

# The Role of Herd Immunity in Parents' Decision to Vaccinate Children: A Systematic Review

## abstract

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**BACKGROUND AND OBJECTIVE:** Herd immunity is an important benefit of childhood immunization, but it is unknown if the concept of benefit to others influences parents' decisions to immunize their children. Our objective was to determine if the concept of "benefit to others" has been found in the literature to influence parents' motivation for childhood immunization.

**METHODS:** We systematically searched Medline through October 2010 for articles on parental/guardian decision-making regarding child immunization. Studies were included if they presented original work, elicited responses from parents/guardians of children <18 years old, and addressed vaccinating children for the benefit of others.

**RESULTS:** The search yielded 5876 titles; 91 articles were identified for full review. Twenty-nine studies met inclusion criteria. Seventeen studies identified benefit to others as 1 among several motivating factors for immunization by using interviews or focus groups. Nine studies included the concept of benefit to others in surveys but did not rank its relative importance. In 3 studies, the importance of benefit to others was ranked relative to other motivating factors. One to six percent of parents ranked benefit to others as their primary reason to vaccinate their children, and 37% of parents ranked benefit to others as their second most important factor in decision-making.

**CONCLUSIONS:** There appears to be some parental willingness to immunize children for the benefit of others, but its relative importance as a motivator is largely unknown. Further work is needed to explore this concept as a possible motivational tool for increasing childhood immunization uptake. *Pediatrics* 2012;130:522–530

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### KEY WORDS

altruism, child, decision-making, immunization, intention, motivation, social responsibility, systematic review, vaccines

### ABBREVIATIONS

HPV—human papillomavirus  
MMR—measles, mumps, rubella

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Over the past several years, immunization rates have declined in certain areas of the United States.<sup>1</sup> As shown by recent disease outbreaks, the decreased rates of immunization threaten herd immunity.<sup>2,3</sup> Reduced immunization has, in part, resulted from the easing of school entry requirements.<sup>1,4,5</sup> Evidence indicates that the decline in immunization rates in certain communities is also caused by concerns about vaccine safety among some groups of parents,<sup>6</sup> with varying levels of concern.<sup>7</sup> A relatively small but vocal set of parents is adamantly opposed to immunizations and is unlikely to change their position, irrespective of the information presented.<sup>8</sup> Other parents are “vaccine-hesitant” but seem willing to learn more about immunizations, especially from their health care providers.<sup>9</sup> Much of the public discussion of vaccine safety and immunization policy has focused on personal issues, such as the benefit or risk to an individual child and a parent’s right to decide on whether their child gets immunized.<sup>10</sup> An essential point that has been largely missing is the issue of benefit to others, which may include protection of family, friends, and patients, as well as maintenance of public health through herd immunity.<sup>11,12</sup> We know that when an individual is immunized, this act benefits others in the community, especially those who are susceptible or vulnerable to disease, by contributing to the achievement and maintenance of herd immunity.<sup>13</sup> There is some evidence that adults do consider the potential benefits to others when they make other medical decisions for themselves, such as the decision to participate in clinical research.<sup>14,15</sup> There is also evidence to suggest that parents consider benefits to others when making decisions for their own children to participate in clinical research.<sup>16</sup>

The concern for others also appears to influence decisions regarding immunization.

In 2 different but similarly structured studies of adult college students (Hershey et al 1994<sup>17</sup> and Vietri et al 2011<sup>18</sup>), participants reported increased willingness to receive an immunization when it was framed in a way that highlighted the concept of altruism or benefiting others. Also emerging as significant factors in adults’ hypothetical immunization decisions were perceptions of others as “free-riding” (taking advantage of the herd immunity maintained by the immunization of others, thereby foregoing immunization for oneself) and “band-wagoning” (deciding to be immunized because of a perception that others are choosing to be immunized).<sup>17</sup>

When parents decide to immunize their children, they also contribute to the maintenance of herd immunity. The authors of previous reviews have described parental beliefs and decision-making about childhood immunizations<sup>19–21</sup>; however, relatively little is known about the extent to which parents consider benefit to others when making immunization decisions. As expectations continue to increase for clear communication from health care providers to parents about health issues, it will become increasingly important to understand how to communicate the linkages between the important concepts of benefit to others, herd immunity, and public health in ways that are understandable and compelling. Drawing upon parents’ concern for others or sense of social responsibility could serve as a potential motivational tool in promoting childhood immunization in both public health and clinical interventions.

In an effort to begin to understand how concern for benefit to others impacts childhood immunization decisions, we systematically reviewed research on parental immunization intention and behavior that includes consideration of the role of benefit to others.

## METHODS

### Definition of Benefit to Others

For the purposes of this study, “benefit to others” was defined as benefit to close contacts outside of the child’s own family, community members, or society, as a result of immunizing one’s child. Benefit to members of the child’s own family was not included in our operationalization of benefit to others. That is, when parents/caregivers consider advantages of immunization to their own families, including themselves, this is largely a self-benefit, even if indirect (eg, avoiding the need to seek medical care and the complications of missed school/work).

We included articles that addressed “social responsibility.” Social responsibility is defined as a sense of duty or obligation, either civic or moral, which is for the “common good.” Although social responsibility tends to be accompanied by a more egoistic, self-focused motivation in that failure to fulfill this responsibility often results in guilt, shame, or general negative affect, there is still an inherent awareness of the benefits to others at large.<sup>22</sup>

### Literature Search

We searched Medline from the beginning of the database through October 2010 for articles regarding parent/guardian decision-making about child immunization. We initially used the Medical Subject Headings terms Immunization OR Immunization Programs OR Vaccines to search for all possible articles referencing childhood immunization. We then searched for articles that combined any of the 3 immunization terms with the following search terms: the Medical Subject Headings terms Altruism OR Motivation OR Intention OR Social Responsibility OR Decision Making, or the key words “decision” OR “refusal” OR “refuse” OR “rationale” OR “compliance” OR “adherence.” An additional search for articles addressing benefit to

others with a focus on social obligation was created by combining the following phrases: “moral\*” OR “civic\*” OR “social\*” OR “societ\*” with “duty” OR “justif\*” OR “responsibilit\*” OR “obligation\*.” The asterisk represents the truncation or “wildcard” symbol, indicating that all suffix variants were included. These search terms were developed through discussion among the authors, based on search terms in previous studies, and through consultation with an experienced medical librarian.

Two authors (Drs Quadri-Sheriff and Finnell) reviewed titles of all articles returned by the initial search, as well as the bibliographies of all relevant review articles to identify which articles would be read in full. Once included studies were identified, their bibliographies and citation indices were also reviewed to identify additional studies.

### Inclusion and Exclusion Criteria

Articles were included for analysis if they were original studies, elicited responses from parents or other current child caregivers, and in any way addressed either willingness to immunize children for the benefit of others or a social responsibility to immunize children. Failure to elicit parent/caregiver status explicitly did not constitute grounds for exclusion so long as the study assessed child caregivers’ reasons for immunization or nonimmunization.

Non-English articles were excluded.

### Data Extraction

Three authors (Drs Quadri-Sheriff, Finnell, and Hendrix) extracted data from articles chosen for full review. Disagreement was resolved through discussion. The studies were organized according to the following study types: qualitative (eg, focus groups, interviews, and an online chat forum) and quantitative (eg, surveys wherein numerical ratings or rankings of important immunization decision factors were

elicited). Each article was initially analyzed to determine whether benefit to others was elicited as a rank-ordered reason to immunize one’s child. In addition, the following characteristics were extracted from each study: year of study, sample size, location, study focus (prospective or retrospective or both), caregiver status (eg, mother, father, grandparent, other), demographic composition of respondents (income/education level and race/ethnicity), and types of immunizations addressed (eg, measles/mumps/rubella [MMR], human papillomavirus [HPV], varicella, or multiple types of immunizations).

## RESULTS

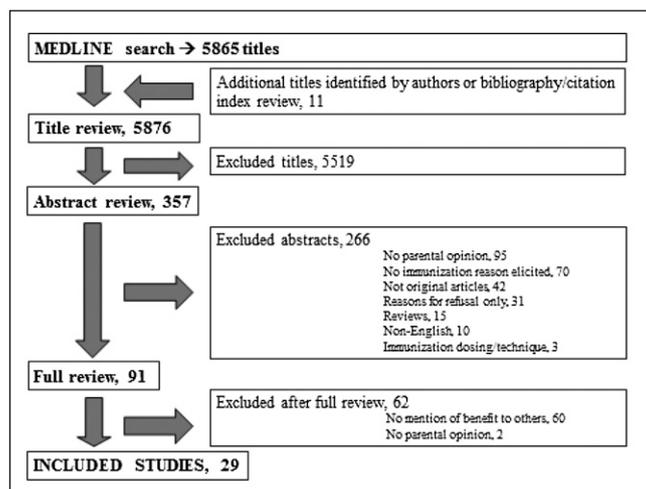
### Literature Search

The literature search yielded 5865 titles. Eleven additional titles were found by either bibliography and citation index review of included studies or by the authors’ contributing published articles on this topic that they were familiar with from their previous work. Based on title alone, 5519 articles were excluded because it was evident that they addressed vaccine development, efficacy, or safety in the setting of an observational or experimental trial. This left 357 abstracts identified as

potentially relevant, 266 of which were excluded after review. Abstracts were excluded when it was clear that the article, based on the abstract, fell into 1 of these exclusion categories: (1) specific reasons for childhood immunization uptake were not elicited (eg, only addressed reasons for refusal); (2) parent or child caregiver opinion regarding immunizations was not addressed; (3) abstract did not describe an original study (eg, was a review article or theory piece); and/or (4) abstract indicated a non-English article. After exclusion of these 266 abstracts, 91 articles were left for full review. Of the articles reviewed in full, 62 were excluded primarily because they did not address the concept of benefit to others or elicit parental/child caregiver opinion (which was not clear based on abstract review alone). Twenty-nine studies met inclusion criteria (Fig 1).

### Analysis of Included Studies

Seventeen of the included studies were qualitative in nature.<sup>23–39</sup> In these studies, data were obtained primarily by interviews with individual parents and/or child caregivers or in focus groups with parents and/or child caregivers. Anywhere from 15 to 50



**FIGURE 1**  
Study selection process.

interviews were conducted, and focus groups generally consisted of 4 to 8 participants. One study (Skea et al 2008)<sup>51</sup> analyzed an online chat forum in which parents discussed the MMR immunization in particular.

Twelve articles were quantitative in nature.<sup>40–51</sup> In these studies, data were obtained by survey administration. In 9 of the 12 quantitative studies, the investigators asked participants to rate the impact of benefit to others, along with other factors, on their decision to immunize their child.<sup>40–42,45–48,50–51</sup> In 3 of these ratings-based studies, the investigators used Likert-type scales.<sup>46,49,51</sup> In 3 of the quantitative studies, investigators asked participants to rank-order the concept of benefit to others as a reason to immunize their child in comparison with other reasons, as further discussed below<sup>43,44,49</sup> (Table 1).

### Time Frame of Studies

Five studies did not specify the data collection time frame.<sup>23,25,27,39,48</sup> For all other studies, the data collection time frame occurred between 1994 and 2009, with the majority of studies collecting data between 2000 and 2006.

Eight studies were prospective in nature, asking participants what they hypothetically would do or planned to do when faced with a variety of immunization decisions.<sup>27,28,35,46–50</sup> Eleven studies were retrospective in nature, asking about immunization decisions the parent or child caregiver had already made.<sup>23,25,26,34,39–42,44,45,51</sup> Finally, 10 studies asked both types of questions of participants, ie, questions regarding both past immunization decisions/behaviors as well as planned or hypothetical decisions/behaviors<sup>24,29–33,36,37,38,43</sup> (Table 1).

### Location of Studies

Twelve of the 29 included studies were conducted in the United

States,<sup>25,28,30,32,35,36,38,42,45,47,49,50</sup> Ten were conducted in Europe, mainly in the United Kingdom,<sup>24,26,29,31,33,34,37,40,41,51</sup> and 6 took place in Australia or New Zealand.<sup>23,27,43,44,46,48</sup> One study was conducted in Hong Kong.<sup>39</sup> In the majority of studies, investigators recruited participants from a mix of urban and suburban areas, and studies took place in both clinical and nonclinical settings (Table 1).

## Demographics of Respondents

### Race and Ethnicity

In 15 of the studies, neither race nor ethnicity of the participants was reported, or the racial or ethnic distribution could not be determined based on given information.<sup>23,24,26,27,29,31,37,39–44,46,51</sup> One study in the UK included only white participants.<sup>33</sup> Two studies (Shui et al 2008<sup>38</sup> and Bair et al 2008<sup>35</sup>) in the United States focused on 2 ethnic minority groups, African-Americans<sup>38</sup> and Latinas.<sup>35</sup> In the remaining 12 studies in which investigators reported race or ethnicity, multiple races were sampled with the majority of participants being white (Table 1).<sup>25,28,30,32,34,36,45,47–50</sup>

### Socioeconomic Status

Twenty-one of the studies included parents or child caregivers from varied socioeconomic backgrounds.<sup>23–30,32–34,36–38,40,43–45,47,50,51</sup> In 5 studies, the majority of the participants came from relatively high socioeconomic backgrounds and/or were well-educated.<sup>31,39,42,48,49</sup> Three studies did not comment on socioeconomic status (Table 1).<sup>35,41,46</sup>

### Caregiver Status

In 24 of the 29 studies, investigators specifically recruited parents or caregivers (eg, legal guardians) of children. In 11 of these studies, investigators recruited only mothers. In the 22 studies that revealed caregiver type, the majority (range = 56%–100%) of participants were mothers.<sup>23–28,30,32–36,38–41,43,45,47–50</sup>

In 4 studies, the authors indicated the participants were parents/caregivers but did not explicitly elicit or report parental status (eg, mother, father, step-parent, grandparent; Table 1).<sup>29,44,46,51</sup>

## Immunization Type Investigated

A variety of immunization types were addressed. Seven of the studies focused on MMR,<sup>24,26,31,40,41,46,51</sup> and, in an additional 4 studies, investigators addressed MMR along with other immunizations.<sup>25,27,34,49</sup> In 8 studies,<sup>23,36–39,42,43,48</sup> investigators asked participants about childhood immunizations in general. The authors of 1 study asked parents about immunizations against sexually transmitted infections in general,<sup>28</sup> and 5 studies<sup>29,30,35,47,50</sup> focused specifically on the HPV immunization. Two studies specifically addressed the varicella immunization,<sup>44,45</sup> 1 study addressed the influenza immunization,<sup>32</sup> and the authors of 1 study asked parents about a childhood immunization catch-up campaign<sup>33</sup> (Table 1).

## Parental Knowledge of Herd Immunity

In 6 of the qualitative studies, both in focus group and interview sessions, at least 1 participant spontaneously mentioned the concept of herd immunity in the context of routine immunization.<sup>24,27,28,31,33,34</sup> In 2 additional studies, when the issue was brought up by the interviewer or other focus group members, participants agreed that herd immunity was a benefit of immunization.<sup>23,26</sup> Some parents' knowledge of herd immunity actually led to their frustration with medical authorities: in 1 study (Evans et al 2001),<sup>26</sup> a parent admitted feeling resentful toward governmental health care bodies that suggest children should be immunized to further herd immunity for the benefit of society. Among the quantitative studies, parental knowledge of herd immunity was

**TABLE 1** Characteristics of Included Studies

| Reference                        | Publication Year | Data Collection Time Frame | Sample Size                                      | Methodology              | Location  | Retro/Prospective | Caregiver Status                               | Demographics                                   | Ethnicity/ Race (0–9) <sup>a</sup> | Vaccine Type                                 |
|----------------------------------|------------------|----------------------------|--|--------------------------|---|-------------------|--|--|------------------------------------|--|
| Bair et al <sup>35b</sup>        | 2008             | 2004–2005                  | 40   | Interviews               | Indianapolis, Indiana                             | Prospective       | Mothers  | Urban, mostly foreign-born                     | 6                                  | HPV  |
| Benin et al <sup>36b</sup>       | 2006             | 2002–2003                  | 33   | Interviews               | New Haven, Connecticut                            | Combination       | Mothers  | Urban and suburban                             | 9: 5, 3, 6                         | Multiple                                     |
| Bond et al <sup>23</sup>         | 1998             | Not specified              | 45   | Interviews               | Melbourne, Australia                              | Retrospective     | Mothers (fathers participated in 6 interviews) | Targeted high and low education levels and SES | 0                                  | Multiple                                     |
| Casiday et al <sup>40</sup>      | 2006             | 2004                       | 996  | Survey                   | Durham, United Kingdom                            | Retrospective     | 93.6% mothers, 6.1% fathers, 0.3% other        | Varied SES but higher than general population  | 0                                  | MMR  |
| Casiday <sup>24</sup>            | 2007             | 2002–2004                  | 87   | Focus groups, interviews | Cambridge and Durham, United Kingdom              | Combination       | 88.5% mothers, 11.5% fathers                   | Varied SES                                     | 0                                  | MMR  |
| Cassell et al <sup>41</sup>      | 2006             | 2004                       | 452  | Survey                   | Brighton, United Kingdom                          | Retrospective     | Mothers  | Unclear  | 0                                  | MMR  |
| Downs et al <sup>25</sup>        | 2008             | Not specified              | 30   | Interviews               | Missouri, Pennsylvania, and Oregon, United States | Retrospective     | 87% mothers, 13% fathers                       | Varied SES, majority college educated          | 9: 5, 3, 1                         | Multiple                                     |
| Evans et al <sup>26</sup>        | 2001             | 2001                       | 48   | Focus groups             | Avon and Gloucestershire, United Kingdom          | Retrospective     | 89.5% mothers, 10.5% fathers                   | Varied SES                                     | 0                                  | MMR  |
| Gazmararian et al <sup>32</sup>  | 2010             | 2006                       | 54   | Focus groups             | Atlanta, Georgia                                  | Combination       | Mothers  | Varied SES                                     | 9: 5, 3, 6, 2                      | Influenza                                    |
| Gellatly et al <sup>51b</sup>    | 2005             | 2003–2004                  | 110  | Survey                   | Edinburgh, United Kingdom                         | Retrospective     | Parents  | Varied SES                                     | 0                                  | MMR  |
| Kennedy et al <sup>42</sup>      | 2008             | 2008                       | 6 focus group participants, 12 household surveys | Focus groups, survey     | Indiana   | Retrospective     | Church leaders, parents                        | Well educated                                  | 0                                  | Multiple                                     |
| Kilmartin et al <sup>43</sup>    | 1998             | 1994–1995                  | 242  | Survey                   | Tasmania, Australia                               | Combination       | Postpartum mothers                             | Varied SES                                     | 0                                  | Multiple                                     |
| Leask et al <sup>27</sup>        | 2006             | Not specified              | 37   | Focus groups             | Sydney, Australia                                 | Prospective       | Mothers  | Varied SES                                     | 0                                  | Multiple                                     |
| Marshall et al <sup>44</sup>     | 2005             | 2004                       | 686  | Survey                   | South Australia                                   | Retrospective     | 56.3% women, 43.7% men                         | Varied SES                                     | 0                                  | Varicella                                    |
| Mays et al <sup>28</sup>         | 2004             | 2000                       | 34   | Interviews               | Indianapolis, Indiana                             | Prospective       | 85.3% women, 14.7% men                         | Urban and suburban                             | 9: 5, 3                            | STI vaccines: HPV, hypothetical GC, HIV, HSV |
| Moran et al <sup>57b</sup>       | 2008             | 2003                       | 66 focus groups                                  | Focus groups             | Europe  | Combination       | General population                             | Varied SES                                     | 0                                  | Multiple                                     |
| Niederhauser et al <sup>45</sup> | 2001             | 1998                       | 262  | Survey                   | Hawaii  | Retrospective     | 87% mothers, 11% fathers, 2% grandmothers      | Varied SES                                     | 9: 2, 4, 5                         | Varicella                                    |

TABLE 1 Continued

| Reference                    | Publication Year | Data Collection Time Frame | Sample Size    | Methodology                   | Location   | Retro/Prospective | Caregiver Status                               | Demographics        | Ethnicity/ Race (0–9) <sup>a</sup> | Vaccine Type  |
|------------------------------|------------------|----------------------------|----------------|-------------------------------|--|-------------------|--|---------------------|------------------------------------|---------------|
| Noakes et al <sup>29</sup>   | 2006             | 2005                       | 6 focus groups | Focus groups                  | United Kingdom   | Combination       | Parents  | Varied SES          | 0                                  | HPV           |
| O'Shen et al <sup>30</sup>   | 2005             | 2003–2004                  | 25             | Focus groups, interviews      | Boston, Massachusetts                                      | Combination       | 88% mothers, 12% fathers                       | Varied SES          | 9: 5, 3, 6                         | HPV           |
| Reiter et al <sup>50</sup>   | 2010             | 2009                       | 406            | Survey                        | United States  | Prospective       | Mothers  | Varied SES          | 9: 5, 3, 6                         | HPV           |
| Skea et al <sup>51</sup>     | 2008             | 2000–2003                  | 132            | Analysis of online chat forum | United Kingdom   | Combination       | 133 users, presumed mostly women               | Presumed higher SES | 0                                  | MMR           |
| Shui et al <sup>58b</sup>    | 2005             | 2003                       | 53             | Focus groups                  | Atlanta, Georgia   | Combination       | Mothers  | Varied SES          | 3                                  | Multiple      |
| Tarrant et al <sup>58b</sup> | 2008             | Not specified              | 15             | Interviews                    | Hong Kong  | Retrospective     | 93.3% mothers, 6.7% fathers                    | Higher SES          | 0                                  | Multiple      |
| Trickner et al <sup>33</sup> | 2007             | 2005–2006                  | 22             | Interviews                    | Southern England   | Combination       | 95.5% mothers, 4.5% fathers                    | Varied SES          | 5                                  | DTaP/IPV/Hib  |
| Trickner et al <sup>34</sup> | 2010             | 2006–2007                  | 19             | Interviews                    | Southern England   | Retrospective     | Mothers (fathers participated in 2 interviews) | Varied SES          | 9: 5, 3                            | DTaP/IPV, MMR |
| Wallace et al <sup>46</sup>  | 2006             | 2004–2005                  | 158            | Survey                        | Australia and New Zealand (some international respondents) | Prospective       | Not reported                                   | Not reported        | 0                                  | MMR           |
| Watts et al <sup>47</sup>    | 2009             | 2007–2008                  | 246            | Survey                        | Boston, Massachusetts                                      | Prospective       | Mothers  | Varied SES          | 9: Latina versus non-Latina        | HPV           |
| Wroe et al <sup>48</sup>     | 2004             | Not specified              | 195            | Survey                        | Auckland, New Zealand                                      | Prospective       | Pre- and postpartum mothers                    | Higher SES          | 9: 5, 2, 4                         | Multiple      |
| Wu et al <sup>49</sup>       | 2007             | 2003                       | 228            | Survey                        | New Haven, Connecticut                                     | Prospective       | Postpartum mothers                             | Higher SES          | 9: 5, 6, 3                         | Multiple      |

DTaP, diphtheria, tetanus, acellular pertussis; GC, *Neisseria gonorrhoeae*; Hib, *Haemophilus influenzae* type b; HSV, herpes simplex virus; IPV, inactivated poliovirus vaccine; Multiple, multiple vaccine types; SES, socioeconomic status; STI, sexually transmitted infection.

<sup>a</sup> 0, not reported/unclear; 1, American Indian or Alaska Native; 2, Asian; 3, black or African-American; 4, Native Hawaiian or Other Pacific Islander; 5, white; 6, Hispanic/Latino(a); and 9, multiple races.

<sup>b</sup> Social responsibility articles.

indirectly assessed in 1 article. Casiday et al (2006)<sup>40</sup> asked parents to state the degree to which they agreed with the following statement, "People who don't vaccinate their kids put others at risk." The majority of participants either strongly agreed (53.6%) or agreed (36.6%) with this statement (Table 1).

### Parents' Report of Benefit to Others as Motivation for Immunization

The concept of benefit to others outside one's own family as a result of childhood immunization was mentioned in 12 qualitative studies.<sup>23,24,26–31,33–35,37</sup> In 2 of these studies,<sup>28,31</sup> parents mentioned the concept of benefit to others as a motivating factor in their decision to immunize their children. In an online chat forum, 1 respondent wrote, "I very much wanted my child to be vaccinated against rubella because I could not live with myself if a baby was born catastrophically damaged (can you imagine a worse hell than being deaf and blind?) because of me & my child passing on an illness."<sup>31</sup>

In contrast, in a qualitative study focusing on the influenza immunization (Gazmararian et al 2010),<sup>32</sup> the authors found that the majority of focus group participants (all mothers) felt that the decision to immunize their children was deeply personal. The idea of immunizing children to protect others, particularly older people, did not resonate with these participants.

Among the studies in which it was quantitatively assessed, a range of 1% to 60% (median = 35%) of parents rated the concept of benefit to others as a reason to have their children immunized.<sup>40,41,43–49,51</sup> The studies varied in terms of how they phrased questions about benefit to others. In Casiday et al (2006),<sup>40</sup> 52% of "MMR acceptors" and 28% of "MMR refusers" strongly agreed with the statement: "I have a responsibility to have my child vaccinated

for the protection of all children." In Cassell et al (2006),<sup>41</sup> participants were asked more directly about their decision-making process. Among "immunization-compliant" mothers, 60% replied yes to the question, "When deciding about MMR did you consider possible benefits to other children?" Interestingly, 61.5% of noncompliant mothers also answered yes to this question. The study results did not suggest possible reasons for these similar rates from seemingly disparate respondent groups of compliant mothers and noncompliant mothers.

In 3 studies, the importance of benefit to others was ranked relative to other motivating factors.<sup>43,44,49</sup> In Kilmartin et al (1998),<sup>43</sup> postpartum mothers were asked to identify the most important reason for their intention to immunize their infants. In response to this open-ended question, benefit to others was reported as the primary motivating factor by 6% of respondents. Marshall et al (2005)<sup>44</sup> also used an open-ended question embedded in a survey to assess parental decision-making. They reported that 1% of respondents (4 of 408) listed concern for preventing disease in others as their main reason for immunizing their child against varicella. In Wu et al (2008),<sup>49</sup> mothers were asked to rank the following reasons to immunize their children: preventing disease in one's own child, preventing disease, preventing disease in society, and trust in the pediatrician or similar provider. The response "to prevent disease in society" was ranked by 37% of respondents as the second most important factor, after preventing disease in one's own child (Table 1).

### DISCUSSION

Although 29 studies were found that examined whether parents consider benefit to others when making immunization decisions for their children, no study was designed with the primary focus on this as a motivating factor

in parental immunization decision-making. Research has revealed that many parents have an incomplete understanding of how immunization achieves protection.<sup>52</sup> In our study, overall, some parents seem to know that herd immunity is an important benefit of childhood immunization. However, although some seem to appreciate the role of childhood immunization in furthering herd immunity, their decision to immunize their own children is, not surprisingly, based largely on the perceived benefit to each child.

Interestingly, the ideas of herd immunity and benefit to others were brought up spontaneously by a number of parents as factors that were important in parental decision-making regarding immunization. Casiday (2007)<sup>24</sup> notes, "Well over a third of the informants spontaneously mentioned contributing to the 'herd immunity' of the population by vaccinating one's own children, as a parent's responsibility to the community."

Also notable, there was little mention of how vaccine-hesitant parents might respond to a discussion of herd immunity and benefit to others in the context of childhood immunization, either in the media or during a clinical encounter. Though their study did not specifically focus on vaccine-hesitant respondents, Cassell et al (2006)<sup>41</sup> report that 67.3% of those who accepted MMR and 37.4% of those who had not accepted MMR answered "yes" to the question: "Is it right for health professionals to advise parents to have their child vaccinated for the benefit of others?" Interestingly, based on a study of general practitioners' vaccine-related communication skills by using standardized scenarios, Leask (2009)<sup>53</sup> cautions practitioners against trying to "strong arm" parents into accepting vaccines via hypothetical scenarios that emphasize parental anticipatory guilt about potential transmission to others.

As reported, there was a wide range of parents who endorsed consideration of benefit to others as motivation for immunizing their children in the included studies. It appears that only 1% to 6% of parents will spontaneously name benefit to others as a primary reason to vaccinate, but ~30% to 60% agree that it is an important reason to vaccinate when asked; perhaps the second most important reason. Although a social desirability bias on the part of respondents could have contributed to this variation, we believe that some of this variation also comes from the fact that questions regarding benefit to others were phrased in a variety of different ways. Also, sampling techniques varied among the included studies. Such variation in quantitative data highlights the potential impact of how this issue is framed, and also highlights the lack of convergence of findings to date about the relative impact of the value of benefit to others as a parental motivator in the context of childhood immunization.

Additional research to understand the meaning to parents of this public health aspect of immunization is recommended to improve public health communication campaigns and provider-parent communication strategies for vaccine-hesitant parents. Specifically, qualitative studies are needed to explore how individual providers and public health initiatives can present the idea of childhood vaccination as a benefit to others, without suggesting that parents consider the welfare of others above that of their own child. An interesting area to investigate would be whether parents who espouse anticipatory regret would be most amenable to motivational interventions that emphasize benefit to others. Quantitative studies will better substantiate the potential impact of this motivational tool and determine the population(s) with whom this argument would most resonate.

This review has limitations that warrant consideration. We found that the concept of benefit to others was elicited by many phrases and keywords in the

literature. Literature search terms were selected to be as inclusive as possible, but may have inadvertently omitted some relevant articles in our search, including any nonpublished data. We also excluded articles that were not in the English language. Lastly, Medline was the only online database that was searched. Although Medline is not comprehensively inclusive of all social/behavioral science journals, the database does index key journals in this discipline, such as the field of social psychology's flagship journal (*Journal of Personality and Social Psychology*). Nonetheless, the potential impact of the concept of benefit to others as a motivational tool when discussing immunizations with vaccine-hesitant parents is largely unknown. Its potential role and strength as a motivator, and the caregiver population that would be most impacted by such an argument, warrants further investigation, particularly in light of the fact that many vaccines are administered predominantly for maintenance of herd immunity.

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