BMJ Open HPV vaccination uptake among Somali American patients at an urban primary care clinic in Minnesota, USA: identifying and testing interventions to improve uptake using video reflexive ethnography

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ABSTRACT

Objectives While there have been efforts to address common and culturally informed barriers to healthcare, Somali Americans have low rates of human papillomavirus (HPV) vaccination. This study aimed to use video reflexive ethnography (VRE) to identify primary care health inequities, derive interventions aimed at improving HPV vaccination rates in Somali Americans, and then test their impact on vaccination rates.

Design The VRE methodology involves three sequential steps: data collection, reflexive discussion and identifying intervention in practice. Preintervention and postintervention vaccination uptake data were collected for Somali patients.

Setting VRE was conducted with medical assistants (MAs) and Somali patients for 3 months (June–August 2018) in an urban primary care clinic in Minnesota, USA. HPV vaccination rates were collected and analysed pre-VRE and for a period of 6 months post the implementation of the interventions identified by VRE.

Participants 14 MAs participated in the VRE which designed the study intervention, which was tested on 324 Somali patients eligible for HPV vaccination.

Primary outcome measure HPV vaccination uptake among Somali patients.

Results MAs identified three practice challenges related to HPV vaccination: provider fatigue related to ongoing patient vaccine hesitancy or refusal, MAs misinterpretation of patient's vaccination dissent language, and missed opportunities to respond to unique patient concerns as a result of following standard work procedures. Using VRE, MAs identified and developed several interventions to address these practice challenges. Adjusted for age at clinic visit (years), the difference in preintervention and postintervention HPV immunisation rates was 10.1 per 100 patient-visits (95% CI 2.97 17.3; $p=0.0057$).

Conclusion VRE can engage MAs in an innovative, participatory process to identify and address concerns about health inequities. In this study, MAs designed and implemented interventions that improved HPV vaccination rates in Somali Americans. Further research

Strengths and limitations of this study

- Video reflexive ethnography (VRE) is a method that engaged providers in a participatory research process where they were partners in reviewing and addressing practice.
- Engaging providers in participatory methods of looking within their own practice or clinic settings can identify innovations that are highly relevant to that practice environment.
- Comparing preintervention and postintervention measures of human papillomavirus vaccination rates is a strength of this study, however, a larger sample size would have strengthened the analysis.
- The study was conducted in a single clinic in the upper Midwest of the USA, which limited the patient sample size; additionally, the practices observed may be particular to this setting.
- Only patients aged 18 years or older consented to being filmed for the VRE fieldwork; additional strategies might be needed to support participation of younger patients.

is needed to more fully assess the impact of such interventions.

BACKGROUND

Somali women have one of the highest incidences of cervical cancer, which is caused by human papillomavirus (HPV), in the world,¹ yet Somali American patients have low rates of HPV vaccination.² Despite having the technologies to prevent 90% of cases through vaccination,³ clinics report completion rates as low as 10% for the HPV series for Somali American patients, compared with 40% for all females and 22% for all males in the USA.⁴ Additionally there are low rates of cervical

cancer screening in the Somali population,⁵ which further increases the urgency to improve approaches to HPV vaccination for the Somali community. A complex set of barriers contribute to low cervical cancer screening rates among Somali American patients, including limited health literacy,⁶ lack of knowledge about cancer^{7 8} and cultural and religious beliefs that may discourage medical screening.^{6 9–12} However, as the literature mostly focuses on individual patient behaviours, opportunities remain to explore broader structural influences on screening uptake.

Similar barriers contribute to inequities in HPV vaccination rates,¹³ including limited awareness,^{13–15} cultural beliefs,¹⁵ concerns about HPV being seen as related to the initiation of sexual activity,^{16 17} mistrust of vaccines^{18–21} and a mistrust of healthcare providers.^{6 15 16} There may also be confusion between HPV and HIV, due to the similarity of the acronym,^{16 22 23} which due to the stigma of HIV may lead to a reluctance to discuss HPV. While much of the literature on HPV vaccine hesitancy has focused on patients, provider behaviour can also be a barrier to vaccination, with provider knowledge^{24–28} and quality of communication²⁹ impacting HPV initiation and completion. Failure to successfully address the barriers to both cervical cancer screening and HPV vaccination rates, contributes to preventable late-stage diagnoses, increased treatment burden and mortality for Somali immigrant men and women.

Somali American patients describe providers as exerting influence on their health decisions,^{30 31} including in relation to the HPV vaccine.³² Yet there are inequities in the quality of communication from providers about HPV, particularly when communicating with minority patients.³³ In order to avoid resistance, providers may provide little information to patients, other than the HPV vaccination series being a routine immunisation.³⁴ The Centers for Disease Control and Prevention (CDC) recommends providers use an authoritative approach by providers in advocating for vaccination,³⁵ and that two doses of the HPV vaccination is offered to all adolescents in the USA around 11–12 years of age and three doses to patients between 13 and 26 years of age. However, an authoritative approach may reinforce fears or concerns about authority, and reduce trust between Somali patients and their providers.²³ The literature has identified a need to find ways to improve the relationship, interactions and communication between providers and parents around HPV,^{24 36} and suggests this will help develop future interventions that foster shared values between parents and providers, culturally appropriate resources, strategies and approaches to address health inequities.²⁴

Despite the challenges in HPV vaccination, research has shown that Somali patients are interested and motivated to participate in cancer prevention,^{30 31 37} including HPV vaccination.²³ There is thus opportunity to gain deeper knowledge about how providers communicate with Somali patients regarding the HPV vaccine, and how improved communication might address the

concerns of Somali young adults. Video reflexive ethnography (VRE) is a novel participatory method leading to targeted transformations in healthcare.^{38–41} It engages health practitioners, patients and families in studying not only real world interactions between patients and providers but identifying tailored interventions for practice improvement.⁴²

VRE allows for the study of the clinical encounter and clinic practices in detail, by using (1) *video* as a way to record in situ interactions between patients and providers as they occur in real world conditions; (2) *reflexive analysis*, which engages those who are videoed as *expert participants* in viewing and analysing their work and interactions, including verbal and non-verbal communication and practices (as opposed to relying on recall) and (3) *ethnography* which focuses on examining naturally occurring, real world practices.^{40 43–45} VRE can generate new insights on the interactions between patients and providers, and the impact of clinic practices, on patient care and outcomes.^{38–41} Those insights are obtained by working with providers to explore strengths and opportunities in their practice for addressing concerns. VRE findings tend to be highly relevant and transferable practice given the use of real word interactions as a data set, and by using a participatory approach with providers that draws on their experience of those clinical encounters.

Medical assistants (MAs) are often the first point of contact in discussing vaccinations and they plan an important but understudied role in HPV vaccination communication. In the USA, MAs are allied healthcare assistants who support the work of clinic nurses and doctors in providing patient care. The aim of this study was to use VRE to focus on the interactions between patients and MAs in discussing the HPV vaccination series. VRE is renowned for highlighting hitherto unappreciated work and thus it is particularly suited to examining the work of MAs who are often the first point of contact in discussing vaccinations. This addresses a particular gap in the literature, being the impact of communication in the clinical encounter on the decision to start or complete the HPV vaccination series. This has the potential to help identify ways to leverage the influence of providers in responding to the specific needs of Somali patients. Additionally, MAs are ideally placed to identify novel opportunities to enhance clinic practices. This study aimed to both identify potential opportunities to improve practice and test the impact of those changes on HPV vaccination rates. This is the first study to apply VRE to the issue of HPV vaccination or HPV vaccination inequity, and is one of only a handful of studies to quantify outcomes to interventions derived from VRE.⁴⁶ The study had two research aims:

Aim 1: Identify opportunities to enhance communication to address common and culturally informed barriers in relation to HPV vaccinations, between medical assistants and Somali patients.

Aim 2: Improve HPV vaccination uptake for Somali patients in primary care by implementing VRE identified strategies.

METHODS

VRE is a participatory method that was used to help identify and test interventions to improve uptake HPV vaccination uptake among Somali American patients. The study setting, the sequential steps of the VRE methodology and approach to measuring preintervention and postintervention vaccination uptake rates for Somali patients is described below.

Design, setting and participants

The VRE fieldwork was conducted between June and August 2018 in an urban primary care clinic that serves a large Somali immigrant population, in Minnesota, USA. The research team met with the clinic MAs to introduce the VRE methodology, discuss the approach and seek permission to conduct a VRE focused on HPV vaccination interactions with Somali and non-Somali patients. Fourteen MAs agreed to participate in the study. Over the course of 3 weeks, nine patient-MA encounters were recorded. These included visits with Somali patients, non-Somali patients and visits that included an interpreter. All patients who agreed to participate were between 18 and 26 years of age, the age eligible for the HPV 'catch up vaccine'. No participant incentives were offered.

Procedures

The VRE methodology involves three sequential steps: data collection (videoing and ethnographic observations and note-taking), reflexive discussion groups where edited video footage is viewed and discussed by research participants and researchers (reflexive sessions), and intervention in practice.⁴³ Our study focused on three processes as follows.

Data collection

The research assistant (CN) conducted 3 weeks of intensive fieldwork at the clinic in July 2018. This began with several days of observing workflow, talking with MAs, and discussing how to best conduct the videoing in ways that were sensitive to the MAs' work and activities. MAs approached patients in the clinic, prior to their appointment to ask if they would consider taking part in a research study that would mean their appointment was video recorded. If the patient was willing, the research assistant introduced the study and obtained written informed consent in a private consultation room, with support from interpreters or by bilingual staff if needed. Study information was provided in both English and Somali. Participants were asked to provide consent for their recording to be reviewed by their MA, their colleagues and the research team. Reassurance was provided that the recordings would not be used for any other purpose. If the patient agreed to participate, the recording was made

by the research assistant using a mini-iPad. The recording focused on the consultation area of the room where the patient was seated by the MA, and did not record clinical examinations. The research assistant entered the room to record the HPV vaccination discussion and was only present for that portion of the visit.

The research assistant also conducted observations of the clinic work happening in and around the HPV vaccination discussions. Initial fieldwork consisted of observation alone, with the researcher gaining insight into how the clinic work was organised. This allowed for trust and rapport to be built between the researcher and the MAs. The researcher then spent time both continuing to observe and interact with MAs as they conducted their work. These observations were drawn on throughout the VRE process, helping to inform the language used in facilitation of reflexive sessions, helping practitioners tailor interventions that would fit in the work flow, and providing examples of practices or experiences that were not video recorded but were influential in the interaction.

Reflexive discussion groups

Four reflexive analysis sessions were held with the MAs and other key colleagues, such as nurses, a bilingual community health worker or clinic leadership. The sessions were facilitated by two members of the research team (RP and CN). During these sessions, excerpts of video selected by the research team, were viewed by the whole group. Eight clips were selected by the research team, and each lasted between 1 and 2 min. The clips were selected to illustrate a range of communication points and interactions about HPV vaccinations during consultations. The videos were only shown with the permission of the MA who was filmed. Consistent with VRE, the facilitators opened each session with revisiting the overall goal, which was to look for best practices⁴² and potential ways to address low HPV vaccination uptake.

The discussion focused on viewing the clips and sharing reflections on what characterised current workflow, how practices viewed related to other team member experiences, how the interactions and communication may have impacted patient decision making, what was similar or different in interactions with different cultural groups, and opportunities for improvement. The discussion was recorded and transcribed. Transcripts were analysed by the research team to identify themes, as informed by constructivist grounded theory.

Intervention in practice

The VRE process focused on engaging the MAs as *expert participants* in viewing and analysing their work and interactions, and as experts in identifying best practices and opportunities to address the vaccination inequities. Emerging opportunities for improving practice were identified, which is discussed in detail in the finding section. New practices were vetted by a small group of community advisors, being two Somali nurse practitioners and

one Somali faith leader, to ensure that the intervention in practice was culturally appropriate.

Statistical analysis of HPV vaccination rates

A dataset drawn from the electronic health records for patients with clinic visits between March 2018 and May 2019 was used for our analyses. HPV immunisation rates for Somali patients between 11 and 20 years of age, were assessed for each month during the duration of this study period. This includes female and male patients, as per CDC recommendations. Due to large differences in the number of immunisations from month to month, for our main analysis we assessed the average rates per quarter (3-month period). Additionally, we estimated the preintervention versus postintervention difference in average immunisation rates, as defined as two or three doses depending on the CDC definition of compliance, between similar quarters in 2018 (preintervention) and 2019 (postintervention); we selected the first 3 months at the start of the study period ('March–May 2018') and the last 3 months at the end of the study period ('March–May 2019') for this comparison.

We created a time variable by assigning numerical values (1–15) to each month: '1' for the first month, March 2018; '2' for the second, May 2018 and so on. We assessed the possibility of a linear trend in HPV immunisation rates across time during the study period by treating the newly created 'Time' variable as a continuous variable and estimating the average change in HPV immunisation rates by each unit increase in 'Time'. Similarly, we assigned numerical variables, 1–5, to each consecutive quarter and assessed possible linear trends in HPV immunisation rates across time.

All analyses were conducted using SAS V.9.4 and p values <0.05 were considered statistically significant. The GENMOD procedure in SAS was used to estimate the unadjusted and adjusted HPV immunisation rates and to estimate the average change in immunisation rates. A repeated statement for a unique patient identifier was included to account for the correlation between repeat visits for each patient. We specified a binomial distribution with an identity link and an 'independence' working correlational structure for these analyses. The reported 95% CIs were estimated using the robust SEs.

Patient and public involvement statement

Patients were not involved in the study design, but patient experience was the central focus of the study. Patients were recruited to the study and their clinical encounter video recorded. Findings were discussed with bilingual community members. Materials developed in the study were widely disseminated to patients in the form of hand-outs and posters placed in the clinic.

RESULTS

The findings are presented in three sections, the findings from the reflexive sessions, the resultant changes in

patient care identified by VRE and the impact on HPV vaccination uptake at the clinic.

Reflexive discussion group findings

Four reflexive sessions were held with the research team and the MAs. Being a busy clinical environment, the group members changed slightly between sessions, but overall approximately 14 MAs and support staff (including nurses, social workers, a bilingual community health worker and team leads) participated in the sessions. Each session was approximately 1 hour in length. During the sessions, the team reviewed selected video clips of current practice and collectively reviewed the data for opportunities for improving practice. The key areas of discussion arising from the reflexive sessions are presented here.

Vaccine decline fatigue

During the reflexive sessions, the MAs were able to identify and give voice to how resigned they had become to having the HPV vaccine declined by Somali patients. They described this impacting their expectations of how discussions about the HPV vaccine would go. In general, hearing 'no' 9 out of 10 times, was experienced as discouraging and demotivating. Some MAs voiced they approached Somali patient HPV discussions with a feeling of fatigue or discouragement.

Communication barriers

Through the reflexive discussion, it emerged that the MAs were not aware, at times, that the patient was saying no to the vaccine. The 'no' may be expressed by comments such as, 'not today', or 'I will discuss that next time', however, the bilingual community health worker present at the analysis sessions, described that the patient was actually declining the vaccine. This had implications for what happened next in the clinical workflow. If it was understood that a patient was saying no, it would prompt the MA to inform the doctor that the vaccination was declined, which would then lead the doctor to further the discussion. However, if the patient was seen to be delaying such a discussion, this would not necessarily be seen as having declined the vaccine, and there would be a lost opportunity for doctor follow-up to be prompted.

Standard work and non-standard patients

In reviewing video excerpts, it was the first time the MAs had seen how peers raised these discussions and they were pleased to see that as a group, they approached the task in a standard way with all patients, regardless of ethnicity. They noted, however, when observing the non-Somali/MA interactions, that their non-Somali patients generally demonstrated more knowledge about HPV. This led them to question whether a standard approach to vaccine discussions might not be as successful with Somali patients. Their view was further substantiated on learning from the research team that Somali patient may commonly confuse HIV and HPV. The MA discussion identified that treating each patient the same was

missing an opportunity to respond to the unique needs that Somali patients may have.

Trying to not say the 'wrong thing'

The reflexive sessions also highlighted that the MAs were quite concerned about saying the wrong thing to Somali patients, particularly with regard to HPV's connection to sexual activity. This is particularly related to concerns that discussing sex might be seen as immodest or offensive, particularly by parents. There was a concern that many Somali families expect there would not be premarital sex and therefore it would not be relevant to talk about such a topic with an adolescent. In an attempt to avoid causing offence, there was sometimes avoidance to mention anything that might bring up the topic of sex at all.

Tailored patient information is needed

One interaction that was filmed was discussed in particular detail. In this interaction the MA offered the HPV vaccine and the patient declined. However, there was much discussion about what happened immediately after the filming was stopped. The patient was accompanied by her younger sister, who had been in the winning school debate team for her sixth grade class, arguing for why people should have the HPV vaccination. The younger sister put her great debate skills to use on her sister, the patient who had declined the vaccination. She offered influential information and validation of the importance of the series, and the patient went on to agree and initiate the HPV series before she left the clinic. This interaction does highlight the importance of family or peer conversations about HPV, and identified the opportunity to use targeted and tailored patient information. Tailored information could be used to bring information into

family conversations, by offering the information such as that shared by this younger sister, and making it available to people to learn and discuss with peers and family members. It is also information that would be available to guide and support medical interpreters in discussions with patients. Despite identifying the potential need for tailored patient information, MAs reflected that it could be hard to sustain knowing what information was available for patient education.

HPV vaccination intervention

Following the reflexivity discussion groups the MAs and clinic leadership agreed on two main action points for improving HPV vaccination rates for all Somali patients eligible for the vaccine. The first was to modify the standard workflow, to require that the physician would engage in a discussion about the HPV vaccination series regardless of the outcome of the MA's discussion. This adjustment aimed to counter the miscommunication identified between patients and MAs, both by providing a second opportunity to discuss the vaccine series and by leveraging the role of the doctor's influence.

Second, the group decided to prepare a tailored patient information tool to address the common concerns identified in the reflexivity session (see figure 1). The patient information tool presented six key informational messages that included ones on vaccine safety, the value of prevention and how people are exposed to HPV. In addition, a faith-based message was included in the form of a health promoting quote from the Quran: 'Allah has sent down both the disease and the cure, and He has appointed a cure for every disease, so treat yourself medically'. Information clarifying the HPV is not the same as

Figure 1 Tailored patient information.

HIV, and that cervical cancer is particularly high for East African women, was also included.

Additionally the tool was designed with the Somali and English text side by side, to accommodate both parents and teens who may have different preferences for written information, and ensure patient information could support family-based discussion of the vaccine. Written information can be problematic for patients with low or no literacy, which is can be common among older Somali patients, but much less common among youth. The patient information tool was intended to increase access to information and by having family accessible tailored information meant information could be discussed at home, and having both English and Somali on the one flyer increased likelihood of overcoming literacy challenges in any one language. The tailored information would also help medical interpreters in sharing information for those that required information to be shared orally. The tailored information was prepared so it could be handed to individual patients and as posters to be put up on the walls of various places in the clinic to raise awareness among patients.

The clinic implemented the adjusted workflow and the patient information tool, the latter through a clinic wide educational session, wall posters and examination room patient handouts, commencing in September 2018.

Preintervention and postintervention HPV vaccination rates

In this sample, there were 324 unique Somali patients aged between 11 and 20 years at each clinic visit, the average age was 15.9 years (SD: 3.1 years), see [table 1](#). Of these patients, 44.4% were male and 55.6% were female. The time period captured by this report spans a 15-month period, from March 2018 to May 2019, and includes 271 unique dates and 718 unique patient visits. Within this 15-month period, the number of visits per patient ranged between 1 and 16 (median (Q1, Q3): 2 (1, 3)), see [table 2](#). There was no association between sex and HPV immunisation ($p=0.22$). There was a significant inverse association between 'age at clinic visit' in years and rate of HPV immunisations (Diff (SE): -0.012 (0.004), $p<0.001$). We adjusted for 'age at clinic visit' in our subsequent analyses.

Overall, HPV vaccines were administered at 11.7% of visits within the 15-month study period. The monthly immunisation rates ranged between 2.13 per 100

Table 1 Sample characteristics

Variables	Data
Somali patients, N	324
Number of visits, median (Q1, Q3) (range)	2 (1, 3) (1–16)
Age at visit (years), mean (SD) (range)	15.9 (3.1) (11–20)
Sex (%)	
Male	144 (44.4%)
Female	180 (55.6%)

Table 2 HPV immunisation rates per month

Month, year	HPV immunisation given?	
	Visits, N	Yes, n (%)
March, 2018	52	3 (5.77%)
April, 2018	58	4 (6.90%)
May, 2018	46	2 (4.35%)
June, 2018	51	8 (15.7%)
July, 2018	42	4 (9.52%)
August, 2018	65	10 (15.4%)
September, 2018	46	5 (10.9%)
October, 2018	53	5 (9.43%)
November, 2018	43	8 (18.6%)
December, 2018	47	1 (2.13%)
January, 2019	56	9 (16.1%)
February, 2019	27	1 (3.70%)
March, 2019	52	7 (13.5%)
April, 2019	36	6 (16.7%)
May, 2019	44	11 (25.00%)

HPV, human papillomavirus.

patient-visits and 25.0 per 100 patient-visits; the lowest reported rate was in December 2018 and the highest reported rate was in May 2019 ([table 2](#), [figure 2](#)). For each quarter (3-month period), the age-adjusted quarterly HPV immunisation rate ranged from 5.96 per 100 patient-visits to 17.3 per 100 patient-visits ([table 3](#)). On average, adjusted for age, the monthly HPV immunisation rates increased by 0.74 per 100 patient-visits each month (95% CI 0.25 to 1.23) and the quarterly HPV immunisation rates increased by 2.08 per 100 patient-visits each quarter (95% CI 0.56 to 3.60) ([table 4](#)). These changes were significant at our set alpha ($p<0.05$), with p values of 0.0035 and 0.0074 respectively.

To estimate the difference between the preintervention and postintervention HPV immunisation rates, holding possible seasonal trends constant, we compared similar

Figure 2 HPV Immunisation rate over time. HPV, human papillomavirus.

Table 3 HPV immunisation rates per 3-month period

Month, year	Visits, N	'Y', N	HPV immunisation rates (per 100 visits)	
			Unadjusted (%)	Adjusted* (%)
March–May 2018	156	9	5.77	5.96
June–August 2018	158	22	13.9	13.1
September–November 2018	142	18	12.7	13.2
December 2018–February 2019	130	11	8.46	9.76
March–May 2019	132	24	18.2	17.3

*Adjusted for 'age at clinic visit' (years).

HPV, human papillomavirus.

3-month periods in 2018 and 2019 (table 3). The difference in HPV immunisation rates between 'March-to-May 2018' and 'March-to-May 2019' was 12.4 per 100 patient-visits (95% CI 4.22 to 20.6). Adjusted for 'age at clinic visit' (years), the difference in HPV immunisation rates between these 3-month periods was 10.1 per 100 patient-visits (95% CI 2.97 to 17.3) (table 4). These differences were significant at our set alpha ($p < 0.05$), with p values of 0.0030 and 0.0057, respectively.

DISCUSSION

In this study, we have explored HPV vaccination inequities through using VRE.^{40 43–45} While most studies on inequities in HPV vaccination for Somali patients have focused on patient knowledge or awareness, this is the first study to examine the real-world practices of MAs as they interact with Somali patients. In this sense, VRE is an innovative methodology that integrates a focus on medical providers and clinical practices to address health inequities, as opposed to focusing on patient behaviour or knowledge alone.

The first aim of this study was to identify opportunities for enhanced communication between MAs and patients to address common and culturally informed barriers in relation to HPV vaccinations. Prior literature has identified in relation to cultural and common barriers focus on individual patient factors, such as HPV awareness,^{13–15} cultural beliefs¹⁵ and mistrust,^{6 15 16 18–21} The findings from this VRE inquiry noted barriers to HPV vaccination that were located in the collective practices of the MAs and the clinic workflow, and offered the opportunity for extensive MA engagement on those practices, as opposed to top-down or externally imposed changes in their

practices. Again, this is consistent with VRE's approach. Through working with and revealing the complexity of health service delivery, VRE recasts healthcare challenges as a property of healthcare being a complex system rather than a result of individual practices. VRE resulted in MAs realising that they mistook declining the vaccine for seeking to delay decision making, and that the focus on treating all patients the same way in conversations regarding HPV, led to opportunities being missed. VRE also assisted MAs in identifying that additional patient informational needs were required, and this was directly addressed through developing tailored patient information. This tailored information supported both patients and MAs, as it provided support to the MAs in knowing what to address in discussions with patients. It was an important part of the study design to ensure new practices and tailored information were reviewed with community representative, who provided insight on the cultural appropriateness of the approach.

Following the identification of strategies to improve HPV vaccination uptake, the second aim was to improve HPV vaccination uptake through implementing those strategies. This study showed that HPV rates improved in the target population. This illustrates the benefits of VRE engaging providers in identifying strategies that have potential to impact vaccination rates in this population. VRE is a participatory approach that engages and motivates healthcare providers to continue to engage innovations that serve their patients and address inequities in care. This study has shown that engaging the MAs themselves in identifying innovations and potential changes in their own practices enhances the ease and pace of change implementation, and perhaps these changes will

Table 4 Change in human papillomavirus immunisation rates

	Model 1	P value	Model 2	P value
Average monthly difference (RD (95% CI))	0.72 (0.15 to 1.29)	0.009	0.74 (0.25 to 1.23)	0.0035
Average 3-month difference (RD (95% CI))	2.05 (0.34 to 3.75)	0.018	2.08 (0.56 to 3.60)	0.0074
Average annual difference (RD (95% CI))	12.4 (4.22 to 20.6)	0.0030	10.1 (2.97 to 17.3)	0.0057

*Model 2 is adjusted for 'age at clinic visit' (years).

RD, risk difference.

more likely be sustained. The data on the impact of the changes made showed an improvement in HPV vaccination rates was achieved in the 6-month period following the VRE. This highlights the potentially high value of VRE as a method to identify innovations in addressing health inequities.

Limitations

This study is the first application of VRE to HPV vaccination inequities, and showed the potential impact of using participatory methods in primary care settings. It was conducted in a single clinic in the upper Midwest of the USA. This limited the sample size available for preintervention and postintervention measures. The practices observed may also be particular to this setting. Additionally patients only 18 years of age and older consented to participate in the VRE itself, and additional strategies might be needed to support broader participation in future iterations of this work. We were also limited by not collecting data on time between HPV vaccination doses, or participation in other vaccinations. There is a potential for a Hawthorne effect on patients and the MAs who were filmed, and while we attempted to mitigate this throughout the study, this is a potential limitation. Future research that used a larger sample size and includes multiple clinics is needed.

CONCLUSION

VRE offers an innovative approach to addressing health inequities by engaging providers in a participatory process to identify opportunities to address concerns like HPV vaccination rates. By engaging providers at looking within their own practice or clinic settings, new innovations in addressing health inequities can be identified and effectively implemented. Further research is needed to more fully assess the impact of VRE on the identification of new practices.

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Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and was approved by Human subjects approval was granted by the Institutional Review Board at the

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