An audit of immunisation uptake in paediatric patients at Zithulele Hospital, South Africa

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Project location:

Zithulele hospital is a rural, state-funded district general hospital in the OR Tambo District of the Eastern Cape in South Africa. The hospital is situated 85km from the nearest town, Mthatha, and 280km from the nearest city, East London. The original hospital was founded in 1956 by the Dutch Reformed Church, and was taken over by the Department of Health in 1976. In 2005, four clinicians moved to Zithulele with the aim of improving healthcare in the region, one of the poorest in South Africa, through the development of infrastructure and wider medical education. The hospital currently has a capacity of 147 beds, split between three main wards: general medical and surgical, obstetrics and paediatrics. Additionally, there is a very busy outpatient department (OPD), which sees 33,000 patients annually, approximately 7,500 of whom are aged between birth and twelve years. The OPD is a casualty facility, where patients are assessed by triage nurses and allocated an appropriate consultation room depending on urgency.

In terms of resources, equipment is very basic and often out-dated. However, the clinical staff have a wealth of experience in general medicine, with most having a special interest in areas such as paediatrics, anaesthetics, emergency medicine and obstetrics. The staff permanently based at the hospital consists of 20 doctors, 160 nurses, four occupational therapists, three physiotherapists and one pharmacist. As such, teamwork is essential, as everyone relies on each other's skills and experiences.

In addition to serving the local population, Zithulele hospital oversees 13 peripheral clinics. As such, the hospital covers a population of 130,000 patients. These clinics were established in an attempt to improve access to healthcare and to increase the compliance of follow up services in OR Tambo district, as distance and cost to travel form a major barrier to healthcare in the local community. Over 10% of the patients registered to Zithulele walk more than an hour to the nearest clinic, and over 35% reside over an hour from the main hospital site itself (Le Roux et al. 2017).

Despite being in a remote setting on the Wild Coast of South Africa, the region attracts many tourists for the unspoilt coastline, hiking and water sports and the traditional Xhosa lifestyle.

Common presentations:

A wide range of illness and disease presents at Zithulele Hospital, as its facilities can provides both primary and secondary care. The most common presentations, however, include HIV with associated complications, tuberculosis, obstetrics, trauma and infectious diseases. Additionally, the local mining industry has resulted in an increasing working population with chronic occupational lung disease.

Challenges to healthcare:

Despite being a state-funded hospital, the most challenging aspect to the working environment at Zithulele was the lack of basic medical equipment. Commonly, there was a shortage of disposable materials and the pharmacy inventory was limited. There was only one functional ultra-sound scanner in the hospital, which itself was very primitive and only two ECG machines. Until recently, the ventilator in theatre was broken, so manual ventilation was required. Laboratory services processed basic haematology and biochemistry samples, with further tests forwarded to larger centres in East London or Johannesburg.

In addition to equipment limitations, there was a very basic IT system, serving as a portal for radiology and laboratory reporting. There were no electronic medical records, so staff relied on patients bringing a clinical notebook. Despite this, medical recording was very well managed, as almost all patients brought their notebook on attendance.

Language barriers also created challenges during consultations. In Eastern Cape, the main language spoken is Xhosa. Few people speak basic English, so translators were often present during consultations and nurses acted as translators on the wards. Non-verbal communication skills were therefore vital if an accurate history was to be obtained.

Locally, human resources were excellent, with a very knowledgeable and experienced clinical team. However, when referral to a tertiary care centre was necessary, the system became very bureaucratic. Patient transfer services were limited and unreliable, and the quality of specialist services in the nearest town, Mthatha, varied with the availability of funding.

Healthcare in South Africa:

State-funded and private healthcare coexists in South Africa, with the Department of Health influencing policy, developing facilities and maintaining standards. In line with this, the country's nine provinces have control of individual budgets and service provision. With a population of approximately 53 million and an estimated healthcare budget of $29.8 billion, spending is estimated to be $562 per capita (Deloitte 2014).

Currently, the Department of Health utilises the Beveridge model of healthcare: one that is fully funded, controlled and operated by the state, with finances raised through taxation and national insurance (Pho 2010). A state funded vaccination schedule is included in this model. In addition to this system, individuals may choose to make use of private services, where they make 'out-of-pocket' payments or purchase private health insurance. The South African Government is increasingly moving towards a National Health Insurance model, where individuals pay national insurance through their employer or finance a private insurance policy. This method is means tested, so for individuals unable to afford or exempt from contribution, such as children and the elderly, the state finances the cost. By utilising this method of healthcare, the government envisages that specialist services currently found only in the private sector will be available to everyone (Econex 2015).

Healthcare in South Africa has improved markedly in recent years, with Statistics South Africa (2015) estimating life expectancy increasing from 53.5 to 62.9 years of age between 2005 and 2015. Despite an increase in HIV prevalence from 4.35 million to 6.19 million in this period of time, the increase in life expectancy is attributed to the Department of Health's introduction of an anti-retroviral programme which was established in April 2014 (Department of Health 2015). Additionally, child health has seen much improvement, with a decrease in neonatal mortality from 13.7 to 11.0 per thousand live births between 2005 and 2015 (WHO 2016). The Department of Paediatrics and Child Health at the University of Pretoria believes that this is in part due to a reduction in both healthcare and patient associated avoidable factors. This includes an increase in medical education in neonatal resuscitation in rural settings, better monitoring for foetal distress and a decrease in delay in seeking medical attention from booking to labour.

Abstract:

Objective: The implementation of childhood vaccinations has contributed to an effective reduction in disease outbreak, economic burden of disease and childhood mortality worldwide. It is suggested that uptake in some rural provinces in South Africa is as low as 63.4%. Through clinical audit, childhood vaccination uptake will be examined at Zithulele Hospital.

Method: The clinical audit cycle was utilised as a model for assessing current practice against the World Health Organisation's recommended immunisation schedule. In doing so, the effectiveness of the current childhood vaccination programme was examined. Criteria included patients aged birth to twelve years of age, outpatient or inpatient attendance, and ownership of a 'Road to Health' book. Data was collected by means of both assessment of immunisation records and vaccination questionnaire.

Results: Data was collected from a total of 211 patients. Of these data sets recorded at Zithulele hospital and peripheral clinics, 127 patients (60.2%) had received their most recent vaccinations. 102 (48.3%) had, to date for their age, a completed vaccination schedule. Uptake decreased as age increased, with a notable decrease of 27.9% between 9 and 18 months of age. Results of the vaccination questionnaire showed that all (100%) parents believed that their child was up to date with their vaccinations, that they are beneficial, and they trusted both government and healthcare professionals. 141 (81.9%) trusted the pharmaceutical industry to develop safe vaccinations. Nine parents (5.2%) had previously been discouraged from having their child vaccinated. 77 (44.5%) said that cost was an influence. The vaccines are funded by the state, but cost occurred in the form of transport to clinics. 59 (34.1%) said that distance formed a basis for the decision about whether or not to have their child vaccinated.

Conclusion: There is great room for improvement in immunisation uptake at Zithulele hospital and in OR Tambo District. By utilising the interventions recommended, it is expected that uptake should further increase, with the ultimate intention of improving patient care and reducing future disease burden.

A repeat audit should take place in 12 months to assess changes made.

Introduction:

Background:

The World Health Organisation's statement in their 2013 Global Vaccine Action Plan that "Immunisation should be recognised as a core component of the human right to health and an individual, community and governmental responsibility" is one of great significance. Many serious infections have been controlled at both an individual and population level through vaccination programmes. As a public health control, the implementation of childhood vaccinations has contributed to an effective reduction of disease outbreak, economic burden of disease and ultimately a reduction in childhood mortality. With the national uptake of childhood vaccinations at 97.4% in Scotland (NHSNSS 2016) and as low as 63.4% in some rural provinces of South Africa (Massyn et al. 2015), this elective project will examine the uptake of childhood vaccinations in paediatric patients aged 0-12 years at Zithulele district hospital in rural Eastern Cape, South Africa. By completing a clinical audit of vaccination uptake, this study will compare current practice at the hospital with the WHO's recommended immunisation schedule, with the ultimate intention of improving patient care and reducing future disease burden.

Method:

Preparation and planning:

A literature review was completed using multiple sources including: The Cochrane Library; PUBMED; Embase; The World Health Organisation; NICE; Information Services Division Scotland; NHS Choices; and open searches of the Internet using Google.

Keywords included: Childhood; Vaccination; Immunisation; Schedule; Up-take; Statistics; United Kingdom; South Africa

Clinical audit:

The National Institute for Health and Care Excellence defines a clinical audit as a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit standards and implementation of change (Shaw 2002).

In examination of childhood vaccination uptake, the clinical audit cycle in *Figure 1.* was utilised as a model for assessing current practice against a defined standard. In doing so, the aim was to identify the effectiveness of the current childhood vaccination programme, and highlight any potential areas of modification with the ultimate intention of improving patient care.

The WHO's recommended childhood vaccination schedule was used as a gold-standard, as this is a well-regarded United Nations' agency, specialising in international public health.

Figure 1. Diagram of the clinical audit cycle, extracted from Ashley et al. (2014)

Immunisation schedule:

The South African Extended Programme of Immunisation (EPI) closely follows the recommended schedule as published by the WHO, with one difference. The combined measles, mumps and rubella (MMR) vaccination is absent from the EPI and subsequently the 'Road to Health' card, a document issued at birth to allow monitoring of health, wellbeing and child development. In place of the MMR vaccination is a course of two measles vaccinations. As these are non-notifiable diseases in South Africa, reliable data is very difficult to access. However, it is estimated by Boshoff and Tooke (2012) that Mumps and Rubella had an estimated incidence of 39 and 660 respectively in 2012. Furthermore, despite these estimates, it is suggested by the Department of Health in the province of Kwazulu-Natal that as no research has been conducted in South Africa on these diseases, the vaccinations "cannot be included in the schedule without scientific data".

It is important to note that the Human Papilloma Virus (HPV) vaccination is routinely offered to all girls aged nine years in South Africa. However, there is no section to record this in the Road to Health booklet. As such, the HPV vaccination was excluded from this audit, as it was deemed data collection would be too inaccurate for this to be examined effectively.

In South Africa, the private and state differences in healthcare extend to childhood vaccination schedules. *Table 1* outlines the vaccinations currently available free of charge to patients provided by the state compared to those that require private administration. The state schedule does not include Hepatitis A, mumps, rubella and varicella vaccines and additional polio, pneumococcal and rotavirus boosters.

Age	State Healthcare	Private Healthcare
Birth	BCG	BCG
	OPV (0)	OPV (0)
		HBV (1)
6 weeks	DTaP-IPV-Hib (1)	DTaP-IPV-Hib-HBV (1)
	HBV (1)	OPV (1)
	OPV (1)	RV (1)
	RV (1)	PCV (1)
	PCV (1)	
10 weeks	DTaP-IPV-Hib (2)	DTaP-IPV-Hib-HBV (2)
	HBV (2)	RV (2)
		PCV (2)
14 weeks	DTaP-IPV-Hib (3)	DTaP-IPV-Hib-HBV (3)
	HBV (3)	RV (3)
	RV (2)	PCV (3)
	PCV (2)	

Age	State Healthcare	Private Healthcare
9 months	Measles (1)	Measles (1)
	PCV (3)	
15 months		PCV (4)
		MMR (1)
		Varicella (1)
		Hep A (1)
18 months	DTaP-IPV-Hib (4)	DTaP-IPV-Hib (4)
	Measles (2)	Hep A (2)
6 years	Td (boost)	MMR (2)
		Varicella (2)
		DTap-IPV (boost)
9 years	HPV	HPV
12 years	Td (boost)	DTap-IPV (boost)

Table 1. South African state and private immunisation schedules

Criteria:

To be eligible for inclusion in this clinical audit, patients must have been 0-12 years of age, attending for outpatient appointments or inpatient admission. Additionally, patients must have had their 'Road to Health' child development book with them.

In cases of twins, one child was excluded from the data collection process. Patients without a Road to Health book were also excluded from the study.

Standards:

A standard of 95% immunisation, as per the South African National Department of Health immunisation schedule, was chosen for this project. This is widely accepted and recommended by Andre et al. to be the statistically significant proportion of population required for herd immunity. Defined by the Centres for Disease Control and Prevention, herd immunity is "a situation in which a sufficient proportion of a population is immune to an infectious disease, to make its spread from person to person unlikely." (CDC 2016)

Ethical approval:

It was not necessary to seek ethical approval for this study, as it was an observational audit of vaccination status with a confidential qualitative questionnaire. Participation had no impact on patient clinical care. However, it should be noted that guardians of patients who were not in date for their most recent vaccinations were advised and directed to an appropriate immunisation clinic.

Data collection:

Current practice was observed and data collected by means of both retrospective assessment of immunisation records of paediatric patients aged 0-12 years and a vaccination questionnaire for their parent or guardian. Data was collected from a total of 216 patients at Zithulele hospital inpatient and outpatient departments, and at Pumalanga, Wilo and Jalamba clinics to provide wider representation of vaccination uptake in OR Tambo district. All paediatric patients attending over a three-week period were assessed for inclusion in the study. To be included, patients must have had with them their Road to Health book. Five patients were a twin, so were excluded from the audit, resulting in a total study population of 211 patients. All clinical areas were utilised for this audit, with an exception of immunisation clinics. It was decided that this could negatively skew results, especially if patients had been directed there for not having up-to-date schedules.

Patients' immunisation records were compared to the state schedule found in Table 1. A document was produced in the planning stages, to allow efficient and accurate data collection to take place. This can be observed in *Appendix 1*. A full name, date of birth, age and vaccination history was recorded for each patient, ensuring that multiple sets of data were not recorded should they attend additional appointments, admissions or clinics during the three-week data collection period. For each vaccination administered and recorded in the Road to Health booklet, a tick was placed in the corresponding section of the data sheet. A cross was placed if a vaccination was missing.

Guardians of patients who were not in date for their most recent vaccinations were advised of this and educated about the need and benefit of vaccines to their child's health. They were also directed to an immunisation clinic, and given a list of clinic dates.

To maintain confidentiality, names and dates of birth were removed from the final electronic document.

From birth to 14 weeks of age, a two-week grace period was allowed after the vaccination due date before a patient was recorded as un-vaccinated. From 9 to 18 months of age, this was extended to one month and for patients aged between six and twelve years, one year was allowed. These were regarded as acceptable durations, as it was expected that some patients would be due vaccinations at the point of examination of their Road to Health booklet.

When the recorded data was converted into an electronic format, a traffic light system was utilised to allow easy visualisation of vaccination status: green indicated vaccinated; yellow, vaccination due; and red, unvaccinated.

The medical questionnaire was used as an assessment tool to provide qualitative data on parental awareness and attitudes towards vaccinations and to examine barriers to healthcare. The outline of which can be seen in *Appendix 2*.

It is important to note that difficulty in communication with patients was identified when first arriving at Zithulele, so it was decided that a local Xhosa translator should be employed to aid the quality of results and minimise error during the data collection process.

Results:

Data was collected from a total of 211 patients. Of this total, 93 patients were at Zithulele outpatient departments, 20 were Zithulele inpatients, and 64 were reviewed at Pumalanga clinic, 20 at Jalamba clinic and 14 at Wilo clinic *(See Table 2).* A translator was present throughout to minimise error during the data collection process.

Location of Data Collection	Number of Patients	Full Vaccination History		Incomplete Vaccination History		Received Most Recent Vaccinations For Age	
Zithulele Inpatients	20	9	45.0%	11	55.0%	10	50.0%
Zithulele Outpatients	93	44	47.3%	49	52.7%	55	59.1%
Pumalanga Clinic	64	32	50.0%	32	50.0%	41	64.1%
Wilo Clinic	14	10	71.4%	4	28.6%	11	78.6%
Jalamba Clinic	20	7	35.0%	13	65.0%	10	50.0%
Zithulele	**113**	**53**	**46.9%**	**60**	**53.1%**	**65**	**57.5%**
Peripheral	**98**	**49**	**50.0%**	**49**	**50.0%**	**62**	**63.3%**
Total	**211**	**102**	**48.3%**	**109**	**51.7%**	**127**	**60.2%**

Table 2. Vaccination status by location of data collection

Of the 93 patients at Zithulele outpatient departments, 55 (59.1%) had received their most recent vaccinations. 44 (47.3%) had a fully completed vaccination history for their age and 49 (52.7%) had vaccinations missing from their schedule. Ten (50.0%) Zithulele inpatients had received their most recent vaccinations and 9 (45.0%) had a completed vaccination history. Of the 113 data sets collected at Zithulele hospital, 65 (57.5%) had received their most recent vaccinations. In contrast, at the peripheral clinics, with a total of 98 patients, 62 (63.3%) had received them. At Pumalanga clinic, data was collected from 64 patients. 41 (64.1%) had received their most recent vaccinations and 32 (50.0%) had a completed vaccination schedule. At Wilo clinic, 11 (78.6%) patients were in-date for their most recent vaccinations, and 10 (71.4%) had a completed vaccination schedule. Twenty patients were seen at Jalamba clinic. Of these patients, 10 (50%) had received their most recent vaccinations. Seven (35%) had a full vaccination schedule.

Of the 211 data sets recorded, 127 patients (60.2%) had received their most recent vaccinations. 102 (48.3%) had a full vaccination schedule, and 109 (51.7%) had missed past vaccinations (See *Figure 2*).

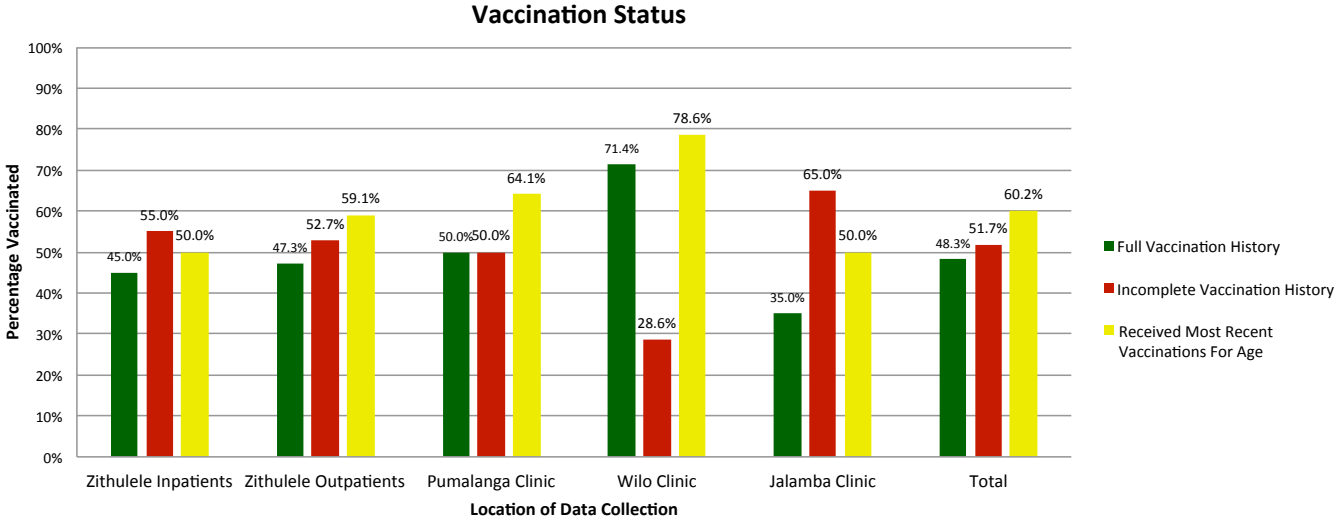

Figure 2. Graph of vaccination status by location of data collection.

When analysing the data by age, an interesting observation was noted. Vaccination uptake decreased as age increased, with a particular reduction when the 18-month DTP-IPV-Hib and Measles vaccinations were due. Analysis for possible causation will be further explored in the discussion section of this report. *Figure 3* and *Table 3* can be found below, summarising this trend of decreased vaccination uptake.

Furthermore, it was evident that there were differences within vaccination age cohorts. The most noticeable of which included 95.3% uptake of the 6-week pneumococcal vaccine, but only 91.1% uptake of the hepatitis B vaccine. Additionally, at 9 months, 91.6% of children received their measles vaccination, with only 84.7% receiving their pneumococcal vaccine. In both cases, despite these vaccinations being given at the same clinic visit, a difference in uptake of 4.2% and 6.9%, respectively, existed.

	Birth		6 weeks				10 weeks		14 weeks				9 months		18 months		6 years
	BCG	Polio	DTP-IPV-Hib	HBV	PCV	Rota	DTP-IPV-Hib	HBV	DTP-IPV-Hib	HBV	PCV	Rota	Measles	PCV	DTP-IPV-Hib	Measles	Td
Total	211	211	190	190	190	190	182	182	178	178	178	178	131	131	102	102	10
Vaccinated	204	206	176	173	181	179	163	161	156	152	158	152	120	111	65	68	2
Percentage (%)	96.7%	97.6%	92.6%	91.1%	95.3%	94.2%	89.6%	88.5%	87.6%	85.4%	88.8%	85.4%	91.6%	84.7%	63.7%	66.7%	20.0%

Table 3. Vaccination uptake by age.

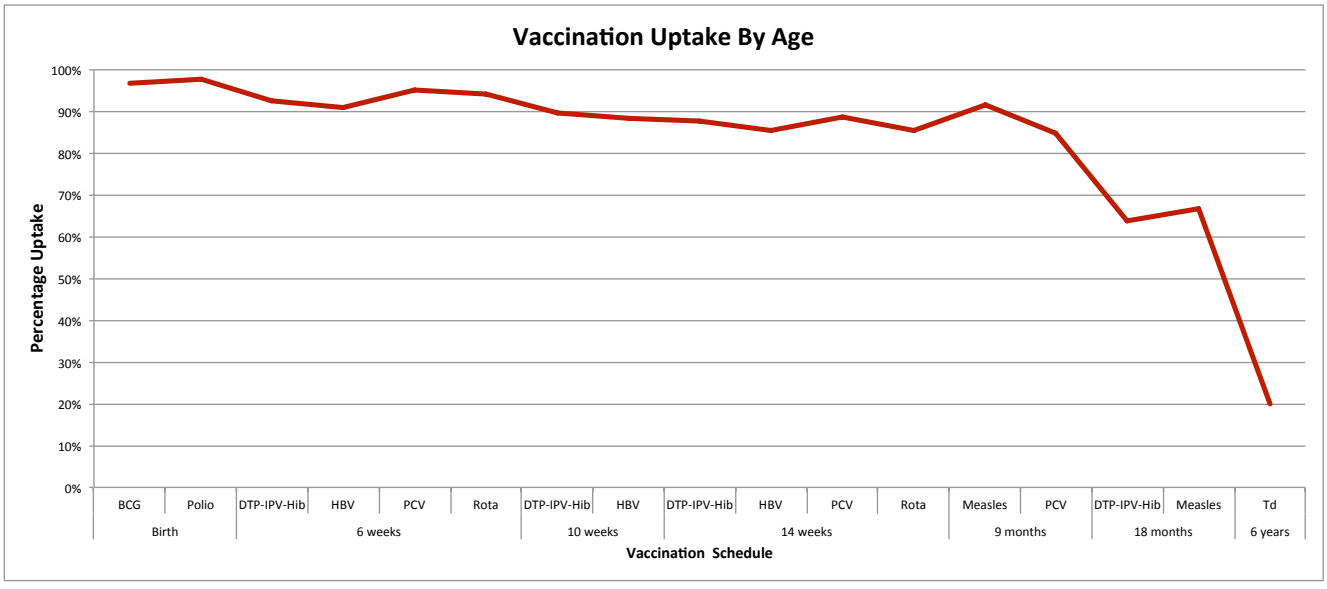

Figure 3. Graph illustrating vaccination uptake by age.

The vaccination questionnaire was completed by 173 of the parents/guardians attending with their child as an inpatient or for outpatient clinics. There was often suspicion surrounding the purpose of the questions. Despite careful explanation of the study through a translator, 38 parents did not wish to take part. They did, however, allow recording of the Road to Health Card.

Interestingly, every parent or guardian interviewed (100%) stated that they believed that their child was in date for their most recent vaccinations. Additionally, all parents believed that vaccinations are beneficial to the health of their child and as such, should be compulsory. All trusted both the government and healthcare professionals to inform them of the risks and benefits of vaccinations. However, only 141 (81.9%) trusted the pharmaceutical industry to develop safe vaccinations. This will be further explored in the discussion.

The section of the questionnaire focusing on health education showed that 95 (45%) parents were aware of tuberculosis, 18 (8.5%) of polio, 12 (5.7%) of measles and seven (3.3%) of hepatitis. No parents were aware of any other diseases that the current immunisation schedule protects against.

Nine parents (5.2%) had at some point been discouraged from getting their child vaccinated. When exploring this further, responses varied but included three concerned about vaccination safety.

Cost was an important factor for many of the parents who took part in the questionnaire. 77 (44.5%) parents said that this formed a basis for the decision about whether or not to have their child vaccinated. Despite vaccines being funded by the state, most parents relied on bus services to access clinics. Responses varied greatly in the price range parents were willing to pay, extending from R20 to R110. Cost was closely associated with travel, 59 (34.1%) saying that distance affected their decision to have their child vaccinated.

A summary of these results can be found in *Table 4* and *Figures 4-7*.

Response	Question Number								
	1	2	3	4	5	6	7	8	9
Yes	173 (100%)	173 (100%)	173 (100%)	9 (5.2%)	173 (100%)	141 (81.9%)	173 (100%)	77 (44.5%)	59 (34.1%)
No	0 (0%)	0 (0%)	0 (0%)	164 (94.8%)	0 (0%)	32 (18.1%)	0 (0%)	96 (55.5%)	114 (65.9%)

Total Response Number = 173

Key:
Question 1: Is your child up-to-date with their vaccinations, with a completed schedule?
Question 2: Do you think vaccinations are beneficial to your child's health?
Question 3: Do you trust doctors & nurses to advise you of the benefits/risks of vaccinations?
Question 4: Has anyone/anything discouraged you from getting your child vaccinated?
Question 5: Do you trust the government to make decisions about your child's health?
Question 6: Do you trust the pharmaceutical industry to produce vaccinations that are safe for your child?
Question 7: Do you think that childhood vaccinations should be compulsory?
Question 8: Would cost affect your decision to get your child vaccinated?
Question 9: Would the distance to travel to a hospital or clinic affect your decision to get your child vaccinated?

Table 4. Vaccination questionnaire responses.

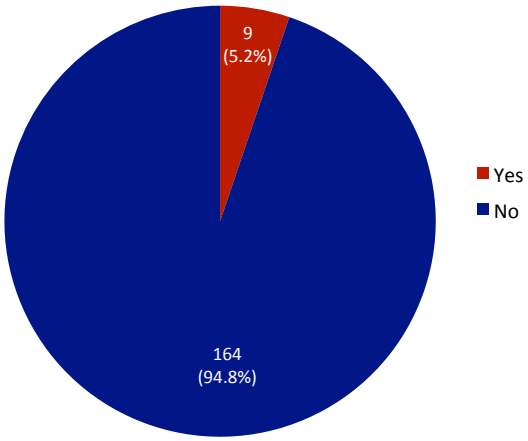

Figure 4. Pie chart of questionnaire results: Has anyone/anything discouraged you from getting your child vaccinated?

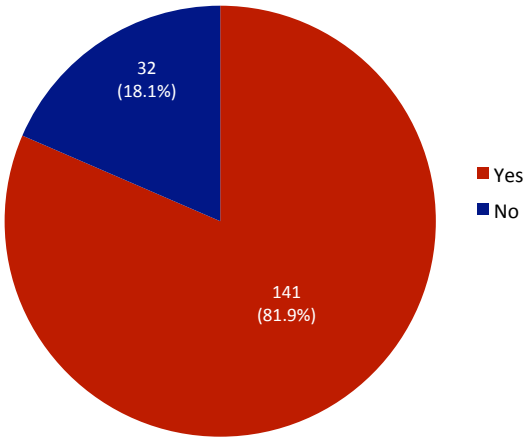

Figure 5. Pie chart of questionnaire results: Do you trust the pharmaceutical industry to produce vaccinations that are safe for your child?

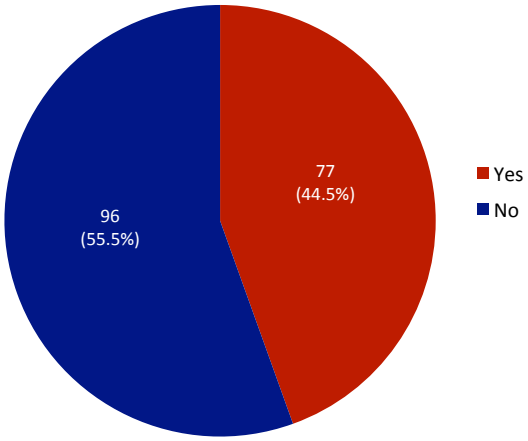

Figure 6. Pie chart of questionnaire results: Would cost affect your decision to get your child vaccinated?

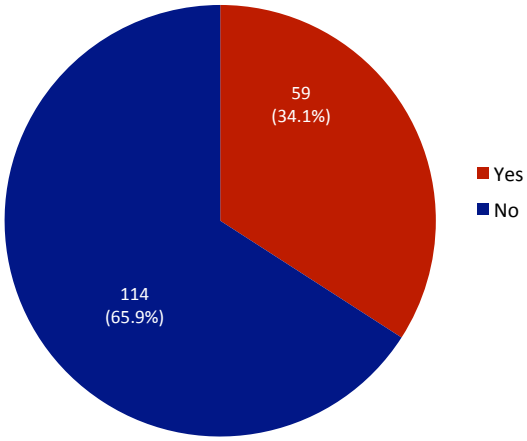

Figure 7. Pie chart of questionnaire results: Would the distance to travel to a hospital or clinic affect your decision to get your child vaccinated?

Discussion:

Of the 211 data sets recorded throughout Zithulele hospital and peripheral clinics, 127 patients (60.2%) had received their most recent vaccinations. 102 (48.3%) had a full vaccination schedule, and 109 (51.7%) had missed past vaccinations. As such, it is important to discuss the reasons for these results.

The 2015 Health Systems Trust (HST) District Health Barometer is an annual study funded by the South African National Department of Health. Immunisation coverage across South Africa in children under one year of age is estimated to be 89.8%. By province, Eastern Cape is estimated to have coverage of 80.9%. Despite an improvement of 11.7% over the last five years, Eastern Cape still has the second lowest in South Africa. OR Tambo District, in which Zithulele hospital and its peripheral clinics are located, has an estimated coverage of 74.9%. This is the fifth lowest coverage of the 52 districts in South Africa. *Table 5* shows immunisation coverage data extracted from the 2015 HST District Health Barometer.

	2010/11	2011/12	2012/13	2013/14	2014/15
Eastern Cape	69.2	71.7	72.3	72.3	80.9
Free State	94.1	96.6	96.2	86.6	90.1
Gauteng	105.3	106.5	102.6	109.0	107.7
KwaZulu-Natal	77.8	87.5	85.6	85.8	89.9
Limpopo	76.9	74.7	71.1	70.3	82.2
Mpumalanga	58.3	58.9	67.8	71.1	80.1
Northern Cape	85.8	88.5	86.6	84.9	85.4
North West	66.5	68.2	72.4	74.2	82.1
Western Cape	85.0	86.2	88.8	84.9	90.9
South Africa	80.8	83.9	83.6	84.4	89.8

Table 5. Immunisation coverage by province, extracted from the HST 2015 District Barometer.

Results from data collected during this audit and results from the national study show a significant difference of 14.7% in estimated immunisation coverage. Potential study limitations may account for the difference. With a study population of 211 patients, it is possible that the small sample size has affected the quality of the results. Equally, the study took place at only five locations, so does not accurately represent the whole district. It may be possible that as the study involved children who were seeking medical attention, the 'well' population was not adequately accounted for. However, as many of these patients were regular attenders for repeat appointments, it could be argued that the study results should be falsely elevated. Regular contact with healthcare professionals should have increased opportunity for immunisation monitoring and timely administration.

It was observed at peripheral clinics that there was a 5.8% increase in patients who had received their most recent vaccinations. It is possible that these clinics, despite being themselves more remote, are located nearer to patients therefore more accessible. The smaller patient populations attending may have also influenced the results, as clinical staff may have more time to provide patients with better medical education and discuss the benefits of immunisations. Additionally, it is possible that the smaller sample size in peripheral clinics could have also positively skewed results.

It was evident from the beginning of the data collection process that transport and cost to travel were important aspects when considering access to healthcare in the region. Furthermore, results from the questionnaire support this. 44.5% and 34.1% expressed the opinion that cost and travel respectively formed major components in decision-making behind access to child vaccination. These barriers to healthcare are tightly linked, as many parents rely on local bus services as a means of transport to Zithulele hospital or a peripheral clinic, due to the rural setting. Cost of transport that parents were willing to pay ranged from R20 to R110. Additionally, the 2015 HST District Health Barometer discusses immunisation coverage by socio-economic quintiles. Quintile one represents the most deprived districts and quintile five the least deprived. Five of the eleven districts represented by quintile one are located in the Eastern Cape, including OR Tambo. *Table 6* summarises immunisation uptake, showing a difference of 21.8% between highest and lowest areas of deprivation.

	SEQ1	SEQ2	SEQ3	SEQ4	SEQ5	Total
Immunisation under 1 year (%)	79.8	85.9	81.2	89.1	101.6	89.8

Table 6. Immunisation uptake by socio-economic quintile

Socio-economic status extends much further than ability to fund the cost of healthcare. In their 2000 report 'Disability, Poverty and Development', the Department For International Development utilises the 'Cycle of Poverty', found in *Figure 8*, to effectively describe the relationship between poverty and healthcare. In conjunction with poverty are malnutrition, deficits in education and social vulnerability. These factors are major determinants of health and form a vicious cycle, which is increasingly difficult to break. It is this population that vaccination programmes should be targeting as a wider public health measure in an attempt to combat the physical, social and psychological burden of disease.

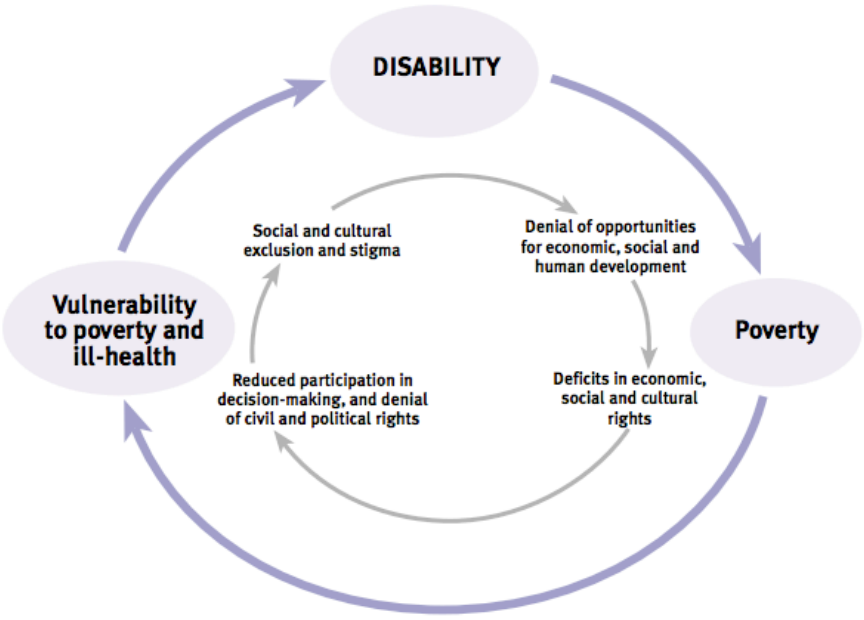

Figure 8. Cycle of Poverty (DFID 2000)

With 5.2% of parents having had someone or something dissuade them from having their child vaccinated, it was important to understand the reasoning behind these cases. Three parents were concerned about vaccination safety. One mother described her baby as “feverish” following previous immunisations, so was concerned about further side effects. Despite this being a normal side effect, there was a clear lack of parental education. Additionally, another mother interviewed was also concerned that her child, who was already unwell and a regular inpatient, would become ill if he were to have his next vaccinations. Several parents held strong beliefs in traditional medicine, whereby families seek advice from traditional healers. This is an important part of Xhosa culture, but almost all who took part in the questionnaire recognised the importance of vaccinations, and used medical advice in conjunction with traditional healers.

It is interesting to further discuss the results focusing on parental awareness of their child’s vaccination status. All parents thought that their child was up-to-date with their most recent vaccinations. It is unclear whether these answers were truthful or whether some parents thought that the results would affect their child’s care, despite being informed that participation in the study was anonymous. Furthermore, many parents were wary of involvement in the study with many only agreeing to participation following a clear explanation of its purpose. Despite careful translation, 38 parents did not wish to take part. They did however allow use of information recorded in the Road to Health Card. Medical education was insufficient, with only 95 (45%) parents aware of tuberculosis, 18 (8.5%) of polio, 12 (5.7%) of measles and seven (3.3%) of hepatitis. No parents were aware of any other diseases that the current immunisation schedule protects against.

Only 141 (81.9%) trusted the pharmaceutical industry to develop safe vaccines. It is unclear as to the reasoning behind this. It is thought on reflection that mistranslation may have occurred. ‘Pharmacy’ and ‘drugs’ are synonymous in Xhosa, so it may have been interpreted as illicit drugs. Furthermore, several answers explained that they “cause harm to the development” of their child, despite agreeing that vaccines are beneficial.

Results show a decrease in the rate of immunisation uptake of 27.9% between the ages of 9 and 18 months. Factors that result in this decrease may include the perception of their child being well, therefore not requiring further booster vaccines. Additionally, it is thought that some parents may forget to have their child vaccinated due to the long time period between dates on the schedule. It is between these age cohorts that parental education and opportunistic monitoring is particularly important, as vital DTaP-IPV-Hib and measles boosters are administered. Additionally, there was an uptake of only 20% for the tetanus and diphtheria boosters.

Recommendations:

Medical education of both parents and allied health professionals to increase awareness and recognition of the importance of vaccinations and the wider public health implications should be emphasised. Parental education can take place in the form of group sessions, of which there are several in existence, currently focussing on breastfeeding and parenting. Additionally, posters could be placed in waiting areas to highlight the need for complete immunisation schedules and where services can be freely accessed. Staff education sessions already include paediatrics, public health and clinical quality improvement, so further awareness of the need for monitoring of immunisation status should take place, focusing on future disease prevention.

It is essential that healthcare facilities adequately stock and safely store vaccines if improvements are to be made. It is unacceptable for vaccines to be stored incorrectly, as this can have a direct impact on their efficacy. Despite regular difficulties in acquiring stock from pharmaceutical depots in the district, it is not satisfactory for parents to turn up to clinics and find that vaccinations are not available. Simple measures such as regular monitoring of refrigerator temperature and levels of stock should take place to prevent this. Further education of healthcare professionals is necessary in this area of practice. Stock levels and storage data should be collected during further audits to assess whether this is negatively impacting the rate of immunisation uptake.

Road-to-Health cards form a key component in the monitoring of immunisation uptake. These should be assessed at every opportunity in clinical practice, and vaccinations given where necessary. Transport and cost form a major barrier to healthcare, but this is a difficult area in which improvements can be made. Routine monitoring and opportunistic administration of vaccines will decrease the need for further clinic visits. This can take place in the outpatient department, on admission, and at weekly paediatric anti-retroviral clinics.

Continuous clinical auditing and quality improvement is essential if immunisation uptake is to be increased at Zithulele hospital and peripheral clinics. Following the presentation of results and recommendations to the clinical team at Zithulele hospital, it was agreed that a further clinical audit should take place in 12 months' time to assess whether improvements have been made.

Conclusion:

As a public health control, the implementation of childhood vaccinations has contributed to an effective reduction of disease outbreak, economic burden of disease and ultimately a reduction in childhood mortality worldwide. There is great room for improvement at Zithulele hospital and in OR Tambo District, despite a dedicated and professional clinical team. By utilising the interventions recommended following the results of this study, such as routine monitoring, stock management and wider education, it is expected that vaccination uptake should further increase, with the ultimate intention of improving patient care and reducing future disease burden.

A repeat audit should take place in 12 months to assess changes made.

Appendices:

Appendix 1:

Location	UPN	Age	Birth		6 weeks				10 weeks		14 weeks				9 months		18 months		6 years	12 years
			BCG	Polio	DTaP-IPV-Hib	HBV	PCV	Rota	DTaP-IPV-Hib	HBV	DTaP-IPV-Hib	HBV	PCV	Rota	Measles	Pneum	DTaP-IPV-Hib	Measles	Td	Td
Z IN	001	2W																		
Z IN	002	19W																		
Z IN	003	7M																		
Z IN	004	1W																		
Z IN	005	22M																		
Z IN	006	2Y																		
Z IN	007	19M																		
Z IN	008	5Y																		
Z IN	009	2Y																		
Z OPD	010	2Y																		
Z OPD	011	3Y																		
Z OPD	012	4W																		
Z OPD	013	11Y																		
Z OPD	014	8Y																		
Z OPD	015	12M																		
Z OPD	016	19W																		
Z OPD	017	2Y																		
Z OPD	018	23M																		
Z OPD	019	8M																		
Z OPD	020	4Y																		
Z OPD	021	9Y																		
PUM	022	17M																		
PUM	023	6Y																		
Z OPD	024	20M																		
Z OPD	025	3W																		
Z OPD	026	21M																		
Z OPD	027	3Y																		
Z OPD	028	6M																		
Z OPD	029	18M																		
Z OPD	030	3Y																		
Z OPD	031	10W																		
Z OPD	032	21M																		
PUM	033	5Y																		
PUM	034	15M																		
PUM	035	11M																		
PUM	036	12M																		
PUM	037	20M																		
PUM	038	19M																		
PUM	039	12W																		
PUM	040	3Y																		
PUM	041	7M																		
PUM	042	12M																		
PUM	043	7M																		
PUM	044	11M																		
PUM	045	12M																		
PUM	046	10W																		
PUM	047	13M																		
PUM	048	21M																		
PUM	049	19W																		
Z OPD	050	20W																		
Z OPD	051	7M																		
Z OPD	052	20W																		
Z OPD	053	15W																		
Z OPD	054	8W																		
Z OPD	055	2Y																		
Z OPD	056	10M																		
Z OPD	057	3Y																		
Z OPD	058	6M																		
Z OPD	059	4Y																		
Z OPD	060	13M																		
Z OPD	061	23M																		
Z OPD	062	13M																		
Z OPD	063	8M																		
Z OPD	064	2Y																		
Z OPD	065	7M																		
Z OPD	066	8M																		
Z OPD	067	15M																		
Z OPD	068	1D																		
Z OPD	069	4Y																		
Z OPD	070	2Y																		
Z OPD	071	8M																		
Z OPD	072	13W																		
Z OPD	073	2Y																		
Z OPD	074	8Y																		
Z OPD	075	1D																		
Z OPD	076	3Y																		
Z OPD	077	20M																		
Z OPD	078	6M																		
Z OPD	079	2Y																		
Z OPD	080	6M																		
Z OPD	081	15M																		
Z OPD	082	2Y																		
Z OPD	083	6Y																		

Location	UPN	Age	Birth		6 weeks				10 weeks		14 weeks				9 months		18 months		6 years	12 years
			BCG	Polio	DTaP-IPV-Hib	HBV	PCV	Rota	DTaP-IPV-Hib	HBV	DTaP-IPV-Hib	HBV	PCV	Rota	Measles	Pneum	DTaP-IPV-Hib	Measles	Td	Td
Z OPD	084	4Y																		
Z OPD	085	2Y																		
Z OPD	086	19M																		
Z OPD	087	3Y																		
Z IN	088	19M																		
Z IN	089	23M																		
Z IN	090	20W																		
Z IN	091	10M																		
Z IN	092	11M																		
PUM	093	6Y																		
PUM	094	5Y																		
PUM	095	2Y																		
PUM	096	5W																		
PUM	097	1W																		
PUM	098	6Y																		
PUM	099	6Y																		
PUM	100	3Y																		
PUM	101	3D																		
PUM	102	19M																		
PUM	103	15M																		
PUM	104	3Y																		
Z OPD	105	10M																		
PUM	106	2Y																		
PUM	107	2W																		
PUM	108	2Y																		
PUM	109	11M																		
PUM	110	23W																		
PUM	111	21M																		
Z OPD	112	16M																		
Z OPD	113	3Y																		
Z OPD	114	22M																		
Z OPD	115	17W																		
Z OPD	116	17W																		
Z OPD	117	8M																		
Z OPD	118	5Y																		
Z OPD	119	17W																		
Z OPD	120	3Y																		
Z OPD	121	2Y																		
Z OPD	122	2Y																		
Z IN	123	5Y																		
PUM	124	3Y																		
PUM	125	6M																		
PUM	126	11W																		
PUM	127	11W																		
PUM	128	2Y																		
PUM	129	4Y																		
PUM	130	11W																		
PUM	131	17W																		
PUM	132	14M																		
PUM	133	24W																		
PUM	134	18M																		
WILO	135	6W																		
WILO	136	8M																		
WILO	137	24W																		
WILO	138	6W																		
WILO	139	4Y																		
WILO	140	2Y																		
WILO	141	13M																		
WILO	142	4W																		
WILO	143	2Y																		
WILO	144	3Y																		
WILO	145	18M																		
WILO	146	7M																		
WILO	147	3Y																		
WILO	148	2W																		
PUM	149	3Y																		
PUM	150	23M																		
PUM	151	2Y																		
PUM	152	4Y																		
PUM	153	10Y																		
PUM	154	3Y																		
Z IN	155	4Y																		
Z IN	156	4Y																		
Z IN	157	22M																		
Z OPD	158	16W																		
Z OPD	159	11W																		
Z OPD	160	12M																		
Z OPD	161	13M																		
Z OPD	162	7Y																		
Z OPD	163	3Y																		
Z OPD	164	4Y																		
Z OPD	165	3D																		
Z OPD	166	12M																		
Z OPD	167	5D																		
Z OPD	168	4Y																		
Z OPD	169	6Y																		
Z OPD	170	3Y																		
Z OPD	171	7Y																		

Location	UPN	Age	Birth		6 weeks				10 weeks		14 weeks				9 months		18 months		6 years	12 years
			BCG	Polio	DTaP-IPV-Hib	HBV	PCV	Rota	DTaP-IPV-Hib	HBV	DTaP-IPV-Hib	HBV	PCV	Rota	Measles	Pneum	DTaP-IPV-Hib	Measles	Td	Td
Z OPD	172	2Y																		
PUM	173	20W																		
PUM	174	3Y																		
PUM	175	13M																		
PUM	176	17M																		
PUM	177	9Y																		
PUM	178	2Y																		
PUM	179	7Y																		
PUM	180	23M																		
PUM	181	13M																		
PUM	182	4M																		
Z IN	183	2W																		
Z IN	184	2Y																		
Z OPD	185	2Y																		
Z OPD	186	2Y																		
Z OPD	187	3Y																		
Z OPD	188	2Y																		
Z OPD	189	16M																		
Z OPD	190	2Y																		
Z OPD	191	3W																		
JAL	192	2D																		
JAL	193	4W																		
JAL	194	14W																		
JAL	195	16M																		
JAL	196	13M																		
JAL	197	5W																		
JAL	198	2Y																		
JAL	199	8M																		
JAL	200	17W																		
JAL	201	8W																		
JAL	202	16M																		
JAL	203	13M																		
JAL	204	18M																		
JAL	205	11M																		
JAL	206	22M																		
JAL	207	8M																		
JAL	208	16M																		
JAL	209	4Y																		
JAL	210	5M																		
JAL	211	10M																		

Z IN = Zithulele Inpatient
Z OPD = Zithulele Outpatient
PUM = Pumalanga Clinic
WILO = Wilo Clinic
JAL = Jalamba Clinic

Vaccinated
Due for vaccination
Not vaccinated

Appendix 2.0

Childhood Vaccination Questionnaire

I am a 5th year medical student visiting from the UK, and would be very grateful if you could please answer the following questions about your thoughts on childhood vaccinations. All answers are strictly confidential and used for educational purposes only. Completion of this questionnaire will not affect your child's treatment. Thank you very much for your time.

Unique Patient Identifier :

1. **Is your child up-to-date with their vaccinations, with a completed schedule?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No

2. **Do you think vaccinations are beneficial to your child's health?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No

3. **Which of the following disease have you heard of?**
   Tick all that apply.
   - ☐ Diptheria, Tetanus, Pertussis (Whooping Cough)
   - ☐ Polio
   - ☐ Measles
   - ☐ Hepatitis B
   - ☐ TB

4. **Do you trust doctors & nurses to advise you of the benefits/risks of vaccinations?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No (please expand)

5. **Has anyone/anything discouraged you from getting your child vaccinated?**
   Mark only one oval.
   - ◯ Yes (please expand)
   - ◯ No

6. **Do you trust the government to make decisions about your child's health?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No (please expand)

7. **Do you trust the pharmaceutical industry to produce vaccinations that are safe for your child?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No (please expand)

8. **Do you think that childhood vaccinations should be compulsory?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No

9. **Would cost affect your decision to get your child vaccinated?**
   Mark only one oval.
   - ◯ Yes
   - ◯ No

10. **Would the distance to travel to a hospital or clinic affect your decision to get your child vaccinated?**
    Mark only one oval.
    - ◯ Yes
    - ◯ No

11. **Is there anything else that would stop you from getting your child vaccinated?**

12. **Any other thoughts would be much appreciated. Thank you for your time.**

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