Physician Response to Parental Requests to Spread Out the Recommended Vaccine Schedule

Allison Kempe, MD, MPH[a,b], Sean T. O'Leary, MD, MPH[a,b], Allison Kennedy, MPH[c], Lori A. Crane, PhD, MPH[a,d], Mandy A. Allison, MD, MPH[a,b], Brenda L. Beaty, MSPH[a], Laura P. Hurley, MD, MPH[a,e], Michaela Brtnikova, PhD[a], Andrea Jimenez-Zambrano, MPH[a], Shannon Stokley, MPH[c]

abstract

OBJECTIVES: To assess among US physicians (1) frequency of requests to spread out recommended vaccination schedule for children <2 years, (2) attitudes regarding such requests, and (3) strategies used and perceived effectiveness in response to such requests.

METHODS: An e-mail and mail survey of a nationally representative sample of pediatricians and family physicians from June 2012 through October 2012.

RESULTS: The response rate was 66% (534 of 815). In a typical month, 93% reported some parents of children <2 years requested to spread out vaccines; 21% reported ≥10% of parents made this request. Most respondents thought these parents were putting their children at risk for disease (87%) and that it was more painful for children (84%), but if they agreed to requests, it would build trust with families (82%); further, they believed that if they did not agree, families might leave their practice (80%). Forty percent reported this issue had decreased their job satisfaction. Most agreed to spread out vaccines when requested, either often/always (37%) or sometimes (37%); 2% would often/always, 4% would sometimes, and 12% would rarely dismiss families from their practice if they wanted to spread out the primary series. Physicians reported using a variety of strategies in response to requests but did not think they were effective.

CONCLUSIONS: Virtually all providers encounter requests to spread out vaccines in a typical month and, despite concerns, most are agreeing to do so. Providers are using many strategies in response but think few are effective. Evidence-based interventions to increase timely immunization are needed to guide primary care and public health practice.

[a]*Children's Outcomes Research, Children's Hospital Colorado, Aurora, Colorado;* [b]*Department of Pediatrics, University of Colorado Anschutz Medical Campus, Aurora, Colorado;* [c]*National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia;* [d]*Department of Community and Behavioral Health, Colorado School of Public Health, Denver, Colorado; and* [e]*Division of General Internal Medicine, Denver Health, Denver, Colorado*

Dr Kempe conceptualized and designed the study, contributed to the data collection instrument design, and drafted the initial and final manuscript; Drs O'Leary, Allison, and Hurley and Ms Kenney and Ms Stokley assisted in study design and creation of the data collection instrument and reviewed and revised the manuscript; Dr Crane conceptualized and designed the study, designed the data collection instrument, and reviewed and revised the manuscript; Ms Beaty contributed to the study design, carried out the initial and further analyses, and reviewed and revised the manuscript; Ms Brtnikova and Ms Clinger contributed to the study design and data collection instrument design, coordinated and supervised all data collection, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Some parents choose to "spread out" the recommended vaccine schedule for their child by decreasing the number of simultaneous vaccines or delaying certain vaccines until an older age. Epidemiologic studies demonstrate increasing numbers of parents are choosing to delay vaccines.

WHAT THIS STUDY ADDS: We demonstrate that almost all providers encounter requests to spread out vaccines in a typical month and, despite concerns, increasing numbers are agreeing to do so. Providers report many strategies in response to requests but think few are effective.

The current routine childhood immunization schedule is estimated to prevent 42 000 deaths and 20 million cases of disease and to save $14 billion in direct medical costs per US birth cohort.[1] Despite these enormous benefits, epidemiologic studies in the United States and internationally have shown that increasing numbers of parents are choosing to delay or refuse certain vaccines because of a variety of concerns.[2–6] A recent national survey in the United States demonstrated that 13% of parents of young children reported using some type of alternative vaccination schedule.[7] Such alternative schedules can lead to underimmunization, which has been shown to significantly increase the risk of acquiring and transmitting vaccine-preventable diseases.[3,8–10]

The percentage of parents who refuse all vaccines is a small subset of those who choose alternative schedules overall,[7,11] with the majority choosing to delay certain vaccines, extend the interval between vaccines, or delay vaccines until a certain age.[12–14] Some parents perceive that alternative schedules that "spread out vaccines" over a longer period of time, with fewer simultaneous injections than the recommended routine schedule may be safer.[14–16] There is limited information about how frequently parents are requesting to spread out the childhood vaccine schedule, how these requests are being handled by primary care physicians, and the impact of these requests on primary care practice. This study examines these issues from the perspective of primary care providers nationally, to guide future interventions to increase full and timely childhood immunization. Our objectives were to examine among pediatric and family medicine physicians: (1) their perception of the frequency of parental requests to spread out the recommended schedule for children <2 years and parental reasons for these requests, (2) their attitudes regarding such requests, (3) their responses to these requests, and (4) their perception of the effects of such requests on their practice.

METHODS

We conducted a survey from June to November 2012 among pediatric and family physicians who were part of sentinel networks within each specialty. The human subjects review board at the University of Colorado Denver approved this study.

Study Population

This survey was conducted as part of the Vaccine Policy Collaborative Initiative, a collaboration with the Centers for Disease Control and Prevention to perform rapid

TABLE 1 Comparison of Respondents and Nonrespondents and Additional Characteristics of Respondents' Practices

Characteristic	Total Respondents (*n* = 534)	Total Nonrespondents (*n* = 281)	Pediatric Respondent (*n* = 282)	FM Respondent (*n* = 252)
Male, %[a]	45	55	40	52
Mean age (SD), y	51.6 (10.3)	51.5 (9.9)	51.1 (10.4)	52.3 (10.2)
Region of the Country, %[a]				
Midwest	24	25	21	28
Northeast	21	16	22	20
South	32	41	34	30
West	23	18	24	22
Practice location, %				
Urban, inner city	35	32	43	26
Urban, non–inner city/suburban	46	47	44	48
Rural	19	21	12	27
Practice setting, %				
Private practice	75	76	78	72
Community or hospital based	19	20	16	23
HMO or MCO	6	4	6	6
Median providers in practice, *n*	5		6	5
Proportion of VFC participants, %	79	—	84	71
Proportion of patients <2 y, %				
<10	40	—	7	76
10–24	31	—	40	21
25–49	25	—	44	3
≥50	5	—	9	0
Proportion of privately insured patients, %				
0–24	20	—	17	23
25–49	21	—	21	21
≥50	59	—	61	56
Proportion of Medicaid/SCHIP patients, %				
0–24	58	—	51	67
25–49	21	—	26	16
≥50	21	—	23	17
Proportion of uninsured patients, %				
0–24	96	—	98	93
25–49	3	—	2	5
≥50	1	—	0	2
Patient race/ethnicity, %				
Black/African American				
<10%	51	—	45	59
≥10%	49		55	41
Hispanic/Latino				
<10%	53	—	46	61
≥10%	47		54	39
Asian/Pacific Islander				
<10%	83	—	77	90
<10%	17	—	23	10

FM, family medicine; Peds, pediatrics; HMO, health maintenance organization; MCO, managed care organization; SCHIP, State Children's Health Insurance Program; VFC, Vaccines for Children program.

[a] $P < .05$ for comparison of respondents and nonrespondents.

turnaround surveys to assess physician attitudes about vaccine issues. We developed national networks of primary care physicians by recruiting from the American Academy of Pediatrics (AAP) and the American Academy of Family Physicians (AAFP). We conducted quota sampling[17] to ensure that network physicians were similar to the AAP and AAFP memberships with respect to region, practice location, and practice setting. Exclusion criteria included practicing <50% primary care, not practicing in the United States, or being in training. We have previously demonstrated that survey responses from network physicians compared with those of physicians randomly sampled from American Medical Association physician databases had similar demographic characteristics, practice attributes, and attitudes about a range of vaccination issues.[17]

Survey Design

We developed the survey in collaboration with the Centers for Disease Control and Prevention, and with input from the AAP and the AAFP. We used 4-point Likert scales for questions assessing physician attitudes, actions, and assessment of effectiveness of their actions in response to parental requests. A national advisory panel of pediatricians and family physicians pretested the survey. On the basis of their input, respondents were asked about "parents who 'spread out' the recommended vaccine schedule due to safety and other concerns," and spreading out was defined as "postponing 1 or more vaccines with the intent of receiving them later." The survey was then piloted among 24 pediatricians and 15 family physicians nationally and further modified based on this feedback.

Survey Administration

We surveyed physicians by Internet (Verint, Melville, NY, http://www.verint.com) or, if they preferred, by mail. We sent the Internet group an initial e-mail with up to 8 reminders, and we sent the mail group an initial mailing and up to 2 additional reminders. We sent Internet survey nonrespondents a mail survey in case of problems with e-mail correspondence. We patterned the mail protocol on Dillman's tailored design method.[18]

Statistical Analysis

We pooled Internet and mail surveys together for analyses because studies have shown that physician attitudes are similar when obtained by either method.[18–20] We compared respondents with nonrespondents using t test and χ^2 analyses and compared pediatrician and family physician responses using χ^2 and Mantel-Haenszel χ^2 tests. We conducted a multivariable analysis with the dependent variable of "often/always" agreeing to spread out vaccines. Independent variables included practice characteristics and strongly agreeing with a variety of attitudes about spreading out vaccines. We used a cutoff of $P < .25$ for inclusion of demographic variables but only included attitudes associated at <.01 because there were so many with significant associations. Our multivariable models used a backward elimination procedure in which the least significant predictor in the model was eliminated sequentially. At each step, estimates were checked to make sure other variables were not affected by dropping the least significant variable. This resulted in retention of only those factors that were significant at $P < .05$ in the final model. Analyses were performed by using SAS software, version 9.4 (SAS Institute, Cary, NC).

RESULTS

The overall response rate was 66% (534 of 815), 70% (282 of 405) among pediatricians and 61% (252 of 410) among family physicians. Table 1 compares responders and nonresponders and describes additional characteristics available only for the responders. Among responders, 83 (9 pediatricians and 72 family medicine physicians, 16% overall) indicated that they did not

TABLE 2 Physicians' Perceptions of How Much Factors Contribute to Requests to Spread Out the Vaccination Schedule (n = 453)

	A Lot, %	Some, %	A Little/Not at All, %
Concern that their child will suffer long-term complications from vaccines[a]	57	29	15
General worries about vaccines without a specific concern[a]	43	37	20
Belief that their child is unlikely to get a vaccine-preventable disease[a]	42	32	27
Concern that their child will suffer immediate, short-term effects (such as fever, pain, or excessive crying) from vaccines	40	31	29
Parental concern that their child could develop autism as a result of vaccination[a]	36	39	25
The belief that they should play a central role in medical decisions for their child	34	32	34
Concern that vaccines will weaken their child's immune system[a]	30	35	35
A friend or relative's positive experience with an "alternative schedule"[a]	26	42	32
Parental desire to decrease the pain associated with multiple injections[b]	25	33	42
Parental concern about possible ill effects of thimerosal	21	42	37
Belief that vaccine-preventable diseases are not severe enough to warrant vaccination[a]	19	36	45
Belief that vaccines are not effective	4	25	71

[a] $P < .05$ for comparison between specialties (χ^2 test) in which pediatricians perceive more often than family medicine physicians.
[b] $P < .05$ for comparison between specialties (χ^2 test) in which family medicine physicians perceive more often than pediatricians.

administer vaccines to children <2 years old and were removed from further analysis.

Prevalence of Requests to Spread Out Immunizations and Reasons for Requests

Ninety-three percent of physicians reported some parents of children <2 years requested spreading out vaccines in a typical month; 21% reported ≥10% of parents made this request. Compared with the previous year, 23% reported increased, 62% unchanged, and 14% decreased requests. Physicians reported a variety of reasons given by parents requesting to spread out vaccines (Tables 2 and 3). Almost all reasons given by parents were more commonly reported by pediatricians than family physicians.

Physician Attitudes Regarding Requests

As shown in Fig 1, the vast majority agreed that it was important that all vaccines in the primary series be given on time (92%), that parents who chose to spread out vaccines were putting their children at risk for contracting disease (87%), and that it was more painful for children to bring them back repeatedly for separate injections (84%). The majority also felt that if they agreed to spread out vaccines, it would build trust with families (82%) and that if they did not agree, families might leave their practice (80%). Thirty-five percent thought that if they complied with requests to spread out, they were giving a mixed message to the family, and 40% reported that parental requests to spread out vaccines had decreased their job satisfaction. Compared with family physicians, pediatricians more strongly agreed with most attitudes examined (Fig 1).

Reported Actions and Strategies Used in Response to Requests

Most physicians reported agreeing to spread out vaccines when requested, either often/always (37%), sometimes

TABLE 3 Physicians' Perceptions of How Much Factors Contribute to Requests to Spread Out the Vaccination Schedule by Specialty (N = 453)

	Family Medicine, %	Pediatricians, %	P
Concern that their child will suffer long-term complications from vaccines			.0001
A lot	48	63	
Some	30	28	
A little/not at all	22	10	
General worries about vaccines without a specific concern			.0001
A lot	36	47	
Some	35	39	
A little/not at all	29	14	
Belief that their child is unlikely to get a vaccine-preventable disease			.0009
A lot	33	48	
Some	33	31	
A little/not at all	34	22	
Concern that their child will suffer immediate, short-term effects (such as fever, pain or excessive crying) from vaccines			.44
A lot	44	37	
Some	28	34	
A little/not at all	28	29	
Parental concern that their child could develop autism as a result of vaccination			<.0001
A lot	27	42	
Some	34	42	
A little/not at all	39	16	
The belief that they should play a central role in medical decisions for their child			.50
A lot	37	32	
Some	30	33	
A little/not at all	33	35	
Concern that vaccines will weaken their child's immune system			<.0001
A lot	17	39	
Some	32	37	
A little/not at all	51	24	
A friend or relative's positive experience with an "alternative schedule"			<.0001
A lot	15	33	
Some	39	44	
A little/not at all	45	23	
Parental desire to decrease the pain associated with multiple injections			.04
A lot	33	20	
Some	28	36	
A little/not at all	39	44	
Parental concern about possible ill effects of thimerosal			.52
A lot	19	23	
Some	44	41	
A little/not at all	38	36	
Belief that vaccine-preventable diseases are not severe enough to warrant vaccination			.06
A lot	14	22	
Some	36	36	
A little/not at all	50	42	
Belief that vaccines are not effective			.55
A lot	5	4	
Some	25	24	
A little/not at all	70	72	

All tests are Mantel-Haenszel χ^2.

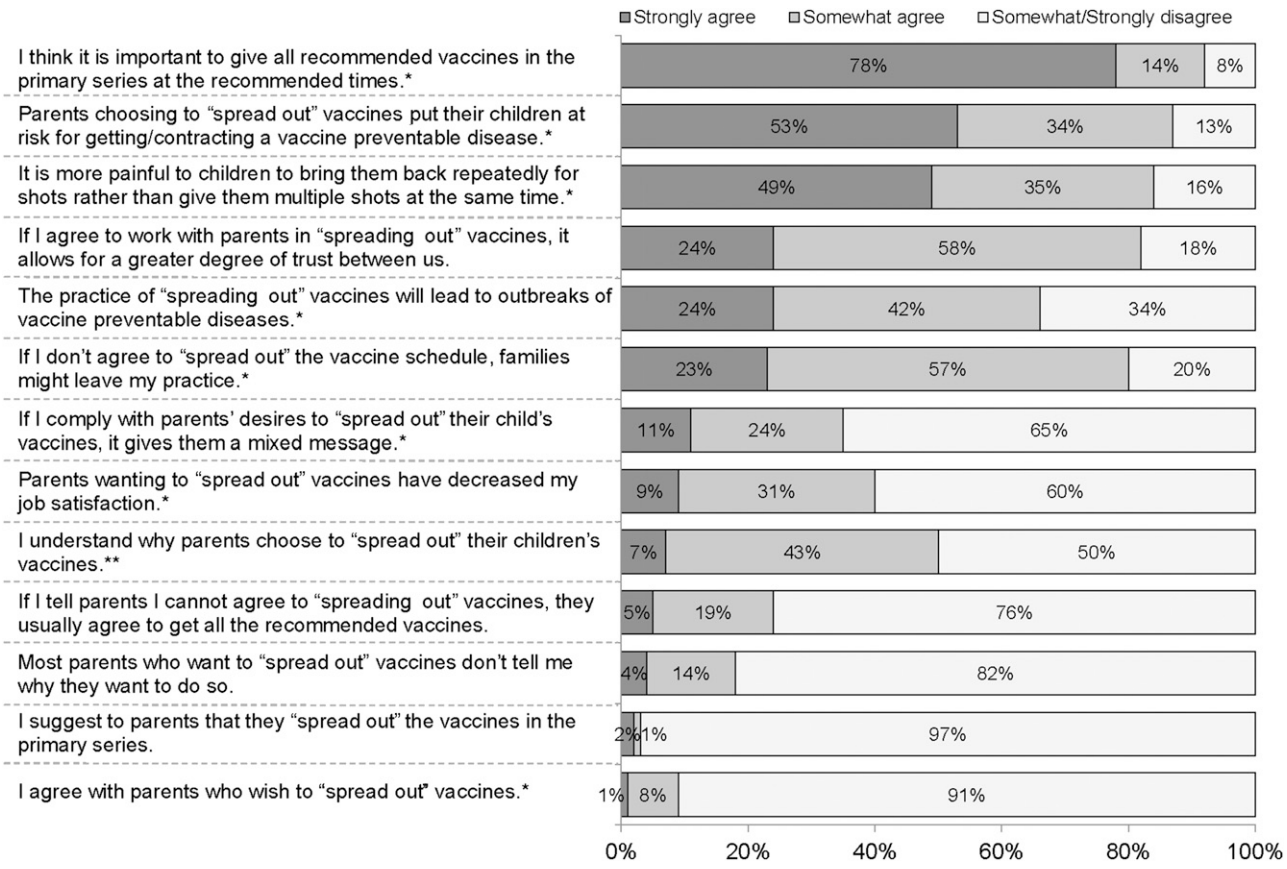

FIGURE 1

Physicians' attitudes related to spreading out vaccines in primary series (n = 453). *$P < .05$ for comparison between specialties (χ^2 test) when pediatricians strongly agree more than family medicine physicians. *$P < .05$ for comparison between specialties (χ^2 test) when family medicine physicians strongly agree more than pediatricians.

(37%), or rarely (26%). Characteristics and attitudes associated with often/always agreeing to spread out in the final multivariable model included pediatric subspecialty, thinking that working with parents regarding the schedule creates a greater degree of trust, and having an understanding of why parents choose to spread out vaccines (see Tables 4 and 5 for bivariable and multivariable models). Conversely, practicing in an urban inner-city location, thinking it was important that all vaccines be given at recommended times, or feeling that complying with requests to spread out the series would send a mixed message were negatively associated with the outcome. Pediatricians were more likely than family physicians to dismiss families from their practice if they insisted on spreading out vaccines either often/always (3% vs 1%), sometimes (6% vs 1%), or rarely (14% vs 8%; $P < .001$), respectively.

Table 6 shows strategies used by physicians in response to parental requests to spread out vaccines and their perceived effectiveness in convincing parents to vaccinate their children according to recommended guidelines. Few physicians thought any of the reported responses were "very effective," although many were thought to be "somewhat effective."

Effects of Requests on Practice

Table 7 shows the reported amount of time providers reported spending personally when discussing vaccines with typical first-time parents of infants or with parents with substantial concerns about vaccines. More pediatricians (57%) than family physicians (34%) reported spending >10 minutes discussing vaccines with parents who have vaccine concerns ($P < .001$). Pediatricians were also more likely to report that spreading out vaccines created extra work for the practice (54% vs 37% strongly agreed, $P < .001$). Reported changes in the practice specifically related to requests to spread out vaccines included requiring extra provider visits for administration of vaccines that parents had chosen to defer (29%) and purchasing vaccines with fewer antigens (15%).

DISCUSSION

In contrast to much of the previous literature regarding parents who refuse all or specific vaccines, the current study focused on the larger group of parents who intend to

vaccinate but request to spread out the recommended vaccine schedule. Our data demonstrate that primary care physicians are spending a good deal of time discussing vaccines when parents have concerns, that they are trying a variety of methods of handling requests to spread out the vaccine schedule, and that, in general, they find few methods to be effective in increasing timely vaccination. Although they perceive that there are harms associated with spreading out vaccines, they usually agree to do so.

Data suggest that during the past decade, increasing numbers of parents are choosing to deviate from the recommended vaccine schedule, either using published alternative schedules[21–23] or, more frequently, requesting to spread out the recommended schedule without a specific model.[4,7] Delaying vaccines has led to more children who are undervaccinated. For example, the prevalence of undervaccination in the first 2 years of life within 8 managed care organizations increased from 41.8% in 2004 to 54.4% in 2008, with ~13% of the total estimated to be undervaccinated by choice.[2] Other national surveys have yielded similar percentages of parents who reported requesting some type of alternative schedule.[7,12] Our data are difficult to directly compare with these parent surveys because they represent incidence rather than prevalence data and are from the physician's perspective rather than self-report of parents.

Physicians reported that parents usually discussed their reasons for wanting to spread out vaccines. Reasons given were similar to other published reasons for either deferral or refusal, including concerns about short- and long-term complications, belief that their child is unlikely to get a vaccine-preventable disease, concerns about weakening their child's immune system, and the belief that the diseases are not severe enough to warrant

TABLE 4 Bivariable and Multivariable Models Predicting Agreeing to Spread Out "Often/Always" (N = 438 with nonmissing values)

Characteristic	Bivariable OR (95% CI)	Multivariable OR (95% CI)
Practice specialty		
Family medicine	Ref.	Ref.
Pediatrics	1.24 (0.83–1.86)	2.18 (1.34–3.56)
Gender		
Female	Ref.	
Male	1.39 (0.94–2.05)	
Age, per 5 y increase	0.99 (0.89–1.09)	
Practice location		
Urban, inner city	0.65 (0.42–1.01)	0.53 (0.33–0.87)
Urban, non–inner/suburban	Ref.	Ref.
Rural	1.24 (0.73–2.10)	1.31 (0.73–2.33)
Region		
Midwest	0.84 (0.49–1.43)	
Northeast	0.77 (0.45–1.34)	
South	Ref.	
West	0.80 (0.47–1.37)	
Practice setting		
Private practice	Ref.	
Community or hospital based	1.06 (0.63–1.78)	
HMO or MCO	0.71 (0.30–1.68)	
Median providers in practice		
≤5	Ref.	
≥6	0.93 (0.63–1.37)	
Participate in VFC		
Yes	Ref.	
No/don't know	0.66 (0.40–1.07)	
Proportion of patients <2 y, %		
<10	0.77 (0.48–1.25)	
10–24	Ref.	
25–49	0.71 (0.44–1.16)	
≥50	0.57 (0.22–1.45)	
Proportion of privately insured patients, %		
10–24	1.10 (0.65–1.85)	
25–49	1.48 (0.91–2.41)	
≥50	Ref.	
Proportion of Medicaid/SCHIP patients, %		
10–24	1.33 (0.80–2.19)	
25–49	Ref.	
≥50	1.74 (0.95–3.19)	
Proportion of uninsured patients, %		
10–24	1.62 (0.42–6.21)	
25–49	Ref.	
≥50	2.67 (0.12–57.60)	
Black/African American, %		
<10	Ref.	
≥10	0.79 (0.53–1.18)	
Hispanic/Latino, %		
<10	Ref.	
≥10	0.90 (0.61–1.33)	
Asian/Pacific Islander, %		
<10	Ref.	
≥10	0.88 (0.52–1.47)	
Strongly agree with:		
Q13m. I think it is important to give all recommended vaccines in the primary series at the recommended times (2, 4, 6, 12–18 mo).	0.37 (0.23–0.59)	0.36 (0.21–0.62)
Q13j. Parents choosing to "spread out" vaccines put their children at risk for getting/contracting a vaccine-preventable disease.	0.53 (0.36–0.79)	

TABLE 4 Continued

Characteristic	Bivariable OR (95% CI)	Multivariable OR (95% CI)
Q13b. It is more painful to children to bring them back repeatedly for shots rather than give them multiple shots at the same time.	0.96 (0.65–1.42)	
Q13e. If I agree to work with parents in "spreading out" vaccines, it allows for a greater degree of trust between us.	2.97 (1.90–4.66)	2.58 (1.58–4.20)
Q13f. The practice of "spreading out" vaccines will lead to outbreaks of vaccine-preventable diseases.	0.51 (0.31–0.83)	
Q13l. If I don't agree to "spread out" the vaccine schedule, families might leave my practice.	1.50 (0.95–2.38)	
Q13i. If I comply with parents' desires to "spread out" their child's vaccines it gives them a mixed message.	0.25 (0.11–0.57)	0.31 (0.13–0.73)
Q13h. Parents wanting to "spread out" vaccines have decreased my job satisfaction.	0.66 (0.33–1.32)	
Q13g. I understand why parents choose to "spread out" their children's vaccines.	4.23 (1.79–9.97)	2.67 (1.04–6.88)
Q13k. If I tell parents I cannot agree to "spreading out" vaccines they usually agree to get all the recommended vaccines.	0.09 (0.01–0.69)	
Q13d. Most parents who want to "spread out" vaccines don't tell me why they want to do so.	0.51 (0.16–1.59)	
Q13c. I suggest to parents that they "spread out" the vaccines in the primary series.	4.40 (0.84–22.96)	
Q13a. I agree with parents who wish to "spread out" vaccines.	6.94 (0.77–62.61)	

HMO, health maintenance organization; MCO, managed care organization; SCHIP, State Children's Health Insurance Program; VFC, Vaccines for Children program.

vaccination.[12–14,24] Some commonly reported reasons, however, were more specific to the request to vaccinate on a modified schedule, including a friend or relative's positive experience with an alternative schedule and the belief that the parents should play a central role in medical decisions about their child. These responses support the importance of social networks in affecting vaccine decisions[25] and underline the importance of control over medical decision-making among vaccine hesitant parents.

Many physicians reported tension between the need to build trust with families by being willing to compromise on the schedule while simultaneously feeling they were putting children at risk and causing them unnecessary pain by spreading out vaccines on multiple visits. A sizable portion of physicians, especially pediatricians, reported that this issue was decreasing their job satisfaction. Roughly half of all physicians reported they spend ≥10 minutes in discussions with parents who have substantial vaccine concerns, and among pediatricians, this number was almost 60%. Previous work has shown that both pediatricians and parents[26] estimate that well-child visits average ~18 minutes. Therefore, if physician estimates are accurate, they may be spending more than half of their appointment time with families who have vaccine concerns discussing this issue alone. Studies about the content of well-child visits show that although immunizations are virtually always discussed, as available visit time decreases, other issues such as developmental assessment, feeding issues, toilet training, child care, guidance about emotional support, sleep position, car seats, and parental smoking are short-changed.[27] A 2006 examination of previous policy statements by the AAP found 162 verbal health advice directives on which pediatricians were recommended to counsel parents and patients throughout childhood.[28] When seen in this context, the amount of visit time physicians are spending on vaccine concerns may be compromising their ability to deliver comprehensive preventive care to children of parents with substantial vaccine concerns.

Compared with a 2009 survey conducted in sentinel networks using the same methodology and the same question as in the current study,[29] the data reported here show a marked difference in physician responses to parental requests to spread out the vaccine schedule. In 2009, only 13% reported often or always agreeing to spread out vaccines, whereas 37% in the present survey often or always agreed to do so. This shift may reflect changes in the beliefs of physicians about what is effective in working with hesitant parents, adherence to published recommendations about how to build trust with vaccine-hesitant parents, or simply a pragmatic reaction to the amount of time it takes to discuss parents' concerns in the context of a busy practice setting and, perhaps, the perceived futility of doing so. Our multivariable model suggests that the importance of building trust with parents is a motivator for agreeing to spread out vaccines, but a strongly held belief that agreeing to do so gives parents a mixed message makes physicians less inclined to agree to spread out vaccines.

Pockets of underimmunization have been associated with outbreaks of several vaccine-preventable diseases including pertussis, varicella, pneumococcal disease,[9,10,30,31] and, especially in recent years, measles.[8,31,32] Additional potential harms of spreading out the vaccine schedule have not been studied. The safety of alternative schedules is unknown, although a recent study demonstrated that delay of the measles, mumps, and rubella vaccine until after 15 months was associated with a higher rate of febrile seizures.[33] The psychological effect of bringing children back for single

TABLE 5 Strategies Used and Perceived Effectiveness of Strategies (N = 453)

Strategy	Frequency Used, %			Perceived Effectiveness, %		
	Often or Always	Sometimes	Rarely/ Never	Very Effective	Somewhat Effective	Not Very/ Not at All Effective
Informing the parents that you immunize (or would immunize) your own children according to the recommended schedule.	66	25	9	20	64	16
Explaining that deviating from the current vaccination schedule puts their child at risk for vaccine preventable diseases.[a]	68	19	13	9	55	36
Informing parents that "spreading out" vaccines is against your recommendation.[a]	66	20	15	7	52	41
Discussing recent outbreaks of vaccine-preventable diseases with parents.[a]	60	31	9	14	58	28
Telling parents that you think it is more painful for their child to come back for multiple visits for shots rather than get them all at once.[c]	50	31	20	9	46	45
Explaining that alternative schedules have not been well studied for safety or effectiveness and that the recommended schedule has.[a]	49	32	19	4	45	51
Involving the parent in vaccine administration by having them hold their child in a comforting way.[b,c]	49	30	22	14	36	51
Explaining that deviating from the current schedule puts other people at risk for vaccine-preventable diseases.[a,c]	49	30	22	2	32	66
Offering to ease the pain of the child's shots by allowing them to breastfeed or bottle-feed.[b,c]	23	34	43	6	32	62
Offering to the parent that he or she can leave the room during vaccine administration.[c]	20	31	49	3	23	73
Informing parents that they will be charged for any extra visits as a result of "spreading out" vaccines.[a]	10	16	74	3	21	76
Offering to ease the pain of the child's shots by using anesthetic cream or other numbing medication.	3	10	87	2	22	76
Informing parents that if they want to "spread out" the vaccine series, they should seek care from a different provider.[a]	3	4	93	4	12	84
Informing parents that your office does not have the capacity to handle children coming back for multiple shot visits.[c]	2	3	95	1	6	93

[a] $P < .05$ for comparison between specialties (χ^2 test) in which pediatricians use more often than family medicine physicians.
[b] $P < .05$ for comparison between specialties (χ^2 test) in which family medicine physicians use more often than pediatricians.
[c] $P < .05$ for comparison between specialties (χ^2 test) in which family medicine physicians perceive higher effectiveness than pediatricians.

shots at frequent intervals, which most physicians surveyed thought was more painful than receiving immunizations simultaneously, has also not been assessed.

Although physicians report using many strategies in response to requests to deviate from the recommended schedule, they had a relatively bleak perception of the effectiveness of most of them. The strategy most often deemed effective was considered "very effective" by only 20% of physicians. In fact, as pointed out by a recent systematic review, there is virtually no published evidence at present demonstrating effective interventions to persuade parents to vaccinate when they already wish to delay or refuse.[34] Most publications have focused exclusively on the interaction between providers and parents and addressed physician communication style, motivational interviewing techniques, or tailoring messages to specific parental positions.[35–40] Focusing interventions on this key relationship has been guided by qualitative and survey data from parents in which they cite health care providers as their most trusted source of vaccine information.[13,41,42] Indeed, among parent survey respondents who have considered delaying or refusing vaccines, the recommendation of a health provider has been reported as the most common reason for getting vaccines as recommended.[12,43]

However, it is not clear that providers are having success in changing the minds of parents who come in already requesting to either spread out or refuse vaccines. In a recent study, only 69% of parents who delayed vaccines and 38% of parents who refused vaccines expressed a high level of trust in their pediatrician's advice on vaccines.[44] Despite the educational materials and tools available from national organizations focused[45] on how to communicate with hesitant parents and what type of messages to give, almost none have been actually studied in a comparative effectiveness trial to assess the impact of their use. The 1 recent randomized trial to compare different types of messages to increase measles, mumps, and rubella vaccine vaccination found that none increased parental intent to vaccinate and those that attempted to increase concerns about diseases or correct false information about vaccines actually decreased intent to vaccinate among parents who had the least favorable vaccine attitudes.[46] Although the messages were delivered over the Internet rather than in a clinical setting by a trusted provider, these results nonetheless underline

TABLE 6 Strategies Used and Perceived Effectiveness of Strategies by Specialty (n = 453)

	Frequency	FM, %	Peds, %	*P*	Effectiveness	FM, %	Peds, %	*P*
Informing the parents that you immunize (or would immunize) your own children according to the recommended schedule.	Often or always	63	68	.93	Very	19	20	.51
	Sometimes	29	22		Somewhat	67	62	
	Rarely/never	7	10		Not very/not at all	14	17	
Explaining that deviating from the current vaccination schedule puts their child at risk for vaccine-preventable diseases.	Often or always	55	76	<.0001	Very	8	10	.84
	Sometimes	25	16		Somewhat	57	53	
	Rarely/never	20	8		Not very/not at all	35	37	
Informing parents that "spreading out" vaccines is against your recommendation.	Often or always	55	73	<.0001	Very	5	8	.57
	Sometimes	24	17		Somewhat	56	49	
	Rarely/never	21	10		Not very/not at all	39	43	
Discussing recent outbreaks of vaccine preventable diseases with parents.	Often or always	46	70	.001	Very	14	15	.43
	Sometimes	45	23		Somewhat	61	56	
	Rarely/never	10	8		Not very/not at all	25	29	
Telling parents that you think it is more painful for their child to come back for multiple visits for shots rather than get them all at once.	Often or always	44	53	.15	Very	10	8	<.0001
	Sometimes	34	29		Somewhat	57	39	
	Rarely/never	22	18		Not very/not at all	33	53	
Explaining that alternative schedules have not been well studied for safety or effectiveness and that the recommended schedule has.	Often or always	42	54	.04	Very	2	5	.14
	Sometimes	37	29		Somewhat	53	41	
	Rarely/never	21	17		Not very/not at all	45	55	
Involving the parent in vaccine administration by having them hold their child in a comforting way.	Often or always	55	45	.003	Very	17	11	.0005
	Sometimes	31	29		Somewhat	42	31	
	Rarely/never	15	26		Not very/not at all	41	58	
Explaining that deviating from the current schedule puts other people at risk for vaccine preventable diseases.	Often or always	41	54	.0001	Very	2	2	.01
	Sometimes	28	30		Somewhat	39	27	
	Rarely/never	31	16		Not very/not at all	58	71	
Offering to ease the pain of the child's shots by allowing them to breastfeed or bottle-feed.	Often or always	30	19	.07	Very	8	4	.01
	Sometimes	31	36		Somewhat	37	29	
	Rarely/never	40	45		Not very/not at all	55	67	
Offering to the parent that they can leave the room during vaccine administration.	Often or always	21	19	.41	Very	3	4	.02
	Sometimes	32	31		Somewhat	31	18	
	Rarely/never	47	50		Not very/not at all	66	78	
Informing parents that they will be charged for any extra visits as a result of "spreading out" vaccines.	Often or always	6	12	.03	Very	1	4	.21
	Sometimes	15	17		Somewhat	28	17	
	Rarely/never	79	71		Not very/not at all	72	79	
Offering to ease the pain of the child's shots by using anesthetic cream or other numbing medication.	Often or always	3	3	.65	Very	2	3	.56
	Sometimes	11	9		Somewhat	25	20	
	Rarely/never	86	88		Not very/not at all	74	77	
Informing parents that if they want to "spread out" the vaccine series, they should seek care from a different provider.	Often or always	1	4	.008	Very	3	4	.31
	Sometimes	2	5		Somewhat	11	12	
	Rarely/never	97	91		Not very/not at all	87	83	
Informing parents that your office does not have the capacity to handle children coming back for multiple shot visits.	Often or always	2	2	0.89	Very	1	0	.02
	Sometimes	3	3		Somewhat	9	4	
	Rarely/never	95	95		Not very/not at all	90	96	

All *P* values are Mantel-Haenszel χ^2 tests. FM, family medicine physicians; Peds, pediatricians.

TABLE 7 Time Spent Discussing Vaccines With Parents by Specialty (n = 453)

	≤4 min, %	5–9 min, %	10–14 min, %	15–19 min, %	≥20 min, %
Typical first-time parents of infants					
Overall	46	41	9	2	1
Peds	46	42	8	2	2
FM	47	41	11	2	0
Parents with substantial concerns about vaccines[a]					
Overall	7	45	34	7	7
Peds	4	38	41	8	8
FM	11	55	23	6	5

FM, family medicine physicians; Peds, pediatricians.

[a] Differences between specialty significant at $P < .0001$ Mantel-Haenszel χ^2.

the importance of testing proposed interventions to see if they actually produce the anticipated effect in real-world settings.

There are important limitations to our findings. Although the sample of sentinel physicians surveyed was designed to be representative of AAP and AAFP memberships, the attitudes, experiences, and practices of sentinel physicians may not be fully generalizable. Additionally, although this survey had a high response rate, nonrespondents may have had different views than respondents. Physicians' perceptions of why parents are requesting to spread out immunizations may not accurately reflect parents' viewpoints. Most important, the survey relied on self-report rather than direct observation.

Our study points out the need for an evidence base to guide primary care physicians in efforts to increase timely vaccination. Given the amount of time discussions with vaccine-hesitant parents take, the inability to charge for extra visits focusing solely on such discussions, and competing demands in primary care, interventions that supplement the limited communication that can occur at well-child visits are also needed. Recent data suggest that vaccine discussions need to begin early in pregnancy because that is when vaccine decision-making begins, especially for parents who are hesitant about vaccines, and interventions during this period may be effective.[44,47,48] Social marketing methods could be used to target vaccine-hesitant parents who may be considering delaying vaccines before these decisions are made.[49] The importance of social networks in shaping parents' vaccination decisions has been underlined and interventions targeting networks within a community could have broader impact.[25] Reinforcing vaccination as a social norm could be better leveraged as it has been in a variety of other health care interventions.[50–55] Amplifying the voice of the vast majority of parents who do follow vaccination recommendations in public messaging and in settings such as preschools and schools could be a powerful tool that, up to the present, has not been used on a large scale. Critically, to guide primary care and public health providers, we need to test any of these proposed approaches in real-world settings in comparative effectiveness trials with the outcome of actually increasing timeliness and completeness of vaccinations.

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Address correspondence to Allison Kempe, MD, MPH, University of Colorado, Department of Pediatrics, Mail Stop F443, 13199 E Montview Blvd, Suite 300, Aurora, CO 80045. E-mail: allison.kempe@childrenscolorado.org

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REFERENCES

1. Zhou F, Shefer A, Wenger J, et al. Economic evaluation of the routine childhood immunization program in the United States, 2009. *Pediatrics*. 2014; 133(4):577–585
2. Glanz JM, Narwaney KJ, Newcomer SR, et al. Association between undervaccination with diphtheria, tetanus toxoids, and acellular pertussis (DTaP) vaccine and risk of pertussis infection in children 3 to 36 months of age. *JAMA Pediatr*. 2013;167(11):1060–1064
3. Omer SB, Pan WK, Halsey NA, et al. Nonmedical exemptions to school immunization requirements: secular trends and association of state policies with pertussis incidence. *JAMA*. 2006; 296(14):1757–1763
4. Robison SG, Groom H, Young C. Frequency of alternative immunization schedule use in a metropolitan area. *Pediatrics*. 2012;130(1):32–38
5. Dubé E, Vivion M, MacDonald NE. Vaccine hesitancy, vaccine refusal and the

anti-vaccine movement: influence, impact and implications. *Expert Rev Vaccines*. 2015;14(1):99–117

6. Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007-2012. *Vaccine*. 2014; 32(19):2150–2159
7. Dempsey AF, Schaffer S, Singer D, Butchart A, Davis M, Freed GL. Alternative vaccination schedule preferences among parents of young children. *Pediatrics*. 2011;128(5):848–856
8. Feikin DR, Lezotte DC, Hamman RF, Salmon DA, Chen RT, Hoffman RE. Individual and community risks of measles and pertussis associated with personal exemptions to immunization. *JAMA*. 2000;284(24): 3145–3150
9. Glanz JM, McClure DL, Magid DJ, et al. Parental refusal of pertussis vaccination is associated with an increased risk of pertussis infection in children. *Pediatrics*. 2009;123(6):1446–1451
10. Glanz JM, McClure DL, O'Leary ST, et al. Parental decline of pneumococcal vaccination and risk of pneumococcal related disease in children. *Vaccine*. 2011;29(5):994–999
11. Smith PJ, Chu SY, Barker LE. Children who have received no vaccines: who are they and where do they live? *Pediatrics*. 2004;114(1):187–195
12. Gust DA, Darling N, Kennedy A, Schwartz B. Parents with doubts about vaccines: which vaccines and reasons why. *Pediatrics*. 2008;122(4):718–725
13. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MM. Parental vaccine safety concerns in 2009. *Pediatrics*. 2010; 125(4):654–659
14. Smith PJ, Humiston SG, Marcuse EK, et al. Parental delay or refusal of vaccine doses, childhood vaccination coverage at 24 months of age, and the Health Belief Model. *Public Health Rep*. 2011;126 (suppl 2):135–146
15. Hilton S, Petticrew M, Hunt K. "Combined vaccines are like a sudden onslaught to the body's immune system": parental concerns about vaccine "overload" and "immune-vulnerability." *Vaccine*. 2006; 24(20):4321–4327
16. Tickner S, Leman PJ, Woodcock A. "It's just the normal thing to do": exploring parental decision-making about the "five-in-one" vaccine. *Vaccine*. 2007;25(42): 7399–7409
17. Crane LA, Daley MF, Barrow J, et al. Sentinel physician networks as a technique for rapid immunization policy surveys. *Eval Health Prof*. 2008; 31(1):43–64
18. Dillman DA, Smyth J, Christian LM. *Internet, Mail and Mixed-Mode Surveys: The Tailored Design Method*. 3rd ed. New York, NY: John Wiley; 2009
19. McMahon SR, Iwamoto M, Massoudi MS, et al. Comparison of e-mail, fax, and postal surveys of pediatricians. *Pediatrics*. 2003;111(4 pt 1). Available at: www.pediatrics.org/cgi/content/full/111/4/e299
20. Atkeson LR, Adams AN, Bryant LA, Zilberman L, Saunder KL. Considering mixed mode surveys for questions in political behavior: using the Internet and mail to get quality data at reasonable costs. *Polit Behav*. 2011;33(1):161–178
21. Cave S, Mitchell D. *What Your Doctor May Not Tell You About Children's Vaccinations*. 2nd ed. New York, NY: Time Warner Book Group; 2007
22. Sears W. *The Vaccine Book: Making the Right Decision for Your Child*. New York, NY: Little, Brown and Company; 2007
23. Miller DW. A user-friendly vaccination schedule. 2004. Available at: http://archive.lewrockwell.com/miller/miller15.html. Accessed September 1, 2014
24. Whyte MD, Whyte Iv J, Cormier E, Eccles DW. Factors influencing parental decision making when parents choose to deviate from the standard pediatric immunization schedule. *J Community Health Nurs*. 2011;28(4):204–214
25. Brunson EK. The impact of social networks on parents' vaccination decisions. *Pediatrics*. 2013;131(5). Available at: www.pediatrics.org/cgi/content/full/131/5/e1397
26. Olson LM, Inkelas M, Halfon N, Schuster MA, O'Connor KG, Mistry R. Overview of the content of health supervision for young children: reports from parents and pediatricians. *Pediatrics*. 2004;113(6 suppl):1907–1916
27. Halfon N, Stevens GD, Larson K, Olson LM. Duration of a well-child visit: association with content, family-centeredness, and satisfaction. *Pediatrics*. 2011;128(4): 657–664
28. Belamarich PF, Gandica R, Stein RE, Racine AD. Drowning in a sea of advice: pediatricians and American Academy of Pediatrics policy statements. *Pediatrics*. 2006;118(4). Available at: www.pediatrics.org/cgi/content/full/118/4/e964
29. Kempe A, Daley MF, McCauley MM, et al. Prevalence of parental concerns about childhood vaccines: the experience of primary care physicians. *Am J Prev Med*. 2011;40(5):548–555
30. Glanz JM, McClure DL, Magid DJ, Daley MF, France EK, Hambidge SJ. Parental refusal of varicella vaccination and the associated risk of varicella infection in children. *Arch Pediatr Adolesc Med*. 2010;164(1):66–70
31. Gahr P, DeVries AS, Wallace G, et al. An outbreak of measles in an undervaccinated community. *Pediatrics*. 2014;134(1). Available at: www.pediatrics.org/cgi/content/full/134/1/e220
32. Gastañaduy PA, Redd SB, Fiebelkorn AP, et al; Division of Viral Disease, National Center for Immunization and Respiratory Diseases, CDC. Measles—United States, January 1–May 23, 2014. *MMWR Morb Mortal Wkly Rep*. 2014;63(22):496–499
33. Hambidge SJ, Newcomer SR, Narwaney KJ, et al. Timely versus delayed early childhood vaccination and seizures. *Pediatrics*. 2014;133(6). Available at: www.pediatrics.org/cgi/content/full/133/6/e1492
34. Sadaf A, Richards JL, Glanz J, Salmon DA, Omer SB. A systematic review of interventions for reducing parental vaccine refusal and vaccine hesitancy. *Vaccine*. 2013;31(40):4293–4304
35. Leask J, Kinnersley P, Jackson C, Cheater F, Bedford H, Rowles G. Communicating with parents about vaccination: a framework for health professionals. *BMC Pediatr*. 2012;12:154
36. Benin AL, Wisler-Scher DJ, Colson E, Shapiro ED, Holmboe ES. Qualitative analysis of mothers' decision-making about vaccines for infants: the importance of trust. *Pediatrics*. 2006; 117(5):1532–1541
37. Gust DA, Kennedy A, Shui I, Smith PJ, Nowak G, Pickering LK. Parent attitudes toward immunizations and healthcare

providers the role of information. *Am J Prev Med*. 2005;29(2):105–112

38. Healy CM, Pickering LK. How to communicate with vaccine-hesitant parents. *Pediatrics*. 2011;127(suppl 1): S127–S133
39. Halperin SA. How to manage parents unsure about immunization. *Can J Contin Med Educ*. 2000;12:62–75
40. Sturm LA, Zimet GD, Klausmeier T. Talking with concerned parents about immunization. *Zero Three*. 2010;20:11–18
41. Cooper LZ, Larson HJ, Katz SL. Protecting public trust in immunization. *Pediatrics*. 2008;122(1):149–153
42. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MM. Sources and perceived credibility of vaccine-safety information for parents. *Pediatrics*. 2011;127(suppl 1):S107–S112
43. McCauley MM, Kennedy A, Basket M, Sheedy K. Exploring the choice to refuse or delay vaccines: a national survey of parents of 6- through 23-month-olds. *Acad Pediatr*. 2012;12(5):375–383
44. Glanz JM, Wagner NM, Narwaney KJ, et al. A mixed methods study of parental vaccine decision making and parent-provider trust. *Acad Pediatr*. 2013;13(5): 481–488
45. Centers for Disease Control and Prevention. Provider resources for vaccine conversations with parents. December 6, 2012. Available at: http://www.cdc.gov/vaccines/hcp/patient-ed/conversations. Accessed September 1, 2014
46. Nyhan B, Reifler J, Richey S, Freed GL. Effective messages in vaccine promotion: a randomized trial. *Pediatrics*. 2014; 133(4). Available at: www.pediatrics.org/cgi/content/full/133/4/e835
47. Wroe AL, Turner N, Owens RG. Evaluation of a decision-making aid for parents regarding childhood immunizations. *Health Psychol*. 2005;24(6):539–547
48. Wroe AL, Turner N, Salkovskis PM. Understanding and predicting parental decisions about early childhood immunizations. *Health Psychol*. 2004; 23(1):33–41
49. Opel DJ, Diekema DS, Lee NR, Marcuse EK. Social marketing as a strategy to increase immunization rates. *Arch Pediatr Adolesc Med*. 2009;163(5):432–437
50. Christakis NA, Fowler JH. The collective dynamics of smoking in a large social network. *N Engl J Med*. 2008;358(21): 2249–2258
51. Linos N, Slopen N, Subramanian SV, Berkman L, Kawachi I. Influence of community social norms on spousal violence: a population-based multilevel study of Nigerian women. *Am J Public Health*. 2013;103(1):148–155
52. Sorensen G, Stoddard AM, Dubowitz T, et al. The influence of social context on changes in fruit and vegetable consumption: results of the healthy directions studies. *Am J Public Health*. 2007;97(7):1216–1227
53. Pelletier JE, Graham DJ, Laska MN. Social norms and dietary behaviors among young adults. *Am J Health Behav*. 2014; 38(1):144–152
54. Bryant-Stephens T, Garcia-Espana JF, Winston FK. Boosting restraint norms: a community-delivered campaign to promote booster seat use. *Traffic Inj Prev*. 2013;14(6):578–583
55. Kunz JH, Greenley RN, Mussatto KA, et al. Personal attitudes, perceived social norms, and health-risk behavior among female adolescents with chronic medical conditions. *J Health Psychol*. 2013;19(7): 877–886

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