

# Attitudes and Beliefs of Parents Concerned About Vaccines: Impact of Timing of Immunization Information

## abstract

**OBJECTIVES:** To determine if giving vaccine-information materials before the 2-month vaccination visit to mothers with concerns about vaccine safety positively changed their attitudes and beliefs about vaccine safety.

**METHODS:** Mothers who indicated concerns about infant vaccinations were recruited from 2 separate sites in Tennessee and California and were given vaccine information at 1 of 3 times: during a prenatal visit; a 1-week postpartum well-child visit; or a 2-month vaccination visit. A separate group of concerned mothers was assigned to be followed longitudinally at all 3 time points and was analyzed separately. The mothers reviewed a new vaccine-information pamphlet and Vaccine Information Statements (VIS) from the Centers for Disease Control and Prevention. Attitudes and beliefs about immunization were assessed both before and after the review of materials with written surveys.

**RESULTS:** A total of 272 mothers with immunization concerns participated in the study. After review of the materials, mothers in all groups were significantly more likely to respond positively to questions and statements supporting the safety and importance of vaccines. Mothers who received this information at earlier visits were not significantly more likely to respond positively than mothers who received the information at the child's 2-month vaccination visit; however, participating mothers did indicate a preference for receiving vaccine information before the first vaccination visit.

**CONCLUSIONS:** Distribution of the vaccine-information pamphlet and Vaccine Information Statements significantly improved attitudes about vaccination regardless of at what visit they were provided. Allowing adequate time to review vaccine information, even if done at the vaccination visit, may benefit concerned mothers. *Pediatrics* 2011;127:S120–S126

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### KEY WORDS

vaccine information, vaccine safety, Centers for Disease Control and Prevention, parental attitudes and beliefs

### ABBREVIATIONS

VIS—Vaccine Information Statements

OR—odds ratio

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Vaccines are one of the most successful public health tools of the 20th century for preventing disease, disability, and death.<sup>1</sup> Because vaccines have been so successful, perceived risks from vaccine-preventable diseases have diminished, whereas perceived risks of vaccination have increased.<sup>2,3</sup> Parental attitudes and beliefs about vaccines are an important factor in predicting a child's immunization status.<sup>4</sup> Results of several studies have suggested that mothers do not feel they have sufficient information about immunization.<sup>5-7</sup> The traditional Vaccine Information Statements (VIS), which providers are required by law to provide to parents (National Childhood Vaccine Injury Act of 1986), have been criticized for their high reading level and for containing insufficient information.<sup>8</sup> Therefore, efforts have been made to evaluate additional informational materials to supplement VIS.<sup>5,9</sup> The current standard of care is to provide written materials including VIS at each vaccination visit, but fewer than three-quarters of pediatricians and family practitioners routinely provide this information.<sup>10</sup> Even when VIS are given, there may be insufficient time for parents to process written materials while also caring for their child during an immunization visit.<sup>10-13</sup> Possible alternatives to the 2-month vaccination visit as a time to provide vaccine information include the prenatal period and a prevaccination well-child visit.<sup>12,14</sup> One study in San Diego, California, randomly assigned 352 women to a prenatal educational intervention (either on vaccine initiation or sudden infant death syndrome) to assess the effect of prenatal immunization education on initiation of immunization visits.<sup>15</sup> After the interventions, knowledge about immunizations and the immunization schedule was significantly greater among women who received the immunization education session prenatally compared with

those who did not, although there was no difference in timing of immunization initiation between the intervention and control groups.

Our study is the second part of a larger effort to examine both the quality and timing of parental access to educational information regarding immunizations. In the initial phase, a newly developed vaccine-information booklet that was targeted toward mothers with vaccine-safety concerns was compared with VIS.<sup>9</sup> Mothers with concerns who reviewed the new pamphlet had increased confidence regarding vaccine safety compared with those who received VIS alone and also rated the new pamphlet significantly more visually appealing than VIS. The main objective of this study was to test whether the earlier distribution of immunization information in the form of the new pamphlet and VIS could further improve parental attitudes about vaccine safety.

## METHODS

### Study Population

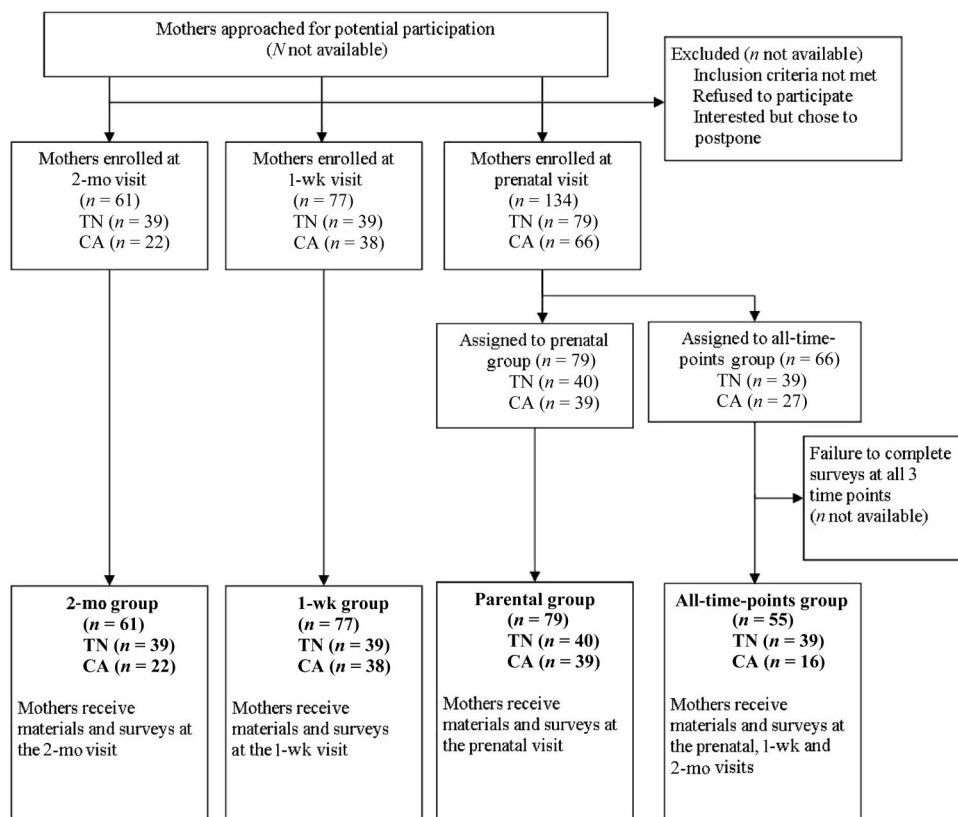
The study was conducted at the outpatient obstetric and pediatric clinics at Vanderbilt University in Nashville, Tennessee, and Palo Alto Medical Clinic in Palo Alto, California. Recruitment occurred from February 2006 through May 2007. The institutional review boards at Stanford University, the Palo Alto Medical Foundation, Vanderbilt University, and the Centers for Disease Control and Prevention approved this study. For the purposes of this report, all participants, whether they were pregnant or had already given birth at the time of enrollment, are referred to as "mothers."

Eligible mothers were aged 18 years or older. Potential study subjects who were attending 1 of the study sites were referred by the clinic staff to study personnel, who introduced the study, obtained informed consent, and

administered the screening survey. The 18-question screening survey collected demographic information such as education, race, age, and income and included 5 questions about attitudes and beliefs toward vaccines (Table 1). On the basis of the screening survey, mothers categorized as being in 1 of the 3 groups indicating concerns about vaccine safety ("health advocates," "fence-sitters," and "worrieds") were enrolled in the study.<sup>16</sup> An audience-segmentation study identified these 3 groups as representing mothers with the most concerns about vaccine safety (of 5 possible groups). Enrolled mothers were given a packet with the educational materials and a posttest with 9 questions and were given an average of 25 to 30 minutes to review the materials and complete the questionnaire. Participants received a small financial reimbursement.

Figure 1 illustrates the recruitment strategy for the intervention. Mothers were categorized into 4 intervention groups (based on the age of their child at attendance to the study site). The study groups included (1) the prenatal group, which received information (pamphlet and VIS) during the third trimester of pregnancy, (2) the 1-week group, which received information at the 1-week pediatric visit, (3) the 2-month group, which received information at the 2-month well-child visit, and (4) the all-time-points group, which received information at each of the 3 preceding time points. The all-time-points group also completed the posttest at each of these time points.

Participants were given a new 2-sided color pamphlet that specifically addressed a number of vaccine-safety questions, including "Why do children need so many vaccinations?" "Why does my child have to receive so many vaccines in one visit?" and "When should my child not receive a vaccine."<sup>9</sup> Mothers



**FIGURE 1** Study design for participants in each of the 4 treatment groups. TN indicates Tennessee; CA, California.

also received a VIS for every vaccine expected to be given at the 2-month visit (hepatitis B; diphtheria, tetanus, and pertussis; *Haemophilus influenzae* type b; pneumococcus; inactivated poliovirus; and influenza), which are 1-page (double-sided) sheets with information about the vaccine being given. VIS were given to all participants, because it is required by law for mothers to receive the

information at the vaccination visit and because they provide important information not included in the pamphlet, such as information about the Vaccine Injury Compensation Program. Materials were available in both English and Spanish.

The screening and posttest surveys contained 5 identical questions about

attitudes and beliefs toward vaccines (Table 1). The difference between pretest/posttest responses formed the basis for our analyses. The posttest also assessed how satisfied the study participant was with receiving vaccine information at that time and when she would prefer to receive this type of material about vaccinations (during pregnancy, at a visit before the visit when

**TABLE 1** Statements and Questions Used to Evaluate Change in Attitudes and Beliefs Among Study Participants

Statement/Question	Possible Responses				
	Positive			Negative	
Vaccines are necessary to prevent certain diseases	Strongly agree	Agree	Neither disagree nor agree	Disagree	Strongly disagree
If I vaccinate my child he/she may have a serious side effect	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
In general, how safe do you think vaccinations are for children?	Very safe	Safe	Somewhat safe	Not at all safe	
How confident are you in the safety of routinely received childhood vaccinations?	Very confident	Confident	Somewhat confident	Not at all confident	
Getting multiple shots in one visit can overload a child's immune system	False		I don't know	True	

the child is vaccinated, or right before the child is given a vaccine).

**Data Analysis**

Changes in maternal attitudes and beliefs about vaccine safety after receipt of information materials were assessed separately for each study group. The prenatal and 1-week groups were also compared with the 2-month group to assess whether earlier distribution of information resulted in a more beneficial change. Mothers in the 2-month group served as a reference group, because that is when vaccination information is customarily provided. Comparisons within and across groups were performed with the prenatal, 1-week, and 2-month groups, and longitudinal data from the all-time-points group were analyzed separately.

Responses to the 5 questions/statements listed in Table 1 were collapsed into dichotomous responses; for questions with an option of “I don’t know” or “neither disagree nor agree,” these answers were coded as a negative belief about vaccination. All statistical analyses were performed with Stata 9 (Stata Corp, College Station, TX). Study participants who omitted answers on the posttest were included in the analysis for those questions that they did answer. For the prenatal, 1-week, and 2-month groups, we calculated the proportion of participants who reported a positive belief or attitude about vaccination and compared pretest and posttest responses within each of the 3 treatment groups using Fisher’s exact tests. To account for within-person association in pretest and posttest comparisons, a generalized estimating equation population-averaged model with interaction terms for treatment group (prenatal versus 1-week versus 2-month groups) and time (pre versus post) was performed to examine the change be-

**TABLE 2** Study Population Demographics According to Treatment Group

	Prenatal Group	1-wk Group	2-mo Group (Reference)	All-Time-Points Group <sup>a</sup>
Total, <i>n</i> (%)	79 (36)	77 (35)	61 (28)	55 (100)
Study site, %				
Stanford ( <i>n</i> = 100)	51	49	36	29
Vanderbilt ( <i>n</i> = 117)	49	51	64	71
Education, %				
Less than high school/graduated from high school	26	20	31	7
Some/graduated from college	44	49	46	44
Postcollege degree	29	30	21	47
Prefer not to answer	1	0	2	2
Prenatal care initiation, %				
First trimester	87	87	90	95
Second trimester	10	12	8	3
Third trimester	3	1	2	0
Prefer not to answer	0	0	0	2
Race, %				
White	48	54	48	73
African American	19	13	21	4
Asian/Pacific Islander	22	10	11	16
Native American	0	0	2	0
Other	10	17	16	5
Prefer not to answer	1	6	2	2
Hispanic, %				
Yes	9	10	13	2
Prefer not to answer	0	2	2	0
First child				
Yes, %	42	56	48	55
If No, mean No. of children	2	2	2	2
Income, %				
Less than \$30 000	28	21	33	4
\$30 001–\$49 999	16	21	21	11
\$50 000–\$74 999	9	21	20	24
\$75 000 or more	39	26	16	47
Prefer not to answer	8	11	10	15
Screening survey classification, %				
Health advocate	13	18	11	15
Fence-sitter	77	57	69	73
Worried	10	25	20	13

<sup>a</sup> The all-time-points group was analyzed separately.

tween pretest and posttest responses in a positive response within groups and between groups. Differences in attitudes within the all-time-points group were analyzed by using a generalized estimating equation population-averaged model with 4 time points: the initial screening and each of the 3 posttests.<sup>17</sup>

**RESULTS**

Two hundred seventy-two women participated in the study. All women screened at Vanderbilt University were classified as a health advocate, fence-sitter, or worried and were enrolled in the study, compared with 47% percent at Stanford (Fig 1). Demographic information for the prenatal, 1-week,

2-month, and all-time-points groups is listed in Table 2. There were no statistically significant differences in demographic variables between participants in the prenatal, 1-week, or 2-month group. There were statistically significant differences between these groups and the all-time-points group with respect to race, education, and income, and they were analyzed separately.

**Attitudes and Beliefs About Vaccine Safety Before and After the Intervention**

Table 3 lists the percentages of mothers who reported agreement with attitudes and beliefs about vaccine safety during pretests and posttests in the

**TABLE 3** Attitudes and Beliefs of Study Participants According to Study Group at the Pretest and Posttest

Treatment Group	Vaccines Are Safe, % (95% CI)	I Am Confident in the Safety of Routinely Recommended Vaccines, % (95% CI)	Multiple Vaccines at Once Do not Overload the Immune System, % (95% CI)	If I Vaccinate My Child, He or She Will Probably not Have a Serious Adverse Effect, % (95% CI)	Vaccines Are Necessary to Prevent Certain Diseases, % (95% CI)
<b>Prenatal</b>					
At screening	77 (66–86)	73 (62–83) <sup>a</sup>	62 (50–72) <sup>a</sup>	46 (35–58)	92 (84–97)
After intervention	94 (86–98)	92 (84–97) <sup>a</sup>	90 (82–95) <sup>a</sup>	45 (34–57)	99 (93–100)
<b>1 wk</b>					
At screening	80 (69–88) <sup>a</sup>	73 (62–83) <sup>a</sup>	50 (38–60) <sup>a</sup>	21 (13–32) <sup>a</sup>	97 (91–100)
After intervention	97 (91–100) <sup>a</sup>	99 (93–100) <sup>a</sup>	80 (69–88) <sup>a</sup>	52 (40–64) <sup>a</sup>	93 (85–98)
<b>2 mo</b>					
At screening	89 (78–95)	85 (74–93)	56 (42–68) <sup>a</sup>	23 (13–36)	93 (84–98)
After intervention	95 (86–99)	92 (82–97)	82 (70–91) <sup>a</sup>	34 (23–48)	93 (84–98)

The all-time-points group was analyzed separately. Results: Vaccines are safe, at screening = 98% (95% CI: 90–100), after intervention = 98% (95% CI: 90–100); I am confident in the safety of routinely recommended vaccines: at screening = 96% (95% CI: 87–100), after intervention = 96% (95% CI: 87–100); Multiple vaccines at once do not overload the immune system: at screening = 96% (95% CI: 87–100), after intervention = 100% (95–100); If I vaccinated my child, he/she will probably not have a serious side effect: at screening = 38% (95% CI: 25–52), after intervention = 49% (95% CI: 35–63); and Vaccines are necessary to prevent certain diseases: at screening = 98% (95% CI: 90–100), after intervention = 98% (95% CI: 90–100). CI indicates confidence interval.

<sup>a</sup> Statistically significant.

prenatal, 1-week, and 2-month groups. After reviewing the materials, a significantly greater proportion of mothers in every treatment group reported that multiple shots do not overload the immune system. More than 90% of the mothers in all 3 treatment groups reported belief at baseline that vaccines are necessary to prevent certain diseases. Table 4 lists the adjusted odds ratios (ORs) for posttest versus pretest responses for each study group. Among participants in the 2-month and the prenatal groups, the odds of responding positively were significantly greater after receiving the information for 3 of the 5 questions and statements supporting the safety and importance of vaccines, whereas in the 1-week group, this was true for 4 of the 5 questions and statements. The timing of the

intervention (ie, whether the participant received material at the prenatal visit, the 1-week well-child visit, or the 2-month well-child visit) did not modify these results (all odds ratios that compared the prenatal or 1-week group to the 2-month group did not deviate significantly from 1.0, and all *P* values for odds ratios were >.05; data not shown).

### Satisfaction With the Timing of Vaccine Information and Timing Preference

There were no statistically significant differences in satisfaction with the timing of vaccine information across groups: in the 2-month group, 93% of the participants said that they were satisfied compared with 97% in the

prenatal group and 96% in the 1-week group (*P* = .71) (Table 5).

However, when given options, the majority of participants reported a preference for receiving vaccine information during pregnancy or at a visit before the vaccination visit; only 3% of participants preferred information to be given only at the time of vaccination. Thirty-four percent of participants preferred receiving information during pregnancy, and 63% of participants preferred it during a prevaccination well-child visit.

### All-Time-Points Group: Repeated Information Review Over Time

The all-time-points group was significantly different from the other 3 groups for variables such as demo-

**TABLE 4** Odds That a Participant in the Treatment Group Will Agree With the Statements After Intervention Compared With Before Intervention

Treatment Group	Adjusted OR (95% CI) <sup>a,b</sup>				
	Vaccines Are Safe	I Am Confident in the Safety of Routinely Recommended Vaccines	Multiple Vaccines at Once Do not Overload the Immune System	If I Vaccinate My Child, He/She Will Probably not Have a Serious Side Effect	Vaccines Are Necessary to Prevent Certain Diseases
2-mo	1.11 (1.00–1.23)	1.13 (1.00–1.27)	1.34 (1.16–1.55)	1.24 (1.05–1.47)	1.04 (0.96–1.12)
Prenatal	1.18 (1.09–1.30)	1.22 (1.10–1.35)	1.34 (1.19–1.52)	0.95 (0.82–1.10)	1.04 (0.97–1.11)
1-wk	1.15 (1.05–1.26)	1.24 (1.12–1.39)	1.43 (1.26–1.63)	1.40 (1.21–1.62)	0.97 (0.91–1.04)

The all-time-points group was analyzed separately. ORs compare the final posttest responses to initial screening test responses. Adjusted ORs: Vaccines are safe = 1.06 (95% CI: 1.00–1.13); I am confident in the safety of routinely recommended vaccines = 1.08 (95% CI: 1.02–1.16); Multiple vaccines at once do not overload the immune system = 1.52 (95% CI: 1.34–1.73); If I vaccinate my child, he/she will probably not have a serious side effect = 1.25 (95% CI: 1.10–1.42); and Vaccines are necessary to prevent certain diseases = 1.02 (95% CI: 0.99–1.05). CI indicates confidence interval.

<sup>a</sup> Adjusted for site, first-time mother, receiving prenatal care, education, race, Hispanic ethnicity, age, and income.

**TABLE 5** Study Participants' Preferences About the Timing of Immunization Information

Treatment Group	Satisfied/Very Satisfied With Receiving Information at Study Time, %	Preferred Visit for Immunization Materials		
		Prefer Information at Prenatal Visit, %	Prefer Information at a Child Visit Before Vaccination, %	Right Before Vaccination, %
2-mo	93	23	74	3
Prenatal	97	53	46	1
1-wk	96	38	57	5

graphics (race) and socioeconomic status (education and income). Similarly, they were significantly more likely to respond positively to questions and statements about vaccine safety at screening compared with those in the other groups. Although the baseline rates were high (eg, 98% agreed or strongly agreed with the statement, "Vaccines are safe"), small improvements in attitudes were evident (adjusted odds ratios ranged from 1.02 to 1.52).

## DISCUSSION

All groups, including the reference group, showed improved attitudes toward vaccines after reading the vaccine information, although there was no clear benefit with providing study materials earlier. The vaccine-information materials seemed to be especially effective in increasing agreement with the statement that multiple shots do not overload the immune system. Repeated provision of vaccine-information materials had a positive impact on maternal attitudes and beliefs, although the relative improvement compared with 1-time review could not be assessed because of the fundamental differences between the all-time-points group and the other groups. It should be noted that the majority of the mothers reported a fear of serious adverse effects after vaccination for their child at baseline, and even after review of vaccine information, approximately half of all the mothers maintained that fear. Future vaccine-information materials should

effectively address this issue for concerned parents.

More than 95% of the participants reported a preference for receiving vaccine-information materials during pregnancy or at a well-child visit before the vaccination visit. However, results did not show significant improvement in attitudes in the prenatal or 1-week groups compared with the 2-month reference group when controlling for a variety of factors. Similarly, in a study of pregnant women in a community with low immunization levels who were randomly assigned to a prenatal educational session either about vaccines or sudden infant death syndrome, the investigators found improved knowledge about vaccination but no change in initiation of vaccination.<sup>15</sup> In our study, the benefit of providing the time to read an improved educational material as well as the mandated VIS may have outweighed the possible benefit of providing the information before the 2-month immunization visit. Mothers have previously reported that a lack of immunization information contributed to their concern about immunizations,<sup>11</sup> and in a survey of providers, 80% recommended the addition of a preimmunization booklet for parents to improve immunization information.<sup>10</sup> Together, these study results indicate the value of maternal education to changing knowledge, attitudes, and beliefs. Because many parents want to be informed about the risks and benefits of immunization and to make their own decisions about immunizations for

their children,<sup>8</sup> the quality of information provided is important. In fact, results of the first phase of this study showed that mothers preferred a new tailored vaccine-information pamphlet over the VIS, although both were provided because presenting the VIS at the vaccination visit is mandated by law. It is worth noting that parents who receive immunization information are less likely to seek information from nonprovider sources,<sup>12</sup> from which parents may receive misinformation.<sup>18</sup> Our study had several limitations. First, we were not able to evaluate whether positive changes in attitudes and beliefs translated into better immunization uptake or whether the positive changes were sustained and, if so, for how long. It is important to note that the reference group for our study, the 2-month group, is not a population reference in the true sense of the word. The mothers in this group both received a new pamphlet, not currently available in provider offices, and were given time to review the materials before vaccine administration, which does not always happen at vaccination visits.<sup>10</sup> A second limitation was that although the calculated sample size was 460 participants, we enrolled only 272 participants because of the withdrawal of a third study site, which decreased the likelihood of detecting any important differences. Another limitation was that the mothers in the all-time-points group were different from all of the other groups. These limitations may have been a result of the inclusion criteria for this group, namely willingness to participate at 2 subsequent visits. The increased burden on this group may have caused selection bias of mothers with an interest in vaccination or positive attitudes and beliefs about health care and health research in general, leading to lack of comparability with the other 3 treatment groups. Finally,

even in this group of selected mothers who are deemed to have concerns about vaccine safety, 9 of 10 participants believed that vaccines were necessary to prevent certain diseases even before receiving information about the vaccines, and more than three-quarters of them believed that vaccines were safe and expressed confidence in the safety of routinely received vaccinations. This is a positive finding in that it shows a basic belief in the value of immunizations.

## CONCLUSIONS

Although our results did not show that receiving vaccine-information materials before the 2-month visit positively changed mothers' attitudes and be-

liefs about childhood vaccines, the mothers in our study indicated that they preferred receiving information before the vaccination visit. It may be optimal to offer vaccine-information materials at all visits to accommodate individual parent preferences. One study found that the majority of obstetricians and gynecologists who do not provide vaccine information to pregnant women would be willing to do so.<sup>14</sup> Given that distribution of the vaccine-information pamphlet and VIS significantly improved attitudes about vaccination, regardless of at what visit they were provided, allowing adequate time to review vaccine information at any visit may benefit concerned mothers.

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Kirsten S. Vannice, Daniel A. Salmon, Irene Shui, Saad B. Omer, Jennifer Kissner, Kathryn M. Edwards, Robert Sparks, Cornelia L. Dekker, Nicola P. Klein and Deborah A. Gust

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