Preferences and attitudes of healthcare providers towards pneumococcal conjugate vaccines for children ages two and under in the United States

Salini Mohanty[1]; Jui-Hua Tsai[2]; Ning Ning[3]; Ana Pena-Molina[2]; Rishi P. Verma[2]; Marieke Heisen[4]; Jessica Weaver[1]; Kristen A. Feemster[1]; Thomas Weiss[1]; Jordana Schmier[2]

[1]Merck & Co., Inc., Rahway, NJ, USA; [2]OPEN Health, Bethesda, MD, USA; [3]OPEN Health, Newton, MA, USA; [4]OPEN Health, Rotterdam, Netherlands

Background

- *S pneumoniae* is a gram-positive bacterium that causes invasive and non-invasive pneumococcal disease[1, 2]
- Young children and elderly adults are particularly vulnerable for pneumococcal disease
- Pneumococcal conjugate vaccinations (PCVs) have been used to prevent pneumococcal disease in children and adults. PCVs have significantly reduced disease burden but residual disease persists due to both vaccine serotypes (eg. 3, 19A) and non-vaccine serotypes[3,4]
- The CDC currently recommends PCV13 (covering 13 serotypes) or PCV15 (covering 15 serotypes) for all infants and children 2 through 59 months of age, and risk based PCV use in older children <19 years of age[5-7]
- There is potential for reduced immunogenicity to each individual serotype as more serotypes are added in higher-valent PCVs. Therefore, as newer PCVs are approved and introduced to the childhood immunization schedule, it is important to understand knowledge, attitudes, and acceptability among healthcare providers (HCPs)

Objectives

- This study examines HCP preferences, knowledge, and attitudes towards existing, and newer, higher-valent PCVs for children in the US

Methods

Study population

- US HCPs were recruited from an online panel and were eligible if they 1) recommended or prescribed vaccines to children ≤2 years, 2) practiced ≥2 years, and 3) spent ≥25% of their time providing care to pediatric patients
- US HCPs were selected through iterative purposeful sampling[8,9] informed by published data on the characteristics of physicians and advanced practitioners in the US[10-14]
- The study sample included physicians (ie, pediatricians and family practitioners) and advanced practitioners (ie, nurse practitioners and physician assistants)

Data collection process

- Online in-depth interviews were conducted between March and June 2022
- Interviewers trained in qualitative research methods used a semi-structured interview guide to conduct the interviews
- Interviews lasted approximately 60 minutes and were audio recorded and transcribed verbatim
- At the time of the interview, PCV15 was not yet approved for use in pediatric patients; approval was granted following the interviews. Therefore, PCV13 was considered the only available and current PCV option during the HCPs' interviews

Analysis

- Baseline demographics and practice characteristics of participants were analyzed descriptively using univariate statistics
- All interview transcripts were coded in Microsoft Excel
- An initial coding structure was determined *a priori* and iteratively refined via open coding and a team-based consensus process, where all coders (N=4) met regularly to evaluate potential newly arising codes and resolve any discrepancies
- Conceptually equivalent codes were merged into broader themes

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Results

Sample characteristics

- A total of 20 HCPs participated in the study (14 physicians and 6 advanced practitioners [AP])
- HCPs had a mean age of 46.2 years and had been in practice for an average of 15.4 years; 65% were female, and 50% worked in a practice in an urban area

Table 1. Participant characteristics

Characteristic		Physicians (N=14)	Advanced practitioners (N=6)	Total (N=20)
Specialty, n (%)	Family medicine	3 (21.4%)	3 (50%)	6 (30%)
	Pediatrics	11 (78.6%)	3 (50%)	14 (70%)
Years in practice since completing residency	Mean (range)	18.5 (5-43)	8.3 (2.5-14)	15.4 (2.5-43)
Estimated number of infants seen in a month, n (%)[a]	10-20 infants	3 (21.4%)	1 (16.7%)	4 (20%)
	20-50 infants	3 (21.4%)	3 (50%)	6 (30%)
	50-100 infants	3 (21.4%)	0 (0%)	3 (15%)
	>100 infants	5 (35.7%)	2 (33.3%)	7 (35%)
Primary practice location, n (%)[a]	Rural	1 (7.1%)	2 (33.3%)	3 (15%)
	Suburban	3 (21.4%)	4 (66.7%)	7 (35%)
	Urban	10 (71.4%)	0 (0%)	10 (50%)
Age (years)	Mean (range)	49 (37-73)	39.5 (26-54)	46.2 (26-73)
Gender, n (%)	Female	9 (64.3%)	4 (66.7%)	13 (65%)
	Male	5 (35.7%)	2 (33.3%)	7 (35%)

[a]Values may not add to 100% due to rounding.

Major Themes

- A total of 5 major themes emerged, including:
  - Attitudes toward the current PCV option (PCV13)
  - Awareness of new PCVs
  - Preference for depth (strength of immune response) vs breadth (number of unique serotypes covered)
  - Preference for more PCV options
  - Knowledge of and attitudes towards immunogenicity creep

Attitudes toward the current PCV option (PCV13)

- The majority of HCPs consider PCV13 to be sufficient in effectiveness, number of serotypes covered, duration of protection, and supply

> **Sufficient efficacy:** *"They're extremely effective. I actually still remember the table from my medical school days that showed the immense drop off in pneumococcal infections within a couple of years of those vaccines heading [into] the market."* –Physician, Family Medicine, Suburban Location

- Though HCPs largely consider PCV13 to be sufficient in effectiveness, some HCPs expressed their desire for improved protection against serotype 3 and protection against otitis media

> **Desire for improved serotype 3 protection:** *"I think my biggest qualm with PCV13 would just be it's not as great as covering the type 3 serotypes."* –Advanced Practitioner, Family Medicine, Suburban Location

- Among the HCPs who considered there to be a sufficient number of serotypes covered in the existing PCV (PCV13), a few expressed their interest in having more serotypes covered

> *"… for the time being, it looks like there are enough serotypes. But if the next vaccine which is coming out, which has more serotypes which cause otitis media and it's covered, then it will be great."* – Physician, Pediatrics, Urban Location

Awareness of new PCVs

- Half of HCPs reported some or limited awareness of new PCVs being developed for children under 24 months

> *"I'm thinking we've been briefed on a potential new vaccine that's up to 15- or 20-valent coverage that may be becoming available in the near future if it's not already available."* – Physician, Family Medicine, Rural Location

- Among the HCPs who were aware of new PCVs being developed for children, there was some confusion regarding which pneumococcal vaccines were indicated for children, as well as the availability and timing of newer higher-valent PCVs for children. For example, at the time of these interviews, PCV15 and PCV20 were approved for use in adults, while PCV13 was the only available and current PCV option for children

> *"Now we have 20 serotype vaccine. And I actually forgot which one was the one in the middle, 15 or 16. But now we have 20. So that is good."* – Physician, Family Medicine, Suburban Location

> *"I think there's a few different valents that might be coming out like a 7 and a 20 and 15 and a 12, but we haven't come across utilizing anything like that in our office to this point."* – Advanced Practitioner, Family Medicine, Suburban Location

Preference for depth vs breadth of serotype coverage

- An equal number of HCPs preferred depth (strength of immune response) or breadth (number of unique serotypes covered)
- HCPs who preferred breadth attributed it to the potential of reducing disease burden and their tolerance for breakthrough disease

> *"I think broader serotype coverage because the first job of this vaccine is to prevent serious illness, hospitalization and death."* – Physician, Pediatrics, Urban Location

> *"I would want more widespread coverage for the different serotypes because although there are some that are more potentially invasive than others, I think that I would prefer better overall coverage than just specifying certain ones."* – Physician, Pediatrics, Urban Location

- The HCPs who preferred depth of coverage attributed their preference to PCVs offering a higher immune response toward specific serotypes that are responsible for a large proportion of invasive pneumococcal disease

> *"Well, it depends what serotypes they cover. So if you give me one that's harder on Serotype 3 or has better coverage on that but has less coverage of other ones I'm not as concerned about, then I would want the one that just covers smaller amount of ones ... I'll just give you a direct answer. Higher immune response."* – Advanced Practitioner, Pediatrics, Rural Location

- Importantly, a few HCPs were unable to decide which option they preferred and expressed the need for more information to make an educated decision

> *"Oh, boy. To answer that question, I would have to see the data. I would have to look at the percentage protection based on the serotypes that you're talking about. Because if you're saying that it covers more of kind of esoteric serotypes that happen 0.001% of the time, then that would certainly affect my answer more than if you're talking about getting rid of serotypes that are much more prevalent."* – Physician, Pediatrics, Suburban Location

Preference for more PCV options

- Most HCPs were interested in having more PCV options. Their main reasons were the potential benefit against invasive serotypes, cost-effectiveness, broader serotype coverage, and increased efficacy

> *"I think that would be great, actually … Well, I always think it's good if we can cover more serotypes of pneumococcal strains as they emerge, as well as we know with antibiotic resistance issues, it's always good if we can prevent infections before they start. And so I think it would be very nice to have more vaccines for more strains for that reason."* – Advanced Practitioner, Family Medicine, Suburban Location

Knowledge of and attitudes towards immunogenicity creep

- Higher-valent PCVs in development have also been found to elicit lower immune responses relative to first-generation PCVs for the shared serotypes,[7] and this phenomenon, known as "immunogenicity creep," becomes more pronounced as more serotypes are added. HCPs were asked about knowledge of and attitudes toward this concept
  - Most HCPs requested an explanation or a refresher for the concept of immunogenicity creep
  - After understanding the concept, the majority of HCPs expressed concern, and a few HCPs were not concerned or were indifferent

> **Concerned:** *"Yes, it would be a concern, especially if it lowered immunity against the most prevalent serotype."* – Physician, Pediatrics, Suburban Location

> **Indifferent:** *"If it would be less effective, then I guess I wouldn't want to give it. But … [if it] protected against a certain amount, but there were some of them that had higher immune response to it, then I would be more open to that, if that would happen. … So I guess I'm kind of impartial."* – Advanced Practitioner, Pediatrics, Rural Location

> **Not concerned:** *"With the pneumococcal vaccine, no [concern] … We have had excellent success with pretty much any pneumococcal vaccine. They all work very, very well. So this is really kind of not a very important fish to fry … It's like choosing a dessert at the best dessert restaurant, [in] the town. Whatever you're going to get is going to be really good."* – Physician, Family Medicine, Suburban Location

Limitations

- As a qualitative study, the results are not intended to be generalizable to all physicians and APs. However, utilizing purposeful sampling, we have included a variety of HCPs with varying age, gender and practice characteristics

Conclusion

- These study results can inform understanding of knowledge, attitudes toward, and acceptability of higher-valent PCVs in pediatric practices
- While many HCPs believed the currently available PCV (PCV13) is sufficient and effective, a majority of HCPs expressed an interest in more PCV options, some noting a preference for an option with broader serotype coverage and others for an option with higher immune response to specific serotypes that cause a higher proportion of disease
- Both immune response and breadth of serotype coverage may influence HCPs' decisions when recommending new PCVs
- Additional quantitative investigations are under way to validate these findings and further explore other factors that may influence HCPs' preferences for recommending PCVs

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