

REPUBLIC OF SOUTH AFRICA
EXPANDED PROGRAMME ON IMMUNISATION (EPI) NATIONAL COVERAGE
SURVEY REPORT
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Preface

The 2019 EPI national coverage survey is the first survey conducted using the new World Health Organization (WHO) guideline to undertake EPI cluster coverage surveys; and the first such survey in the last two decades. The EPI programme of the National Department of Health (NDoH) commissioned the South Africa Medical Research Council Vaccines and Infectious Diseases Analytics Research Unit (SA-MRC- VIDA) previously known as the SA-MRC Respiratory and Meningeal Pathogens Research Unit (RMPRU) to design and implement the survey on their behalf. The National Institute for Communicable Diseases (NICD), WHO and UNICEF provided technical support to the survey. Fieldwork and data collection were carried out between end-July and mid-December, 2019.

The main objective of the survey was to determine vaccine coverage in children aged 24 to 35 months. This included to estimate vaccination coverage among children 24 to 35 months of age at a representative district level; measure the drop-out rates between vaccination dose series; measure the timeliness of vaccinations; identify reasons for missed vaccinations; and investigate the health system and personal predictors for and barriers to vaccination uptake in South Africa. Being a national survey, it was envisaged that this survey would provide data that can be used for policy and programme development and implementation.

Overall, 83.9% (95% CI:82.9-84.9) of children in the survey had received all basic vaccinations up to age 1 year i.e. up to measles 1. The vaccination coverage declined to 81.4% (95% CI: 80.3-81.5) for children vaccinated with doses scheduled up to 12 months i.e. up to measles 2. Vaccination coverage for child fully vaccinated (received all age-appropriate vaccinations from birth to 18 months) was 76.8% (75.4-78.2). The dropout rates from PCV 2 to 3 (14 weeks to 9 months), from measles 1 to 2 (6 months to 12 months) and from measles 2 to hexavalent 4 (12 month to 18 month) was 2.9%, 5.1% and 4.3% respectively. 4.3% of children were unvaccinated.

The findings of the 2019 EPI coverage survey presented in this report provide up-to-date and reliable information on a number of key EPI programme indicators to planners, policymakers, program managers, and researchers that will guide in the planning, implementation, monitoring, and evaluation of child vaccination programs in South Africa. Data on inter-district heterogeneity, vaccination coverage estimates and reasons for missed doses are provided at district level and thus provide locally relevant information for targeted interventions.

The survey investigators, survey implementers and the NDoH acknowledges the NICD, WHO and UNICEF for technical assistance, Provincial EPI and health promotion program units, and government officials at all levels of administration who contributed immensely to the successful completion of the 2017 EPI survey. We highly appreciate and commend the 2019 EPI survey field and data personnel for

their great commitment to high-quality work. Special gratitude goes to all of the survey respondents who generously gave their valuable time to provide information that forms the basis of this report.

Chapter I: Introduction

Background

Infant vaccination is considered to be the most cost-effective way to reduce morbidity and mortality.¹ However, many children are left unvaccinated or under vaccinated. Studies have shown that there are numerous factors that affect vaccination uptake.^{1,5,6,7} A 2012 review of 126 global studies from the grey literature to identify reasons why eligible children had incomplete or no vaccinations, found that the major factors were healthcare facility obstacles such as service inaccessibility, poor attitudes and behaviour of healthcare workers, lack of resources and poor logistics resulting in vaccine stock-outs, and false and incorrect vaccine information from the healthcare workers.⁷ Also, lack of parental knowledge relating to vaccinations, fear of side effects, and parental conflicting priorities were reported, especially in poor populations.⁷ Similarly, a recent study from South Africa found that healthcare facility obstacles were the major reason for missed vaccinations, with vaccine stock-outs being responsible for 62% of missed vaccinations.⁸ However, fear of side effects and issues related to vaccine hesitancy were not reported.⁸ These findings show that reasons for non- and under-vaccination are complex, driven by a variety of context-specific factors which not only vary by socio-economic status but are also dependent on access to and quality of the health care system.^{1,5,6,7,8} While there have been a number of South African EPI coverage studies, these have generally had small sample sizes,^{3,8} and none have been nationally representative. A nationally representative EPI survey with a statistically powerful sample size is essential to understand reasons for under-vaccination within the South African context.

The aim of the National Department of Health (NDoH) EPI-SA is to ensure that 90% of all children are fully immunised by the age of one year.^{2,3} EPI-SA considers a child aged 12-23 months to have received all age-appropriate vaccinations if the child has received all basic vaccinations, which includes a birth dose of BCG; two doses of OPV (given at birth and 6 weeks); three doses of the hexavalent (DTaP-IPV-Hib-HepB, introduced in 2015 to replace the pentavalent DTaP-IPV-Hib and monovalent HepB) vaccine (given at age 6, 10, and 14 weeks); three doses of PCV (given at age 6 and 14 weeks, and 9 months); two doses of RV (given at age 6 and 14 weeks); and one dose of measles vaccine (given at 6 months).² A child who is age 24-35 months has received all age appropriate vaccinations if they have also received a second dose of measles vaccine (given at 12 months), and a fourth dose of DTaP-IPV-Hib-HepB (given at 18 months) in addition to all of the age-appropriate vaccinations relevant for a child age 12-23 months.² Vaccination coverage surveys are vital for monitoring and evaluating immunisation programmes. Administrative data have inherent limitations thus vaccination coverage surveys that provide high quality coverage data are imperative for effective decision-making within immunisation programmes at all levels of government.^{3,9,10}

The SADHS 2016 which collected information on vaccination coverage among children born in the 3 years preceding the survey, provides evidence that there is variation in vaccination coverage between

provinces. Overall, 61% of children age 12-23 months received all basic vaccinations, and 53% received all age-appropriate vaccinations; lower for girls than boys (59% versus 64%) and lower for those living in urban areas compared with non-urban areas (59% versus 65%). Coverage for North West, Gauteng and Mpumalanga provinces were lower than these national averages. Coverage rates drastically declined for subsequent doses, from 92% for the birth dose of OPV, 91% for the first dose of DTaP-IPV-Hib, 90% for the first dose of HepB, 89% for the first dose of PCV, 88% for the first dose of RV, 86% for first dose of measles vaccine, and only 59% for the second dose of measles vaccine. In addition, only 65% received three doses of DTaP-IPV-Hib and HepB, and only 70% received two doses of RV. Of children aged 24 to 35 months, only 42% received all age-appropriate vaccinations, with the lowest coverage being in Gauteng (36%) and North West (32%).³

Vaccination coverage surveys rely either on parental recall, or on vaccination-related information captured by vaccinators in documents retained by parents, which in South Africa are referred to as the Road-to-Health card (RtHC). In, the SADHS, possession of RtHCs was observed for 66% and 60% of the children age 12-23 months and 24-35 months respectively,³ whilst a study including 470 children in the Eastern Cape reported 89% RtHC retention at 24 months.¹¹

The 2016 SADHS³ highlights crucial gaps in vaccination coverage and provides preliminary data required for programme planning and informed targeted resource allocation to areas most in need. However, there are fundamental limitations to this survey that calls for a more rigorous and robust vaccination coverage survey that provides more accurate vaccination estimates. Of critical importance the sample size was very small, with only 677 children aged 12- 23 months and 660 children aged 24-35 months in total, and with Northern Cape and Free State being represented by a total of 12 and 30 children respectively. Additionally, the survey methodology was not in line with the World Health Organization (WHO) Vaccination Coverage Cluster Surveys Reference Manual.¹⁰ The results from the SADHS 2016 survey differ significantly from the official 2016/2017 administrative estimates in the District Health Information System (DHIS), which reported an annual fully immunised under one year-old coverage estimate above 80%, with some districts reporting coverage rates above 100%.¹² There was thus an urgent need for South Africa to conduct a robust national vaccination coverage survey utilising methodology provided by the WHO, namely the WHO Vaccination Coverage Cluster Surveys Reference Manual.¹⁰ This would allow the NDoH to accurately estimate vaccination coverage across the 52 districts, and generate fundamental robust data to inform vaccination policy, planning, practice and resource allocation.

In addition to obtaining estimates of vaccination coverage, a survey on immunisation should ideally also use the platform to interrogate the reasons for under-immunisation. A number of international and national studies have been undertaken to identify barriers to immunisation and these barriers are well recognised to be complex. Barriers can generally be considered in the following categories:

1. Health system barriers: Lack of availability of vaccines and other factors that limit accessibility of services – poor attitudes of healthcare workers, poor quality of care, lack of knowledge of healthcare workers, opening times of clinics.^{7,8,13,14}
2. Personal barriers: Fears about vaccination, cultural beliefs, level of maternal education, income.^{7,13,14}

The WHO recommends that national EPI coverage surveys are conducted regularly to validate official administrative estimates.¹⁰ As such, between end-July to mid-December 2019, the NDoH EPI programme commissioned MRC-VIDA/RMPRU to conduct a nationally representative EPI coverage survey, powered to estimate coverage at district level and using the survey methodology outlined in the WHO Vaccination coverage cluster survey reference manual.

Purpose of the survey

This survey describes vaccination of children aged 24 to 35 months of age and provides estimates for vaccination coverage among children 24 to 35 months of age at a representative district level; quantifies the drop-out rates between vaccination dose series as well as the timeliness of vaccinations; identifies reasons for missed vaccinations; and investigates the health system and personal predictors for and barriers to vaccination uptake in South Africa. Being a nationally representative survey, results from this survey will be invaluable in providing true vaccination coverage estimates at the district level and will validate estimates routinely obtained through administrative data. These data will direct policy implementation, showcase best practice and highlight districts requiring targeted interventions aimed at improving EPI programme performance.

Specific Objectives

Primary objective

To estimate the proportion of children in South Africa, at national and district level, who are fully immunised with all the vaccines scheduled within the first year of life (i.e. up to and including the 3rd PCV dose scheduled at 9 months) and the second year of life (i.e. up to and including the 4th dose of DTaP-IPV-Hib-HepB scheduled at 18 months of age) with precision of 0.1 at 5 % significance level (95% confidence interval) if the coverage is 65% or higher.

Secondary objectives

1. To quantify the proportion of children aged 24 to 35 months who are under vaccinated for vaccines scheduled up to and including those scheduled at 9 months of age and at 18 months of age.
2. To quantify dropout rates throughout the vaccination schedule
3. To assess validity and timeliness of each dose
4. To identify and quantify reasons for missed vaccinations

5. To identify and quantify factors (predictors and barriers) associated with missed vaccinations and non-vaccination

Objectives 3 and 5 will be addressed in a separate supplementary report.

Survey Organization

SA-MRC VIDA/RMPRU was mainly responsible for survey implementation. A steering committee comprising of senior experts from EPI and health promotion programmes at NDoH, NICD, UNICEF, WHO and specialist paediatricians, epidemiologists and expert vaccinologists was established to direct protocol development and oversee survey planning as well as successful accomplishment at national level. A senior epidemiologist was responsible for the oversight and technical aspects in all phases of the survey. In addition, a technical working group was set up to manage logistical aspects of the survey and to serve as master trainers and manage district teams. The provincial and district EPI and health promotion managers were instrumental in organising training venues, mobilising communities and providing locally relevant assistance to the field teams.

Chapter II: Survey Methodology

Survey design

This survey was a national vaccination coverage cluster survey based on the WHO vaccination coverage cluster surveys reference manual with coverage estimates at district level,¹⁰ and involved administering a questionnaire (Appendix 2) to mothers or primary caregivers of eligible children to acquire information on the immunisation status of their children and health care utilisation. A household questionnaire was also administered to capture household circumstances such as living arrangements, household head details, household characteristics and assets. Furthermore, photographs of the immunisation records in the RtHC were taken, allowing for validation of information provided by the caregivers. For children without a RtHC, immunisation details were based on oral recall and captured as such. In cases where children were found to be un-immunised or partially immunised, reasons for non-vaccination were documented. The survey did not include health facility records verification due to resource constraints.

Target population

Inclusion criteria

Primary caregivers of children aged 24 to 35 months between July and December 2019 in selected survey clusters. Every eligible respondent had a chance of being selected for the sample and this probability of selection was calculated. Caregivers of all eligible children in each household were interviewed. Any child aged 24 to 35 months who slept in the selected household the night prior to the interview was eligible for the survey. In line with WHO recommendations, the 24 to 35 months cohort was selected to ensure that coverage with all the infant and toddler series of vaccines offered in EPI-SA, which includes DTaP-Hib-IPV-HepB at 18 months of age in South Africa,^{3,10} can be calculated.

Sample size

Sample size calculations are based on the formulae and rationale given in the WHO vaccination coverage cluster surveys reference manual.¹⁰

Parameters for sample size calculation

- Number of strata = 52 (to estimate vaccination coverage in the 52 districts of South Africa)
- Target population size per district (for proportional sampling of clusters). Used 2018 District Health Information System (DHIS) routine population data. Population statistics for children aged 1 year was used as a proxy for children aged 24-35 years.
- Anticipated vaccination coverage (p) = 65%
- Intracluster correlation coefficient (ICC) = 0.33
- Confidence level (α) = 5%; precision 0.1

- Target number of respondents per cluster (m) = 6
- Average number of household visits before an eligible child is found (N_{HH} to find eligible child) = 16
 - N_{HH} to find eligible child = $1/[(YC \cdot BR)/(1000/HS) \cdot (1000 - IM)/10000]$
 - Where YC: number of years child spends in the cohort = 1
 - BR: birth rate per 1000 population = 20.2
 - HS: average household size = 3.3
 - IM: infant mortality rate per 1000 live births = 32.8

Assumptions made in calculating sample size

Number of households where the eligible child is not at home or refuses to participate = 1.11

Sample size calculation are based on the formulae and rationale given in the WHO vaccination coverage cluster surveys reference manual.¹⁰

The table 1 below provides target population size and the corresponding sample size and corresponding minimum required sample size to estimate coverage at district level with precision of 0.1 and 95% CI. WHO guidelines allow for confidence level (α) of 5% or 10% and precision from 0.05 to 0.15, for vaccination coverage estimates. Additionally, the table shows number of interviews successfully completed in each district.

Table 1: Target population size per district and the corresponding sample size

District	Population aged 1 year	Minimum required sample size (precision ± 0.1 and 95% CI)	Number of complete analysed interviews	% achieved of minimum required sample size
Alfred Nzo	22380	276	305	111%
Amajuba	14823	183	585	320%
Amathole	23348	288	254	88%
Bojanala	32237	397	383	96%
Buffalo City	17425	215	234	109%
Cape Winelands	15989	197	205	104%
Capricorn	27540	339	664	196%
Central Karoo	1395	17	34	194%
Chris Hani	19076	235	83	35%
City of Cape Town	66799	823	119	14%
City of Johannesburg	93261	1150	2,191	191%

City of Tshwane	65575	808	720	89%
Dr Kenneth Kaunda	15293	189	238	126%
Ehlanzeni	39310	485	412	85%
Ekurhuleni	62401	769	1,117	145%
eThekwini	70675	871	1,390	160%
Fezile Dabi	8883	109	158	145%
Frances Baard	6368	78	206	264%
Garden Route (Eden)	10706	132	121	92%
Gert Sibande	22092	272	358	132%
Greater Sekhukhune	28681	354	394	111%
Harry Gwala	14638	180	631	351%
iLembe	15274	188	429	228%
Joe Gqabi	8323	103	112	109%
John Taolo Gaetsewe	4847	60	5	8%
King Cetshwayo	26772	330	1,227	372%
Lejweleputswa	12193	150	289	193%
Mangaung	14459	178	241	135%
Mopani	27682	341	840	246%
Namakwa	1765	22	29	132%
Nelson Mandela Bay	26272	324	415	128%
Ngaka Modiri Molema	18609	229	555	242%
Nkangala	26517	327	397	121%
O.R. Tambo	1802	468	595	127%
Overberg	4760	59	151	256%
Pixley ka Seme	3543	44	33	73%
Ruth Segomotsi Mompati	11431	141	131	93%
Sarah Baartman	10630	131	361	276%
Sedibeng	18639	230	539	234%
Thabo Mofutsanyane	15697	193	53	27%
Ugu	19204	237	225	95%
UMgungundlovu	24804	306	54	18%
Umkhanyakude	18447	227	266	117%
Umzinyathi	14802	182	279	153%
Uthukela	20763	256	773	302%

Vhembe	33531	413	790	191%
Waterberg	14194	175	112	64%
West Coast	8452	104	85	81%
West Rand	16923	209	431	206%
Xhariep	2075	26	88	338%
ZF Mgcawu	3970	49	75	153%
Zululand	22866	282	503	178%
TOTAL	1119411	14351	20 884	146%

Selection of clusters

DHIS population estimates for 2018 were used to determine the proportional number of clusters from each district. The number of clusters from each district were based on the population density of children aged 1 year in that particular district relative to the national population of children in that same age group (the larger the population density, the more clusters in that district). The STATS-SA sampling frame at small area layer (SAL) level was used as the sampling frame from which the final clusters were selected stratified into formal residential, informal residential, traditional residential, farms and small holdings. Systematic random cluster selection with probability proportional to estimated size and without replacement was used to select clusters from the sampling frame. All SALs with less than 25 households were excluded whilst all SALs where the number of households was greater than the sampling interval were split to ensure the number of households was less than the sampling interval. This was meant to eliminate the possibility of a cluster having a probability of selection = 1 hence guaranteed that no SAL had an automatic chance of being selected. SALs with more than 25 households, but less than 125 households were combined to ensure that the required 6 households per cluster was achievable.

Figure 1 below shows the cluster selection process, following which systematic sampling of households was done by selecting each Nth household within each cluster. N was calculated as (number of households in the cluster/6). A minimum number of 6 households successfully interviewed per cluster was required.

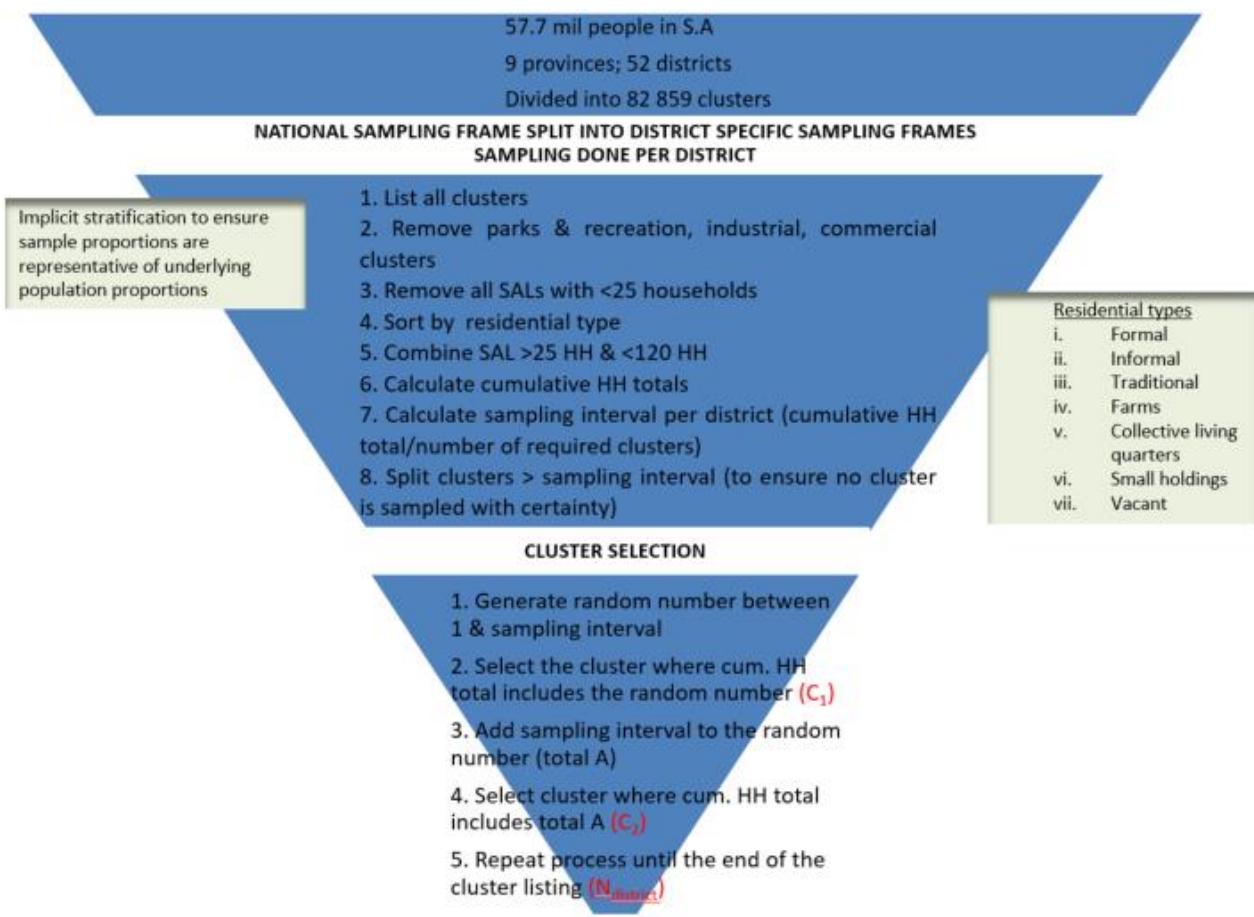


Figure 1: National EPI coverage survey sample selection procedure per district

Selection of households

Household selection was done centrally to minimise selection bias by field teams. For each cluster, households to approach for screening were selected as follows; the STATS-SA dwelling frame was used to determine the number of households in each cluster. The total number of households per cluster was divided by (6 times the probability of getting a child aged 24 to 35 months) to generate n- the household selection interval. Every nth household/dwelling was visited, screened for eligibility and approached for consent if there was a child aged 24 to 35 months. For each cluster, an electronic map was generated using the STATS-SA dwelling frame, with a pre-determined starting point on the top left hand corner of each cluster. In clusters where there was no dwelling at the top left hand corner, the dwelling nearest was used a starting point. The starting point was the first household to be screened followed by each nth household on the left hand side facing the starting point.

Following the sampling process, analyses was done to determine if the selected sample was indeed representative of the underlying South African population. Population characteristics employed in this analyses included population geographic distribution and racial descriptions. Figure 2 below illustrate the results of the representativeness analyses

Sampling results: Sample Geographic Distribution

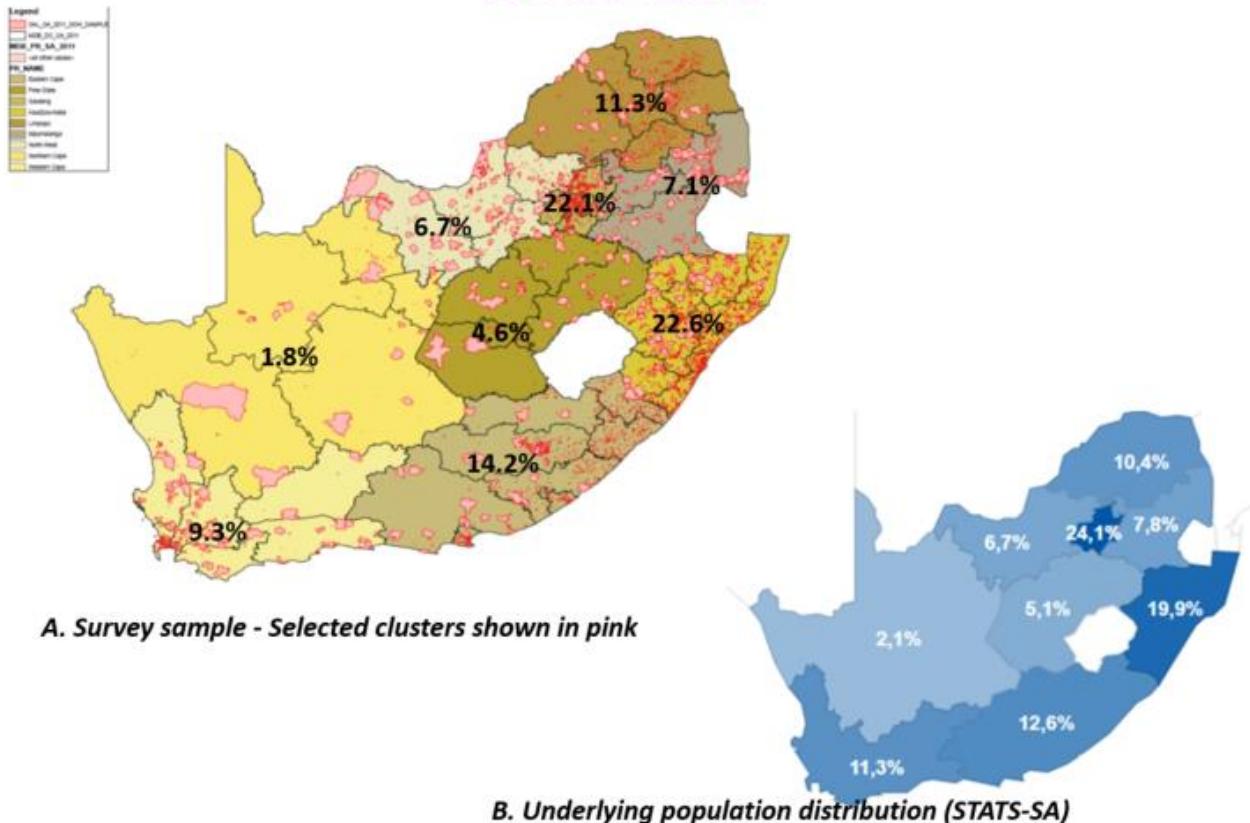


Figure 2A: Distribution of selected clusters in relation to the underlying population of South Africa

Sampling results : Racial Description

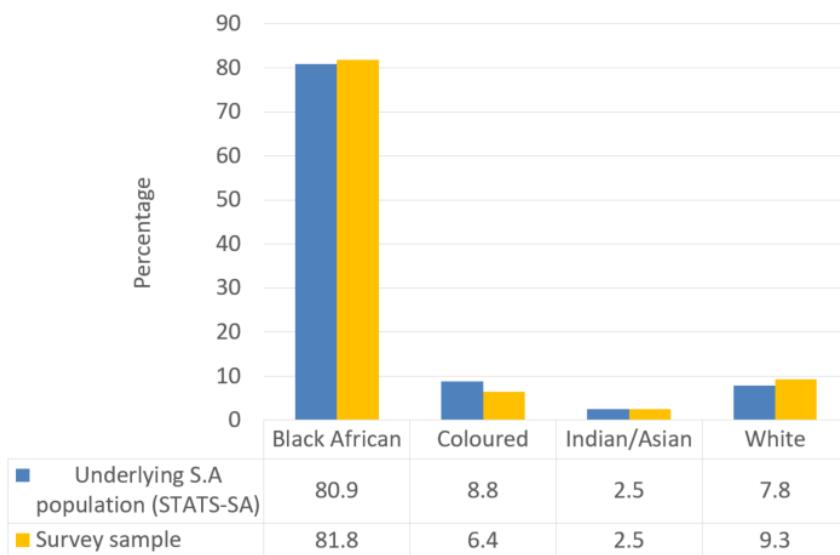


Figure 2B: Racial distribution of selected sample in relation to the underlying South African racial distribution

Data collection Process

Field worker/research assistant training

A comprehensive standardised training programme was developed covering the basics of research and research ethics, immunisation and the South Africa EPI programme. More in-depth training was done on the survey methodology, questionnaires and field procedures. In addition, all survey staff were taken through employment and company policies. Standard operating procedures (SOPs), guidelines and flow charts were developed both for trainers and for data collection teams. A multi-tiered training approach was used comprising of central training for the master trainers who then cascaded training to the field teams at district level.

Training of field teams was done at district level with 59 training sessions across the 52 districts. The initial training was conducted over 3 days and covered all survey components including the survey protocol and methodology, data collection tools and methods, use of the map application and data collection tablets, field team responsibilities and field based data quality assurance processes. Pre- and post-training assessments were done and these were used to not only assess comprehension, but also competency for field data collection or supervisory responsibilities. The second training session entailed distribution of field work and responsibilities thereof. A detailed training report is appended to this report.

Data collection and field procedures

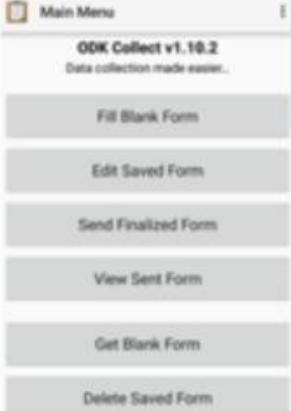
All households were preloaded onto a map application and installed on all data collection tablets. This platform ensured that cluster boundaries were clearly demarcated as well as the starting point for data collection. The map application also ensured that data could only be captured when the fieldworkers were within 30 meters of the dwelling unit. In addition to assisting field teams with field navigation the application had several capabilities that allowed the central management office to track data collection time, plot the geo-location of where data was being collected from and track areas with high refusals and non-household contact. A summary of the tracking dashboard is provided under the results section.

All data collection was electronic using Samsung tablets on an Open Data Kit (ODK) front end data capture platform. Real time data uploads were enabled and in areas where there was no connectivity, data upload was automatically done when connectivity became available. All field teams were encouraged to double-check that all data uploads were successful.

Trained fieldworkers



Electronic date collection



Data quality control



QUESTIONNAIRE

- HH demographics
- SES
- Education
- HCU
- Primary caregiver
- MO & FA details
- Vaccination
- Oral recall
- Reasons for missed doses

Figure 3: Data collection and management

The figure below details the data collection process at the household level

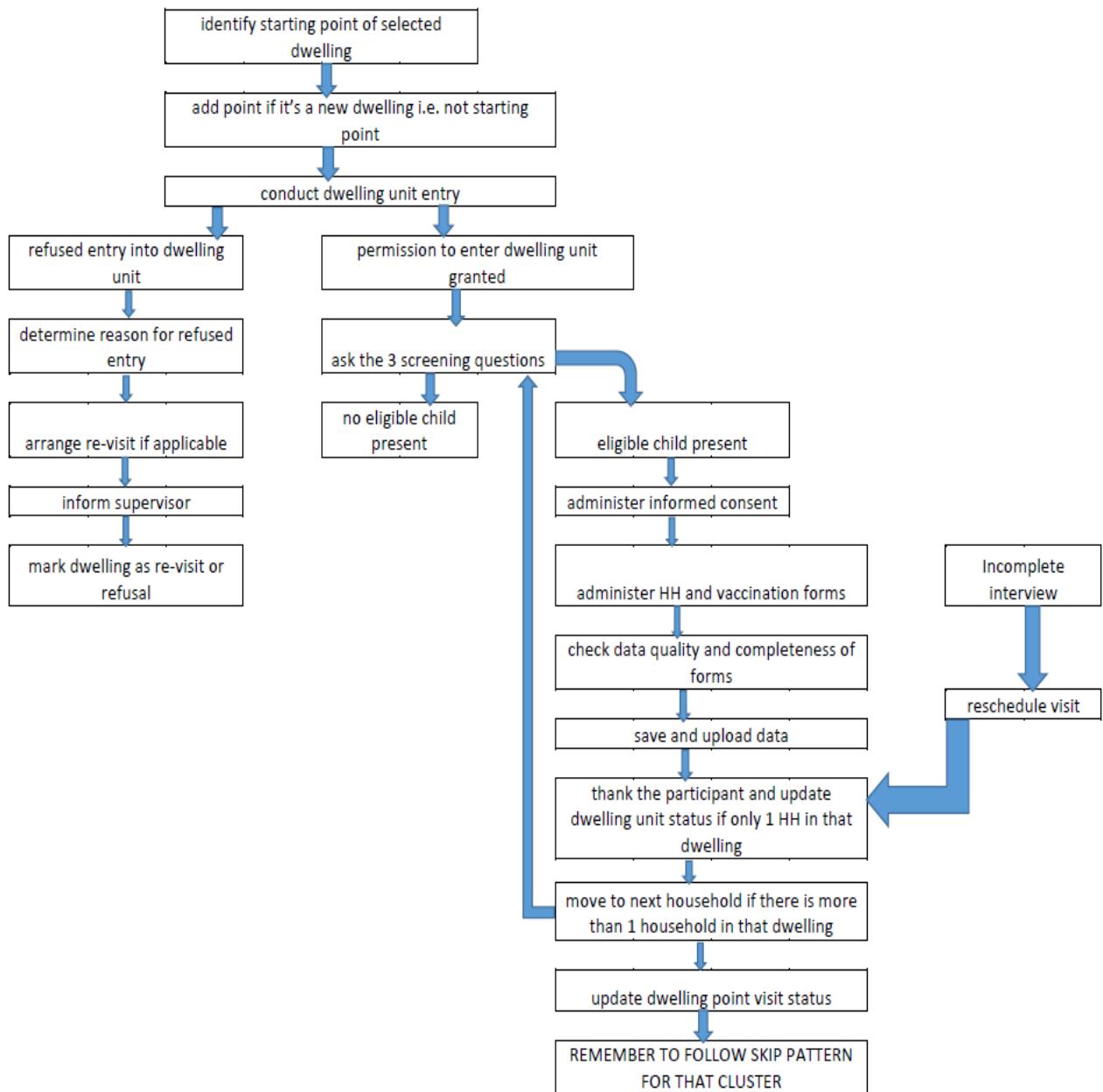


Figure 4: Flow of field procedures at household level

Stringent data quality assurance processes were implemented through direct database constraints and real time data logic checks. Data quality assurance processes were as outlined in the Figure 5 below.

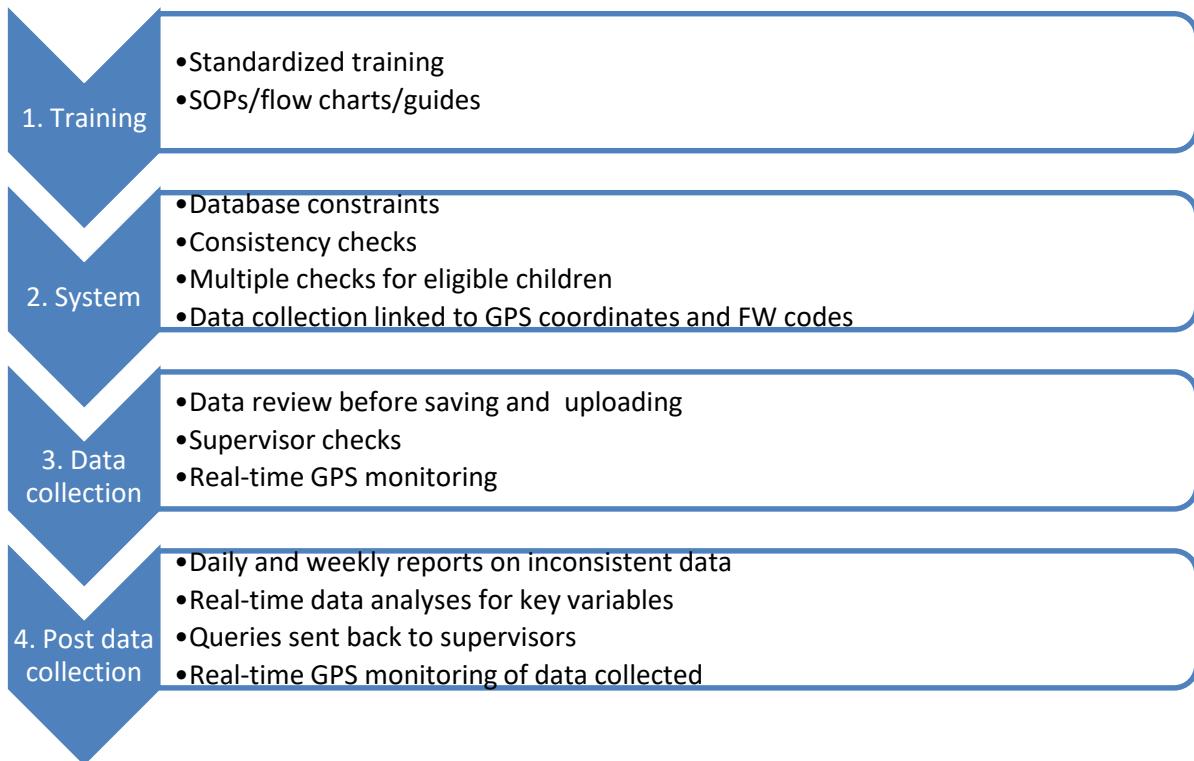


Figure 5: Data quality assurance checks for the SA national EPI coverage survey

Data analysis

Table 2 below details the data analysis plan. Where applicable, results are reported with accompanying 95% confidence intervals.

Table 2: Data analysis plan per survey objective

Objective	Analysis plan
1. Quantify the proportion of children aged 24 to 35 months who are fully vaccinated	Proportion (percentage) of children aged 24 to 35 months who are fully vaccinated as per the EPI-SA vaccination schedule
2. Quantify the proportion of children aged 24 to 35 months who are under vaccinated for vaccines scheduled up to and including those scheduled at 9 months of age and at 18 months of age.	Proportion (percentage) of children aged 24 to 35 months who are under vaccinated as per the EPI-SA vaccination schedule. Proportion will be computed for each

	vaccination dose and then as proportion missing one or more vaccine doses.
3. To quantify dropout rates throughout the vaccination schedule	<ul style="list-style-type: none"> i. Proportion of children fully vaccinated at each scheduled vaccination time point. ii. Using the total number of the children who received the preceding dose as the denominator, the drop-out rate will be calculated between each series of doses.
4. To assess (i) validity and (ii) timeliness of doses	<ul style="list-style-type: none"> i. Proportion of eligible children who received the correct vaccine doses ii. Proportion of children who received their vaccination doses at the scheduled time points
5. To identify and quantify reasons for missed vaccinations	Categorise reasons for non- or under-vaccination and quantify number and proportion of children in each category
6. To determine factors (socio-demographics; internet access; type of healthcare provider utilised; etc) associated with missed vaccinations and non-vaccination	<ul style="list-style-type: none"> i. Univariable analysis of factors associated with non- or under-vaccination. All factors significant at 15% significance level in the univariable logistic regression model will be added to a multivariable ordered logistic regression model. Outcome will be categorised as fully vaccinated, under vaccinated and not vaccinated.

Objectives 4 and 6 will be addressed in a separate supplementary report.

Ethical considerations and informed consent

The survey was guided by the following principles of research ethics: justice, autonomy and beneficence. The risks associated with participation were minimal and were far outweighed by the benefits to society. Autonomy was ensured as the decision to participate in the survey was individual, voluntary and made without any sort of external constraint or coercion. All strata of society were

included in the survey sample and field workers were well trained to fully respect the dignity and integrity of all participants throughout the course of the investigation.

Data on personal identifiers were restricted to residential addresses, and were anonymised prior to analyses. Participants were assured that all data collected (written and verbal) during the discussions will remain private and be kept in a secure location. No data including individual responses was shared beyond the study team. Unique survey identifiers were used during data collection. Finally, ethics approval was obtained from Sefako Makgatho University Research Ethics Committee (SMUREC). Informed consent was also obtained from all survey participants.

Chapter III: Survey results

Household visit outcomes

A total of 1 942 179 households were visited between 27 June 2019 and 22 December 2019. The survey was implemented in a phased approach mainly dependent on logistical and operational issues, with the first district starting on the 27th of June and the last district starting on the 26 September 2019. Electronic real-time dashboards were used to monitor data collection and ensure progress; illustrated by the figure below

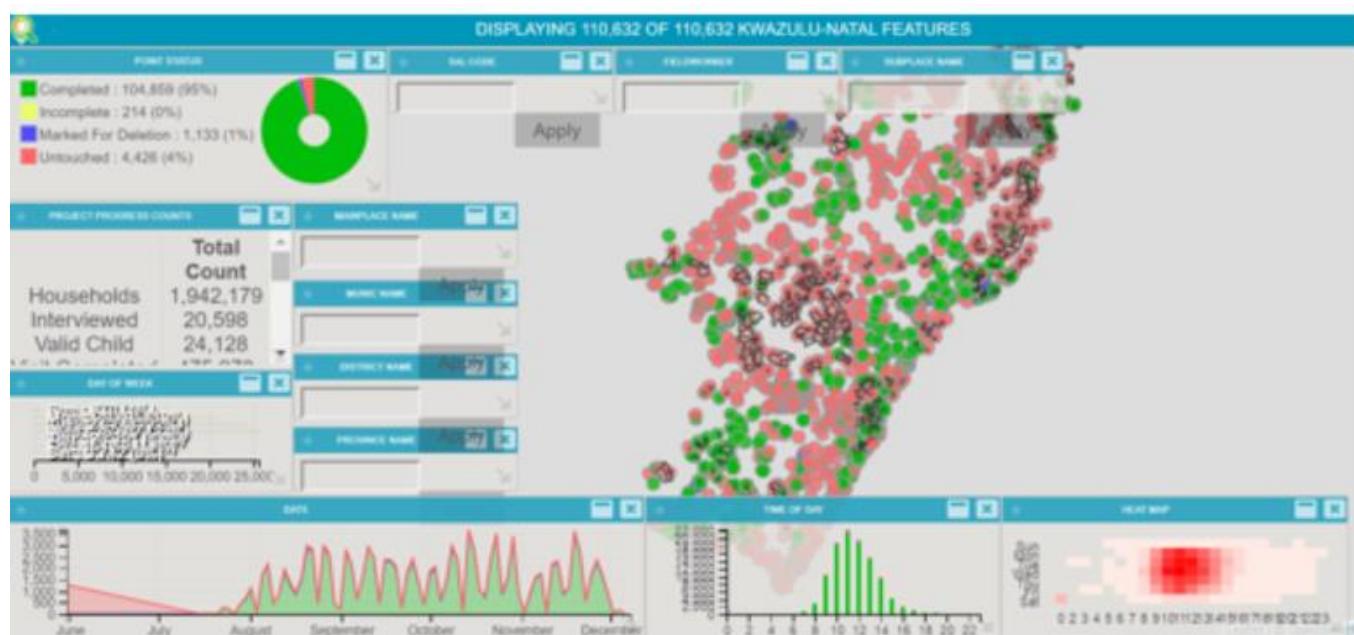


Figure 6 : Data and field operations monitoring dashboards

From the 1 942 179 households screened, a total of 22 244 households had at least one child aged 24-35 months old yielding 20 867 child interviews (94% consent rate). All other provinces had >90% consent rate except for Western Cape which had a consent rate of 80%. For 138 households eligibility

could not be determined because the respondent refused to proceed to the consent process due to the following reasons: privacy and security concerns (35%), too busy (10%), not interested (25%) and fear of negative consequences (15%). Table 3 below provides the provincial breakdown.

Sample characteristics

Respondent and household characteristics

Median age of respondents was 31 years (IQR: 25-39 years); with the median ranging between 30 and 32 years across the 9 provinces. Nationally, the majority (33%) of the respondents were the head of household but with variability across provinces. The median number of households per dwelling unit was 1; IQR: 1-3 with a median of 3 household members per household. Table 4 below details variability of respondent and household characteristics across the nine provinces.

Household head characteristics

Across all provinces, median age of the household head was over 35 years and over two thirds of households were headed by females. Aligned with the underlying South Africa population, the majority of caregivers interviewed were black African whilst Christianity was the predominant religion. Table 5 provides provincial specific details on the head of household for households included in the survey.

Characteristics of children included in the survey

In 94% of households, there was only one eligible child and in 6% of households there were two eligible children; the maximum number of eligible children per household was six. The median age of children included in the survey was 29 months (IQR: 26-32) with little variability across the provinces. There was equal gender distribution across all provinces. Table 6 illustrates these findings.

Table 3: National and provincial specific consent rates for eligible households

Indicator	National		Eastern Cape		Free State		Gauteng		Kwazulu-Natal		Limpopo		Mpumalanga		North West		Northern Cape		Western Cape	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Proceed with consent process	22 244	99.4	2 605	11.7	866	3.9	5 271	23.7	6 853	30.8	2 821	12.7	1 199	5.4	1 374	6.2	363	1.6	892	4.0
Refused to hear about the survey	138	0.6	40	29.0	4	2.9	14	10.1	69	50.0	5	3.6	2	1.4	1	0.7	0	0.0	3	2.2
Consent given (Yes)	20 867	93.8	2 362	90.8	828	95.6	4 994	94.8	6 355	92.8	2 796	99.2	1 166	97.4	1 305	95.0	347	95.6	714	80.0

Table 4: Respondent and household characteristics of children interviewed by province

		National		EC		FS		GP		KZN		LP		MP		NW		NC		WC	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Respondent relationship to HH head																					
Head of household	6,940	33.26	900	38.1	325	39.25	1638	32.8	2002	31.5	780	27.9	382	32.76	476	36.48	136	39.19	301	42.16	
Spouse	2,824	13.53	168	7.11	178	21.5	784	15.7	664	10.45	543	19.42	70	6	163	12.49	72	20.75	182	25.49	
Child	4,872	23.35	403	17.06	216	26.09	632	12.66	1794	28.23	873	31.22	341	29.25	439	33.64	90	25.94	84	11.76	
Parent	5,485	26.29	782	33.11	57	6.88	1,814	36.32	1651	25.98	487	17.42	362	31.05	177	13.56	27	7.78	128	17.93	
Other	746	3.58	109	4.61	52	6.28	126	2.52	244	3.84	113	4.04	11	0.94	50	3.83	22	6.34	19	2.66	
Dwelling type																					
Formal residential	14,318	68.62	1,726	73.07	717	86.59	3,711	74.31	3,337	52.51	2,473	88.45	816	69.98	814	62.38	274	78.96	450	63.03	
Informal residential	4,068	19.49	424	17.95	97	11.71	1,172	23.47	1,414	22.25	143	5.11	283	24.27	222	17.01	66	19.02	247	34.59	
Traditional residential	2,040	9.78	174	7.37			8	0.16	1,440	22.66	143	5.11	34	2.92	240	18.39	1	0.29	0	0	
Farm	139	0.67	24	1.02	5	0.6	14	0.28	38	0.6	26	0.93	11	0.94	13	1	2	0.58	6	0.84	
Collective living quarters	262	1.26	8	0.34	7	0.85	88	1.76	122	1.92	7	0.25	6	0.51	10	0.77	3	0.86	11	1.54	

Missing	40	0.19	6	0.25	2	0.24	1	0.02	4	0.06	4	0.14	16	1.37	6	0.46	1	0.29	0	0
Number of HH in dwelling unit																				
Median (IQR)	1	1-3	1	1-2	1	1-2	1	1-3	1	1-2	1	1-2	1	1-3	1	1-3	1	1-1	1	1-2
Number of household members per household																				
Median (IQR)	3	2-5	2	2-3	4	3-5	3	2-4	3	2-4	4	3-5	3	2-5	4	3-6	4	3-6	3	2-4
Language commonly used in household																				
Afrikaans	763	3.66	195	8.26	62	7.49	91	1.82	6	0.09	2	0.07	2	0.17	7	0.54	136	39.19	262	36.69
English	1,007	4.83	129	5.46	30	3.62	285	5.71	256	4.03	48	1.72	5	0.43	98	7.51	84	24.21	72	10.08
Isindebele	270	1.29	6	0.25			95	1.9	2	0.03	24	0.86	137	11.75	5	0.38			1	0.14
Isixhosa	2,812	13.48	1,778	75.28	21	2.54	354	7.09	300	4.72	3	0.11	23	1.97	36	2.76	8	2.31	289	40.48
Isizulu	7,432	35.62	26	1.1	18	2.17	1,681	33.66	5,392	84.85	8	0.29	299	25.64	7	0.54			1	0.14
Khoi, Nama and San	6	0.03					4	0.08	1	0.02			1	0.09						
Sepedi	1,449	6.94			3	0.36	409	8.19	1	0.02	894	31.97	135	11.58	7	0.54				
Sesotho	1,498	7.18	20	0.85	517	62.44	781	15.64	18	0.28	40	1.43	11	0.94	94	7.2			17	2.38
Setswana	1,611	7.72	4	0.17	74	8.94	436	8.73			22	0.79	36	3.09	930	71.26	108	31.12	1	0.14
	179	0.86					17	0.34	5	0.08	4	0.14	142	12.18	11	0.84				

Number of rooms occupied by household

1	2,769	13.27	192	8.13	42	5.07	1,449	29.01	635	9.99	176	6.29	43	3.69	78	5.98	28	8.07	126	17.65
2-3	5,681	27.22	793	33.57	206	24.88	1,435	28.73	1,718	27.03	552	19.74	168	14.41	368	28.2	127	36.6	314	43.98
4-5	7,368	35.31	1,008	42.68	426	51.45	1,446	28.95	2,249	35.39	987	35.3	377	32.33	532	40.77	132	38.04	211	29.55
6-7	3,126	14.98	265	11.22	113	13.65	482	9.65	1,060	16.68	599	21.42	271	23.24	233	17.85	49	14.12	54	7.56
8+	1,923	9.22	104	4.4	41	4.95	182	3.64	693	10.9	482	17.24	307	26.33	94	7.2	11	3.17	9	1.26

Tenure status

Rented	3434	16.46	255	10.8	78	9.42	1,862	37.28	692	10.89	181	6.47	95	8.15	96	7.36	26	7.49	149	20.87
Owned	9408	45.09	944	39.97	359	43.36	1,176	23.55	3,316	52.18	1,889	67.56	763	65.44	669	51.26	121	34.87	171	23.95
Occupied rent-free	3600	17.25	504	21.34	66	7.97	711	14.24	1,560	24.55	330	11.8	90	7.72	186	14.25	26	7.49	127	17.79
RDP or state subsidized dwelling	4083	19.57	613	25.95	293	35.39	1,176	23.55	735	11.57	361	12.91	199	17.07	337	25.82	160	46.11	209	29.27
Do not know	186	0.89	35	1.48	7	0.85	53	1.06	34	0.54	26	0.93	18	1.54	10	0.77	2	0.58	1	0.14
Other	156	0.75	11	0.47	25	3.02	16	0.32	18	0.28	9	0.32	1	0.09	7	0.54	12	3.46	57	7.98

Main Income source

Salaries or wages or commission	2364	11.33	383	16.22	37	4.47	211	4.23	1,286	20.24	240	8.58	137	11.75	42	3.22	3	0.86	25	3.5
Income from formal or informal business	18159	87.02	1954	82.73	785	94.81	4675	93.61	4952	77.92	2517	90.02	999	85.68	1246	95.48	342	98.56	689	96.5
No income	344	1.65	25	1.06	6	0.72	108	2.16	117	1.84	39	1.39	30	2.57	17	1.3	2	0.58	0	0

Table 5: Household head details of children included in the survey stratified by province

	National		EC		FS		GP		KZN		LP		MP		NW		NC		WC		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Age of Household head																					
median (IQR)	39		30-53	37	29-52	43	32-55	35	29-45	41	31-56	44	34-58	38	30-53	42	32-57	41	32-53	35	28-43
Gender of household head																					
Male	5,308	25.49	386	16.38	302	36.56	1563	31.3	1283	20.2	864	30.95	221	19.22	329	25.33	129	37.28	231	32.35	
Female	15,519	74.51	1970	83.62	524	63.44	3430	68.7	5068	79.8	1928	69.05	929	80.78	970	74.67	217	62.72	483	67.65	
Education of household head																					
No schooling	2,010	9.65	255	10.82	47	5.69	281	5.63	659	10.38	451	16.15	140	12.17	140	10.78	30	8.67	7	0.98	
Primary school (grade 0 -7)	3,567	17.13	364	15.45	188	22.76	598	11.98	1,370	21.57	409	14.65	127	11.04	342	26.33	58	16.76	111	15.55	
Secondary (grade 8-12)	12,637	60.68	1,437	60.99	491	59.44	3,380	67.69	3,641	57.33	1,466	52.51	742	64.52	709	54.58	232	67.05	539	75.49	
Certificate/diploma	1,822	8.75	211	8.96	38	4.6	546	10.94	515	8.11	306	10.96	108	9.39	58	4.46	10	2.89	30	4.2	
Degree	323	1.55	45	1.91	7	0.85	73	1.46	104	1.64	67	2.4	10	0.87	8	0.62	3	0.87	6	0.84	
Don't know	446	2.14	41	1.74	54	6.54	109	2.18	59	0.93	90	3.22	20	1.74	41	3.16	13	3.76	19	2.66	
Other	22	0.11	3	0.13	1	0.12	6	0.12	3	0.05	3	0.11	3	0.26	1	0.08			2	0.28	
Employment status of household head																					
Unemployed	11,255	54.04	1,317	55.9	375	45.4	2,624	52.55	3,706	58.35	1,454	52.08	645	56.09	702	54.04	140	40.46	292	40.9	
Pensioner	2,450	11.76	230	9.76	161	19.49	322	6.45	892	14.05	379	13.57	131	11.39	244	18.78	55	15.9	36	5.04	
Informally employed/ self-employed	3,066	14.72	401	17.02	121	14.65	692	13.86	858	13.51	485	17.37	161	14	179	13.78	58	16.76	111	15.55	
Formally employed	3,801	18.25	366	15.53	165	19.98	1,300	26.04	838	13.19	426	15.26	191	16.61	151	11.62	90	26.01	274	38.38	
Student	201	0.97	31	1.32	4	0.48	46	0.92	51	0.8	24	0.86	20	1.74	21	1.62	3	0.87	1	0.14	
Don't know	54	0.26	11	0.47	0	0	9	0.18	6	0.09	24	0.86	2	0.17	2	0.15					
Marital Status of household head																					

Married	8527	40.9	897	38.1	410	49.6	2192	43.9	2240	35.3	1414	50.6	436	37.9	466	35.9	148	42.8	324	45.4
Divorced	1270	6.1	157	6.7	38	4.6	404	8.1	225	3.5	178	6.4	103	9	109	8.4	19	5.5	37	5.2
Widowed	2102	10.1	196	8.3	132	16	278	5.6	726	11.4	407	14.6	103	9	180	13.9	46	13.3	34	4.8
Single	8,928	42.9	1106	46.9	246	29.8	2119	42.4	3160	49.8	793	28.4	508	44.2	544	41.9	133	38.4	319	44.7

Religion of household head

Christianity	19,495	93.6	2,305	97.84	784	94.92	4,681	93.75	5,845	92.03	2,495	89.36	1118	97.2	1258	96.8	337	97.4	672	94.12
Islam	98	0.47	13	0.55	1	0.12	21	0.42	36	0.57	2	0.07			2	0.2	3	0.9	20	2.8
Buddism	7	0.03	1	0.04			1	0.02	2	0.03			1	0.1	2	0.2				
Judaism	6	0.03							5	0.08			1	0.1						
Hinduism	17	0.08							17	0.27										
Agnosticism	1	0											1	0.1						
Atheism	4	0.02					3	0.06									1	0.3		
No religious affiliation/belief	384	1.84	6	0.25	28	3.39	88	1.76	112	1.76	117	4.19	19	1.7	5	0.4	0	0	9	1.3
Traditional African religion	641	3.08	30	1.27	12	1.45	155	3.1	289	4.55	135	4.84	7	0.6	1	0.1	1	0.3	11	1.5
Other	75	0.36	1	0.04	0	0	6	0.12	31	0.49	1	0.04	1	0.1	30	2.3	4	1.2	1	0.1
Don't know	99	0.48	0	0	1	0.12	38	0.76	14	0.22	42	1.5	2	0.2	1	0.1	0	0	1	0.1

Population group of household head

Black African	19723	94.7	2,118	89.9	773	93.6	4,849	97.12	6,226	98.03	2,777	99.46	1145	99.6	1282	98.7	174	50.3	379	53.1
Coloured	942	4.5	227	9.63	46	5.6	121	2.42	31	0.49	5	0.18	3	0	16	1.2	163	47.11	330	46.2
Indian/Asian	83	0.4	1	0.04			6	0.12	72	1.13	2	0.07	0	0	1	0.1	1	0.3	0	0
White	47	0.2	8	0.34	6	0.7	9	0.18	18	0.28	1	0.04	1	0.1	0	0	2	0.6	2	0.3
Other	32	0.2	2	0.08	1	0.1	8	0.16	4	0.06	7	0.25	1	0.1	0	0	6	1.73	3	0.4

Table 6: Characteristics of children included in the survey stratified by Province

	National		EC		FS		GP		KZN		LP		MP		NW		NC		WC	
	N	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Number of eligible children in the household																				
1	19,624	94.0	2,249	95.2	787	95.1	4,786	95.8	5,862	92.2	2,613	93.5	1,091	93.6	1,225	93.9	338	97.4	673	94.3
2	1,156	5.5	105	4.5	41	5.0	194	3.9	453	7.1	172	6.2	71	6.1	76	5.8	9	2.6	35	4.9
3	60	0.3	8	0.3	0	0	6	0.1	29	0.5	11	0.4	0	0	4	0.3	0	0	2	0.3
4	21	0.1	0	0	0	0	2	0.0	11	0.2	0	0	4	0.3	0	0	0	0	4	0.6
6	6	0.03	0	0	0	0	6	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Number of children in same HH not sharing same caregiver																				
	1153	5.5	147	6.2	61	7.4	123	2.5	385	6.1	185	6.6	85	7.3	138	10.6	12	3.5	17	2.4
Number of children in same HH not sharing same mother																				
	2,658	12.7	307	13	169	20.4	224	4.5	832	13.1	580	20.7	220	18.9	255	19.5	24	6.9	47	6.6
Number of children in same HH not sharing same father																				
	3,259	15.6	415	17.6	227	27.4	307	6.2	952	15	680	24.3	288	24.7	292	22.4	35	10.1	63	8.8
Child's age (median & IQR)																				
	29	26-32	29	26-32	29	27-32	29	26-32	29	26-32	29	27-32	29	26-32	29	27-32	29	27-32	29	26-32
Child's gender																				
	10579	50.7	1189	50.3	393	47.5	2564	51.3	3212	50.5	1428	51.1	589	50.5	667	51.1	183	52.7	354	49.6

Children without vaccination cards

Overall, 82.3% (95% CI: 81.8-82.8%) of children had a road to health booklet seen by the survey interviewer. Of the 3687 children whose vaccination cards were not seen by the interviewer, 2152 had reasons captured for not providing a vaccination card; of these 1,403 (65.2%) - ranging from 45% in WC to 77% in FS reported that the card was in another household. Thirteen percent reported the card lost – ranging from 8% in MP to 26% in WC, whilst 184 (8.6%) refused to produce the vaccination card – ranging from 3% in FS to 13% in KZN. Nationally 2 642 (13.7%) of 19 332 children who ever received a vaccination card reported that they had paid for the vaccination card – 21% in EC, 9% in FS, 19% in GP and MP and 14% in KZN. Availability of vaccination cards was high across all provinces with majority of districts having over 75% of children interviewed producing vaccination cards. However, the following districts are of concern as >25% of children's vaccination cards were not seen by the interviewer; Umzinyathi, eThekwini, Capricorn and Vhembe. This was despite all four districts reporting high proportions of children who ever received a vaccination card - Umzinyathi (92%), eThekwini (88%), Capricorn (93%) and Vhembe (94%).

District specific data on the number of children who ever received vaccination cards and those whose cards were seen by the interviewer is tabulated below.

Table 7: Proportion of children with vaccination cards stratified by district and province

		Ever received a vaccination card									Vaccination card seen by interviewer		
Province	District	Yes			No			Total	Yes				
		n	%	95% CI	n	%	95% CI		n	%	95% CI		
EC	Alfred Nzo	283	92.8	89.3 95.2	22	7.2	4.8 10.7	305	271	88.9	84.8 91.9		
EC	Amathole	228	97.9	94.9 99.1	5	2.1	0.9 5.1	233	220	94.4	90.6 96.7		
EC	Buffalo City	237	92.9	89.1 95.5	18	7.1	4.5 10.9	255	211	82.7	77.6 86.9		
EC	Chris Hani	80	96.4	89.3 98.8	3	3.6	1.2 10.7	83	79	95.2	87.8 98.2		
EC	Joe Gqabi	110	98.2	93.1 99.6	2	1.8	0.4 6.9	112	110	98.2	93.1 99.6		
EC	Nelson Mandela Bay	394	94.9	92.4 96.7	21	5.1	3.3 7.6	415	326	78.6	74.3 82.2		
EC	O.R.Tambo	522	87.3	84.4 89.7	76	12.7	10.3 15.6	598	372	62.2	58.2 66.0		
EC	Sarah Baartman	356	98.6	96.7 99.4	5	1.4	0.6 3.3	361	348	96.4	93.9 97.9		
Eastern Cape		2,210	93.6	92.5 94.5	152	6.4	5.5 7.5	2,362	1,937	82.0	80.4 83.5		
FS	Fezile Dabi	146	92.4	87.1 95.6	12	7.6	4.4 12.9	158	128	81.0	74.1 86.4		
FS	Lejweleputswa	285	100.0	. .	0	0.0		285	285	100.0	. .		
FS	Mangaung	199	81.2	75.8 85.6	46	18.8	14.4 24.2	245	187	76.3	70.6 81.2		
FS	Thabo Mofutsanyane	51	98.1	87.4 99.7	1	1.9	0.3 12.6	52	50	96.2	85.7 99.0		
FS	Xhariep	81	92.0	84.2 96.2	7	8.0	3.8 15.8	88	81	92.0	84.2 96.2		
Free State		762	92.0	90.0 93.7	66	8.0	6.3 10.0	828	731	88.3	85.9 90.3		
GP	City of Johannesburg	1,959	89.5	88.1 90.7	229	10.5	9.2 11.8	2,190	1,711	78.1	76.3 79.8		
GP	City of Tshwane	679	94.0	92.1 95.6	42	5.8	4.3 7.8	722	621	86.0	83.3 88.4		
GP	Ekurhuleni	1,018	91.4	89.6 92.9	95	8.5	7.0 10.3	1,114	890	79.9	77.4 82.1		
GP	Sedibeng	522	96.8	95.0 98.0	17	3.2	2.0 5.0	539	514	95.4	93.2 96.8		

GP	West Rand	402	93.7	91.0	95.7	24	5.6	3.8	8.2	429	382	89.0	85.7	91.7
Gauteng		4,580	91.7	90.9	92.4	407	8.1	7.4	8.9	4,994	4,118	82.5	81.4	83.5
KZN	Amajuba	516	88.1	85.2	90.4	68	11.6	9.2	14.5	586	470	80.2	76.8	83.2
KZN	Sisonke	603	96.8	95.1	97.9	19	3.0	2.0	4.7	623	597	95.8	93.9	97.1
KZN	Ugu	224	99.1	96.5	99.8	1	0.4	0.1	3.1	226	187	82.7	77.2	87.1
KZN	Umgungundlovu	60	100.0	.	.	0	0.0			60	60	100.0	.	.
KZN	Umkhanyakude	255	95.9	92.7	97.7	11	4.1	2.3	7.3	266	243	91.4	87.3	94.2
KZN	Umzinyathi	255	91.4	87.5	94.2	24	8.6	5.8	12.5	279	205	73.5	68.0	78.3
KZN	Uthukela	742	96.0	94.4	97.2	31	4.0	2.8	5.6	773	700	90.6	88.3	92.4
KZN	Uthungulu	1,176	95.9	94.7	96.9	50	4.1	3.1	5.3	1,226	986	80.4	78.1	82.6
KZN	Zululand	460	91.6	88.9	93.8	37	7.4	5.4	10.0	502	399	79.5	75.7	82.8
KZN	eThekweni	1,215	87.6	85.8	89.2	170	12.3	10.6	14.1	1,387	887	64.0	61.4	66.4
KZN	iLembe	410	96.0	93.7	97.5	17	4.0	2.5	6.3	427	359	84.1	80.3	87.3
Kwazulu-Natal		5,916	93.1	92.4	93.7	428	6.7	6.1	7.4	6,355	5,093	80.1	79.1	81.1
LP	Capricorn	616	93.1	90.8	94.8	46	6.9	5.2	9.2	662	493	74.5	71.0	77.7
LP	Mopani	753	89.6	87.4	91.5	84	10.0	8.1	12.2	840	680	81.0	78.2	83.5
LP	Sekhukhune	351	89.3	85.8	92.0	42	10.7	8.0	14.2	393	345	87.8	84.2	90.7
LP	Vhembe	739	93.5	91.6	95.1	49	6.2	4.7	8.1	790	589	74.6	71.4	77.5
LP	Waterberg	111	100.0	.	.	0	0.0			111	111	100.0	.	.
Limpopo		2,570	91.9	90.8	92.9	221	7.9	7.0	9.0	2,796	2,218	79.3	77.8	80.8
MP	Ehlanzeni	404	98.1	96.2	99.0	8	1.9	1.0	3.8	412	396	96.1	93.8	97.6
MP	Gert Sibande	336	93.9	90.8	95.9	21	5.9	3.9	8.8	358	284	79.3	74.8	83.2
MP	Nkangala	371	93.7	90.8	95.7	25	6.3	4.3	9.2	396	328	82.8	78.8	86.2

Mpumalanga		1,111	95.3	93.9	96.4	54	4.6	3.6	6.0	1,166	1,008	86.4	84.4	88.3
NC	Frances Baard	205	99.5	96.6	99.9	1	0.5	0.1	3.4	206	200	97.1	93.7	98.7
NC	John Taolo Gaetsewe	5	100.0	.	.	0	0.0			5	5	100.0	.	.
NC	Namakwa	27	93.1	75.8	98.3	2	6.9	1.7	24.2	29	27	93.1	75.8	98.3
NC	Pixley ka Seme	32	100.0	.	.	0	0.0			32	32	100.0	.	.
NC	Z F Mgcawu	68	90.7	81.6	95.5	7	9.3	4.5	18.4	75	61	81.3	70.8	88.7
Northern Cape		337	97.1	94.7	98.4	10	2.9	1.6	5.3	347	325	93.7	90.6	95.8
NW	Bojanala	309	81.1	76.8	84.7	72	18.9	15.3	23.2	381	299	78.5	74.1	82.3
NW	Dr Kenneth Kaunda	211	88.7	84.0	92.1	27	11.3	7.9	16.0	238	210	88.2	83.5	91.8
NW	Dr Ruth Segomotsi Mompati	123	93.9	88.2	96.9	8	6.1	3.1	11.8	131	106	80.9	73.2	86.8
NW	Ngaka Modiri Molema	499	89.9	87.1	92.2	56	10.1	7.8	12.9	555	484	87.2	84.2	89.7
North West		1,142	87.5	85.6	89.2	163	12.5	10.8	14.4	1,305	1,099	84.2	82.1	86.1
WC	Cape Winelands	206	99.5	96.6	99.9	1	0.5	0.1	3.4	207	179	86.5	81.1	90.5
WC	Central Karoo	33	100.0	.	.	0	0.0			33	33	100.0	.	.
WC	City of Cape Town	113	95.8	90.2	98.2	5	4.2	1.8	9.8	118	101	85.6	78.0	90.9
WC	Eden	121	100.0	.	.	0				121	121	100.0	.	.
WC	Overberg	151	100.0	.	.	0	0.0			151	143	94.7	89.7	97.3
WC	West Coast	80	95.2	87.9	98.2	4	4.8	1.8	12.1	84	74	88.1	79.2	93.5
Western Cape		704	98.6	97.4	99.2	10	1.4	0.8	2.6	714	651	91.2	88.9	93.0
South Africa		19332	92.6	92.3	93.0	1511	7.2	6.9	7.60	20867	17180	82.3	81.8	82.8

Vaccination coverage

National estimates

Overall, 83.9% (95% CI:82.9-84.9) of children in the survey had received all basic vaccinations up to age 1 year i.e. up to measles 1. The vaccination coverage declined to 81.4% (95% CI: 80.3-81.5) for children vaccinated with doses scheduled up to 12 months i.e. up to measles 2. Vaccination coverage for child fully vaccinated (received all age-appropriate vaccinations from birth to 18 months) was 76.8% (75.4-78.2). The dropout rates from PCV 2 to 3 (14 weeks to 9 months), from measles 1 to 2 (6 months to 12 months) and from measles 2 to hexavalent 4 (12 month to 18 month) was 2.9%, 5.1% and 4.3% respectively. 4.3% of children were unvaccinated.

Vaccination coverage for children with vaccination cards

District level estimates

Of the 17 180 children aged 24-35 months whose vaccination cards were seen by the interviewer, 76.1% (95% CI: 75.4-76.7) were fully vaccinated i.e. had received all 14 doses from birth to 18 months. Between the 52 districts, coverage estimates ranged from 53% to 100%. Pixley ka Seme, O.R Tambo, Capricorn, Fezile Dabi and Ilembe were the poorest performing districts with coverage of 53%, 54%, 62%, 63% and 64% respectively.

Children fully vaccinated with all vaccines up to and including measles 2 given at 12 months, but excluding hexavalent 4 was 80.9% ranging from 60 to 100%; with the poorest performing districts being O.R.Tambo, Fezile Dabi, iLembe, Pixley ka Seme, Capricorn, Umgungundlovu , Eden and Uthukela whose coverage rates were below 75%.

The proportion of children fully vaccinated at 9 months i.e. having received all vaccine doses except measles 2 and hexavalent 4 was 83.9% ranging from 65 to 100%. Only 7 districts managed to achieve the national target of 90% of children fully vaccinated children under 1 year, namely Umzinyathi, Cape Winelands, Thabo Mofutsanyane, Frances Baard, Namakwa, Central Karoo and John Taolo Gaetsewe.

Tables 8-10 below provide coverage estimates for fully vaccinated children at each of 9, 12 and 18 months in the 52 districts.

Table 8: Vaccination coverage estimates for children aged 24-35 months who were fully vaccinated with all 14 vaccine doses

Province	District	VACCINATION CARD				ORAL RECALL			
		Sample size	Proportion vaccinated	95% CI		Sample size	Proportion vaccinated	95% CI	
NC	Pixley ka Seme	32	53.1%	35.9%	69.6%				
EC	O.R.Tambo	372	53.8%	48.7%	58.8%	226	76.5%	69.4%	82.4%
LP	Capricorn	493	62.1%	57.7%	66.3%	169	79.3%	72.5%	84.8%
FS	Fezile Dabi	128	62.5%	53.8%	70.5%	30	73.3%	53.1%	87.0%
KZN	iLembe	359	63.5%	58.4%	68.3%	68	88.2%	78.1%	94.0%
KZN	Umgungundlovu	60	66.7%	53.8%	77.5%				
KZN	Uthukela	700	67.4%	63.9%	70.8%	73	89.0%	78.3%	94.8%
LP	Waterberg	111	67.6%	58.3%	75.6%				
FS	Xhariep	81	67.9%	57.0%	77.2%	7	100.0%	.	.
EC	Chris Hani	79	69.6%	58.6%	78.8%	4	100.0%	.	.
KZN	Zululand	399	70.2%	65.5%	74.5%	103	49.5%	37.8%	61.3%
NC	Z F Mgawu	61	70.5%	57.8%	80.6%	14	57.1%	27.3%	82.5%
LP	Mopani	680	71.2%	67.7%	74.5%	160	76.9%	68.3%	83.7%
MP	Ehlanzeni	396	71.7%	67.1%	75.9%	16	31.3%	12.4%	59.4%
WC	Eden	121	71.9%	63.2%	79.2%				
LP	Sekhukhune	345	72.8%	67.8%	77.2%	48	77.1%	62.5%	87.2%
MP	Nkangala	328	73.2%	68.1%	77.7%	68	88.2%	78.5%	93.9%
NW	Bojanala	299	73.2%	67.9%	78.0%	82	82.9%	75.1%	88.6%

NW	Ngaka Modiri Molema	484	74.6%	70.5%	78.3%	71	87.3%	76.9%	93.4%
KZN	Uthungulu	986	74.9%	72.1%	77.6%	240	96.3%	93.0%	98.0%
KZN	eThekwinı	887	75.6%	72.7%	78.4%	500	88.6%	83.3%	92.3%
EC	Alfred Nzo	271	76.8%	71.3%	81.4%	34	76.5%	60.1%	87.5%
KZN	Amajuba	470	77.2%	73.2%	80.8%	116	82.8%	71.4%	90.2%
EC	Joe Gqabi	110	77.3%	68.5%	84.2%	2	100.0%	.	.
MP	Gert Sibande	284	77.5%	72.2%	82.0%	74	82.4%	72.3%	89.4%
EC	Buffalo City	211	77.7%	71.6%	82.8%	44	81.8%	64.8%	91.6%
EC	Amathole	220	77.7%	71.7%	82.8%	13	61.5%	41.3%	78.4%
LP	Vhembe	589	77.8%	74.2%	80.9%	201	81.6%	73.5%	87.6%
FS	Thabo Mofutsanyane	50	78.0%	64.3%	87.5%	2	50.0%	1.9%	98.1%
NW	Ruth Segomotsi Mompati	106	78.3%	69.4%	85.2%	25	84.0%	68.1%	92.8%
WC	West Coast	74	78.4%	67.5%	86.4%	10	50.0%	17.0%	83.0%
GP	Sedibeng	514	78.4%	74.6%	81.8%	25	88.0%	65.4%	96.6%
NW	Dr Kenneth Kaunda	210	78.6%	72.5%	83.6%	28	75.0%	55.0%	88.0%
GP	City of Tshwane	621	78.9%	75.5%	81.9%	101	83.2%	71.2%	90.8%
KZN	Umzinyathi	205	79.0%	72.9%	84.1%	74	82.4%	71.8%	89.6%
WC	Overberg	143	79.7%	72.3%	85.5%	8	87.5%	47.7%	98.2%
KZN	Sisonke	597	80.6%	77.2%	83.6%	26	88.5%	71.0%	96.0%
KZN	Umkhanyakude	243	81.1%	75.6%	85.5%	23	95.7%	72.7%	99.5%
KZN	Ugu	187	81.3%	75.0%	86.3%	39	84.6%	69.2%	93.1%
EC	Nelson Mandela Bay	326	81.3%	76.7%	85.2%	89	78.7%	65.1%	87.9%
FS	Lejweleputswa	285	81.8%	76.8%	85.8%				

GP	Ekurhuleni	890	82.0%	79.4%	84.4%	224	85.7%	79.9%	90.1%
EC	Sarah Baartman	348	82.5%	78.1%	86.1%	13	76.9%	35.6%	95.3%
GP	City of Johannesburg	1,711	82.5%	80.7%	84.3%	479	87.9%	84.2%	90.8%
GP	West Rand	382	82.7%	78.6%	86.2%	47	70.2%	49.2%	85.1%
FS	Mangaung	187	83.4%	77.4%	88.1%	58	77.6%	64.4%	86.9%
WC	City of Cape Town	101	84.2%	75.6%	90.1%	17	58.8%	32.5%	80.9%
WC	Cape Winelands	179	84.9%	78.9%	89.5%	28	89.3%	77.2%	95.4%
NC	Frances Baard	200	87.0%	81.6%	91.0%	6	66.7%	20.5%	94.0%
NC	Namakwa	27	92.6%	74.2%	98.2%	2	100.0%	.	.
WC	Central Karoo	33	97.0%	80.9%	99.6%				
NC	John Taolo Gaetsewe	5	100.0%	.	.				

Table 9: Vaccination coverage estimates for children aged 24-35 months who were fully vaccinated with all vaccine doses from birth to 2nd measles dose given at 12 months

Province	District	VACCINATION CARD				ORAL RECALL			
		Sample size	Proportion	95% CI		Sample size	Proportion	95% CI	
EC	O.R.Tambo	372	59.7%	54.6%	64.6%	226	81.9%	74.6%	87.4%
FS	Fezile Dabi	128	63.3%	54.6%	71.2%	30	76.7%	56.5%	89.2%
KZN	iLembe	359	66.3%	61.2%	71.0%	68	89.7%	79.6%	95.1%
NC	Pixley ka Seme	32	68.8%	50.7%	82.5%				
LP	Capricorn	493	69.2%	64.9%	73.1%	169	85.8%	80.4%	89.9%
KZN	Umgungundlovu	60	73.3%	60.7%	83.0%				
KZN	Uthukela	700	74.3%	70.9%	77.4%	73	90.4%	79.8%	95.7%
WC	Eden	121	74.4%	65.8%	81.4%				
EC	Chris Hani	79	75.9%	65.3%	84.1%	4	100.0%	.	.
LP	Mopani	680	76.0%	72.7%	79.1%	160	80.6%	72.6%	86.7%
NW	Bojanala	299	76.9%	71.8%	81.4%	82	82.9%	75.1%	88.6%
NC	Z F Mgcawu	61	77.0%	64.8%	86.0%	14	64.3%	34.0%	86.3%
LP	Sekhukhune	345	77.1%	72.4%	81.2%	48	81.3%	64.8%	91.1%
MP	Nkangala	328	77.4%	72.6%	81.6%	68	91.2%	81.9%	95.9%
MP	Ehlanzeni	396	78.0%	73.7%	81.8%	16	31.3%	12.4%	59.4%
LP	Waterberg	111	79.3%	70.7%	85.9%				
NW	Ngaka Modiri Molema	484	79.3%	75.5%	82.7%	71	90.1%	79.9%	95.4%
KZN	Zululand	399	79.7%	75.5%	83.4%	103	53.4%	41.2%	65.2%
WC	West Coast	74	79.7%	69.0%	87.4%	10	70.0%	30.0%	92.7%
FS	Thabo Mofutsanyane	50	80.0%	66.5%	89.0%	2	50.0%	1.9%	98.1%

FS	Xhariep	81	80.2%	70.1%	87.6%	7	100.0%	.	.
KZN	Uthungulu	986	80.3%	77.7%	82.7%	240	97.1%	94.0%	98.6%
KZN	eThekwini	887	80.5%	77.8%	83.0%	500	89.4%	84.2%	93.0%
EC	Buffalo City	211	80.6%	74.7%	85.4%	44	81.8%	64.8%	91.6%
EC	Amathole	220	82.3%	76.6%	86.8%	13	69.2%	38.4%	89.0%
NW	Dr Kenneth Kaunda	210	82.4%	76.6%	87.0%	28	78.6%	62.9%	88.8%
MP	Gert Sibande	284	82.7%	77.9%	86.7%	74	87.8%	77.8%	93.7%
LP	Vhembe	589	82.9%	79.6%	85.7%	201	85.1%	77.5%	90.4%
EC	Alfred Nzo	271	83.0%	78.1%	87.0%	34	85.3%	68.5%	93.9%
GP	Sedibeng	514	83.3%	79.8%	86.3%	25	88.0%	65.4%	96.6%
GP	City of Tshwane	621	83.4%	80.3%	86.1%	101	86.1%	74.0%	93.1%
KZN	Amajuba	470	83.6%	80.0%	86.7%	116	85.3%	75.4%	91.7%
KZN	Sisonke	597	83.9%	80.7%	86.7%	26	92.3%	67.8%	98.6%
NW	Ruth Segomotsi Mompati	106	84.0%	75.7%	89.8%	25	88.0%	75.0%	94.7%
EC	Nelson Mandela Bay	326	84.4%	80.0%	87.9%	89	78.7%	65.1%	87.9%
KZN	Umkhanyakude	243	85.2%	80.1%	89.1%	23	95.7%	72.7%	99.5%
FS	Lejweleputswa	285	85.3%	80.6%	88.9%				
EC	Joe Gqabi	110	85.5%	77.5%	90.9%	2	100.0%	.	.
KZN	Ugu	187	85.6%	79.7%	89.9%	39	89.7%	75.7%	96.1%
GP	City of Johannesburg	1,711	85.6%	83.8%	87.2%	479	92.7%	89.8%	94.8%
WC	Overberg	143	86.0%	79.3%	90.8%	8	100.0%	.	.
GP	West Rand	382	86.1%	82.3%	89.2%	47	72.3%	50.1%	87.2%
EC	Sarah Baartman	348	86.2%	82.2%	89.5%	13	92.3%	52.5%	99.2%

GP	Ekurhuleni	890	86.3%	83.9%	88.4%	224	91.5%	86.7%	94.7%
WC	Cape Winelands	179	86.6%	80.8%	90.9%	28	92.9%	79.9%	97.7%
FS	Mangaung	187	86.6%	80.9%	90.8%	58	82.8%	70.1%	90.8%
WC	City of Cape Town	101	87.1%	79.0%	92.4%	17	64.7%	38.5%	84.3%
KZN	Umgonyathi	205	87.8%	82.6%	91.6%	74	86.5%	76.7%	92.6%
NC	Frances Baard	200	92.0%	87.3%	95.0%	6	83.3%	29.5%	98.4%
NC	Namakwa	27	96.3%	77.3%	99.5%	2	100.0%	.	.
WC	Central Karoo	33	97.0%	80.9%	99.6%				
NC	John Taolo Gaetsewe	5	100.0%	.	.				

Table 10: Vaccination coverage estimates for children aged 24-35 months who were fully vaccinated with all vaccine doses from birth to PCV3 given at 9 months

Province	District	VACCINATION CARD				ORAL RECALL			
		sample size	Proportion	95% CI		sample size	Proportion	95% CI	
EC	O.R.Tambo	372	65.3%	60.3%	70.0%	226	84.5%	78.0%	89.4%
KZN	iLembe	359	67.1%	62.1%	71.8%	68	89.7%	79.6%	95.1%
FS	Fezile Dabi	128	68.0%	59.4%	75.5%	30	83.3%	63.0%	93.6%
NC	Pixley ka Seme	32	71.9%	53.9%	84.8%				
LP	Capricorn	493	75.1%	71.0%	78.7%	169	87.6%	82.2%	91.5%
WC	Eden	121	76.9%	68.5%	83.5%				
KZN	Uthukela	700	78.6%	75.4%	81.5%	73	90.4%	79.8%	95.7%
MP	Nkangala	328	79.0%	74.2%	83.0%	68	94.1%	85.3%	97.8%
LP	Mopani	680	79.7%	76.5%	82.6%	160	83.1%	75.6%	88.7%
EC	Chris Hani	79	79.7%	69.4%	87.2%	4	100.0%	.	.
NW	Bojanala	299	80.9%	76.1%	85.0%	82	84.1%	76.4%	89.7%
LP	Sekhukhune	345	81.2%	76.7%	84.9%	48	85.4%	75.1%	91.9%
NC	Z F Mgawu	61	82.0%	70.2%	89.8%	14	71.4%	41.1%	89.9%
KZN	eThekwini	887	82.8%	80.1%	85.1%	500	89.8%	84.6%	93.4%
NW	Ngaka Modiri Molema	484	82.9%	79.2%	86.0%	71	90.1%	79.9%	95.4%
EC	Buffalo City	211	82.9%	77.2%	87.4%	44	81.8%	64.8%	91.6%
MP	Ehlanzeni	396	83.1%	79.1%	86.5%	16	43.8%	18.8%	72.3%

KZN	Umgungundlovu	60	83.3%	71.6%	90.8%				
KZN	Uthungulu	986	83.6%	81.1%	85.8%	240	97.1%	94.0%	98.6%
KZN	Zululand	399	83.7%	79.7%	87.0%	103	55.3%	42.7%	67.3%
FS	Xhariep	81	85.2%	75.6%	91.4%	7	100.0%	.	.
GP	Sedibeng	514	85.6%	82.3%	88.4%	25	88.0%	65.4%	96.6%
EC	Alfred Nzo	271	85.6%	80.9%	89.3%	34	85.3%	68.5%	93.9%
LP	Vhembe	589	86.1%	83.0%	88.6%	201	86.6%	78.7%	91.8%
GP	City of Tshwane	621	86.5%	83.5%	88.9%	101	88.1%	75.5%	94.7%
WC	West Coast	74	86.5%	76.6%	92.6%	10	90.0%	46.7%	98.9%
EC	Nelson Mandela Bay	326	86.5%	82.3%	89.8%	89	78.7%	65.1%	87.9%
KZN	Sisonke	597	86.8%	83.8%	89.3%	26	92.3%	67.8%	98.6%
NW	Dr Kenneth Kaunda	210	87.1%	81.9%	91.0%	28	85.7%	71.0%	93.6%
KZN	Umkhanyakude	243	87.2%	82.4%	90.9%	23	95.7%	72.7%	99.5%
LP	Waterberg	111	87.4%	79.8%	92.4%				
KZN	Amajuba	470	87.9%	84.6%	90.5%	116	89.7%	80.2%	94.9%
EC	Amathole	220	88.2%	83.2%	91.8%	13	76.9%	44.2%	93.3%
EC	Joe Gqabi	110	88.2%	80.7%	93.0%	2	100.0%	.	.
NW	Ruth Segomotsi Mompati	106	88.7%	81.1%	93.5%	25	96.0%	83.1%	99.2%
KZN	Ugu	187	88.8%	83.4%	92.6%	39	92.3%	74.4%	98.0%
EC	Sarah Baartman	348	88.8%	85.0%	91.7%	13	92.3%	52.5%	99.2%

WC	Overberg	143	88.8%	82.5%	93.0%	8	100.0%	.	.
GP	Ekurhuleni	890	88.9%	86.6%	90.8%	224	94.2%	90.1%	96.7%
WC	City of Cape Town	101	89.1%	81.3%	93.9%	17	64.7%	38.5%	84.3%
FS	Lejweleputswa	285	89.1%	84.9%	92.3%				
GP	City of Johannesburg	1,711	89.1%	87.6%	90.5%	479	94.6%	92.1%	96.3%
GP	West Rand	382	89.3%	85.7%	92.0%	47	72.3%	50.1%	87.2%
MP	Gert Sibande	284	89.4%	85.3%	92.5%	74	87.8%	77.8%	93.7%
FS	Mangaung	187	89.8%	84.6%	93.4%	58	84.5%	72.3%	91.9%
KZN	Umgazi	205	90.7%	85.9%	94.0%	74	86.5%	76.7%	92.6%
WC	Cape Winelands	179	91.1%	85.9%	94.5%	28	92.9%	79.9%	97.7%
FS	Thabo Mofutsanyane	50	92.0%	80.4%	97.0%	2	50.0%	1.9%	98.1%
NC	Frances Baard	200	94.5%	90.3%	96.9%	6	83.3%	29.5%	98.4%
NC	Namakwa	27	96.3%	77.3%	99.5%	2	100.0%	.	.
WC	Central Karoo	33	100.0%	.	.				
NC	John Taolo Gaetsewe	5	100.0%	.	.				

It is concerning that only 7 districts managed to reach the national target of 90% for fully immunised under 1 year coverage.

Drop-out rates in fully vaccinated children with all vaccines scheduled up to 9 months vs all vaccines scheduled up to 18 months

Considering children with vaccination cards, the drop-out rate in children fully vaccinated with all vaccines scheduled up to 9 months compared to children vaccinated with all scheduled vaccines up to 18 months ranged from 26% in Pixley ka Seme district to 5% in iLembe and City of Cape Town. The drop-out rates in three districts in NC was between 3% and 0%, but the sample size in these 3 districts was considerably smaller. The proportion of fully vaccinated children declined when assessing vaccine doses from birth to 9 months compared to fully vaccinated children who had received all 14 doses in the primary EPI schedule; from 83.9% to 76.1%. The largest drop-out rate was in Pixley ka Seme, Waterberg, Xhariep, Umgungundlovu, O.R.Tambo, Capricorn, Zululand and Thabo Mofutsanyane where the drop-out rates were >15%.

Figure below illustrates these drop-out rates for each district. The length of the line is proportional to the magnitude of the percentage decline. The space between the shapes represents the magnitude of the drop-out rate between the vaccine time points. As such, the districts with the worst dropout rates are represented on the left side of the graph.

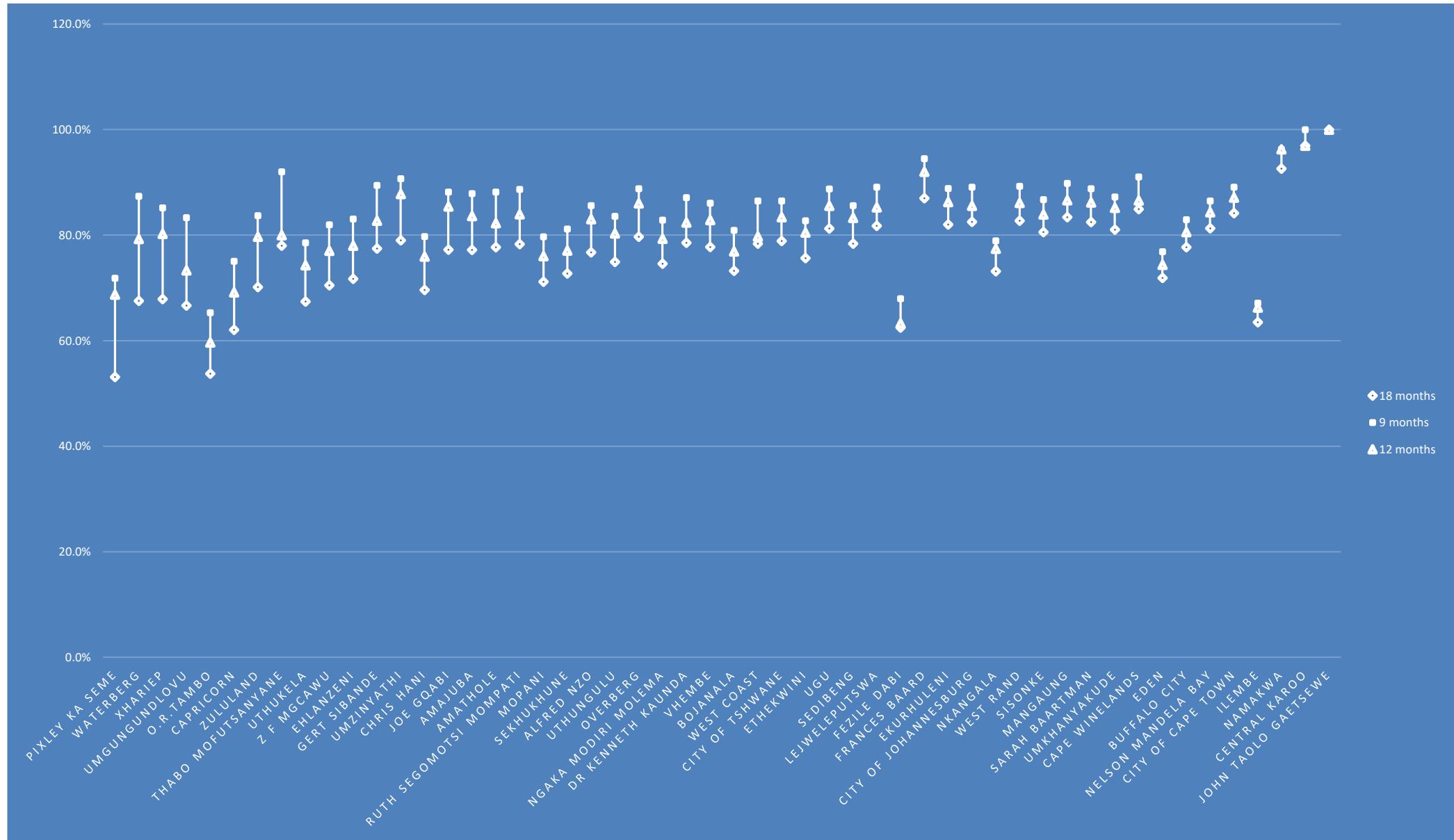


Figure 7: drop-out rates in fully vaccinated children comparing vaccines scheduled up to 9 months and all 14 vaccine doses scheduled up to 18 months

Unvaccinated children

Unvaccinated children are a major concern in any EPI programme; overall 763 children (4.3%) were unvaccinated (95% CI: 4.1 - 4.8%) – ranging from 0% to 29.5% across the 52 districts. Of the 52 districts, only J.T Gaetsewe had no unvaccinated children; but the sample size was small. The number of unvaccinated children was > 5% in 17 districts, and > 10% in four districts, namely Capricorn, iLembe, Thabo Mofutsanyane and Z.F Mgawu. These are districts that require supplementary vaccination activities especially in hard to reach areas to ensure unvaccinated children are vaccinated.

The proportion of unvaccinated children increased slightly when the unvaccinated children indicator excluded children who only received BCG and OPV birth doses. However, O.R Tambo, Buffalo City and Xhariep had larger increases in unvaccinated children after removing children who only received BCG and OPV birth doses. Figure 8 below presents these findings for each of the 52 districts.

Vaccination coverage for children without vaccination cards

Of the 3 687 children who did not have a vaccination card, the reported vaccination estimates were generally markedly higher than coverage estimates recorded through vaccination cards. For example, in Xhariep and Chris Hani districts, the proportion of children fully vaccinated with all doses on vaccination cards was 68% and 70% respectively but 100% for both districts reported via oral recall. This pattern was generally consistent across most districts for vaccines at 9, 12 and 18 months. Tables 8 to 10 provides detailed estimates of coverage estimates determined through vaccination records vs oral recall.

Because of the high vaccination coverage estimates reported through oral recall, the proportion of unvaccinated children reported through oral recall was < 1% across all districts; probably an underestimate of the true number.

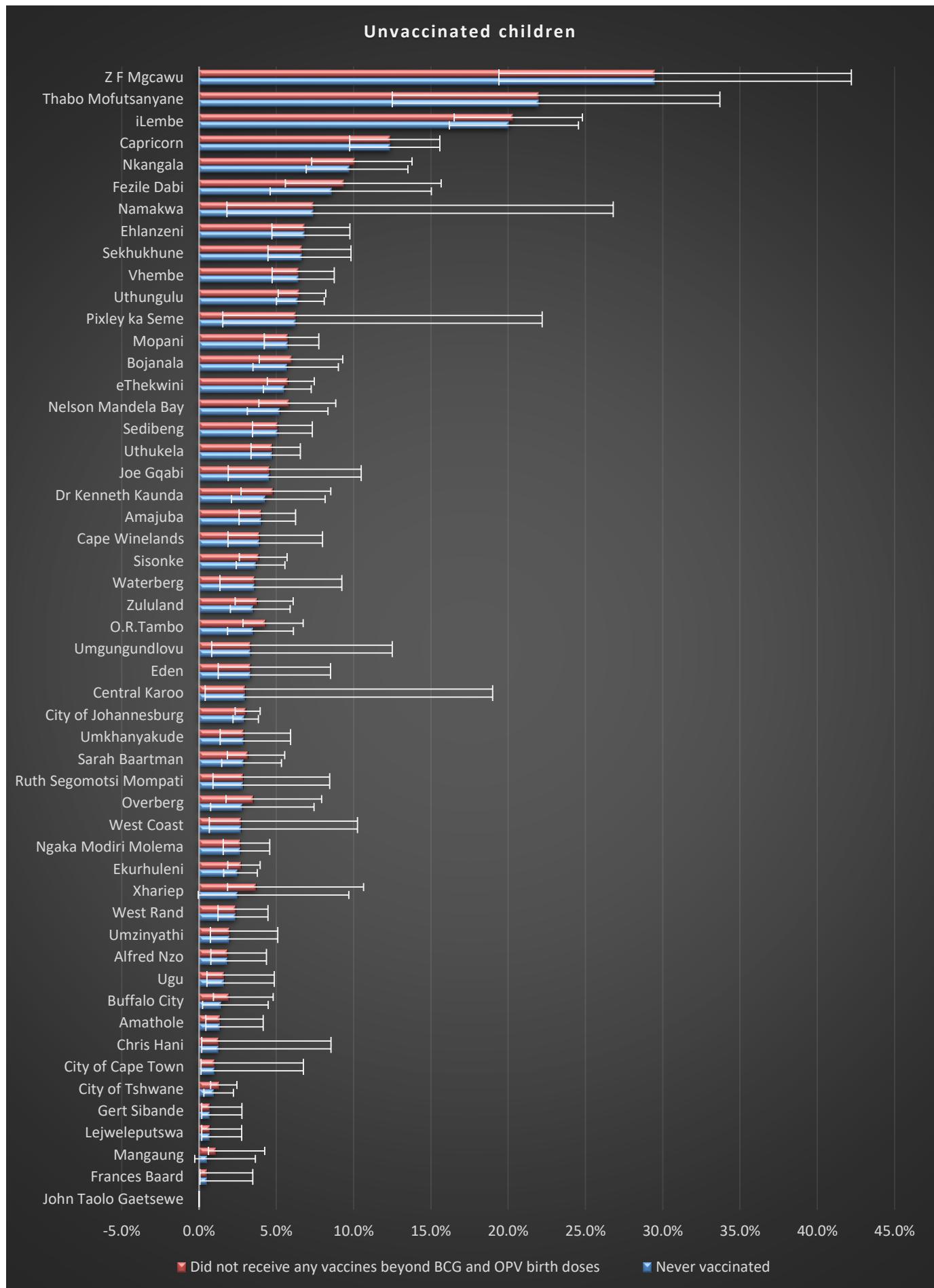


Figure 8: Proportion of unvaccinated children stratified by district

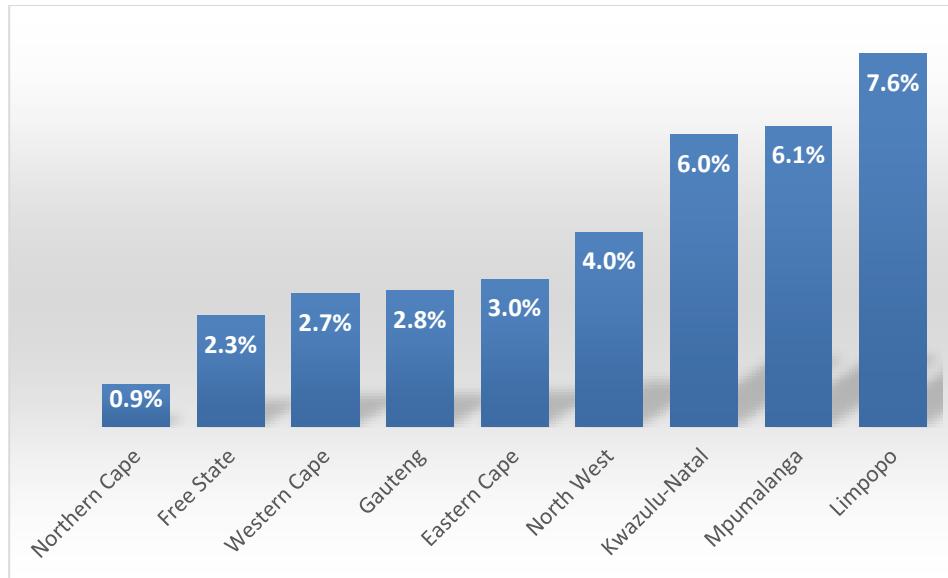


Figure 9: Proportion of unvaccinated children per province

Dropout rates between vaccine doses

OPV birth dose and OPV1 dropout rates

The change in proportion of children vaccinated with OPV0 compared to OPV1 is tabulated below (Table 11). Across all districts there was a decline in the proportion of children receiving OPV1 compared to OPV0 except for City of Cape Town district. The largest decline was in Fezile Dabi in the FS province, Eden in WC, Pixley ka Seme in NC, Chris Hani and OR Tambo in EC where the drop-out rates were >5%.

Table 11: Percentage drop-out between OPV0 and OPV1 by district

Province	District	Sample size	OPV0			OPV1			
FS	Fezile Dabi	128	91.4%	85.1%	95.2%	81.3%	73.5%	87.1%	-11.1%
WC	Eden	121	96.7%	91.5%	98.8%	88.4%	81.4%	93.0%	-8.5%

NC	Pixley ka Seme	32	93.8%	77.8%	98.5%	87.5%	70.7%	95.3%	-6.7%
EC	Chris Hani	79	98.7%	91.5%	99.8%	92.4%	84.0%	96.6%	-6.4%
EC	O.R.Tambo	372	95.4%	92.8%	97.1%	90.3%	86.9%	92.9%	-5.4%
FS	Thabo Mofutsanyane	50	100.0%	.	.	96.0%	85.2%	99.0%	-4.0%
NC	Namakwa	27	100.0%	.	.	96.3%	77.3%	99.5%	-3.7%
LP	Sekhukhune	345	92.8%	89.5%	95.1%	89.6%	85.9%	92.4%	-3.4%
EC	Buffalo City	211	98.6%	95.7%	99.5%	95.3%	91.4%	97.4%	-3.4%
MP	Nkangala	328	90.2%	86.5%	93.0%	87.5%	83.5%	90.7%	-3.0%
WC	Overberg	143	97.2%	92.8%	98.9%	94.4%	89.2%	97.2%	-2.9%
EC	Joe Gqabi	110	95.5%	89.5%	98.1%	92.7%	86.1%	96.3%	-2.9%
NW	Bojanala	299	94.3%	91.0%	96.4%	91.6%	87.9%	94.3%	-2.8%
GP	City of Tshwane	621	98.9%	97.7%	99.5%	96.3%	94.5%	97.5%	-2.6%
FS	Xhariep	81	97.5%	90.6%	99.4%	95.1%	87.5%	98.1%	-2.5%
EC	Amathole	220	98.6%	95.8%	99.6%	96.4%	92.9%	98.2%	-2.3%
EC	Alfred Nzo	271	98.2%	95.6%	99.2%	95.9%	92.8%	97.7%	-2.3%
LP	Mopani	680	93.5%	91.4%	95.2%	91.5%	89.1%	93.4%	-2.2%
GP	Sedibeng	514	94.6%	92.2%	96.2%	92.6%	90.0%	94.6%	-2.1%
LP	Capricorn	493	87.4%	84.2%	90.1%	85.8%	82.4%	88.6%	-1.9%
EC	Sarah Baartman	348	97.1%	94.7%	98.4%	95.4%	92.6%	97.2%	-1.8%
WC	Cape Winelands	179	96.1%	92.0%	98.1%	94.4%	89.9%	97.0%	-1.7%
KZN	iLembe	359	79.9%	75.5%	83.8%	78.6%	74.0%	82.5%	-1.7%
KZN	Umkhanyakude	243	97.1%	94.1%	98.6%	95.5%	92.0%	97.5%	-1.7%
KZN	Uthukela	700	95.3%	93.4%	96.6%	93.7%	91.7%	95.3%	-1.6%

KZN	eThekwini	887	94.0%	92.3%	95.4%	92.6%	90.6%	94.1%	-1.6%
WC	West Coast	74	97.3%	89.7%	99.3%	95.9%	88.1%	98.7%	-1.4%
EC	Nelson Mandela Bay	326	94.5%	91.4%	96.5%	93.3%	90.0%	95.5%	-1.3%
FS	Mangaung	187	98.9%	95.8%	99.7%	97.9%	94.4%	99.2%	-1.1%
MP	Gert Sibande	284	99.3%	97.2%	99.8%	98.2%	95.8%	99.3%	-1.1%
GP	Ekurhuleni	890	97.1%	95.7%	98.0%	96.1%	94.6%	97.2%	-1.0%
KZN	Zululand	399	96.5%	94.2%	97.9%	95.5%	93.0%	97.1%	-1.0%
NC	Frances Baard	200	99.0%	96.1%	99.8%	98.0%	94.8%	99.2%	-1.0%
NW	Dr Kenneth Kaunda	210	95.7%	92.0%	97.8%	94.8%	90.8%	97.1%	-1.0%
LP	Waterberg	111	96.4%	90.8%	98.6%	95.5%	89.6%	98.1%	-0.9%
KZN	Sisonke	597	96.0%	94.1%	97.3%	95.1%	93.1%	96.6%	-0.9%
FS	Lejweleputswa	285	98.6%	96.3%	99.5%	97.9%	95.4%	99.1%	-0.7%
KZN	Amajuba	470	96.0%	93.7%	97.4%	95.3%	93.0%	96.9%	-0.7%
GP	City of Johannesburg	1,711	97.0%	96.0%	97.7%	96.4%	95.4%	97.2%	-0.6%
KZN	Ugu	187	97.3%	93.7%	98.9%	96.8%	93.0%	98.6%	-0.5%
LP	Vhembe	589	93.0%	90.7%	94.8%	92.5%	90.1%	94.4%	-0.5%
GP	West Rand	382	97.4%	95.2%	98.6%	96.9%	94.5%	98.2%	-0.5%
NW	Ngaka Modiri Molema	484	97.1%	95.2%	98.3%	96.7%	94.7%	98.0%	-0.4%
MP	Ehlanzeni	396	93.2%	90.2%	95.3%	92.9%	89.9%	95.1%	-0.3%
KZN	Uthungulu	986	92.4%	90.6%	93.9%	92.3%	90.5%	93.8%	-0.1%
WC	Central Karoo	33	100.0%	.	.	100.0%	.	.	0.0%
NC	John Taolo Gaetsewe	5	100.0%	.	.	100.0%	.	.	0.0%
NW	Ruth Segomotsi Mompati	106	97.2%	91.5%	99.1%	97.2%	91.5%	99.1%	0.0%

KZN	Umgungundlovu	60	96.7%	87.5%	99.2%	96.7%	87.5%	99.2%	0.0%
KZN	Umzinyathi	205	97.6%	94.3%	99.0%	97.6%	94.3%	99.0%	0.0%
NC	Z F Mgcau	61	98.4%	89.1%	99.8%	98.4%	89.1%	99.8%	0.0%
WC	City of Cape Town	101	97.0%	91.1%	99.0%	98.0%	92.4%	99.5%	1.0%

Hexavalent1 to hexavalent4 dropout rates

Dropout rates between hexavalent 1 and 4 are a proxy for poor retention in the EPI programme. Table 12 below details drop-out rate between hexavalent doses per district; dropout rates ranged from 26% in Pixley ka Seme to 0% in Fezile Dabi district. Pixely ka Seme also had high drop-out rates between OPV0 and OPV1 doses (see above). Thirty out of 52 (57%) of districts had drop-out rates greater than 10% highlighting that retention is an important problem within the EPI programme.

Table12: Dropout rates from between hexa1 to hexa4 by district

			HEXA1		HEXA2		Hexa1 to Hexa2 drop- out	HEXA3			Hexa2 to Hexa3 drop- out	HEXA4			Hexa3 to Hexa4 drop- out	Total % drop- out		
			Sample size	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI					
NC	Pixley ka Seme	32	90.6%	74.3%	97.0%	81.3%	63.7%	91.4%	-10.3%	78.1%	60.4%	89.3%	-3.8%	68.8%	50.7%	82.5%	-12.0%	-26.2%
LP	Waterberg	111	96.4%	90.8%	98.6%	94.6%	88.4%	97.6%	-1.9%	92.8%	86.2%	96.4%	-1.9%	73.9%	64.9%	81.2%	-20.4%	-24.2%
FS	Xhariep	81	96.3%	89.1%	98.8%	92.6%	84.4%	96.7%	-3.8%	93.8%	85.9%	97.4%	1.3%	76.5%	66.0%	84.6%	-18.4%	-20.9%
KZN	Zululand	399	95.0%	92.4%	96.7%	95.2%	92.7%	96.9%	0.3%	93.7%	90.9%	95.7%	-1.6%	77.9%	73.6%	81.7%	-16.8%	-18.2%

LP	Capricorn	493	86.0%	82.6%	88.8%	86.6%	83.3%	89.3%	0.7%	85.8%	82.4%	88.6%	-0.9%	71.6%	67.5%	75.4%	-16.5%	-16.8%
WC	West Coast	74	97.3%	89.7%	99.3%	97.3%	89.7%	99.3%	0.0%	89.2%	79.8%	94.5%	-8.3%	82.4%	72.0%	89.6%	-7.6%	-15.9%
EC	Alfred Nzo	271	96.7%	93.7%	98.3%	96.7%	93.7%	98.3%	0.0%	95.6%	92.4%	97.5%	-1.1%	83.4%	78.5%	87.4%	-12.7%	-13.9%
KZN	Uthukela	700	93.3%	91.2%	94.9%	92.7%	90.5%	94.4%	-0.6%	92.7%	90.5%	94.4%	0.0%	80.6%	77.5%	83.3%	-13.1%	-13.7%
MP	Gert Sibande	284	98.2%	95.8%	99.3%	98.2%	95.8%	99.3%	0.0%	97.9%	95.4%	99.0%	-0.4%	84.9%	80.2%	88.6%	-13.3%	-13.7%
KZN	Umzinyathi	205	97.1%	93.6%	98.7%	96.6%	93.0%	98.4%	-0.5%	95.6%	91.8%	97.7%	-1.0%	83.9%	78.2%	88.3%	-12.2%	-13.8%
NC	Z F Mgcawu	61	96.7%	87.7%	99.2%	100.0%	.	.	3.4%	96.7%	87.7%	99.2%	-3.3%	83.6%	72.0%	91.0%	-13.6%	-13.4%
NW	Ngaka Modiri Molema	484	94.8%	92.5%	96.5%	95.2%	92.9%	96.8%	0.4%	93.2%	90.6%	95.1%	-2.2%	82.0%	78.3%	85.2%	-12.0%	-13.7%
KZN	Amajuba	470	95.3%	93.0%	96.9%	93.6%	91.0%	95.5%	-1.8%	93.8%	91.3%	95.7%	0.2%	83.2%	79.5%	86.3%	-11.3%	-12.9%
NW	Ruth Segomotsi Mompati	106	97.2%	91.5%	99.1%	95.3%	89.1%	98.0%	-1.9%	95.3%	89.1%	98.0%	0.0%	84.9%	76.7%	90.6%	-10.9%	-12.8%
FS	Thabo Mofutsanyane	50	98.0%	86.9%	99.7%	98.0%	86.9%	99.7%	0.0%	98.0%	86.9%	99.7%	0.0%	86.0%	73.3%	93.2%	-12.2%	-12.2%
MP	Nkangala	328	88.7%	84.8%	91.7%	88.4%	84.5%	91.5%	-0.3%	86.9%	82.8%	90.1%	-1.7%	78.0%	73.2%	82.2%	-10.2%	-12.2%
FS	Lejweleputswa	285	99.3%	97.2%	99.8%	97.9%	95.4%	99.1%	-1.4%	97.9%	95.4%	99.1%	0.0%	87.4%	83.0%	90.8%	-10.8%	-12.2%
EC	O.R.Tambo	372	86.6%	82.7%	89.7%	87.9%	84.2%	90.8%	1.6%	84.4%	80.4%	87.8%	-4.0%	76.3%	71.8%	80.4%	-9.6%	-12.0%
EC	Joe Gqabi	110	92.7%	86.1%	96.3%	91.8%	85.0%	95.7%	-1.0%	93.6%	87.2%	96.9%	2.0%	81.8%	73.4%	88.0%	-12.6%	-11.6%
EC	Amathole	220	97.7%	94.6%	99.1%	96.8%	93.5%	98.5%	-0.9%	95.0%	91.2%	97.2%	-1.9%	86.4%	81.2%	90.3%	-9.1%	-11.9%

NW	Dr Kenneth Kaunda	210	94.8%	90.8%	97.1%	93.3%	89.0%	96.0%	-1.5%	91.9%	87.4%	94.9%	-1.5%	83.8%	78.2%	88.2%	-8.8%	-11.8%
LP	Mopani	680	91.9%	89.6%	93.7%	92.1%	89.8%	93.9%	0.2%	90.4%	88.0%	92.4%	-1.8%	81.6%	78.5%	84.4%	-9.8%	-11.4%
LP	Vhembe	589	92.2%	89.7%	94.1%	91.9%	89.3%	93.8%	-0.4%	90.8%	88.2%	92.9%	-1.1%	82.0%	78.7%	84.9%	-9.7%	-11.2%
GP	Sedibeng	514	94.2%	91.8%	95.9%	93.8%	91.3%	95.6%	-0.4%	93.0%	90.4%	94.9%	-0.8%	84.0%	80.6%	87.0%	-9.6%	-10.9%
KZN	Uthungulu	986	92.7%	90.9%	94.2%	91.7%	89.8%	93.3%	-1.1%	91.3%	89.3%	92.9%	-0.4%	82.8%	80.3%	85.0%	-9.3%	-10.9%
KZN	Umgungundlovu	60	93.3%	83.4%	97.5%	96.7%	87.5%	99.2%	3.6%	96.7%	87.5%	99.2%	0.0%	83.3%	71.6%	90.8%	-13.8%	-10.2%
NW	Bojanala	299	93.0%	89.5%	95.4%	91.3%	87.5%	94.0%	-1.8%	90.6%	86.8%	93.5%	-0.7%	83.3%	78.6%	87.1%	-8.1%	-10.6%
WC	Overberg	143	94.4%	89.2%	97.2%	94.4%	89.2%	97.2%	0.0%	96.5%	91.9%	98.5%	2.2%	84.6%	77.7%	89.7%	-12.3%	-10.1%
GP	City of Tshwane	621	96.5%	94.7%	97.7%	95.3%	93.4%	96.7%	-1.2%	95.8%	93.9%	97.1%	0.5%	86.5%	83.5%	88.9%	-9.7%	-10.4%
GP	Ekurhuleni	890	96.6%	95.2%	97.6%	95.5%	93.9%	96.7%	-1.2%	94.9%	93.3%	96.2%	-0.6%	86.9%	84.5%	88.9%	-8.5%	-10.3%
FS	Mangaung	187	97.3%	93.7%	98.9%	98.4%	95.1%	99.5%	1.1%	97.9%	94.4%	99.2%	-0.5%	87.7%	82.2%	91.7%	-10.4%	-9.8%
MP	Ehlanzeni	396	89.9%	86.5%	92.5%	89.9%	86.5%	92.5%	0.0%	89.6%	86.2%	92.3%	-0.3%	81.1%	76.9%	84.6%	-9.6%	-9.9%
LP	Sekhukhune	345	91.6%	88.2%	94.1%	91.9%	88.5%	94.3%	0.3%	90.7%	87.2%	93.4%	-1.3%	82.6%	78.2%	86.3%	-8.9%	-9.9%
EC	Buffalo City	211	95.3%	91.4%	97.4%	95.3%	91.4%	97.4%	0.0%	94.8%	90.8%	97.1%	-0.5%	86.3%	80.9%	90.3%	-9.0%	-9.5%
KZN	eThekweni	887	92.4%	90.5%	94.0%	91.7%	89.6%	93.3%	-0.9%	91.8%	89.8%	93.4%	0.1%	83.8%	81.2%	86.1%	-8.7%	-9.5%
KZN	Ugu	187	97.9%	94.4%	99.2%	98.4%	95.1%	99.5%	0.5%	96.3%	92.3%	98.2%	-2.2%	88.8%	83.4%	92.6%	-7.8%	-9.4%
EC	Sarah Baartman	348	96.0%	93.3%	97.6%	96.3%	93.7%	97.8%	0.3%	94.8%	91.9%	96.7%	-1.5%	87.6%	83.7%	90.7%	-7.6%	-8.8%
NC	Frances Baard	200	99.0%	96.1%	99.8%	99.5%	96.5%	99.9%	0.5%	98.5%	95.4%	99.5%	-1.0%	90.5%	85.6%	93.9%	-8.1%	-8.6%

GP	City of Johannesburg	1,711	95.6%	94.5%	96.5%	95.3%	94.2%	96.2%	-0.4%	94.8%	93.6%	95.8%	-0.5%	87.8%	86.1%	89.3%	-7.4%	-8.3%
KZN	Sisonke	597	94.6%	92.5%	96.2%	94.1%	91.9%	95.8%	-0.5%	94.5%	92.3%	96.0%	0.4%	87.1%	84.2%	89.6%	-7.8%	-8.0%
EC	Nelson Mandela Bay	326	93.9%	90.7%	96.0%	92.9%	89.6%	95.3%	-1.0%	92.0%	88.5%	94.5%	-1.0%	86.5%	82.3%	89.8%	-6.0%	-8.0%
GP	West Rand	382	97.4%	95.2%	98.6%	96.1%	93.6%	97.6%	-1.3%	95.8%	93.3%	97.4%	-0.3%	90.1%	86.6%	92.7%	-6.0%	-7.6%
WC	City of Cape Town	101	97.0%	91.1%	99.0%	97.0%	91.1%	99.0%	0.0%	94.1%	87.4%	97.3%	-3.1%	90.1%	82.5%	94.6%	-4.2%	-7.3%
KZN	Umkhanyakude	243	93.8%	90.0%	96.2%	94.2%	90.5%	96.6%	0.4%	93.8%	90.0%	96.2%	-0.4%	87.2%	82.4%	90.9%	-7.0%	-7.0%
WC	Eden	121	95.9%	90.4%	98.3%	95.0%	89.4%	97.8%	-0.9%	90.9%	84.3%	94.9%	-4.3%	89.3%	82.3%	93.7%	-1.8%	-7.0%
WC	Cape Winelands	179	95.0%	90.6%	97.4%	94.4%	89.9%	97.0%	-0.6%	93.9%	89.2%	96.6%	-0.6%	88.8%	83.3%	92.7%	-5.4%	-6.5%
KZN	iLembe	359	76.9%	72.2%	81.0%	76.3%	71.6%	80.4%	-0.7%	76.6%	71.9%	80.7%	0.4%	72.4%	67.6%	76.8%	-5.5%	-5.8%
EC	Chris Hani	79	92.4%	84.0%	96.6%	97.5%	90.4%	99.4%	5.5%	93.7%	85.6%	97.4%	-3.9%	87.3%	78.0%	93.1%	-6.8%	-5.2%
NC	Namakwa	27	96.3%	77.3%	99.5%	100.0 %	.	.	3.8%	100.0 %	.	.	0.0%	92.6%	74.2%	98.2%	-7.4%	-3.6%
WC	Central Karoo	33	100.0%	.	.	100.0 %	.	.	0.0%	100.0 %	.	.	0.0%	97.0%	80.9%	99.6%	-3.0%	-3.0%
FS	Fezile Dabi	128	82.0%	74.4%	87.8%	82.8%	75.2%	88.4%	1.0%	82.8%	75.2%	88.4%	0.0%	82.0%	74.4%	87.8%	-0.9%	0.0%
NC	John Taolo Gaetsewe	5	100.0%	.	.	100.0 %	.	.	0.0%	100.0 %	.	.	0.0%	100.0%	.	.	0.0%	0.0%

PCV1 to PCV3 dropout rates

The highest PCV percentage dropout was 10% in West Coast district; drop-out rates remained > 5% in 13 districts and occurred in all provinces except GP. In GP the district with largest drop-out rate was Tshwane with a 5% drop-out rate. Eden district in WC and Namakwa in NC had an increase in the proportion of children vaccinated with PCV3 compared to the proportion vaccinated with PCV1. Table 13 below details drop-out rates from PCV1 to PCV3.

Table 13: Dropout rates from PCV1 to PCV3 by district

			PCV1			PCV2			PCV1 to PCV2 dropout	PCV3			PCV2 to PCV3 dropout	Total % dropout
	District	sample size	%	95% CI		%	95% CI		%	95% CI				
WC	West Coast	74	97.3%	89.7%	99.3%	89.2%	79.8%	94.5%	-8.3%	87.8%	78.2%	93.6%	-1.5%	-9.8%
NC	Z F Mgcawu	61	100.0%	.	.	96.7%	87.7%	99.2%	-3.3%	91.8%	81.7%	96.6%	-5.1%	-8.4%
NW	Ngaka Modiri Molema	484	96.9%	94.9%	98.1%	94.8%	92.5%	96.5%	-2.1%	90.1%	87.1%	92.4%	-5.0%	-7.1%
NC	Pixley ka Seme	32	90.6%	74.3%	97.0%	87.5%	70.7%	95.3%	-3.4%	84.4%	67.2%	93.4%	-3.6%	-7.0%
EC	Buffalo City	211	96.2%	92.6%	98.1%	96.2%	92.6%	98.1%	0.0%	90.0%	85.2%	93.4%	-6.4%	-6.4%
KZN	Zululand	399	96.0%	93.6%	97.5%	95.5%	93.0%	97.1%	-0.5%	90.0%	86.6%	92.6%	-5.8%	-6.3%
MP	Nkangala	328	89.0%	85.2%	92.0%	87.5%	83.5%	90.7%	-1.7%	83.5%	79.1%	87.2%	-4.5%	-6.2%
NW	Dr Kenneth Kaunda	210	95.2%	91.4%	97.4%	93.3%	89.0%	96.0%	-2.0%	90.0%	85.1%	93.4%	-3.6%	-5.6%
FS	Lejweleputswa	285	98.9%	96.8%	99.7%	98.6%	96.3%	99.5%	-0.4%	93.7%	90.2%	96.0%	-5.0%	-5.3%
KZN	iLembe	359	79.7%	75.2%	83.5%	78.3%	73.7%	82.2%	-1.7%	75.5%	70.8%	79.7%	-3.6%	-5.3%
LP	Capricorn	493	87.0%	83.7%	89.7%	86.2%	82.9%	89.0%	-0.9%	82.6%	78.9%	85.7%	-4.2%	-5.2%
KZN	Umgungundlovu	60	95.0%	85.5%	98.4%	96.7%	87.5%	99.2%	1.8%	90.0%	79.4%	95.5%	-6.9%	-5.1%
NW	Bojanala	299	93.6%	90.2%	95.9%	92.3%	88.7%	94.8%	-1.4%	89.0%	84.9%	92.1%	-3.6%	-5.1%
GP	City of Tshwane	621	98.4%	97.0%	99.1%	97.3%	95.6%	98.3%	-1.1%	93.6%	91.3%	95.2%	-3.8%	-5.0%
NW	Ruth Segomotsi Mompati	106	97.2%	91.5%	99.1%	94.3%	87.9%	97.4%	-2.9%	92.5%	85.6%	96.2%	-2.0%	-4.9%

LP	Waterberg	111	95.5%	89.6%	98.1%	95.5%	89.6%	98.1%	0.0%	91.0%	84.0%	95.1%	-4.7%	-4.7%
FS	Mangaung	187	98.4%	95.1%	99.5%	98.4%	95.1%	99.5%	0.0%	94.1%	89.7%	96.7%	-4.3%	-4.3%
EC	Nelson Mandela Bay	326	93.9%	90.7%	96.0%	91.7%	88.2%	94.3%	-2.3%	89.9%	86.1%	92.7%	-2.0%	-4.3%
KZN	Uthukela	700	94.9%	93.0%	96.3%	93.3%	91.2%	94.9%	-1.7%	90.9%	88.5%	92.8%	-2.6%	-4.3%
EC	Sarah Baartman	348	96.3%	93.7%	97.8%	95.4%	92.6%	97.2%	-0.9%	92.2%	88.9%	94.6%	-3.3%	-4.2%
EC	Alfred Nzo	271	97.0%	94.2%	98.5%	97.0%	94.2%	98.5%	0.0%	93.0%	89.3%	95.5%	-4.2%	-4.2%
GP	Sedibeng	514	94.2%	91.8%	95.9%	94.0%	91.5%	95.7%	-0.2%	90.3%	87.4%	92.6%	-3.9%	-4.1%
KZN	Amajuba	470	96.0%	93.7%	97.4%	94.9%	92.5%	96.6%	-1.1%	92.1%	89.3%	94.2%	-2.9%	-4.0%
KZN	Umkhanyakude	243	95.9%	92.5%	97.8%	96.3%	93.0%	98.1%	0.4%	92.2%	88.1%	95.0%	-4.3%	-3.8%
GP	Ekurhuleni	890	97.0%	95.6%	97.9%	95.7%	94.2%	96.9%	-1.3%	93.4%	91.5%	94.8%	-2.5%	-3.7%
EC	Chris Hani	79	93.7%	85.6%	97.4%	97.5%	90.4%	99.4%	4.1%	89.9%	81.0%	94.9%	-7.8%	-3.7%
MP	Gert Sibande	284	98.2%	95.8%	99.3%	98.2%	95.8%	99.3%	0.0%	94.7%	91.4%	96.8%	-3.6%	-3.6%
FS	Fezile Dabi	128	87.5%	80.5%	92.2%	89.8%	83.3%	94.0%	2.7%	84.4%	77.0%	89.7%	-6.1%	-3.4%
KZN	Uthungulu	986	93.1%	91.3%	94.5%	92.7%	90.9%	94.2%	-0.4%	90.0%	87.9%	91.7%	-3.0%	-3.4%
EC	Amathole	220	98.2%	95.2%	99.3%	96.8%	93.5%	98.5%	-1.4%	95.0%	91.2%	97.2%	-1.9%	-3.3%
KZN	eThekwini	887	93.0%	91.1%	94.5%	92.8%	90.9%	94.3%	-0.2%	90.1%	87.9%	91.9%	-2.9%	-3.2%
LP	Vhembe	589	93.4%	91.1%	95.1%	91.9%	89.3%	93.8%	-1.6%	90.5%	87.8%	92.6%	-1.5%	-3.1%
WC	City of Cape Town	101	97.0%	91.1%	99.0%	95.0%	88.6%	97.9%	-2.0%	94.1%	87.4%	97.3%	-1.0%	-3.1%
GP	City of Johannesburg	1,711	96.6%	95.6%	97.3%	95.6%	94.5%	96.5%	-1.0%	93.7%	92.4%	94.7%	-2.0%	-3.0%
EC	O.R.Tambo	372	93.3%	90.2%	95.4%	92.7%	89.6%	95.0%	-0.6%	90.6%	87.2%	93.2%	-2.3%	-2.9%
GP	West Rand	382	96.9%	94.5%	98.2%	96.1%	93.6%	97.6%	-0.8%	94.2%	91.4%	96.2%	-1.9%	-2.7%
FS	Xhariep	81	96.3%	89.1%	98.8%	96.3%	89.1%	98.8%	0.0%	93.8%	85.9%	97.4%	-2.6%	-2.6%
KZN	Umgonyathi	205	98.0%	94.9%	99.3%	96.6%	93.0%	98.4%	-1.5%	95.6%	91.8%	97.7%	-1.0%	-2.5%

MP	Ehlanzeni	396	92.4%	89.4%	94.7%	92.4%	89.4%	94.7%	0.0%	90.2%	86.8%	92.7%	-2.5%	-2.5%
LP	Mopani	680	93.4%	91.2%	95.0%	93.4%	91.2%	95.0%	0.0%	91.2%	88.8%	93.1%	-2.4%	-2.4%
FS	Thabo Mofutsanyane	50	100.0%	.	.	100.0%	.	.	0.0%	98.0%	86.9%	99.7%	-2.0%	-2.0%
LP	Sekhukhune	345	93.0%	89.8%	95.3%	92.5%	89.2%	94.8%	-0.6%	91.3%	87.8%	93.9%	-1.3%	-1.9%
KZN	Ugu	187	97.9%	94.4%	99.2%	97.9%	94.4%	99.2%	0.0%	96.3%	92.3%	98.2%	-1.6%	-1.6%
KZN	Sisonke	597	95.5%	93.5%	96.9%	95.3%	93.3%	96.7%	-0.2%	94.0%	91.8%	95.6%	-1.4%	-1.6%
NC	Frances Baard	200	99.0%	96.1%	99.8%	98.0%	94.8%	99.2%	-1.0%	97.5%	94.1%	99.0%	-0.5%	-1.5%
EC	Joe Gqabi	110	93.6%	87.2%	96.9%	93.6%	87.2%	96.9%	0.0%	92.7%	86.1%	96.3%	-1.0%	-1.0%
WC	Overberg	143	95.8%	91.0%	98.1%	95.8%	91.0%	98.1%	0.0%	95.1%	90.1%	97.7%	-0.7%	-0.7%
WC	Cape Winelands	179	94.4%	89.9%	97.0%	93.9%	89.2%	96.6%	-0.6%	93.9%	89.2%	96.6%	0.0%	-0.6%
WC	Central Karoo	33	100.0%	.	.	100.0%	.	.	0.0%	100.0%	.	.	0.0%	0.0%
NC	John Taolo Gaetsewe	5	100.0%	.	.	100.0%	.	.	0.0%	100.0%	.	.	0.0%	0.0%
NC	Namakwa	27	96.3%	77.3%	99.5%	100.0%	.	.	3.8%	96.3%	77.3%	99.5%	-3.7%	0.1%
WC	Eden	121	94.2%	88.3%	97.2%	96.7%	91.5%	98.8%	2.6%	95.0%	89.4%	97.8%	-1.7%	0.9%

RV dropout rates

The highest dropout rate between RV1 and Rv2 was 7% in Pixley ka Seme in NC and West Coast in WC. The drop-out rates declined to 4% in City of Cape Town and then further down to 2.5% in eThekwin (KZN) and Kenneth Kaunda (NW). However, in ten districts there was an increase in number of children receiving RV2 compared to RV2 as illustrated in Table 14.

Table 14: Dropout rates between RV1 and RV2 by district

			RV1			RV2			% dropout from RV1 to RV2
	District	Sample size	%	95% CI		%	95% CI		
NC	Pixley ka Seme	32	87.5%	70.7%	95.3%	81.3%	63.7%	91.4%	-7.1%
WC	West Coast	74	95.9%	88.1%	98.7%	89.2%	79.8%	94.5%	-7.0%
WC	City of Cape Town	101	99.0%	93.2%	99.9%	95.0%	88.6%	97.9%	-4.0%
KZN	eThekweni	887	93.2%	91.4%	94.7%	90.9%	88.8%	92.6%	-2.5%
NW	Dr Kenneth Kaunda	210	95.2%	91.4%	97.4%	92.9%	88.5%	95.7%	-2.5%
EC	Amathole	220	97.7%	94.6%	99.1%	95.5%	91.7%	97.5%	-2.3%
GP	City of Tshwane	621	97.9%	96.4%	98.8%	95.8%	93.9%	97.1%	-2.1%
EC	Sarah Baartman	348	96.0%	93.3%	97.6%	94.0%	90.9%	96.0%	-2.1%
KZN	Umgonyathi	205	97.6%	94.3%	99.0%	95.6%	91.8%	97.7%	-2.0%
KZN	Uthungulu	986	93.1%	91.3%	94.5%	91.5%	89.6%	93.1%	-1.7%
NC	Z F Mgcawu	61	96.7%	87.7%	99.2%	95.1%	85.7%	98.4%	-1.7%
LP	Vhembe	589	93.4%	91.1%	95.1%	91.9%	89.3%	93.8%	-1.6%
FS	Mangaung	187	98.4%	95.1%	99.5%	96.8%	93.0%	98.6%	-1.6%
LP	Sekhukhune	345	92.8%	89.5%	95.1%	91.3%	87.8%	93.9%	-1.6%
NW	Ngaka Modiri Molema	484	96.7%	94.7%	98.0%	95.2%	92.9%	96.8%	-1.5%
NW	Bojanala	299	93.0%	89.5%	95.4%	91.6%	87.9%	94.3%	-1.4%
MP	Gert Sibande	284	98.6%	96.3%	99.5%	97.2%	94.5%	98.6%	-1.4%
GP	Ekurhuleni	890	97.1%	95.7%	98.0%	95.7%	94.2%	96.9%	-1.4%
EC	Chris Hani	79	96.2%	88.8%	98.8%	94.9%	87.2%	98.1%	-1.3%

LP	Capricorn	493	87.2%	84.0%	89.9%	86.2%	82.9%	89.0%	-1.2%
MP	Ehlanzeni	396	92.7%	89.7%	94.9%	91.7%	88.5%	94.0%	-1.1%
GP	West Rand	382	97.1%	94.9%	98.4%	96.1%	93.6%	97.6%	-1.1%
KZN	iLembe	359	79.1%	74.6%	83.0%	78.3%	73.7%	82.2%	-1.1%
MP	Nkangala	328	88.4%	84.5%	91.5%	87.5%	83.5%	90.7%	-1.0%
EC	Nelson Mandela Bay	326	93.6%	90.3%	95.8%	92.6%	89.2%	95.0%	-1.0%
NW	Ruth Segomotsi Mompati	106	96.2%	90.3%	98.6%	95.3%	89.1%	98.0%	-1.0%
LP	Waterberg	111	96.4%	90.8%	98.6%	95.5%	89.6%	98.1%	-0.9%
KZN	Amajuba	470	96.0%	93.7%	97.4%	95.1%	92.7%	96.7%	-0.9%
KZN	Sisonke	597	95.1%	93.1%	96.6%	94.3%	92.1%	95.9%	-0.9%
GP	Sedibeng	514	94.0%	91.5%	95.7%	93.2%	90.7%	95.1%	-0.8%
KZN	Zululand	399	95.7%	93.2%	97.3%	95.0%	92.4%	96.7%	-0.8%
GP	City of Johannesburg	1,711	96.1%	95.1%	96.9%	95.4%	94.3%	96.3%	-0.7%
FS	Lejweleputswa	285	98.9%	96.8%	99.7%	98.2%	95.8%	99.3%	-0.7%
EC	O.R.Tambo	372	91.9%	88.7%	94.3%	91.4%	88.1%	93.9%	-0.6%
KZN	Ugu	187	97.9%	94.4%	99.2%	97.3%	93.7%	98.9%	-0.5%
EC	Buffalo City	211	95.3%	91.4%	97.4%	94.8%	90.8%	97.1%	-0.5%
KZN	Uthukela	700	93.6%	91.5%	95.2%	93.1%	91.0%	94.8%	-0.5%
LP	Mopani	680	92.2%	89.9%	94.0%	92.1%	89.8%	93.9%	-0.2%
WC	Cape Winelands	179	93.9%	89.2%	96.6%	93.9%	89.2%	96.6%	0.0%
WC	Central Karoo	33	100.0%	.	.	100.0%	.	.	0.0%
NC	John Taolo Gaetsewe	5	100.0%	.	.	100.0%	.	.	0.0%
KZN	Umkhanyakude	243	95.5%	92.0%	97.5%	95.5%	92.0%	97.5%	0.0%

NC	Frances Baard	200	98.0%	94.8%	99.2%	98.5%	95.4%	99.5%	0.5%
WC	Overberg	143	95.8%	91.0%	98.1%	96.5%	91.9%	98.5%	0.7%
EC	Alfred Nzo	271	97.0%	94.2%	98.5%	97.8%	95.2%	99.0%	0.8%
WC	Eden	121	94.2%	88.3%	97.2%	95.0%	89.4%	97.8%	0.9%
EC	Joe Gqabi	110	92.7%	86.1%	96.3%	93.6%	87.2%	96.9%	1.0%
FS	Xhariep	81	95.1%	87.5%	98.1%	96.3%	89.1%	98.8%	1.3%
FS	Thabo Mofutsanyane	50	98.0%	86.9%	99.7%	100.0%	.	.	2.0%
NC	Namakwa	27	96.3%	77.3%	99.5%	100.0%	.	.	3.8%
FS	Fezile Dabi	128	83.6%	76.1%	89.1%	87.5%	80.5%	92.2%	4.7%
KZN	Umgungundlovu	60	90.0%	79.4%	95.5%	95.0%	85.5%	98.4%	5.6%

Measles1 to measles2 dropout rates

Measles dropout rates were higher than other vaccine doses but lower than that for hexavalent with the drop-out rate ranging from 12% to 1% and a marginal increase in the proportion of children vaccinated with measles2 compared to measles1 in two districts, namely JT Gaetsewe and Eden (Table 15). JT Gaetsewe had a very small sample size hence the results might not be representative of the whole district.

Table 15: Dropout rate between measles1 and measles 2 per district

			MEAS1			MEAS2			% dropout between meas1 and meas2
Province	District	Sample size							
KZN	Umgungundlovu	60	95.0%	85.5%	98.4%	83.3%	71.6%	90.8%	-12.3%
LP	Waterberg	111	93.7%	87.3%	97.0%	82.9%	74.7%	88.8%	-11.5%

FS	Fezile Dabi	128	89.8%	83.3%	94.0%	80.5%	72.7%	86.5%	-10.4%
FS	Thabo Mofutsanyane	50	96.0%	85.2%	99.0%	86.0%	73.3%	93.2%	-10.4%
LP	Capricorn	493	83.6%	80.0%	86.6%	75.5%	71.5%	79.1%	-9.7%
EC	O.R.Tambo	372	90.3%	86.9%	92.9%	81.7%	77.5%	85.3%	-9.5%
MP	Ehlanzeni	396	91.7%	88.5%	94.0%	84.1%	80.1%	87.4%	-8.3%
MP	Gert Sibande	284	96.1%	93.1%	97.8%	88.4%	84.1%	91.6%	-8.1%
EC	Amathole	220	96.4%	92.9%	98.2%	88.6%	83.7%	92.2%	-8.0%
FS	Xhariep	81	95.1%	87.5%	98.1%	87.7%	78.5%	93.3%	-7.8%
WC	West Coast	74	89.2%	79.8%	94.5%	82.4%	72.0%	89.6%	-7.6%
NW	Ruth Segomotsi Mompati	106	94.3%	87.9%	97.4%	87.7%	80.0%	92.8%	-7.0%
NC	Z F Mgcau	61	95.1%	85.7%	98.4%	88.5%	77.7%	94.5%	-6.9%
NC	Pixley ka Seme	32	90.6%	74.3%	97.0%	84.4%	67.2%	93.4%	-6.9%
EC	Chris Hani	79	96.2%	88.8%	98.8%	89.9%	81.0%	94.9%	-6.6%
KZN	Amajuba	470	93.4%	90.8%	95.3%	87.4%	84.1%	90.2%	-6.4%
KZN	Uthukela	700	88.1%	85.5%	90.3%	82.7%	79.7%	85.3%	-6.2%
KZN	Zululand	399	90.7%	87.5%	93.2%	85.2%	81.4%	88.4%	-6.1%
EC	Alfred Nzo	271	93.4%	89.7%	95.8%	87.8%	83.4%	91.2%	-5.9%
NW	Ngaka Modiri Molema	484	91.7%	88.9%	93.9%	86.4%	83.0%	89.1%	-5.9%
LP	Vhembe	589	91.9%	89.3%	93.8%	86.6%	83.6%	89.1%	-5.7%
NW	Bojanala	299	90.0%	86.0%	92.9%	84.9%	80.4%	88.6%	-5.6%
WC	Cape Winelands	179	94.4%	89.9%	97.0%	89.4%	83.9%	93.1%	-5.3%
GP	City of Tshwane	621	95.8%	93.9%	97.1%	90.8%	88.3%	92.9%	-5.2%
NW	Dr Kenneth Kaunda	210	91.9%	87.4%	94.9%	87.1%	81.9%	91.0%	-5.2%

FS	Mangaung	187	96.3%	92.3%	98.2%	91.4%	86.5%	94.7%	-5.0%
KZN	Uthungulu	986	91.7%	89.8%	93.3%	87.3%	85.1%	89.3%	-4.8%
GP	City of Johannesburg	1,711	94.9%	93.7%	95.8%	90.4%	88.9%	91.7%	-4.7%
LP	Sekhukhune	345	89.0%	85.2%	91.9%	84.9%	80.7%	88.3%	-4.6%
NC	Frances Baard	200	99.0%	96.1%	99.8%	94.5%	90.3%	96.9%	-4.5%
KZN	Ugu	187	96.8%	93.0%	98.6%	92.5%	87.7%	95.5%	-4.4%
FS	Lejweleputswa	285	96.1%	93.2%	97.9%	91.9%	88.1%	94.6%	-4.4%
KZN	Umkhanyakude	243	94.2%	90.5%	96.6%	90.1%	85.7%	93.3%	-4.4%
WC	Overberg	143	96.5%	91.9%	98.5%	92.3%	86.6%	95.7%	-4.3%
MP	Nkangala	328	86.0%	81.8%	89.3%	82.3%	77.8%	86.1%	-4.3%
GP	West Rand	382	95.3%	92.6%	97.0%	91.4%	88.1%	93.8%	-4.1%
KZN	iLembe	359	78.3%	73.7%	82.2%	75.2%	70.5%	79.4%	-3.9%
GP	Ekurhuleni	890	94.7%	93.0%	96.0%	91.0%	88.9%	92.7%	-3.9%
GP	Sedibeng	514	92.0%	89.3%	94.1%	88.5%	85.5%	91.0%	-3.8%
KZN	eThekwini	887	92.0%	90.0%	93.6%	88.5%	86.2%	90.4%	-3.8%
NC	Namakwa	27	100.0%	.	.	96.3%	77.3%	99.5%	-3.7%
EC	Sarah Baartman	348	94.8%	91.9%	96.7%	91.7%	88.3%	94.2%	-3.3%
EC	Buffalo City	211	91.5%	86.9%	94.6%	88.6%	83.6%	92.3%	-3.1%
WC	Central Karoo	33	100.0%	.	.	97.0%	80.9%	99.6%	-3.0%
LP	Mopani	680	88.5%	85.9%	90.7%	85.9%	83.1%	88.3%	-3.0%
KZN	Sisonke	597	92.5%	90.0%	94.3%	89.8%	87.1%	92.0%	-2.9%
EC	Joe Gqabi	110	94.5%	88.3%	97.5%	91.8%	85.0%	95.7%	-2.9%
EC	Nelson Mandela Bay	326	90.8%	87.1%	93.5%	88.7%	84.7%	91.7%	-2.4%

KZN	Umzinyathi	205	96.1%	92.4%	98.0%	94.1%	90.0%	96.7%	-2.0%
WC	City of Cape Town	101	92.1%	84.9%	96.0%	91.1%	83.7%	95.3%	-1.1%
NC	John Taolo Gaetsewe	5	100.0%	.	.	100.0%	.	.	0.0%
WC	Eden	121	92.6%	86.3%	96.1%	93.4%	87.3%	96.7%	0.9%

Provincial specific coverage estimates

Children with vaccination cards

The national vaccination coverage rate for all 14 vaccine doses was 77%. Table 16 details provincial specific coverage rates for fully vaccinated children with 1) all 14 vaccines 2) vaccines scheduled up to 12 months and 3) vaccines scheduled up to 9 months respectively. The province with the highest coverage was NC (81.6%) followed by GP (81.4%).

Table 16: Provincial vaccination coverage estimates for fully vaccinated children at 9, 12 and 18 months

Province		Proportion fully vaccinated with all 14 doses			Proportion vaccinated with doses scheduled up to 12 months			Proportion vaccinated with doses scheduled up to 9 months		
		Sample size	%	95% CI	%	95% CI	%	95% CI		
Eastern Cape	1,937	75.4%	72.1%	76.0%	80.0%	77.0%	80.6%	83.3%	80.6%	84.0%
Free State	731	76.7%	73.8%	79.9%	80.7%	77.8%	83.5%	85.2%	82.6%	87.7%
Gauteng	4,118	81.4%	80.2%	82.5%	85.2%	84.0%	86.2%	88.3%	87.2%	89.2%
Kwazulu-Natal	5,093	74.3%	73.1%	75.5%	79.7%	78.7%	80.9%	82.7%	82.0%	84.0%
Limpopo	2,218	70.5%	69.0%	72.8%	76.3%	74.8%	78.4%	80.7%	79.3%	82.6%
Mpumalanga	1,008	73.9%	71.0%	76.4%	79.2%	76.5%	81.6%	83.4%	81.1%	85.7%
North West	1,099	75.2%	72.7%	77.8%	79.5%	77.2%	82.0%	83.5%	81.4%	85.8%
Northern Cape	325	81.6%	76.6%	85.1%	87.7%	83.3%	90.6%	90.4%	86.4%	93.0%
Western Cape	651	80.9%	77.9%	83.9%	84.0%	81.0%	86.6%	87.4%	84.8%	89.9%
South Africa	17180	76.8%	75.4%	78.2%	81.4%	80.3%	81.5%	83.9%	82.9%	84.9%

Factors associated with missed doses

Factors associated with missed vaccinations were determined through logistic regression. Any child with at least one missed vaccine dose was considered under the missed vaccine dose category. Non-vaccinated children were not included in this analyses, but were assessed in a separate analyses reported subsequent to this section.

Several factors were associated with increased odds of having missed a vaccine dose as these are detailed below

- a. Using GP province as reference, EC, FS, KZN, LP and NW had 71%, 39%, 42%, 65%, 45% and 35% increased odds of having children who had missed at least one vaccination dose. The odds for having missed a vaccine dose in NC and WC was not statistically significantly different compared to that in GP
- b. Children born at home were 4 times more likely to miss at least 1 vaccination dose compared to those born in a public health facility. The odds of missing vaccine doses were the same whether the child was born in a public or private health facility.
- c. Compared to Black African children, Colored children were 22% less likely to miss vaccine doses whilst Indian children were 3 times more likely to miss vaccines.
- d. Children from households that reported to not belong to any religious beliefs were 47% more likely to have missed vaccine doses.
- e. Children from households in which the household head had achieved secondary level education or higher were less likely to have missed vaccine doses. The odds of having missed a vaccine decreased with increased household head education.
- f. Children from households headed by individuals aged less than 30 years were 16% more likely to have missed vaccine doses compared to children from households headed by individuals aged 30-39 years old. There was a non-statistically significant trend towards increased odds of missed vaccine doses for children who came from households headed by individuals aged 40 years and above.
- g. With each individual increase in number of household members, the odds of a child having missed a vaccination dose increased by 8% whilst an increase in number of rooms occupied by the household was associated with a 5% decreased odds of having missed a vaccination dose; possibly an indication of the association between vaccination coverage and household socio-economic status

Reported utilisation of antenatal health care, the child's gender, household head gender and employment and marital status of household head was not significantly associated with vaccination.

Table 17: Factors associated with missed vaccination doses (based on children with at least 1 missed vaccination dose)

Children with missed vaccination doses	Odds Ratio	P-value	95% Confidence Interval	
			Lower bound	Upper bound
Gauteng	Ref			

	Eastern Cape	1.72	<0.001	1.49	1.98
	Free State	1.39	0.002	1.13	1.72
	KwaZulu-Natal	1.42	<0.001	1.27	1.60
	Limpopo	1.65	<0.001	1.43	1.91
	Mpumalanga	1.45	<0.001	1.19	1.76
	North West	1.35	0.001	1.13	1.61
	Northern Cape	1.31	0.097	0.95	1.80
	Western Cape	1.17	0.222	0.91	1.49
Child's gender					
	Male	Ref			
	Female	1.03	0.443	0.95	1.11
Place of child's birth					
	Public health facility	Ref			
	Private health facility	1.20	0.115	0.96	1.49
	Home delivery	3.88	<0.001	2.59	5.81
	Other	1.99	0.049	1.00	3.93
Antenatal health care during pregnancy					
	Yes	Ref			
	No	1.09	0.115	0.98	1.21
	Don't know	1.76	<0.001	1.41	2.20
Population group of household head					
	Black African	Ref			
	Colored	0.78	0.026	0.62	0.97
	Indian/Asian	2.71	0.01	1.27	5.77
	White	2.03	0.151	0.77	5.30
	Other	0.68	0.54	0.19	2.36
Household head Religion					
	Christianity	Ref			
	Islam/Hinduism/Judaism & other	1.04	0.839	0.69	1.58
	Traditional African/atheism	1.01	0.926	0.80	1.27
	No religious beliefs	1.47	0.005	1.12	1.93
	Don't know	0.43	0.048	0.19	0.99
Marital status of household head					
	Married	Ref			
	Divorced	1.16	0.098	0.97	1.39
	Widowed	1.03	0.72	0.88	1.20
	Single	1.06	0.228	0.96	1.18
Employment status of household head					
	Unemployed	Ref			
	Pensioner	1.03	0.711	0.87	1.22
	Informally employed/self employed	0.99	0.908	0.88	1.12
	Formally employed	0.96	0.536	0.85	1.09
	Student	1.04	0.848	0.69	1.57
	Don't know	0.63	0.367	0.23	1.71
Level of education of household head					
	No formal education	Ref			
	Primary school (grade 0 -7)	0.91	0.216	0.78	1.06
	Secondary (grade 8-12)	0.72	<0.001	0.63	0.83
	Certificate/diploma	0.67	<0.001	0.54	0.81
	Degree	0.44	<0.001	0.28	0.69
	Don't know	0.66	0.009	0.48	0.90
	Other	1.51	0.417	0.56	4.09

Age of head of household					
	30-39yrs	Ref			
	<20yrs	1.38	0.137	0.90	2.11
	20-29yrs	1.16	0.012	1.03	1.30
	40-49yrs	0.95	0.384	0.84	1.07
	50-59yrs	0.95	0.431	0.82	1.09
	60yrs and above	0.84	0.063	0.70	1.01
Gender of household head					
	Male	Ref			
	Female	1.07	0.246	0.96	1.20
Number of household members					
Number of rooms occupied by the household					
Number of households in the dwelling unit					
	1	Ref			
	2	1.21	0.001	1.08	1.36
	>2	1.10	0.04	1.00	1.21

Factors associated with non-vaccination

Factors associated with non-vaccination as determined through logistic regression included

- Compared to GP, children in KZN, LP, MP had more than twice the odds of having unvaccinated children whilst the NC had 76% less odds of having unvaccinated children
- Children born at home or in other places other than a public or private healthcare facility were 500% more likely to be unvaccinated compared to those born in a public healthcare facility. Similar to missed doses, there was no difference in odds for children born in public compared to private healthcare facilities
- Children born to mothers who did not attend antenatal healthcare were borderline more likely to not be vaccinated
- Minority population groups exclusive of Black Africa, Colored, Indian/Asian and White were 7 times more likely to be non-vaccinated
- Similar to missed vaccination, the education level of the household head was inversely associated with non-vaccination

Child's gender, gender of household head and employment status of the household were not associated with non-vaccination

Table 18: Factors associated with non-vaccination

Province	Never vaccinated	Odds Ratio	P>z	95% confidence interval	
				Lower bound	Upper bound
Gauteng	Ref				
Eastern Cape	1.00	0.989		0.70	1.42
Free State	0.82	0.494		0.47	1.44
KwaZulu-Natal	2.40	<0.001		1.89	3.04

	Limopo	2.90	<0.001	2.20	3.82
	Mpumalanga	2.63	<0.001	1.86	3.74
	North West	1.40	0.081	0.96	2.06
	Northern Cape	0.24	0.02	0.07	0.80
	Western Cape	0.85	0.569	0.48	1.49
Child's gender					
	Male	Ref			
	Female	1.01	0.852	0.87	1.18
Place of birth					
	Public health facility	Ref			
	Private health facility	0.75	0.281	0.45	1.26
	Home delivery	5.74	<0.001	3.19	10.35
	Other	5.28	0.001	2.06	13.57
Antenatal health care during pregnancy					
	Yes	Ref			
	No	1.21	0.069	0.99	1.48
	Don't know	1.69	0.013	1.12	2.55
Population group of household head					
	Black African	Ref			
	Coloured	1.33	0.238	0.83	2.15
	Indian/Asian	1.00			
	White	1.97	0.519	0.25	15.58
	Other	7.45	<0.001	2.50	22.25
Household head Religion					
	Christianity	Ref			
	Islam/Hinduism/Judaism & other	1.49	0.278	0.73	3.04
	Traditional African/atheism	1.02	0.928	0.67	1.55
	No religious beliefs	1.00	0.991	0.59	1.71
	Don't know	0.16	0.088	0.02	1.31
Marital status of household head					
	Married	Ref			
	Divorced	1.45	0.024	1.05	2.01
	Widowed	0.98	0.92	0.73	1.33
	Single	1.01	0.907	0.83	1.23
Employment status of household head					
	Unemployed	Ref			
	Pensioner	1.00	0.98	0.72	1.37
	Informally employed/self employed	0.86	0.208	0.68	1.09
	Formally employed	0.86	0.242	0.68	1.10
	Student	1.23	0.589	0.58	2.59
	Don't know	0.48	0.493	0.06	3.94
Level of education of household head					
	No formal education	Ref			
	Primary school (grade 0 -7)	0.70	0.015	0.53	0.93
	Secondary (grade 8-12)	0.69	0.007	0.53	0.90
	Certificate/diploma	0.61	0.013	0.42	0.90
	Degree	0.83	0.585	0.42	1.63
	Don't know	0.88	0.65	0.50	1.54
	Other	0.75	0.788	0.09	6.09
Age of head of household					
	30-39yrs	Ref			
	<20yrs	0.63	0.434	0.19	2.02

	20-29yrs	1.12	0.324	0.89	1.40
	40-49yrs	0.93	0.538	0.73	1.18
	50-59yrs	0.97	0.844	0.75	1.27
	60yrs and above	0.91	0.598	0.64	1.29
Gender of household head					
	Male	Ref			
	Female	0.83	0.079	0.67	1.02
Number of household members					
	1.00	0.905	0.96	1.05	
Number of rooms occupied by the household					
	0.94	0.001	0.91	0.98	
Number of households in the dwelling unit					
	1	Ref			
	2	0.93	0.532	0.73	1.17
	>2	0.79	0.016	0.65	0.96

Vaccination in children without vaccination cards

Compared to a national coverage rate of 77% for children with vaccination cards that are fully vaccinated with all 14 doses, the national coverage rate reported through oral recall was 83% (Table 17). The provincial specific coverage estimates from oral recall are tabulated below. Across all provinces the reported proportion of unvaccinated children was between 1.9% and 0.2% with four provinces reporting unvaccinated children.

Table 19: Oral recall - provincial vaccination coverage estimates for children fully vaccinated at 18, 12 and 9 months

Province	Sample size	%	95% CI		%	95% CI		%	95% CI	
		Proportion fully vaccinated with all 14 doses			Proportion vaccinated with doses scheduled up to 12 months			Proportion vaccinated with doses scheduled up to 12 months		
Eastern Cape	425	77.8%	72.5%	82.3%	81.5%	76.2%	85.8%	82.9%	77.8%	87.1%
Free State	97	77.6%	67.8%	85.2%	81.8%	72.2%	88.6%	84.8%	75.7%	90.9%
Gauteng	876	85.8%	82.8%	88.4%	90.4%	87.8%	92.6%	92.4%	89.8%	94.3%
Kwazulu-Natal	1,262	86.8%	83.8%	89.3%	88.3%	85.4%	90.7%	89.0%	86.1%	91.3%
Limpopo	578	79.2%	75.2%	82.7%	83.8%	80.2%	86.9%	85.9%	82.4%	88.8%
Mpumalanga	158	80.5%	72.9%	86.3%	84.3%	76.7%	89.7%	86.7%	79.4%	91.7%
North West	206	83.3%	78.1%	87.5%	85.1%	80.2%	88.9%	87.4%	82.6%	91.0%
Northern Cape	22	64.4%	40.9%	82.5%	73.2%	50.4%	88.0%	77.7%	54.8%	90.9%
Western Cape	63	73.8%	61.3%	83.5%	81.8%	70.0%	89.7%	84.7%	73.2%	91.8%
National	3687	83.3%	81.8%	84.8%	86.8%	85.4%	88.1%	88.5%	87.1%	89.7%

Reasons for missed doses

Children with vaccination cards

The analyses for reasons for missed doses was based on children with vaccination cards as there was proof of given and missed doses. The top ranking reason for missed doses across all vaccines was vaccines being out of stock. Interestingly a significant proportion of children who missed vaccine doses had primary caregivers reporting that the reason for missed vaccines was that the primary caregiver didn't know that the child was due for vaccines. Missed vaccination opportunities are highlighted by the proportion of children who went to a health facility while the child was ill, but where the vaccine was not administered. Despite MomConnect being widely available between 2% and 10% of caregivers reported that they forgot that the child was due for vaccination; vaccination reminders could be built into the MomConnect platform to improve vaccination coverage. Religious reasons played a negligible part in missed vaccinations. The figures below illustrate reasons given for missed doses. The majority of reasons given are health service related factors; calling for improvement of EPI services at health facilities to promote vaccination uptake.

Figure 10a & b: Reasons for missed BCG (a) and OPV0 (b) doses

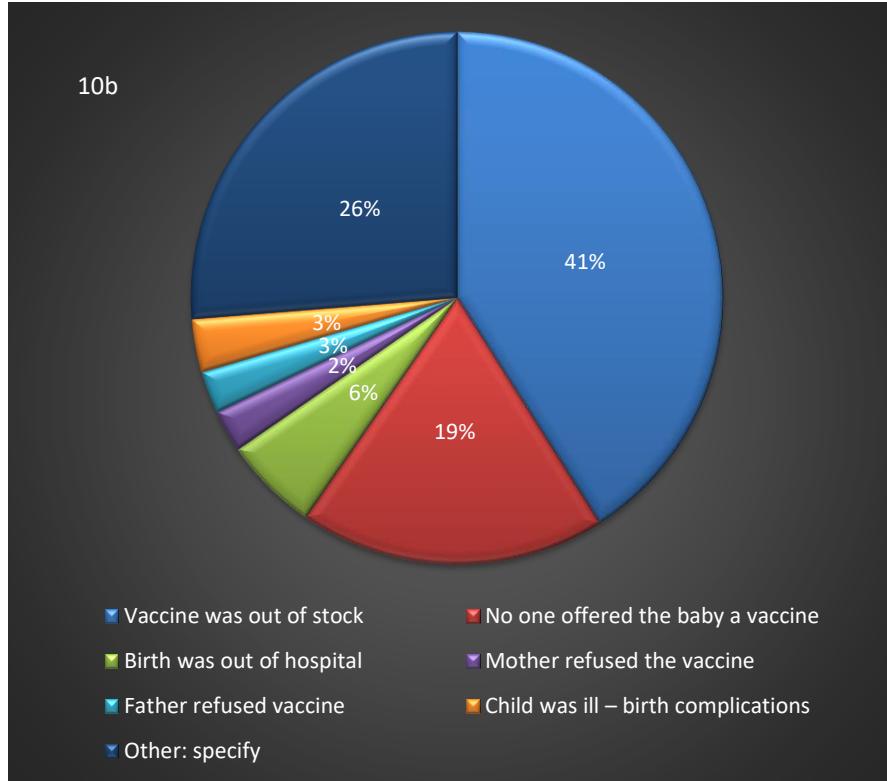
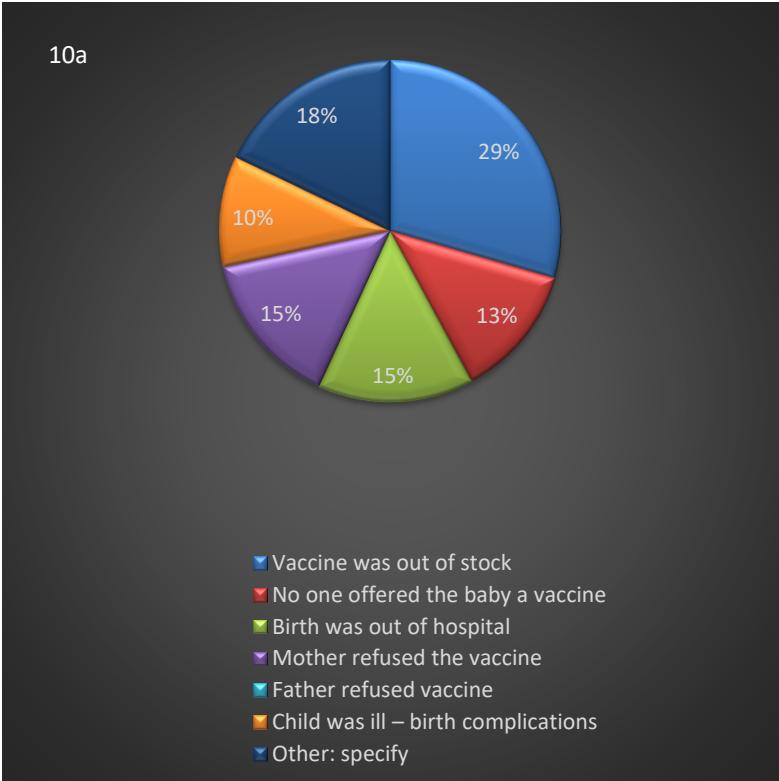
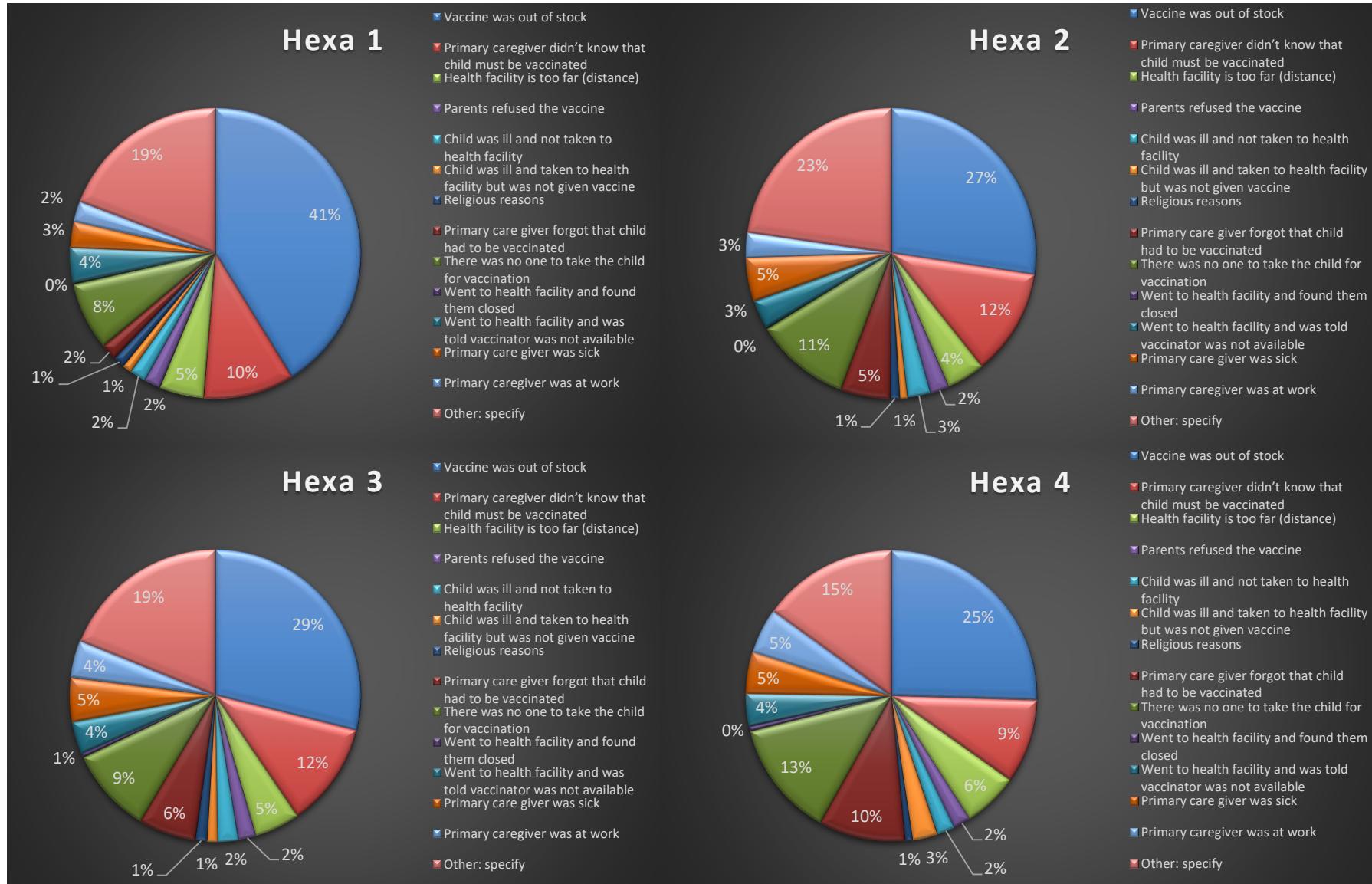


Figure 11: Reasons for missed hexa 1 to hexa 4



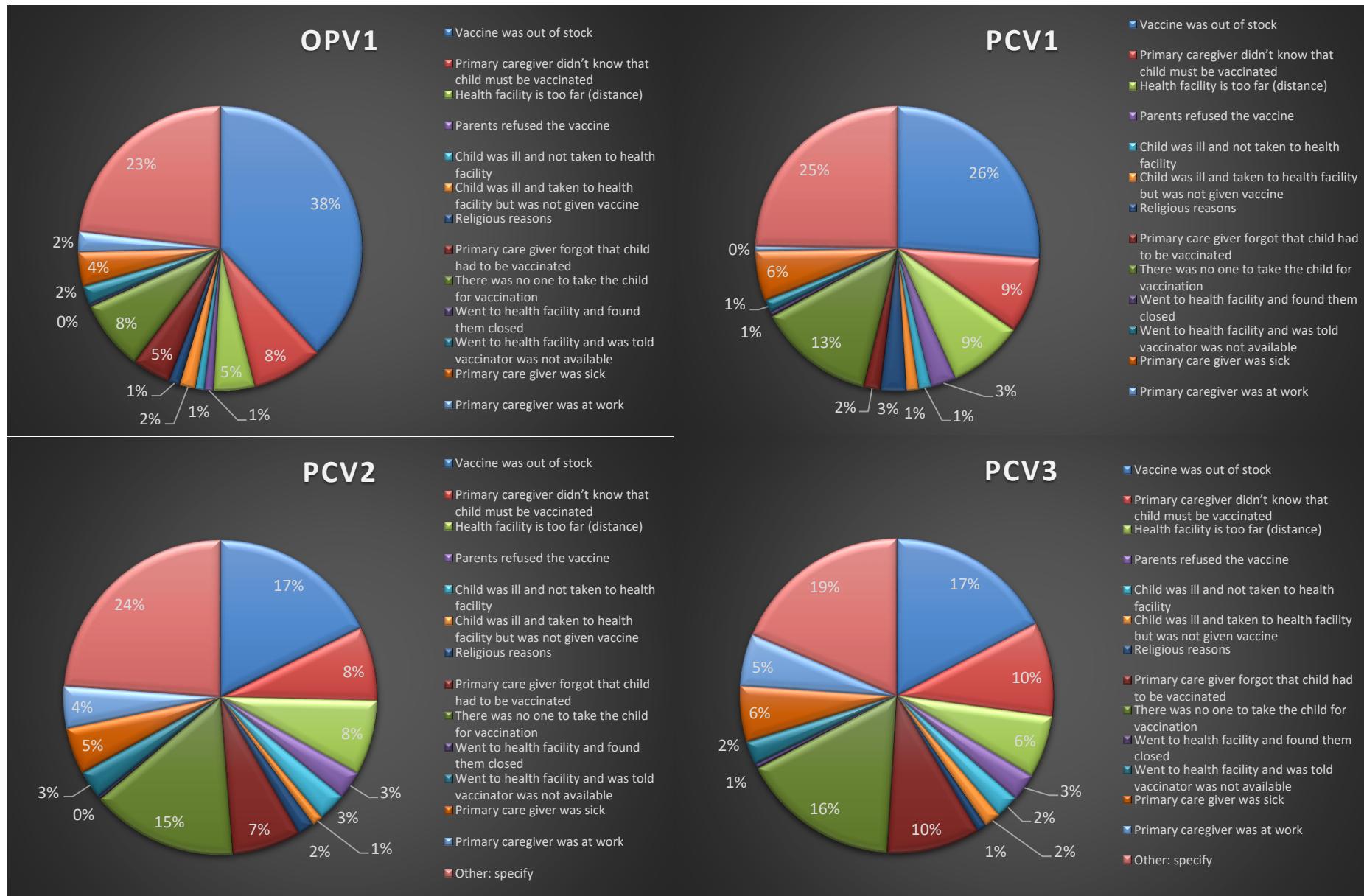


Figure 12: Reasons for missed OPV1 and PCV1 to PCV3

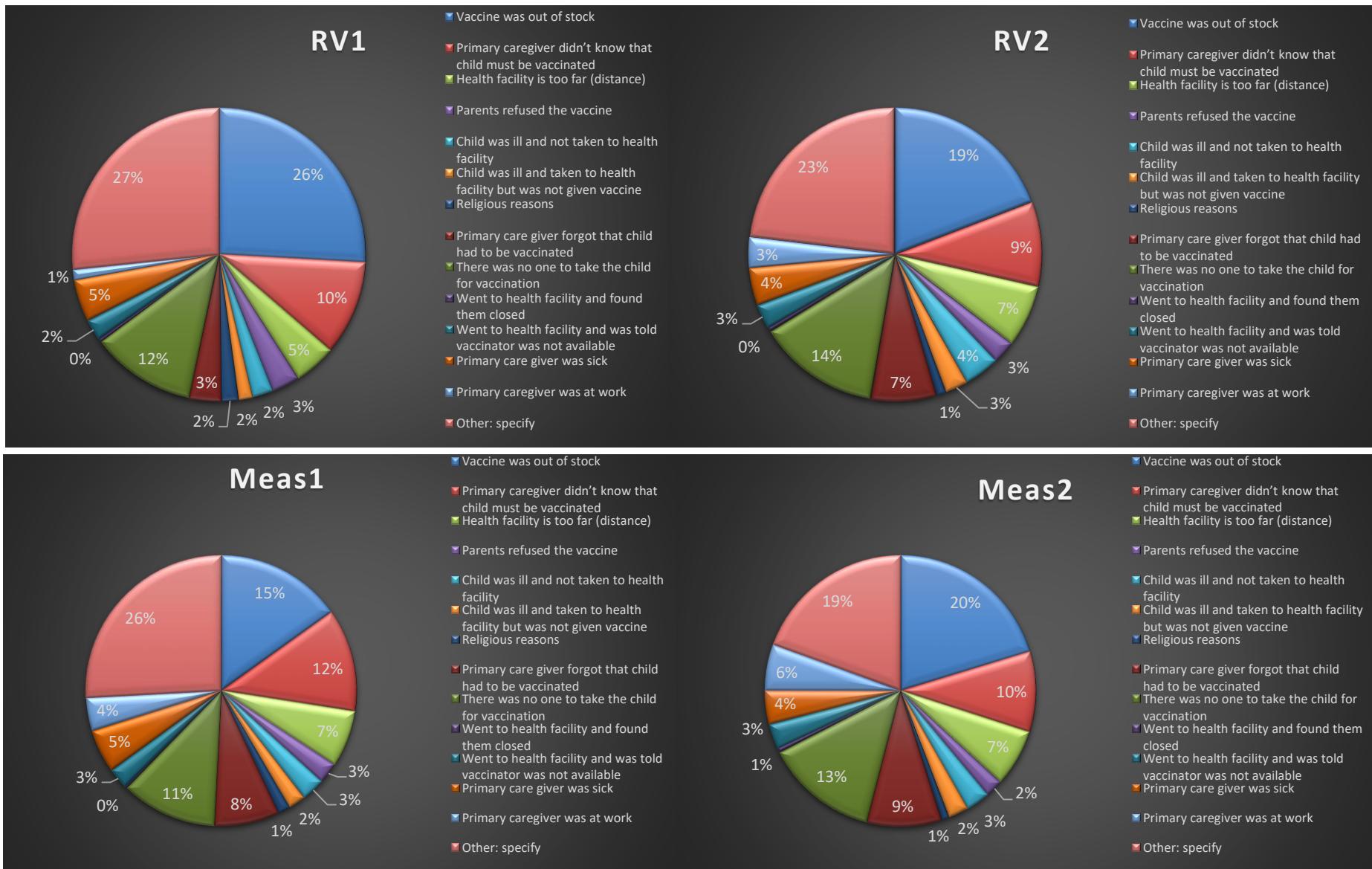


Figure 13: Reasons for missed RV and Measles doses

Chapter IV: Discussion

Sensitivity analysis

In the 2016 DHS, 44% of respondents did not produce a vaccination card at the time of interview while in the 2019 EPI survey, only 18% of respondents did not produce a vaccination card. This may have been due to the national EPI survey interviewers making every effort to get the vaccination card including conducting repeat visits to allow the respondent to get the vaccination card if it was in a nearby location. The proportion of children without vaccination cards had significant variability across different districts, for 3 districts O.R Tambo, Umzinyathi and EThekweni - 38%, 26% and 36% respectively did not produce a vaccination card; all other districts had less than 25% of respondents who did not produce a vaccination card. For children without vaccination cards, vaccination details were collected through oral recall from the primary caregiver and as such the accuracy could not be determined. To account for bias arising from oral recall, we conducted a sensitivity analyses on the proportion of children fully vaccinated with all 14 vaccine doses, making the following assumptions

1. Children without vaccination cards were assumed to be unvaccinated (grey bars)
2. Children without vaccination cards were assumed to be vaccinated at the same level as children without vaccination cards (blue bars)
3. Oral recall was assumed to be reported as accurate (yellow bars)

In the first scenario, vaccination coverage estimates were calculated as

$\text{Children recorded as vaccinated on the vaccination card} / \text{total children in the survey}$

In the second scenario, vaccination coverage estimate was considered to be equivalent to the vaccination coverage for children with vaccination cards i.e.

$\text{Children recorded as vaccinated on the vaccination card} / \text{total children with vaccination cards}$

In the third scenario, vaccination coverage estimate was calculated as

$(\text{Children recorded as vaccinated on the vaccination card} / \text{total children in the survey}) +$

$(\text{Children reported to be vaccinated on recall} / \text{total children without vaccination cards})$

Considering that this was a survey specifically focusing on vaccination, it is most likely that primary care givers of children without vaccination cards would have over-reported the vaccination status of their children. This is highlighted by the fact that in the 2016 DHS which collects vaccination data amongst other things, 7.8% of children without vaccination cards were unvaccinated compared to only 0.8% of those without vaccination cards reporting that their children were unvaccinated. Additionally, children with vaccination cards are more likely to have been vaccinated compared to children without vaccination cards. As such, scenario 2 and 3 are

likely to over-estimate vaccination coverage whilst scenario 1 is likely to under-estimate vaccination coverage. The figure and table below provide adjusted coverage estimates at provincial and district levels.

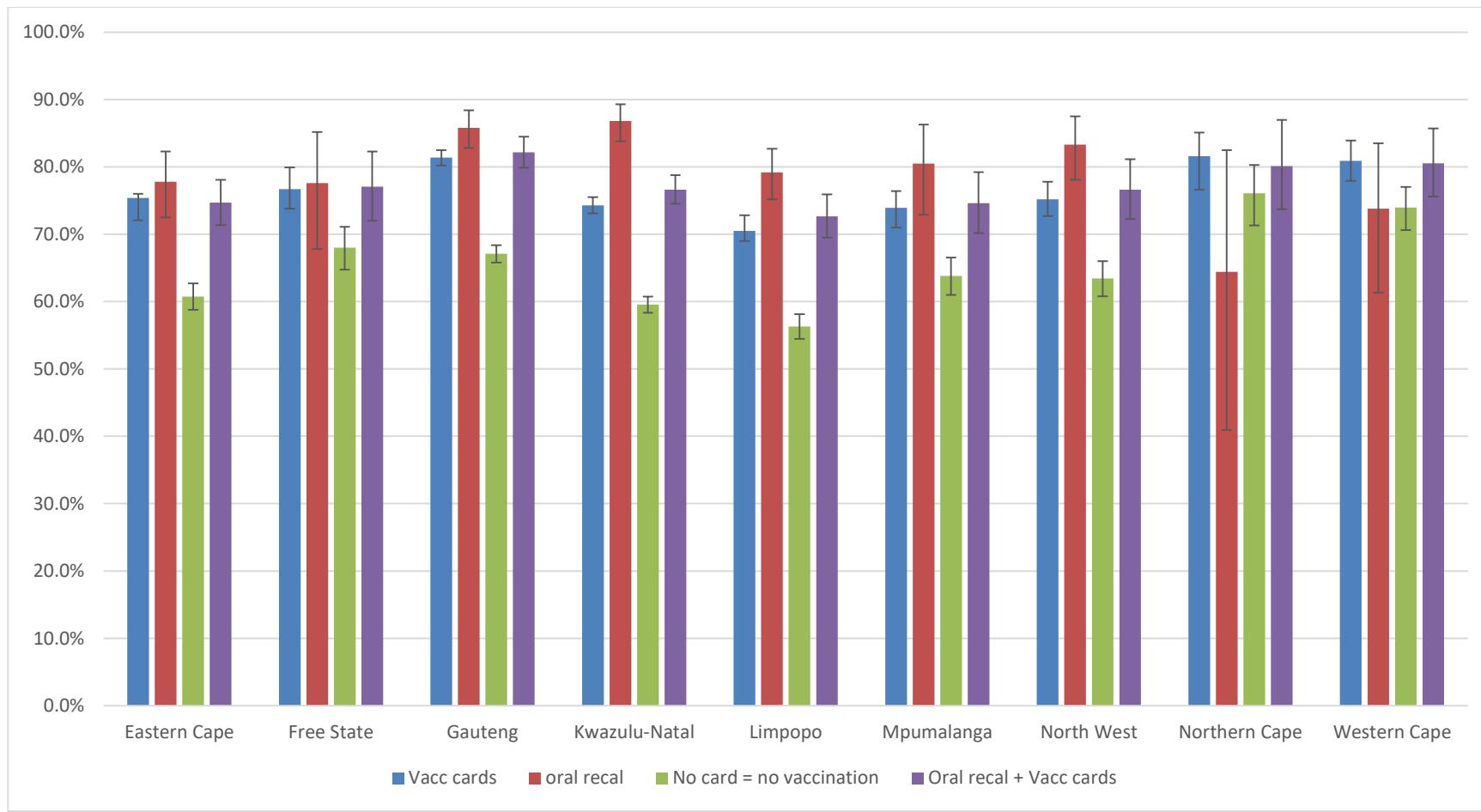


Figure 14: Sensitivity analyses for full coverage by province

Provincial estimates

The blue and red bars present vaccination estimates derived from vaccination cards and oral recall respectively. Across all provinces except for NC and WC, here was consistently higher vaccination coverage through oral recall compared to vaccination coverage in children with vaccination cards; possibly due to respondents giving interviewer desirable responses. Assuming that children without vaccination cards are unvaccinated, coverage significantly goes down across all provinces. The purple bars provide coverage estimates derived from combining proportion vaccinated on oral recall with the proportion vaccinated on vaccination cards. Interestingly across all provinces there were no significant differences in coverage estimates using vaccination card evidence compared to combining oral recall and vaccination card evidence (blue bars and purple bars) – all confidence intervals overlapped.

District estimates

At district level, the most conservative estimates were based on the assumption that all children without vaccination cards were unvaccinated. Across all districts coverage estimates based on oral recall were higher than estimates based on vaccination coverage and also higher than the adjusted estimates (Figure below). However, if one considers only children with vaccination cards and disregards oral recall the vaccination coverage estimates are not significantly different from a scenario where one assumes that oral recall is accurate. Hence total coverage is equal to the coverage reported on vaccination cards plus vaccination coverage reported via oral recall (note overlapping 95% CI in Table below).

The assumption that children without vaccination cards were unvaccinated had the greatest impact on coverage estimates in OR Tambo, Umzinyathi, eThekwini and Capricorn – districts with the largest proportion of children without vaccination cards. In eThekwini the coverage estimate is halved assuming that all children without vaccination cards are unvaccinated compared to the estimate considering vaccination cards only (48.4% vs 75.6%). For EPI planning purposes it is recommended to use the most conservative estimates.

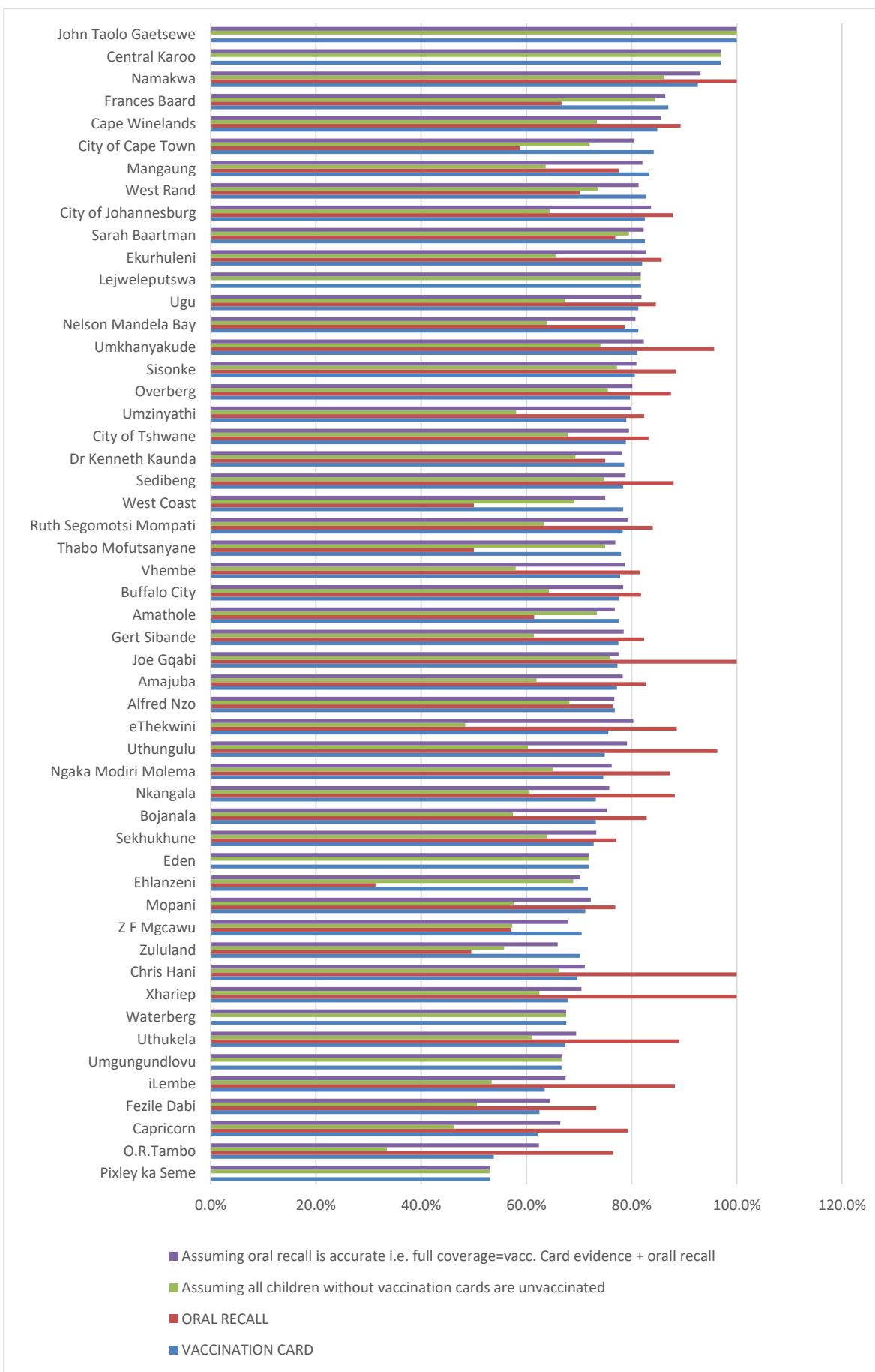


Figure 12: Adjusted vaccination coverage estimates based on children fully vaccinated with all 14 vaccine doses

Table 19: Sensitivity analyses for full vaccination coverage at district level

		VACCINATION CARD			ORAL RECALL				ASSUMING ALL CHILDREN WITHOUT VACCINATION CARDS ARE UNVACCINATED			ASSUMING ORAL RECALL IS ACCURATE I.E. FULL COVERAGE=VACC. CARD EVIDENCE + ORAL RECALL			
Province	District	Sample size	% vaccinated	95% CI		Sample size	% vaccinated	95% CI		% vaccinated	95% CI		% vaccinated	95% CI	
NC	Pixley ka Seme	32	53.1%	35.9%	69.6%					53.1%	35.9%	69.6%	53.1%	35.9%	69.6%
EC	O.R.Tambo	372	53.8%	48.7%	58.8%	226	76.5%	69.4%	82.4%	33.4%	29.8%	37.3%	62.4%	55.2%	70.0%
LP	Capricorn	493	62.1%	57.7%	66.3%	169	79.3%	72.5%	84.8%	46.2%	42.5%	50.0%	66.5%	59.8%	73.5%
FS	Fezile Dabi	128	62.5%	53.8%	70.5%	30	73.3%	53.1%	87.0%	50.6%	42.9%	58.4%	64.6%	52.2%	78.6%
KZN	iLembe	359	63.5%	58.4%	68.3%	68	88.2%	78.1%	94.0%	53.4%	48.6%	58.1%	67.4%	59.7%	75.8%
KZN	Umgungundlovu	60	66.7%	53.8%	77.5%					66.7%	53.8%	77.5%	66.7%	53.8%	77.5%
KZN	Uthukela	700	67.4%	63.9%	70.8%	73	89.0%	78.3%	94.8%	61.1%	57.6%	64.4%	69.5%	64.2%	75.0%
LP	Waterberg	111	67.6%	58.3%	75.6%					67.6%	58.3%	75.6%	67.6%	58.3%	75.6%
FS	Xhariep	81	67.9%	57.0%	77.2%	7	100.0%	.	.	62.5%	51.9%	72.0%	70.5%	55.7%	87.8%
EC	Chris Hani	79	69.6%	58.6%	78.8%	4	100.0%	.	.	66.3%	55.4%	75.6%	71.1%	57.2%	87.9%
KZN	Zululand	399	70.2%	65.5%	74.5%	103	49.5%	37.8%	61.3%	55.8%	51.4%	60.1%	65.9%	59.2%	73.2%
NC	Z F Mgcawu	61	70.5%	57.8%	80.6%	14	57.1%	27.3%	82.5%	57.3%	45.9%	68.1%	68.0%	51.3%	88.0%
LP	Mopani	680	71.2%	67.7%	74.5%	160	76.9%	68.3%	83.7%	57.6%	54.2%	60.9%	72.3%	66.7%	78.1%
MP	Ehlanzeni	396	71.7%	67.1%	75.9%	16	31.3%	12.4%	59.4%	68.9%	64.3%	73.2%	70.1%	64.8%	76.1%
WC	Eden	121	71.9%	63.2%	79.2%					71.9%	63.2%	79.2%	71.9%	63.2%	79.2%
LP	Sekhukhune	345	72.8%	67.8%	77.2%	48	77.1%	62.5%	87.2%	63.9%	59.0%	68.5%	73.3%	65.9%	81.2%
NW	Bojanala	299	73.2%	67.9%	78.0%	82	82.9%	75.1%	88.6%	57.5%	52.5%	62.4%	75.3%	66.8%	84.4%
MP	Nkangala	328	73.2%	68.1%	77.7%	68	88.2%	78.5%	93.9%	60.6%	55.7%	65.3%	75.8%	67.6%	84.3%
NW	Ngaka Modiri Molema	484	74.6%	70.5%	78.3%	71	87.3%	76.9%	93.4%	65.0%	61.0%	68.9%	76.2%	69.8%	83.0%

KZN	Uthungulu	986	74.9%	72.1%	77.6%	240	96.3%	93.0%	98.0%	60.3%	57.5%	63.0%	79.1%	74.3%	84.1%
KZN	eThekewini	887	75.6%	72.7%	78.4%	500	88.6%	83.3%	92.3%	48.4%	45.8%	51.0%	80.3%	75.3%	85.5%
EC	Alfred Nzo	271	76.8%	71.3%	81.4%	34	76.5%	60.1%	87.5%	68.2%	62.7%	73.2%	76.7%	68.6%	85.4%
KZN	Amajuba	470	77.2%	73.2%	80.8%	116	82.8%	71.4%	90.2%	61.9%	57.9%	65.8%	78.3%	71.5%	85.4%
EC	Joe Gqabi	110	77.3%	68.5%	84.2%	2	100.0%	.	.	75.9%	67.1%	82.9%	77.7%	67.5%	89.8%
MP	Gert Sibande	284	77.5%	72.2%	82.0%	74	82.4%	72.3%	89.4%	61.5%	56.3%	66.4%	78.5%	69.8%	87.7%
EC	Amathole	220	77.7%	71.7%	82.8%	13	61.5%	41.3%	78.4%	73.4%	67.3%	78.7%	76.8%	69.1%	85.4%
EC	Buffalo City	211	77.7%	71.6%	82.8%	44	81.8%	64.8%	91.6%	64.3%	58.2%	70.0%	78.4%	68.6%	88.9%
LP	Vhembe	589	77.8%	74.2%	80.9%	201	81.6%	73.5%	87.6%	58.0%	54.5%	61.4%	78.7%	72.6%	85.1%
FS	Thabo Mofutsanyane	50	78.0%	64.3%	87.5%	2	50.0%	1.9%	98.1%	75.0%	61.4%	85.0%	76.9%	61.7%	97.6%
NW	Ruth Segomotsi Mompati	106	78.3%	69.4%	85.2%	25	84.0%	68.1%	92.8%	63.4%	54.8%	71.2%	79.4%	65.4%	94.6%
GP	Sedibeng	514	78.4%	74.6%	81.8%	25	88.0%	65.4%	96.6%	74.8%	70.9%	78.3%	78.8%	73.6%	84.4%
WC	West Coast	74	78.4%	67.5%	86.4%	10	50.0%	17.0%	83.0%	69.0%	58.3%	78.0%	75.0%	60.8%	91.6%
NW	Dr Kenneth Kaunda	210	78.6%	72.5%	83.6%	28	75.0%	55.0%	88.0%	69.3%	63.2%	74.9%	78.2%	69.0%	88.0%
GP	City of Tshwane	621	78.9%	75.5%	81.9%	101	83.2%	71.2%	90.8%	67.9%	64.4%	71.2%	79.5%	73.9%	85.4%
KZN	Umzinyathi	205	79.0%	72.9%	84.1%	74	82.4%	71.8%	89.6%	58.1%	52.2%	63.7%	79.9%	69.6%	90.8%
WC	Overberg	143	79.7%	72.3%	85.5%	8	87.5%	47.7%	98.2%	75.5%	68.0%	81.7%	80.1%	70.2%	91.1%
KZN	Sisonke	597	80.6%	77.2%	83.6%	26	88.5%	71.0%	96.0%	77.2%	73.7%	80.3%	80.9%	76.2%	85.8%
KZN	Umkhanyakude	243	81.1%	75.6%	85.5%	23	95.7%	72.7%	99.5%	74.1%	68.4%	79.0%	82.3%	73.9%	91.2%
EC	Nelson Mandela Bay	326	81.3%	76.7%	85.2%	89	78.7%	65.1%	87.9%	63.9%	59.1%	68.3%	80.7%	72.7%	89.1%
KZN	Ugu	187	81.3%	75.0%	86.3%	39	84.6%	69.2%	93.1%	67.3%	60.9%	73.1%	81.9%	71.4%	92.9%
FS	Lejweleputswa	285	81.8%	76.8%	85.8%					81.8%	76.8%	85.8%	81.8%	76.8%	85.8%
GP	Ekurhuleni	890	82.0%	79.4%	84.4%	224	85.7%	79.9%	90.1%	65.5%	62.7%	68.3%	82.8%	77.8%	87.8%

GP	City of Johannesburg	1,711	82.5%	80.7%	84.3%	479	87.9%	84.2%	90.8%	64.5%	62.4%	66.5%	83.7%	80.1%	87.4%
EC	Sarah Baartman	348	82.5%	78.1%	86.1%	13	76.9%	35.6%	95.3%	79.5%	75.0%	83.4%	82.3%	76.5%	88.4%
GP	West Rand	382	82.7%	78.6%	86.2%	47	70.2%	49.2%	85.1%	73.7%	69.3%	77.6%	81.4%	74.8%	88.2%
FS	Mangaung	187	83.4%	77.4%	88.1%	58	77.6%	64.4%	86.9%	63.7%	57.5%	69.5%	82.0%	71.4%	93.2%
WC	City of Cape Town	101	84.2%	75.6%	90.1%	17	58.8%	32.5%	80.9%	72.0%	63.2%	79.4%	80.5%	67.8%	94.5%
WC	Cape Winelands	179	84.9%	78.9%	89.5%	28	89.3%	77.2%	95.4%	73.4%	67.0%	79.0%	85.5%	75.3%	96.3%
NC	Frances Baard	200	87.0%	81.6%	91.0%	6	66.7%	20.5%	94.0%	84.5%	78.8%	88.8%	86.4%	79.6%	93.9%
NC	Namakwa	27	92.6%	74.2%	98.2%	2	100.0%	.	.	86.2%	68.1%	94.8%	93.1%	69.8%	119.0%
WC	Central Karoo	33	97.0%	80.9%	99.6%					97.0%	80.9%	99.6%	97.0%	80.9%	99.6%
NC	John Taolo Gaetsewe	5	100.0%	.	.					100.0%	.	.	100.0%		

Comparison of coverage estimates

The EPI survey results were compared with the routine administrative data District Health Information System (DHIS) 2019, the District Health Barometer (DHB) 2018/2019 and the 2016 Demographic and Health Survey (2016 DHS). Key definitions and methodology from these data sources are summarized below

2016 DHS

Information from DHS 2016 was obtained in two ways: from written vaccination records, including the Road-to-Health booklet and other health cards, and from mothers' verbal reports. In the SADHS, for each child born in the 3 years before the survey, mothers were asked to show the interviewer the Road-to-Health booklet or health card used for recording the child's immunizations. Children are considered to have received all basic vaccinations when they have received the BCG vaccine, three doses each of DTaP and polio vaccines and a single dose of the measles vaccine

2018/2019 DHB

The 2018/2019 DHB utilized DHIS data. A child aged 12-23 months is considered to have received all age-appropriate vaccinations if the child has received all basic vaccinations, doses of OPV at birth and at 6 weeks, three doses of the HepB vaccine (given at age 6, 10, and 14 weeks), three doses of PCV (given at age 6 and 14 weeks, and 9 months), a single dose of measles vaccine and two doses of RV (given at age 6 and 14 weeks). A child who is age 24-35 months has received all age appropriate vaccinations if they have received a fourth dose of DTaP-IPV-Hib and a second dose of the measles vaccine (both given at 18 months) in addition to all of the age-appropriate vaccinations relevant for a child age 12-23 months.

DHIS

The DHIS system uses the same definitions as above. These same definitions were also adopted for the EPI survey.

Comparison of DHIS and national EPI coverage survey

In majority of districts (34/52) across all indicators, coverage estimates from the EPI national survey, based only on children with vaccination cards, were consistently higher than those reported in the DHIS; probably owing to the fact that DHIS estimates do not accurately capture vaccinations done in the private sector. This calls for strengthened vaccination data sharing between the public and private sector to ensure that private sector data are fed into DHIS. It is also possible that EPI national survey estimates are higher because children with vaccination cards are more likely to have been vaccinated. To some extent there is a possibility of poor data capturing and management at the various data collection and collation levels in DHIS resulting in underestimation of coverage. In 18 districts, DHIS estimates were higher than those reported in the EPI survey – highest in Mpumalanga and KZN. Both Mpumalanga and KZN had districts that were amongst the poorest performing districts, raising a need to closely monitor DHIS estimates to ensure that they do not artificially

inflate the true coverage. NC DHIS reported coverage rates > 100 % for BCG, measles 1 and hexavalent and these remained high in the EPI survey (between 96% and 99%).

On the converse, assuming that all children who did not have vaccination cards in the EPI national survey were unvaccinated – considering the immunization under 1 year coverage indicator, the coverage estimates in the EPI survey become significantly less than estimates in DHIS except for Free State, Western Cape and Limpopo. For these three provinces immunization under 1 year coverage using DHIS estimates were similar to that in the EPI national survey assuming that all children without vaccination cards were unvaccinated. This is an interesting finding considering that in FS and WC, 11.7% and 11.1% did not have vaccination cards respectively compared to 20.7% of children did not have vaccination cards in Limpopo. The figures below show coverage estimates difference between DHIS 2019 data and the national EPI survey data.

Figure 16: BCG and Hexa 1 coverage estimates – DHIS 2019 compared to 2019 national EPI survey





Figure 17: Hexa4 and Measles2 coverage estimates – DHIS 2019 compared to 2019 national EPI survey

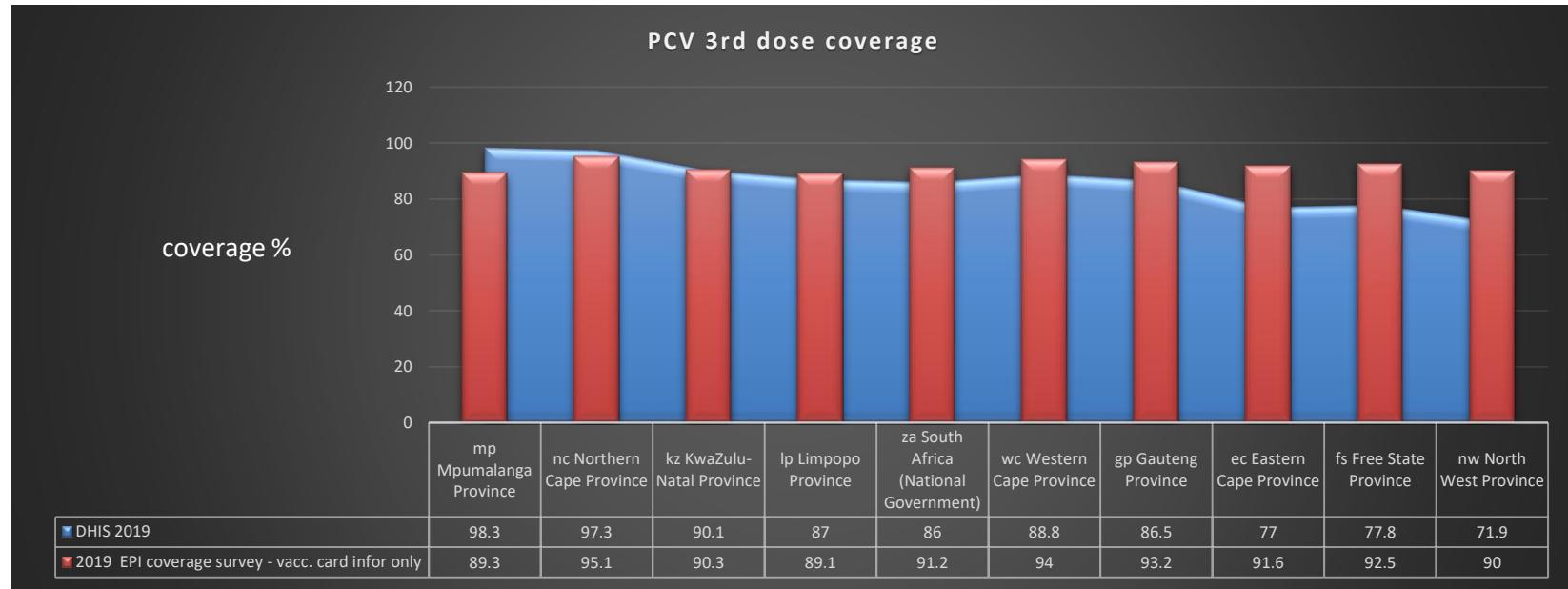
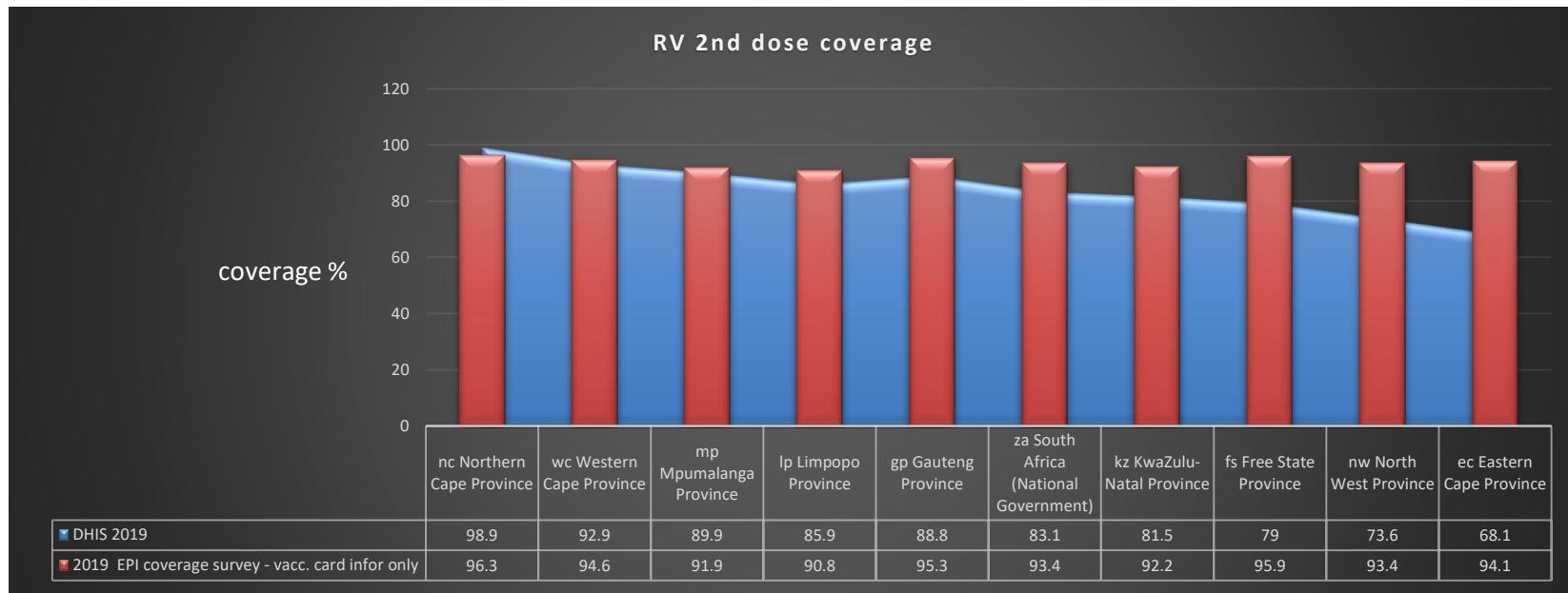


Figure 18: RV2 and PCV3 coverage estimates – DHIS 2019 compared to 2019 national EPI survey

Immunization under 1 year coverage

The figure below illustrates the differences in vaccination coverage estimates across the three data sources. The most conservative estimate is based on the 2019 national EPI survey assuming that all children without vaccination cards are unvaccinated. Based on children with vaccination cards in the 2019 EPI survey; under 1 year immunization coverage estimates closely mirrored estimates from the DHIS 2019 in GP, WC, NC and EC; with significant differences in NW, MP, LP, KZN and FS. These are provinces that need strengthening of DHIS data collection and collation. In KZN and MP all 3 data sources varied significantly showing huge variability in data accuracy thus a need to strengthen administrative data. Nationally the DHB, DHIS and 2019 national EPI survey had similar estimates; mainly because national estimates do not depict real differences at provincial and district level. Still the national target of 91% remains unmet across all provinces.

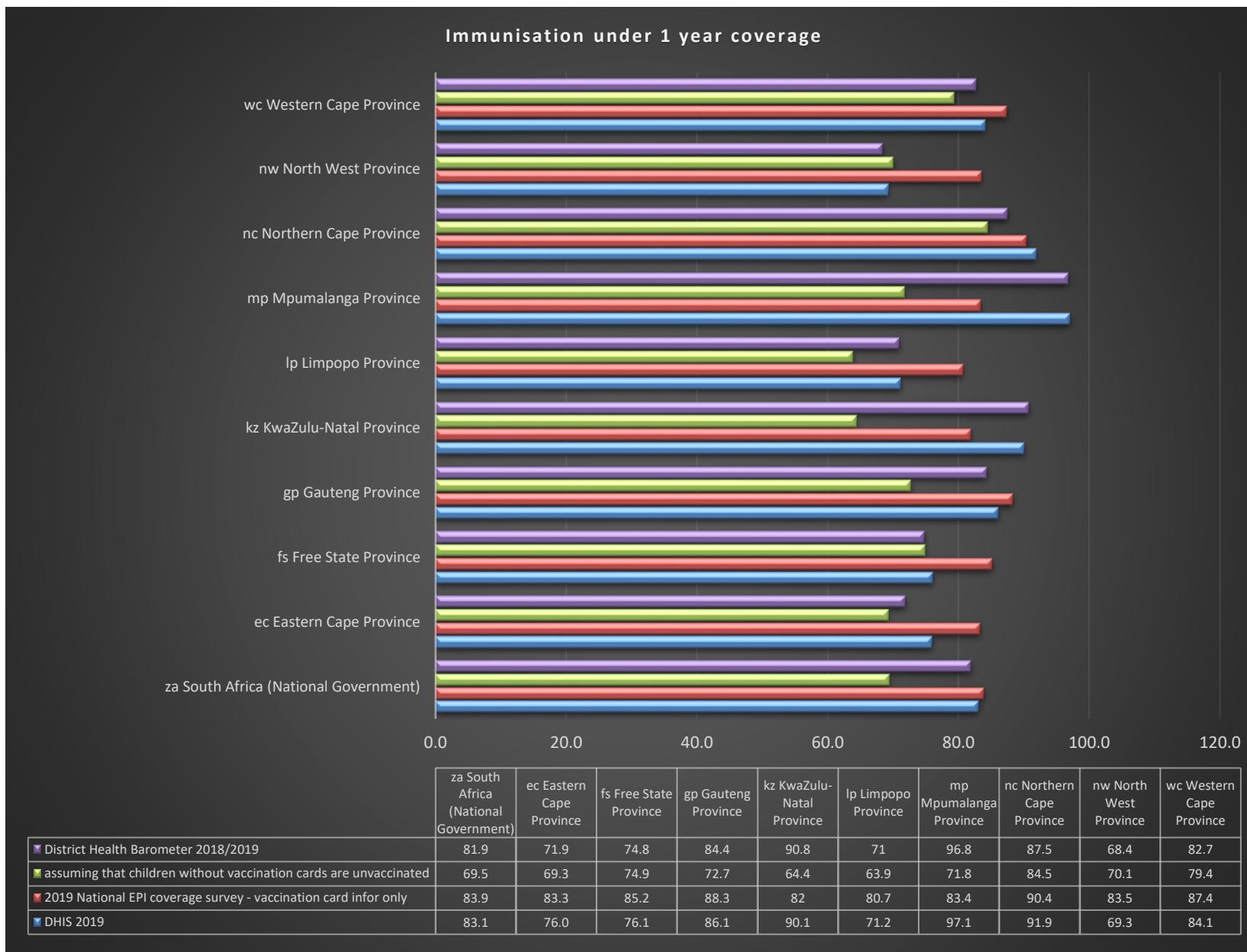


Figure 19: Immunization under 1 year coverage- comparison of DHB 2018/2019, 2019 national EPI survey and DHIS2019

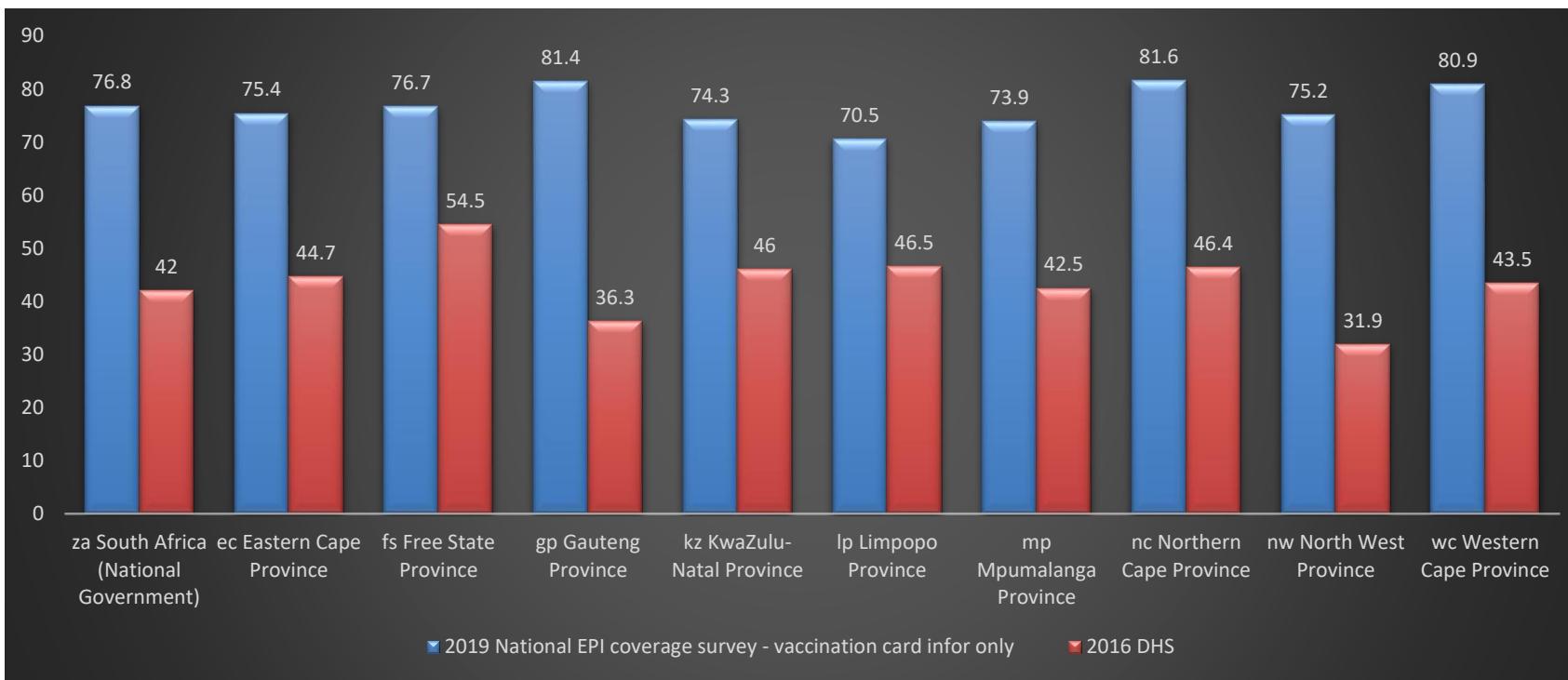
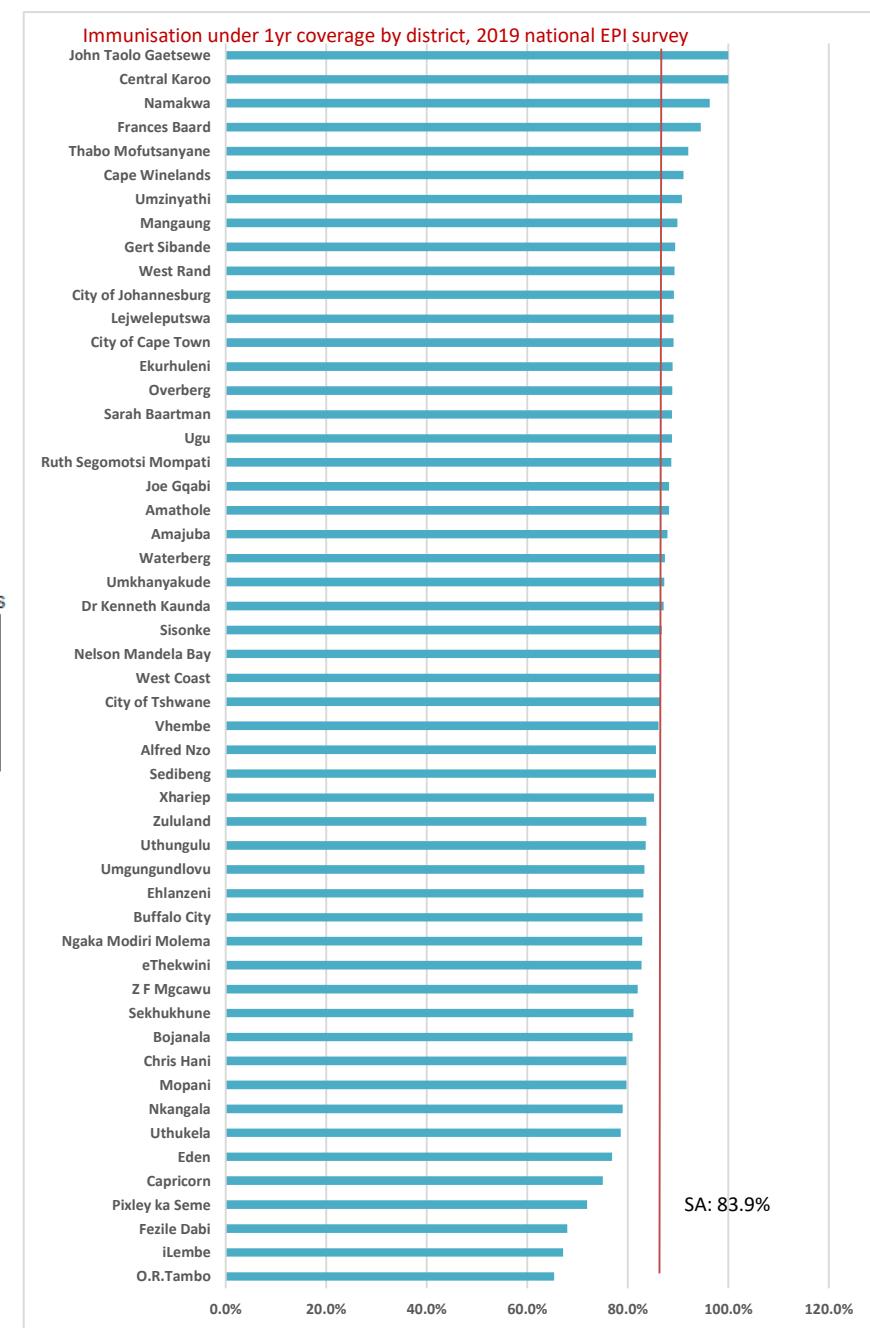
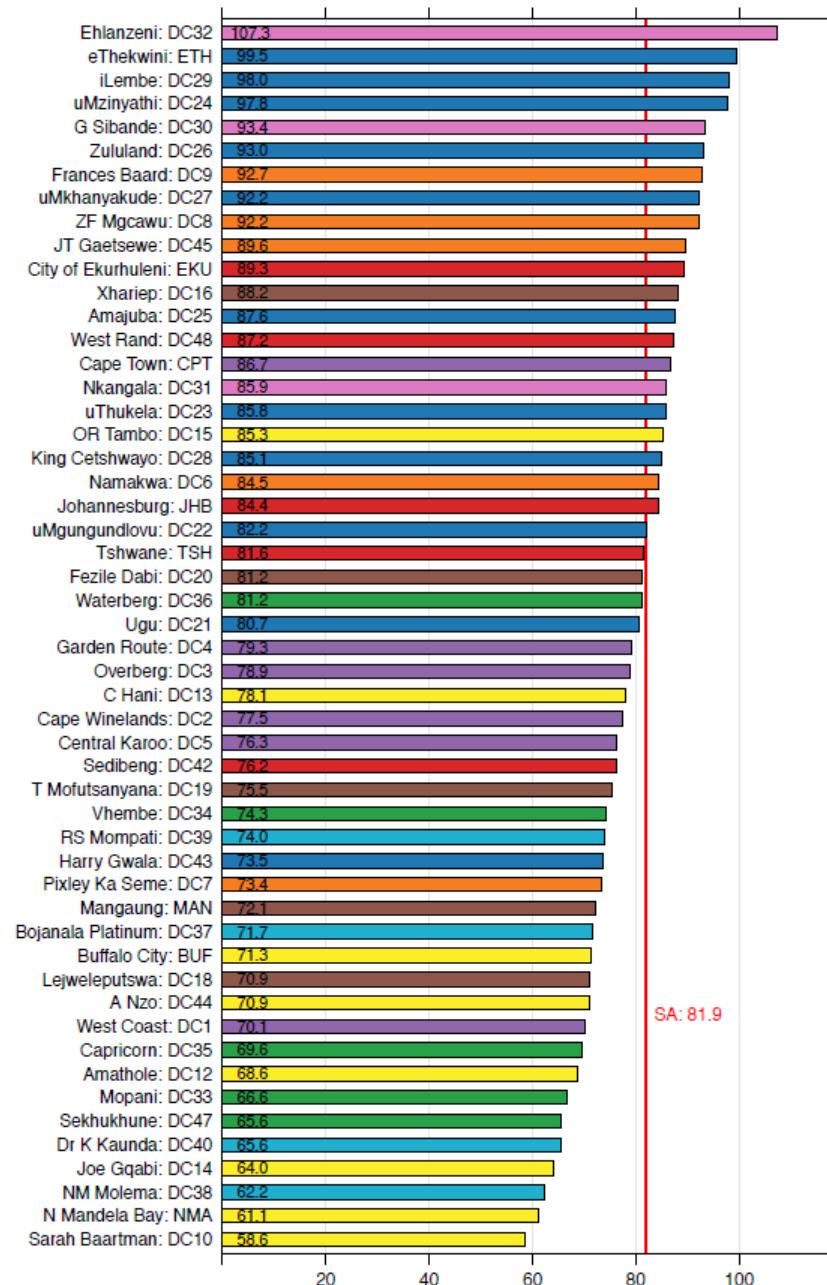


Figure 20: children fully vaccinated with all 14 vaccine doses - 2019 national EPI survey compared to 2016 DHS

Figure 21: Comparison of 2018/2019 DHB and 2019 national EPI survey for children fully vaccinated with all 14 doses

Figure 2: Immunisation under 1 year coverage by district, 2018/19



Chapter V: Conclusions and recommendations

Findings

Availability of vaccination cards was high across all provinces with the majority of districts having over 75% of children interviewed producing vaccination cards. 21% in EC, 9% in FS, 19% in GP and MP and 14% in KZN reported that they had to pay to get a vaccination; raising districts where children are not able to afford to pay for vaccination cards. Of concern are the following districts that had >25% of children whose vaccination cards were not seen by the interviewer; Umzinyathi, eThekwin, Capricorn and Vhembe. This was despite all four districts reporting high proportions of children who ever received a vaccination card - Umzinyathi (92%), eThekwin (88%) Capricorn (93%) and Vhembe (94%).

Recommendation: every child must be given a vaccination card at birth and efforts made through MomConnect and vaccination visits to remind mothers of the importance of retaining vaccination cards. Community healthcare workers should become more involved in the EPI programme; they could help to raise awareness of the importance of retaining vaccination cards as well as acting as a link between health facilities and families that require vaccination cards.

Findings

Across all districts except for JT Gaetsewe, the country failed to reach the set target of 91% of children fully vaccinated. Nationally, of the 17 180 children aged 24-35 months whose vaccination cards were seen by the interviewer, only 76.1% (95% CI: 75.4-76.7) were fully vaccinated i.e. had received all 14 doses from birth to 18 months. Pixley ka Seme, O.R Tambo, Capricorn, Fezile Dabi and Ilembe were the poorest performing districts with coverage of 53%, 54%, 62%, 63% and 64% respectively. The proportion of children fully vaccinated at 9 months i.e. having received all vaccine doses except measles 2 and hexavalent 4 was 83.9%.

Only 7 districts managed to achieve the national target of 91% of children fully vaccinated children under 1 year, namely Umzinyathi, Cape Winelands, Thabo Mofutsanyane, Frances Baard, Namakwa, Central Karoo and John Taolo Gaetsewe; John Taolo Gaetsewe had a very small sample size which may not be representative of the whole district.

The proportion of fully vaccinated children declined when assessing vaccine doses from birth to 9 months compared to fully vaccinated children who had received all 14 doses in the primary EPI schedule; from 83.9% to 76.1%. The largest drop-out rate was in Pixley ka Seme, Waterberg, Xhariep, Umgungundlovu, O.R.Tambo, Capricorn, Zululand and Thabo Mofutsanyane where the drop-out rates were >15%.

Unvaccinated children are a major concern in any EPI programme. Of the 52 districts, only J.T Gaetsewe district had no unvaccinated children; but the sample size was small. The number of unvaccinated children was > 5% in 17 districts, increasing to > 10% in Capricorn, iLembe, Thabo Mofutsanyane and Z.F Mgawu. These are districts that require supplementary vaccination activities especially in the hard to reach areas to ensure unvaccinated children are vaccinated.

The analyses for reasons for missed doses utilised children with vaccination cards as these had proof of given and missed doses. The top ranking reason for missed doses across all vaccines was vaccines being out of stock. Interestingly a significant proportion of children who missed vaccine doses had primary caregivers reporting that the reason for missed vaccines was that the primary caregiver didn't know that the child was due for vaccines. Missed vaccination opportunities are highlighted in the proportion of children who went to the health facility while child was ill, but vaccine wasn't administered.

Recommendation

The EPI programme needs to invest in robust health facility and community based interventions including use of mainstream and social media platforms to increase vaccination coverage across all districts to ensure children are fully vaccinated and retained within the EPI programme until completion of the primary vaccination schedule. Special focus must be given to Pixley ka Seme, O.R Tambo, Capricorn, Fezile Dabi and Ilembe where coverage was below the anticipated national coverage of 65% (this estimate was based on routine administrative data). Community healthcare workers should become more involved in the EPI programme; they could help to raise awareness of the importance of immunization and trace defaulters.

Real time data collection, collation and analyses will help monitor and sustain progress towards improving vaccination coverage. It's recommended that districts employ public health data analysts that analyse data real time and provide coverage estimates and identify groups at high risk of not receiving vaccines as well as of dropping out of the vaccination programme. These data must then be utilised timeously by the EPI programme at the local level for targeted interventions.

Addressing vaccine stock issues will significantly increase vaccination coverage. Real time electronic systems that link pharmacy with health facility records may improve vaccine stock management. For BCG and OPV0 a considerable proportion of missed doses was due to parents refusing vaccine; maybe parental consent must not be sought for these vaccines? Despite MomConnect being widely available between 2% and 10% of caregivers reported that they forgot that the child was due for vaccination; vaccination reminders could be built into the MomConnect platform to improve vaccination coverage. Considering that religious reasons were a negligible reason for missed doses, intensified vaccination campaigns could possibly result in major vaccination coverage gains. Additionally, the EPI programme needs to improve health facility related issues such as hours of operation (vaccinations clinics must be open daily with late operating hours) and have mobile vaccination clinics to cater for children that stay far from the health facility. Vaccination facilities must be visited, supervised and monitored often to ensure optimum performance and service delivery. Any contact with a child must be used as a vaccination opportunity and all child support services and programmes used to encourage vaccination.

This survey included children vaccinated in the public and private sector thus vaccination coverage estimates in this survey were higher than from routine data; albeit coverage being inadequate across all vaccination coverage data sources. Efforts must be made to include private sector vaccine coverage

with the public sector data to ensure a true reflection on national and local level vaccination coverage and to ensure that vaccination issues within the private sector are also identified and addressed.

Factors associated with missed doses

Several factors were associated with increased odds of having missed a vaccination dose; Compared to GP, children in EC, FS, KZN, LP and NW were more likely to have missed a vaccination dose. Additionally children in KZN, LP and MP had more than twice the odds of having unvaccinated children, calling for more efforts in these provinces to enhance vaccination coverage.

Children born at home were more likely to miss vaccination doses as well as being unvaccinated, again highlighting the need for integrated health services involving home based and ward based outreach teams.

Higher achieved education level of the household head was associated with less likelihood of missed vaccines; educative community based vaccination campaigns may assist increase vaccination uptake.

Large number of household members living in a few number of rooms is a proxy for low socio-economic status and children from such household had a higher odds of having missed vaccination doses. Mobile community based vaccination clinics may assist reduce the number of unvaccinated children.

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Appendices

Appendix A: Survey training report

Appendix B: Hard to reach areas

Despite intensive community mobilization activities at national, provincial and local levels there were certain areas where the survey staff were denied access. In all cases where access was denied, the local health promotion and EPI teams were deployed to negotiate access. The table below illustrates hard to reach areas and outcomes subsequent to intervention. Areas where the survey team completely failed to access are documented as such.

Communities	Problem Reported	Intervention	Outcomes and Status
Farms in Lejweleputswa	Field Workers Denied Access	The matter was escalated to AGRISA National Office and all the survey documents were sent as requested. And the farm protocol was shared with filed supervisors	AGRISA National Office committed to and communicates the survey message and documents to all the provinces and districts.
Farms in Harry Gwala,KZN	Field Workers Denied Access	The matter was escalated to AGRISA National Office and all the survey documents were sent as requested. And the farm protocol was shared with filed supervisors. The farm Security company (Prestige Security Services and farm protection) was called	AGRISA National Office committed to and communicates the survey message and documents to all the provinces and districts. All the efforts did not yield the positive results as the access was still denied.
Elardus Park	Field Workers Denied Access	This number was called- 083 597 4054 to request access.	Access completely denied
Krugersdorp West, Krugersdorp	Field Workers Denied Access	The concerned councillor Naude was called- 082 657 6211.	Access granted
Bulfontein Farms, Wesselbron Farms and Hertzogville Farms in Free State, Twelepel.	Field Workers Denied Access and the farmers never wanted to hear anything to do with the government	The matter was escalated to AGRISA National Office and all the survey documents were sent as requested. And the farm protocol was shared with filed supervisors	Access completely denied
Rayton Farm in Cullinan Pretoria	Field Workers Denied Access	The matter was reported to the Gauteng provincial and district office to intervene.	Access completely denied.

Mooikloof Lodge, MooiRidge, Aklaan-Mooi, Anni-Spruit, Ietz-Nietz, Oupos Rubenstein 877 and Riverview.	Field Workers Denied Access	All the mentioned gated communities denied access and refused even to give contact details of their body cooperates.	Access completely denied
Umfolozi, Gliblands Hostel, Mt Edgecombe, Balito, Phoenix and Umhlanga Rocks	Field Workers Denied Access	The intervention meeting was convened at the provincial office and later at EThekini Municipal Offices with counsellors. All the matters were resolved.	The access was granted by the counsellors and further committed to invite district and field supervisors to their constituency meeting.
Centurion Amberfield.	Field Workers Denied Access	The matter was reported to the Gauteng provincial and district office to intervene. All the survey documentation was sent.	Access completely denied
Thembisa in Mandela 2	Field Workers Denied Access due to the child that went missing in the community and later found dead.	Counsellor Sibulalwa was called and he organised a community to present the survey and introduce the field workers. All the survey documentation was sent and the field supervisor was linked with the counsellor.	The field supervisor and Ekurhuleni set with the counsellor and attended to the matter
Vannesfield and Hamilton Lodge Flats in King Cetshawayo	Field Workers Denied Access	The matter was escalated to the KZN Health Promotion which later sent further to King Cetshawayo colleagues.	Access completely denied
York garden Part, Port Alfred.	Field Workers Denied Access	The matter was escalated to EC Health Promotion provincial office which later was sent to Sara Baartman Ndlambe Sub-district to intervene.	Access was granted
Midstream Estate and Norton Estate	Field Workers Denied Access	Officials from NDOH went to these places.	Midstream completely denied access and the Norton Estate was found to be a non-residential area (no people are staying in the place)
Empangeni Flats	Field Workers Denied Access	The matter was escalated to the KZN Health Promotion which later sent further to Empangeni colleagues.	Access denied.
Kingswood Estate in EC	Field Workers Denied Access	The estate manager was called and all the survey documentation was sent as agreed	Access was granted.

Managung Flats in Bloemfontein	Field Workers Denied Access	Mr Louis (Complex manager) was called and the matter was resolved	Access was granted.
Bohalenin Complex in EKurhuleni	Field Workers Denied Access	The matter was addressed with the Security Head who later referred us to the Complex Manager. All the documents were sent and he was never found available and never reverted back to us	Access was never granted
Merchant Hotel-Midvaal	Field Workers Denied Access	The matter was attended successfully with Mr Rolsee. All the survey documents were sent.	The access was granted.
Maluti Estate, Ekurhuleni.	Field Workers Denied Access	The matter was attended successfully with the estate manager and all the survey documents were sent as agreed.	The access was granted.
Brishona Lodge, Ekurhuleni.	Field Workers Denied Access	The estate manager was called and he totally refused.	Access was completely denied.
Brentwood part in Birchley	Field Workers Denied Access	The complex was visited by the National Social Mobilisation Team and met with Security manager who was very rude and completely refused, mentioning that they do not want anything to do with government.	Access was completely denied.
Two Rivers Estate, in EC.	Field Workers Denied Access	The matter was referred to EC Provincial Health Promotion manager who later engaged Sara Baartman Health Promotion for intervention	Access was completely denied.
Gholpark, Naboomspruit	Field Workers Denied Access	The centre manager was engaged and it was discovered that the place is an old age home	Old age home
Mambulu Community in KZN	Field Workers Denied Access	A community meeting was organised through the ward counsellor and the National, Local Hospital and Field Supervisors attended the meeting. The community was addressed and the community welcomed the fieldworkers.	Access was granted

Langhoven Park Bloemfontein	Field Workers Denied Access	All efforts to access the place were done but nothing convinced them	The access was completely denied.
Mimosa Park, Small Holdings, Waveren farm, Summerwood Country Estate, and Gwenbali Waterworld, in Bloemfontein.	Field Workers Denied Access	All efforts to access the place were done but nothing convinced them	The access was completely denied.
Lakitha Precinct	Field Workers Denied Access	The matter was referred to Health Promotion in Limpopo province and district(Mr Digale and Mr Mbau)	Access was granted
Vanderbijlpark and Vereeniging	Field Workers Denied Access	The following counsellors were engaged, clrr Verbeek, Coertzee, Roshnee, Rustervaal, Tlhokwe, and Mahabela	Access was granted
Primrose, Germistone, Bedford Park, and Boksburg Parkrand.	Field Workers Denied Access	The matter was referred to Ekurhuleni Health Promotion who intervened.	Access was granted
Herford Apartments in Tshwane	Field Workers Denied Access	The matter was referred to Tshwane Health Promotion who intervened.	Access was granted
Breeding Exotic Farm	Field Workers Denied Access	Contacts were made with the manger and it was found that its game reserve	Game reserve.
Rosshahof, Vanderbijlpark, Henely on Klip, Meyerton, and Three Rivers in Vereeniging.	Field Workers Denied Access	The following counsellors were engaged, Labuschne, Mashaba, and Dalene. And the matter was attended to.	Access was granted
Norkem Villas, Kempton Park	Field Workers Denied Access	All efforts to make inroads did not succeed.	Access completely denied
Dundee, KZN	Field Workers Denied Access	The matter was referred to Provincial Health Promotion which later was sent to the concerned district	Access was granted
King Heights Private Estate, Grahamstown	Field Workers Denied Access	The estate manager was engaged and all the survey documents were sent	Access was granted
Alexandra Community, Johannesburg	Field Workers Denied Access	The matter was attended through the local clinic	Access was granted
Raba ridge and Diepsloot, Gauteng	Field Workers Denied Access	This matter was reported to Wits Health Consortium because the access was denied due to the fact that the fieldworkers were not from the community.	Access completely denied