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FOREWORD

In this issue:

Domestic dogs are the primary source of human rabies cases in South Africa. Rabies control therefore hinges on mass vaccination of dogs, a measure that has led to a substantial reduction in incidence in KwaZulu-Natal Province. Reviewed here is the current and historical incidence of human rabies in South Africa.

Disease surveillance reports for South Africa for 2018 include measles, rubella and hepatitis B. Amongst an array of findings, these reports show that the national measles and rubella incidence rates have decreased, and that the bulk of hepatitis B cases currently occur in persons aged between 25 and 49 years.

An analysis of the incidence of influenza and other respiratory viruses in South Africa for the period 2009 – 2017 shows that influenza is typically seasonal with peaks between May and September. These data also show ongoing circulation of respiratory syncytial virus (RSV) each year, with the RSV season generally preceding the influenza season.

The national antenatal HIV prevalence survey for 2017, the 27th such survey, is especially important because additional incidence and coverage data were collected. This survey shows that South Africa's overall HIV prevalence at national level was stable at 30.7%, consistent with the previous 2015 survey, and that the highest HIV prevalence occurred in KwaZulu-Natal and Mpumalanga provinces.

We hope our readers will find this edition informative, and thank all contributors and reviewers for their inputs.

Basil Brooke, Editor

EPIDEMIOLOGY OF HUMAN RABIES IN SOUTH AFRICA, 2008-2018

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Executive summary

Rabies is a neglected public health issue affecting mostly children in impoverished communities in dog-rabies endemic locations around the globe. This report provides an assimilation of the epidemiological features of human rabies in South Africa through review of previous reports and secondary analysis of laboratory-confirmed cases. The epidemiology of human rabies in South Africa for the period 2008-2018, with comparison to the period 1983-2007, is described. For the study period, the median yearly frequency of human cases was n=9, with the greatest number occurring in male children below the age of ten years (50%). Less than a third of the total number of reported cases involved adults. The importance of the domestic dog, as the major source of rabies infection in humans, was reiterated by findings for the reporting period. During the period 2008 to 2018, the occurrence of laboratory-confirmed human rabies cases increased in Limpopo and Eastern Cape provinces. Prior to this period, the highest number of confirmed human rabies was reported along the coastal areas of the KwaZulu-Natal Province. The failure of post-exposure management for confirmed human rabies cases was investigated and it was found that many of these did not seek any medical intervention post-exposure. For cases that did seek medical intervention, several points concerning failure to deliver post-exposure prophylaxis were noted.

Introduction

Rabies is a highly fatal and neglected zoonotic disease that causes approximately 59 000 human deaths each year worldwide, with 95% of cases occurring in the developing countries of Africa and Asia.[1] Rabies is caused by RNA viruses of the *Lyssavirus* genus of the *Rhabdoviridae* family. It is transmitted through the infected saliva of a rabid mammalian

vector.[2,3] Human rabies cases in Africa and Asia are most often associated with exposures to rabid domestic dogs.[1]

The development of clinical disease can be prevented through timely prophylaxis either pre- or post-exposure to the virus.[3] Pre-exposure prophylaxis (PrEP) is recommended for persons who have a high or continual risk of exposure to the rabies virus, including veterinary practitioners, animal welfare organisation staff, selected travellers and laboratory personnel in rabies diagnostic laboratories. Rabies vaccination is also recommended for those travelling to dog-rabies endemic countries and where access to post-exposure prophylaxis (PEP) may be limited. PEP is provided to those who have potentially been exposed to the virus (e.g. a bite from a stray animal), and is comprised of three components, namely: wound management, vaccine administration and administration of rabies immunoglobulin (RIG). Current rabies vaccines that are registered for PrEP and PEP comply with WHO criteria in terms of potency and harmlessness and have been satisfactorily assessed for human use in well-designed field trials.[4,5] These inactivated, purified vaccines are safe and effective, and can be used in pregnant mothers as well as children.[4,5]

The history of rabies in South Africa: epidemiology and control

Rabies became an emerging and resurgent health problem in South Africa with the introduction of canine rabies in 1950. Canine rabies in southern Africa originates from the endemic region north of the Zambezi River and was discovered in Zimbabwe and Botswana for the first time in the 1940s.[6] From there it spread to South Africa's Limpopo Province[7], causing an outbreak that subsequently spread to Mozambique and then to South Africa's KwaZulu-Natal Province in 1961.[8] Although the KwaZulu-Natal outbreak was brought under control, the disease reappeared in 1976 congruent with an influx of refugees from Mozambique due to civil war.[9] Rabies reached the Eastern Cape Province in 1986.[10] Ever since, canine rabies and dog-associated human cases have continued to re-emerge in previously-controlled areas in South Africa. Rabies remains endemic in certain parts of KwaZulu-Natal, Eastern Cape and other provinces.[11]

A canine rabies outbreak occurred in Limpopo Province in 2005-2006, involving 26 laboratory-confirmed human cases. This outbreak occurred several years after rabies had

been controlled in dogs[12], with the three most recent laboratory-confirmed human cases prior to this outbreak occurring in 1980, 1981 and 1998 (R. Swanepoel, pers. comm.). A widespread outbreak across Mpumalanga Province followed in 2008.[13] In 2009, the Free State Province, in which endemic disease is normally associated with yellow mongoose, experienced an outbreak of canid biotype rabies.[14] Only sporadic cases of rabies in domestic dogs had previously been reported in this region, and it was demonstrated that these were a cross-over infection of the mongoose virus biotype.[15,16] At least one human case per year has been reported from Free State Province in most years since 2012, with other single-case reports dating back to 2005 and 1993, and a few in the 1980s. In 2010, Gauteng Province experienced an outbreak in dogs and one human case was confirmed.[17]

Rabies control methods in South Africa and elsewhere have focused on vaccinating domestic dogs because of their close proximity to humans, and the persistent epidemics occurring in dogs in the eastern part of South Africa and other endemic regions in Africa. The law in South Africa has required the vaccination of domestic dogs and cats by owners since 1952.[18] Mass vaccination programmes have been implemented in rural and urban areas and have proved effective in reducing rabies incidence, even if the effect is sometimes transitory in certain areas.[11]

Rabies surveillance in South Africa

Human and animal rabies are notifiable conditions in South Africa according to the Health Act of 1977 and the Animal Disease Act of 1984.[19,20] A National Notifiable Medical Conditions Surveillance System (NMCSS), managed by the National Institute for Communicable Diseases (NICD) on behalf of the National Department of Health, was rolled out in 2018. In this system clinical and confirmed human cases are categorised as NMC 1, requiring immediate notification. Despite this system, cases in both animals and humans are most likely underreported, especially when they occur in remote areas where awareness amongst communities and health facilities is reduced, recognition of the disease is limited and tissue samples for diagnostic purposes are not submitted.

Human rabies surveillance is primarily a case-referral system that comprises healthcare facilities and general practices nationwide, with a specialised laboratory based at the NICD in

Johannesburg. The NICD's Center for Emerging Zoonotic and Parasitic Diseases, Special Viral Pathogens Laboratory (SVPL) performs the standard direct fluorescent antibody test on brain samples collected post-mortem. Additionally, the SVPL tests brain and saliva samples, and cerebrospinal fluid and skin biopsies collected from clinically suspected patients prior to death for detection of rabies virus genomic RNA using reverse transcription polymerase chain reaction. The SVPL also provides a diagnostic service for testing antibody titres in pre-vaccinated individuals.

Human rabies epidemiology in South Africa, 2008-2018

Demographics

From 2008 to 2018, there were 105 laboratory-confirmed cases of human rabies at the NICD. For the preceding 25-year preceding period, 1983 – 2007 (for which data were available at the NICD), rabies was confirmed in 353 people.[21] All patients died of their infections with the exception of one child in KwaZulu-Natal Province in 2012.[22] Males predominated in both periods: 76% (n=79) for 2008-2018 and 67% (n=229) for 1983-2007 (Table 1 and Figure 1). The median age of rabies cases was similar for both periods, namely 9 to 10 years, with half of the cases falling between the ages of 6 and 25 years (Table 1). The youngest cases were 1-2 years and the oldest were 80-85 years. The age distribution was skewed towards the younger age groups (Table 1).

Table 1. Demographics of rabies cases in South Africa for the periods 1983-2007[21] and 2008-2018.

Demographics	1983-2007	2008-2018
Sex		
Male	229/340 (67%)	79/104 (76%)
Female	111/340 (33%)	25/104 (24%)
Unrecorded	13	1
M:F ratio	2.1	3.2
Age (in years)		
Children < 10	145/338 (43%)	52/103 (51%)
Adolescents (10-19)	98/338 (29%)	23/103 (22%)
Adults ≥ 20	95/338 (28%)	28/103 (27%)
Unrecorded	15	2
Median age (IQR*) range	9 (7-24) 1-85	10 (6-25) 2-80

*IQR: interquartile range; M:F = male to female ratio

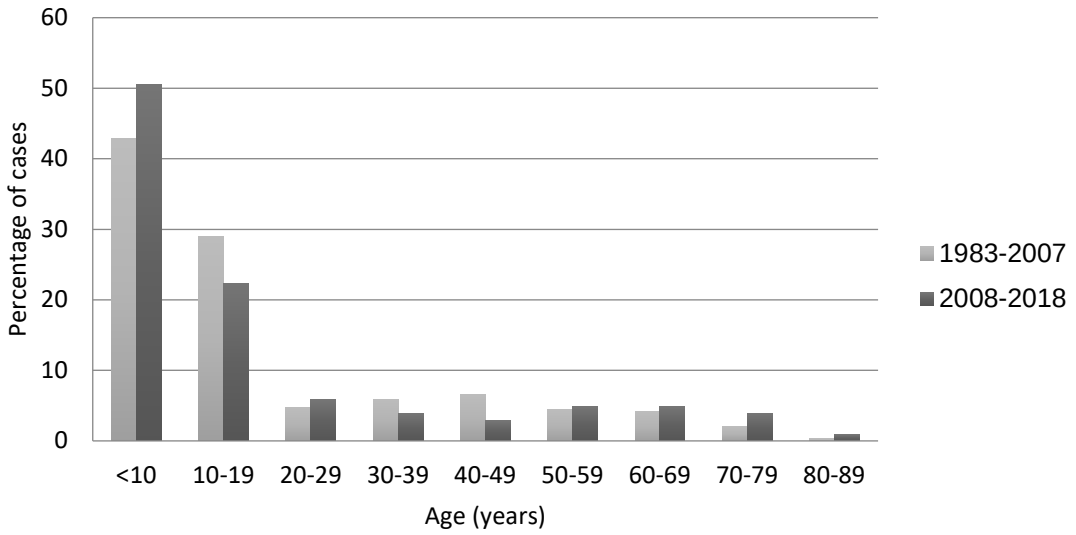

Figure 1. Age distribution of human rabies cases in South Africa for the periods 1983-2007 and 2008-2018.

Geographical distribution of cases

In the period 2008-2018, the highest number of human rabies cases occurred in the Eastern Cape Province (n=34; 32%), followed by KwaZulu-Natal (n=31; 30%) and Limpopo (n=22; 21%) provinces. Free State and Mpumalanga provinces reported 7% (n=7) and 8% (n=8) of cases respectively. Single cases were recorded in each of the Northern Cape, North West and Gauteng provinces. No cases were reported in the Western Cape Province (Figure 2).

The distribution of cases in South Africa since 1983 has largely remained the same. From 1983-2007, the majority of cases were recorded in KwaZulu-Natal Province (n=279; 79%).[21] The Eastern Cape and Limpopo provinces reported 28 (8%) and 23 (7%) cases respectively.[21] Only a few cases were recorded in the Northern Cape (n=4; 1%), North West (n=5; 1%) and Gauteng (n=1; <1%) provinces.[17,21] No cases were recorded in the Western Cape Province (Figure 2). It is however noteworthy that the proportion of cases in Limpopo Province increased from 7% (n=23) during 1983-2007 to 21% (n=22) in 2008-2018. This increase correlates with the introduction of dog-transmitted rabies in the province in 2004.[12] There was also a notable increase in the number and proportion of cases in the Eastern Cape: 8% (n=28) during 1983-2007 and 32% (n=34) during 2008-2018.

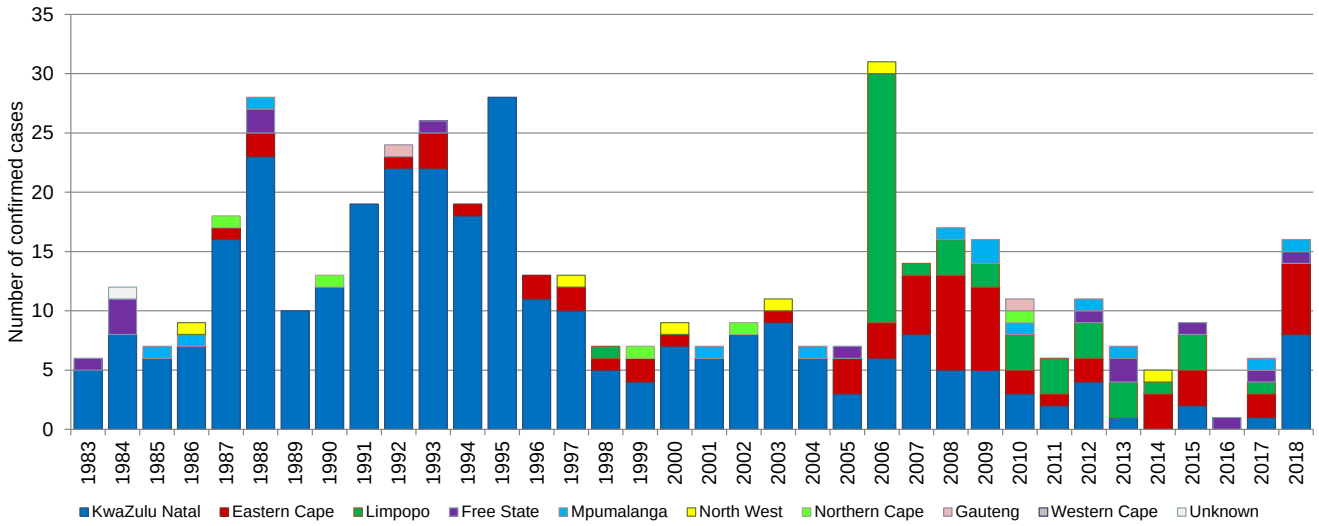

Figure 2. Numbers of laboratory confirmed human rabies cases per annum by province, South Africa, 1983-2018.

Sources of exposure

Most human cases reported during 2008-2018 were linked to domestic dogs (n/N=79/85, >90%). During the same period five cases (n/N=5/85, 6%) were linked to domestic cats. This shows a proportional increase in the number of cat-associated cases from 3% (n/N=9/314) reported during 1983-2007. There was one mongoose-associated exposure reported during 2008-2018, while the period 1983-2007 showed a range of wildlife exposures resulting in human deaths: mongoose (n=4), wild felines (n=3), wild canines (n=2) and bats (n=1). One human rabies infection was associated with livestock exposure.

Post-exposure management of cases

For the period 2008-2018, data for the post-exposure management of confirmed rabies cases were only available for 70 of the 105 cases reported. Of these cases, 67% (n=47) received no post-exposure treatment. Medical treatment post-exposure was sought in 23 cases. Of these, 9/70 (13%) received only wound treatment and some vaccination, 12/70 (17%) were vaccinated but received no rabies immunoglobulin (RIG), and only 2/70 (3%) patients received RIG and rabies vaccination (Table 2).

Table 2. Post-exposure prophylaxis management of laboratory-confirmed human rabies cases for the periods 1983-2007[21] and 2008-2018, South Africa.

Administration	1983-2007	2008-2018
No data recorded	321/353 (91%)	35/105 (33%)
Data recorded	32/353 (9%)	70/105 (67%)
No rabies PEP	23/32 (72%)	47/70 (67%)
Only wound care	1/32 (3%)	9/70 (13%)
Some vaccination, no RIG	6/32 (19%)	12/70 (17%)
RIG, some doses of vaccine	2/32 (6%)	2/70 (3%)

Discussion and conclusion

The NICD has been involved in laboratory-based human rabies surveillance in South Africa for more than 35 years. In this study, data accumulated for the past decade (i.e.2008 – 2018) were compared to data available from 1983-2007. Overall, the epidemiology of human rabies in South Africa for the period 2008-2018 remained largely unchanged when compared to the preceding 25 years. The median yearly frequency of cases from 2008-2018 (n=9) was not significantly different from 1983-2007 (n=11), (p=0.09). The demographics of the cases were also unchanged with children most affected by the disease. It was also found that male children are disproportionally affected. This finding is similar to observations in other countries where dog-rabies associated cases are reported. Domestic dogs are the primary source of human rabies in South Africa, with children under the age of ten being the most vulnerable to dog bites and thereby infection with the virus.

Some changes in the geographical distribution of human rabies cases were noted. During the period 2008 to 2018, the occurrence of laboratory-confirmed human cases increased in Limpopo and Eastern Cape provinces. Historically, between 1983 and 2007, the highest number of confirmed human rabies occurred along the coastal areas of KwaZulu-Natal Province. The proportional increase in the numbers of human cases in the Eastern Cape and Limpopo provinces can be attributed to the increased occurrence of rabies in domestic dogs. The number and proportion of confirmed human rabies cases in KwaZulu-Natal Province dropped almost 3-fold from 79% during the period 1983 – 2007 to 30% during the period 2008 – 2018. This follows control by the mass vaccination of domestic dogs in the province.[11]

The failures in response to rabies exposures also remain unchanged over the past 35 years with most cases not accessing medical intervention post-exposure. This may speak to lack of awareness of the risk of rabies in affected communities and it is therefore recommended that health education campaigns in high-risk communities be prioritized. In addition, several treatment failures were identified in those cases that did present for medical treatment post-exposure, involving the non-provision of immunoglobulin and non-administration of full PEP as per the recommended protocol. The latter can be addressed through continued healthcare worker training, particularly in high-risk areas, and by improving the capacity for follow-up of patients who need to complete their PEP vaccination schedules.

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ANNUAL MEASLES AND RUBELLA SURVEILLANCE REVIEW, SOUTH AFRICA, 2018

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Executive summary

In 2018, 3 761 febrile rash cases were recorded via active national surveillance in South Africa, of which 69 (1.8%) were laboratory-confirmed measles cases and 1 228 (32.7%) were laboratory-confirmed rubella cases. KwaZulu-Natal, Gauteng and the Western Cape provinces had the highest burden of measles and rubella cases. Notably, a 7-month-old infant with confirmed measles died in KwaZulu-Natal Province. While the national measles incidence rate decreased from 3.7 per million in 2017 to 1.2 per million in 2018, this figure still exceeds the African pre-elimination goal of <1 per million. Nevertheless, only one province failed to meet the national measles surveillance target of at least two suspected rash cases per 100 000 population. In general, the national surveillance system affirmed its capability to detect a measles cluster and respond rapidly. Improvements in surveillance and vaccine coverage by government and community participation are necessary to prevent further deaths attributed to measles.

Introduction

Measles is a highly contagious viral infection of the *Morbillivirus* genus.[1] Symptoms usually develop 10 to 12 days after exposure and last 7 to 10 days. The first sign of measles is usually a high fever, often greater than 38°C, followed by cough, coryza and/or conjunctivitis (the 3 Cs) as well as a generalized non-vesicular maculopapular rash. Koplik spots are pathognomonic for measles. Mild to serious complications can occur during acute infection and may include diarrhoea, otitis media, pneumonia, encephalitis and death. Children aged less than 5 years have the highest risk for serious complications. Moreover, measles can cause increased susceptibility to other opportunistic infections by suppressing the immune system for up to three years post-infection.[2,3]

Rubella (German measles) is a mild infection caused by the *Rubella* virus. A maculopapular rash may start 14 to 17 days after exposure and last for three days. Unlike measles, complications of rubella are rare and generally occur more often in adults than in children. The most serious complication of rubella infection is congenital rubella syndrome (CRS), when infection occurs during the first trimester of pregnancy. This can result in foetal death or severe congenital defects such as sensorineural deafness, eye abnormalities (retinopathy, cataract, glaucoma and microphthalmia), congenital heart disease (pulmonary artery stenosis and patent ductus arteriosus) and mental retardation in as many as 85% of infected infants. In 2010, it was estimated that there were more than 100 000 infants born with CRS globally.[4]

Measles and rubella are preventable through vaccination. In South Africa, the measles vaccine is available in single (MeasBio®) or in combination format, such as measles-mumps-rubella (MMR, Trimovax® or Priorix®) or measles-mumps-rubella-varicella (MMRV, Priorix Tetra®). Currently, the South African Expanded Programme of Immunisation (EPI-SA) offers Measbio® to the public health sector at 6 months and 12 months of age; however, the rubella vaccine has never been part of the EPI-SA schedule. The private health sector offers Trimovax® or Priorix® at 15 months and 6 years of age. The measles vaccine is highly effective and almost all individuals who receive two doses are protected.[5] Moreover, measles vaccine coverage of 95% or higher can prevent disease spread by inducing herd immunity.[6] Consequently, measles mortality in Africa declined by 85% between 2000 and 2015, making the measles vaccine one

of the most successful public health interventions ever undertaken.[7] Waning vaccine coverage over the past few years and increased vaccine hesitancy have, however, eroded these gains.[8,9] World Health Organisation (WHO) reports that coverage in sub-Saharan Africa has stagnated at 72%, and estimates 60% for second-dose measles vaccine in South Africa.[10] Measles outbreaks over the last two decades in South Africa[11-13] have enabled identification of pockets of vaccine-hesitant communities, as well as areas that have fewer than the two recommended doses of measles vaccine, thus giving rise to large coverage gaps amongst children and adults. Measles 2nd dose administrative coverage declined in 2018 compared to 2017 (76.4% vs. 83.6%, respectively) and was below the national target of 87%.[14]

This report summarises the results of the South African measles and rubella surveillance programme for the period 1 January to 31 December, 2018.

Methods

As measles is a category 1 Notifiable Medical Condition (NMC) in South Africa, all healthcare workers in the public and private health sectors are required to report any suspected measles case to the National Department of Health (NDoH) within 24 hours. Additionally, all suspected cases must have a blood sample taken for confirmatory testing at the Centre for Vaccines and Immunology, National Institute for Communicable Diseases (NICD). Private laboratories that test for measles are requested to send all positive measles samples to the NICD for confirmatory testing and inclusion in the national database.

Unlike measles, other public and private laboratories test for rubella IgM antibodies for diagnostic purposes and positive samples do not require confirmatory testing at the NICD. Thus, the rubella surveillance data presented here are from samples tested at the NICD only.

Sample collection and laboratory testing

All serum samples were tested using commercial enzyme-linked immunosorbent assay (ELISA) kits for measles and rubella specific IgM antibodies (Euroimmun, Luebeck, Germany) according to the manufacturer's instructions. A second sample was requested for repeat testing on all those with measles IgM equivocal result. Sera that tested positive and/or equivocal for measles IgM were assayed for the presence of measles virus by real-time

reverse transcription (RT)-PCR amplification and, where possible, selected for measles genotyping. Of note, sera are suboptimal samples for measles detection by RT-PCR. Throat swabs should ideally be sent but these are not routinely requested.

Based on the measles serology and/or PCR result, each suspected case was provisionally classified as measles IgM positive, measles PCR positive, measles compatible, or epidemiologically linked. Each case was thereafter classified as either discarded, compatible or confirmed (Table 1) at bi-monthly meetings with representation from the NICD, NDoH and WHO.

Table 1. Final classifications for laboratory-confirmed measles cases in South Africa.

Final measles classification	Comment
1. Discarded	Case did not meet the clinical or laboratory definition (IgM –ve, vaccine associated, or had vaccine strain present)
2. Compatible	Case met the clinical case definition, was not epidemiologically linked, but no blood specimen was received, or blood specimen was equivocal
3. Confirmed	Case met the clinical case definition and was laboratory-confirmed (IgM +ve and/or PCR +ve and/or epidemiologically-linked)

IgM: Immunoglobulin M; PCR: polymerase chain reaction; +ve: positive; -ve: negative

Congenital rubella syndrome (CRS) surveillance

CRS sentinel-site surveillance was established in 2015 at 28 clinical sites and 6 laboratories.[15] Paediatricians, neonatologists, paediatric infectious disease specialists and the virology departments of the National Health Laboratory Service (NHLS) are requested to share information on any lab-confirmed CRS cases. The CRS case definition includes any positive rubella result in patients aged ≤12 months who present with cataract, congenital glaucoma, congenital heart disease, hearing impairment, pigmentary retinopathy, purpura, hepatosplenomegaly, jaundice, microcephaly, developmental delay, meningoencephalitis, or radiolucent bone disease.[16]

New notifiable medical conditions (NMC) system

In November 2017, a web- and mobile-based NMC notification (app) system was launched to provide for the collection, collation, analysis, interpretation and dissemination of health/disease surveillance information in South Africa.[17] For this report, any NMC cases notified without samples received for confirmatory testing were not included in the analysis until the new web/mobile-based NMC tool was fully integrated and operational within all provinces.

Data analysis

Descriptive analyses were performed using Excel 2016. Results were reported as frequencies for categorical variables or as median values with ranges for continuous variables.

Results

Measles and rubella

Based on the date of rash onset or date of sample collection, 3 761 febrile rash-based samples were received between 1 January to 31 December, 2018 (Figure 1). A total of 3 710 (98.6%) samples was tested for measles and rubella IgM antibodies, whilst the remaining 51 (1.4%) were rejected due to insufficient sample volume or inappropriate sample type (e.g. cerebrospinal fluid, urine or only a throat swab). For measles, 77 (2.1%) were IgM positive, 92 (2.5%) were IgM equivocal and 3 541 (95.4%) were IgM negative. For rubella, 1 228 (33.1%) were IgM positive, 284 (7.7%) were IgM equivocal and 2 198 (59.2%) were IgM negative. Of note, 40 (1.1%) samples were dual positive for measles and rubella IgM antibodies. Of the IgM-positive (n=77) and PCR-positive (n=3) measles cases (n=80), 69 were classified as confirmed measles, 1 was denotified and 10 were discarded. Of the confirmed measles cases, 53% (37 of 69) were dual infected with rubella.

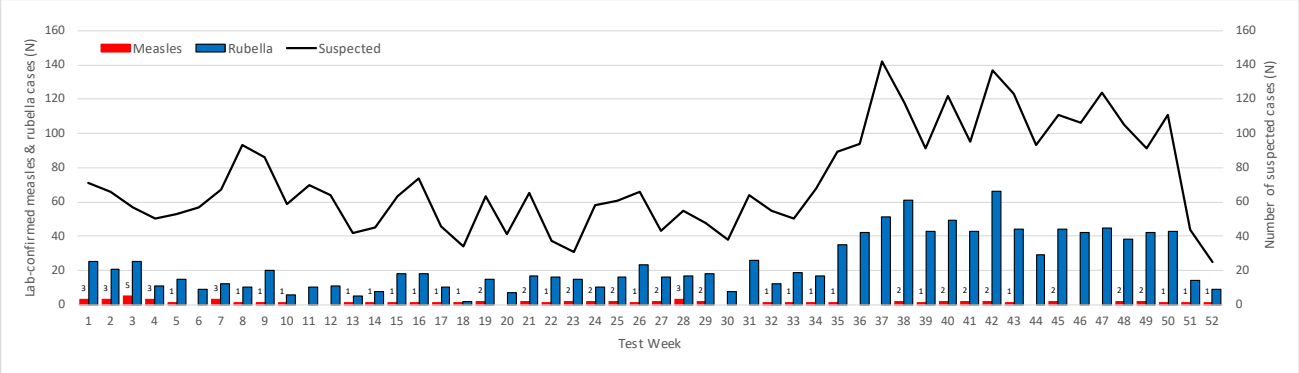

Figure 1. The number of suspected cases (n=3 761) from febrile rash surveillance in South Africa with corresponding laboratory-confirmed measles (n=69) and rubella cases (n=1 228) for the period 1 January to 31 December, 2018.

Laboratory-confirmed measles cases occurred throughout the year, but not in every week, in all nine of South Africa's provinces (Figure 2). KwaZulu-Natal (n=23), Gauteng (n=14) and the Western Cape (n=8) provinces had the highest measles burden (33.3%, 20.6% and 11.8%, respectively). Nationally, laboratory-confirmed measles cases occurred equally in males and females (47.8% vs. 50.7%, respectively). Cases occurred predominantly in the 1-4 year old age group, accounting for 44.9% of the total measles cases (Figure 3A). When stratifying according to age group population figures as defined by Statistics South Africa[18], the 0-4 year old age group had the highest measles incidence rate compared to the other age groups (Table 2). However, when comparing age distribution of lab-confirmed measles cases without rubella infection (Figure 3B), the 20-44 year old age group had the highest burden. Although hospitalization admission for measles was infrequent (9 of 68, 13.0%), only one death occurred, in a 7-month-old male.

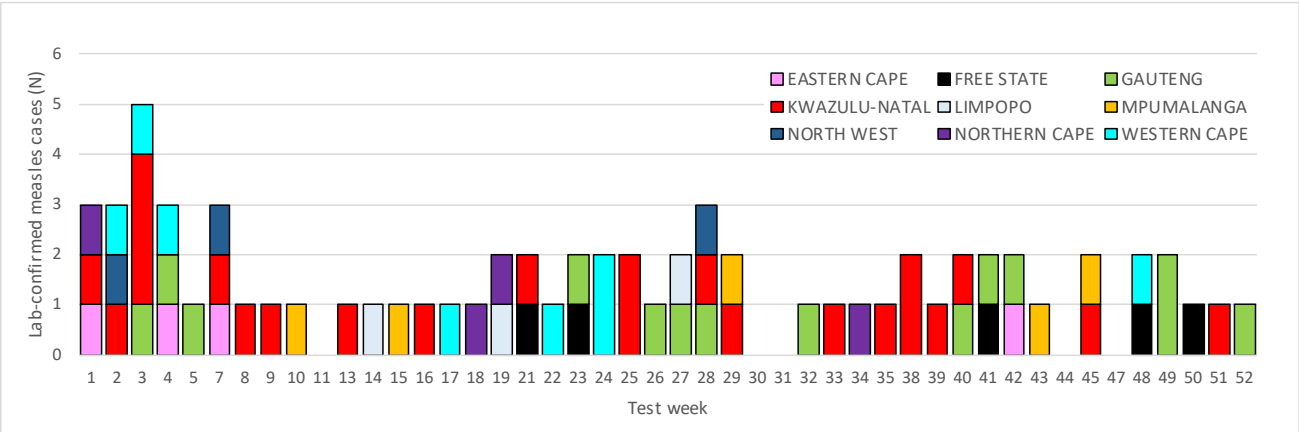

Figure 2. Epidemic curve showing provincial distribution of laboratory-confirmed measles cases in South Africa for the period 1 January to 31 December, 2018 (n=69).

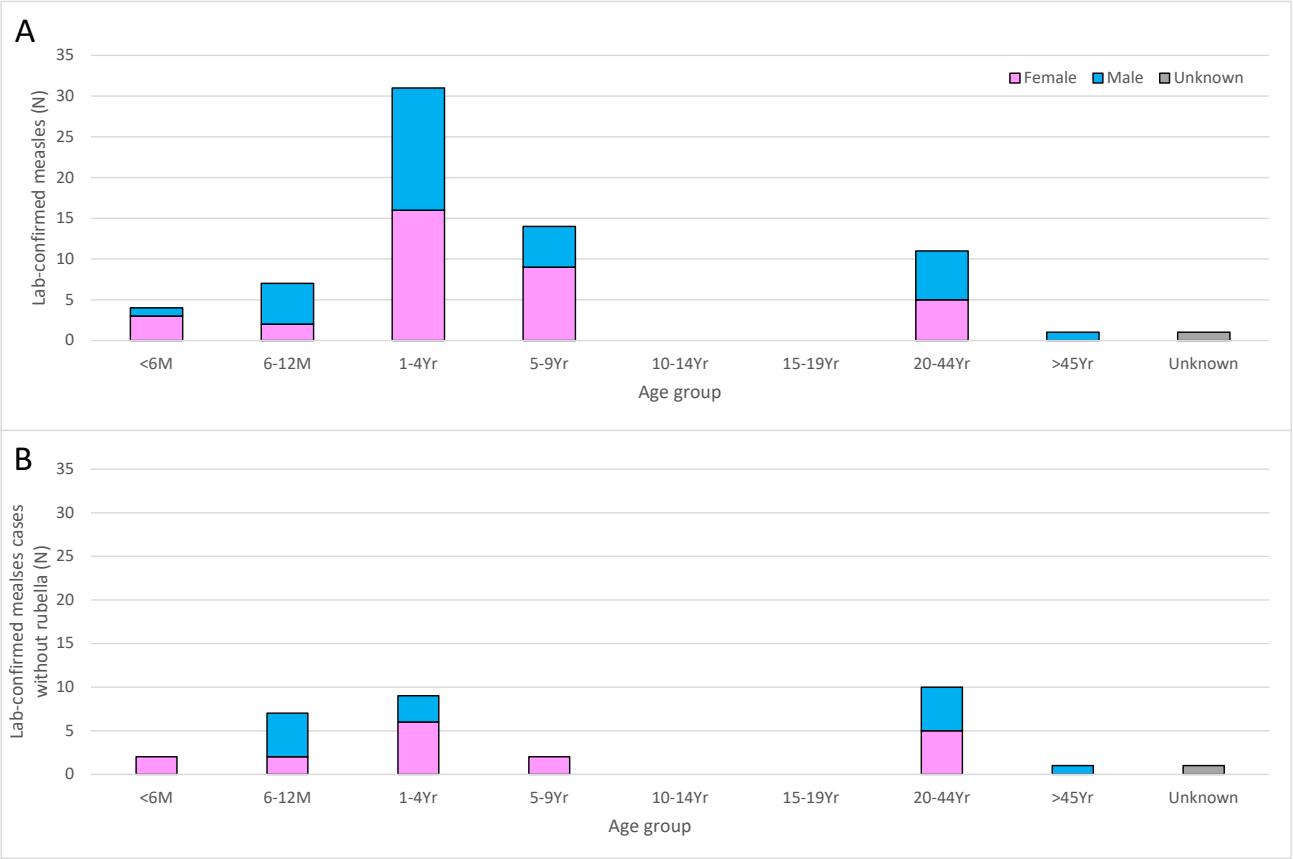

Figure 3A. Age and gender distribution of laboratory-confirmed measles cases (n=69; males n=33; females n=35; unknown n=1) in South Africa for the period 1 January to 31 December, 2018.

Figure 3B. Age distribution of laboratory-confirmed measles cases after exclusion of dual rubella positive cases (n=32).

Of the measles IgM-equivocal cases (n=92), 21 met the clinical case definition and were classified as compatible. Compatible measles cases were mostly identified in the KwaZulu-Natal (n=9, 42%) and the Eastern Cape provinces (n=6, 28.6%), and were predominantly in the 1-4 year old age group (data not shown). Additionally, 9 (42.8%) of the compatible measles cases were also positive for rubella IgM antibodies, suggesting that despite best efforts to classify the measles equivocal cases, a proportion were likely not true measles, although that possibility cannot be excluded. Other concomitant rash illnesses may cause elevated IgM antibody levels leading to false positive measles serology.

Table 2. Laboratory-confirmed measles and rubella incidence rate per million by age group in South Africa for the period 1 January to 31 December, 2018.

Age group (years)	Confirmed rubella cases	Confirmed Measles cases	Total population per age group	Confirmed rubella case incidence per 1 000 000	Confirmed measles case incidence per 1 000 000
0 – 4	519	42	5 928 951	87.54	7.08
5 – 9	568	14	5 862 081	96.89	2.39
10 – 14	74	-	5 252 485	14.09	-
15 – 19	15	-	4 733 790	3.17	-
20 – 44	25	11	23 681 677	1.06	0.46
> 45	2	1	12 266 622	0.16	0.08
unknown	25	1	-	-	-
Total	1 228	69	57 725 606	21.27	1.20

Total population figures by age group are 2018 mid-year population estimates supplied by Statistics South Africa[18].

Of 3 710 serum samples tested, 33.1% were laboratory-confirmed rubella cases, with KwaZulu-Natal (43.2%) and the Eastern Cape (21.2%) provinces having the highest burden of disease (Figure 4). Rubella was similarly distributed amongst males (n=612, 49.8%) and females (n=579, 47.1%) and was predominant in the 1-4 and 5-9 year old age groups (Figure 5). Notably, females aged between 15-44 years comprised only 1.95% of the total rubella cases.

Regarding surveillance indicators (Table 3) of the laboratory-confirmed measles cases who were rubella negative, 68.8% had a case investigation form (CIF), 59.4% had a unique epidemiological (EPID) number, 46.9% had both a CIF and EPID, and measles vaccination status was recorded in 34.4%. Importantly, 6.3% were infants too young to have received their first measles vaccine (i.e. <6 months of age). Moreover, when comparing measles vaccine doses, only 54.5% of the measles-confirmed cases had received the recommended two doses as compared to 82.6% in the dual measles and rubella cases, 89.2% in the rubella cases, and 80.0% in the discarded (M-R-) cases. This suggests that people with measles infection were less likely to have been vaccinated.

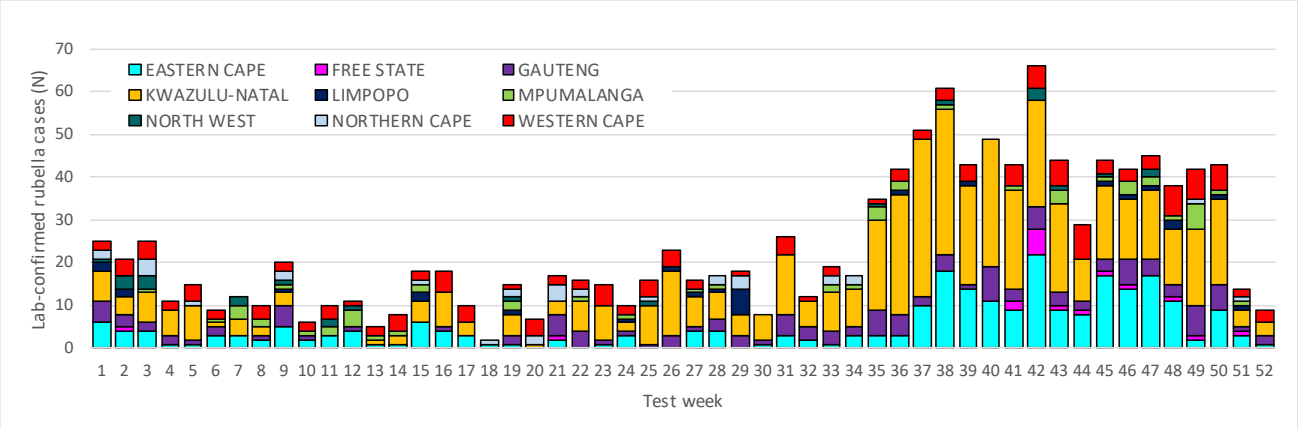

Figure 4. Epidemic curve showing provincial distribution of laboratory-confirmed rubella cases in South Africa for the period 1 January to 31 December, 2018 (n=1 228).

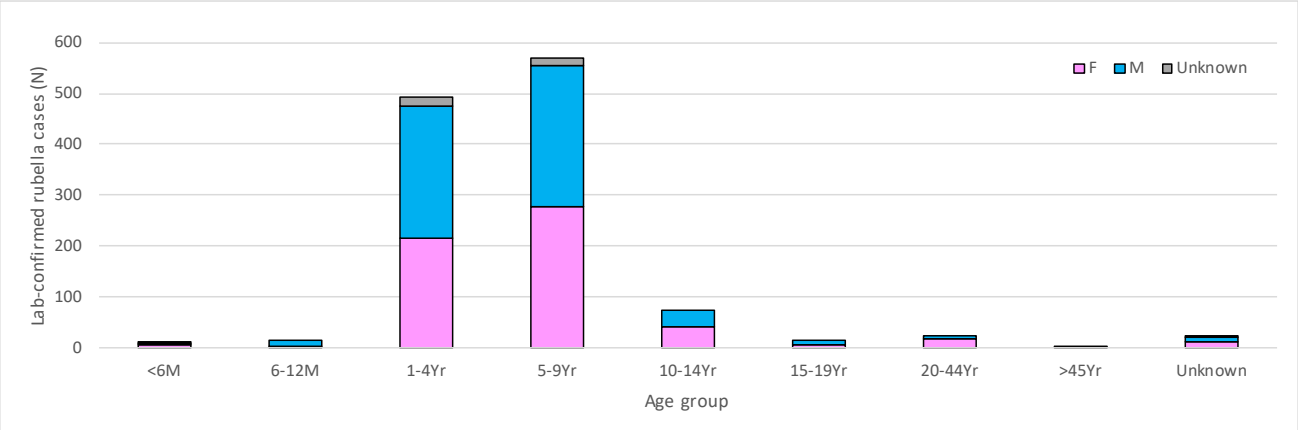

Figure 5: Age and gender distribution of laboratory-confirmed rubella cases in South Africa for the period 1 January to 31 December, 2018 (males, n=612; females, n=579; unknown, n=37).

Table 3. Surveillance indicators for laboratory-confirmed measles (n=32), laboratory-confirmed dual measles and rubella (n=37), laboratory-confirmed rubella (n=1 191), and discarded cases (n=2 451) in South Africa for the period 1 January to 31 December, 2018.

Category	Laboratory-confirmed measles (M+R-) n=32	Laboratory-confirmed dual measles & rubella (M+R+) n=37	Laboratory-confirmed rubella (M-R+) n=1 191	Discarded (M-R-) n=2 451
Case investigation form (CIF)	22 (68.8%)	25 (67.6%)	830 (69.7%)	1 171 (47.8%)
Epidemiological (EPID) number	19 (59.4%)	27 (73.0%)	717 (60.2%)	1 620 (66.1%)
Cases with a CIF & EPID number	15 (46.9%)	22 (59.5%)	608 (51.0%)	913 (37.3%)
Measles vaccination status				
Too young (<6months)	2 (6.3%)	2 (5.4%)	9 (0.8%)	102 (4.2%)
Blank	18 (56.3%)	11 (29.7%)	600 (50.4%)	1568 (64.0%)
No	1 (3.1%)	1 (2.7%)	0 -	0 -
Yes	11 (34.4%)	23 (62.2%)	582 (48.9%)	781 (31.9%)
Measles vaccine doses				
1	3 (27.3%)	1 (4.3%)	36 (6.2%)	124 (15.9%)
2 or more	6 (54.5%)	19 (82.6%)	519 (89.2%)	625 (80.0%)
Dosage unknown	2 (18.2%)	3 (13.0%)	27 (4.6%)	32 (4.1%)

Note: M+R- denotes laboratory-confirmed measles alone; M+R+ denotes laboratory-confirmed dual infection with measles and rubella; M-R+ denotes laboratory-confirmed rubella alone; and M-R- denotes all discarded cases IgM negative for measles and rubella, measles IgM-equivocal cases not meeting the case definition, as well as the small number of compatible cases (n=12).

Measles genotyping and cluster detection

A total of 73 specimens (1 throat swab and 72 sera) was tested using RT-PCR. Only 12 (16.4%) were positive for the presence of measles virus, of which 2 were genotyped (one D8 and one B3 genotype). Similarly, during the 2017 outbreak,[11] a D8 genotype wild-type measles virus had been detected. It is possible that the D8 measles strain identified in the sample collected in January 2018 from the Western Cape Province was related to the Western Cape D8 cluster identified in 2017.

Of interest, the case with the B3 genotype was the second case detected at a health facility situated in the City of Tshwane, Gauteng Province. After thorough investigation, the 33-year-old female was epidemiologically linked to another laboratory-confirmed (IgM positive) measles case. The index case was a 42-year-old male who had recently travelled to Mecca, Saudi Arabia and, upon return to South Africa, was admitted into intensive care at a hospital in the City of Tshwane. A few days later, a third measles case was confirmed in a 39-year-old female who had also visited the same health facility. Importantly, all three cases were unvaccinated. While these cases met the measles outbreak definition of three confirmed cases within one district within one month, they were defined as an epidemiologically-linked measles cluster. This cluster was detected through routine measles surveillance and, after prompt detection and notification, 35 case contacts and 15 hospital staff (14 nurses and 1 doctor) were vaccinated. Infection prevention and control at the health facility was reinforced and no further cases were reported.

Congenital rubella syndrome (CRS) surveillance

In 2018, responses to monthly e-mails sent to clinicians at study sites varied from 22% to 37%. Overall, there were five laboratory-confirmed cases of CRS from four provinces (Figure 6), lower than the number reported in 2017 (n=8). Gender incidence was 40% male and 60% female. Congenital heart disease (80%) and microcephaly (60%) were the most common complications reported in infants with CRS. Four (80%) mothers of CRS infants tested rubella IgM seropositive, their median age being 25 years (range: 16 - 32 years) with a median parity of 2 (range: 1 - 3).

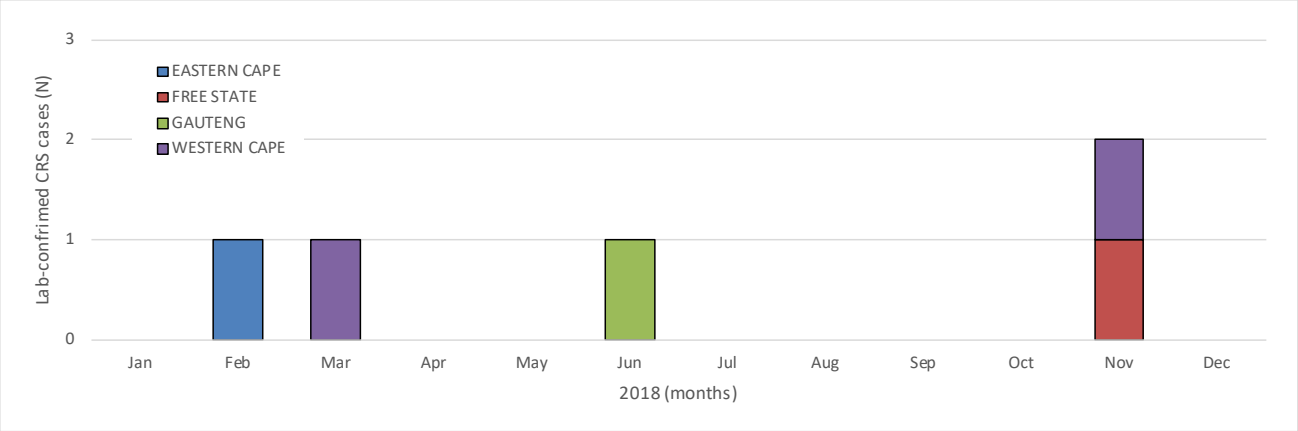

Figure 6. Provincial distribution of laboratory-confirmed congenital rubella syndrome (CRS) cases in South Africa for the period 1 January to 31 December, 2018 (n=5).

Field and laboratory surveillance indicators for suspected rash cases

In 2018, the national detection rate for non-measles and non-rubella febrile rash illness was 4.25 per 100 000 population, and the confirmed measles case incidence rate was 1.18 per million population (Table 4). This is an improvement compared to 2017 figures where the national measles incidence rate was 3.7 per million in 2017.[11] Given that the national target for non-measles and non-rubella febrile rash illness is >2 per 100 000 population, all provinces except Limpopo exceeded this target. As the measles pre-elimination target is <1 confirmed case per million, only three provinces met this target, with Northern Cape Province having the worst rate at 2.45 cases per million.

Of the 3 710 samples tested, results for 3 694 (99.6%) were reported within seven days of receipt in the laboratory, exceeding the target of 80%, with 3 280 (88.4%) results reported within three days. Only 1 693 (45.6%) samples were, however, received within three days, of which the longest sample delivery time was 163 days, indicating substantial logistical difficulties.

Table 4. Field surveillance adequacy and the confirmed measles case rate by province, South Africa, for the period January – December, 2018.

Province	Non-measles & non-rubella febrile rash illness cases	Confirmed measles cases	Total population	Non-measles & non-rubella febrile rash illness rate per 100 000 population (WHO target >2:100 000)	Confirmed measles case incidence rate per 1 000 000 population (WHO target <1:1 000 000)
Eastern Cape	275	4	6 522 700	4.22	0.61
Free State	83	5	2 954 300	2.81	1.69
Gauteng	636	14	14 717 000	4.32	0.95
KwaZulu-Natal	485	23	11 384 700	4.26	2.02
Limpopo	107	3	5 797 300	1.85	0.52
Mpumalanga	252	5	4 523 900	5.57	1.11
Northern Cape	155	4	1 225 600	12.65	2.45
North West	128	3	3 979 000	3.22	1.01
Western Cape	330	8	6 621 100	4.98	1.21
South Africa	2 451	69	57 725 600	4.25	1.20

Population estimates obtained from Statistics South Africa mid-year population estimates, 2018.[18] For non-measles, febrile rash illness rate per 100 000, green indicates good performance by meeting the WHO surveillance target and red indicates poor performance i.e. not meeting the surveillance target. For confirmed measles incidence rate per 1 000 000, green indicates good performance below the pre-elimination goal and red indicates poor performance.

Regional reference laboratory function

A total of 462 serum samples was received from national laboratories of other countries in southern Africa. These were retested for measles and rubella IgM as part of WHO quality control. Mauritius experienced a large measles outbreak and sent 19 throat swab specimens for genotyping. All were found to be genotype D8 and were closely related to a strain circulating in India.

Discussion

Of 69 confirmed measles cases in South Africa, there were 9 hospital admissions and one death (7-month-old infant). An imported measles case from Saudi Arabia led to a cluster of cases that were promptly identified and successfully contained. Other measles cases occurred sporadically throughout the year, highlighting the endemicity of measles in South Africa and suggesting that cases are under-reported. Overall, there was a 3-fold decrease in the national measles incidence rate in 2018 compared to 2017. The 2018 measles cases largely presented in the 0-4-year-old group (31 of 69, 44.9%) as compared to the 2017 measles cases where the 20-44-year-old age group had the highest numbers (73 of 210, 34.8%). Changes in age distribution may be due to absence of an outbreak in 2018.

The rubella incidence rate decreased from 4.4 per 100 000 in 2017 to 2.1 per 100 000 in 2018. This reduction may be indicative of reduced surveillance in the absence of a measles outbreak rather than a general reduction of circulating rubella. Despite the fact that rubella was predominant in the younger age groups, 2% of the laboratory-confirmed rubella cases were females aged between 15 to 44 years old, suggesting an immunity gap. This immunity gap is relevant to plans for the future introduction of the rubella vaccine into the SA-EPI. Suboptimal vaccine introduction (e.g. vaccinating girls only, vaccinating infants only, having poor vaccine coverage and/or not having a vaccine catch-up campaign) may increase the proportion of non-immune females of childbearing age by decreasing the burden of circulating rubella in children, and shifting the age distribution upwards leading to increased CRS incidence. In 2018, through sentinel-site surveillance, five infants were diagnosed with CRS. There are, however, no 2018 data on national incidence of CRS outside of sentinel sites.

It is important to note that after reviewing and classifying the 2018 measles and rubella data independently and then reviewing them in tandem, many of the lab-confirmed measles cases had dual infection. Given that rubella is endemic in South Africa and there is no rubella vaccine in the current national EPI, it is possible for dual measles and rubella infections to occur. However, we speculate that rubella infections, which cause elevated IgM antibody levels, can lead to false-positive measles serology. In measles elimination settings where evaluation and interpretation of measles diagnostic results can be complex, it is better to err on the side of

'false positives' rather than 'false negatives'. For this review, we therefore included laboratory-confirmed dual measles and rubella cases as part of the total measles cases.

Using the 2018 surveillance indicators, areas of surveillance evidently need improvement. These include sample delivery time, CIF completion, EPID number allocation and follow-up investigation reports. Nevertheless, despite low estimated immunization coverage, there were only sporadic cases and one small cluster, suggesting that herd immunity was sufficient to contain transmission. Herd immunity may be high due to routine coverage, previous measles outbreaks[11,13] and/or the 2017 supplementary immunisation activities.

Conclusion

In general, the national surveillance system affirmed its capability to detect a measles cluster and respond rapidly. As the African measles 2020 elimination goal nears, it seems unlikely that measles elimination is feasible in South Africa within this short time frame. A new target date will need to be set. Improvements in surveillance and vaccine coverage by government and community participation are necessary to prevent further deaths attributed to measles.

Acknowledgements

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LABORATORY-BASED HEPATITIS B SURVEILLANCE IN SOUTH AFRICA, 2018

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Executive summary

In order to assess the burden of laboratory-confirmed hepatitis B infection in the public sector in South Africa in 2018, data were extracted from the National Health Laboratory Service (NHLS) Central Data Warehouse (CDW) and analysed. For the period 01 January 2018 to 31 December 2018, 36 614 cases tested positive for HBsAg out of 553 827 cases tested, giving a positivity rate of 6.6%. There were 1 076 acute hepatitis B infections ((anti-HB core IgM (HBcIgM) positive) identified. Gender distribution showed that despite higher testing rates in females, the number of HBsAg-positive males was substantially higher per 100 000 population. The number of acute infections (HBcIgM positives) was similar between males and females. In terms of age distribution, persons over 24 years of age would not have been eligible for the vaccination programme, and the bulk of HBsAg-positive cases occurred in persons between 25 and 49 years old. The bulk of acute cases was detected in persons aged 20 to 49 years. There were, however, 167 HBsAg-positive cases detected amongst children aged 0 to 1, showing that infants are still at risk of infection, as is the 50+ age group, which accounted for 6.6% of acute cases. The low detection rate in the 2 to 24 year age group may

reflect vaccination efficacy. In terms of geographical distribution, hepatitis B incidence tends to mirror population density, with the highest proportions of HBsAg and HBcIgM-positive cases detected in Gauteng Province (36.5% and 36.8% respectively). Epidemic curves for each province showed peaks in the number of acute cases at particular times during 2018. These varied by province and district. It is concluded that increased vaccination coverage in infants using the current schedule is critical to hepatitis B prevention, as well as heightened awareness of transmission routes and prevention measures in adult population groups.

Introduction

Hepatitis B is a potentially life-threatening viral infection of the liver. Infection with hepatitis B may lead to acute or chronic disease. Chronic hepatitis B places people at high risk of cirrhosis and liver cancer, particularly hepatocellular carcinoma. According to World Health Organization (WHO) estimates for 2015, 257 million people (3.5% of the world's population) were living with chronic hepatitis B globally, with the African and Western Pacific regions accounting for 68% of those infected.[1] There were 887 000 deaths due to hepatitis B in 2015.[2]

Hepatitis B virus is transmitted through contact with the blood or other body fluids of an infected person, including sexual transmission. Vertical mother-to-child transmission also occurs. Hepatitis B virus can survive in the external environment for at least seven days and is still infective during this time.[2] Its incubation period varies from 30 to 180 days, averaging 75 days. Following infection, the virus can be detected in the blood within 30 to 60 days.

Acute hepatitis B infection occurs within the first six months following exposure to the virus. The majority of hepatitis B infections are asymptomatic during the acute phase, although some people experience symptoms that may last several weeks. Symptoms include jaundice, abdominal pain, fatigue, nausea and vomiting. Infants infected from their mothers or before the age of 5 years are less likely to show symptoms, but have a higher risk of developing chronic infection. In adulthood, less than 5% of infections lead to chronic hepatitis.[3]

South Africa introduced the hepatitis B vaccine into the expanded programme on immunisation in April 1995, administered as a monovalent dose at 6, 10 and 14 weeks of age. Studies conducted post-implementation have shown the schedule to be highly effective.[4]

Hepatitis B vaccine is currently part of the hexavalent vaccine (DTaP-IPV-HIB-HepB) used in South Africa since December 2015, administered at ages 6, 10 and 14 weeks (primary vaccination series) and 18 months (booster dose). The primary vaccination series induces protective antibody levels in >95% of individuals and may provide lifelong immunity.[2] Although the WHO recommends a birth dose of the vaccine to combat vertical transmission,[5] South Africa has yet to implement this regimen. Prior to vaccination, horizontal rather than vertical transmission accounted for most infections in children under 5 years of age.[4,6] In South Africa, vaccination coverage with three doses of hepatitis B vaccine averaged 85.9% for the period 2012 to 2017, ranging from 82.3% to 89.8%.[7] Provincial coverage data from 2012 to 2017 showed that Gauteng Province exceeded its target with the highest average at 104.5%, and Limpopo Province had the lowest average at 73.5%.[7]

Disease diagnosis requires laboratory confirmation by detection of hepatitis B surface antigen (HBsAg). The persistence of HBsAg for more than 6 months indicates chronic infection.[2] Acute hepatitis B infection is defined by the presence of high levels of IgM antibody against the core antigen (HBcIgM). Low-level HBcIgM positives can be seen in reactivation of hepatitis B infection or flares amongst chronic hepatitis B cases.[8,9] Interpretation of results and relevant comments on HBsAg and HBcIgM markers is given in Table 1.

The burden of laboratory-confirmed hepatitis B infection in the public sector in South Africa for 2018 is reported here.

Table 1. Interpretation of hepatitis B markers used for laboratory analysis and disease diagnosis.

Hepatitis B Marker	Result	Interpretation	Comments
Hepatitis B surface antigen (HBsAg)	Negative	Not infected	Screening marker of infection. Considered as chronic if HBsAg persists for more than 6 months
	Positive	Infected	
Anti-hepatitis B core IgM (HBcIgM)	Negative	Absence of acute infection, reactivation or flare	Marker of acute infection or reactivation
	Low positive	Associated with reactivation / flare	
	High positive	Acutely infected	

Methods

Data on hepatitis B diagnostic testing for 2018 were extracted from the National Health Laboratory Service (NHLS) Central Data Warehouse (CDW), which represents over 80% of the public health sector. Data were analysed following cleaning and deduplication using Stata/IC (version 14.1, Texas, USA). Deduplication was performed to exclude repeat testing so that each case appeared once only. Samples tested for the purpose of quality control as well as those from project or clinical trials were excluded. The distribution of hepatitis B cases by gender, age group and province were analysed. 'Province of origin' assignment was based on the location of the testing facility.

Laboratory-confirmed HBsAg- and HBcIgM-positive cases for 2018 were collated. Case detection rates were determined by the number of positive cases as a proportion of the total tested. Population rates were determined as the number of cases per 100 000 population using provincial population figures for 2017.[10]

Throughout NHLS laboratories, there were five types of instrument with which hepatitis B testing was performed (Table 2). These instruments may over-report HBcIgM on low-positive results. A reliability threshold was therefore established for HBcIgM results for each instrument through consultation with the Virology Expert Committee of the NHLS (Table 2). For each testing facility, the instrument used was identified in order to apply the appropriate thresholds during data analysis. HBcIgM-positive cases with HBcIgM values below these thresholds were excluded from the analyses as low-positive values may represent reactivation or flares in chronic infections.[8,9]

Table 2. Virology Expert Committee (NHLS) recommended anti-hepatitis B core IgM (HBcIgM) detection thresholds based on instrument platform and positivity range.

Instrument platform	HBcIgM positive range (S/CO)*	Recommended threshold
Abbott Architect	1 to 50	20
Advia Centaur	1 to >9	≥9
Beckman DXI	1 to 24	5
Cobas	1 to 50	20
Liason	15 to 34	20

*S/CO = sample relative light units/cutoff relative light units

Results

For the period 01 January 2018 to 31 December 2018, 36 614 cases tested positive for HBsAg out of 553 827 cases tested for HBsAg, giving a positivity rate of 6.6%. There were 1 076 acute hepatitis B infections (HBcIgM positive) identified, and 1 175 cases that tested positive for HBcIgM but had values below the recommended threshold and were excluded.

Gender distribution of hepatitis B cases

Amongst the HBsAg positive cases, the number of infected males was higher than females (20 160 vs 15 911 respectively) (Table 3). The HBsAg detection rates per total tested (9.50% vs 4.80%) and per 100 000 population (73.0 vs 55.1) were also higher in males than females respectively (Table 3). The HBsAg testing rate per 100 000 population was, however, lower in males than females (770 vs 1150).

Of acute infections (HBcIgM positives), there were similar numbers of males and females (513 vs 548 respectively). The detection rate by total tested was 1.3% in males and 1.2% in females. The detection rate by population was 1.9/100 000 in both males and females. The HBcIgM testing rate per 100 000 population was higher in females than males (164 vs 138).

Table 3. Gender distribution of hepatitis B cases by surface antigen (HBsAg) and anti-hepatitis B core IgM (HBcIgM) detection, South Africa, 2018.

		Female	**Male**
Population		28901400	27620600
HBsAg	Total tested	332496	212954
	Positive cases	15911	20160
	Detection rate (positive cases/total tested)	4.80%	9.50%
	Detection rate (positive cases/100 000 population)	55.1/100 000	73.0/100 000
	Testing rate (total tested /100 000 population)	1150/100 000	770/100 000
HBcIgM	Total tested	47311	38166
	Positive cases	548	513
	Detection rate (positive cases /total tested)	1.20%	1.30%
	Detection rate (positive cases /100 000 population)	1.9/100 000	1.9/100 000
	Testing rate (total tested /100 000 population)	164/100 000	138/100 000

Age distribution of hepatitis B cases

The age group 30 to 34 years comprised the largest number of HBsAg positives cases (19.5%) (Table 4). The HBsAg detection rate by total tested was highest in age group 40 to 44 years (8.6%). The HBsAg detection rate by population was highest in the age group 35 to 39 years (159.6/100 000). The HBsAg testing rate per 100 000 population was highest in age group 35 to 39 years (1899/100 000).

The age group 25 to 29 years represented the highest number of acute HBcIgM positive cases (25.2%) (Table 4). The HBcIgM detection rate by total tested was highest in age group 20 to 24 years (2.6%), and the detection rate by population was highest in age group 25 to 29 years (4.9/100 000). The HBcIgM testing rate per 100 000 population was highest in age group 35 to 39 years (290/100 000).

On further analyses of the under 5 years age group, 167 HBsAg positive cases and 2 acute cases in the 0 to 1 year age group, and 51 HBsAg positive cases and 1 acute case in the 2 to 4 year age group, were identified. In individuals aged 5 to 24 years old (part of the vaccine-eligible age group), there were 2 892 HBsAg positive and 214 acute cases.

Table 4. Age distribution of hepatitis B cases by surface antigen (HBsAg) and anti-hepatitis B core IgM (HBcIgM) detection, South Africa, 2018.

HBsAg

Age Group (years)	Population	Total Tested	Positive cases	Detection rate (positive cases / total tested)	Testing rate (total tested / 100 000 population)	Detection rate (positive cases /100 000 population)
0-4	5866573	6597	218	3.3	112	3.7
5-9	5764576	4523	64	1.4	78	1.1
10-14	5093681	7450	118	1.6	146	2.3
15-19	4592001	21227	509	2.4	462	11.1
20-24	5031271	55450	2201	4	1102	43.7
25-29	5518305	85821	5579	6.5	1555	101.1
30-34	5253733	94599	7147	7.6	1801	136
35-39	4243537	80600	6772	8.4	1899	159.6
40-44	3392431	60071	5175	8.6	1771	152.5
45-49	2787590	43305	3383	7.8	1553	121.4
50-54	2376586	30018	2011	6.7	1263	84.6
55-59	2005845	21636	1239	5.7	1079	61.8
≥60	4595819	32223	1450	4.5	701	31.6

HBcIgM

Age Group (years)	Population	Total Tested	Positive cases	Detection rate (positive cases /total tested)	Testing rate (total tested/ 100 000 population)	Detection rate (positive cases /100 000 population)
0-4	5866573	1414	3	0.2	24	0.1
5-9	5764576	700	0	0	12	0
10-14	5093681	1043	2	0.2	20	0
15-19	4592001	2439	33	1.4	53	0.7
20-24	5031271	6928	179	2.6	138	3.6
25-29	5518305	11955	271	2.3	217	4.9
30-34	5253733	13715	233	1.7	261	4.4
35-39	4243537	12324	135	1.1	290	3.2
40-44	3392431	9617	66	0.7	283	1.9
45-49	2787590	7240	40	0.6	260	1.4
50-54	2376586	5373	20	0.4	226	0.8
55-59	2005845	4124	23	0.6	206	1.1
≥60	4595819	6911	28	0.4	150	0.6

Burden of hepatitis B by province

In 2018, Gauteng Province had the highest proportion of HBsAg positive cases at 13 360/36 614 (36.5%). The detection rate of HBsAg by total tested was highest in Mpumalanga Province (8.6%) (Figure 1). The HBsAg detection rate by population was highest in Gauteng Province (93.6/100 000) (Figure 2).

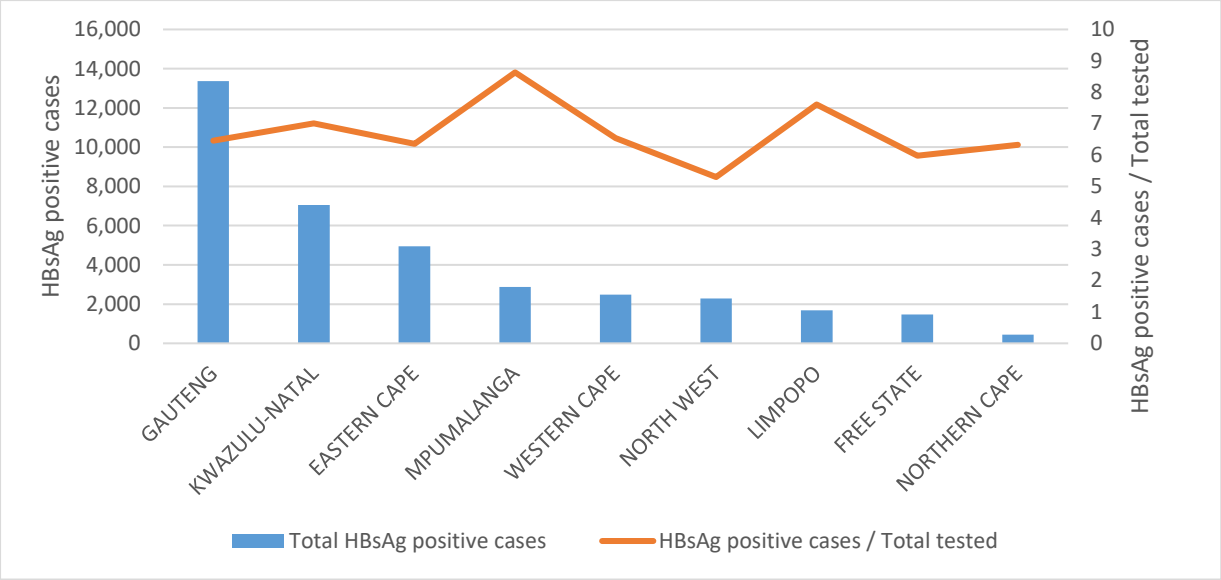

Figure 1. Detection rate of hepatitis B surface antigen (HBsAg) by total cases tested by province, South Africa, 2018.

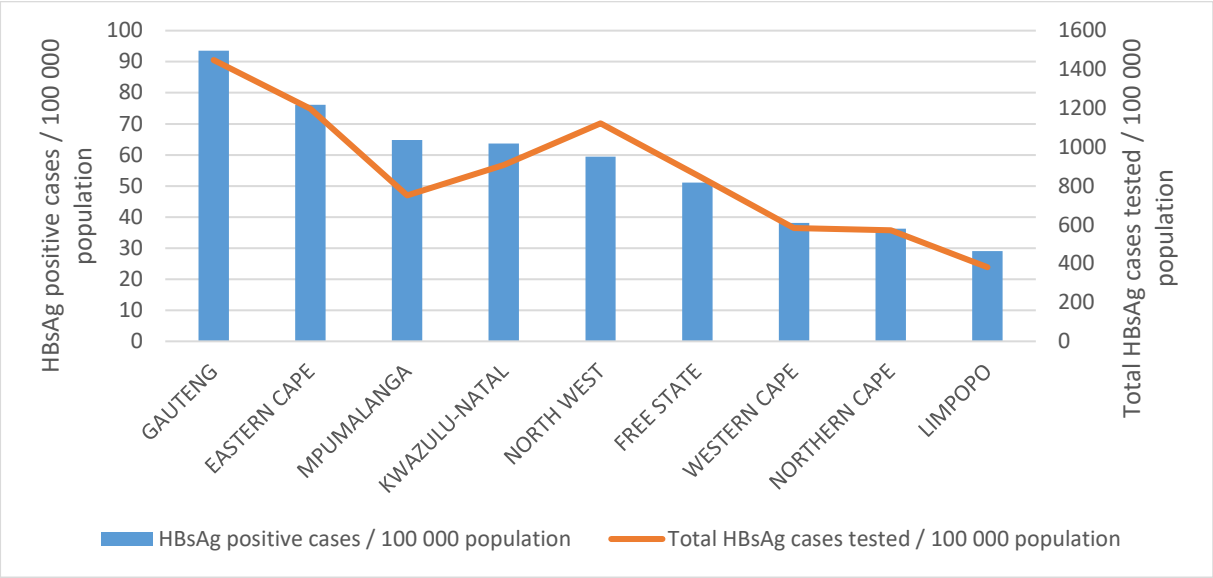

Figure 2. Detection rate of hepatitis B surface antigen (HBsAg) per 100 000 population by province, South Africa, 2018.

As with HBsAg positive cases, Gauteng Province had the highest number of acute (HBcIgM positives) cases at 36.7%. The detection rate of acute cases by total tested for HBcIgM was highest in Mpumalanga Province (2.8%) (Figure 3). The detection rate of acute cases by population was highest in Northern Cape Province (3.5/100 000) (Figure 4).

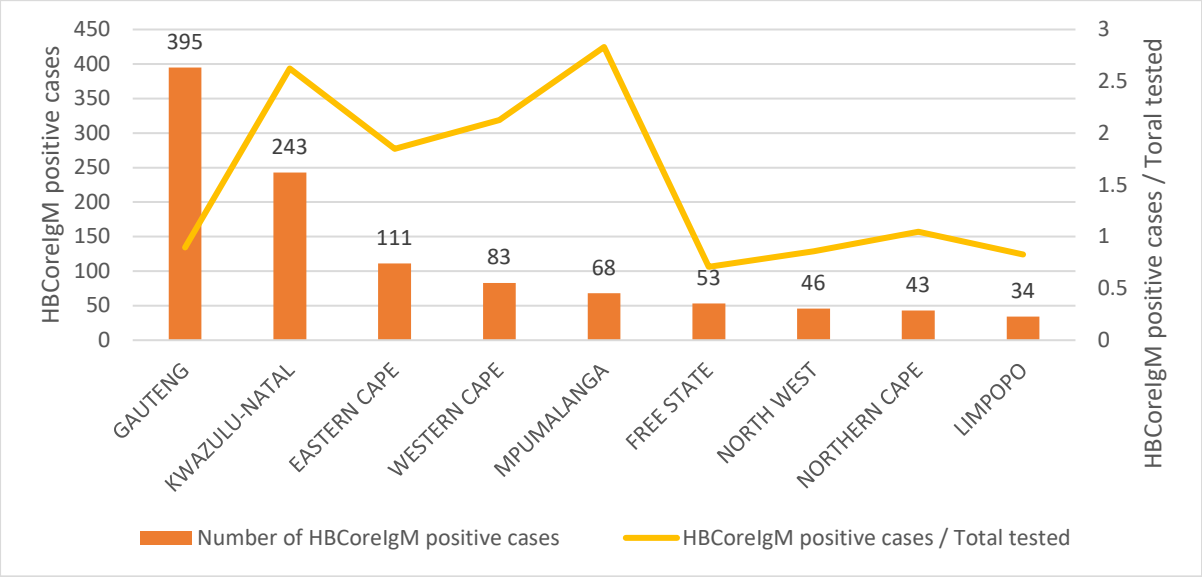

Figure 3. Detection rate of anti-hepatitis B core IgM (HBcIgM - acute cases) by total cases tested by province, South Africa, 2018.

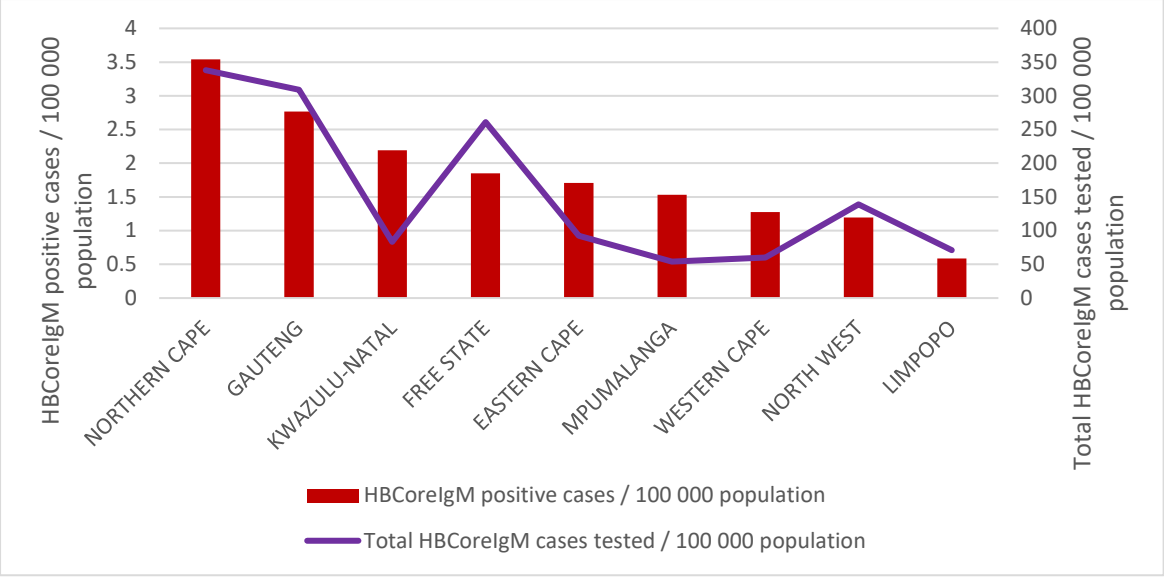

Figure 4. Detection rate of anti-hepatitis B core IgM (HBcIgM - acute cases) per 100 000 population by province, South Africa, 2018.

Epidemic curves of incidence of hepatitis B acute infections

Epidemic curves of acute cases (HBcIgM positives) were generated for each province and 2018 testing week (Figure 5). Peaks in cases were identified in Gauteng (weeks 4, 7, 41 and 45) and Kwazulu-Natal (weeks 10, 14 and 26) provinces. Lower peaks were observed in Eastern Cape, Mpumalanga and Western Cape provinces.

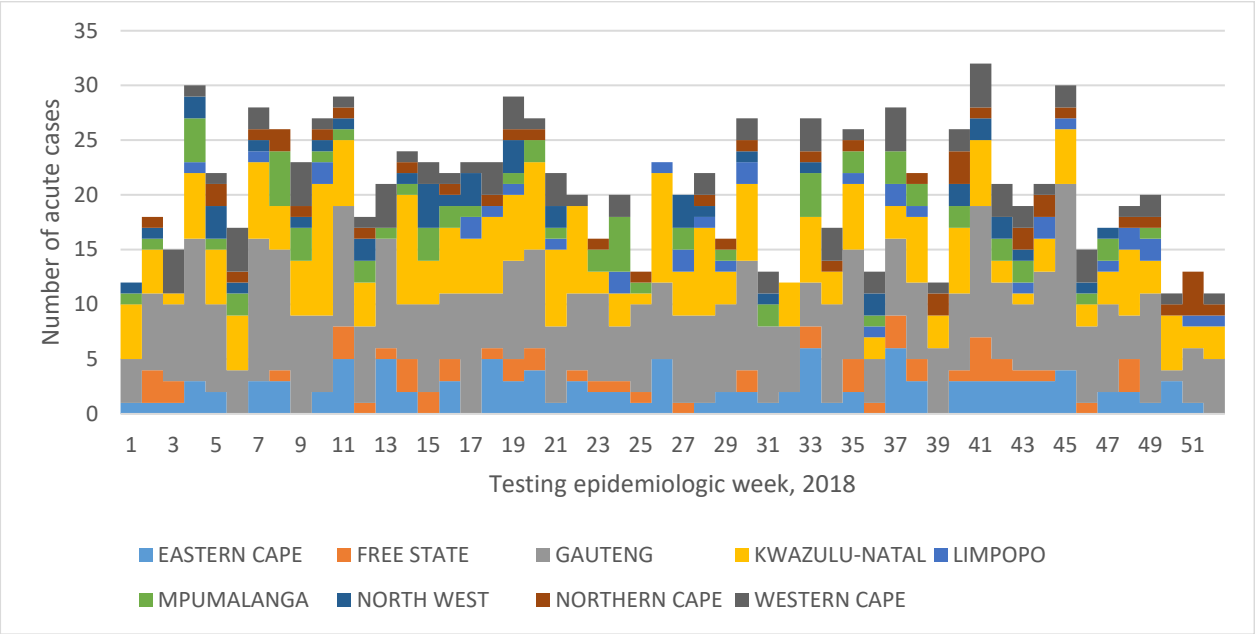

Figure 5. Epidemiological curve of acute hepatitis B cases (HBcIgM positive) by province, South Africa, 2018.

District level epidemiological curves were subsequently generated for Gauteng and Kwazulu-Natal, the provinces with the highest number of acute cases. In Gauteng Province, Johannesburg Metro and Ekurhuleni accounted for the majority of acute cases (32.4% and 26.5% respectively) (Figure 6). In Johannesburg Metro, peaks in acute cases were seen in weeks 4, 11, 28, 29, 34 and 35. In Ekurhuleni, peaks were observed in weeks 8, 17, 20, 45 and 49. An unusual incidence of 7 acute cases occurred in Tshwane in week 7. These were distributed between Tshwane regions 1, 3, 4 and 6. In Kwazulu-Natal Province, Ethekwini District accounted for 41.6% of acute cases, with peaks observed in weeks 10, 14, 21 and 30 (Figure 7).

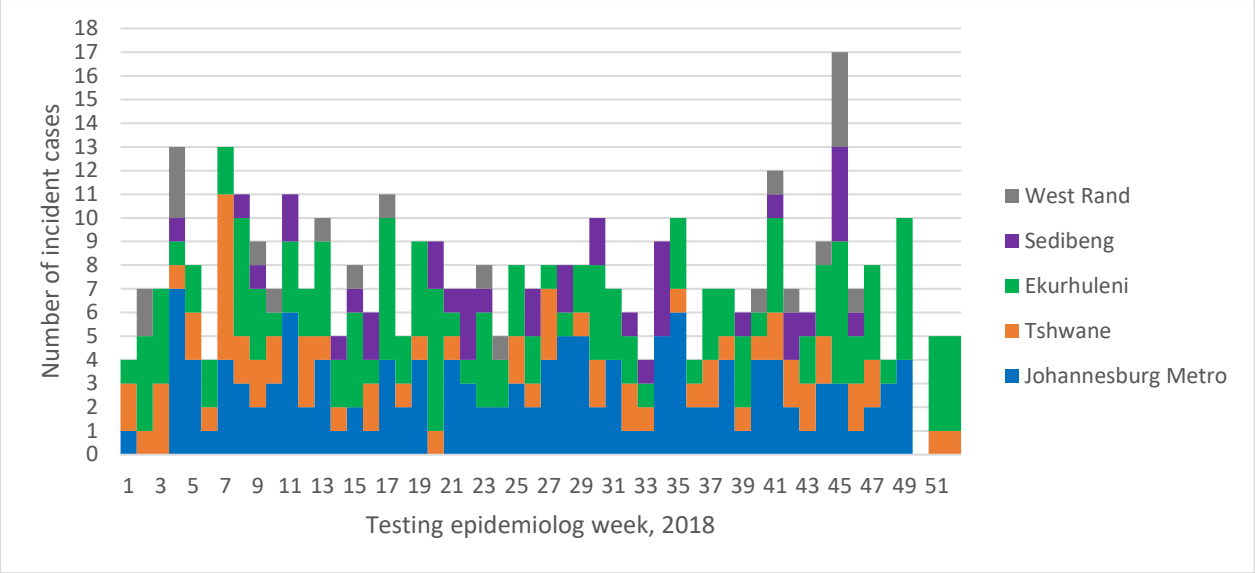

Figure 6. District-level epidemiological curve of acute hepatitis B (HBcIgM positive) cases in Gauteng Province, South Africa, 2018.

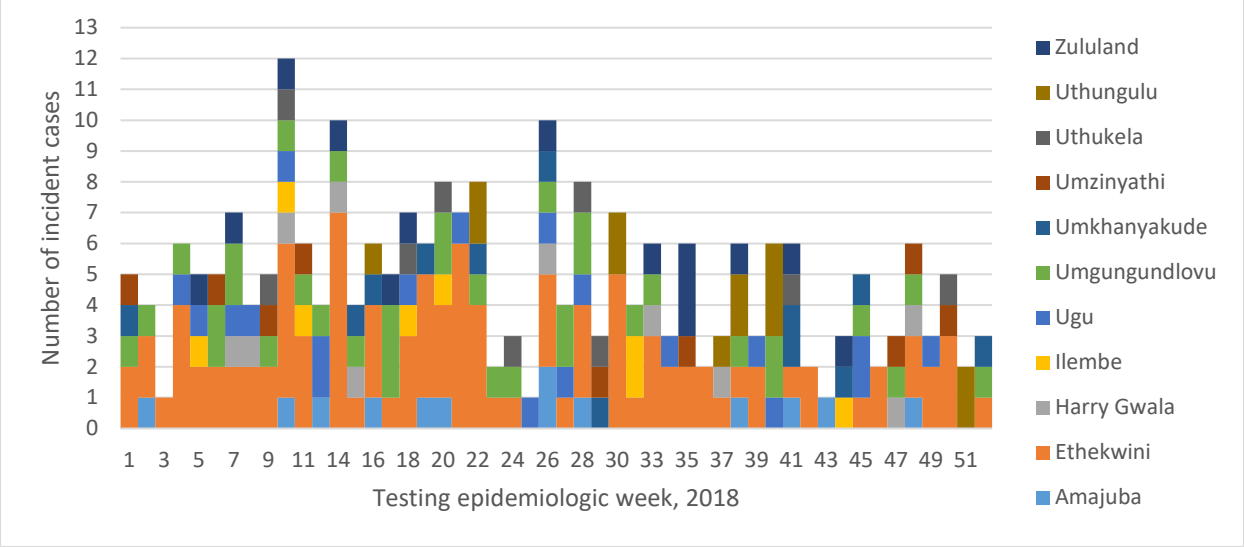

Figure 7. District-level epidemiological curve of acute hepatitis B (HBcIgM positive) cases in Kwazulu-Natal Province, South Africa, 2018.

Discussion and conclusions

From the data presented, gender distribution showed that despite higher testing rates in females, the number of HBsAg-positive males was substantially higher per 100 000 population. Interestingly, the number of acute infections (HBcIgM positives) was similar between males and females per 100 000 population, despite higher testing rates in females. One possible explanation is that despite similar rates of acute infection, more males progress

to chronic disease. Alternatively, there may be greater numbers of undiagnosed acute infections in males owing to their lower healthcare-seeking tendency.

Regarding age distribution, persons over 24 years of age would not have been eligible for the vaccination programme, which began in 1995. The majority of the HBsAg-positive cases fell within the 30 to 34 years age group, although the detection rate of HBsAg cases per 100 000 population was highest in the 35 to 39 years group. The bulk of HBsAg-positive cases was amongst persons aged between 25 and 49 years. The detection rate of acute cases per 100 000 population was highest in the 25 to 29 years age group, with the bulk of acute cases detected in persons aged 20 to 49 years old. These distributions suggest risky lifestyle habits in the 20 to 49 years age group, including promiscuity, unprotected sex and/or intravenous drug use coupled to a lack of prior immunity acquired through vaccination or natural infection. Persons 50 years and older comprised 12.8% of the total HBsAg-positive cases. Chronic hepatitis B cases are more likely to be symptomatic in older individuals, which may result in healthcare-seeking behaviour at these ages. It is however notable that 6.6% of acute cases were detected in individuals 50 years and older, indicating ongoing transmission in this age group. Testing for HBsAg (>1000 tests per 100 000) is most common in the 20 to 59 years age group and for HBcIgM (>200 tests per 100 000) in the 25 to 59 years group. The lower detection rates in children and teenagers may reflect lower healthcare-seeking behaviour rather than absence of infection. Hepatitis B is typically less symptomatic in younger persons.

There were 167 HBsAg-positive cases detected amongst children aged 0 to 1. Potential reasons include vertical transmission of hepatitis B, or horizontal transmission during early childhood. Vertical transmission may be reduced with a birth dose of the hepatitis B vaccine.[11] The need for a birth dose of hepatitis B vaccine has been debated in South Africa as transmission in children under 5 years was seen to be largely horizontal prior to vaccine introduction.[4,6] Data presented here show that 0 to 1 year old children are still at risk, although the route of infection in this group cannot be determined, and their vaccination status cannot be verified. A possible confounder of these data may be transient HBsAg positivity, which can occur in patients following hepatitis B vaccination.[12] The reasons for testing in this age group are uncertain and may include symptomatic cases or children admitted for other medical conditions in which hepatitis B screening was performed.

Hepatitis B is usually described as subclinical in young individuals. The reasons for testing them for hepatitis B cannot be determined without access to their clinical histories.

There were fewer positive results in the 2 to 24 years age group compared to the older groups. This may reflect the chronicity of the disease and long time interval before seeking health care, or may reflect effective vaccination in this group. Hepatitis B cases in children and teenagers suggests suboptimal vaccine coverage resulting in continued transmission. Suboptimal vaccine efficacy in risk groups, such as HIV-infected children, may also be a contributing factor.[13]

The distribution of hepatitis B cases by province showed that Gauteng, the most populous province, had the highest proportion of HBsAg and HBcIgM-positive cases (36.5% and 36.8% respectively). Although the HBsAg detection rate by population was also highest in Gauteng Province, the detection rate for acute cases by population was highest in Northern Cape Province (the least populous province). Further studies into risk behaviour in the Northern Cape Province may be warranted.

The epidemiological curves by province show peaks in the number of acute cases at particular times during 2018. Focusing on Gauteng and Kwazulu-Natal, the provinces with the majority of acute cases, Johannesburg Metro and Ekurhuleni districts in Gauteng, and Ethekwini district in Kwazulu-Natal, had the majority of cases. These districts are highly-populated metropolitan centres and interpretation of incidence rates would require denominators. However, for the purposes of interventions, concentrating on transmission within metropolitan areas would decrease countrywide incidence figures.

A limitation of this study is that the location of the testing facility does not reflect the place of residence or birth for each case. People may have travelled to facilities as referrals for enhanced care and management. In addition, due to limited availability of diagnostic testing amongst public health facilities in South Africa, and variation in access and utilization of testing by province, the numbers presented here represent minimum estimates, and provincial differences may represent differences in testing practices rather than disease

burden. These data represent the public sector only and are therefore incomplete as private pathology laboratories also provide hepatitis B testing.

It is concluded that interrogation of passive laboratory hepatitis B data is an informative resource and may be valuable for planning public health programmes and detection of outbreaks. Future monitoring of hepatitis B data in real time could allow timeous investigations and interventions where applicable. Critical to hepatitis B prevention is increased vaccination coverage through routine 6, 10, and 14 week, and 18 month vaccine visits. As new generations of vaccinated children reach adulthood, hepatitis B incidence and prevalence should shift to older age groups. Without vaccination programmes in adults, incidence may be reduced through heightened awareness of transmission routes and prevention measures.

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DETECTION OF INFLUENZA AND OTHER RESPIRATORY VIRUSES 2009-2017: ENHANCED VIRAL WATCH PROGRAMME, SOUTH AFRICA

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Executive summary

Seasonal influenza presents a significant health burden. A primary contributing factor to the persistence of a high burden of severe disease and mortality from influenza in South Africa is the high prevalence of comorbid illnesses, especially tuberculosis and HIV. In order to monitor and describe the epidemiology of respiratory pathogens in South Africa, the National Institute for Communicable Diseases (NICD) coordinates a number of syndromic respiratory illness surveillance activities, most notably the Viral Watch (VW), Enhanced Viral Watch (EVW) and pneumonia surveillance programmes. The pneumonia surveillance programme focuses on the detection of influenza, other respiratory viruses and *Streptococcus pneumoniae*. This hospital-based programme has been implemented in five South African provinces. Hospitalised patients are prospectively enrolled into the programme if they meet a standard clinical definition of acute or chronic respiratory illness. Viral Watch is a national, prospective sentinel surveillance programme based on data from outpatients with influenza-like illness. The Enhanced Viral Watch (EVW) surveillance programme was established in 2009 at the time of the influenza A(H1N1)pdm09 pandemic to allow for the enrolment of hospitalised patients outside of the pneumonia sentinel surveillance programme. Data from the EVW for the core pathogens, influenza and respiratory syncytial virus (RSV) for the period 2009 to 2017 were analysed with the aim of evaluating whether this programme should be continued. The national influenza positivity rate in the EVW for the period under review was 10.6% (172/1628). Specimen numbers varied over the years with the majority of samples collected from patients at pneumonia surveillance sites (1238/1617, 77%). Influenza detection was seasonal with peaks between May and September each year. Of patients enrolled in the EVW in 2017, 29.0% died, presenting a substantially higher case fatality rate than among patients

enrolled in the pneumonia surveillance programme. This suggests that the pneumonia surveillance programme is less likely to enrol patients with more severe illness, leading to an underestimation of in-hospital mortality. The overall detection rate for RSV was 12.0%. RSV circulated each year, with the RSV season preceding the influenza season, typically starting in March, peaking between May and June and ending in September. Although data from the EVW programme is useful, the programme is limited by variability in numbers of samples submitted and the lack of systematic data collection. This limits the ability of the programme to provide representative data on influenza epidemiology in South Africa.

Introduction and methods

Seasonal influenza presents a significant health burden. It caused approximately 9000 annual deaths in South Africa between 1998 and 2009, and 291 243 – 645 832 annual deaths globally between 1999 and 2015.[1–3] A primary contributing factor to the persistence of a high burden of severe disease and mortality from influenza, especially in South Africa, may be the high prevalence of comorbid illnesses such as tuberculosis and HIV.[2,4] According to a study conducted in South Africa, influenza-associated mortality rates were 20 times greater in HIV-positive individuals in comparison to those not infected with HIV.[5] Influenza imposes a significant economic burden in sub-Saharan Africa due to out-of-pocket medical treatment costs, transportation and future loss of productivity.[6]

Considering that influenza and other respiratory viral infections contribute significantly to hospitalisations for acute pneumonia, there was a need to establish and maintain influenza surveillance systems to track trends in disease burden, detect novel viruses and monitor the impact of influenza-specific interventions.[7,8] In order to monitor and describe the epidemiology of respiratory pathogens in South Africa, the National Institute for Communicable Diseases (NICD) coordinates a number of syndromic respiratory illness surveillance programmes and has served as one of the National Influenza Centres for the WHO since the 1950s.[9,10] Currently, the two main surveillance programmes are the Viral Watch surveillance programme and the Pneumonia Surveillance Programme which are further described below.

The Pneumonia Surveillance Programme introduced by NICD in 2009 is an active, prospective, hospital-based sentinel surveillance for severe acute respiratory illness (SARI) and is currently in operation.[7,11] The programme initially focused on the detection of influenza but also included testing for other respiratory viruses as well as *Streptococcus pneumoniae*.[7] The surveillance programme was first implemented in 3 of South Africa's 9 provinces (Gauteng, KwaZulu-Natal and Mpumalanga) and was expanded to North West Province in 2010 and Western Cape in 2015.[9] Dedicated staff prospectively enrol hospitalised patients into the programme when a standard clinical definition of acute or chronic respiratory illness is met, and respiratory samples are collected.[9] The methodology and case definitions of the pneumonia surveillance programme have been described in previous studies.[5,7,12]

The Viral Watch programme (VW) was first established in South Africa in 1984. It is an active, prospective sentinel surveillance programme.[13] Specimens are submitted by participating clinicians (mostly private practitioners) from outpatients with influenza-like illness. Participation in the programme is voluntary. The main aim of the programme is to describe the epidemiology of influenza as well as to provide influenza strains for global vaccine strain selection.[13] This programme has been conducted at sentinel sites in both public and private clinics in all 9 of South Africa's provinces since 2008.[13,14] From 1984 to 2008, the total number of sites ranged between 10 and 170.[13] The Enhanced Viral Watch (EVW) surveillance programme was established in 2009, at the time of the influenza A(H1N1)pdm09 pandemic, to allow for enrolment of hospitalised patients outside of the pneumonia sentinel surveillance sites.

This report describes the EVW surveillance programme and its contribution to the national influenza surveillance system in South Africa. More specifically, this report presents the clinical characteristics and presentation of patients enrolled into the EVW programme between 2009 and 2017 as well as the viral detection rates for the core pathogens, influenza and respiratory syncytial virus (RSV). Overall, these results can be used to evaluate whether or not to continue the EVW programme.

Description of the EVW surveillance programme

In 1984, the Viral Watch sentinel surveillance programme was introduced in South Africa by the NICD as an active, prospective surveillance programme that was designed to monitor outpatient influenza-like illness by volunteer physicians.[13] In response to the 2009 influenza pandemic, the EVW programme was introduced in mid-2009 in order to capture cases of influenza-associated hospitalisations as well as to detect any emerging or novel viruses, by timing and geographic distribution, which could have been missed by the Viral Watch and pneumonia surveillance programmes.[15] Like the pneumonia surveillance programme, EVW was conducted among hospitalised patients in South Africa but differed in that enrolment into the programme was clinician-initiated (rather than by surveillance nurses) and laboratory test results were provided to clinicians in real-time for use in patient management, if needed. The EVW sites included seven provinces that were outside of the pneumonia sentinel sites in order to improve the chances of identifying emerging respiratory viruses and unusual events. The EVW additionally enrolled patients at pneumonia surveillance sites who may not have been enrolled into the pneumonia surveillance programme if they were too sick to provide consent (intubated or confused patients), where clinician-initiated testing was conducted as part of clinical care.[15] In 2009, EVW surveillance was initially performed at 14 sentinel sites in private (1/14) and public (13/14) hospitals in seven of South Africa's nine provinces. These included the Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape and North West provinces. Non-surveillance sites were health facilities that were not part of the NICD pneumonia surveillance programme. All healthcare facilities from both surveillance and non-surveillance sites were public institutions with the exception of one private facility located in Johannesburg.

Case definitions and patient enrolment

During 2009-2014, patients of all ages were eligible for enrolment into the EVW programme if they met the World Health Organization's (WHO) severe acute respiratory tract infection case definition and presented with an onset of symptoms including fever and cough or sore throat, shortness of breath or difficulty with breathing within 7 days of admission.[16] After 2014, patients were eligible to be enrolled into the EVW programme once they were hospitalised with a physician-diagnosed lower respiratory tract infection or pneumonia, with the onset of fever (≥38ºC) or history of fever and cough for all age groups within 10 days of

admission.[16] Participation in the EVW programme was on a voluntary basis by the physicians. Patients who were not attended by their participating physician or who were not hospitalised at one of the sentinel sites were excluded.[15]

Sample collection and processing

Nasopharyngeal swabs and or throat swabs were collected from all patients who were not intubated. Tracheal aspirates were collected from intubated patients. Specimens were placed in viral transport medium, kept refrigerated at 4°C and transported to the NICD for testing. These were kept on ice packs during transport and delivered within 72 hours post-collection.

Data collection

A physician at each of the participating sentinel sites completed a specimen collection form, including basic demographic information. In order to evaluate whether EVW in-hospital case fatality ratios (CFRs) were similar to those for patients enrolled into the pneumonia surveillance system, NICD-employed surveillance officers reviewed patient records retrospectively, to establish in-hospital outcome.

Detection of viral pathogens

Multiplex real-time reverse–transcription PCR assay was used to test specimens for respiratory viruses. This included influenza A and B and RSV for the full study period. Testing for parainfluenza virus 1, 2 and 3, human metapneumovirus, enterovirus, rhinovirus and adenovirus was conducted until 2017. Specimens that tested positive for influenza were further subtyped by PCR using the US Centers for Disease Control and Prevention (CDC)-designed primers and probes for influenza A(H1N1) and A(H3N2). Results were provided within 3 working days of specimen receipt.

Data management and analysis

All laboratory, clinical and demographic data were captured onto Microsoft Access. From 2009 through 2017, 1637 patient specimens were recorded onto the database; however, 12 records with missing vital demographic information and 8 duplicate records were excluded, leaving 1617 (99%) specimens for the final analysis. Univariate analysis was conducted using logistic regression for patient demographic and clinical characteristics associated with

enrolment at pneumonia surveillance and non-surveillance sites. The detection of circulating respiratory viruses at the EVW sentinel sites was additionally described. Statistical significance was assessed at $p<0.05$. All statistical analyses were performed on Stata software, version 14 (StataCorp Limited, College Station, Texas, USA).

Ethical considerations

The protocol was covered under the clearance certificate for essential communicable diseases surveillance and outbreak response investigation activities of the National Institute for Communicable Diseases Human Research Ethics Committee (Medical), University of the Witwatersrand (M160667). All data stored on Microsoft Access were protected by a password that was only shared with individuals involved in the study.

Results

Specimen collection across hospital facilities in South Africa

From July 2009 through December 2017, 1617 patients were enrolled into the EVW programme (Figure 1). Of these, 76.5% (1238/1617) were from pneumonia surveillance sites with the remaining 23.4% (379/1617) from non-surveillance sites. Almost half of the surveillance site samples came from Rahima Moosa Mother and Child Hospital (631/1238, 51.0%), followed by Tshepong Hospital (340/1238, 27.5%) and Edendale Hospital (241/1238, 19.5%). The majority of non-surveillance site samples were collected from Chris Hani Baragwanath Hospital 50.9% (193/379), followed by Grey's Hospital (31/379, 8.1%) and Kimberley Hospital (104/379, 27.4%).

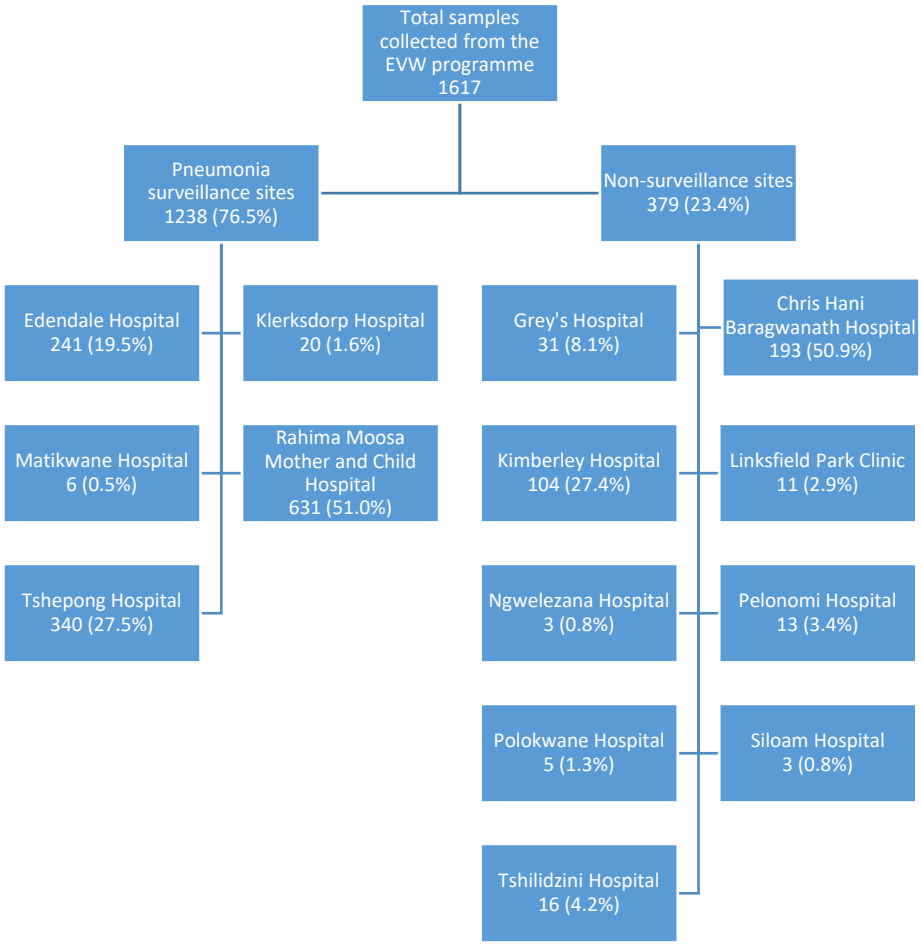


Figure 1. Numbers of specimens collected by health facilities in the Enhanced Viral Watch (EVW) surveillance programme, South Africa, 2009-2017.

Specimen collections across pneumonia surveillance and non-surveillance sites from 2009 through 2017

For the period 2009 through 2017, the number of specimens collected by pneumonia surveillance and non-surveillance sites varied significantly (Figure 2). As the years progressed, hospitals within the pneumonia surveillance sites collected more specimens with the highest number collected in 2017 (348/1238, 28.1%). Conversely, there was a decline in specimen collection from non-surveillance sites from 2009 to 2017, with the highest in 2010 (140/379, 36.9%) and lowest in 2017 (0/379, 0.0%).

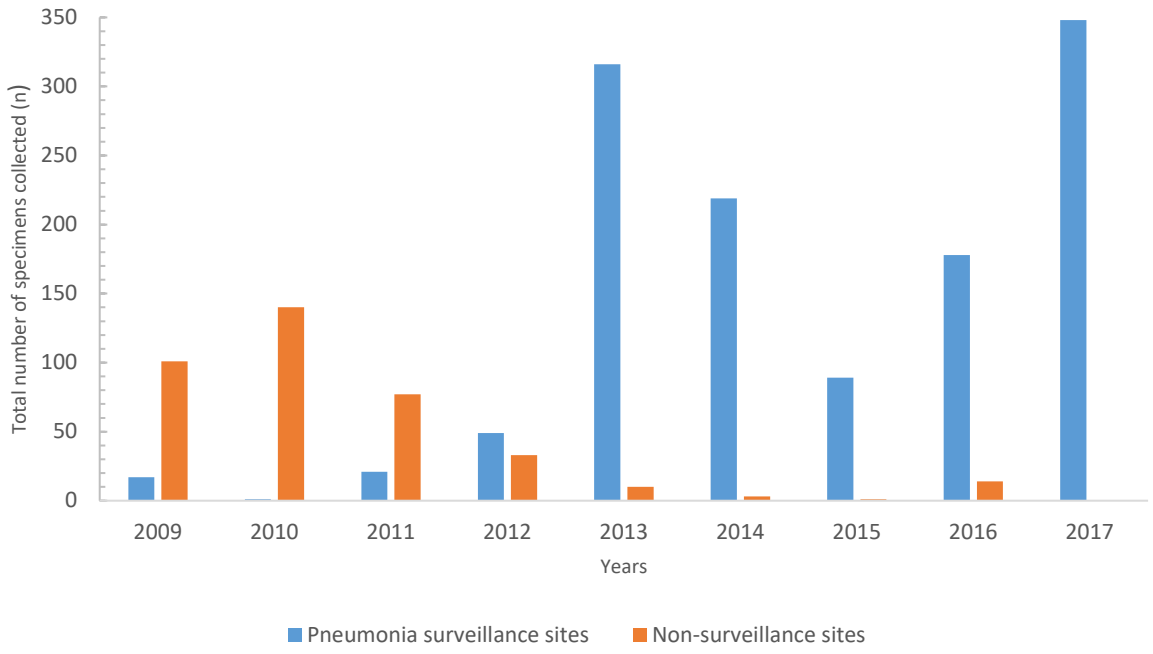
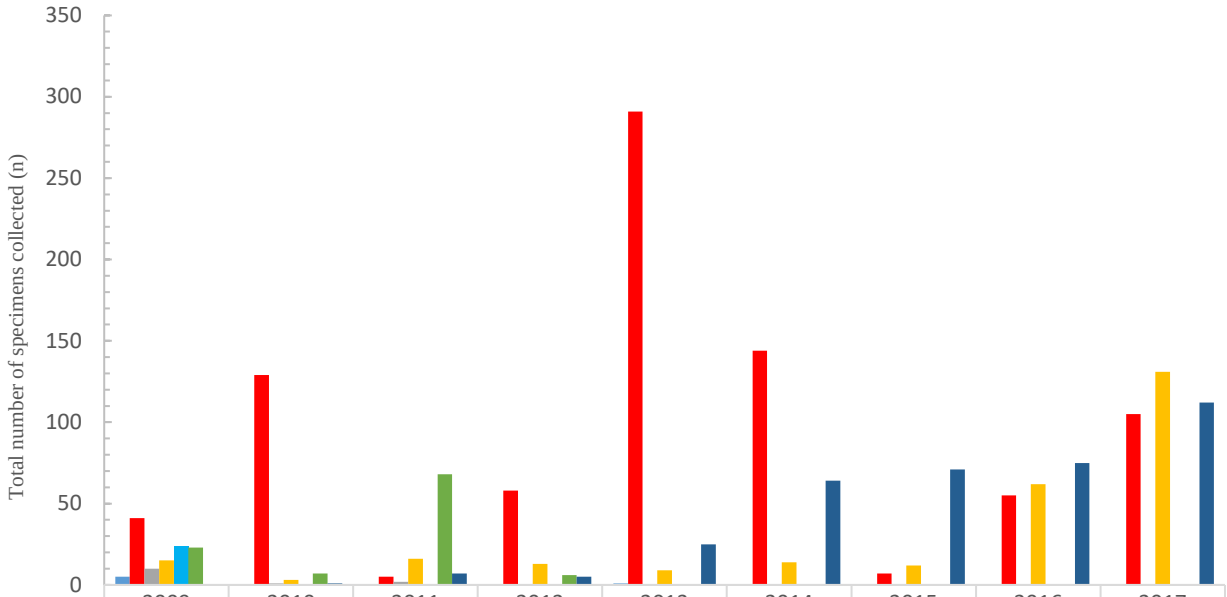


Figure 2. Numbers of specimens collected by pneumonia surveillance and non-surveillance sites in the Enhanced Viral Watch (EVW) programme, South Africa, 2009-2017.

Specimen collection across provinces in South Africa

From 2009 through 2017, the number of specimens collected varied, with the greatest number received in 2017 (348/1617, 21.5%) followed by 2013 (326/1617, 20.0%) and 2014 (222/1617, 13.7%). The lowest number of specimens collected was in 2012 (82/1617, 5.1%). In 2009, 10 sentinel sites in 6 of the 9 provinces (Mpumalanga, Gauteng, Free State, KwaZulu-Natal, Limpopo and Northern Cape) participated in EVW. However, only 4 sentinel sites in Gauteng, KwaZulu-Natal and North West provinces participated in the EVW programme in 2017 - all were public hospitals which were also part of the pneumonia surveillance programme (Figure 3).



	2009	2010	2011	2012	2013	2014	2015	2016	2017
Mpumulunga	5	0	0	0	1	0	0	0	0
Gauteng	41	129	5	58	291	144	7	55	105
Free State	10	1	2	0	0	0	0	0	0
KwaZulu Natal	15	3	16	13	9	14	12	62	131
Limpopo	24	0	0	0	0	0	0	0	0
Northern Cape	23	7	68	6	0	0	0	0	0
North West	0	1	7	5	25	64	71	75	112

Figure 3. Numbers of specimens collected, by province and year, among patients enrolled in the Enhanced Viral Watch (EVW) programme in South Africa, 2009-2017.

Patient demographic and clinical characteristics associated with pneumonia surveillance and non-surveillance sites

1. **Age & Gender**

Of the 1617 patients enrolled in the EVW programme, half were children below the age of 5 years (803/1617, 49.7%). This was apparent at pneumonia surveillance and non-surveillance sites (Table 1). The median age of all patients was 27 years (range: 0 days to 101 years). Based on a multivariate analysis, pneumonia surveillance sites, as compared to those who were from non-surveillance sites, were less likely to enrol patients aged 45-64 years (aOR, 0.2 95%CI 0.1-0.7) and more likely to enrol individuals aged 0-4 years (OR 17.5 95%CI 5.7-54.0) than individuals aged 25-44 years.

2. **Province**

More than half of patients at pneumonia surveillance sites and non-surveillance sites were enrolled in Gauteng Province followed by North West and KwaZulu-Natal provinces (Table 1).

Based on a multivariate analysis, patients from pneumonia surveillance sites, as compared to those who were from non-surveillance sites, were more likely to be from the KwaZulu-Natal (aOR, 21.4; 95%CI, 1.0-468.5), Mpumalanga (aOR, 1737.6; 95%CI 22.8-132434.5) and North West provinces (aOR, 397671.2; 95%CI, 167.0-9421778), and were less likely to be from the Northern Cape Province (aOR, 0.1; 95%CI, 0.0-0.6) than the Free State Province.

3. Treatment received and influenza vaccination

The percentage of patients treated with antibiotics was higher in pneumonia surveillance sites compared to non-surveillance sites (1024/1238, 82.7% vs 25/379, 6.6%; p<0.05). However, this could be a reporting error as the guidelines for pneumonia management state that it is a requirement to administer antibiotics once a diagnosis has been made.[17] Of the 1238 patients enrolled in the pneumonia surveillance system, 1.2% (15/1238) were vaccinated for influenza as compared to 1.6% (6/379) of patients enrolled in the EVW programme respectively (p=0.57).

4. Underlying conditions

Based on multivariate analysis, patients from pneumonia surveillance sites were more likely to be HIV positive as compared to non-surveillance sites (aOR, 3.3; 95%CI, 1.4-7.7).

Table 1. Comparison of demographic and clinical characteristics of hospitalised patients enrolled in the Enhanced Viral Watch (EVW) programme from pneumonia surveillance sites and non-surveillance sites, South Africa, 2009-2017.

Characteristic	All EVW surveillance sites n/N (%) n=1617	Pneumonia EVW surveillance sites n/N (%) N=1238	Non-surveillance EVW sites n/N (%) N=379	Univariate analysis OR (95% CI)	p-value	Multivariate analysis OR (95% CI)	p-value
Demographic and clinical characteristics							
Age groups (years)							
0-4	803/1617 (49.7)	617/1238 (49.8)	186/379 (49.1)	1.5 (1.1-2.1)	**0.01**	**17.5 (5.7-54.0)**	**<0.01**
5-24	111/1617 (6.9)	71/1238 (5.7)	40/379 (10.6)	1.4 (0.9-2.1)	0.88	2.1 (0.9-8.5)	0.08
25-44	243/1617 (15.0)	167/1238 (13.5)	76/379 (20.1)	1	1	1	1
45-64	231/1617 (14.3)	175/1238 (14.1)	56/379 (14.8)	0.8 (0.5-1.3)	0.38	0.2 (0.1-0.7)	**0.01**
>65	229/1617 (14.2)	208/1238 (16.8)	21/379 (5.5)	4.7 (1.9-5.1)	**<0.01**	1.9 (0.4-8.5)	0.41
Gender (Male)	884/1617 (54.5)	695/1238 (56.1)	189/379 (49.9)	1.3 (1.0-1.6)	**0.04**	-	-
Province							
Free State	13/1617 (0.8)	0/1238 (0.0)	13/379 (3.4)	1	1	1	1
Gauteng	835/1617 (51.6)	631/1238 (51.0)	204/379 (53.8)	83.7 (5.0-1415.2)	**<0.01**	3.8 (0.2-87.2)	0.40
KwaZulu-Natal	275/1617 (17.0)	241/1238 (19.5)	34/379 (9.0)	189.0 (11.0-3250.3)	**<0.01**	21.4 (1.0-468.5)	**0.05**
Limpopo	24/1617 (1.5)	0/1238 (0.0)	24/379 (6.3)	0.6 (0.0-29.4)	0.77	0.9 (0.0-67.3)	1.00
Mpumalanga	6/1617 (0.4)	6/1238 (0.5)	0/379 (0.0)	351.0 (6.2-19744.1)	**<0.01**	1737.6 (22.8-132434.5)	**<0.01**
Northern Cape	104/1617 (6.4)	0/1238 (0.0)	104/379 (27.4)	0.1 (0.00-6.8)	0.31	0.1 (0.0-0.6)	**0.03**
North West	360/1617 (22.3)	360/1238 (29.1)	0/379 (0.0)	197467.7 (372.2-1018323)	**<0.01**	39671.2 (167.0-9421778)	**<0.01**

Year							
2009	118/1617 (7.3)	17/1238 (1.4)	101/379 (26.7)	1	1	1	1
2010	141/1617 (8.7)	1/1238 (0.1)	140/379 (37.0)	0.1 (0.0-0.3)	**0.01**	1. (0.0-0.3)	**<0.01**
2011	98/1617 (6.1)	21/1238 (1.7)	77/379 (20.3)	1.6 (0.8-3.2)	0.18	11.8 (3.3-42.6)	**<0.01**
2012	82/1617 (5.1)	49/1238 (4.0)	33/379 (8.7)	8.6 (4.4-16.8)	**<0.01**	10.1 (3.7-27.6)	**<0.01**
2013	326/1617 (20.2)	316/1238 (25.5)	10/379 (2.6)	174.8 (78.8-388.0)	**<0.01**	41.4 (13.4-127.5)	**<0.01**
2014	222/1617 (13.8)	219/1238 (17.7)	3/379 (0.8)	363.7 (112.7-1173.7)	**<0.01**	95.2 (21.7-417.0)	**<0.01**
2015	90/1617 (5.6)	89/1238 (7.2)	1/379 (0.3)	346.1 (63.8-1878.4)	**<0.01**	57.8 (7.3-455.4)	**<0.01**
2016	192/1617 (11.9)	178/1238 (14.4)	14/379 (3.7)	71.4 (34.0-149.3)	**<0.01**	11.1 (3.5-35.1)	**<0.01**
2017	348/1617 (21.5)	348/1238 (28.1)	0/379 (0)	4042.6 (241.0-67809.2)	**<0.01**	1491.7 (76.6-29031.2)	**<0.01**
Treatments received							
Ventilation	147/1617 (9.1)	89/1238 (7.2)	55/379 (15.3)	0.4 (0.3-0.6)	**<0.01**	-	**-**
Oseltamivir	105/1617 (6.5)	63/1238 (5.1)	42/379 (11.1)	0.4 (0.3-0.6)	**<0.01**	-	-
Steroid	211/1617 (13.1)	164/1238 (13.3)	47/379 (12.4)	1.1 (0.8-1.5)	0.68	-	-
Antibiotics	1049/1617 (64.9)	1024/1238 (82.7)	25/379 (6.6)	67.6 (43.9-104.0)	**<0.01**	5.5 (2.5-12.3)	**<0.01**
Influenza vaccine received	21/1617 (1.3)	15/1238 (1.2)	6/379 (1.6)	0.8 (0.3-2.0)	0.57	-	-
Known underlying conditions							
TB	229/1617 (14.2)	193/1238 (15.6)	36/379 (9.5)	1.8 (1.2-2.6)	**<0.01**	**-**	-
Obesity	66/1617 (4.1)	44/1238 (3.5)	22/379 (5.8)	0.6 (0.4-1.0)	**0.05**	**-**	-
Asthma	39/1617 (2.4)	26/1238 (2.1)	13/379 (3.4)	0.6 (0.3-1.2)	0.14	**-**	-
Diabetes	82/1617 (5.1)	66/1238 (5.3)	16/379 (4.2)	1.3 (0.7-2.2)	0.40	**-**	-
HIV	409/1617 (25.3)	334/1238 (27.0)	75/379 (19.8)	1.5 (1.2-2.0)	**<0.01**	3.3 (1.4-7.7)	**<0.01**
Pregnant	16/1617 (1.0)	10/1238 (0.8)	6/379 (1.6)	0.5 (0.2-1.4)	0.19	-	**-**
COPD	52/1617 (3.2)	35/1238 (2.8)	17/379 (4.5)	0.6 (0.3-1.1)	0.11	**-**	-
Influenza positive (one sample was excluded due to contamination)							
Yes	171/1616 (10.6)	114/1238 (9.2)	57/378 (15.0)	0.6 (0.4-0.8)	**<0.01**	-	-
Influenza subtypes							

Influenza A (H1N1)pdm09	63/171 (36.8)	31/114 (27.2)	33/57 (57.9)	0.3 (0.2-0.5)	**<0.01**	-	-
Influenza A (H3N2)	49/171 (28.7)	35/114 (30.7)	14/57 (24.6)	0.8 (0.4-1.4)	0.38	-	-
Influenza A untyped	1/171 (0.6)	0/114 (0.0)	1/57 (1.8)	0.1 (0.0-2.3)	0.15	-	-
Influenza B	56/171 (32.7)	47/114 (41.2)	9/57 (15.8)	1.6 (0.8-3.3)	0.19	-	-
Influenza coinfections	2/171 (1.2)	1/114 (0.9)	1/57 (1.7)	0.9 (0.0-22.5)	0.96	-	-
Other respiratory pathogens (Other respiratory pathogens, excluding RSV were tested from 2009 to beginning of 2016)							
RSV	194/1616 (12.0)	142/1238 (11.5)	52/379 (13.7)	0.8 (0.6-1.2)	0.23	-	-
hMPV	23/271 (8.5)	18/228 (7.9)	5/43 (11.6)	1.3 (0.4-4.3)	0.64	-	-
Adenovirus	52/271 (19.2)	38/228 (16.7)	14/43 (32.6)	1	1	-	-
Enterovirus	21/271 (7.7)	19/228 (8.3)	2/43 (4.7)	3.5 (0.7-17.0)	0.12	-	-
Rhinovirus	83/271 (30.6)	72/228 (31.6)	11/43 (25.6)	2.4 (1.0-5.8)	**0.05**	-	-
Parainfluenza viruses, 1, 2 and 3 (PIV1-3)	19/271 (7.0)	16/228 (7.0)	3/43 (7.0)	2.0 (0.5-7.8)	0.34	-	-
Co-infection of two or more respiratory viruses *	73/271 (26.9)	65/228 (28.5)	8/43 (18.6)	3.00 (1.2-7.8)	**0.03**	-	-

Surveillance sites include: Matikwane Hospital, Edendale Hospital, Klerksdorp Hospital, Rahima Moosa Mother and Child Hospital and Tshepong Hospital. Non-surveillance sites include Baragwanath Hospital, Grey's Hospital, Kimberley Hospital, Linksfield Park Clinic, Ngwelezana Hospital, Pelonomi Hospital, Polokwane Hospital, Siloam Hospital and Tshildzini Hospital.

Abbreviations: TB=tuberculosis, RSV=respiratory syncytial virus, hMPV=human metapneumovirus

*Coinfection of two or more respiratory viruses include the combination of adenovirus, enterovirus, RSV, parainfluenza subtype 1, 2 and 3, rhinovirus and human metapneumovirus

Detection of influenza by subtype (2009-2017)

The subtypes detected from pneumonia surveillance and non-surveillance sites were similar. Peaks for all influenza subtypes were noted between May and September each year, coinciding with the start and end of each winter season. However, due to low specimen numbers collected in the EVW programme, influenza seasonality was unclear in some years (Figure 4).

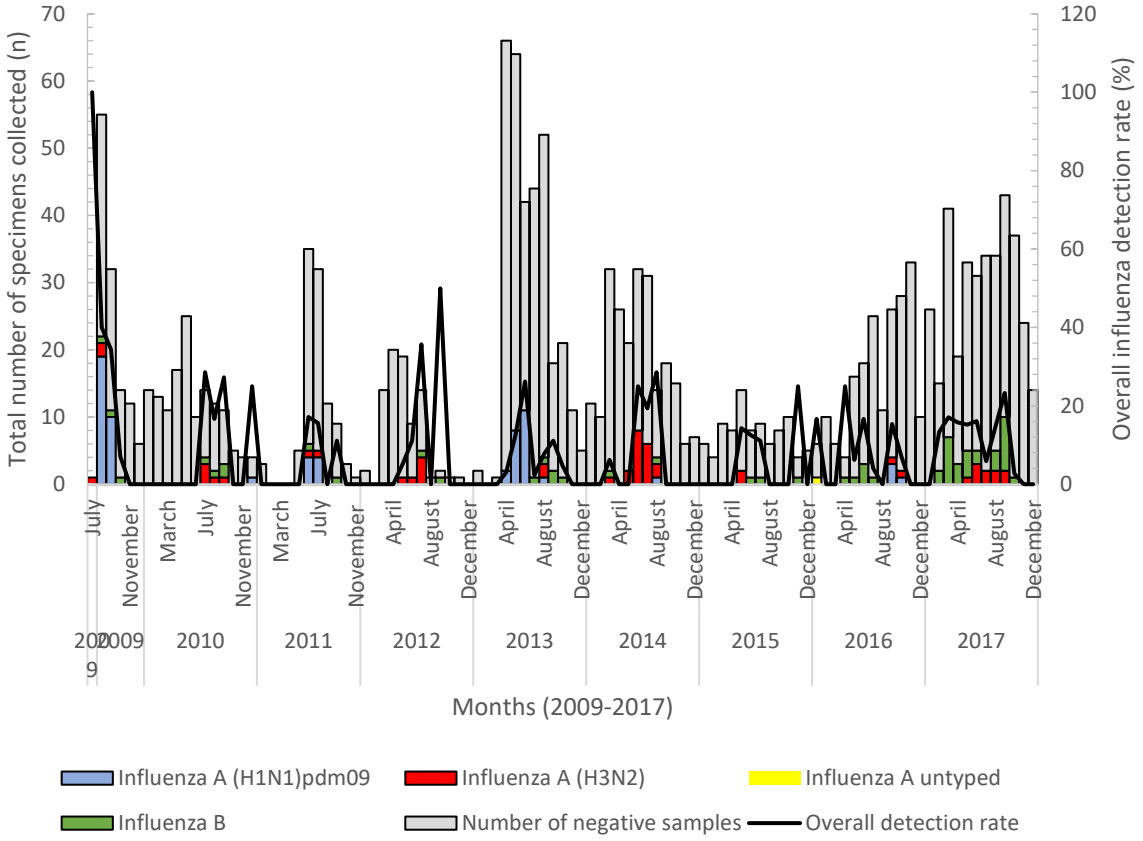


Figure 4. Numbers of influenza-positive samples and influenza detection rate, by subtype and month, in patients enrolled in the Enhanced Viral Watch (EVW) programme in South Africa, 2009-2017.

Detection of respiratory syncytial virus (RSV), 2009-2017

From 2009 to 2017, the overall detection rate for RSV was 12.0% (194/1616) and was similar for pneumonia surveillance and non-surveillance sites (Table 1). RSV circulated each year, with the RSV season proceeding the influenza season, typically starting in March, peaking between May and June and ending in September (Figure 5). No RSV was detected in 2009 as the programme

only started in mid-July. Due to low numbers of specimens collected from 2015 to 2016, RSV seasonality was unclear in those years.

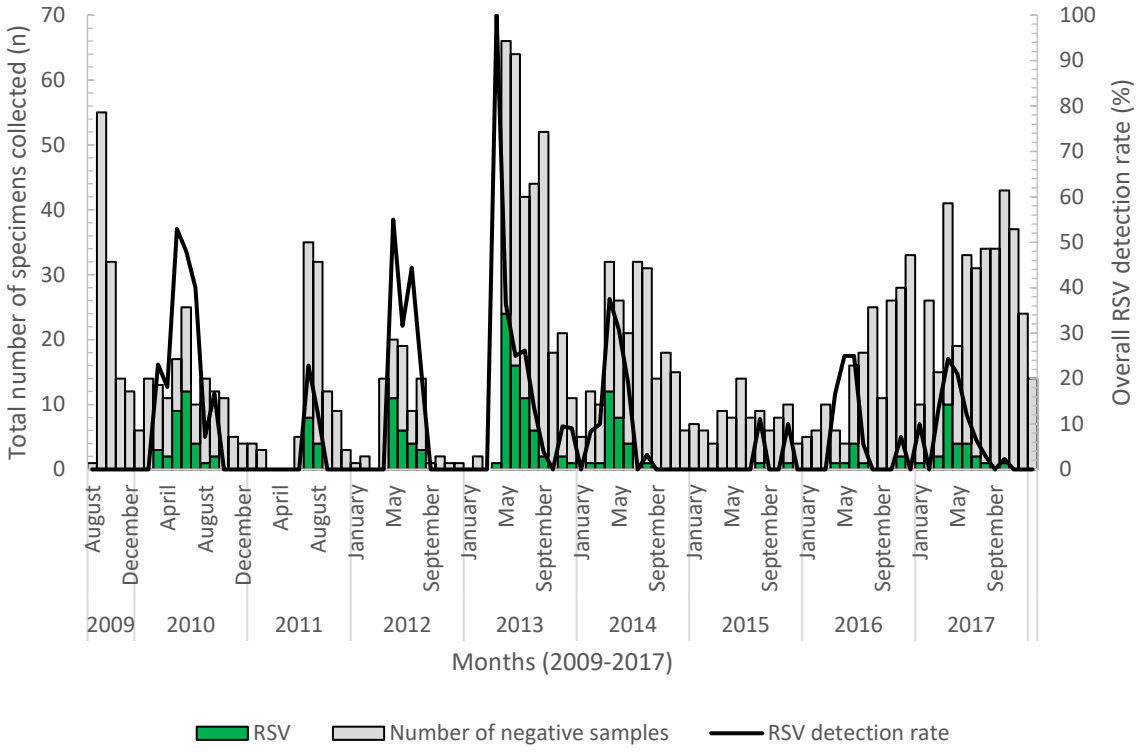


Figure 5. Numbers of samples positive for respiratory syncytial virus (RSV) and RSV detection rate by month, in patients enrolled in the Enhanced Viral Watch (EVW) programme in South Africa, 2009-2017.

Patient outcomes in 2017

In terms of patient outcomes, the EVW programme does not follow up on those who were enrolled in the programme, unlike the pneumonia surveillance system. Patients' records were therefore only obtained for those enrolled at pneumonia surveillance sites in 2017. As a result, only 47.9% (193/403) of patient outcomes were known, of which 29.0% (56/193) died.

Discussion

The results of this report provide insight into the usefulness of the EVW programme in South Africa and its contribution to the national influenza surveillance system. The EVW programme

has characterised seasonal influenza trends in South Africa. Similar influenza detection rates were found in comparison to a South African study that focused on hospitalised patients enrolled in the pneumonia surveillance system between 2009-2013 and which reported an influenza positivity rate of 8%, whilst this study showed a positivity rate of 10.6% (172/1628).[5] Regarding seasonality, data collected from the EVW programme reported seasonal influenza peaks (May-September) throughout 2009-2014, which were similar to published literature.[9,18,19] However, seasonality was less clear due to the small number of specimens collected.

Of patients enrolled in the EVW, 29.0% died. This is higher than that reported among all patients with SARI during 2009 to 2012, in which the case-fatality rate was 2% among children aged <5 years and 7% among individuals aged ≥5 years.[20,21] This suggests that the pneumonia surveillance system is less likely to enrol patients with more severe conditions, leading to an underestimation of in-hospital mortality. A possible reason for selective non-enrolment of severe cases into the pneumonia surveillance programme may be the fact that surveillance officers may have challenges with obtaining consent for surveillance inclusion from severely ill patients, in contrast to the EVW where enrolment is clinician-driven. In addition, severely ill patients may die before enrolment.

There are several limitations that warrant discussion. The small numbers of specimens collected from non-surveillance sites may lead to reduced power. The EVW may not be truly representative of SARI throughout South Africa because 75% of the specimens collected were from existing sentinel sites within the pneumonia surveillance programme, and therefore the EVW programme was not successful in the objective of increasing geographic representation of pneumonia data. The decrease in patients enrolled in the EVW surveillance programme could be attributed to declining clinician interest. More specifically, there was an increased number of patients recruited into the EVW programme during the 2009 influenza A pdm09(pH1N1) pandemic, likely due to enhanced interest by clinicians, which may since have waned.

Conclusion

Although the importance of gaining a better understanding of the epidemiology of influenza by maintaining surveillance for respiratory illnesses associated with hospitalisation has not diminished, the usefulness and the quality of data from the EVW programme remains questionable due to a lack of systematic data collection. As a result, the number of specimens collected, and the limited number of surveillance sites, does not reflect the true extent of influenza transmission in South Africa.

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KEY FINDINGS OF THE 2017 SOUTH AFRICAN ANTENATAL HIV SENTINEL SURVEY (ANCHSS)

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Executive summary

South Africa has conducted national antenatal sentinel HIV prevalence surveys since 1990, the 2017 survey being the 27th. Between 1990 and 2015, the survey focused primarily on estimating HIV prevalence trends over time among pregnant women attending antenatal care (ANC). In the 2017 survey, additional data on HIV incidence, knowledge of HIV status (1st 90), antiretroviral treatment (ART) coverage (2nd 90), viral suppression (3rd 90), syphilis screening coverage, and agreement between point-of-care HIV rapid testing and laboratory-based HIV testing were collected. In total, 32 716 women were enrolled in the 2017 antenatal survey. The overall HIV prevalence at national level was stable at 30.7% (95% CI: 30.1%−31.3%). Consistent with the previous 2015 survey, the highest HIV prevalence was in KwaZulu-Natal Province (41.1%, 95% CI: 39.9%−42.3%) followed by Mpumalanga Province (37.3%, 95% CI: 35.4%−39.2%). The lowest HIV prevalence was in Western Cape Province at 15.9% (95% CI: 14.2%–17.8%). Between 2011 and 2017, there was a consistent but moderate decline in HIV prevalence among first-ANC-visit attendees in the age groups 15−24 years (declined by 2% points) and 25−29 years (declined by 6% points). HIV testing uptake was high (over 99%) in the routine prevention of mother-to-child HIV transmission (PMTCT) testing programme. Knowledge of HIV-positive status (1st 90) among

women attending follow-up ANC visits was 96.7%. Of these, 98.2% were on ART (2nd 90). The ART adherence rate among follow-up ANC visit attendees was 98.7%, as self-reported from 3-day recall. Knowledge of HIV-positive status prior to the first ANC visit was low. More than a third (39.2%) of HIV-positive pregnant women nationally were unaware of their HIV-positive status prior to their first ANC visit. A larger proportion of adolescent pregnant women (61.1%) were unaware of their HIV-positive status prior to pregnancy compared with older (35 – 49 years) (24.5%) women. It is concluded that national HIV prevalence among pregnant women was stable at approximately 30% in 2017. The consistent decline in HIV prevalence observed among young women (15 – 24 years) is encouraging, as this population has traditionally been at increased risk of HIV acquisition. Knowledge of HIV status prior to first ANC visit was low, especially among young women (15 – 24 years), highlighting the gap in access to youth-friendly reproductive health services. The 1st and 2nd 90 targets have been reached among pregnant women across all provinces. The achievement of these targets in the PMTCT programme, despite the high proportion who were unaware of their HIV status prior to their first ANC visit, indicates how effective the PMTCT programme is at identifying HIV-positive pregnant women and enrolling them into treatment.

Introduction

HIV remains a major public health problem in South Africa. In 2017, 7.9 million people living with HIV (PLHIV), representing 20% of PLHIV globally, were living in South Africa.[1] As a member state of the United Nations, South Africa has made a commitment to ending the public health threat of HIV/AIDS by 2030, including reaching the 90-90-90 targets, which aim to ensure that 90% of PLHIV know their HIV status, that 90% of those who know their HIV-positive status receive antiretroviral therapy (ART), and viral suppression among 90% of those on ART by 2020.[2,3] The fifth South African national household survey showed the tremendous progress the country has made towards these 90–90–90 targets.[4] According to the 2017 survey, 85% of PLHIV nationally knew their HIV status, 71% of those who knew their status were receiving ART and 86% of those on ART were virally suppressed.[4]

Poor linkage to treatment and retention are the main barriers to reaching the 90-90-90 targets in South Africa.[5] While new HIV testing technologies have made access to tests easier, active facilitation of linkage to care for those testing HIV-positive, and tracking/follow-up of those initiated on treatment, is sub-optimal.[6,7] Progress towards the 90-90-90 targets also greatly varies by population group, being far slower among adolescent girls and young women (AGYW), men and other key populations such as men who have sex with men (MSM) and female sex workers (FSWs).[4,8] Given this sub-population variation, it is important to track the progress of the epidemic in different population groups.

Since 1990, the South African antenatal sentinel survey has tracked HIV prevalence trends over time among pregnant women attending routine antenatal care (ANC) (annually until 2015, and biennially since then). In the early stage of the epidemic, when HIV infection and mortality rates were still low, HIV prevalence estimates from the antenatal survey provided reliable data for monitoring trends in prevalence as a proxy for incidence. As both the epidemic and the response to HIV expanded, additional indicators were needed to track the progress of the epidemic. In 2017, the survey gathered additional data on HIV incidence, knowledge of HIV status (1st 90), ART coverage (2nd 90), viral suppression (3rd 90), maternal syphilis screening coverage, and agreement between point-of-care HIV rapid testing and laboratory-based HIV testing.

The aim of this report is to present the key 2017 survey findings concerning HIV prevalence trends, knowledge of HIV status (first 90), ART coverage (the second 90) and syphilis screening coverage. A fuller report containing detailed discussion of the survey findings is presented elsewhere.[9] Data on viral load suppression rate, laboratory confirmed treatment adherence, and incidence rate will be included in an instalment to be released in the last quarter of 2019.

Methods

The 2017 antenatal survey was cross-sectional and linked-anonymous. It involved HIV screening of selected eligible pregnant women aged 15−49 years attending ANC in public health facilities in South Africa. Between 1990 and 2014, the survey included first-ANC-visit attendees only, but

in the 2015 and 2017 surveys, follow-up visit attendees were included, so as to facilitate other programmatic or evaluation questions relevant for public health policies to be explored, e.g. the prevention of mother-to-child transmission (PMTCT) cascade.

Between 1st October and 15th November 2017, pregnant women attending ANC from 1 595 public health facilities, selected from 52 districts of South Africa, were enrolled into the survey. Health workers providing routine ANC services collected the data. The data collection procedures included: obtaining written informed consent, a brief interview, data abstraction from medical records and blood specimen collection from each consecutive, eligible (15-49 years old), consenting, pregnant woman attending an ANC visit during the survey period. Demographic and clinical information collected through interview included: education, marital status, race, gravidity, parity and ART adherence in the 3 days preceding the survey. Data on age, gestational age, ANC visit type, HIV testing history, latest HIV rapid test result and maternal syphilis screening coverage were extracted from medical records of enrolled women, while data on initiation of ART were extracted from medical records (if available) or self-reported by participants. A blood specimen was taken from each woman regardless of prior knowledge of HIV status or ART history, and tested for HIV infection. A detailed description of site selection criteria, sampling of women, and the data collection procedures is presented elsewhere.[9]

Specimen testing for HIV

Specimens were tested for the presence of HIV antibodies and antigens using a serial algorithm that consisted of two fourth-generation enzyme-immunoassay (IA) platforms (Figure 1). All specimens that were reactive on IA-1 were further tested using a confirmatory assay (IA-2). If specimens were reactive on IA-2 they were classified as HIV-positive. If IA-2 was non-reactive, the specimen was considered to have a “discrepant” HIV result.

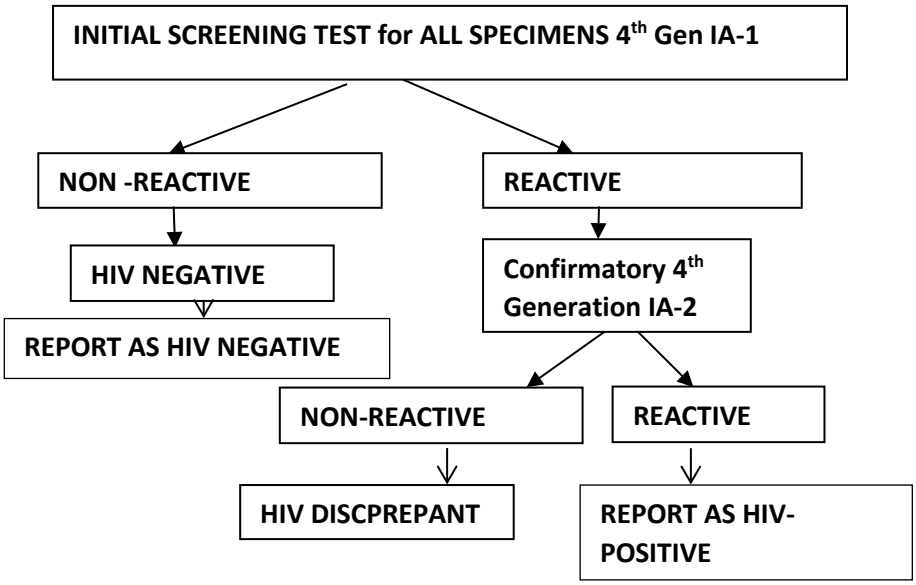


Figure 1. The laboratory HIV testing algorithm for the 2017 antenatal survey, South Africa.

Data analysis

Data were analysed using STATA 14 software (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). Analysis took into account the survey design (clustering within facilities, and stratification by district) and was weighted using the number of women of reproductive age (15–49 years) from the Statistics South Africa (Stats SA) 2017 mid-year population estimates.

The primary outcome of the survey was HIV prevalence, defined as the proportion of eligible pregnant women who participated in the survey and with a positive HIV IA test. HIV prevalence was compared across provinces and by age group using chi-square tests.

The HIV prevalence trend for 2011–2017 (excluding 2015) was analysed by 5-year age band and by province. This analysis was restricted to first-ANC-visit attendees, because the inclusion of follow-up visit attendees was expected to result in a slight increase in overall HIV prevalence, owing to new HIV infections acquired during pregnancy. The 2015 survey was excluded from this trend analysis as the data were not stratified by visit type. A separate analysis compared HIV prevalence among all pregnant women between 2015 and 2017 by province and district.

The PMTCT cascade analysis included uptake of HIV testing (among all pregnant women), knowledge of HIV-positive status and ART coverage (2nd 90). Knowledge of HIV-positive status and ART initiation prior to pregnancy was estimated in order to assess the coverage of the "test and treat" programme among pregnant women. The denominator for HIV-positive status knowledge prior to pregnancy was the number of IA positive individuals. Of those who knew their HIV-positive status prior to pregnancy, the proportion who were initiated on ART prior to pregnancy was reported.

Each analysis was done using complete observations, excluding individuals with missing values for the relevant variables. The non-response rate was low (<2%) for most variables. Two variables had >5% missing values, which were participant age (8.2%) and maternal syphilis screening (14.1%). For maternal syphilis screening, sensitivity analysis was applied by treating all missing values as "syphilis screening not done", and including them in the denominator accordingly.

Results

In the 2017 antenatal survey, 36 128 participants were interviewed. Sixty-five (0.2%) were excluded as they were out of the age range (15–49 years), 1 687 participants were missing their HIV test results or interview data, and 1 595 (4.4%) had their blood specimens rejected (80.0% of specimen rejections were due to haemolysis). Of the remaining 32 781 specimens processed, 65 (0.2%) were excluded for discrepant or equivocal results, leaving 32 716 (90.6%) observations for inclusion in the analysis.

National HIV prevalence

At national level, HIV prevalence has been stable since 2004 at approximately 30%. Prevalence in 2017 was 30.7% (95% confidence interval [CI]: 30.1%−31.3%) (Figure 2).

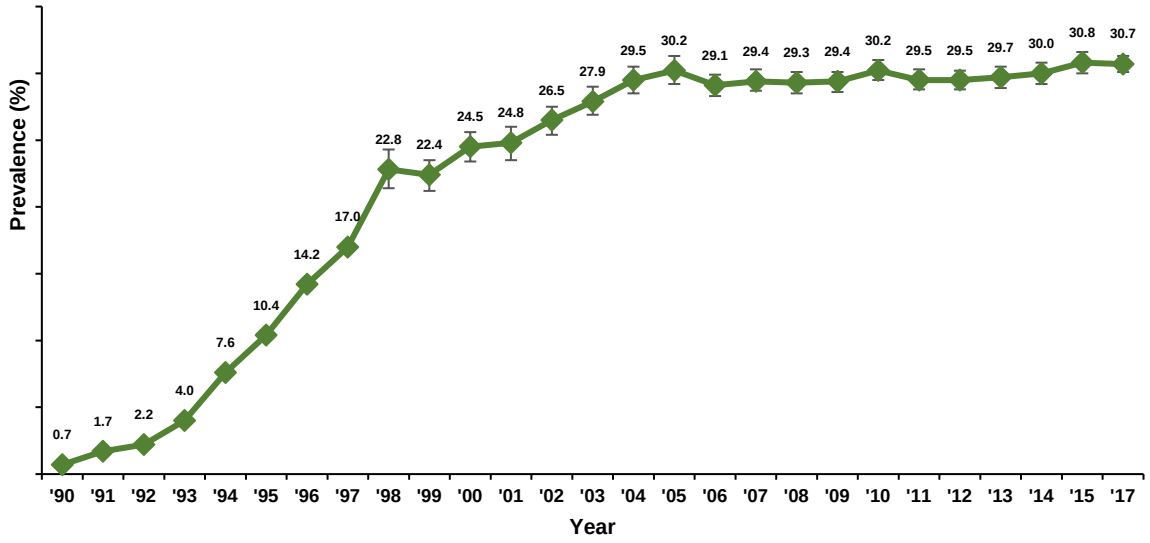
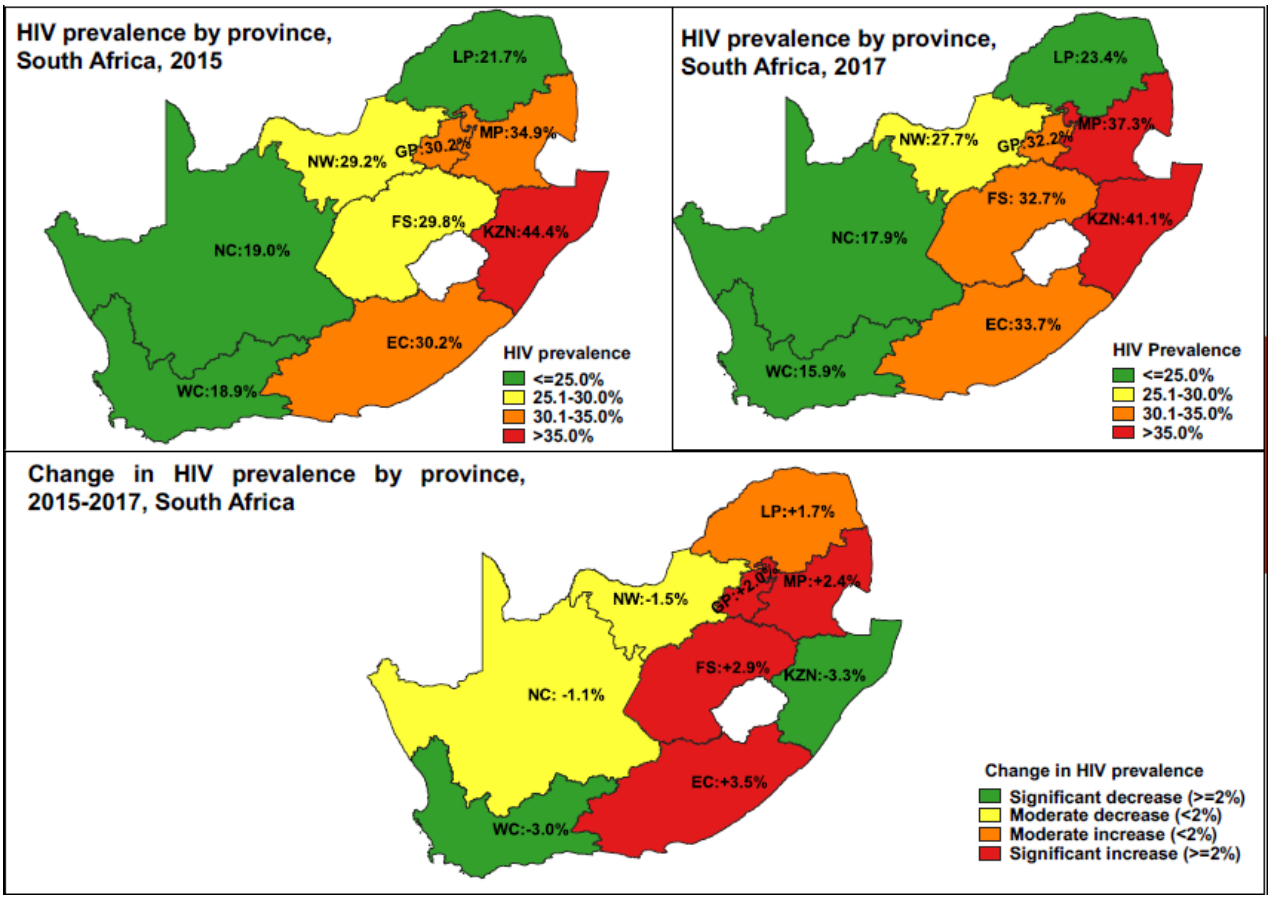


Figure 2. HIV prevalence by year at national level among all pregnant women, antenatal survey, South Africa. Prevalence among both first-ANC-visit attendees and follow-up ANC visit attendees.

The highest overall HIV prevalence was in KwaZulu-Natal (KZN) Province (41.1%) followed by Mpumalanga (MP) (37.3%) and Eastern Cape (EC) provinces (33.7%) (Figure 3). The lowest overall HIV prevalence by province were in Western Cape (WC) Province at 15.9% and Northern Cape (NC) Province (17.9%). The point estimates for overall prevalence between 2015 and 2017 increased in five provinces [EC, Free state (FS), Gauteng (GP), Limpopo (LP) and MP] and decreased in four provinces [KZN, NC, North West (NW) and WC].

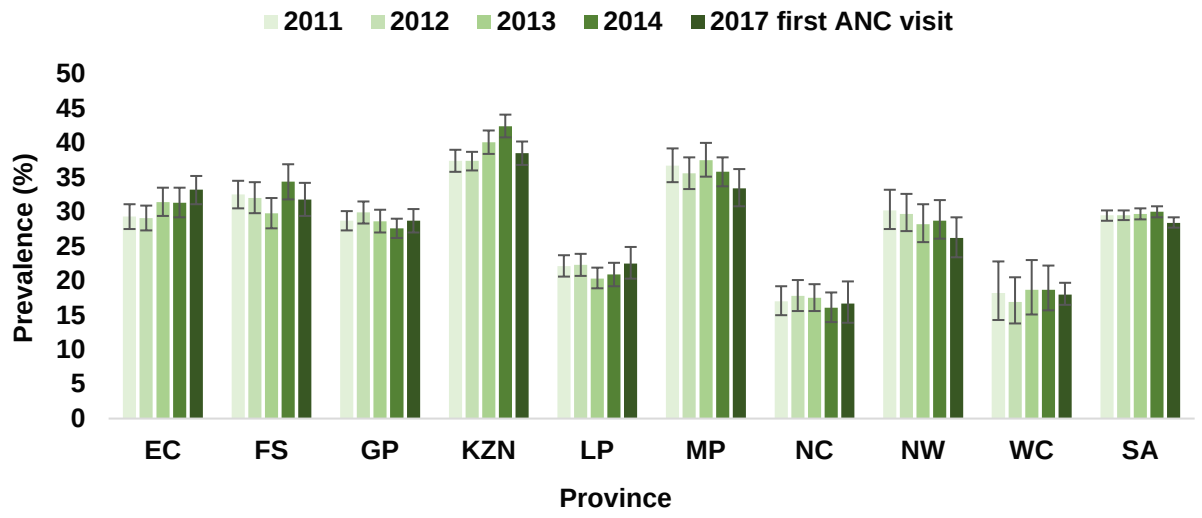


95% CI for 2017 prevalence: Eastern Cape (EC): 32.2–35.3; Free State (FS): 31.1–34.4; Gauteng (GP): 30.7–33.6; KwaZulu-Natal (KZN): 39.9–42.3; Limpopo (LP): 21.8–25.1; Mpumalanga (MP): 35.4–39.2; Northern Cape (NC): 16.0–20.1; North West (NW): 25.7–29.8; Western Cape (WC): 14.2–17.8

Figure 3. HIV prevalence by province and point percent change in HIV prevalence from 2015-2017, antenatal survey, South Africa.

HIV prevalence trends among women attending first-ANC-visit in their current pregnancy by province

There was no statistically significant upward or downward trend in HIV prevalence between 2011 and 2017 in all nine provinces (Figure 4). Note that the 2015 survey was excluded from this trend analysis as the data were not identified by visit type (i.e. as first and follow-up ANC visit). In KZN, after a consistent increase in HIV prevalence between 2012 and 2015, a significant decline was evident in 2017 - from 42.4% (95% CI: 40.8%–44.1%) in 2014 to 38.5% in 2017 (95% CI: 36.8%–40.2%) (P value from *chi-square test* < 0.01).



EC = Eastern Cape Province; FS = Free State Province; GP = Gauteng Province; KZN = KwaZulu-Natal Province; LP = Limpopo Province; MP = Mpumalanga Province; NC = Northern Cape Province; NW = North West Province; WC = Western Cape Province; SA = South Africa

Figure 4. HIV prevalence trends among first-ANC-visit attendees (2011–2017) by province and year, antenatal survey, South Africa.

HIV prevalence trends among women attending first-ANC-visit in their current pregnancy by age group

From 2011 to 2017, HIV prevalence among women attending first-ANC-visit in their current pregnancy consistently declined by 4.8, 2.0 and 6.0 percentage points in the age groups 20−24 years, 15−24 years and 25−29 years, respectively (P value from trend test < 0.01) (Figure 5).

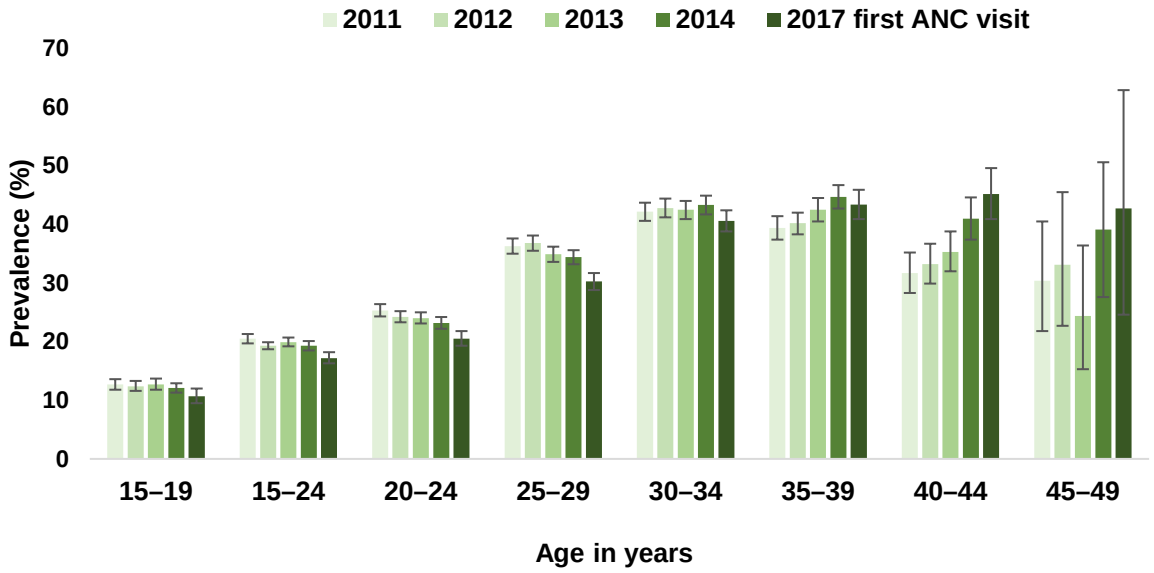


Figure 5. National HIV prevalence trends by age group by year among first-ANC-visit attendees, 2011– 2017, antenatal survey, South Africa.

Prevention of mother-to-child HIV transmission (PMTCT) cascade

HIV testing uptake was high (99.7%) in the routine PMTCT HIV testing programme. Knowledge of HIV-positive status (1st 90) among women attending follow-up ANC visits was 96.7%. Of these, 98.2% were on ART (2nd 90). The ART adherence rate among follow-up ANC visit attendees receiving ART was 98.7%, as self-reported from 3-day recall (Figure 6).

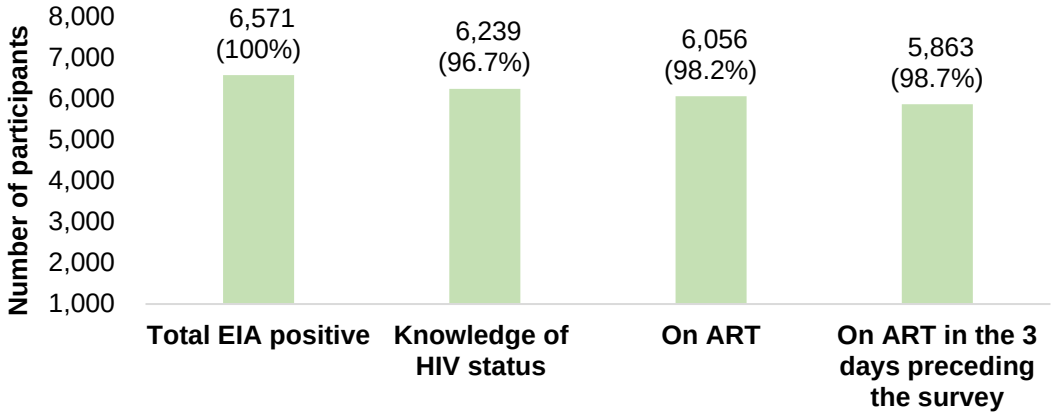
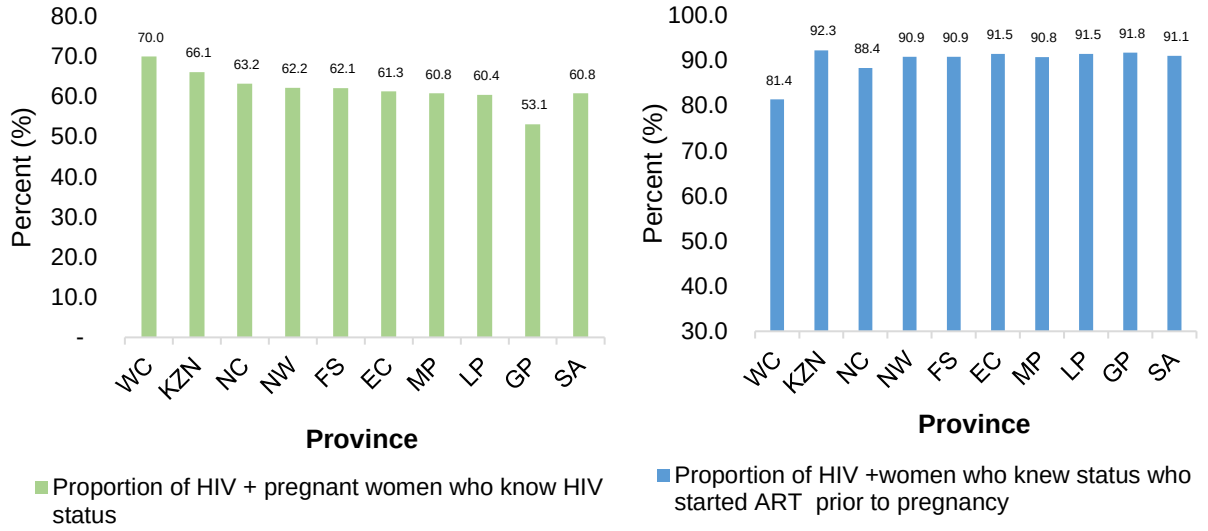


Figure 6. Prevention of mother-to-child HIV transmission (PMTCT) cascade among HIV-positive pregnant women attending follow-up ANC visit in the 2017 antenatal survey, South Africa.

Knowledge of HIV status and ART initiation prior to pregnancy

Overall, knowledge of HIV-positive status prior to first-ANC-visit was low. In this survey, 39.2% of HIV-positive pregnant women nationally were unaware of their HIV-positive status prior to their first-ANC-visit. About three-fifths (60.8%) of HIV-positive pregnant women were aware of their HIV status before pregnancy, of whom 91.1% reported starting ART before pregnancy. The highest knowledge of HIV status prior to pregnancy was in the Western Cape (70.0%) and KwaZulu-Natal (66.1%) provinces, whilst Gauteng Province had the lowest knowledge of HIV status (53.1%) (Figure 7).

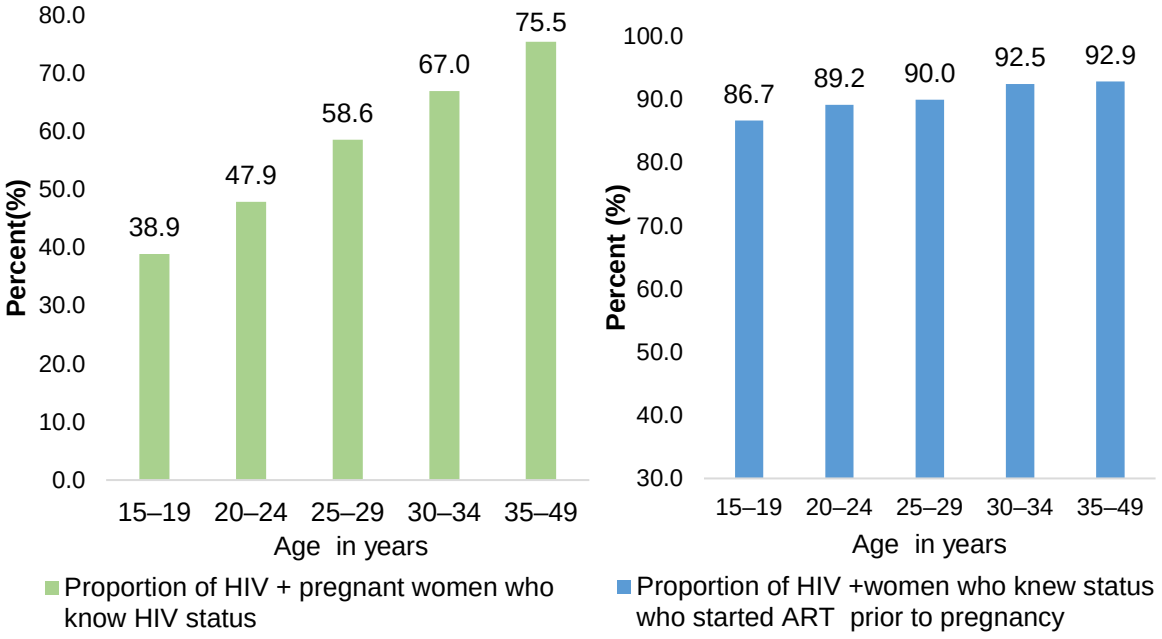


Denominator for knowledge of HIV-positive status prior to pregnancy was IA positives. Denominator for ART initiation prior to pregnancy was the number of HIV-positive women who were aware of their HIV-positive status prior to pregnancy. EC = Eastern Cape Province; FS = Free State Province; GP = Gauteng Province; KZN = KwaZulu-Natal Province; LP = Limpopo Province; MP = Mpumalanga Province; NC = Northern Cape Province; NW = North West Province; WC = Western Cape Province; SA = South Africa

Figure 7. Knowledge of HIV-positive status and ART initiation prior to pregnancy by province, 2017 antenatal survey, South Africa.

Knowledge of HIV status and ART initiation prior to pregnancy by age

Knowledge of HIV-positive status and ART initiation prior to the current pregnancy was higher in the older age group. Three-quarters (75.5%) of women in the age group 35–49 years, compared to just above a third (38.9%) of women in the age group 15–19 years, were aware of their HIV-positive status prior to first-ANC-visit in the current pregnancy (Figure 8).



Denominator for knowledge of HIV-positive status prior to pregnancy was IA positives. Denominator for ART initiation prior to pregnancy was the number of HIV-positive women who were aware of their HIV-positive status prior to pregnancy

Figure 8. Knowledge of HIV status and ART initiation prior to pregnancy by age group, 2017 antenatal survey, South Africa.

Maternal syphilis screening service coverage

Maternal syphilis screening coverage was 96.7% at national level among enrolled pregnant women, excluding 14.1% of participants for whom this data was missing (Figure 9).

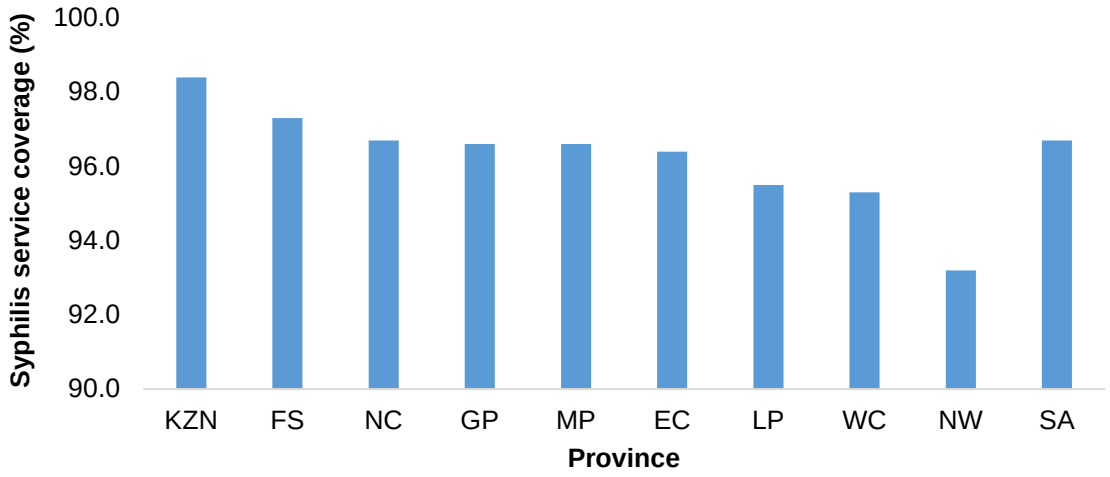


Figure 9. Maternal syphilis screening coverage among antenatal women at national level, 2017 antenatal survey, South Africa.

Conclusions and recommendations

Since 2004, HIV prevalence among pregnant women has stabilised at approximately 30% in South Africa. The consistent decline in HIV prevalence among young women (15−24 years) is encouraging, as it may reflect a positive impact of interventions targeting this group (e.g. "She Conquers" and "DREAMS" initiatives).[10,11] The percentage of HIV-positive women who knew their HIV status prior to the current pregnancy was low, especially in the 15 to 24 year old group highlighting the gap in access to youth-friendly reproductive health services. Accessible and youth-friendly HIV testing services need to be scaled-up nationally, combined with effective HIV prevention interventions, to ensure those who test HIV-negative maintain their HIV-negative status and those who are positive receive early treatment. In addition, factors that delay access to testing and treatment services – such as poor service utilization, psychosocial and structural factors, and challenges associated with disclosure– should be addressed, to increase the coverage of early diagnosis and ART initiation.[12,13]

The achievement of the first and second 90 targets in the PMTCT programme, despite a high proportion of respondents who were unaware of their HIV status prior to pregnancy, shows excellent performance by the PMTCT programme in identifying and enrolling HIV-positive pregnant women into treatment. These findings suggest that this critical program is an important contributor to achievement of HIV prevention and treatment in South Africa. Self-reported adherence rate to treatment was also high (98.7%); however this figure needs to be validated against laboratory-based treatment adherence data.

The maternal syphilis screening coverage (96.7%) exceeded the World Health Organization's (WHO) target of >95% of pregnant women.[14] This result however needs to be interpreted with caution, as syphilis-screening data were missing for 14.1% of participants. If this means that no screening took place in these cases, the syphilis screening coverage drops to 83.3%, well below the WHO target.

The antenatal survey was restricted to public facilities, which may limit the generalizability of its findings to the overall population, since the number of white and Indian people in particular, and others from high income groups who attend public health facilities, is typically small. The sample size of women attending first-ANC-visit was too small to detect significant prevalence trend changes over time in this group.

The cross-sectional design of the survey does not provide an opportunity to follow up on the ART status of pregnant women newly diagnosed as HIV-positive. For this reason, the PMTCT cascade was not measured among first-ANC-visit attendees. The self-reported data used to measure treatment adherence may be susceptible to social desirability bias. We aim to validate this data using laboratory-based measures of treatment adherence. The results from the laboratory data for antiretroviral (ARV) treatment adherence and other data – on viral load suppression rate, and incidence rate – will be presented in subsequent reports.

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Disclaimer

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