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Vaccine health beliefs and educational influences among pediatric residents

Gitanjli Arora [a,*], Deborah Lehman [b], Sandhya Charlu [a], Nicole Ross [a], Adriana Ardy [a], Bahareh Gordon [b], Pia S. Pannaraj [a,c]

[a] Department of Pediatrics, Children's Hospital Los Angeles, United States
[b] Department of Pediatrics, University of California Los Angeles, United States
[c] Department of Molecular Microbiology and Immunology, University of Southern California, United States

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ABSTRACT

Objective: A pilot study of pediatric residents to describe perceived benefits and effects of vaccines and educational influences on vaccine practice among pediatric residents.
Study design: Eighty-seven residents, from two institutions in a region with relatively high vaccine hesitancy, responded to a survey conducted in 2014–2015.
Results: Residents identified professional experiences with vaccine preventable diseases (VPDs) and observing pediatricians as most impactful to their vaccine beliefs. Residents who had observed pediatric faculty agreeing to alternative or delayed vaccinations were more likely to believe this to be acceptable vaccine practice (70.1% vs. 21.1%, $\chi^2 = 17.778$, $p < 0.001$). Most residents (68 [79.1%]) reported feeling confident in their ability to discuss vaccines.
Conclusions: Pediatricians must be equipped with accurate vaccine health beliefs to impact parental vaccine hesitancy. This study identifies important gaps in medical education, with pediatric residents reporting limitations in their professional experience with VPDs and high rates of observing alternative vaccination practice.

1. Introduction

Vaccines have contributed to the decline in mortality and morbidity from various infectious diseases [1]. Despite this, pediatricians encounter parents who delay or refuse childhood vaccination. A survey of pediatric practitioners found 87% had experienced parental vaccine refusal in the preceding year [2]. Parental vaccine hesitancy has led to areas in the United States (U.S.) with vaccination below the coverage needed to maintain herd immunity [3,4]. For example, measles, declared eliminated from the U.S. in 2000, has resurged, including in 2015 with a multistate outbreak linked to a California amusement park [5,6] and a 2018 measles outbreak in the European Union [7].

Parental vaccine hesitancy is influenced by many factors, including misinformation and low perceived risk of VPDs [8]. In California there are relatively high levels of vaccine hesitancy, reflected in 2.5% of children enrolled in kindergarten in 2014–2015 were reported to have nonmedical exemptions to vaccination, as compared to the national median of 1.5% for nonmedical vaccination exemptions reported that same year [9]. Of note, after this study period, California became one of the three states in the U.S. to allow only medical exemptions from the mandatory state school-entry vaccination requirement [10]. In the majority of the U.S., where there is continued allowance of personal belief and other non-medical vaccine exemptions, there is growing parental vaccine hesitancy and a decline in rates of routine childhood vaccination [11].

A main predictor of vaccine acceptance is the recommendation made by the child's pediatrician [12–15]. Using the Health Belief Model, we conducted a pilot study to assess residents at two pediatric training programs in Los Angeles, California for their understanding of perceived severity of VPDs, perceived susceptibility of VPDs, and their belief in their ability to successfully counsel parents on the benefits and perceived risks of vaccination. Although the HBM traditionally applies to patient health behaviors, studies have applied the model to evaluate healthcare workers (HCW) in adopting infection control measures and increasing HCW influenza vaccination rates for the benefit of their patients [16,17]. The HBM,

* Corresponding author at: Department of Pediatrics, Children's Hospital Los Angeles, 4650 Sunset Blvd #170, Los Angeles, CA 90027, United States.
E-mail address: garora@chla.usc.edu (G. Arora).

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as applied to this study, is based on the understanding that a person will take a health-related action (i.e. counsel parents on VPDs and vaccines) if that person understands that a negative health condition can be avoided by such action [18]. Residents in this study were also asked to identify the educational influences that had affected their beliefs about VPDs and vaccine practice. Previous studies of pediatric residents have found deficiencies in self-reported confidence in treating VPDs [19], knowledge of vaccine practice and safety [20–22], and addressing parental vaccine hesitancy [23]. Given the importance of practitioners' beliefs to vaccine uptake in their patients [24–26], these gaps in vaccine education may lead to potential under-immunization of patients. This pilot study was conducted to identify areas for strengthening knowledge and attitudes as related to vaccine beliefs.

2. Methods

2.1. Study population

The study participants were residents at two Los Angeles, California based pediatric training programs, University of California Los Angeles (UCLA) and Children's Hospital Los Angeles (CHLA). Pediatric residents were invited by email to participate in the survey in November 2014 and January 2015 at UCLA, and in July, October, and November 2015 at CHLA.

2.2. Survey

An optional, anonymous on-line survey evaluated residents' perceived severity of VPDs, perceived susceptibility of VPDs, perceived risks and benefits of vaccination, and confidence in addressing parental vaccine concerns. We also assessed perception of educational strategies impacting vaccine beliefs. Response formats included yes/no responses, multiple response selection, 5-point Likert scale, and rankings. The Institutional Review Boards at UCLA and CHLA approved the study, and there were no incentives provided for completion of the survey.

2.3. Statistical analysis

Results of closed-ended questions and 5-point Likert scales of strongly agree to strongly disagree are reported in frequencies and percentages. Cross-tabulations were analyzed using Pearson χ^2 test. The significance level was set at $p \leq 0.05$ for asymptomatic significance (2-sided). All statistical analyses were performed using SPSS Version 24 (IBM Corp.).

3. Results

3.1. Demographics

Of the 92 UCLA and 96 CHLA pediatric residents, 87 (46.3%) completed the survey. One survey was excluded for repetitive nonsensical responses. Response rates among post-graduate training years were PGY-1 32/61 (52.5%), PGY-2 27/61 (44.3%), PGY-3 24/57 (42.1%), and PGY-4 (chief and forth-year medicine-pediatrics residents) 3/9 (33%) and at institutions UCLA 33/92 (35.9%) and CHLA 53/96 (55.2%).

3.2. Perceived severity of VPDs

Half of participants (48 [55.9%]) felt they had received adequate education on VPDs and vaccines during medical school. More residents (63 [73.2%]) reported having received adequate VPD education during pediatric residency training, with the highest (79.2%) reported by PGY-3 residents. Education about VPDs and vaccines was most frequently received from didactic lectures, informal conversations, and independent Internet searches (Fig. 1a). However, the strongest influence on residents' beliefs about vaccines was the resident's own professional experience with VPDs (Fig. 1b). Only one third (34 [39.5%]) reported experiencing at least one patient disabled from VPDs. Residents with global health experience were more likely to have seen a permanent disability resulting from VPDs, compared to residents with no previous participation in medically-related international work (81% vs. 19%, $X^2 = 5.170$, $p = 0.041$). Twenty-three (26.7%) residents reported observing one or more patients dying from VPDs.

3.3. Perceived susceptibility of VPDs

We assessed the frequency of disease encounter to estimate the residents' perceived susceptibility of VPDs. All but three respondents (83 [96.5%]) had observed or treated a patient with VPDs, with experiences varied by disease (Fig. 2). Nearly a quarter (22.1%) of respondents had never seen a patient with influenza or pertussis, and nearly half (45.3%) had never observed, diagnosed, or treated a patient with varicella. Experience with re-emerging diseases such as measles or mumps was very low; 89.5% and 97.7% of respondents had never taken care of a patient with measles and mumps, respectively.

3.4. Benefits of vaccines

All respondents (100%) agreed that the benefits of vaccines outweigh the risks. Most residents supported school entry vaccination requirements (84 [97.7%]) and elimination of personal belief vaccine exemption (78 [90.7%]). The majority of residents (78 [90.7%]) supported a licensing requirement for all health care workers to be fully protected from VPDs that pose a transmission risk to patients.

3.5. Barriers to vaccination

Common misconceptions about vaccines were assessed (Table 1). Some (6 [7%]) residents believed that infants and children receive too many vaccines at a single visit, and that multiple vaccines given at the same time could overload the immune system (2 [2.4%]) and increase the risk of learning disorders (2 [2.4%]). None of the residents reported concerns regarding association between the measles, mumps and rubella (MMR) vaccine and autism.

3.6. Educational influences on vaccine practice

Most residents were familiar with and/or knew where to locate the most up-to-date vaccination schedule (84 [97.7%]) and where to locate catch up vaccination schedules (79 [91.9%]). Observation of pediatricians talking with patients and parents about vaccines was reported as an important factor in residents' vaccine beliefs (Fig. 1b). Eleven (12.8%) residents identified that media coverage had increased their concerns about vaccine safety.

More than three-quarters of residents (67 [78.0%]) reported witnessing pediatric faculty agree to alternative or delayed vaccination schedules, and 83.7% (n = 72) of respondents had observed community pediatricians agree to alternative or delayed schedules. Although less common than agreeing to an alternative vaccination schedule, some respondents reported pediatric faculty and community pediatricians promoting alternative or delayed vaccination schedules (Table 2). Residents who observed pediatric faculty agree to alternative or delayed schedules were more likely to perceive that such schedules were acceptable (70.1% vs. 21.1%,

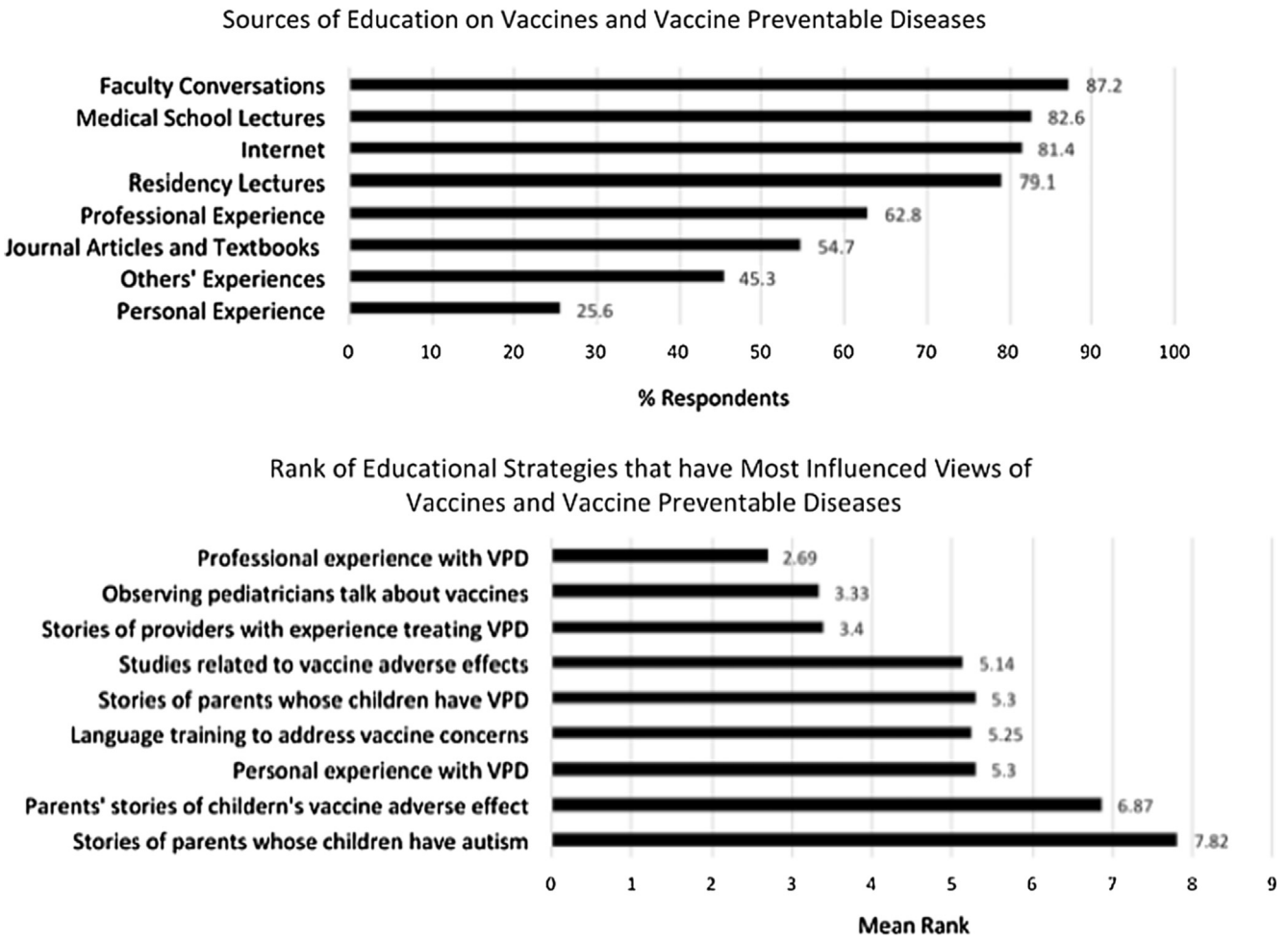

Fig. 1. (A) **Sources of education received on VPD and vaccines as described by pediatric residents.** Respondents were able to select more than one answer. (B) **Ranking of educational strategies that most influenced residents' vaccine beliefs.** Residents were asked to rank the nine education strategies in order of most influential to least influential. The mean rank is displayed for each strategy. A lower number indicates a more influential strategy. Friedman test indicated that the educational strategies were rated differently, Friedman's Q = 247.6, $p < 0.001$.

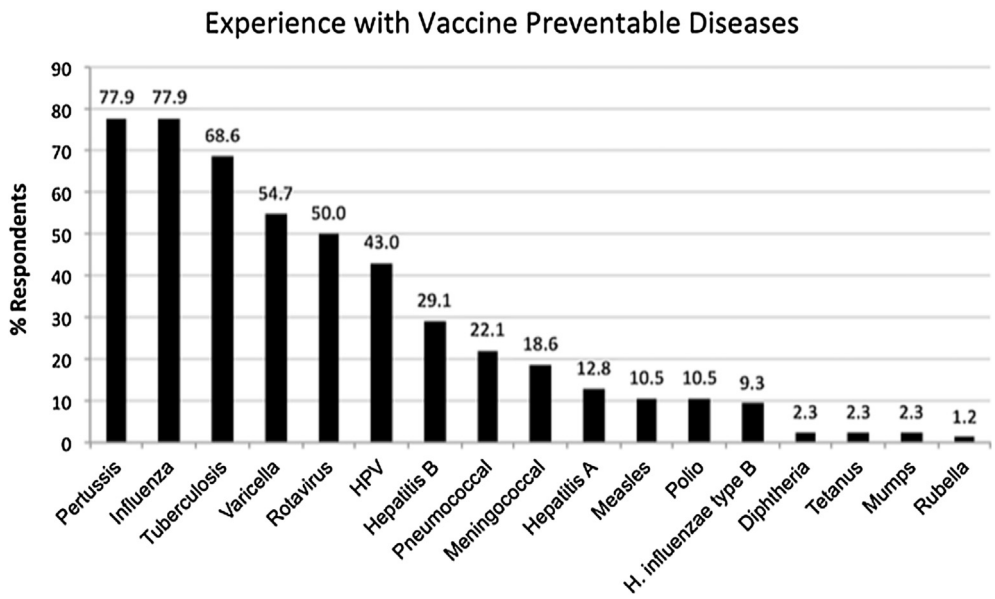

Fig. 2. VPD observed, diagnosed, or treated by pediatric resident respondents.

Table 1
Attitudes and beliefs about vaccines and vaccine hesitancy.

	Frequency (n = 86)	Percent (%)
The recommended vaccination schedule requires that infants and children receive too many vaccines in a single visit		
Yes	6	7.0
No	80	93.0
Giving multiple vaccines at the same visit has the potential to overload the immune system		
Strongly agree	1	1.2
Agree	1	1.2
Neither agree nor disagree	5	5.8
Disagree	23	26.7
Strongly disagree	56	65.1
The administration of multiple vaccines at the same visit may increase the chance of a learning disorder because vaccines contain small amounts of neurotoxins, including mercury, aluminum, and/or formaldehyde		
Strongly agree	1	1.2
Agree	1	1.2
Neither agree nor disagree	2	2.3
Disagree	22	25.6
Strongly disagree	60	69.8
Media coverage regarding vaccines has increased my concerns about the safety of vaccines		
Strongly agree	4	4.7
Agree	7	8.1
Neither agree nor disagree	10	11.6
Disagree	38	44.2
Strongly disagree	27	31.4
The advice of a health care provider is an important factor affecting whether and individual accepts immunizations for him/herself or for his/her family		
Strongly agree	37	43.0
Agree	39	45.3
Neither agree nor disagree	6	7.0
Disagree	3	3.5
Strongly disagree	1	1.2
Educating parents and patients about vaccines is an important way to increase vaccine coverage rates		
Strongly agree	56	65.1
Agree	27	31.4
Neither agree nor disagree	2	2.3
Disagree	1	1.2
Strongly disagree	0	0
Educating the media about vaccines is an important way to increase vaccine coverage rates		
Strongly agree	55	64.7
Agree	26	30.6
Neither agree nor disagree	4	4.7
Disagree	0	0
Strongly disagree	0	0

Table 2
Clinical experience with vaccine hesitancy.

	Frequency (n = 86)	Percent (%)
How often have you seen parents refusing to vaccinate their children?		
Many times (10+ times)	33	38.4
Several (2–10 times)	33	38.4
Rarely (1–2 times)	19	22.1
Never	1	1.2
How often have you seen pediatric faculty agree to alternative or delayed schedules if requested by parent?		
Many times (10+ times)	9	10.5
Several (2–10 times)	28	32.6
Rarely (1–2 times)	30	34.9
Never	19	22.1
How often have you seen pediatric faculty promote alternative or delayed vaccination schedules?		
Many times (10+ times)	2	2.3
Several (2–10 times)	7	8.1
Rarely (1–2 times)	20	23.3
Never	57	66.3
How often have you seen community pediatricians agree to alternative or delayed schedules if requested by parent?		
Many times (10+ times)	14	16.3
Several (2–10 times)	27	31.4
Rarely (1–2 times)	31	36.0
Never	14	16.3
How often have you seen community pediatricians promote alternative or delayed vaccination schedules?		
Many times (10+ times)	8	9.3
Several (2–10 times)	15	17.4
Rarely (1–2 times)	30	34.9
Never	33	38.4

$X^2 = 17.778$, $p < 0.001$). Over half (51 [59.3%]) of residents agreed with the statement "alternative or delayed schedules for parental preference ARE an acceptable alternative to the recommended Centers for Disease Control (CDC) and American Academy of Pediatrics (AAP) vaccination schedule." Thirty-six (41.8%) residents agreed with the statement that parental stress can be reduced by practitioner flexibility in spreading out necessary childhood vaccines over several visits or by delaying the vaccines. These respondents were also more likely to believe that alternative schedules were acceptable as compared to respondents who did not believe that practitioner flexibility could reduce parental distress (75.0% vs. 13.3%, $X^2 = 16.415$, $p < 0.001$).

Almost all residents (83[96.5%]) believed that educating parents and patients about vaccines is an important way to increase vaccine coverage rates. Seventy-six (88.4%) residents identified that the advice of a health care provider is an important factor affecting whether an individual is vaccinated. Most residents reported feeling confident in their ability to discuss vaccines with patients and parents (68 [79.1%]). Confidence level increased with level of training: with 23 (74.2%) PGY-1 residents felt comfortable or strongly comfortable compared to 21 (77.8%) PGY2 and 21 (87.5%) PGY-3 residents. In addition, 81 (94.2%) believed that educating the media about vaccines is an important way to increase vaccine coverage rates.

4. Discussion

Pediatricians are essential promoters of vaccine acceptance, and in accordance with the HBM, must appreciate the severity and susceptibility to VPDs and the benefits and risks of vaccines to take action to address vaccine hesitancy. This preliminary study suggests important gaps in medical education as related to vaccines.

While residents reported their own professional experience with VPDs as most influential to their vaccine beliefs, nearly a quarter reported having not seen the more prevalent VPDs of influenza and pertussis, and most had no experience with VPDs on the rise again, such as measles. Given the variability of presentation of many VPDs and limited experience, it is possible the residents may have encountered but did not recognize a VPD. It has been suggested that decreased clinical experience with VPDs is associated with decreased beliefs that vaccines are efficacious and safe [27]. Our survey found that residents with prior global health experience were more familiar with VPDs, although the difference in vaccine beliefs was not found to be significant. The growth of global health education in pediatric residency programs [28] may offer residents and faculty another opportunity to better appreciate the impact of VPDs on patients and communities. In addition to influencing one's own health beliefs, professional experience can also be shared with vaccine-hesitant parents' to strengthen their understanding of the severity and susceptibility to VPDs [8].

The educational strategy ranked by the respondents to be the second most impactful to beliefs about vaccines was observing pediatricians talk about vaccines with patients and parents. Another study of residents reported that education on addressing vaccine concerns was most often received through in-person patient care or observing their preceptor in conversation with patients and families [23]. It is notable that residents in that study identified personal and observational experiences were also their preferred option for learning. However, most residency programs lack formal curriculum to educate pediatric residents about vaccines [22,23]. Although our survey participants possessed a high perception of adequacy of training, another study found that only 30% of surveyed residents felt they had learned enough about vaccine communication during residency [23].

Modeling vaccination discussion is especially important as many studies have shown that the characteristics of the provider recommendation impact vaccine uptake [29–34]. Strategies to improve adherence to the recommended vaccination schedule include being attentive to parental concerns while correcting misconceptions, presumptive delivery, personalizing the medical information, and motivational interviewing [8].

In this study resident observation of faculty pediatricians agreeing to alternative or delayed vaccination schedules was associated with the belief of this as acceptable vaccine practice. While it is recommended to continue to engage with vaccine-hesitant parents while attempting to modify their opposition to vaccines [8], delaying vaccines greatly increases the period of time that a child remains susceptible to VPDs and residents should recognize that alternative or delayed vaccination schedules are not an acceptable alternative to the recommended immunization schedule. Further study on how to mitigate the acquisition of this perception when observing pediatric faculty and community pediatricians' work with vaccine-hesitant parents and the long-term impact of this observation on residents' future vaccine practice is necessary.

A significant limitation of the study is that we did not assess the reasons why observed pediatricians agreed to alternative or delayed vaccination schedules. This context may be critical to forming pediatric resident beliefs. Pediatricians may agree to parental requests for alternative or delayed vaccines to build trust with families and/or to retain the patient and family in their practice [35]. However, vaccine misperceptions and vaccine hesitancy may also be present in pediatricians. Pediatric residents in our study reported common misconceptions about vaccines of children receiving too many vaccines at a single visit, multiple vaccines given at the same time could overload the immune system, and increase the risk of learning disorders at similar rates to what is reported in practicing pediatricians [25]. The reasons why pediatricians serving as role-models to these residents engaged in alternative or delayed vaccine practice are unknown. Given the influence of witnessing pediatricians' vaccine practice on residents' vaccine beliefs, providing training to pediatric faculty on addressing vaccine hesitancy [34,36,37] may be beneficial in strengthening vaccine beliefs among their trainees.

Additional limitations of this study include the findings are of reported experience rather than observed practice. The survey had a low response rate and was performed at only two institutions in a single city. Future studies are needed to verify if these findings are generalizable to the larger population of pediatric residents and in varying locations.

5. Conclusions

To ensure that children remain protected from VPDs, pediatric practitioners must be effectively able to counsel parents on the benefits of vaccines and the risks of delaying or refusing vaccinations. Our study found that professional experience with VPDs and observing pediatricians talk about vaccines with patients and parents are the most impactful vaccine education strategy for pediatric residents. However, a large proportion of surveyed residents have observed academic and community faculty agree to or even promote alternative or delayed vaccination schedules. By doing so, these faculty may inadvertently decrease the perception of the importance of the CDC/AAP vaccination schedule among residents by agreeing to delayed or alternative schedules. This underscores the importance of providing formal, organized training on addressing vaccine hesitancy for both residents and faculty mentors. This may be increasingly important in times of low VPD incidence, when lack of experience with VPDs contribute to parental vaccine hesitancy and to increased vaccine hesitancy among pediatricians. The educational strategy of modeling recommended vaccination practice must be optimized to strengthen residents' perceptions of VPDs and benefits of vaccines and to improve adherence of future pediatric practitioners to recommended vaccine practice.

Description

This manuscript describes findings from a preliminary study of beliefs about vaccine preventable diseases and vaccines among pediatric residents at two training programs in a region of the United States with relatively high parental vaccine hesitancy. The participants were also asked to describe the educational influences on their vaccine beliefs. Residents identified that observing pediatricians talk with patients and their parents about vaccines as most influential in shaping vaccine beliefs. Importantly, we found that observing pediatric faculty agree to delay or withhold vaccines was associated with residents' belief that not adhering to the recommended vaccination schedule is acceptable practice. This study suggests areas for strengthening vaccine education to strengthen vaccine health beliefs among pediatric residents, enabling them to more effectively influence vaccine uptake among their patients.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2018.12.038.

References

[1] Centers for Disease Control and Prevention (CDC). Ten great public health achievements in the 20th century, available at http://www.cdc.gov/about/history/tengpha.htm. [accessed August 1, 2017].
[2] Hough-Telford C, Kimberlin DW, Aban I, et al. Vaccine delays, refusals, and patient dismissals: a survey of pediatricians. Pediatrics 2016;138(3):e20162127.
[3] Phadke VK, Bednarczyk RA, Salmon DA, Omer SB. Association between vaccine refusal and vaccine-preventable diseases in the United States: A review of measles and pertussis. JAMA 2016;315(11):1149–58.
[4] Olive JK, Hotez PJ, Damania A, Nolan MS. The state of the antivaccine movement in the United States: a focused examination of nonmedical exemptions in states and counties. Plos Med 2018;15(6):e1002578.
[5] Centers for Disease Control and Prevention (CDC). Measles cases and outbreaks available at https://www.cdc.gov/measles/cases-outbreaks.html. [accessed August 1, 2017].
[6] Lo NC, Hotez PJ. Public health and economic consequences of vaccine hesitancy for measles in the United States. JAMA Pediatrics 2017. epublished ahead of print July 24, 2017.
[7] World Health Organization, (WHO). Measles cases hit record high in the European Region. http://www.euro.who.int/en/media-centre/sections/press-

releases/2018/measles-cases-hit-record-high-in-the-european-region [accessed November 21, 2018].
[8] Edwards K, Hackell J. Committee on infections diseases, the committee on practice and ambulatory medicine, et al. countering vaccine hesitancy. Pediatrics 2016;138(3).
[9] Centers for Disease Control and Prevention (CDC). Vaccination coverage among children in kindergarten - United States -SY. MMWR Morb Mortal Wkly Rep. 2015; 64(33): 897–904.
[10] Yang YT, Barraza L, Weidenaar K. Measles outbreak as a catalyst for stricter vaccine exemption legislation. JAMA 2015;314(12):1229–30.
[11] Gowda C, Dempsey AF. The rise (and fall?) of parental vaccine hesitancy. Hum Vaccin Immunother 2013;9(8):1755–62.
[12] Dubé E, Gagnon D, Macdonald NE. Strategies intended to address vaccine hesitancy: Review of published reviews. Vaccine 2015;33:4191–203.
[13] Kundi M, Obermeier P, Helfert S, et al. The impact of the parent-physician relationship on parental vaccine safety perceptions. Curr Drug Saf 2015;10:16–22.
[14] Chung Y, Schamel J, Fisher A, Frew PM. Influences on immuniztion decision-making among US parents of young children. Matern Child Health J. 2017. epublished ahead of print.
[15] Opel DJ, Heritage J, Taylor JA, et al. The architecture of provider-parent vaccine discussions at health supervision visits. Pediatrics 2013;132:1037–46.
[16] Ziegheimat F, Edabi A, Rahmati-Najarkolaei F, Ghadamgahi F. An investigation into the effect of health belief model-based education on healthcare behaviors of nursing staff in controlling nosocomial infections. J Educ Health Promot. 2016;5(23).
[17] Corace KM, Srigley JA, Hargadon DP, et al. Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review. Vaccine 2016;34(28):3235–42.
[18] Rosenstock IM. Historical origens of the health belief model. Health Educ Monogr 1974;2:328–86.
[19] Cordrey K, McLaughlin L, Das P, Milanaik R. Pediatric resident education and preparedness regarding vaccine-preventable diseases. Clin Pediatr 2018;57(3):327–34.
[20] England L, Shelton R, Schubert CJ. Immunizing preschool children: beliefs and practices of pediatric residents. Clin Pediatr 1997;36(3):129–34.
[21] Campbell JR, Szilagyi PG, Rodewald LE, Winter NL, Humiston SG, Roghmann KJ. Intent to immunize among pediatric and family medicine residents. Arch Pediatr Adolesc Med 1994;148(9):926–9.
[22] Williams SE. R S. Formal training in vaccine safety to address parental concerns not routinely conducted in U.S. pediatric residency programs. Vaccine 2014;30(32):3175–8.
[23] Sarnquist C, Sawyer M, Calvin K, et al. Communicating about vaccines and vaccine safety: what are medical residents learning and what do they want to learn? J Public Health Manag Pract 2013;19(1):40–6.
[24] Zimmerman RK, Schlesselman JJ, Baird AL, Mieczkowski TA. A national survey to understand why physicians defer childhood immunizations. Arch Pediatr Adolesc Med 1997;151:657–64.
[25] Suryadevara M, Handela A, Bonvillea CA, Cibulab DA, Domachowskea JB. Pediatric provider vaccine hesitancy: An under-recognized obstacle to immunizing children. Vaccine 2015;33:6629–34.
[26] Smith PJ, Kennedy AM, Wooten K, Gust DA, Pickering LK. Association between health care providers' influence on parents who have concerns about vaccine safety and vaccination coverage. Pediatrics 2006;118:e1287–92.
[27] Mergler MJ, Omer SB, Pan WK, et al. Are recent medical graduates more skeptical of vaccines? Vaccines 2013;29(1):154–66.
[28] Butteris SM, Schubert CJ, Batra M, et al. Global health education in US pediatric residency programs. Pediatrics 2015;136(3):458–65.
[29] Gilkey MB, Calo WA, Moss JL, Shah PD, Marciniak MW, Brewer NT. Provider communication and HPV vaccination: The impact of recommendation quality. Vaccine 2016;34(9):1187–92.
[30] Nyhan B, Reifler J, Richey S, Freed GL. Effective messages in vaccine promotion: a randomized trial. Pediatrics 2014;133(4):e835–42.
[31] Gilkey MB, Malo TL, Shah PD, Hall ME, Brewer NT. Quality of physician communication about human papillomavirus vaccine: findings from a national survey. Cancer Epidemiol Biomarkers Prev 2015;24(11):1673–9.
[32] Brewer NT, Hall ME, Malo TL, Gilkey MB, Quinn B, Lathren C. Announcements versus conversations to improve HPV vaccination coverage: a randomized trial. Pediatrics 2017;139(1).
[33] Jacobson RMVEL, Bahta L. The C.A.S.E. approach: guidance for talking to vaccine-hesitant parents. Minn Med 2013;96(4):49–50.
[34] Dempsey AF, Pyrznawoski J, Lockhart S, et al. Effect of a health care professional communication training intervention on adolescent human papillomavirus vaccination: a cluster randomized clinical trial. JAMA Pediatr 2018;172(5):e180016.
[35] Kempe A, O'Leary ST, Kennedy A, et al. Physician response to parental requests to spread out the recommended vaccine schedule. Pediatrics 2015;135(4):666–7.
[36] Henrikson NB, Opel DJ, Grothaus L, et al. Physician communication training and parental vaccine hesitancy: a randomized trial. Pediatrics 2015;136(1):70–9.
[37] Perkins RB, Zisblatt L, Legler A, Trucks E, Hanchate A, Gorin SS. Effectiveness of a provider-focused intervention to improve HPV vaccination rates in boys and girls. Vaccine 2015;33(9):1223–9.