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The Comparative Analysis of Different Formulations of PCV and Its Effect on Immune Response after Prophylactic Administration of Antipyretic in Pediatrics

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ABSTRACT:

BACKGROUND INFORMATION: Streptococcus pneumoniae is the leading bacterial pathogen in children, particularly in infants and young children. Can cause lobar pneumonia (affecting one or more lung lobes) or bronchopneumonia (patchy areas in both lungs). Vaccination is a simple, safe, and effective way of protecting people against harmful diseases before they come into contact with them. It uses the body's natural defenses to build resistance to specific infections and makes the immune system stronger. Vaccine adherence in the children and reporting immune responses and counseling about the missed dose schedules.

MATERIALS AND METHODS: A descriptive research approach with a nonexperimental design was adopted for the study. a total of 144 children with immunization schedules who met with inclusion criteria were selected. All the immunization charts of the children were monitored and noted. The most preferred vaccine for the children was compared based on their availability and cost-effectiveness. Immune responses were reported by communicating with the caretakers any missed dose schedules by the children were informed about the benefits of vaccine adherence to avoid the complications associated with the pneumococcal infection.

RESULTS: The study represented about the pneumococcal conjugate vaccine indicates that older children > (0-6 months) are more likely to have missed doses compared to younger age groups < (0-6), the gender distribution of the participants is 49.3% of the participants are female, and 50.7% are male. Vaccine preferred shows the majority of children, 56.9% received the Synflorix vaccine. Vaccines are preferred based on mostly their availability 67%, followed by cost-effectiveness 47% and side effects. PCV successfully induced an immune response in a substantial proportion of individuals (72.9%) and (27.1%) did not. Mostly Pain 56.3%, fever 55.6%, erythema 43.8%, followed by itching 29.9% are the immune responses. Prophylactic treatment Antipyretic suggests that 64.6% of individuals receive it to prevent fever. Missed doses (52.1%) of the children completed their PCV schedule without missing any doses and 47.9% of children not. Irritability for more than 24 hours is seen in 27.8% of children. Counseling regarding given and missed doses was received by 94.4%, while only 5.6% did not.

CONCLUSION: The findings from this study underscore the importance of a multifaceted approach to improving pneumococcal conjugate vaccine coverage. Addressing the safety profile and reactogenicity of PCV formulations, optimizing deployment strategies, ensuring effective use of

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prophylactic antipyretics, enhancing parental knowledge, and addressing barriers to vaccine adherence is crucial for improving vaccination rates. Future research should continue to explore these areas, focusing on the development of strategies to mitigate side effects, optimize vaccine delivery, prevalence of missing dosing schedules, more focus on missing the booster dose, and enhance parental education through counseling. By addressing these factors, we can work towards achieving higher vaccine coverage and better protection against pneumococcal disease.

INTRODUCTION

Streptococcus pneumoniae is a major cause of morbidity and mortality worldwide, especially in children under 5 years of age, and it was estimated to cause about 294,000 deaths in children aged 1–59 months in 2015. Pneumococcus is capable of colonizing the nasopharyngeal region; carriage can last from weeks to years. Although colonization with pneumococcal strains is asymptomatic, it can lead to respiratory and systemic disease and is a source of spread within the community. Young children are considered the most important vector for the dissemination of pneumococci within the community because of their high frequency of nasopharyngeal carriage [1]. Pneumococcal conjugated vaccines (PCVs) were licensed in 2000 and their use has a substantial impact on the burden of pneumococcal disease leading to a significant reduction in invasive pneumococcal disease through direct and indirect protection. Different amounts of pneumococcal antibodies are required to protect against systemic disease and colonization, with higher titers needed for protection against certain serotypes and mucosal colonization [2]. While the contribution of pneumococcal vaccines to public health is indisputable, their administration is associated with mild adverse events such as decreased appetite, irritability, or local reactions (swelling and pain) in almost half of the recipients. The incidence of some events like febrile seizures seems to occur more frequently when PCVs are co-administered with other routine vaccines. There are also concerns that the reactogenicity of PCVs may increase by inserting more serotypes in the new conjugated vaccine formulations, created to deal with the "serotype replacement" phenomenon. Although the adverse events of PCVs are mild and transient, they decrease parents' acceptance and trust. Antipyretic analgesics are widely used to ameliorate vaccine adverse reactions and decrease parental anxiety, but their use has been associated with blunted vaccine immune responses to specific pneumococcal serotypes. As two new PCVs (15-valent and 20-valent) are currently in phase 3 clinical trials, the effect of antipyretics on the antibody titer to specific serotypes will be crucial.[3]

EPIDEMIOLOGY AND TYPES OF PNEUMONIA

Childhood pneumonia is a significant global health issue, particularly affecting children under five years old. It is the leading infectious cause of death in this age group, accounting for approximately 14% of all deaths among children under five, with around 740,000 fatalities reported in 2019 alone. [4]

INCIDENCE AND PREVALENCE

Globally, pneumonia affects about 156 million children annually, with the incidence estimated at 0.29 episodes per child year in developing countries and 0.05 in developed nations. The highest burden is seen in South Asia and sub-Saharan Africa, where the incidence can reach 2,500 cases per 100,000 children. Notably, India, China, and Pakistan contribute significantly to the global pneumonia burden, with millions of new cases each year. [5]

TYPES OF PNEUMONIA

Bacterial Pneumonia - The most common type, often caused by Streptococcus pneumoniae bacteria. Can affect all ages but the risk is higher with weakened immunity, chronic illness, smoking, etc. Can cause lobar pneumonia (affecting one or more lung lobes) or bronchopneumonia (patchy areas in both lungs).

Viral Pneumonia - Caused by viruses like influenza, responsible for about 1/3 of pneumonia cases Symptoms are usually milder than bacterial pneumonia. Having viral pneumonia can increase the risk of developing bacterial pneumonia. [6]

Mycoplasma Pneumonia - Also called "atypical" or "walking" pneumonia. Caused by Mycoplasma pneumoniae bacteria, symptoms are milder and more

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widespread. Mainly affects older children and young adults. [7]

Fungal Pneumonia - Caused by fungi found in soil or bird droppings, mainly affects those with weakened immune systems. One type is pneumocystis jirovecii pneumonia (PCP) which often affects AIDS patients. [8]

PATHOPHYSIOLOGY OF PNEUMONIA

Pneumonia is an invasion of the lower respiratory tract below the larynx by pathogens either by inhalation, aspiration, respiratory epithelium invasion, or hematogenous spread. There are barriers to infection that include anatomical structures (nasal hairs, turbinates, epiglottis, cilia) and humoral and cellular immunity. [9] Once these barriers are breached, infection, either by fomite/droplet spread (mostly viruses) or nasopharyngeal colonization (mostly bacterial), results in inflammation and injury or death of surrounding epithelium and alveoli. This is ultimately accompanied by a migration of inflammatory cells to the site of infection, causing an exudative process, which in turn impairs oxygenation. In the majority of cases, the microbe is not identified, and the most common cause is viral etiology. [10]

IMMUNIZATION

Vaccination is a simple, safe, and effective way of protecting people against harmful diseases before they come into contact with them. It uses the body's natural defenses to build resistance to specific infections and makes the immune system stronger. Vaccines contain weakened or killed forms of germs like viruses or bacteria. [11] When administered, they stimulate the immune system to produce antibodies, just as it would when have exposed to the actual disease. However, vaccines do not cause the disease or put you at risk of its complications. Most vaccines are given by injection, but some are given orally (by mouth) or sprayed into the nose. Vaccination is the administration of a vaccine to help the immune system develop immunity from a disease. [12]

PCV VACCINATION SCHEDULES

The pneumococcal conjugate vaccine (PCV) is recommended for infants, children, and adults to protect against invasive pneumococcal disease, pneumonia, and acute otitis media caused by Streptococcus pneumoniae. For infants and children under 2 years old, the CDC recommends a 4-dose series of PCV15 or PCV20 at the ages OF 2 months,4 months,6 months, and 12-15 months. If a child misses' doses or starts the series late, they should still get vaccinated. The number of doses and intervals depend on the child's age when vaccination begins. For adults 65 years or older who have not previously received PCV13 or PCV15, a single dose of PCV15 or PCV20 is recommended. [13] If PCV15 is used, it should be followed by a dose of PPSV23 at least 1 year later (minimum 8 weeks for those with immunocompromising conditions, the cochlear implant, or CSF leak). If PCV20 is used, no additional PPSV23 dose is needed. For adults 19-64 years old with certain medical conditions, a single dose of PCV15 or PCV20 is recommended, followed by PPSV23 as above. PCV doses should be administered at least 4 weeks apart. PCV and PPSV23 should be given at least 1 year apart for most adults (minimum 8 weeks for those with risk conditions). Do not repeat the dose if a dose is inadvertently given earlier than the minimum interval. PCV is administered as a 0.5 mL intramuscular injection in the anterolateral thigh for infants and deltoid muscle for children ≥2 years old. Doses should be given in the right thigh if multiple injections are needed. [14]

MATERIALS AND METHODS

It is a prospective Observational study on "The comparative analysis of different formulations of PCV and its effect on immune response after prophylactic administration of antipyretic in paediatrics" conducted at the Department of Paediatrics at Malla Reddy Hospitals, Hyderabad, Telangana. The study was carried out for 6 months and the sample size was 144 patients. After obtaining ethical clearance, all required information was collected using a patient data collection form. The study procedure will be explained to the subject attender and informed consent obtained from them individually. All the information regarding the child's immunization status was collected from the patient's profile form using the data collection form. Based on the data collected the vaccine types are categorized accordingly. The offender of the subject will be queried regarding any history of fever after immunization. The inclusion criteria include patients who were aged 0 to 3, healthy pediatric patients, both genders, and Patients from OPD and IPD. The exclusion criteria include patients who were with chronic abnormalities, Patients with other co-morbidities, genetic abnormalities, and chronic use of analgesics, and

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Pediatric patients above 3 years of age. The data was noted in the data collection form and analyzed through MICROSOFT EXCEL for analysis. IBM SPSS Software will be utilized for further analysis by a statistician to conclude. Thereafter, the results will be stratified and the detailed project report will be prepared and submitted.

RESULTS

Table 1. Distribution of children according to age

Age class	COUNTS	CUMULATIVE %
(0-6)	63	43.8%
(0-12)	28	19.4%
(12-18)	23	16%
(24-30)	18	12.5%
(18-24)	10	6.9%
(30-36)	2	1.3%

The age-wise distribution of the study participants indicates that the majority of the children (43.8%) fall within the age range of (0-6) months. The high representation in this age (0-6) group indicates a critical opportunity for vaccination to prevent serious diseases like pneumonia and meningitis in the most vulnerable population. The 30-36 months age group has the smallest representation with only 2 patients (1.3%). This indicates a very low prevalence.

Table 2. Distribution of children according to gender

GENDER	COUNT	% OF TOTAL
MALE	73	50.7 %
FEMALE	71	49.3 %

In this study examining the effects of the pneumococcal conjugate vaccine, the gender distribution of the participants is relatively balanced, with a slight predominance of male participants. Specifically, 49.3% of the participants are female, and 50.7% are male. This near-equal distribution ensures that gender-related factors are likely to be evenly represented, minimizing gender bias and enhancing the reliability of the findings across both sexes.

Table 3. Distribution of children according to the frequency of different vaccine brands

VACCINATION	COUNTS	% OF TOTAL
INFANRIX	15	10.4 %
PENTAVAC PFS	20	13.9 %
PREVENAR – 13	12	8.3 %
QUADRAVAC PFS	15	10.4 %
SINFLORIX	82	56.9 %

The data shows the distribution of children according to the frequency of different vaccine brands in a study on the pneumococcal conjugate vaccine. The majority of children, 56.9% (82 children), received the Synflorix vaccine, making it the most commonly administered vaccine. The remaining children were vaccinated with the following brands: Pentavac PFS (13.9%, 20 children), Infanrix and Quadravac PFS (both 10.4%, 15 children each), and Prevenar-13 (8.3%, 12 children).

Table 4. Distribution according to the dose

DOSE	COUNTS	% of Total
Booster dose - 15 months	29	20.1%
First dose - with in 6 weeks	49	34.0 %
First dose - with in 6 weeks, second dose - with in 10 weeks	1	0.7 %
First dose - within 6 weeks, second dose - within 10weeks, third dose - within 14weeks, booster dose - 15 months	1	0.7%
Second dose - within 10 weeks	32	22.2%
Third dose - within 14 weeks	31	21.5%
Third dose - within 14 weeks, booster dose - 15 months	1	0.7 %

The distribution of children according to the dose regimen of the pneumococcal conjugate vaccine is as follows:

34.0% (51 children) received the first dose within 6 weeks.

22.2% (32 children) received the second dose within 10 weeks.

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21.5% (31 children) received the third dose within 14 weeks.

20.1% (29 children) received the booster dose at 15 months.

A small percentage of children followed more complex dosing regimens:

0.7% (1 child) received both the first and second doses on schedule, and

0.7% (1 child) completed the full vaccination schedule with three doses plus a booster.

0.7% (1 child) received the third dose and a booster.

The data indicates that a significant portion of the children (34%) received the first dose of the pneumococcal conjugate vaccine within the recommended time frame of 6 weeks, with subsequent doses being administered at progressively lower rates.

TABLE 5. Distribution according to the vaccine preferred based on the following Factors

Vaccine preferred based on	FEMALE	MALE	TOTAL %
Availability	34	27	67
Cost-effective	20	27	47
Efficacy	0	1	1
Less side effects	16	18	34

The data provided represents the preferences for a pneumococcal conjugate vaccine based on various factors (availability, cost-effectiveness, efficacy, and fewer side effects)

1. Availability: 67%

2. Cost-Effectiveness: 47%

3. Fewer Side Effects: 34%

4. Efficacy: 1%

The analysis reveals that the most crucial factor in the decision-making process for the pneumococcal conjugate vaccine is its availability, followed by cost-effectiveness and side effects. Efficacy is the least considered factor. These insights could guide public health strategies to prioritize making vaccines widely accessible and affordable to increase vaccination rates, especially in populations where these factors dominate in decision-making.

Table 6. Distribution according to the doses missed by the children

MISSED DOSES	COUNTS	% OF TOTAL
NO	75	52.1 %
YES	69	47.9 %

The data represents the distribution of children who missed doses of the pneumococcal conjugate vaccine.

1. No Missed Doses: 52.1%

2. YES Missed Doses: 47.9%

The data reveals a concerning level of missed doses, with 47.9% of children not completing the pneumococcal conjugate vaccine schedule.

This suggests that nearly half of the population may not achieve full protection against pneumococcal disease, highlighting the need for targeted interventions to improve vaccine adherence. Addressing the barriers to completing the vaccination schedule is critical to ensuring optimal immunization coverage and effectiveness.

Table 7. Distribution according to the frequencies of missed reason

MISSED REASON	COUNTS	% OF TOTAL
DOSE NOT MISSED	74	51.4 %
FINANCIAL INSTABILITY	14	9.7 %
LACK OF KNOWLEDGE	40	27.8 %
POOR HEALTH OF CHILD	16	11.1 %

The distribution of missed reasons for pneumococcal conjugate vaccine (PCV) doses reveals the following:

Dose Not Missed (74 counts, 51.4%): Over half of the cases show no missed doses, indicating that a significant portion of the population effectively adheres to the vaccination schedule. Lack of Knowledge (40 counts, 27.8%): Nearly a third of missed doses are due to a lack

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of knowledge, highlighting a crucial area where educational interventions could improve vaccination rates.

Poor Health of Child (16 counts, 11.1%): Addressing these key areas could substantially reduce missed vaccinations and improve vaccine coverage.

Financial Instability (14 counts, 9.7%): Least reported.

Table 8. Distribution according to frequencies of immune response

Immune response	Counts	% OF TOTAL
Absent	39	27.1%
Present	105	72.9%

The data represents the distribution of immune responses among individuals after receiving the pneumococcal conjugate vaccine.

1. Present Immune Response: A significant majority (72.9%) of individuals demonstrated a positive immune response to the vaccine. This indicates that the pneumococcal conjugate vaccine effectively stimulates an immune response in most recipients.

2. Absent Immune Response: A minority (27.1%) of individuals did not exhibit an immune response following vaccination. This suggests that while the vaccine may not elicit a detectable immune response in all recipients, this group represents less than one-third of the population studied.

Table 8.1. Distribution according to fever as immune response

FEVER	COUNTS	% OF TOTAL
NO	64	44.4 %
YES	80	55.6 %

The data represents the distribution of children who experienced fever as an immune response following the administration of the pneumococcal conjugate vaccine.

Fever: YES

1. More than half (55.6%) of the children experienced fever as an immune response after receiving the vaccine. This suggests that fever is a relatively common post-vaccination response, which may be indicative of the body's active immune response to the vaccine.

2. A substantial portion (44.4%) of children did not experience fever following vaccination. This indicates that nearly half of the vaccinated children had no febrile reaction, suggesting a good tolerability of the vaccine in this group.

Table 8.2. distribution according to the frequencies of itching:

ITCHING	COUNTS	% OF TOTAL
NO	101	70.1 %
YES	43	29.9 %

The data represents the distribution of children who experienced itching as a side effect following the administration of the pneumococcal conjugate vaccine.

1. **Itching**: NO

The majority (70.1%) of children did not experience itching after receiving the vaccine. This indicates that itching is not a common side effect, suggesting that the vaccine is generally well-tolerated concerning this particular reaction.

2. **Itching**: YES

A smaller proportion (29.9%) of children reported itching as a side effect.

While less frequent, this side effect still affects nearly one-third of the vaccinated population, highlighting the need for awareness and potential management of this reaction.

Table 8.3. Distribution according to the frequencies of Erythema

ERYTHEMA	COUNT	% OF TOTAL
NO	81	56.3 %
YES	63	43.8 %

The data represents the distribution of children who experienced erythema (redness of the skin) as a side effect after administering the pneumococcal conjugate vaccine.

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Erythema: NO

Most children (56.3%) did not experience erythema after vaccination. This indicates that more than half of the children tolerated the vaccine without this side effect, suggesting a generally favorable reaction profile.

Erythema: YES

A significant proportion (43.8%) of children experienced erythema at the injection site. Although less than half, this side effect is still relatively common, indicating that erythema is a notable reaction that should be anticipated in a considerable number of cases.

Table 8.4. Distribution according to the frequencies of PAIN

PAIN	COUNT	% OF TOTAL
ABSENT	63	43.8 %
PRESENT	81	56.3 %

The data represents the distribution of children who experienced pain at the injection site following the administration of the pneumococcal conjugate vaccine.

Pain: Present

The majority (56.3%) of children reported pain at the injection site. This suggests that pain is a relatively frequent side effect and is the most commonly reported post-vaccination reactions among the symptoms surveyed.

Pain: Absent

A significant portion (43.8%) of children did not experience pain after vaccination. This indicates that while pain is a common reaction, a substantial number of children tolerate the vaccine without this discomfort.

Table 8.5. Distribution according to the frequencies of Irritability for more than

24 hours

IRRITABILITY	COUNT	% OF TOTAL
NO	104	72.2 %
YES	40	27.8 %

The data represents the distribution of children who experienced irritability for more than 24 hours following the administration of the pneumococcal conjugate vaccine.

Irritability: NO

A majority (72.2%) of children did not experience irritability lasting more than 24 hours after vaccination. This indicates that a significant proportion of children did not have prolonged irritability, suggesting that the vaccine is well-tolerated concerning this side effect for most children.

Irritability: YES

A notable proportion (27.8%) of children experienced irritability for more than 24 hours following the vaccine. While less than a third, this percentage indicates that irritability is a relevant concern for a subset of the vaccinated.

Table 8.6. Distribution according to the prophylactic treatment antipyretic

Paracetamol

PTA_ PARACETAMOL	COUNTS	% OF TOTAL
NO	51	35.4%
YES	93	64.6 %

The data presents the distribution of individuals who received prophylactic treatment with antipyretic Paracetamol following the administration of the pneumococcal conjugate vaccine.

Prophylactic Paracetamol: YES

The majority (64.6%) of individuals were administered prophylactic Paracetamol following vaccination. This indicates a prevalent use of antipyretics to mitigate the risk of fever post-vaccination, reflecting a common practice in managing postvaccination symptoms.

Prophylactic Paracetamol: NO

A minority (35.4%) of individuals did not receive prophylactic Paracetamol after vaccination. This suggests that a significant portion of the population either did not require or was not administered Paracetamol as a preventive measure against potential vaccine-related fever.

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Table 9. Distribution according to the frequencies of counselling

COUNSELING	COUNTS	% OF TOTAL
NO	8	5.6 %
YES	136	94.4 %

The data represents the distribution of whether counselling was provided to caregivers regarding the pneumococcal conjugate vaccine.

Counselling: YES

The vast majority (94.4%) of caregivers received counselling regarding the pneumococcal conjugate vaccine. This high percentage indicates that counselling is a prevalent and integral part of the vaccination process, reflecting a strong emphasis on ensuring that caregivers are well-informed about the vaccine.

Counseling: NO

A very small proportion (5.6%) of caregivers did not receive counselling about the vaccine. This indicates that counselling is not commonly omitted, suggesting a high standard of practice in providing information to caregivers.

DISCUSSION

This study includes a total of n=144 children and the data provided highlights several factors related to the pneumococcal conjugate vaccine, with a focus on age, gender, missed dose, vaccination brand, dosing regimen, vaccine preference, immune response, prophylactic treatment, and patient counselling. This discussion integrates and contextualizes the data findings within broader themes of vaccine safety, deployment optimization, and parental education. It provides actionable insights for improving vaccination practices and addressing the factors influencing missed doses. Older children > (0-6 months) are more likely to have missed doses than younger age groups. This suggests that adherence to the vaccination schedule is better in younger children, and interventions might be needed to improve vaccine uptake among children. The high representation in this age group (0-6) indicates a critical opportunity for vaccination to prevent serious diseases like pneumonia and meningitis in the most vulnerable population.

A similar report was observed in Susanna Esposito, Alessandro Lizioli, and Annalisa Lastrico. A simplified PCV-7 vaccination schedule of two doses at 3 and 5 months, followed by a booster at 11-12 months, can be as effective as the traditional four-dose schedule in both premature and full-term infants. Gender in this study examining the effects of the pneumococcal conjugate vaccine the gender distribution of the participants is relatively balanced, with a slight predominance of male participants. Specifically, 49.3% of the participants are female, and 50.7% are male. This near-equal distribution ensures that gender-related factors are likely to be evenly represented, minimizing gender bias and enhancing the reliability of the findings across both sexes.

Vaccine preferred shows the majority of children, 56.9% received the Synflorix vaccine, making it the most commonly administered vaccine. The remaining children were vaccinated with Pentavac PFS (13.9%,), Infanrix and Quadravac PFS (both 10.4%,), and Prevenar-13 (8.3%) indicates a strong preference or availability of the Synflorix vaccine in the study population. The significant use of Synflorix suggests that it is a primary vaccine in the immunization schedule for pneumococcal disease in this cohort. The relatively lower usage of Prevenar-13 and other vaccines may reflect differences in vaccine availability, healthcare provider preferences, or regional vaccination policies. Understanding these factors is crucial for evaluating the comparative effectiveness and potential impact of different vaccine brands on pneumococcal disease prevention in the studied population.

A similar report was observed in Xiuting MM; Gai Tobe, Ruoyan MSc, PhD; Liu, Xiaoyan MPH; Mori, Rintaro MD, MPH, PhD. The overall efficacy of PCV-13 against pneumonia, IPD, and AOM was 83.1%, 85.2% and 55.3%, respectively, calculated by multiplying the PCV-7 direct efficacy by the serotype coverage. [15] Dosing regimen data indicates that a significant portion of the children (34%) received the first dose of the pneumococcal conjugate vaccine within the recommended time frame of 6 weeks, with subsequent doses being administered at progressively lower rates. The distribution reflects a drop-off in adherence as the vaccine schedule progresses, particularly in the transition from the first to the third doses and the booster dose. This pattern suggests challenges in maintaining full adherence to the vaccination schedule, which could be due to factors

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such as vaccine availability, parental compliance, or healthcare access. The relatively high percentage of children receiving the initial dose indicates good initiation of the vaccine schedule, but the drop in subsequent doses highlights a potential area for public health intervention to ensure more complete coverage and optimal protection against pneumococcal disease. A similar report was observed in Maren Laurenz Christof von Eiff, Kathrin Borchert et al**.** The majority of patients waited roughly two years after receiving their third dose before getting a booster shot which led to delay in the dosage regimen. [16]

Vaccines are preferred based on mostly its availability, followed by cost-effectiveness and side effects. Efficacy is the least considered factor. These insights could guide public health strategies to prioritize making vaccines widely accessible and affordable to increase vaccination rates, especially in populations where these factors dominate in decision-making.

The analysis highlights the need for a multifaceted approach to increase PCV uptake. Public health strategies should prioritize making vaccines widely accessible, affordable, and safe to address the key factors influencing vaccine choice. By focusing on these aspects, vaccination rates can be improved, leading to better health outcomes and reduced burden of pneumococcal diseases in the population.

A similar report was observed in Menno R. van den Bergh, Judith Spijkerman, and Kristien M. Swinnen. Pneumococcal conjugate vaccination reduces nasopharyngeal colonization and density of vaccine serotypes, contributing to the prevention of mucosal diseases like pneumonia. This reduction also leads to group protection, enhancing the overall effectiveness of the vaccine. PCV-10 (sinflorix) has been observed to be the most effective, accessible, and affordable for the patient's guardians. [17]

The immune response shows that the pneumococcal conjugate vaccine successfully induces an immune response in a substantial proportion of individuals (72.9%). However, there is a notable minority (27.1%) who did not exhibit an immune response, which may warrant further investigation into factors such as individual health status, vaccine administration, or the need for booster doses. This information is crucial for evaluating the overall efficacy of the vaccine and guiding future immunization strategies. Addressing these issues is crucial for improving vaccination strategies and ensuring broader protection against pneumococcal infections. Prophylactic treatment Antipyretic suggests that prophylactic administration of Paracetamol is a common practice after the pneumococcal conjugate vaccine, with 64.6% of individuals receiving it to prevent fever. However, 35.4% did not receive Paracetamol, which may indicate variability in the approach to managing potential side effects.

A similar report was observed in Rashmi Ranjan Das, Inusha Panigrahi, Sushree Samiksha Naik Prophylactic antipyretic administration decreases the post-vaccination adverse reactions. A recent study finds that they may also decrease the antibody responses to several vaccine antigens. This systematic review aimed to assess the evidence for a relationship between prophylactic antipyretic administration, post-vaccination adverse events, and antibody response in children. [18] Missed doses reveal a concerning level of more than half (52.1%) of the children completed their pneumococcal conjugate vaccine schedule without missing any doses and 47.9% of children do not complete the pneumococcal conjugate vaccine schedule. This suggests that nearly half of the population may not achieve full protection against pneumococcal disease, highlighting the need for targeted interventions to improve vaccine adherence. Addressing the barriers to completing the vaccination schedule is critical to ensuring optimal immunization coverage and effectiveness. A similar report was observed by Zhen Zhao, Philip J. Smith, and Holly A. Hill. Missed opportunities could be reduced by provider implementation of systems to ensure that all recommended vaccines are offered at each visit. Strategies providers could use to reduce missed opportunities for simultaneous administration of the fourth dose of PCV include patient recall, provider reminders, standing orders, extended office hours, and the use of immunization information systems (IIS). [19] Doses missed due to the majority of individuals adhering to the vaccination schedule, there are specific areas that need addressing. The most significant factor leading to missed doses is a lack of knowledge, which constitutes nearly 28% of cases. This suggests that targeted educational programs are essential for improving vaccine uptake. Financial instability, while less significant, still affects around 10% of cases, implying that financial

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support mechanisms could further enhance vaccination coverage. The minor role of poor health as a reason for missed doses suggests that health-related issues are less likely to be a barrier compared to educational and economic factors. Addressing these key areas could substantially reduce missed vaccinations and improve overall vaccine coverage. Fever as an immune response shows that fever occurred in 55.6% of children following the pneumococcal conjugate vaccine, making it a relatively common immune response. This indicates an active immune response, the occurrence of fever in more than half of the vaccinated children While a substantial portion (44.4%) of children did not experience fever following vaccination. These findings could inform healthcare providers and caregivers about the likelihood of fever post-vaccination and the potential need for appropriate supportive care as a prophylactic treatment.

A similar report was observed in Roman Chlibek, MD, and Helena Zemlickova, MD. The study shows that fever is part of the normal inflammatory process after immunisation, prophylactic antipyretic drugs are sometimes recommended to allay concerns of high fever and febrile convulsion. Itching as an immune response, itching is an uncommon side effect of the pneumococcal conjugate vaccine, with 29.9% of children experiencing it. The majority (70.1%) did not report itching, indicating good overall tolerability. However, the occurrence in nearly a third of the population suggests that healthcare providers should be prepared to address and manage this reaction in a minority of cases. These findings contribute to a comprehensive understanding of the vaccine's safety profile, which is essential for informing both healthcare providers and parents. Erythema as immune response shows that erythema occurred in 43.8% of children following the pneumococcal conjugate vaccine, making it a fairly common side effect. While the majority (56.3%) of children did not experience this reaction, the substantial occurrence of erythema suggests that healthcare providers and caregivers should be aware of its likelihood. Proper communication about this potential side effect can help manage expectations and provide appropriate care if it occurs, contributing to the overall safety and effectiveness of the vaccination program. Pain as immune response was present in 56.3% of children following the pneumococcal conjugate vaccine, making it a prevalent side effect. Although 43.8% of children did not experience pain, the majority did, highlighting the need for healthcare providers to inform caregivers about the likelihood of pain and to consider strategies for managing it. Understanding this common reaction is essential for improving the vaccination experience and ensuring better compliance with vaccination schedules. Irritability for more than 24 hours indicates that irritability lasting more than 24 hours is experienced by 27.8% of children following the pneumococcal conjugate vaccine, while the majority (72.2%) do not have prolonged irritability. Although irritability is less common than other side effects, it still affects a significant minority. These findings suggest that while most children tolerate the vaccine without extended irritability, healthcare providers should be prepared to address and manage this potential reaction in affected individuals. This can help improve the overall vaccination experience and support parental concerns. A similar report was observed in Aoi Noda, Takamasa Sakai, Genoyanagi (Pub- 3 July 2020). The characteristics of Adverse events following immunization (AEFI) reports varied considerably by pediatric patient age in previous reports. Therefore, we need to consider pediatric AEFI reports with more detailed age classifications because the potential risk of serious AEFI and the types of vaccines vary with age.

Counseling regarding given and missed doses is a prevalent practice, with 94.4% of caregivers receiving it, while only 5.6% did not. Parental knowledge about vaccine-preventable diseases, vaccine safety, and the importance of the immunization schedule significantly impacts vaccine adherence. Educational Interventions Providing educational resources and counseling to parents can address gaps in knowledge and increase awareness about the importance of completing the vaccination schedule. Initiatives such as informational pamphlets, workshops, and one-on-one counseling sessions can help improve understanding and support adherence. [20]

CONCLUSION

The findings from this study underscore the importance of a multifaceted approach to improving pneumococcal conjugate vaccine coverage. Addressing the safety profile and reactogenicity of PCV formulations, optimizing deployment strategies ensuring effective use of prophylactic antipyretics, enhancing parental knowledge, and addressing barriers to vaccine adherence

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are crucial for improving vaccination rates. This distribution indicates a strong preference or availability of the Synflorix vaccine in the study population. The significant use of Synflorix suggests that it is a primary vaccine in the immunization schedule for pneumococcal disease in this cohort. Also shows that the pneumococcal conjugate vaccine successfully induces an immune response in a substantial proportion of individuals (72.9%) mainly fever, pain, and erythema. Future research should continue to explore these areas, focusing on the development of strategies to mitigate side effects, optimize vaccine delivery, the prevalence of missing dosing schedules, more focus on missing the booster dose, and enhance parental education through counseling. By addressing these factors, we can work towards achieving higher vaccine coverage and better protection against pneumococcal disease.

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