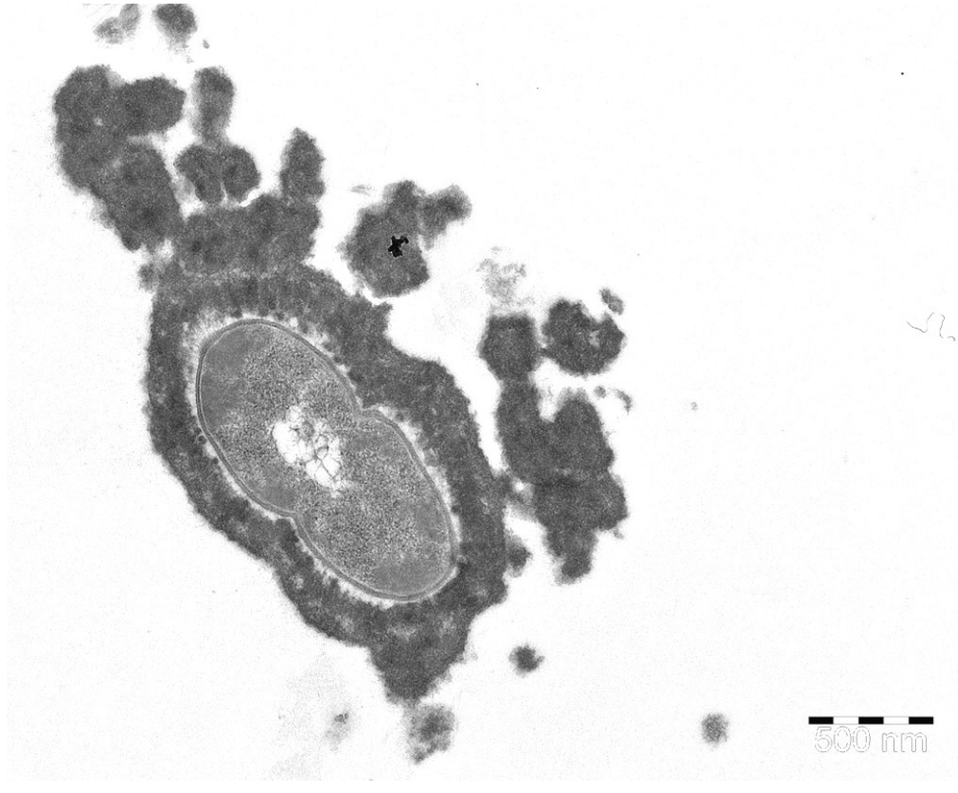
Province	Total isolates available for serotyping	7-valent serotypes*		Serotype 6A#		10-valent serotypes*		13-valent serotypes*	
		n	(%)	n	(%)	n	(%)	n	(%)
Eastern Cape	20	3	(15)	0	(0)	4	(20)	7	(35)
Free State	28	5	(18)	1	(4)	9	(32)	13	(46)
Gauteng	146	24	(16)	5	(3)	31	(21)	45	(31)
KwaZulu-Natal	45	8	(18)	1	(2)	11	(24)	13	(29)
Limpopo	4	1	(25)	1	(25)	1	(25)	3	(75)
Mpumalanga	5	0	(0)	2	(40)	1	(20)	2	(40)
Northern Cape	6	1	(17)	0	(0)	1	(17)	1	(17)
North West	7	1	(14)	0	(0)	1	(14)	3	(43)
Western Cape	61	12	(20)	4	(7)	16	(26)	20	(33)
South Africa	**322**	**55**	**(17)**	**14**	**(4)**	**75**	**(23)**	**107**	**(33)**

*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 .[13]

Figure 14: Pneumoccocal serotypes, in descending order, causing laboratory-confirmed, invasive pneumococcal disease reported to GERMS-SA in children <5 years, South Africa, 2009-2013.



2009:N=1,337, n=1,009 with viable isolates; 2010: N=909; n=649 with viable isolates; 2011: N=696, n=464 with viable isolates; 2012: N=509, n=353 with viable isolates; 2013: N=498, n=322 with viable isolates.



An invasive isolate of *Streptococcus pneumoniae* with an extensive capsule—image courtesy of Monica Birkhead, Centre for Emerging and Zoonotic Diseases, NICD

CASE-CONTROL STUDY TO ESTIMATE THE EFFECTIVENESS OF A PNEUMOCOCCAL CONJUGATE VACCINE (PCV) AGAINST INVASIVE PNEUMOCOCCAL DISEASE (IPD) IN SOUTH AFRICA

South Africa introduced the 7-valent pneumococcal conjugate vaccine (PCV-7) in April 2009, and PCV-13 replaced PCV-7 in June 2011. A case-control study to assess the effectiveness of PCV against invasive pneumococcal disease (IPD) was started in March 2010. The results for the PCV-7 component of the study have been published.[14]

The PCV-13 component of the study is ongoing and case enrollment is planned to end in December 2014. The final date of study close-out is dependent on the results of an interim analysis planned for June 2014. From June 2011 to the 11th June 2014 346 children <5 years were screened and all were age-eligible. Of these, 259 cases have completed enrolment. The case-control sets, with known HIV-status, consist of 250 HIV-uninfected cases with 1,158 controls and 82 HIV-infected cases with 251 controls. Overall, HIV-uninfected cases have a higher average number of controls per case (5.1 controls) than HIV-infected cases (4.3 controls).

The numbers of HIV-infected cases enrolled into the PCV-13 component of the study are still lower than projected despite the addition of new case enrolment sites to try and address this issue. Due to the ongoing improved Prevention-of-Mother-to-Child-Transmission (PMTCT) programme and increased access to antiretro-viral treatment for children, this is unlikely to change. However, a pooled analysis at the end of the study (using all HIV-infected cases from 2010) is planned to increase case numbers.

STAPHYLOCOCCUS AUREUS

Results

The number of cases of *Staphylococcus aureus* bacteraemia reported to GERMS-SA from Gauteng province from January through December 2013 was 378. Of these, the majority of cases were detected from sentinel sites in Johannesburg (71.4%), followed by Tshwane (28.6%) (figure 15). The number of cases was almost equally distributed throughout the whole year, although there was a decline during spring, which picked up in the autumn months (figure 16). Resistance to oxacillin (MRSA) was determined in 63 (29.2%) isolates. From a total of 216 viable *S. aureus* isolates, 69% were susceptible to clindamycin and 56 (26%) isolates expressed positive using the D-zone test. Five non-susceptible vancomycin isolates were noted in 2013. A total of 175 (81%) isolates were susceptible to mupirocin and 179 (83%) to rifampicin (table 34).

Discussion

Staphylococcus aureus cases could be separated into hospital admission categories using patient data in 187/342 (49%) cases. However, molecular data confirming community vs. hospital acquired Methicillin-resistant *Staphylococcus aureus* (MRSA) are pending. MRSA accounted for 29% of the total number of *S. aureus* isolates submitted to the NICD from Gauteng Province, which is significantly lower than the MRSA proportion recorded in 2012 (41%, p=0.004). Clindamy-

cin-resistant *S. aureus* isolates occurred at high rates (31%). In addition, 26% were clindamycin D-zone test positive and the five vancomycin non-susceptible isolates identified have not yet been confirmed with the reference method. Three isolates were non-susceptible to daptomycin and three were non-susceptibleto linezolid.

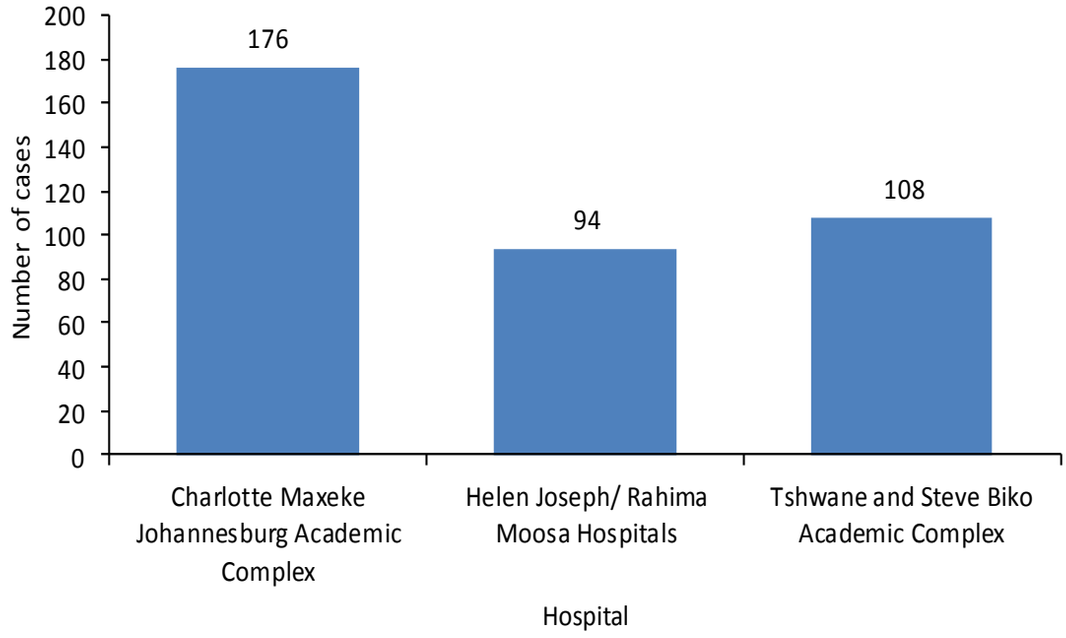


Figure 15: Numbers of laboratory-confirmed *Staphylococcus aureus* bacteraemia cases reported to GERMS-SA by Gauteng Province sentinel sites, 2013. n=378.

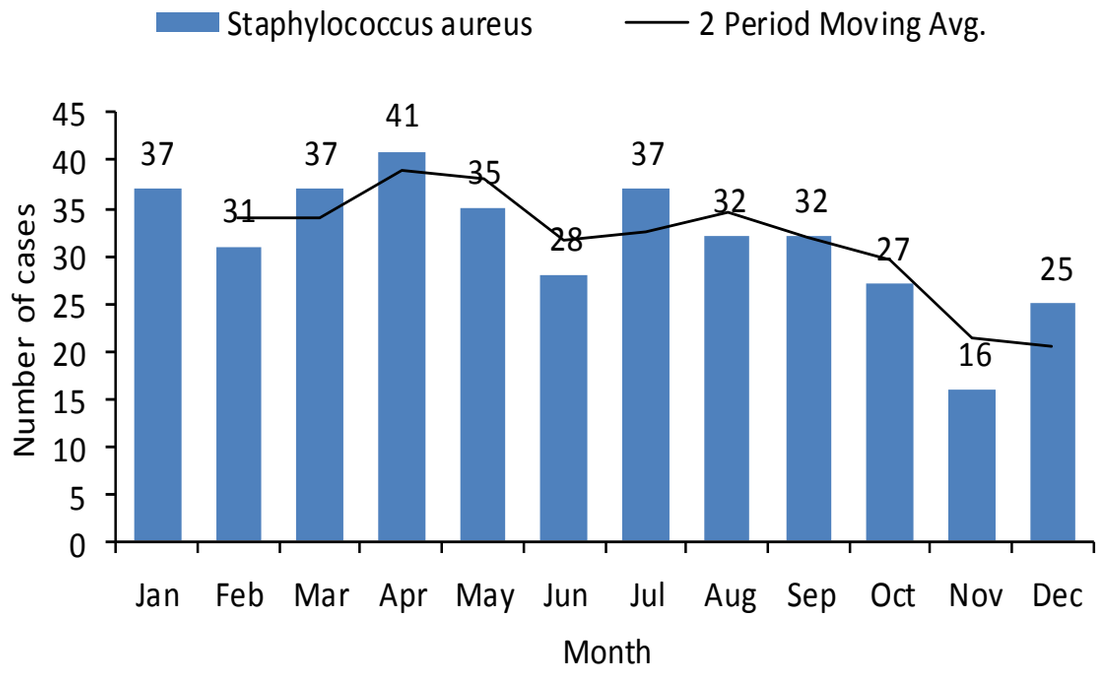


Figure 16: Numbers and trend of laboratory-confirmed *Staphylococcus aureus* bacteraemia cases reported by GERMS-SA Gauteng Province sentinel sites by month, 2013. n=378.

Table 34: Numbers of viable, laboratory-confirmed *Staphylococcus aureus* cases reported by GERMS-SA Gauteng Province sentinel sites by antimicrobial susceptibility, 2013.

Province	Antimicrobial agents													
	Oxacillin		Clindamycin		Inducible Clindamycin test		Vancomycin		Mupirocin		Daptomycin		Rifampicin	
	S*	NS**	S	NS	D-zone +	D-zone -	S	NS	S	NS	S	NS	S	NS
Gauteng	153	63	149	67	56	160	211	5	175	41	213	3	179	37
Total	**153**	**63**	**149**	**67**	**56**	**160**	**211**	**5**	**175**	**41**	**213**	**3**	**179**	**37**

*S: susceptible; **NS: non-susceptible; +: positive; -: negative

RIFAMPICIN-RESISTANT TUBERCULOSIS

South Africa has a high burden of Tuberculosis (TB) (1,003/100,000), together with high numbers of multi-drug resistant TB (MDR-TB) cases (15,419 laboratory confirmed cases in 2012).[15] Co-infection with HIV is common. In March 2011, in response to these public health challenges, the National Department of Health and National Health Laboratory Service (NHLS) initiated phased implementation of Xpert MTB/RIF (Xpert), a rapid diagnostic test that simultaneously diagnoses TB and assesses resistance to Rifampicin (RIF). This implementation was completed in October 2013 and Xpert is currently the initial diagnostic test for all TB suspects in South Africa. From March 2011 to 31 January 2014, 2,823,270 samples were submitted for Xpert testing; 12.75% detected MDR-TB and of these, 6.85% were RIF-resistant.[16] As per a national diagnostic algorithm, patients diagnosed as RIF-resistant on Xpert submit a second sputum specimen for confirmation and assessment of susceptibility to isoniazid (INH) and second-line TB drugs. Ongoing surveillance is important in order to describe the demographics, risk factors and HIV status of Xpert RIF-resistant patients and to estimate the proportion of MDR-TB. In October 2012, enhanced surveillance of Xpert RIF-resistant cases was piloted in Gauteng as part of the existing GERMS-SA platform. Surveillance was subsequently introduced in the Eastern Cape, Northern Cape, Mpumalanga, Limpopo and North West Provinces during 2013. Surveillance sites include selected NHLS laboratories, associated hospitals and several feeder clinics.

Results

In 2013, 271 patients were diagnosed as Xpert RIF-resistant at Gauteng GERMS-SA sites. One hundred and seventy seven case report forms (CRF) collected over this period were analysed (74% diagnosed at Chris Hani Baragwanath and 26% at clinic sites). There was an even distribution between males (48.6%) and females (49.7%), with gender unknown for 3 cases. The majority (79%) of patients were aged between 25 and 49 years. Preliminary data on risk factors for TB and HIV are summarised in table 35.

Discussion

The high percentage of HIV positive statuses highlights the need for managing co-infection in this group of patients. One in four patients reported a household contact with TB, emphasising the importance of

identifying and tracing contacts. Seventy three (41%) patients reported previous TB treatment. This suggests that ongoing transmission is likely to be playing a role and supports the routine testing of all cases for drug resistance. These preliminary results from surveillance in Gauteng support the value of this surveillance system and roll out to the remaining three provinces. Lessons learned from implementation at this site will result in overall improvements to the surveillance system.

Table 35: Selected risk factors for TB and HIV from Gauteng Province using case report form data, 2013.

Risk Factor	Yes	(%)	No	(%)	Unknown	(%)
Previous TB treatment	73	(41.2)	90	(50.9)	14	(7.9)
Household member with previous TB diagnosis	45	(25.5)	113	(63.8)	19	(10.7)
Stayed in SA previous 6 months	161	(91.0)	3	(1.7)	13	(7.3)
Imprisoned in the last 10 years	11	(6.2)	151	(85.3)	15	(8.5)
Worked in mines/quarry/sandblasting	1	(0.5)	161	(91.0)	15	(8.5)
Worked in clinic/hospital/medical laboratory	0	(0.0)	162	(91.5)	15	(8.5)
HIV positive at admission (documented)	157	(88.7)	11	(6.2)	9	(5.1)

Discussion

This year saw various changes to the GERMS surveillance platform: rifampicin-resistant TB surveillance was rolled out to four additional sites; identification of *Staphylococcus aureus* bacteraemic cases was limited to three Gauteng sites; electronic capture on mobile phones of enhanced surveillance (ES) case report forms (CRFs) by surveillance officers was initiated for cryptococcosis and *S. aureus* bacteraemia; and surveillance officers' CRFs at ES sites were audited for quality. NHLS laboratory information systems continued to move over from DISA*Lab to TrakCare Lab and the resultant challenges of mapping the information onto the Corporate Data Warehouse (CDW) may have impacted on total case counts. Overall in 2013, the total number of cases matching the GERMS definitions dropped from over 17,000 in 2012 to approximately 12,000 cases, in part due to fewer participating sites for *S. aureus* surveillance and the cessation of *Klebsiella* spp surveillance, but mostly because of the decrease in the number of *Cryptococcus* spp and invasive *Streptococcus pneumoniae* cases. At enhanced surveillance sites, the rate of surveillance officer completion of CRFs by interview continued to improve.

Three-quarters of patients presenting at enhanced surveillance sites were co-infected with HIV, mainly in patients with cryptococcosis or TB. Cryptococcosis incidence decreased nationally but increased in Gauteng and the Western Cape, possibly due to improved case detection. A large proportion of patients was on concurrent ART or had previously received ART. The in-hospital case fatality remains high (34%) and unchanged over the years.

Monitoring of TB resistance, identification and tracing of contacts, and managing HIV co-infection are important aspects of TB control. On-going surveillance is important in order to describe the demographics, risk factors and HIV status of rifampicin-resistant TB patients and to estimate the proportion of MDR-TB.

The epidemiology of candidaemia remained different in Gauteng and the Western Cape (WC) and information concerning local hospital epidemiology should guide empiric treatment. In Gauteng, amphotericin B remains the empiric drug of choice for the public sector; and in the WC, high dose fluconazole or amphotericin B are reasonable choices for the public sector.

The incidence of meningococcal disease has stabilised since 2012 and the prevalence of non-susceptibility of *Neisseria meningitidis* isolates to penicillin remained low in 2013. Reductions in cases of invasive *Haemophilus influenzae* and *Streptococcus pneumoniae* disease may be attributable to the effect of the respective vaccines, or may be related to interventions such as improved prevention and treatment of HIV in infants or changes in the diagnosis and reporting of cases.

Among *S. aureus* surveillance isolates from patients with bacteraemia received from Gauteng sentinel sites, the percentage of resistance to methicillin declined significantly from 2012, which highlights the changing epidemiology of diseases caused by this organism. For the new agent daptomycin, the non-susceptibility rate was very low. Periodic national surveillance seems appropriate for clinically significant isolates in order to monitor trends in resistance to major antimicrobial agents.

Salmonella Typhi non-susceptibility to ciprofloxacin has been demonstrated over the last few years and azithromycin and ceftriaxone are suggested alternative therapies. *Shigella* non-susceptibility to fluoroquinolones remains low, but should continue to be monitored.

GERMS-SA constantly strives to reduce the number of cases detected on audit, as the programme is unable to perform additional microbiological characterisation of these isolates. The full participation of public and private laboratories is imperative for the laboratory-based surveillance programme. Laboratories are therefore urged to continue submitting all isolates matching the GERMS case definitions to the NICD for serotyping/ serogrouping, antimicrobial susceptibility testing and molecular work. Pertinent information will be communicated to stakeholders to improve the health of all South Africans.

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The full annual report is available on the NICD website at http://nicd.ac.za/assets/files/GERMS-SA%20AR%202013.pdf.

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Table 1: Provisional number of laboratory confirmed cases of diseases under surveillance reported to the NICD - South Africa, corresponding periods 1 January - 30 June 2013/2014*

Disease/Organism	1 Jan to 30 Jun, year	EC	FS	GA	KZ	LP	MP	NC	NW	WC	South Africa
Anthrax	2013	0	0	0	0	0	0	0	0	0	0
	2014	0	0	0	0	0	0	0	0	0	0
Botulism	2013	0	0	0	0	0	0	0	0	0	0
	2014	0	0	0	0	0	0	0	0	0	0
Cryptococcus spp.	2013	352	108	1015	874	70	169	22	122	268	3000
	2014	338	84	648	653	49	135	19	96	306	2328
Haemophilus influenzae, invasive disease, all serotypes	2013	15	11	61	28	1	4	4	1	48	173
	2014	18	8	55	29	1	6	3	3	44	167
Haemophilus influenzae, invasive disease, < 5 years											
Serotype b	2013	3	1	8	2	0	2	0	0	4	20
	2014	1	1	5	1	0	0	1	0	8	17
Serotypes a,c,d,e,f	2013	0	1	3	0	0	0	1	0	4	9
	2014	0	0	1	2	0	0	0	0	1	4
Non-typeable (unencapsulated)	2013	0	1	9	1	0	0	1	0	8	20
	2014	1	0	10	4	0	1	0	0	10	26
No isolate available for serotyping	2013	1	2	13	4	0	2	1	0	3	26
	2014	4	1	13	7	1	2	0	2	3	33
Measles	2013	1	0	1	0	0	0	0	0	0	2
	2014	1	1	2	2	0	1	0	0	1	8
Neisseria meningitidis, invasive disease	2013	21	7	22	17	0	1	1	1	22	92
	2014	16	3	20	2	0	1	0	0	27	69
Novel Influenza A virus infections	2013	0	0	0	0	0	0	0	0	0	0
	2014	0	0	0	0	0	0	0	0	0	0
Plague	2013	0	0	0	0	0	0	0	0	0	0
	2014	0	0	0	0	0	0	0	0	0	0
Rabies	2013	0	2	0	1	1	1	0	0	0	5
	2014	2	0	0	0	1	0	0	1	0	4
*Salmonella typhi***	2013	1	1	18	8	0	9	0	0	8	45
	2014	1	1	24	8	0	6	0	0	9	49
Streptococcus pneumoniae, invasive disease, all ages	2013	152	89	419	221	20	49	27	45	226	1248
	2014	102	81	422	207	12	48	14	48	247	1181
Streptococcus pneumoniae, invasive disease, < 5 years	2013	28	22	110	28	4	4	3	16	34	249
	2014	12	10	92	38	3	8	3	9	38	213
Vibrio cholerae O1	2013	0	0	0	0	1	0	0	0	0	1
	2014	0	0	0	0	0	0	0	0	0	0
Viral Haemorrhagic Fever (VHF)											
Crimean Congo Haemorrhagic Fever (CCHF)	2013	0	2	0	0	0	0	0	1	0	3
	2014	0	1	0	0	0	0	0	0	0	1
Other VHF (not CCHF)	2013	0	0	0	0	0	0	0	0	0	0
	2014	0	0	0	0	0	0	0	0	0	0

Footnotes

*Numbers are for cases of all ages unless otherwise specified. Data presented are provisional cases reported to date and are updated from figures reported in previous bulletins.

Provinces of South Africa: EC – Eastern Cape, FS – Free State, GA – Gauteng, KZ – KwaZulu-Natal, LP – Limpopo, MP – Mpumalanga, NC – Northern Cape, NW – North West, WC – Western Cape

0 = no cases reported

**Laboratory-based surveillance for *Shigella* and *Salmonella* spp other than typhi has been discontinued as of 2014

Table 2: Provisional laboratory indicators for NHLS and NICD, South Africa, corresponding periods 1 January - 30 June 2013/2014*

Programme and Indicator	1 January to 30 June, year	EC	FS	GA	KZ	LP	MP	NC	NW	WC	South Africa
Acute Flaccid Paralysis Surveillance											
Cases < 15 years of age from whom specimens received	2013	27	9	28	28	16	17	1	10	17	153
	2014	27	15	41	42	16	20	7	10	14	192

Footnotes

*Numbers are for all ages unless otherwise specified. Data presented are provisional numbers reported to date and are updated from figures reported in previous bulletins.

Provinces of South Africa: EC – Eastern Cape, FS – Free State, GA – Gauteng, KZ – KwaZulu-Natal, LP – Limpopo, MP – Mpumalanga, NC – Northern Cape, NW – North West, WC – Western Cape

Monitoring for the presence of polio in a country is based on AFP (acute flaccid paralysis) surveillance – the hallmark clinical expression of paralytic poliomyelitis. The clinical case definition of AFP is an acute onset of flaccid paralysis or paresis in any child under 15 years of age. AFP is a statutory notifiable disease and requires that 2 adequate stool specimens are taken as soon as possible, 24 to 48 hours apart, but within 14 days after onset of paralysis, for isolation and characterisation of polio virus. The differential diagnosis of AFP is wide, the most common cause of which is Guillain-Barre Syndrome. The incidence of AFP in a population has been studied in a number of developing countries and WHO have determined, as a result of these studies, that the criterion for adequate surveillance of AFP is 2 cases per 100 000 population of children less than 15 years of age (it was formerly 1 per 100,000 but this was thought to be inadequately sensitive).

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