NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

Cumulative invasive pneumococcal disease case numbers reported by the GERMS-SA surveillance programme, 1 January 2012 to 31 July 2022

GERMS-SA surveillance programme

- GERMS-SA is a national, active, laboratory-based surveillance system initiated in 2003.
- Invasive pneumococcal disease (IPD) cases defined as hospitalised individuals with *Streptococcus pneumoniae* detected from normally sterile-site specimens (e.g. cerebrospinal fluid, blood or joint fluid).
- Repeat isolates from the same individual within 21 days were excluded.
- ~190 laboratories each year send reports and isolates.
- Age, sex, date of specimen collection, and source of specimen were captured.
- Pneumococcal isolates were serotyped by Quellung reaction using specific antisera (Statens Serum Institute, Copenhagen, Denmark). Culture-negative/bacterial antigen detection test positive, or isolates that lost viability were confirmed positive using a real-time *lyt*A PCR[1] and serotyped using an adaption from the method described by Azzari *et al*.[2] This molecular assay includes targets for 38 serotypes (42 serotypes prior to 2014) and covers all serotypes included in PCV13. Only samples with an initial *lytA* PCR ct value of ≤35 were included. Where ct value was ≤35 but no serotype could be identified by including the 38 targets (42 targets prior to 2014), serotype was classified as non-vaccine type. Where *lytA* PCR ct value was ≥36, serotype was classified as unknown and was not included in graphs. Where the PCR target could not distinguish between vaccine and non-vaccine serotype, serotype was classified as unknown and not included in the figures (targets: 18ABC, 18ABCF, 7AF, 9ALVN and 9AV).
- **Cumulative graph case numbers include viable isolates and those non-viable but characterised using molecular diagnostic techniques.**
- Figures 1 – 3 are for cases < 5 years, and Figures 4 – 6 for cases 5 years and older. Cases with unknown age were excluded from the figures.
- There are three graphs for each age group:
  - Disease caused by any of the seven serotypes in PCV7 (4, 6B, 9V, 14, 18C, 19F and 23F)
  - Disease caused by any of the six additional serotypes in PCV13 but not in PCV7 (1, 3, 5, 6A, 7F, 19A)
  - Disease caused by any serotypes not in PCV13
- Figures showing number of viable isolates submitted to GERMS-SA from 2008 to 2012 can be found in the appendix at the end of this report.
- More information on the GERMS-SA system available at: https://www.nicd.ac.za/centres/division-of-public-health-surveillance-and-response/

PCV vaccine introduction in South Africa

- The 7-valent pneumococcal conjugate vaccine (PCV7) was introduced into the South African Expanded Programme on Immunisation in April 2009, with no catch-up vaccination campaign.
- There was a graded replacement of PCV7 by 13-valent pneumococcal conjugate vaccine (PCV13) in 2011. By June 2011 all provinces were using PCV13.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

- There was a limited PCV13 catch-up campaign in 2011 and 2012.
- WHO/UNICEF vaccine coverage estimates for receiving a third dose of the PCV vaccine in South Africa are 10% in 2009, 58% in 2010, 62% in 2011, 75% in 2012, 77% in 2013, 85% in 2014, 85% 2015, 82% in 2016, 78% in 2017, 83% in 2018, 86% in 2019 and 83% in 2020.[3]
- The effect of the vaccine on IPD in South Africa has been described.[4,5]

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

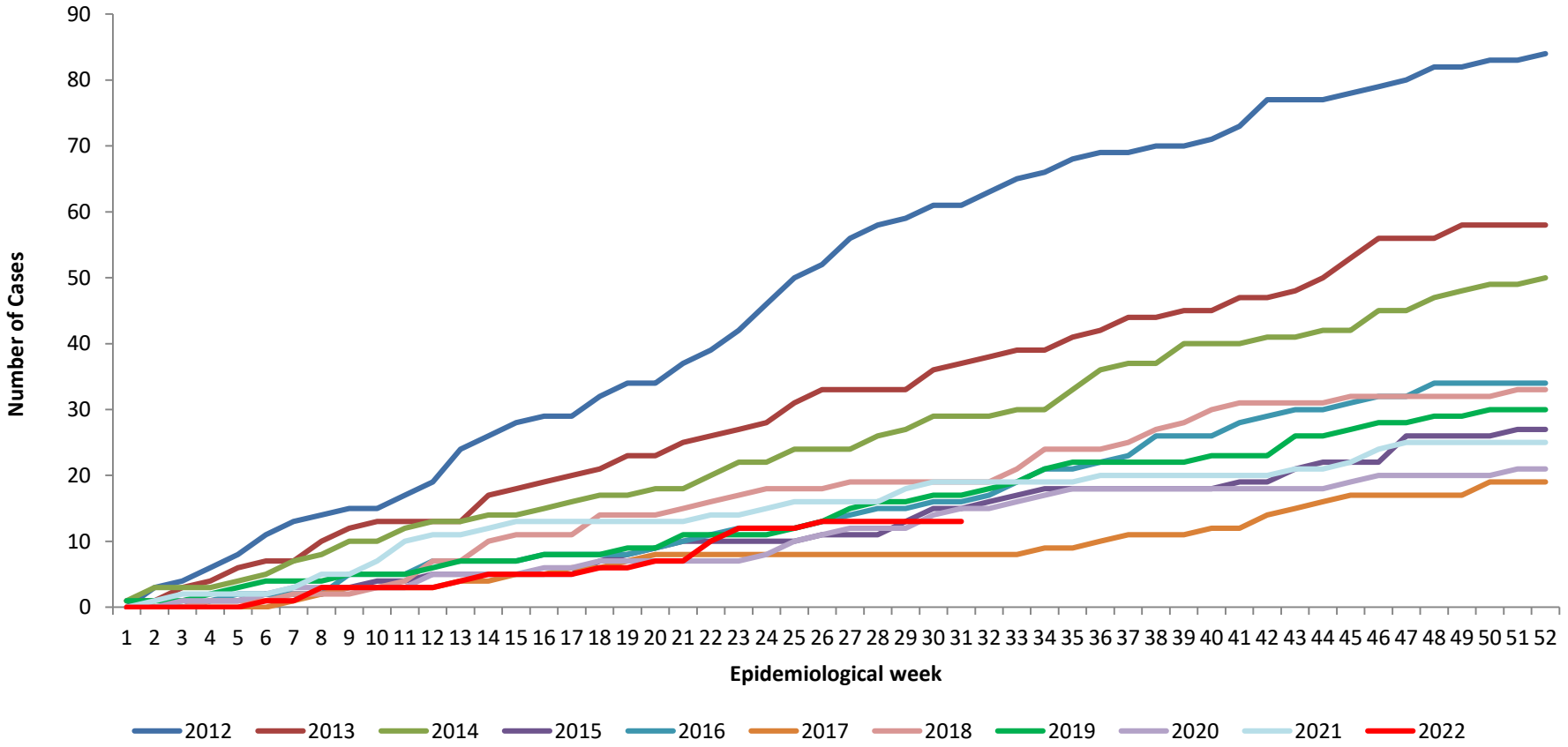

Figure 1. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the seven serotypes (4, 6B, 9V, 14, 18C, 19F and 23F) in PCV7: children <5 years of age in South Africa, from 2012 to date. Viable isolates and those serotyped using molecular techniques included.

Data are provisional as reported to date.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

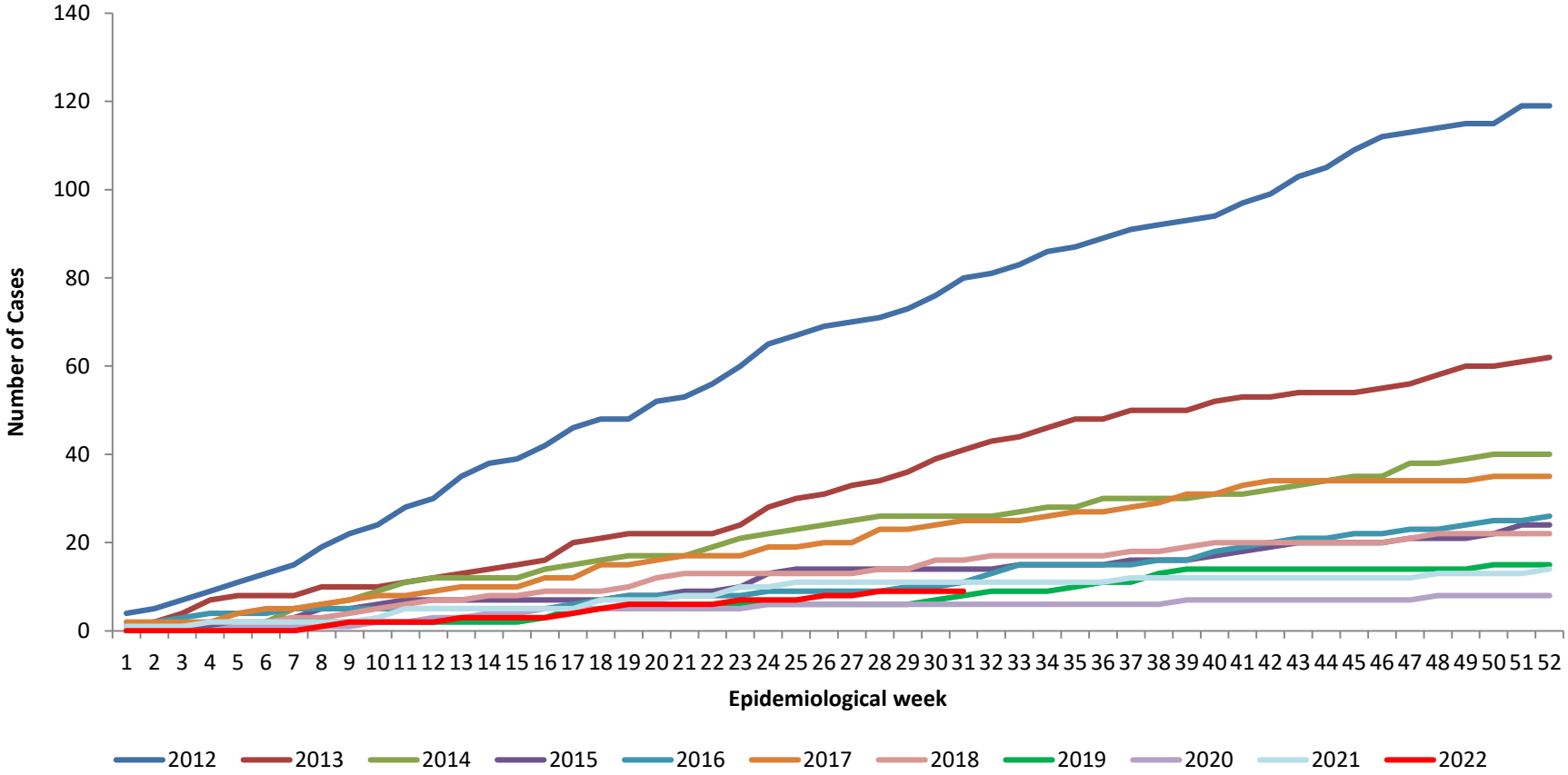

Figure 2. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the six additional (1, 3, 5, 6A, 7F, 19A) serotypes in PCV13 but not in PCV7: children <5 years of age in South Africa, from 2012 to date. Viable isolates and those serotyped using molecular techniques included. (Note: There is reported cross protection between 6A and 6B which is included in PCV7[6])

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

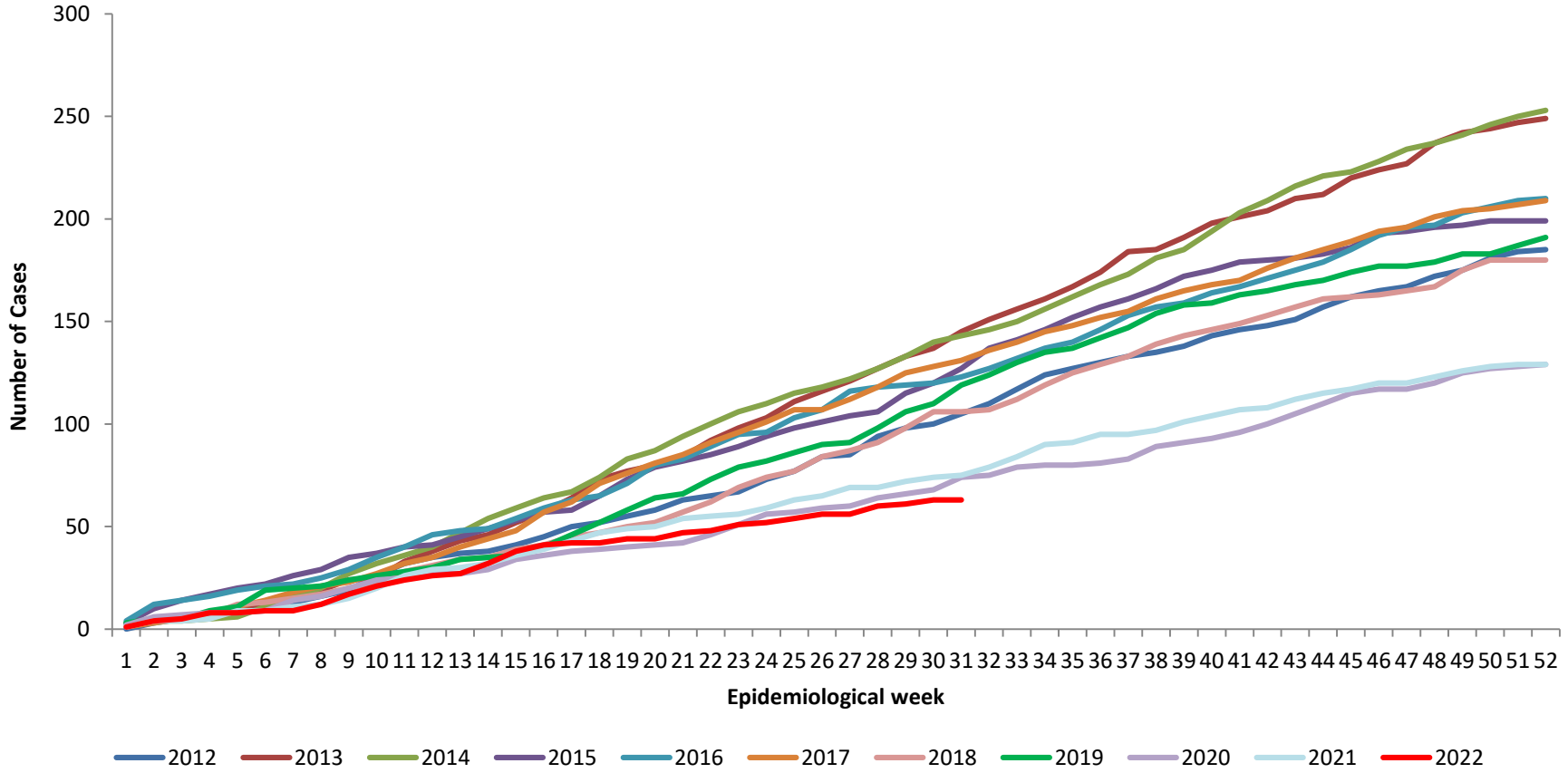

Figure 3. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the serotypes not in PCV13: children <5 years of age in South Africa, from 2012 to date. Viable isolates and those serotyped using molecular techniques included.

Data are provisional as reported to date.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

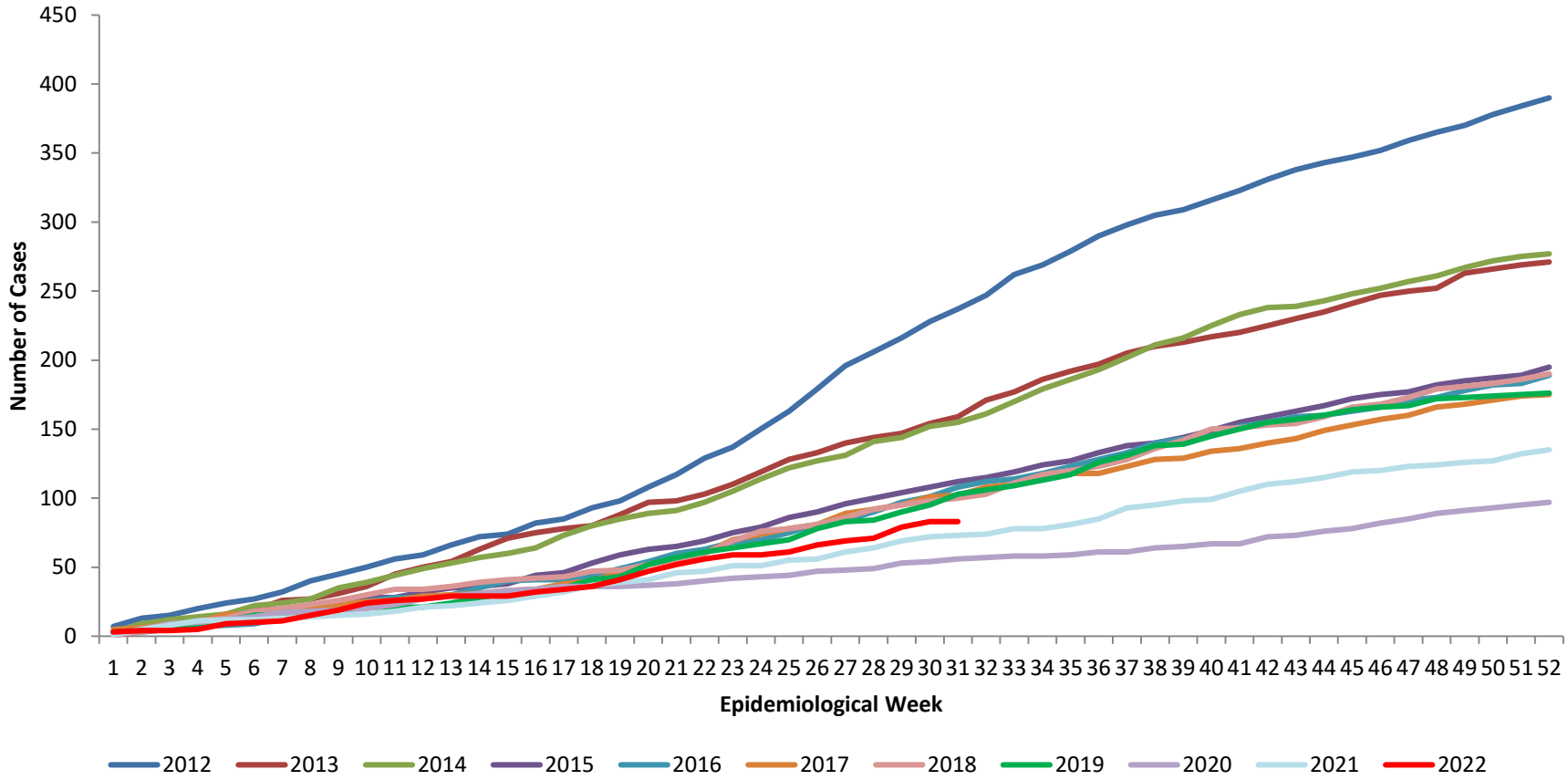

Figure 4. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the seven serotypes (4, 6B, 9V, 14, 18C, 19F and 23F) in PCV7: individuals ≥5 years of age in South Africa, from 2012 to date. Viable isolates and those serotyped using molecular techniques included.

Data are provisional as reported to date.

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

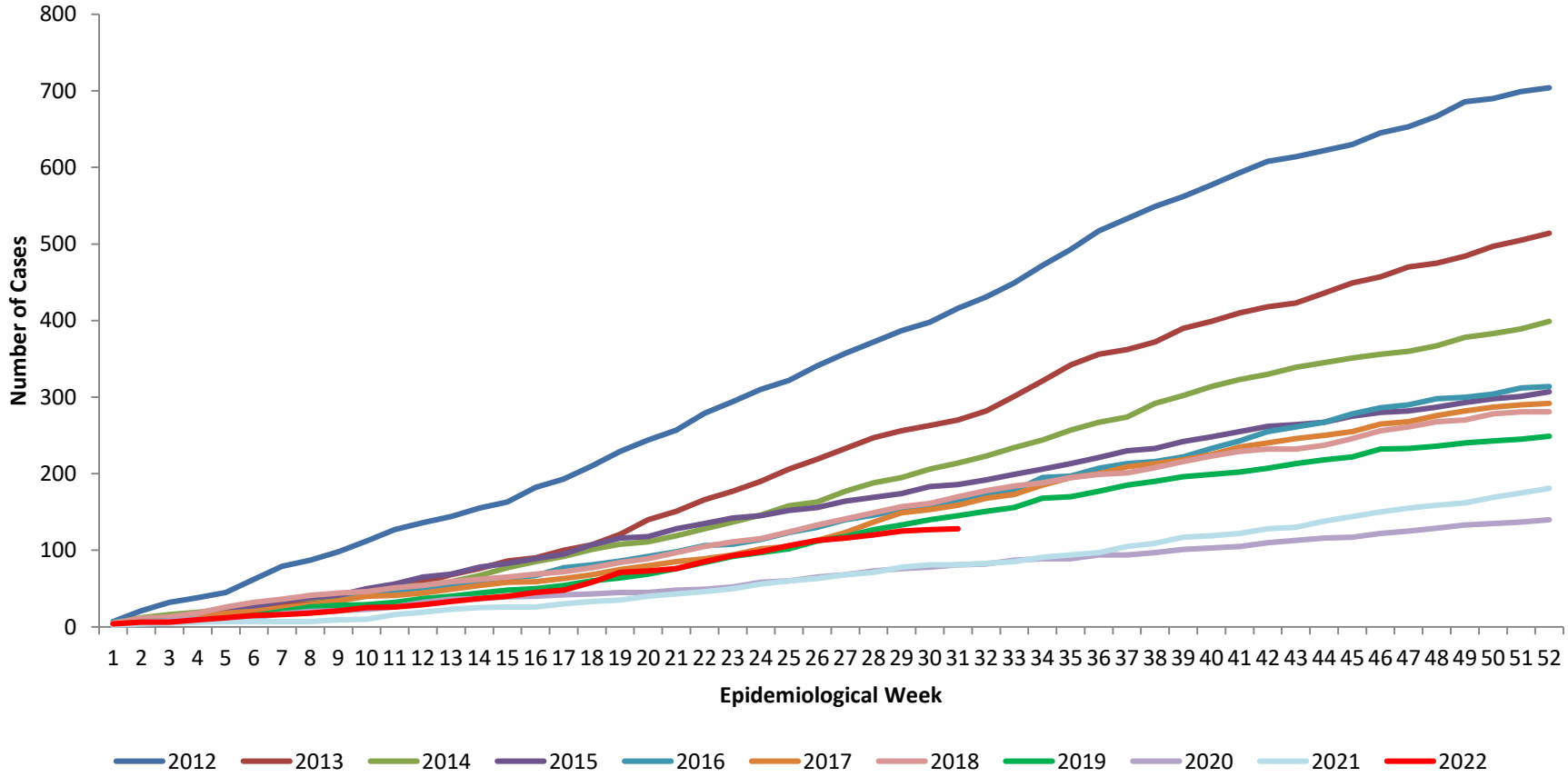

Figure 5: Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the six additional (1, 3, 5, 6A, 7F, 19A) serotypes in PCV13 but not in PCV7: individuals ≥5 years of age in South Africa, from 2012 to date. Viable isolates and those serotyped using molecular techniques included (Note: There is reported cross protection between 6A and 6B which is included in PCV7[6])

Data are provisional as reported to date.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

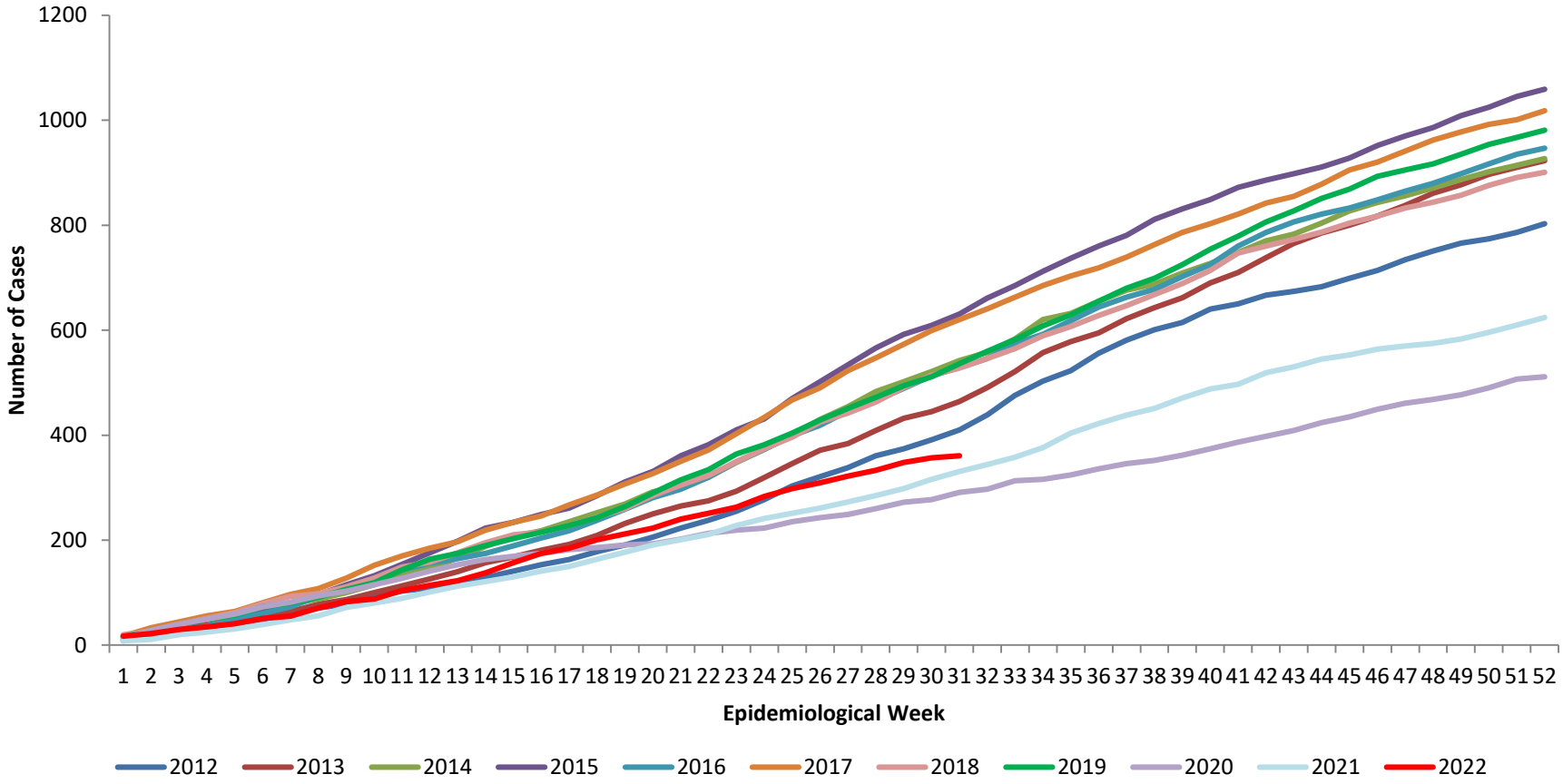

Figure 6. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the serotypes not in PCV13: individuals ≥5 years of age in South Africa, from 2012 to date. Viable isolates and those serotyped using molecular techniques included.

Data are provisional as reported to date.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

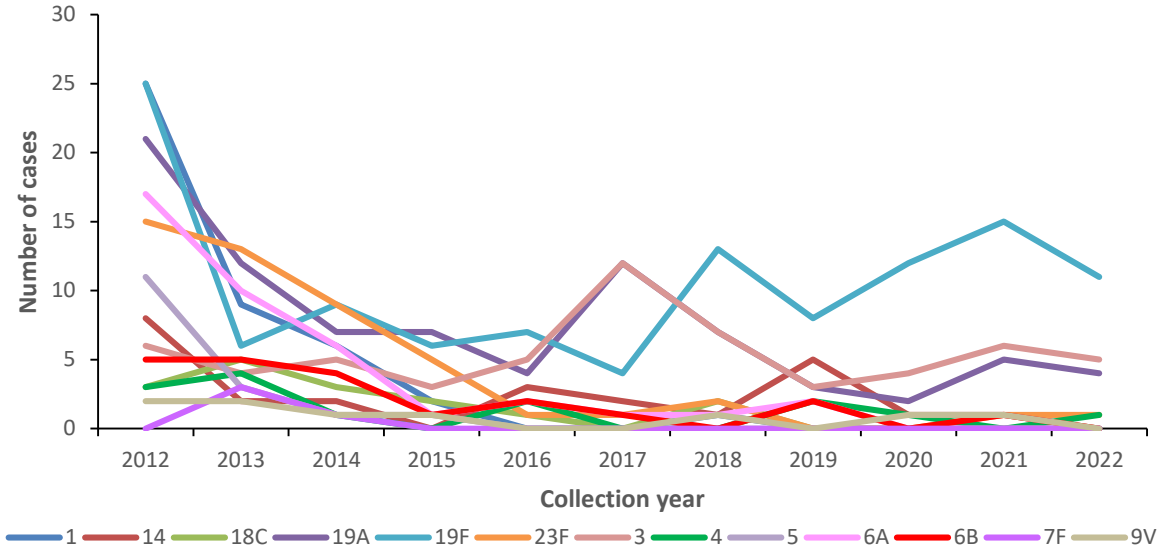

Figure 7. Number of disease episodes of invasive pneumococcal disease due to serotypes included in PCV13: individuals <5 years of age in South Africa, up to current reporting week (week 31/year) from 2012 to date. Viable isolates and those serotyped using molecular techniques included.

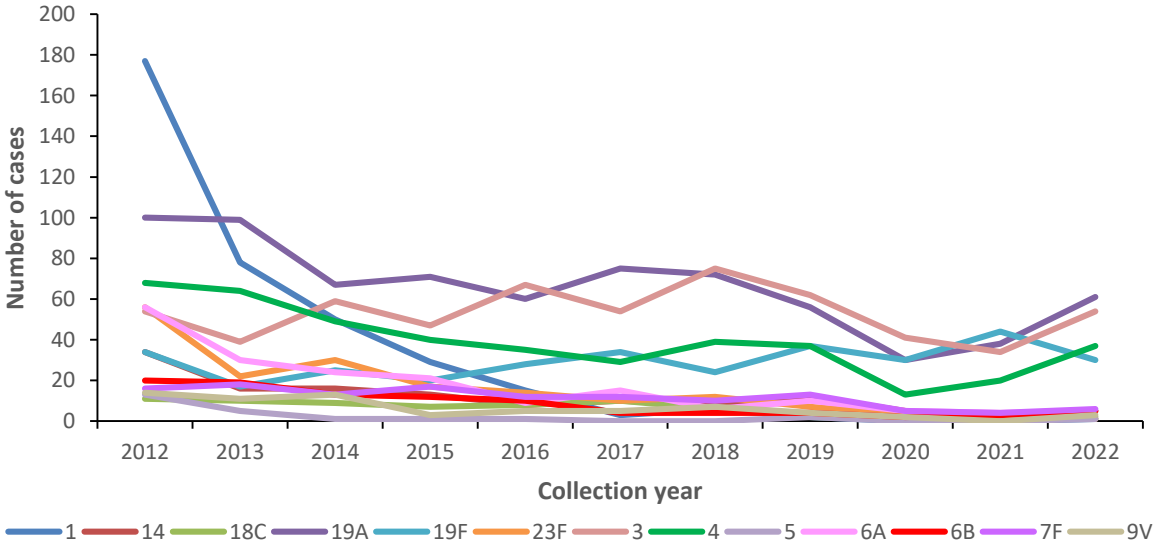

Figure 8. Number of disease episodes of invasive pneumococcal disease due to serotypes included in PCV13: individuals ≥5 years of age in South Africa, up to current reporting week (week 31/year) from 2012 to date. Viable isolates and those serotyped using molecular techniques included.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

Missing information

Age was unknown for 1039 of the cases (Table 1). By the time that this report was produced there were 8 viable isolates with pending serotype results (Table 2). For 407 isolates in the reporting period, serotype could not be identified due to high C_t value during *lytA* PCR, or PCR serotype target not distinguishing between vaccine and non-vaccine serotype.

Table 1. Isolates with missing age; number of viable, non-viable isolates and audit cases identified, January 2012 to date.

	Age missing, n(%)		Viable, n(%)		Non-viable, n(%)		Audit/missing isolates, n(%)		Capture delays*, n(%)		Total
2012	248	(8)	2,160	(67)	273	(8)	789	(24)	0	(0)	3222
2013	138	(5)	1,932	(67)	268	(9)	665	(23)	0	(0)	2865
2014	165	(6)	1,752	(64)	291	(11)	688	(25)	0	(0)	2731
2015	157	(6)	1,700	(65)	208	(8)	727	(28)	0	(0)	2635
2016	41	(2)	1,578	(65)	197	(8)	658	(27)	0	(0)	2433
2017	34	(1)	1,535	(63)	280	(11)	625	(26)	0	(0)	2440
2018	42	(2)	1,336	(58)	327	(14)	650	(28)	0	(0)	2313
2019	38	(2)	1,385	(59)	345	(15)	621	(26)	0	(0)	2351
2020	30	(2)	790	(64)	183	(15)	269	(22)	0	(0)	1242
2021	97	(6)	984	(63)	247	(16)	328	(21)	0	(0)	1559
2022	49	(5)	639	(71)	78	(9)	147	(16)	35	(4)	899
All	1039	(4)	15,791	(64)	2697	(11)	6167	(25)	35	(0)	24,690

*Cases reported to CRDM, but viability is unknown due to capturing delays.

Table 2. Cases where serotype was not available at the time this report was produced

	Not typed	Unknown serotype	Viable, serotype pending	Non-viable, serotype pending	Viability unknown*, serotype pending	Total serotypes pending
2012	38	9	0	0	0	0
2013	38	12	0	0	0	0
2014	1	39	0	0	0	0
2015	0	38	0	0	0	0
2016	2	30	0	0	0	0
2017	3	44	0	0	0	0
2018	0	38	0	0	0	0
2019	0	68	0	0	0	0
2020	0	43	0	0	0	0
2021	0	64	3	5	0	8
2022	0	22	5	7	35	47
Total	82	407	8	12	35	55

* Viability unknown due to capturing delays

Discussion

Compared to previous years, there was a marked reduction in IPD episodes in 2020 and 2021. Due to the coronavirus disease 2019 (COIVD-19) pandemic, a nation-wide lockdown was implemented on 26 March 2020 (week 13). The reduction in IPD episodes could be related to one or more of the following: reduced healthcare seeking behaviour; closures of work-places, schools and universities; physical distancing and the mandatory wearing of masks.[7] This reduction in invasive pneumococcal disease in 2020 is a global phenomenon which coincided closely with the introduction of COVID-19 containment measures in each country.[8] IPD episodes have increased again in 2022, most evident in individuals aged ≥5 years, but with episode numbers still remaining below what was observed in 2019. Serotypes 19F, 19A and 3 continue to be the most detected vaccine serotypes among young children <5 years of age (Figure 7) and serotypes 3, 19A and 4 among individuals aged ≥5 years (Figure 8).

Data Source
National Institute for Communicable Diseases | GERMS-SA

Last updated: 29 August 2022
Next update: 1 December 2022

References

1. Carvalho MdGS, Tondella ML, McCaustland K, et al. Evaluation and Improvement of Real-Time PCR Assays Targeting lytA, ply, and psaA Genes for Detection of Pneumococcal DNA. *J Clin Microbiol.* 2007;45(8):2460-2466.
2. Azzari C, Moriondo M, Indolfi G, et al. Realtime PCR Is More Sensitive than Multiplex PCR for Diagnosis and Serotyping in Children with Culture Negative Pneumococcal Invasive Disease. *PLoS One.* 2010;5(2):e9282.
3. WHO/UNICEF. South Africa: WHO and UNICEF estimates of immunization coverage: 2020 revision. 2021; https://www.who.int/publications/m/item/immunization-zaf-2021-country-profile.
4. von Gottberg A, de Gouveia L, Tempia S, et al. Effects of vaccination on invasive pneumococcal disease in South Africa. *N Engl J Med.* 2014;371(20):1889-1899.
5. Kleynhans J, Cohen C, McMorrow M, et al. Can pneumococcal meningitis surveillance be used to assess the impact of pneumococcal conjugate vaccine on total invasive pneumococcal disease? A case-study from South Africa, 2005-2016. *Vaccine.* 2019;37(38):5724-5730.
6. Whitney CG, Pilishvili T, Farley MM, et al. Effectiveness of seven-valent pneumococcal conjugate vaccine against invasive pneumococcal disease: a matched case-control study. *The Lancet.* 2006;368(9546):1495-1502.

7. National Institute for Communicable D. Reduction in invasive pneumococcal disease in South Africa, January through July 2020. Available from https://www.nicd.ac.za/wp-content/uploads/2020/08/Pneumococcal-disease.pdf Accessed 14 September 2020. *Communicable Diseases Communique.* 2020;19(8):5.
8. Brueggemann AB, Jansen van Rensburg MJ, Shaw D, et al. Changes in the incidence of invasive disease due to Streptococcus pneumoniae, Haemophilus influenzae, and Neisseria meningitidis during the COVID-19 pandemic in 26 countries and territories in the Invasive Respiratory Infection Surveillance Initiative: a prospective analysis of surveillance data. *The Lancet Digital Health.* 2021;3(6):e360-e370.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

Appendix: Cumulative invasive pneumococcal disease case numbers reported by the GERMS-SA surveillance programme, January 2005 to December 2012

GERMS-SA surveillance programme

- GERMS-SA is a national, active, laboratory-based surveillance system initiated in 2003.
- Invasive pneumococcal disease (IPD) cases defined as hospitalised individuals with *Streptococcus pneumoniae* cultured from normally sterile site specimens (e.g. cerebrospinal fluid, blood or joint fluid).
- Repeat isolates from the same individual within 21 days were excluded.
- ~190 laboratories each year send reports and isolates.
- Age, sex, date of specimen collection, and source of specimen were captured.
- Pneumococci were serotyped by Quellung reaction using specific antisera (Statens Serum Institute, Copenhagen, Denmark).
- **Only viable isolates are included in cumulative graph case numbers as molecular diagnostic techniques were only introduced in 2007.**
- Figures 1 – 3 are for cases < 5 years, and Figures 4 – 6 for cases 5 years and older. Cases with unknown age were excluded from the figures.
- There are three graphs for each age group:
  - Disease caused by any of the seven serotypes in PCV7 (4, 6B, 9V, 14, 18C, 19F and 23F)
  - Disease caused by any of the six additional serotypes in PCV13 but not in PCV7 (1, 3, 5, 6A, 7F, 19A)
  - Disease caused by any serotypes not in PCV13
- More information on the GERMS-SA system available at: http://www.nicd.ac.za/centres/division-of-public-health-surveillance-and-response/

PCV vaccine introduction in South Africa

- The 7-valent pneumococcal conjugate vaccine (PCV-7) was introduced to the South African Expanded Programme on Immunization in April 2009, with no catch-up vaccination campaign.
- There was a graded replacement of PCV-7 by 13-valent pneumococcal conjugate (PCV-13) in 2011. By June 2011 all provinces were using PCV-13.
- There was a limited PCV-13 catch-up campaign in 2011 and 2012.

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

Appendix: Cumulative invasive pneumococcal disease case numbers reported by the GERMS-SA surveillance programme, 1 January 2005 to December 2012

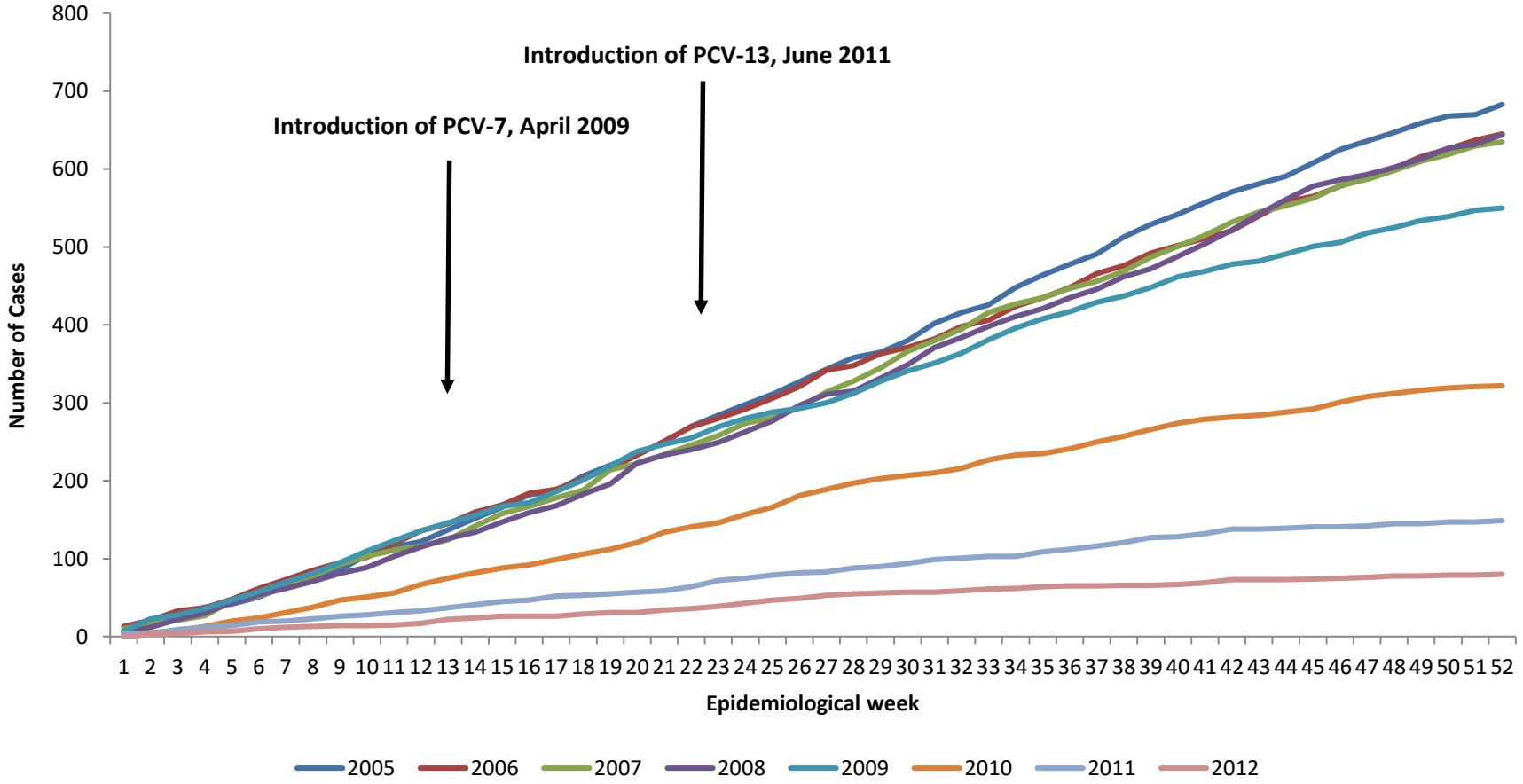

Figure 1. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the seven serotypes (4, 6B, 9V, 14, 18C, 19F and 23F) in PCV-7: children <5 years of age in South Africa, from 2005 to 2012. Only viable isolates serotyped using Quellung method included.

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

Appendix: Cumulative invasive pneumococcal disease case numbers reported by the GERMS-SA surveillance programme, 1 January 2005 to December 2012

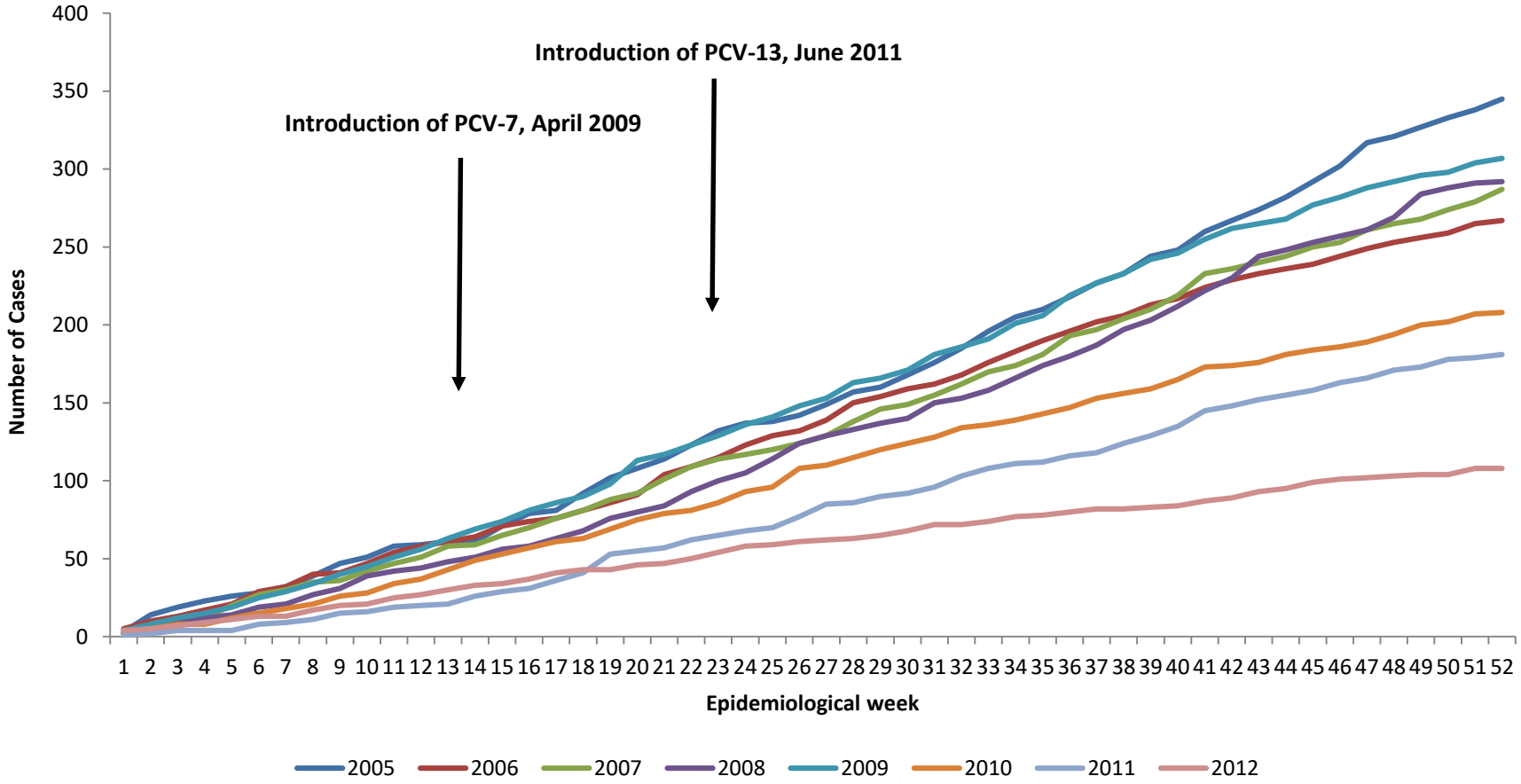

Figure 2. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the six additional (1, 3, 5, 6A, 7F, 19A) serotypes in PCV-13 but not in PCV7: children <5 years of age in South Africa, from 2005 to 2012. Only viable isolates serotyped using Quellung method included. (Note: There is reported cross protection between 6A and 6B which is included in PCV7[6])

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

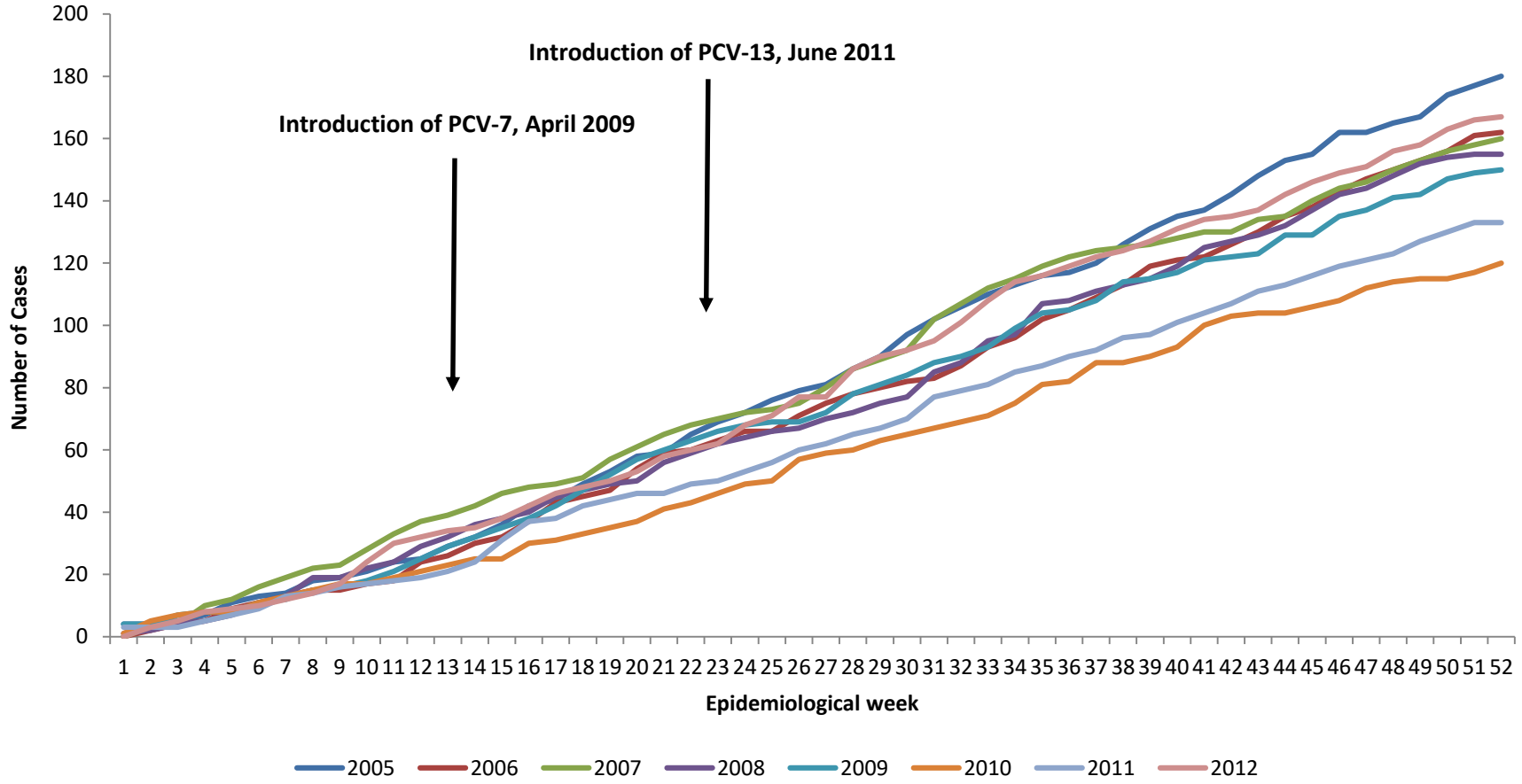

Figure 3. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the serotypes not in PCV13: Children <5 years of age in South Africa, from 2005 to 2012. Only viable isolates serotyped using Quellung method included.

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

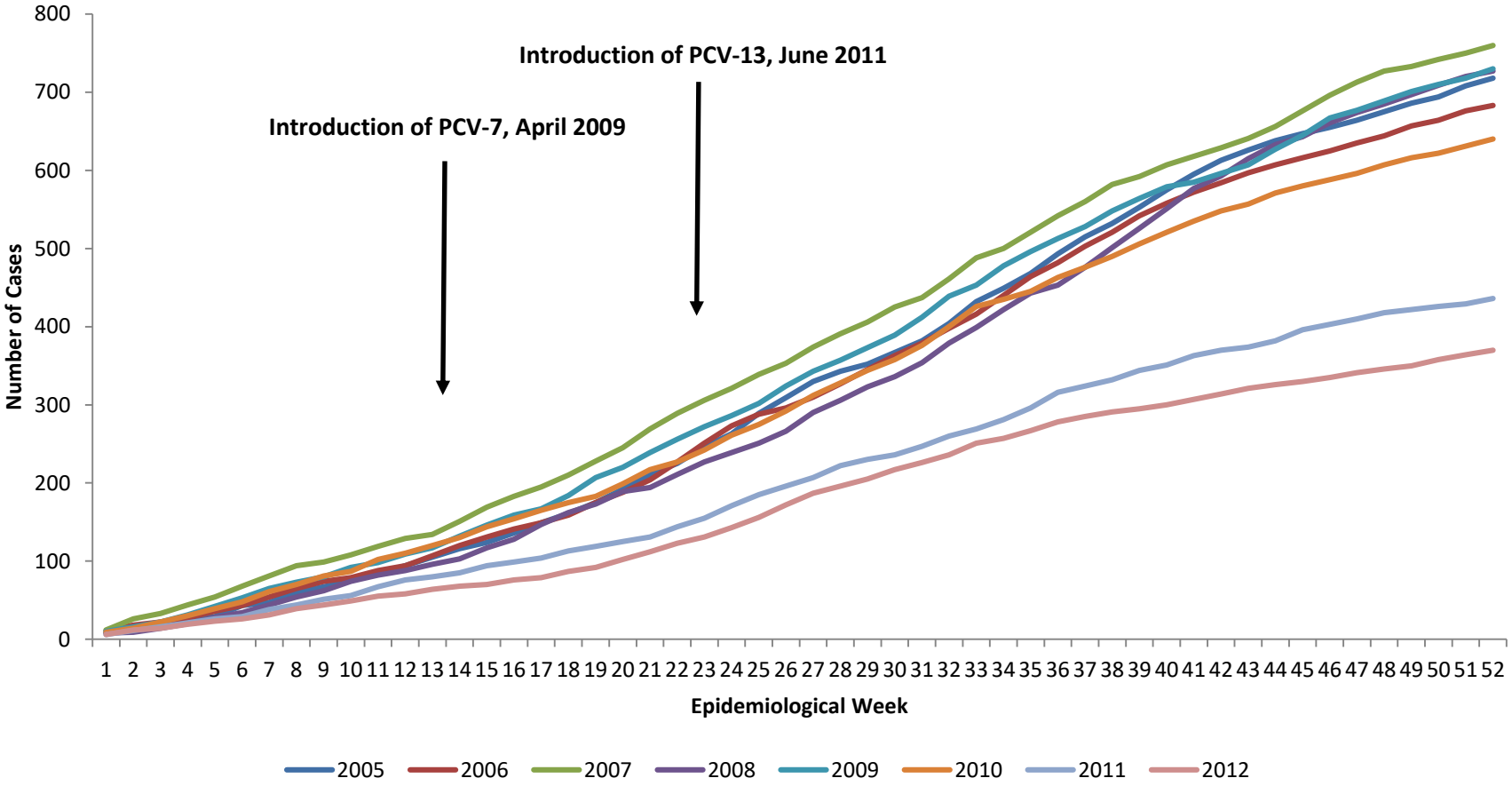

Figure 4. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the seven serotypes (4, 6B, 9V, 14, 18C, 19F and 23F) in PCV-7: Individuals ≥5 years of age in South Africa, from 2005 to 2012. Only viable isolates serotyped using Quellung method included.

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

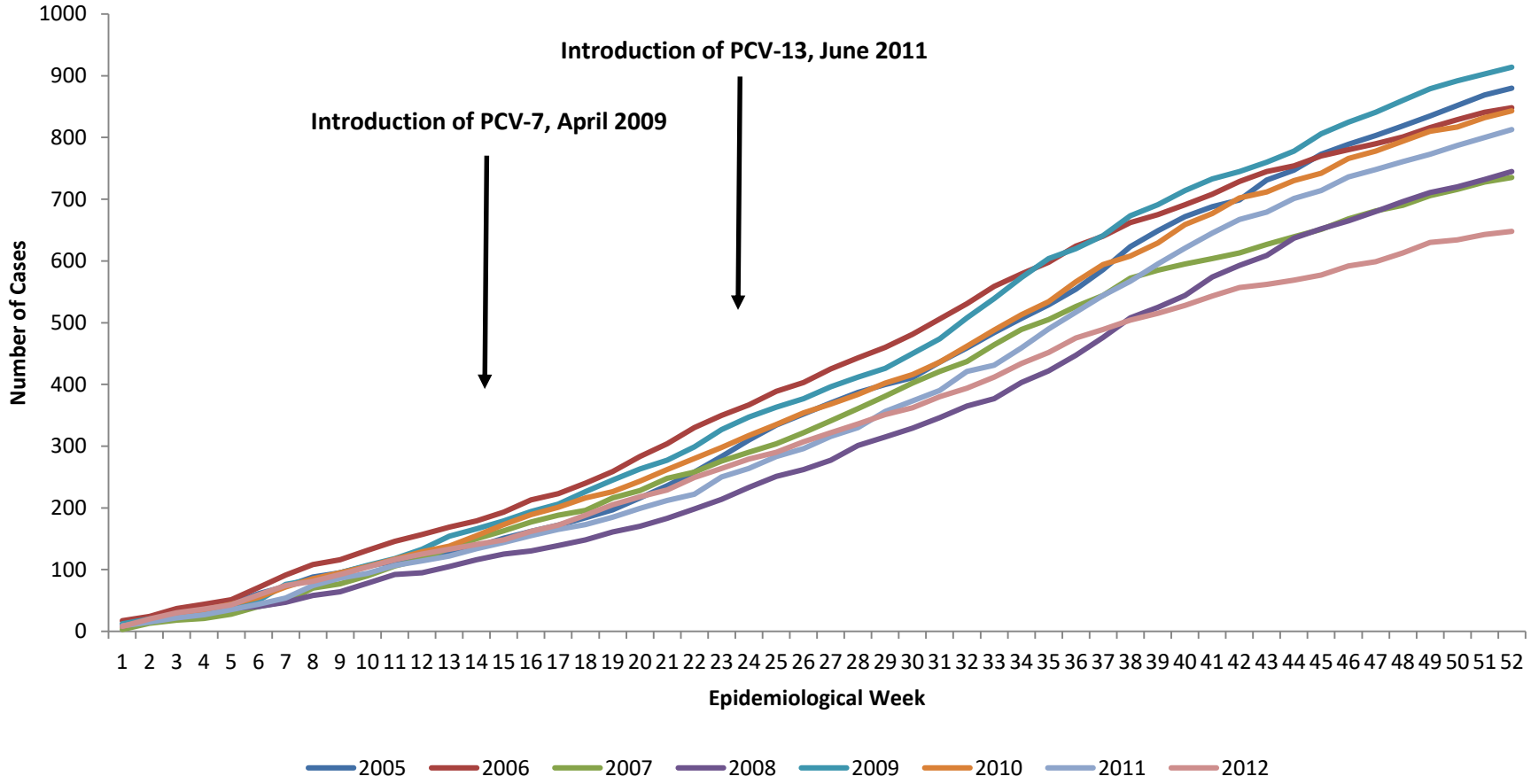

Figure 5: Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the six additional (1, 3, 5, 6A, 7F, 19A) serotypes in PCV-13 but not in PCV-7: individuals ≥5 years of age in South Africa, from 2005 to 2012. Only viable isolates serotyped using Quelling method included. (Note: There is reported cross protection between 6A and 6B which is included in PCV-7[6])

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

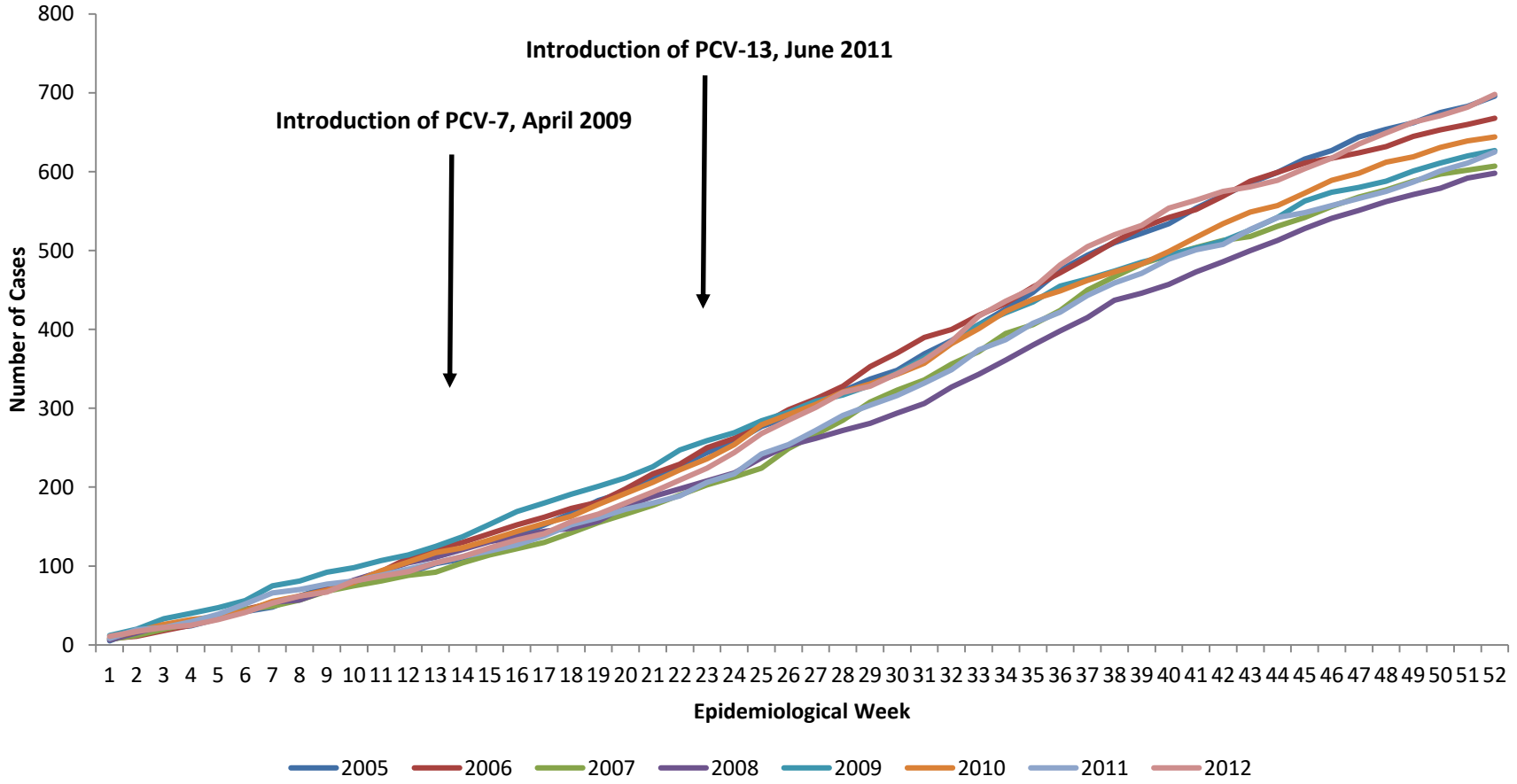

Figure 6. Cumulative weekly number of disease episodes of invasive pneumococcal disease due to any of the serotypes not in PCV-13: individuals ≥5 years of age in South Africa, from 2005 to 2012. Only viable isolates serotyped using Quellung method included.

Centre for Respiratory Diseases and Meningitis
National Institute for Communicable Diseases
1 Modderfontein Road
Sandringham
2192

Appendix: Cumulative invasive pneumococcal disease case numbers reported by the GERMS-SA surveillance programme, 1 January 2005 to December 2012

Missing information

Table 1. Isolates with missing age; number of viable and non-viable isolates and audit cases identified, 2005-2012

	Age missing, n (%)		Viable, n (%)		Non-viable, n (%)		Audit, n (%)		Total
2005	236	(5)	3,650	(75)	380	(8)	856	(18)	4,886
2006	223	(5)	3,419	(72)	444	(9)	868	(18)	4,731
2007	217	(5)	3,329	(70)	597	(13)	816	(17)	4,742
2008	208	(4)	3,327	(69)	576	(12)	932	(19)	4,835
2009	161	(3)	3,387	(71)	532	(11)	841	(18)	4,760
2010	141	(3)	2,873	(68)	515	(12)	809	(19)	4,197
2011	218	(6)	2,409	(63)	451	(12)	944	(25)	3,804
2012	248	(8)	2,160	(67)	344	(11)	718	(22)	3,222
All	1,652	(5)	24,554	(67)	3,839	(12)	6,784	(20)	35,177