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Exploring beliefs about pneumococcal vaccination in a predominantly older African American population: the Pharmacists' Pneumonia Prevention Program (PPPP)

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ABSTRACT

Objectives: To assess the association of the Pharmacists' Pneumonia Prevention Program (PPPP) with changes in beliefs related to pneumonia vaccination (PV) in a predominately older African American population.

Methods: PPPP was an educational intervention delivered using a senior center model of care consisting of a formal pharmacist presentation, live skit, small group action planning, and optional PV. A 15-item instrument assessed participants' beliefs at baseline, post-test, and three months across four domains: pharmacists and pharmacies, vaccination, pneumococcal disease, and physicians. Friedman tests and pairwise Wilcoxon signed rank tests were used to determine the statistical significance of the mean change in belief responses across timepoints.

Results: 190 older adults participated; the sample was majority female (76.3%) and African American (80.5%), and had a mean age of 74.3 years. Statistically significant improvements in beliefs at post-test were observed in the following domains: pharmacists and pharmacies, vaccination, and the pneumococcal disease; however, some of these gains were incompletely sustained at three months.

Conclusion: PPPP positively impacted beliefs post-program regarding the pneumococcal disease, pharmacists and pharmacies, and vaccination; however, sustained efforts may be needed to reinforce these gains.

Policy implications: Support for pharmacist educational services in senior centers should be considered.

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Pneumonia vaccine; pharmacist education program; senior center model of care; vaccination education; older adults; beliefs

Introduction

Understanding patient beliefs about disease and healthcare delivery remains a critical component to providing patient-centric care. (Hernandez et al. 2013; Street and Haidet 2011; Epstein and Peters 2009). Previous research has demonstrated that African

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Americans are at particularly high risk for decreased trust in the healthcare system due to historical racism, prejudice, and discriminatory practices (Boulware et al. 2003; Corbie-Smith et al. 1999; Wasserman, Flannery, and Clair 2007; Shavers, Lynch, and Burmeister 2000). Decreased trust in medical practice and physicians ultimately have negative effects on shared decision-making and adherence (Peek et al. 2013; Schoenthaler et al. 2013). Due to these factors, the older African American population may be at greater risk for less use of preventative care.

Invasive pneumococcal disease, caused by *Streptococcus pneumoniae*, is responsible for an estimated 18,000 deaths per year in adults 65 years old and older (Adults: Protect Yourselves 2015). The Advisory Committee on Immunization Practices (ACIP) recommends that all patients receive one dose of pneumococcal polysaccharide vaccine-23 (PPSV23) at 65 years or older and receive one dose of pneumococcal conjugate vaccine-13 (PCV13) one year later (PCV13 (Pneumococcal Conjugate) Vaccine 2015a). Most people will only need a one-time dose of PPSV23; however, certain high-risk individuals, such as those with functional or anatomical asplenia or immunocompromising conditions such as HIV infection or lymphoma, may need up to three doses of PPSV23 over a lifetime to provide sufficient coverage. Currently, ACIP does not recommend more than one PCV13 vaccination over a lifetime.

Since 1981, Medicare has provided coverage for beneficiaries to receive a single pneumococcal vaccine in their lifetime (Immunizations 2014). For certain high-risk individuals in need of a 'booster' vaccine of PPSV23, Medicare also reimburses the administering practitioner for the 'booster' vaccine and administration fees given five years have passed since the last vaccination. In 2016 alone, the Department of Health and Human Services (HHS) allocated over 300 million dollars to the Centers for Disease Control and Prevention (CDC) for the support of improving vaccine coverage to adults, adolescents, and children (Prevention and Public Health 2016). Despite government support of vaccination coverage, a 2006 Centers for Medicare and Medicaid Services (CMS) study found that among a group of Medicare beneficiaries, only 36% of African Americans reported ever receiving a pneumococcal vaccine, as compared to 62% of non-Hispanic whites (Immunizations 2014).

The CDC supports pharmacist-driven vaccination programs (CDC and HHS request 2012). Pharmacists administer vaccinations in local communities, increasing access to these preventive services which may otherwise be inaccessible to persons without means of transportation to a primary care provider. Community pharmacists and pharmacy schools have a long history of partnerships with senior centers to perform medication reconciliation (O'Connell et al. 2015), counseling (Bartlett et al. 2015), and other geriatric services, yet there is limited evidence on changes in beliefs about vaccination. The Health Belief Model (HBM) is a theoretical model for understanding how an individual's health beliefs relate to health behaviors. In the HBM, key predictors of health behaviors include an individual's perceived susceptibility to a given condition, the perceived seriousness of the condition, the perceived benefits of taking a health-related action, and the barriers to taking the action (Rosenstock 1974). Our conceptual framework, based on the HBM, indicates that some beliefs and barriers to vaccination may be best addressed through a senior center model of care, while others can be addressed by a pharmacist; thus, combining a pharmacist intervention with a senior center model of care may effectively leverage both benefits to improve beliefs and decrease barriers to vaccination (Cannon-Dang et al. 2014). This study evaluates the effects of a community-based pneumococcal

prevention program on participants' beliefs of pneumococcal vaccination through a pharmacist-senior center model.

Methods

Study objectives

The primary study objective was to assess the effect of the Pharmacists' Pneumonia Prevention Program (PPPP) on participants' beliefs about pneumonia vaccination across four domains: (1) pharmacists and pharmacies, (2) vaccination, (3) pneumococcal disease, and (4) physicians from baseline to post-test (directly after PPPP). The secondary objective was to assess the change in participants' beliefs about pneumococcal vaccination across the four domains from baseline to three months.

Overall study design

This study was a part of PPPP, a pneumococcal disease education program in northwest Philadelphia and consisting of three components: (1) an educational presentation given by a pharmacist, (2) a culturally sensitive skit performed by peer actors, and (3) small group action planning. The pneumococcal program targeted three areas for improvement: (1) participants' knowledge and awareness of the pneumococcal disease, (2) beliefs about PV and related beliefs, and (3) activation regarding PV. This report focuses on the second area, beliefs about PV.

Study participants

This study was undertaken in partnership with a nationally recognized senior center located in northwest Philadelphia (New Models of Senior Centers Taskforce Final Report 2009). Community organizers from the senior center recruited older adults from within their membership as well as the surrounding community for participation from March to November 2014. The partner senior center was utilized as the primary recruitment site due to active partnerships with local churches and senior centers. Participation in PPPP was completely voluntary. Informed consent was obtained by trained study personnel in which the participants were explained the purpose of the study and the procedures for ensuring confidentiality, and were then given time to review the consent form privately and ask questions before consenting. Participants were not blinded to the purpose of the study. Consented individuals were contacted via phone and made aware of the dates the pneumococcal program at the senior center. On the program dates anyone who attended was eligible to receive the free counseling; however, only individuals who met the inclusion criteria were included in the study. Individuals who consented to participate in the study and met all of the following inclusion criteria were included in the analysis: (1) age $\geq$50; (2) self-stated ability to attend a 1.5-hour session as determined by pre-screening during outreach by the senior center to its membership and the community sites; (3) cognitively intact based on responses to an abbreviated mental test score (AMTS) of $\geq$7; and (4) speak and read English at $\geq$4th grade level as evidenced by the ability to read a brief passage. There were no exclusion criteria. This study was approved by the Thomas Jefferson University Institutional Review Board.

The instrument

Beliefs instrument

Potential barriers to vaccination were identified through a review of the literature. Across several studies assessing PV in both minority and older adult populations, lack of awareness among participants about the risk of pneumococcal disease or their susceptibility to it was found to be common among those participants who did not receive PV. Additional barriers identified include a lack of awareness about their eligibility to receive PV and lack of belief in the efficacy of the vaccine in preventing pneumococcal disease (Harris et al. 2006; Jones et al. 2010; Mieczkowski and Wilson 2002; Norwalk et al. 2004; Santibanez et al. 2002; James A., Santibanez, and Wortley 2005; Zimmerman et al. 2003). However, these studies showed that participants who did receive PV believed that the best way to prevent pneumococcal disease was through vaccination, and demonstrated an understanding about both their susceptibility to pneumococcal disease and their eligibility to receive the vaccine. Furthermore, participants who were able to demonstrate an understanding of the pneumococcal disease and its symptoms had a significant association with positive PV status (Santibanez et al. 2002). Based on these literature findings, an instrument to measure participants' beliefs in PV and related beliefs was developed (Table 1). The instrument was organized into four beliefs domains: Beliefs about Pharmacists and Pharmacies (Domain 1), Beliefs about Vaccination (Domain 2), Beliefs about Pneumococcal Disease (Domain 3), and Beliefs about Physicians (Domain 4). These four domains comprised 15 Likert-scale items, with responses ranging from one (completely agree) to four (completely disagree), except for the '[getting] vaccinations can make me sick' item, which was reverse-coded (i.e. 1 = completely disagree, 4 = completely agree).

PPPP

PPPP was conducted at the partner senior center and three additional community facilities on eight occasions from March to November 2014.

Table 1. Beliefs instrument.

Domain 1: Beliefs About Pharmacists and Pharmacies
I trust my pharmacist to give me information about vaccines
I trust my pharmacist to give me information about my medications
I trust my pharmacist to vaccinate me
My pharmacist thinks it is important for me to get a pneumonia shot
I am comfortable getting a vaccination at my pharmacy
Domain 2: Beliefs About Vaccination
Getting vaccinations is important to my health
Getting vaccinations can make me sick
Domain 3: Beliefs About Pneumococcal Disease
The pneumonia shot keeps a person from getting pneumonia
My friends and family think it is important for me to get a pneumonia shot
A person who does not get the pneumonia shot will probably get pneumonia
I am at risk of getting pneumococcal disease
It would be easy for me to get a pneumonia shot if I wanted one
Domain 4: Beliefs About Physicians
I trust my doctor to give me advice about vaccinations
I am comfortable with getting vaccines from my doctor
My doctor thinks it is important for me to get a pneumonia shot

Educational presentation

Pharmacists from a local pharmacy school delivered a 30-minute formal presentation on the pneumococcal disease to address knowledge and beliefs-related barriers to vaccination. The presentation and all reading materials were delivered at a fourth-grade reading level. The presentation covered multiple areas related to pneumococcal disease including: causes of pneumococcal disease, symptoms and potential complications of infection, high-risk individuals, modes of transmission, pneumococcal vaccines, and resources for vaccination. The pharmacist also explained the role of licensed pharmacists as PV immunizers.

Culturally sensitive skit

A group of Philadelphia community senior actors, the Living Well Players, delivered a culturally sensitive skit on the dangers of pneumococcal disease and the value of receiving the immunization. The aim of the skit was to reinforce knowledge and beliefs about the pneumococcal vaccine that was addressed in the educational presentation. Performers also addressed culturally relevant barriers to receipt of the pneumococcal vaccine, such as the Tuskegee experiment and opinions of family and friends. The performers also addressed general anxieties related to vaccines, such as fear of needles and getting sick upon receipt of a vaccine. The skit concluded with a song composed by the Living Well Players encouraging study participants to consider the receipt of pneumococcal vaccination.

Small group action planning

Small group action planning consisted of 5–10 participants and one pharmacist. Participants worked with pharmacists to determine action steps that consisted of either activation to immediate vaccination or steps to potential vaccination in the future. The small group action planning also served to address remaining barriers to pneumococcal vaccination. Participants who were uninterested in vaccination were assisted in developing individual action plans to include the following information: a specific timeline to pursue a discussion about vaccination with their primary healthcare provider, a plan to pursue a discussion with family/friends about vaccination, potential vaccine locations, and vaccination options given the participant's insurance status.

Optional, no cost vaccination

Vaccinations were available immediately after the PPPP small group action planning or were offered on a separate vaccination day at the partner senior center. The vaccine utilized was the Pneumococcal Vaccine Polyvalent (Pneumovax®23) and was administered free of charge to participants. Participant eligibility for the vaccine was determined based on criteria recommended by the Advisory Committee on Immunization Practices (ACIP) (Update Recommendations for Prevention 2010; Pneumococcal Polysaccharide Vaccine 2015b; 'Pneumococcal Polysaccharide Vaccination'). All vaccines received during PPPP were administered by licensed pharmacists.

Assessing participants' beliefs

Pharmacists and pharmacy students administered the Beliefs Instrument at baseline, post-test (i.e. immediately after the skit, during small group action planning), and three months post-intervention.

Study outcomes

For each item, a mean belief response was calculated at each study time point. The primary study outcomes were the change in mean belief responses (baseline vs. post-test) for all 15 items of the instrument. Secondary outcomes were the sustained changes in mean belief responses (baseline vs. three months) for all 15 items. The percentage of participants who completely agreed was calculated for each belief item at all study time points (baseline, post-test, and three months post-intervention).

Statistical analysis

Statistical analysis was performed using an intention to treat (ITT) approach. The ITT sample represents participants that participated in the baseline, post-test, and three-month assessments; however, if the post-test or thre- month assessment was missing, the most recent previous responses (baseline or post-test) were carried forward. Descriptive statistics were conducted to summarize sample demographics. Friedman's test was used to investigate differences in responses across all three timepoints for each belief item using a significance threshold of $\alpha = 0.05$. For those beliefs items shown to be significant by the Friedman test, *post hoc* pairwise Wilcoxon signed rank tests were performed for the three timepoint pairs (i.e. baseline vs. post-test, baseline vs. three months, and post-test vs. three months) to determine which timepoint pair(s) were truly statistically different. To avoid the problem of alpha inflation with multiple pairwise tests, the Bonferroni correction was used; thus the significance level for the Wilcoxon signed rank tests was $\alpha = 0.05/3 = 0.0167$. All statistical analyses were completed using SPSS23 software (IBM, Armonk, NY, USA).

Results

Demographics

The PPPP educational program was delivered eight times between March and November 2014 at the partner senior center (five sessions) and three community sites (one session each). The partner senior center contributed the largest number of participants ($n = 127$). A total of 276 individuals attended PPPP, of whom 190 were included in the ITT sample (Table 2). The mean age of the population was 74.3 ± 8.9 years and the population ranged in age from 54–101 years. Most participants were female (76.3%), Christian (55.8%), and identified as African American or Black (80.5%), and 33.2% of participants had at least a high school education, with an additional 40.5% having some post-secondary education.

Beliefs

The percentage of participants who completely agreed with each belief item at each timepoint is presented in Figure 1, and the statistical analysis is shown in Table 3.

Beliefs about pharmacists and pharmacies (Domain 1)

For pharmacist-related beliefs, the percentage of participants who completely agreed for each of the five items in this domain increased at post-test as compared to baseline

Table 2. Baseline PPPP Participant Demographics ($N = 190$).

Demographic Characteristics	Intention to Treat Sample $N = 190$ Frequency	Percent (%)
Gender		
Male	22	11.6
Female	145	76.3
Race		
Black[a]	153	80.5
Caucasian	2	1.1
Other	3	1.6
Marital Status		
Never married	27	14.2
Married or living as married	32	16.8
Widowed, not currently married	60	31.6
Divorced, not currently married	32	16.8
Separated	8	4.2
Number of People Living in Home		
Lives alone	68	35.8
Lives with 1 other individual	55	28.9
Lives with 2 or more other individuals	76	16.2
Highest Level of Education Completed		
High school graduate or GED	63	33.2
Some college or vocational school	37	19.5
College graduate	40	21.1
Religious Preference		
Christian	106	55.8
Jewish	2	1.1
Islamic	13	6.8
Other[b]	22	11.6

Note: Table 2 contains baseline demographic information (gender, race, marital status, number of people living in home, highest level of education completed, and religious preference) about the study participants. The frequencies and percentages do not sum to 100 percent due to participants preferring not to answer.

[a]Black represents the sum of participants that identify as African-American, Black-Caribbean, and Black-African.

[b]Other represents all participants that are religious but are not Christian, Jewish, or Muslim, or do not identify with a religion.

(Figure 1). In four of the five items, there was a decrease in the percentage of participants who completely agreed at three months from post-test, yet the number of participants who completely agreed did not fall below the baseline. For the statement 'I trust my pharmacist to give me information about my medications,' the percentage of participants who completely agreed increased from baseline to post-test, and again from post-test to three months.

Statistical analysis of the pharmacist-related beliefs (Table 2) shows significant changes across the three timepoints for all items in this domain except for 'I trust my pharmacist to give me information about vaccines.' Specifically, 'I trust my pharmacist to give me information about my medications' ($p = .042$), 'I trust my pharmacist to vaccinate me' ($p < .001$), 'My pharmacist thinks it is important for me to get a pneumonia shot' ($p = .045$), and 'I am comfortable getting a vaccination at my pharmacy' ($p = .002$). On pairwise tests, significant improvements were seen in two items from baseline to post-test: 'I trust my pharmacist to vaccinate me' ($p < .001$) and 'My pharmacist thinks it is important for me to get a pneumonia shot' ($p = .002$). These improvements were incompletely sustained at three months. For the item 'I am comfortable getting a vaccination at my pharmacy', significant improvement was seen from baseline to three months ($p = .016$) (Table 3).

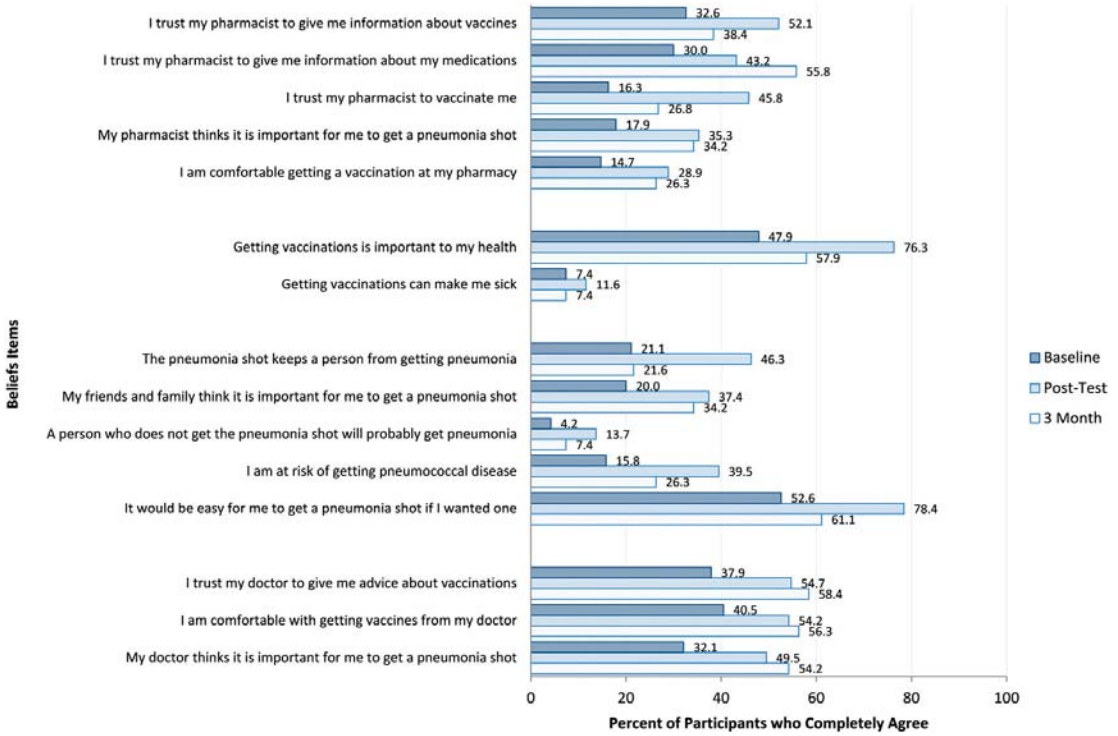

Figure 1. Percent of participants who completely agree with beliefs items, all timepoints (*N*=190).

Beliefs about vaccination (Domain 2)

When participants were asked to respond to the statement, 'Getting vaccinations is important to my health,' 48% stated they completely agreed at baseline (Figure 1). At post-test, there was a 28% gain in persons who completely agreed that vaccinations were important to health. Comparing baseline to three months, there was an overall 10% gain in participants whom agreed that 'vaccinations (were) important to my health.' Interestingly, there was an increase in respondents who reported they completely agreed that 'vaccinations can make me sick' at post-test. The percentage returned to the baseline level at the three-month assessment.

Statistically significant changes across the three timepoints were observed for both items in this domain (Table 3), 'Getting vaccinations is important to my health' ($p = .025$) and 'Getting vaccinations can make me sick' ($p = .008$). Pairwise testing showed significant improvement in agreement with the item 'Getting vaccinations is important to my health' ($p = .009$) from baseline to post-test; this improvement was incompletely sustained at three months.

Beliefs about pneumococcal disease (Domain 3)

A trend is observed in respondents who completely agreed with the beliefs items at baseline, post-test, and three months (Figure 1). For all items, there was an increase in percentage of participants who completely agreed at post-test vs. baseline. At three months the percentage of participants who completely agreed decreased, yet did not drop below the baseline. There were gains across all five items from baseline to three months.

Table 3. Statistical analysis of beliefs responses ($N = 190$).

Item	Friedman *p*-Value[a]	Kendall's W Effect Size	Pairwise Comparisons	Wilcoxon p-Value[b]
Domain 1: Beliefs About Pharmacists and Pharmacies				
I trust my pharmacist to give me information about vaccines	0.138	--	--	--
I trust my pharmacist to give me information about my medications	0.042	0.051	BL vs. PT	0.519
			BL vs. M3	0.028
			PT vs. M3	0.210
I trust my pharmacist to vaccinate me	<0.001	0.128	BL vs. PT	<0.001*
			BL vs. M3	0.023
			PT vs. M3	<0.001
My pharmacist thinks it is important for me to get a pneumonia shot	0.045	0.076	BL vs. PT	0.002*
			BL vs. M3	0.962
			PT vs. M3	0.015
I am comfortable getting a vaccination at my pharmacy	0.002	0.137	BL vs. PT	0.020
			BL vs. M3	0.016*
			PT vs. M3	0.032
Domain 2: Beliefs About Vaccination				
Getting vaccinations is important to my health	0.025	0.044	BL vs. PT	0.009*
			BL vs. M3	0.024
			PT vs. M3	0.442
Getting vaccinations can make me sick	0.008	0.083	BL vs. PT	0.913
			BL vs. M3	0.045
			PT vs. M3	0.143
Domain 3: Beliefs About Pneumococcal Disease				
The pneumonia shot keeps a person from getting pneumonia	<0.001	0.131	BL vs. PT	<0.001*
			BL vs. M3	0.901
			PT vs. M3	0.006
My friends and family think it is important for me to get a pneumonia shot	0.701	--	--	--
A person who does not get the pneumonia shot will probably get pneumonia	0.085	--	--	--
I am at risk of getting pneumococcal disease	0.105	--	--	--
It would be easy for me to get a pneumonia shot if I wanted one	0.040	0.039	BL vs. PT	0.014*
			BL vs. M3	0.200
			PT vs. M3	0.589
Domain 4: Beliefs About Physicians				
I trust my doctor to give me advice about vaccinations	0.013	0.068	BL vs. PT	0.157
			BL vs. M3	0.263
			PT vs. M3	0.033
I am comfortable with getting vaccines from my doctor	0.444	--	--	--
My doctor thinks it is important for me to get a pneumonia shot	0.032	0.061	BL vs. PT	0.067
			BL vs. M3	0.578
			PT vs. M3	0.104

Note: Bold values represent statistically significant results; asterisks in the pairwise tests indicate improved agreement with the belief statement for those tests that are statistically significant. Table 3 presents the statistical analysis of beliefs responses across all three timepoints (Friedman test with effect size given by Kendall's W) and pairwise for the three timepoint pairs (Wilcoxon signed rank tests).

[a]Friedman tests were performed using a significance level of $\alpha = 0.05$.

[b]Pairwise Wilcoxon signed rank tests were performed using a significance level of $\alpha = 0.0167$.

Statistical analysis of the beliefs about pneumococcal disease (Table 3) showed significant differences across the timepoints in two of the five items in this domain: 'The pneumonia shot keeps a person from getting pneumonia' ($p < .001$) and 'It would be easy for me to get a pneumonia shot if I wanted one' ($p = .040$). Pairwise testing showed significant improvements in both of these items from baseline to post-test ($p < .001$ and $p = .014$, respectively); however, these improvements were incompletely sustained at three months.

Beliefs about physicians (Domain 4)

A positive trend was observed in the percentage of participants who completely agreed across observations for all physician belief items (Figure 1). By three months, over 50% of participants completely agreed with each item.

Statistical analysis of the beliefs about physicians (Table 3) showed significant changes across the three timepoints in the items 'I trust my doctor to give me advice about vaccinations' ($p = .013$) and 'My doctor thinks it is important for me to get a pneumonia shot' ($p = .032$). However, pairwise testing did not reveal any significant differences between the timepoints.

Discussion

Beliefs regarding immunizations can influence a person's decision to receive a vaccination. In a recent investigation of knowledge, attitudes, beliefs, and behaviors of older adults regarding the pneumococcal vaccine in a Canadian-based self-administered survey, participants who agreed that the pneumonia vaccine keeps a person from getting pneumonia were nearly twice as likely to have received the vaccination (Schneeberg et al. 2014). At baseline in the PPPP study, 21% completely agreed with the statement that the pneumococcal vaccine would prevent pneumonia. This proportion more than doubled following the program, but retreated to baseline levels after three months. This may indicate that a brief educational program may have a short-term influence on certain healthcare-related beliefs.

The PPPP model of care provided access to a preventive health care service by combining accessible Philadelphia senior centers with pharmacists licensed to provide immunizations. However, the proportion of participants that trusted pharmacists as immunizers was low at baseline (16%). Following the program, trust improved such that nearly half of participants trusted a pharmacist to provide them with a vaccination at post-test. The trust in pharmacists as vaccine providers declined by the end of the study (27%), but remained considerably higher than baseline levels. While the levels of trust in pharmacists as immunizers improved during the study, it remained significantly lower than trust in physicians. This indicates that sustained trust in pharmacists as immunization providers is not something that can be attained through a single brief program. Trust takes time to build; we suspect that additional outreach and education are likely needed over a longer term in order to foster trusting relationships between vaccinating pharmacists and the communities they serve.

We observed statistically significant improvements in all domains except for Domain 4 'Beliefs about Physicians' at post-test as compared to baseline. Comparing baseline to three months, there was a statistically significant improvement in only one item in Domain 1 'Beliefs about Pharmacists and Pharmacies' and no statistically significant improvements in any of the other three domains. These findings further underscore the need for additional outreach to sustain the improvements achieved at post-test.

Previous studies have evaluated the effect of pharmacist interventions focused on vaccines (Wang et al. 2013; Loughlin et al. 2007). Mills found that the rate of Tdap vaccination was significantly higher in relatives of newborns who received education about the dangers of pertussis and vaccination from community pharmacists (8.1%) than individuals who did not receive the intervention (5.5%) ($p < .01$) (Mills et al. 2014). We utilized pharmacist

and pharmacy students to primarily deliver the educational program. Previous research has shown that pharmacists significantly improve both vaccination uptake (Steyer et al. 2004) and patients' attitudes towards vaccines. (Chou et al. 2014) Our results are in agreement with a previous study that demonstrated student pharmacists can positively affect patients' views on PV (Chou et al. 2014). Our study demonstrated that participants sustained a significant improved agreement with the item 'I am comfortable getting a vaccination at my pharmacy' at three months compared to baseline; additionally, short-term improvements were observed in the item 'My pharmacist thinks it is important for me to get a pneumonia shot' and 'I trust my pharmacist to vaccinate me'. This may suggest that our program was successful in positively impacting participants' beliefs regarding pharmacists.

To our knowledge, this is the first study to evaluate the effects of a pneumococcal education program on beliefs related to PV, specifically within a predominantly African American community. Among individuals 65 years old and older, the number of African Americans who received a PV was 20% less than Caucasians counterparts (Immunizations and African Americans 2016). Levels of trust and PV vaccination rates may be correlated. Research has shown that individuals of African American descent are at particular high risk for decreased trust in healthcare due to historical systematic racism, prejudice, and discriminatory practices (Wasserman, Flannery, and Clair 2007; Gamble 1997). The disparity of lower vaccination rates is not specific to patients of African American descent, Hispanic adults have been found to have lower influenza and PV immunization rates than Caucasian adults (Immunizations and Hispanics 2016). Further analysis of patient-specific factors associated with vaccination beliefs among minority groups is needed.

We believe that the improvements in pneumococcal-related beliefs achieved by PPPP were made possible through partnership with the senior center. Evidence has shown that public health initiatives are more effectively achieved with active community engagement through trusted relationships and partnerships (Pioneering Healthier Communities). With respect to the importance of joint partnership, we partnered with the Living Well Players to develop and deliver a culturally sensitive skit. This may be a key component of PPPP that improved participants' PV beliefs. Furthermore, seniors residing in metropolitan areas may have barriers to visiting a physician office, such as lack of transportation. Clinical pharmacists, who specialize in geriatric care, have partnered with senior centers, nursing homes, and senior homes to perform vaccinations and immunization counseling. To this end, the pharmacist-senior center model was a critical component of PPPP.

Our study demonstrates a baseline measurement of PV beliefs in a predominantly older, African American population and a method to measure beliefs. We demonstrate that pharmacist partnerships with senior centers can are effective models of community engagement. We found that sustaining improvements related to PV beliefs is challenging as the majority of significant improvements were found at post-test rather than three months post-intervention. As a result of our program, we did not observe significant changes in participants' beliefs about physicians. Individuals experience a lifetime of healthcare encounters that affect beliefs and altering beliefs may require sustained efforts. The continuation of programs, such as PPPP, is needed to foster positive beliefs related to pneumococcal vaccination.

Limitations

A large limitation to this study is the lack of an active control group. We did not include a control group for two primary reasons. First, this study was intended to serve as an initial assessment of the intervention and as such, we were most interested in gaining preliminary data as to its potential beliefs impact. Second, our senior center partner sought to maximize the public health benefit of this program to older Philadelphians and felt it would be a disservice to exclude study participants from the intervention. Another limitation of this study is that we did not assess the impact of improved beliefs upon vaccination status. As the aim of this study was to improve vaccine-related beliefs, not to increase vaccination, the study was not structured to assess how vaccination status changed as beliefs changed.

Eighty percent of participants in this study were of African American descent. While this was the select population for our study, the results may not be generalizable to other ethnic groups given the possible interaction between race and beliefs. The Beliefs Instrument was constructed following a literature search targeted to the potential barriers to vaccination experienced by our population; therefore, the presented tool may require alteration before application in similar studies. Additionally, although the improvement was seen at post-test for most beliefs, these improvements were incompletely sustained at three months. People experience a lifetime of exposures to the healthcare system, which affects their belief system. Our educational program was a one-day event; therefore, we cannot expect significant changes to beliefs that have developed over a lifetime.

Another limitation of this study is that the pairwise comparisons of timepoints within each item was performed using the Bonferroni correction to the significance level, which reduced the threshold from $\alpha = 0.05$ to $\alpha = 0.0167$. The Bonferroni correction is a conservative method of protecting against alpha inflation, and accordingly, some of the items which were found to have significant differences by the Friedman test did not show significance upon pairwise testing of the timepoints.

A final limitation is that the Beliefs Instrument, which was constructed for this study, is not formally validated, and its psychometric properties, including inter-item reliability, were not assessed.

Public health implications

Despite the widespread availability of immunizations that can reduce infection-related morbidity and mortality, many individuals, including those at high risk of infections and complications remain unvaccinated. Additionally, disparities in the delivery and receipt of preventative care services related to race, ethnicity and socioeconomic status persist. Limitations in knowledge and access as well as formed beliefs regarding healthcare are among the barriers that can influence an individual's decision to be immunized. This study acknowledged that healthcare beliefs, in particular, are a function of an individual's environment and community. For older individuals, senior centers are a trusted community resourced that provides opportunities for social, recreational, health and fitness, arts and humanities and lifelong learning activities. Pharmacists are also a trusted community resource that routinely provides healthcare services, including immunizations to community members. PPPP successfully linked the pharmacist to the senior center, developing a partnership that utilized the assets of each to positively influence the healthcare beliefs

among community members. Future public health initiatives that intend to impact the healthcare beliefs of seniors should consider the pharmacist-senior center model of care.

Conclusion

We conclude that the Pharmacists' Pneumonia Prevention Program (PPPP) significantly improved participants' beliefs about the importance of PV for health. Overall, PPPP yielded significant benefits and represents a model of care worthy of future investment, particularly towards building relationships of trust between vaccinating pharmacists and the communities they serve.

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