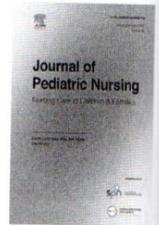




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Best shot: A motivational interviewing approach to address vaccine hesitancy in pediatric outpatient settings



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ABSTRACT

Background: Vaccine hesitancy in parents and childhood vaccine refusal is increasing. A standard of care to address this problem has not been identified.

Purpose: To identify if the use of motivational interviewing by pediatric providers during routine well child visits, when compared to standard of care, would increase vaccine rates in children 0–12 months of age. Factors associated with vaccine hesitancy were also investigated.

Methods: A quasi-experimental study was completed on a convenience sample of pediatric providers ($N = 6$) and caregivers of children 0–12 months of age ($N = 66$). Four providers were trained to use motivational interviewing. During the well child visit the Parent Attitudes About Childhood Vaccines survey was completed, and the motivational interviewing intervention was implemented. Clinic's data were compared with other clinic data of non-trained providers.

Findings: Vaccine refusal/delays rate was 11.4% among caregivers. Vaccine refusal rate decreased after the intervention (9.00% pre-intervention and 6.40% post-intervention). An ordinal regression identified caregivers with higher vaccine hesitancy scores and more children were more likely to delay or refuse vaccines, while caregivers ≥ 30 years or with high income were less likely to delay/refuse vaccines. A difference in difference analysis identified that an additional 2.6% of children received vaccines when seen by trained providers compared to non-trained ($\beta = -0.330$, $OR = 0.719$, $p = 0.470$).

Discussion: Findings indicate a condensed motivational interviewing education session may be clinically significant in decreasing vaccine hesitancy among this population.

Applications to practice: A more robust study to confirm these findings is recommended prior to practice implementation.

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Introduction

The use of vaccines, which prevent up to 3 million deaths worldwide each year, has been identified as an economic solution for disease prevention (World Health Organization, 2019). Despite the well-documented benefits of vaccines, along with the historic elimination of preventable diseases such as the measles in the United States (US), the number of parents who choose not to vaccinate their children is increasing (Dubé et al., 2021). A recent analysis of national vaccine status data identified that nearly 40% of all children 19–35 months old in the

US are not up to date on their vaccines, and over 30% of those being vaccinated are utilizing an alternative or unknown schedule (Hargreaves et al., 2020). The term used to describe this decrease in vaccine confidence and acceptance is vaccine hesitancy (VH). The WHO Immunization Practices Advisory Committee (IPAC) defines VH as a fluid state that involves the refusal of or deviation from the recommended vaccine schedule despite vaccine access (Immunization Practices Advisory Committee, 2019).

In the US, nearly 300 children die annually from illnesses that could be prevented through appropriate vaccination (Office of Disease Prevention and Health Promotion, 2020). Each year, adherence to the standard seven vaccine series schedule precludes 14 million illnesses, prevents 33,000 deaths, and decreases direct costs of health care by nearly \$10 billion (ODPHP, 2020). The reasons behind VH are numerous. A US study conducted in 2019 identified one of every 15 parents as

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vaccine hesitant of childhood vaccine schedules, and one of every eight parents had specific vaccine safety concerns (Kempe et al., 2020). Of the studies relating to VH, few articles focus on the childhood vaccine series. Rather, a descriptive bibliometric study identified that the literature on VH has been concentrated in addressing concerns related to the human papilloma virus (HPV) and the influenza vaccine (Sweileh, 2020). Findings support O'Leary's belief that current research has focused on defining VH without identifying how to approach this issue (National Academies of Sciences, Engineering, and Medicine, 2021). More research is needed to identify how to decrease VH among parents of children 0–12 months of age.

Understanding VH and addressing parental apprehensions is imperative for clinicians to improve vaccination coverage. Current tools identified to address VH include use of provider recommendation, a presumptive approach, education interventions, communication method training, and motivational interviewing (Brewer et al., 2017). Motivational interviewing (MI) is a communication tool that uses a guiding approach for “eliciting from patients their own good motivations for making behavior changes in the interest of their health” (Rollnick et al., 2008, p. 6). This tool is unique due to its collaborative approach coupled with a focus on promoting a change in behavior (Miller & Rollnick, 2013). Motivational interviewing allows the provider to work in partnership with the parent by eliciting and affirming vaccine concerns while guiding the individual towards a desire for change and vaccine adherence (Rosengren, 2018). Utilizing a tool that can be implemented consistently and effectively is also important. Behavioral interventions such as MI are susceptible to a lack of standardization. (Miller & Rollnick, 2014). One instrument that has been created to measure the fidelity of MI interventions is the Motivational Interviewing Treatment Integrity code (MITI) (Schmidt et al., 2019). Addressing the fidelity of any MI intervention is crucial in ensuring consistency in patient care.

Purpose

The primary purpose of this study was to answer the following question: does the use of motivational interviewing by pediatric providers during routine well child visits, when compared to standard of care, increase vaccine rates in children 0–12 months of age? Secondary goals were to explore provider comfort talking to parents about vaccines, provider comfort using MI, and provider confidence in the use of MI to decrease vaccine hesitancy as well as to determine caregivers' attitudes about childhood vaccines and factors associated with vaccine hesitancy.

Methods

Study design

Upon Institutional Review Board (IRB) approval from the University and Beacon Health and completion of the data-sharing agreement, a quasi-experimental study was conducted on a convenience sample of caregivers presenting with children for a 0–12 month well child check (WCC) from June 1, 2021, to August 31, 2021. Four providers from three clinics were trained to use MI to talk with caregivers about vaccinations. To determine the effect of training, retrospective data related to vaccination delay and refusal were obtained for both trained and non-trained providers in the corresponding months of 2019 and 2020 and repeated during the intervention period in 2021. Providers were recruited through an email with an attached provider flyer. Caregivers were recruited using informational cards displayed in both English and Spanish at all participating practices. Intervention providers received training on MI in May prior to the study onset. During the well child visit the Parent Attitudes About Childhood Vaccines (PACV) survey was completed, and the MI intervention was implemented.

Settings & participants

The setting included three urban clinics in a midwestern county. Providers within this county who saw patients for well child checks at 0–12 months of age were recruited. Providers who did not conduct well child checks were excluded from this study. All clinics accepted both private insurance and Medicaid. A range of clinics was used to increase the generalizability of findings. Caregivers of children who were <18 years of age were excluded from this study. Each caregiver only participated in the study once.

Intervention

Four providers including pediatric specialists and family practice providers completed education in the form of a one-hour introductory PowerPoint, attended a 2-h in person training session by a certified Motivational Interviewing Network of Trainers (MINT) instructor, and received a copy of the provider guide: MI & VH. The provider guide was designed by the researcher and adopted with permission from the copyrighted Modified Drug Adherence Work-Up (M-DRAW) tool (Lee et al., 2020). The Provider guide gives prompting for applying the MI intervention and incorporates the attitude roots model (Hornsey & Fielding, 2017). The provider guide also details recommendations from the American Academy of Pediatrics (AAP) on addressing VH (Edwards & Hackell, 2016). The final pages of the provider guide offer a list of reputable resources that can be given to parents. Incorporating these concepts into the provider MI approach allow for prompt identification of the reasoning behind rejection and guide the provider in promoting change in each individual parent.

Procedures

Data were collected at three different time-points throughout this study (Table 1). At time-point one, baseline vaccine data from 2019 and 2020 were obtained via the electronic health record (EHR) to identify the number of patients seen for a WCC and of those visits, the number of children who were not up to date on vaccines. Both years were obtained to account for the impact of the COVID-19 pandemic on WCCs. The same baseline electronic vaccine data were also collected for three control providers that did not participate in MI training.

Providers trained in MI completed a survey identifying provider comfort when talking to parents about vaccines, provider comfort using MI, and provider confidence in the impact of MI on VH. Demographic data were collected from both the trained and untrained providers. At time-point two upon completion of the well child visit, clinical staff documented the vaccine status of the corresponding child. At time-point three upon completion of the three-month intervention period, vaccine data collection obtained at time point one was repeated. Also, at time-point three, participating providers were given a post-study questionnaire.

All caregivers 18 years of age who presented with their children for a 0–12 month well child check with a participating provider were offered the PACV survey along with the study information sheet. Consent for

Table 1
Study measures and variables.

| Variable | Measure | Time point collection |
|--------------------------------|--|-----------------------|
| Vaccine Status | Clinic Form | 2 |
| Vaccine Status | IT Report | 1 & 3 |
| Provider Vaccine Confidence | Provider Pre- & Post-intervention Survey | 1 & 3 |
| Provider MI Comfort/Confidence | Provider Pre- & Post-intervention Survey | 1 & 3 |
| Demographics | PACV Survey | 2 |
| Vaccine Hesitancy | PACV Survey | 2 |
| MI Feasibility | Provider Post-intervention Survey | 3 |

Note. IT = information technology, MI = motivational interviewing, PACV = parent attitudes about childhood vaccines.

participation in this study was obtained by including a consent statement in the study information sheet. Caregivers who completed the survey were considered enrolled in this study. During the well child visit providers utilized the motivational interviewing techniques taught in training and outlined in the provider guide.

Documents were kept in a secure folder on each unit, collected regularly, and stored in a locked file box. All electronic data were stored on a password-protected USB or within an online HIPPA protected L3 BOX file. All paper and electronic documents and data were maintained by the researcher KJ. All related study materials were kept within a secure location for a period of 3 years following completion of this study.

Tools

Caregiver demographics were obtained, and caregiver VH was measured using the PACV survey (Opel, Mangione-Smith, et al., 2011). This survey consisted of 23-items including eight demographic questions and 15 questions to assess parental VH (Opel et al., 2013). The parental hesitancy questions were a combination of yes or no questions as well as Likert-type questions on a 10-point and 5-point scale. The demographic data identified if the qualifying child was firstborn, the relationship of respondent to the child, parental age, marital status, caregiver education, household income, children per household, and race/ethnicity (Opel et al., 2013). In determining the validity and reliability of this survey, the 15 questions were divided into three groups including "safety and efficacy" with four items and a Cronbach α of 0.74, "general attitudes" with nine items and a Cronbach α of 0.84, and "behavior" with two items and a Cronbach α of 0.74 (Opel, Taylor, et al., 2011, p. 6603). Provider data were obtained via a provider survey.

Statistical analysis

Analysis was completed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were calculated for provider data, caregiver data, and the PACV surveys. Wilcoxon Signed Rank tests were performed to assess change in provider comfort talking to parents about vaccines, provider comfort using MI, and provider confidence that MI would improve vaccine rates. An ordinal regression to predict vaccine status of the child post the intervention based on demographic data were performed. A difference in differences (DiD) analysis was completed to identify on average the impact MI had on improving VH while also considering natural trends related to VH.

Findings

Primary goal

Vaccine Hesitancy before and after the intervention. Vaccine refusal rates for the clinics sampled overall in 2019, 2020, and 2021 were 8%, 9%, and 7% respectively. The DiD analysis (Table 2) identified that within the intervention group, vaccine refusal rates dropped by 2.6 percentage points in patients from 2019/2020 to 2021. Vaccine refusal rates of patients from 2019/2020 to 2021 within the control group did not change. Considering both natural trends in vaccine status along with the impact of the MI intervention, an additional 2.6% of children 0–12 months of age in treatment clinics received vaccines because of the MI intervention. A logistic regression DiD model was utilized to assess the statistical significance of this change. It was found that the DiD among

the intervention and control groups was not a statistically significant predictor of the vaccine rates of children 0–12 months of age, $\beta = -0.330$, OR = 0.719, $p = 0.470$.

Four intervention providers were recruited, completed training, and finished the study. Three control providers were also recruited to provide standard of care. One of the four intervention providers did not have any caregivers of children 0–12 months of age provide consent for the study and was therefore removed from the analysis. Baseline data for the six providers identified that one provider had 3–5 years of experience while remaining providers had 11 years or more of clinical experience. The percentage of children who did not vaccinate on time was estimated to be >50% by one provider and <25% by the remaining five providers. Half the providers identified as being somewhat comfortable talking to parents about vaccines and half identified as being very comfortable talking to parents about vaccines. None of the providers had prior experience using MI.

Provider comfort talking to parents about vaccines, comfort level using MI, and confidence in MI before and after the intervention period were analyzed using a Wilcoxon Signed Rank Test. This analysis did not reveal a statistically significant change in provider scores for any variable including comfort talking to parents about vaccines, ($z = 1.414$, $n = 4$, $p = 0.157$), with a large effect size ($r = 0.4999$), comfort level using MI, ($z = -1.00$, $n = 4$, $p = 1.00$), with a medium effect size ($r = 0.354$), or confidence in MI, $z = 1.414$, $n = 4$, $p = 0.157$, with a large effect size ($r = 0.4999$). In comparing providers, pre-intervention to post-intervention, the median score on comfort talking to parents about vaccines increased from 4.5 to 5, the median score on comfort level using MI remained the same at 4.0, and the median score on confidence in MI to improve vaccine rates increased from 3.5 to 4.0.

Post intervention, 75% of providers either agreed or strongly agreed that the use of MI during a routine well child check to decrease vaccine hesitancy in parents was feasible, and 100% of providers either agreed or strongly agreed that they would continue to use MI in their practice. The number of well child visits seen in the months of June, July, and August decreased in the years during the COVID-19 pandemic with 649 well child visits being completed prior to the pandemic, only 388 visits being completed in 2020, and only 461 visits being completed in 2021.

Secondary goals

A summary of caregiver demographics can be found in Table 3. Participants included 66 caregivers who were predominately seen in the month of June (51.5%), presented with a child that was not their first-born (69.7%), were mothers (81.8%), were thirty years of age or older (66.7%), were married (87.9%), had a 4-year college degree (47%), had a household income of \$75,001 or more (51.5%), had two children in the household (47%), and identified as white (75.8%).

Vaccine hesitancy among caregivers. Fig. 1 provides a summary of caregivers' vaccine hesitancy. Of the 66 caregivers surveyed, 19.7% reported they had delayed a shot and 12.1% reported they had refused a shot for reasons other than illness or allergy. Caregivers identified concerns about the recommended shot schedule, the number of shots given at a time, safety, efficacy, and side effects from a vaccine. Of those surveyed 18.2% of caregivers said no or were unsure if they would want their next child to get all the recommended shots; 22.8% of caregivers rated themselves as very hesitant or somewhat hesitant about childhood shots; most caregivers (94%) indicated strong trust in their child's provider (score of ≥ 9).

Of the 66 children seen with their caregivers, 65 vaccine status forms were completed. Recommended vaccines were given to 87.9% of the children while 6.1% delayed vaccines or used an alternative schedule and 4.5% refused all vaccines. The mean PACV score was 24.45 ± 24.17 with a range of 0–87. Of those parents surveyed, 15.2% of caregivers scored ≥ 50 consistent with vaccine hesitancy and under-immunization.

Factors associated with vaccine hesitancy. Researchers examined the relationship between vaccine status and caregiver demographics (Table 4).

Table 2

Difference in difference analysis: vaccine refusal rates 2019/2020 vs 2021.

| | Pre-intervention period | Post-intervention period | Differences |
|-----------------|-------------------------|--------------------------|-------------|
| Treatment group | 9.0% | 6.4% | -2.6% |
| Control group | 6.6% | 6.6% | 0 |
| Differences | -2.4% | -0.2% | -2.6% |

Table 3
Caregiver demographics (N = 66).

| | N | % |
|--|----|------|
| Caregiver status | | |
| Mother | 54 | 81.8 |
| Father | 10 | 15.2 |
| Other | 1 | 1.5 |
| Both parents | 1 | 1.5 |
| Parent's age ≥ 30 years | 44 | 66.7 |
| Marital Status | | |
| Single | 5 | 7.6 |
| Married | 58 | 87.9 |
| Living with partner | 3 | 4.5 |
| Educational level | | |
| Some high school | 1 | 1.5 |
| High school or GED | 4 | 6.1 |
| 4-year college degree | 31 | 47.0 |
| >4-year college degree | 13 | 19.7 |
| Missing | 1 | 1.5 |
| Household income, \$ | | |
| 30,000 or less | 6 | 9.1 |
| 30,001–50,000 | 11 | 16.7 |
| 50,001–75,000 | 13 | 19.7 |
| 75,001 or more | 34 | 51.5 |
| Missing | 2 | 3.0 |
| Race/ethnicity | | |
| White | 50 | 75.8 |
| Black/African American | 3 | 4.5 |
| Hispanic/Latino | 2 | 3.0 |
| Asian | 3 | 4.5 |
| Other | 2 | 3.0 |
| More than one selected | 5 | 7.6 |
| Missing | 1 | 1.5 |
| No. of children in household | | |
| 1 | 16 | 24.2 |
| 2 | 31 | 47.0 |
| 3 | 7 | 10.6 |
| 4 or more | 11 | 16.7 |
| Missing | 1 | 1.5 |
| Child eligible for survey is firstborn | 20 | 30.3 |

In evaluating the ordinal regression, there was a significant improvement in fit of the final model over the null model [$\chi^2(11) = 58.246, p < 0.001$]. In this analysis, both the Pearson chi-square test [$\chi^2(169) = 14.720, p = 1.00$], and the deviance test [$\chi^2(169) = 14.604, p = 1.00$] were both not significant, suggesting a good model fit. Significant positive predictors of vaccine intervention status included the independent variable final total ($p = 0.013$) and children ($p = 0.028$).

Thus, for caregivers scoring higher on the PACV survey, there is an increased probability of choosing to delay or decline childhood vaccines. In addition, the greater the number of children a caregiver has in the household; there is an increased probability of choosing to delay or decline childhood vaccines. Significant negative predictors of vaccine status included age ($p = 0.032$) and Income3 ($p = 0.036$). These findings indicate that for caregivers ≥30 years, there is a decreased probability of choosing to delay or decline childhood vaccines and that for a caregiver with an income of \$50,001–\$75,000, there is a decreased probability of choosing to delay or decline childhood vaccines. All other independent variables (first born, relationship3, married vs other, race, and education) were not significant predictors of vaccine intervention status in the model.

Discussion

The present results support the use of MI as a feasible option within a well child visit and identify factors associated with vaccine refusal or delay that need to be recognized and addressed. This study also identifies caregiver characteristics associated with refusing or delaying childhood vaccines.

Primary goal

Vaccine hesitancy among caregivers

As expected, the higher the PACV score, the more likely a caregiver was to refuse or delay vaccines. >15% of caregivers within this study

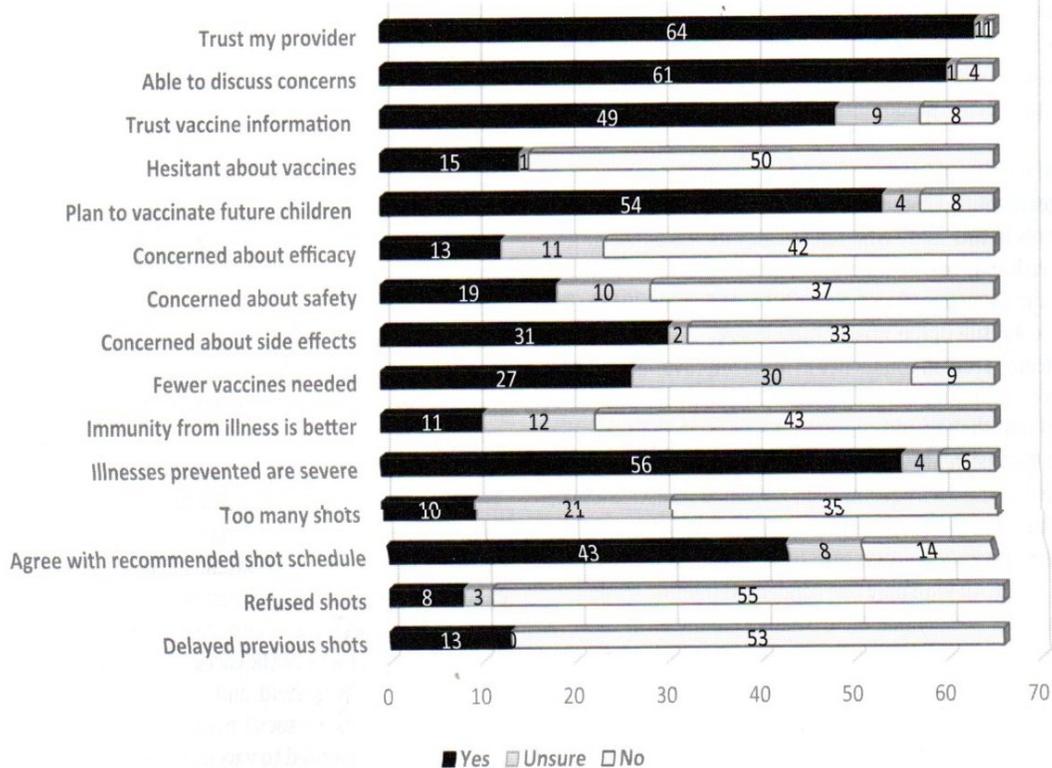


Fig. 1. Caregiver PACV survey statement responses.
Note. Totals may not add up to N = 66 due to missing data. PACV = Parent Attitudes about Childhood Vaccines.

Table 4
Ordinal logistical regression predicting vaccine status of a child.

| | | Estimate | SE | Wald | df | p | 95% CI | |
|---------------------------------|---------------------------|----------|--------|-------|----|-------|-------------|-------------|
| | | | | | | | Lower bound | Upper bound |
| Threshold | 1. Vaccinate per schedule | 12.242 | 43.780 | 0.078 | 1 | 0.780 | −73.565 | 98.050 |
| | 2. Delay vaccines | 14.780 | 43.803 | 0.114 | 1 | 0.736 | −71.073 | 100.632 |
| | 3. Refuse vaccines | 18.627 | 43.910 | 0.180 | 1 | 0.671 | −67.435 | 104.689 |
| Total PACV score | | 0.433 | 0.174 | 6.225 | 1 | 0.013 | 0.093 | 0.773 |
| Firstborn child | | −10.218 | 6.940 | 2.168 | 1 | 0.141 | −28.820 | 3.384 |
| Caregiver relationships | | 2.867 | 5.124 | 0.313 | 1 | 0.576 | −7.176 | 12.909 |
| Age | | −17.624 | 8.242 | 4.573 | 1 | 0.032 | −33.778 | −1.471 |
| Married or not | | 1.453 | 42.482 | 0.001 | 1 | 0.973 | −81.810 | 84.717 |
| race | | 1.230 | 0.961 | 1.639 | 1 | 0.201 | −0.653 | 3.114 |
| Number of children | | 11.047 | 5.019 | 4.844 | 1 | 0.028 | 1.210 | 20.884 |
| Education: High school or less | | 16.360 | 42.667 | 0.147 | 1 | 0.701 | −67.265 | 99.985 |
| Education: 2–4 years of college | | 11.934 | 7.524 | 2.516 | 1 | 0.113 | −2.813 | 26.680 |
| Education: ≥ 4 years of college | | 0 | . | . | 0 | . | . | . |
| Income: \$50,000 or less | | −31.508 | 42.807 | 0.542 | 1 | 0.462 | −115.409 | 52.392 |
| Income: \$50,001–75,000 | | −22.542 | 10.750 | 4.398 | 1 | 0.036 | −43.611 | −1.474 |
| Income: \$75,001 or more | | 0 | . | . | 0 | . | . | . |

Note. Abbreviations: PACV = Parent attitudes about childhood vaccines. SE = standard error. df = degrees of freedom. P = significance. CI = confidence interval.

were identified as being vaccine hesitant with most identifying concerns regarding the number of vaccines given at one time. This finding is a recurrent point identified by those with vaccine hesitancy (Rodriguez, 2016). Providing caregivers with education and tools to address the concern of vaccine numbers is necessary to reduce vaccine fears in parents.

The present study identified the more children present in the household, the more likely caregivers were to refuse or delay vaccines. These results are consistent with a Middle Eastern study that identified the greater the number of siblings a child has, the more likely vaccine delays were to occur (Alrowaili et al., 2019). Additionally, a systematic review including 13 different countries and 23 studies identified higher birth order as a commonly cited factor associated with vaccine refusals or delays (Tauil et al., 2016). Being reproduceable within this study even with a small sample size reinforces the prevalence of this finding. In addition, the ≥30-year age group was identified as being less likely to decline or delay vaccines along with those whose income was closer to \$75,000. These findings contrast with previous findings identifying these characteristics as predictive of vaccine delay and refusal (Smith et al., 2011). This inconsistency could be due to the smaller sample size and the study demographic being predominantly white families with higher incomes.

The reported number of vaccine delays and refusals were consistent with percentages identified in the US (Gilkey et al., 2016). However, the number of parents in this study who refused all vaccines at the time of the well child visit was higher than the typical refusal rate found in most high-income countries (Beard et al., 2016; Hill et al., 2018). This elevation may be a result of the smaller sample size.

Providers median score in confidence in MI to improve vaccine rates increased after completing the study and all providers agreed or strongly agreed that they would continue to use MI in their practice. These results are consistent with the literature that found providers who were trained to use MI frequently and identified its usefulness increased over time (Reno et al., 2018). The baseline experience of the providers in the intervention group may have impacted the comfort level and ability to use MI with only one condensed training session.

The present results identify that the COVID-19 pandemic negatively impacted the number of children seen for their wellness visits with 261 less children being seen in 2020, and 188 less children being seen in 2021 compared to pre-pandemic numbers. This negative trend is consistent with findings in both the US and Germany (McNally & Bernstein, 2020; Vogel et al., 2021).

Providers play an important role in influencing parents' vaccine decisions (Braun & O'Leary, 2020; Larson et al., 2018; Mbaeyi et al., 2020;

Williams et al., 2020). According to a meta-synthesis of VH, understanding parents' reasoning for VH is imperative (Díaz Crescitelli et al., 2020). Similarly, a recent systematic review of the literature suggests VH needs to be approached utilizing a provider intervention that can be modified to address each parent's unique concerns and questions (Olson et al., 2020). Current literature has identified the growing rate of VH; however, a clinical best practice has not been identified to help providers use their position to improve vaccine rates in children (Dubé et al., 2015; Jarrett et al., 2015). Motivational interviewing has the potential to serve as this best practice.

Secondary goals

Nearly a third of the caregivers surveyed either delayed or refused a vaccine for reasons other than allergy or illness. This finding is consistent with the literature that 30% of parents in the US do not follow recommended vaccine guidelines (Hargreaves et al., 2020). Similarly, 18.2% of caregivers said no or were unsure if they would choose to vaccinate their next child per the recommended guidelines. Caregivers have differing concerns regarding childhood vaccines. One major concern of parents is the safety of the number of vaccines given at such a young age (Glanz et al., 2016). With most vaccines being given before the age of 12 months, this age group is at the highest risk of not adhering to the recommended vaccine guidelines. For this reason, this study focused on parents of children presenting for newborn checks through the 12-month well child visit. The trust in vaccine safety is another parental concern with increasingly more parents believing the disease is safer than obtaining the vaccine (Díaz Crescitelli et al., 2020). Vaccine formulation, specifically the use of preservatives is also a concern (Spencer et al., 2017). Thimerosal contains ethyl mercury and was commonly used to protect against bacterial and fungal growth (Spencer et al., 2017). Many vaccines including the Measles, Mumps, Rubella (MMR) vaccine never contained thimerosal, and in 2001 this component was removed from all childhood vaccines in the US (Centers for Disease Control and Prevention, 2020). Even with this formulation change, parents continue to question vaccine preservatives (Spencer et al., 2017). Many parents also maintain the false belief that immunizations, in particular the MMR vaccine, cause autism despite the erroneous findings of Wakefield and his work (Pivetti et al., 2020). The expansion and use of social media have compounded the problem, allowing those opposed to vaccines to spread false information online (Williams et al., 2020). Lastly, the COVID-19 pandemic, which led many parents to cancel or postpone routine care, has further complicated parental compliance with recommended childhood vaccines

(Garcia et al., 2021). The results of this study are consistent with the finding that vaccine hesitancy exists along a spectrum (Braun & O'Leary, 2020). Utilizing a regular screening tool like the PACV survey will allow for prompt identification of parental concerns and allow the provider to directly address these issues.

Practice implications

This study suggests a condensed MI education session may improve vaccine rates in children 0–12 months of age and is feasible to use within a typical outpatient well child visit based on provider feedback. This study also recognizes caregivers' concerns about childhood vaccines which need to be identified and consistently addressed. The regular use of a vaccine hesitancy survey like the PACV, coupled with provider MI training would be beneficial to be completed with all expectant caregivers or caregivers of newborns to establish a baseline of vaccine hesitancy. Starting the vaccine conversation during pregnancy is particularly important as strong evidence identifies this period as a crucial time to influence vaccine hesitancy (Chopra et al., 2020; Garcia et al., 2021; & Olson et al., 2020).

Although some benefits of MI have been identified, additional research is essential to determine the impact of using MI in an outpatient clinic (Lemaitre et al., 2019; Limaye et al., 2021; Mical et al., 2021). A Cochrane systematic review identified a face-to-face MI intervention among parents may improve vaccine rates for childhood vaccines (Kaufman et al., 2018). There have been studies conducted in postpartum mothers in Canada utilizing a MI approach via a vaccine promotion strategy called PromoVac; however, these interventions required 20 min to administer and would not be feasible to use during an outpatient well child visit (Gagneur et al., 2018; Lemaitre et al., 2019). A recent study of parents of rural children aged two months to five years targeted parents with VH using a presumptive and MI approach. However, when the intervention required MI the appointment time was lengthened by up to 10 min (Mical et al., 2021). The use of the MOTIVE (motivational interviewing tool to improve vaccine adherence) tool significantly improved vaccine uptake of the influenza vaccine among children 6 months to 6 years while only improving the uptake of a select number of other childhood vaccines (Cole et al., 2022). One on-going randomized controlled trial will assess a MI tool meant to be used within an outpatient clinical setting. The study, which is evaluating the PIVOT with MI tool, was implemented in September of 2019 and follows children from birth to 19 months of age (Opel et al., 2020). To the best of the researcher's knowledge, the PIVOT with MI study will be the first randomized controlled trial (RCT) to evaluate the use of MI to address parental vaccine hesitancy within an outpatient practice setting.

In addition to identifying an appropriate tool, the time commitment required to train practitioners is also a concern. For the use of the MOTIVE tool, training required four 45-min sessions (Cole et al., 2021). The time required to train users in the PromoVac study intervention is not specified (Gagneur et al., 2018; Lemaitre et al., 2019). The PIVOT with MI study will require providers to complete an online video module, a 60-min in person training, and two follow up sessions lasting from 30 to 60 min (Opel et al., 2020). Both training requirements for providers and the time necessary to implement MI need to be feasible for the outpatient pediatric provider. Modification to existing tools utilizing MI will be necessary to allow use within a typical 20–30 min well child visit. Lastly, condensing training for providers will also be necessary to ensure provider compliance.

Strengths and limitations

Despite the strengths of this study including focusing on VH among caregivers of infants, utilization of a large EHR dataset, having a control

group, utilizing multiple clinic sites, and including both family practice and pediatric providers, findings should be interpreted considering the following limitations. One major limitation of this study was the small sample size along with the small number of providers in both the intervention and control groups. Due to inconsistencies in providers using billing codes when a vaccine was refused, tracking of the number of vaccine refusals at well child checks was difficult. To calculate refusal rates a formula was created by the author and verified by one of the participating pediatricians. All data from the surveys were self-reported, and the accuracy of responses cannot be confirmed. In addition, findings may have been impacted by the response bias of less vaccine hesitant caregivers who were more likely to participate in the study. Predetermined questions in the survey limited the detail of demographic data collected, for example precise age of caregivers and religious beliefs. Lastly, demographic data from caregivers in the control group was not obtained.

Conclusion

The present study identified gaps in the use of MI in the outpatient setting within the routine well child appointment and highlighted concerns related to current interventions requiring extensive provider training and time. Current findings support the use of a condensed MI training course as an intervention within the routine well child visit to decrease vaccine hesitancy. A more robust study to confirm these findings would be recommended prior to practice implementation. Since most providers identified MI use as feasible and planned to continue to use MI in the future, similar interventions may be beneficial to other outpatient clinics and should be considered as an option to decrease vaccine hesitancy in parents of children 0–12 months of age. Repeating the intervention with a more diverse group of providers would be ideal to identify the full impact experience has on the ability of providers to incorporate MI into an outpatient well child office visit. Further research needs to be completed to identify why parents with larger families are more inclined to refuse or delay vaccines, a finding consistent across different cultures and socioeconomic statuses, so this population can be targeted to better address vaccine hesitancy. A more robust study to confirm these findings is recommended prior to practice implementation.

Author statement

This article has not been published and is not being considered for publication elsewhere.

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CRediT authorship contribution statement

Kristin C. Jamison: Conceptualization, Methodology, Investigation, Data curation, Writing – original draft, Visualization. **Azza H. Ahmed:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Deborah A. Spoerner:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Daniel Kinney:** Writing – review & editing, Supervision.

Declaration of Competing Interest

The author declares that there is no conflict of interest.

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