



Assessing and Improving Zoster Vaccine Uptake in a Homeless Population

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Abstract

The herpes zoster (shingles) vaccine is recommended for all adults aged ≥ 60 years without contraindications to prevent shingles and post-herpetic neuralgia. There are no published studies on zoster vaccination rates, barriers, or workflows in adults who have experienced homelessness. Due to barriers specific to this vaccine, including difficulty determining insurance coverage, high upfront costs, need for storage in a freezer, and under-prescription by physicians, uptake is lower compared to other recommended vaccines for older adults. To address these barriers, we developed a new approach of partnering our on-site primary care clinic in a transitional homeless shelter with a local pharmacy and offering vaccination on Shingles Immunization Days with a goal of matching or exceeding the national zoster immunization rate of 30.6%. Over a 3-year period, the live attenuated zoster vaccine was offered to 86% of eligible patients resulting in an immunization rate of 38.1%. This is higher than the estimated national rate but significantly lower than rates of tetanus (80.6%), pneumococcal (76.3%), and influenza (69.6%) vaccination in the same population, highlighting the unique obstacles to zoster immunization. Major reasons that patients were not immunized included lack of insurance coverage and patient refusal of all vaccines. Our findings demonstrate that homeless adults are interested in zoster vaccination and a model of on-site primary care in a shelter partnering with a pharmacy can successfully improve vaccine uptake in this population. Coverage of the new inactivated zoster vaccine under Medicare Part B could increase the national zoster immunization rate.

Keywords Zoster · Zoster vaccine · Shingles · Shingles vaccine · Homelessness · Vulnerable populations

Introduction

Though homeless adults are at high risk for morbidity and mortality due to vaccine-preventable disease [1–3], there are no published studies of herpes zoster (shingles) incidence, immunization rates, barriers to vaccination, or models to increase immunization rates among adults in the United States who have experienced homelessness. The Advisory Committee on Immunization Practice (ACIP) recommends

zoster vaccination in all adults aged ≥ 60 years to prevent shingles and post-herpetic neuralgia (PHN) [4–6]. Despite this, zoster immunization rates in the United States are significantly lower compared to other recommended vaccines for older adults [7]. Only 30.6% of adults aged ≥ 60 years self-reported ever receiving the zoster vaccine in the 2015 National Health Interview Survey (NHIS), thus barely meeting the Healthy People 2020 Target of 30% [7]. A large retrospective study of zoster vaccine insurance claims between 2007 and 2013 estimated the national zoster immunization rate even lower at 19.5% [8]. Given that one-third of Americans will suffer from shingles during their lifetime, 13% of adults over 60 who develop shingles will experience PHN [5], and zoster immunization has been shown to be cost-effective [9–11], it is imperative to identify and address barriers to zoster vaccination among all Americans, including those who have experienced homelessness.

The low rate of zoster immunization is due to barriers unique to this vaccine [6, 12–18]. To begin, insurance coverage is poor and variable, with copayment costs ranging from

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\$0 to > \$250 across prescription drug plans (PDPs) [12–14, 16–20]. The need for the live zoster vaccine to be stored in a freezer and administered within 30 min of thawing, unlike other adult vaccines which are stored in a refrigerator, decreases the likelihood that pharmacies and provider offices will stock the vaccine [12, 13, 18]. Moreover, in some states, pharmacists cannot administer the zoster vaccine without a provider's prescription or authorization [15]. Consequently, current workflows for zoster immunization include either stocking and vaccinating in the provider's office, prescribing to a pharmacy for the patient to bring in for administration in the provider's office, or prescribing to a pharmacy for administration at the pharmacy [13, 18]. Due to these barriers, surveys of primary care physicians have shown that the zoster vaccine is prioritized below and not recommended as frequently as other adult vaccines [12–14, 18, 19, 21]. There is also a large disparity in administration between different states [22, 23] and racial/ethnic groups [24]; self-reported rates of zoster vaccination are 34.6% for white patients compared to 16% of Hispanic and 13.6% of African-American patients [7]. Published interventions to increase zoster immunization include pharmacy interventions such as fliers, increased patient education, and directly mailing or calling patients for vaccination [25–31]; electronic health record alerts sent to providers and/or patients about the need for vaccination [32, 33]; a nurse practitioner-based clinic model that stocks the zoster vaccine and directly bills Medicare Part D [34]; administration in an ophthalmology clinic [35]; and campaigns to improve zoster vaccine education among patients and providers [12, 36, 37].

Adults who have experienced homelessness may have even lower rates of zoster vaccination due to many factors, including increased barriers to access and navigate the healthcare and health insurance systems, decreased ability to afford copayments, and overrepresentation of minorities in the U.S. homeless population [38–41]. In the present study, we sought to increase the rate of zoster immunization from a baseline of 1% of active patients at a primary care clinic in a transitional homeless shelter for medically and/or psychiatrically complex homeless adults in New York City. Barriers included lack of an onsite medical freezer and an efficient way to determine vaccine cost for each patient. In addition, in New York, pharmacists need a prescription for vaccine administration [42] and there is a \$20 shipping fee to order less than five doses at one time from the manufacturer [43]. To address these obstacles, we developed a new workflow in which we partnered with a local pharmacy to identify copayment costs and deliver the vaccine for administration on group Shingles Immunization Days. After a nearly 3-year study period, we performed a retrospective chart review of the results. Our primary objective was to determine if an on-site primary care clinic in a homeless shelter partnering with a pharmacy could match or exceed the national zoster

immunization rate of 30.6%. A secondary objective was to identify barriers to zoster immunization in adults who have experienced homelessness.

Methods

Study Design

The Institute for Family Health (IFH), affiliated with the Icahn School of Medicine at Mount Sinai, is a federally qualified community health center network providing primary care services in New York City and the Mid-Hudson Valley. The present study was based at Valley Lodge, a transitional homeless shelter for medically and psychiatrically complex homeless adults aged ≥ 50 years, which is run by the West Side Federation for Senior and Supportive Housing (WSFSSH), a private non-profit organization, with funding from the NYC Department of Homeless Services. Through a subcontract with Care for the Homeless, IFH provides weekly on-site health care services. The clinic is staffed by one family physician who sees patients two full days/week and a nurse who sees patients on two different half days/week. At any given time, the clinic provides primary care for about half of the 92 current shelter residents. One-third of the active clinic population is also comprised of former residents who have moved to permanent housing and return for ongoing primary medical care. Residents generally live in the transitional shelter for 3 months to 2 years while they seek permanent, affordable housing.

In February 2015, the clinic physician gave a 30-min talk on the zoster vaccine at the shelter. From February 2015 through December 2017, zoster vaccination was offered during routine primary care visits as time permitted to all eligible patients per the ACIP/CDC guidelines [4]. For patients interested in vaccination, a live attenuated zoster vaccine (Zostavax™) prescription was e-prescribed to a local pharmacy three blocks from the shelter. After receiving the prescription, the pharmacy electronically determined insurance coverage and cost of co-payment within minutes. During a break in the workday, the provider or shelter Associate Director contacted the pharmacy to determine the cost for each prescription. At the next patient visit, the provider discussed the cost, risks, and benefits of vaccination with the patient, who would then decide whether to be vaccinated. As the partnering pharmacy did not stock or administer the vaccine in-house and had to pay \$20 in shipping costs if < 5 doses of the vaccine were ordered, a list was kept in the electronic health record of patients who had agreed to vaccination. After at least six patients were ready for vaccination, the appropriate number of doses were ordered for delivery to the shelter, and the vaccine was administered during individual appointments on Shingles Immunization Days.

Each Immunization Day had at least 1–2 alternate patients to account for acute patient contraindications to vaccination or no-shows. Five Shingles Immunization Days were held over the study period.

Alternate immunization options were offered but infrequently utilized. Patients were offered the opportunity for the vaccine to be e-prescribed to a national chain retail pharmacy a half block from the shelter for on-site vaccination, but halfway through the study period this pharmacy closed. Patients could also bring the vaccine frozen from an outside pharmacy to be administered in clinic or receive it at another site in our organization where the vaccine was stocked in-house.

Vaccine administration was recorded in the electronic health record (EHR) as for all other vaccines. We also documented in the EHR the cost of co-payment if known and reasons why patients declined the vaccine.

Data Analysis

At the end of the study period, a retrospective chart review was performed to determine the rate of and barriers to administration of the zoster vaccine. We included all patients aged ≥ 60 years who received primary care at the transitional homeless shelter clinic and were seen by their primary care provider at least twice during the study period. Logistic regression was performed to compute odds ratios and 95% confidence intervals (CIs) for associations between patient characteristics and consent to vaccination, adjusting for age, sex, race/ethnicity, residence in the transitional homeless shelter (yes/no), number of medical comorbidities (≥ 3 vs. < 3), mental illness/dementia (yes/no), and patient refusal of at least one other vaccine (yes/no). Age was dichotomized as 60–64 or ≥ 65 years because insurance coverage improves at age 65 when adults are eligible to select Medicare Part D, which covers the zoster vaccine. We also evaluated rates of vaccination against tetanus, pneumonia, and influenza (which are stored in an on-site medical refrigerator) and cost of zoster vaccination in our population of adults aged ≥ 60 years.

Results

We identified 103 patients at our clinic aged ≥ 60 years. A majority (56.3%) of patients were men and the largest racial/ethnic group was African-American (45.6%) (Table 1). Most (54.4%) patients had three or more major medical comorbidities, and almost half (46.6%) had a diagnosis of dementia or mental illness. Nearly all (98.1%) were insured. Of these 103 patients, ten were excluded because they were already vaccinated or had medical contraindications, such as immunosuppression due to HIV/AIDS, current chemotherapy or

radiation treatment for malignancy, steroid or other immune suppression for autoimmune disease, or diagnosis or concern for hematologic malignancy (Fig. 1).

Of the 93 medically eligible patients, 13 (14.0%) patients were not offered the zoster vaccine due to transfer of care prior to discussing vaccination, lack of time during visits, or lack of a visit since turning 60 years old. As a result, the zoster vaccine was offered to 80 (86.0%) medically eligible patients. The vaccine was accepted by 37 of the 93 medically eligible patients (acceptance rate 39.8%), including those who had agreed to receive the vaccine but were waiting for an immunization day (see Fig. 1). At the end of the study period, four patients were still awaiting a second visit to find out the vaccine cost and decide whether to receive it.

Characteristics of patients who either accepted or declined the zoster vaccine are shown in Table 1. Most (58.1%) men and 36.4% of women accepted the vaccine ($P=0.06$ for difference by sex). Patients with three or more major comorbidities were more than twice as likely to accept the vaccine than those with fewer comorbidities (63.0 vs. 27.0%; $P<0.01$). Those who had previously declined other vaccines were also less likely to accept the zoster vaccine (see Table 1). No significant differences in vaccine acceptance were found by race/ethnicity or any other patient characteristics.

The primary reasons for declining the zoster vaccine were lack of insurance coverage or patient refusal of all vaccines. After adjusting for covariates, patients who had previously declined at least one other vaccine had a 92% reduced odds of accepting the zoster vaccine (Table 2). Some patients were specifically concerned about the side effects of a live vaccine or wanted a longer time interval between vaccines. The only other significant predictor of zoster vaccine acceptance was number of medical co-morbidities. After adjusting for covariates, patients with ≥ 3 co-morbidities had more than a fivefold odds of accepting the zoster vaccine relative to those with fewer chronic conditions (Table 2). Patients had a variety of PDPs, which all had different vaccine costs. For most patients who had insurance coverage, the co-payment was $< \$10$, but for others it was $\$30$ – $\$100$ (Fig. 2). The manufacturer of the live attenuated zoster vaccine offers a Patient Assistance Program that fully covers the vaccine cost for uninsured patients and one uninsured patient received the vaccine through this program [44].

A total of 38.1% of this patient population were immunized against zoster during the study period or prior to establishing care, which is higher than the reported national average of 30.6% and the Healthy People 2020 goal of 30% (Table 3). In addition, our rate of 37.1% vaccination among those aged 60–64 years is significantly higher than the rate of 21.7% reported in the 2015 NHIS [7]. Notably, 51% of African-American and 50% of Hispanic patients in our study population (compared to 41% of Caucasians)

Table 1 Characteristics of all patients aged ≥ 60 years and those who accepted or declined the zoster vaccine

	All patients ≥ 60 years (N=103)	Accepted vaccine (N=37)	Declined vaccine (N=39)	Proportion of those offered vaccine who accepted	
	n (%)	n (%)	n (%)	%	P value
Age (years) ^a					
60–64	36 (35%)	13 (35%)	13 (33%)	48	0.95
≥ 65	67 (65%)	24 (65%)	26 (67%)	49	
Gender					
Female	45 (44%)	12 (32%)	21 (54%)	36	0.06
Male	58 (56%)	25 (68%)	18 (46%)	58	
Race/ethnicity					
African-American	47 (46%)	16 (43%)	15 (38%)	52	0.55
Caucasian	28 (27%)	9 (24%)	13 (33%)	41	
Hispanic	23 (22%)	10 (27%)	10 (26%)	50	
Other/unknown	5 (5%)	2 (5%)	1 (3%)	67	
Current shelter resident ^a					
Yes	69 (67%)	24 (65%)	30 (77%)	44	0.25
No	34 (33%)	13 (35%)	9 (23%)	59	
Has three or more major medical comorbidities ^b					
Yes	56 (54%)	29 (78%)	17 (44%)	63	<0.01
No	47 (46%)	8 (22%)	22 (56%)	27	
Diagnosis of dementia or mental illness					
Yes	48 (47%)	16 (43%)	16 (41%)	50	0.85
No	55 (53%)	21 (57%)	23 (59%)	48	
History of tobacco abuse					
Yes	59 (58%)	26 (70%)	21 (54%)	55	0.14
No	44 (43%)	11 (30%)	18 (46%)	38	
History of alcohol abuse					
Yes	26 (25%)	10 (27%)	6 (15%)	63	0.21
No	77 (75%)	27 (73%)	33 (85%)	45	
History of other substance abuse					
Yes	26 (25%)	10 (27%)	8 (21%)	56	0.50
No	77 (75%)	27 (73%)	31 (79%)	47	
Has declined at least one recommended immunization ^c					
Yes	31 (30%)	3 (8%)	19 (49%)	14	<0.01
No	72 (70%)	34 (92%)	20 (51%)	63	
Has declined more than one recommended immunization ^c					
Yes	20 (19%)	0 (0%)	15 (38%)	0	<0.01
No	83 (81%)	37 (100%)	24 (62%)	61	
Tetanus vaccine UTD ^c					
Yes	83 (81%)	33 (89%)	26 (67%)	56	0.02
No	20 (19%)	4 (11%)	13 (23%)	24	
Influenza vaccine UTD ^{c,d}					
Yes	71 (70%)	33 (89%)	23 (59%)	59	0.03
No	31 (30%)	4 (11%)	16 (41%)	20	
Pneumonia vaccine UTD ^{c,e}					
Yes	72 (76%)	34 (97%)	20 (57%)	63	<0.01
No	23 (24%)	1 (3%)	15 (43%)	6	
Insurance status					
Insured	101 (98%)	36 (97%)	38 (97%)	49	0.06
Uninsured	2 (2%)	1 (3%)	1 (3%)	50	

Table 1 (continued)

UTD up to date

^aAge/housing status at time of vaccination or when vaccination was discussed if declined or still awaiting vaccination

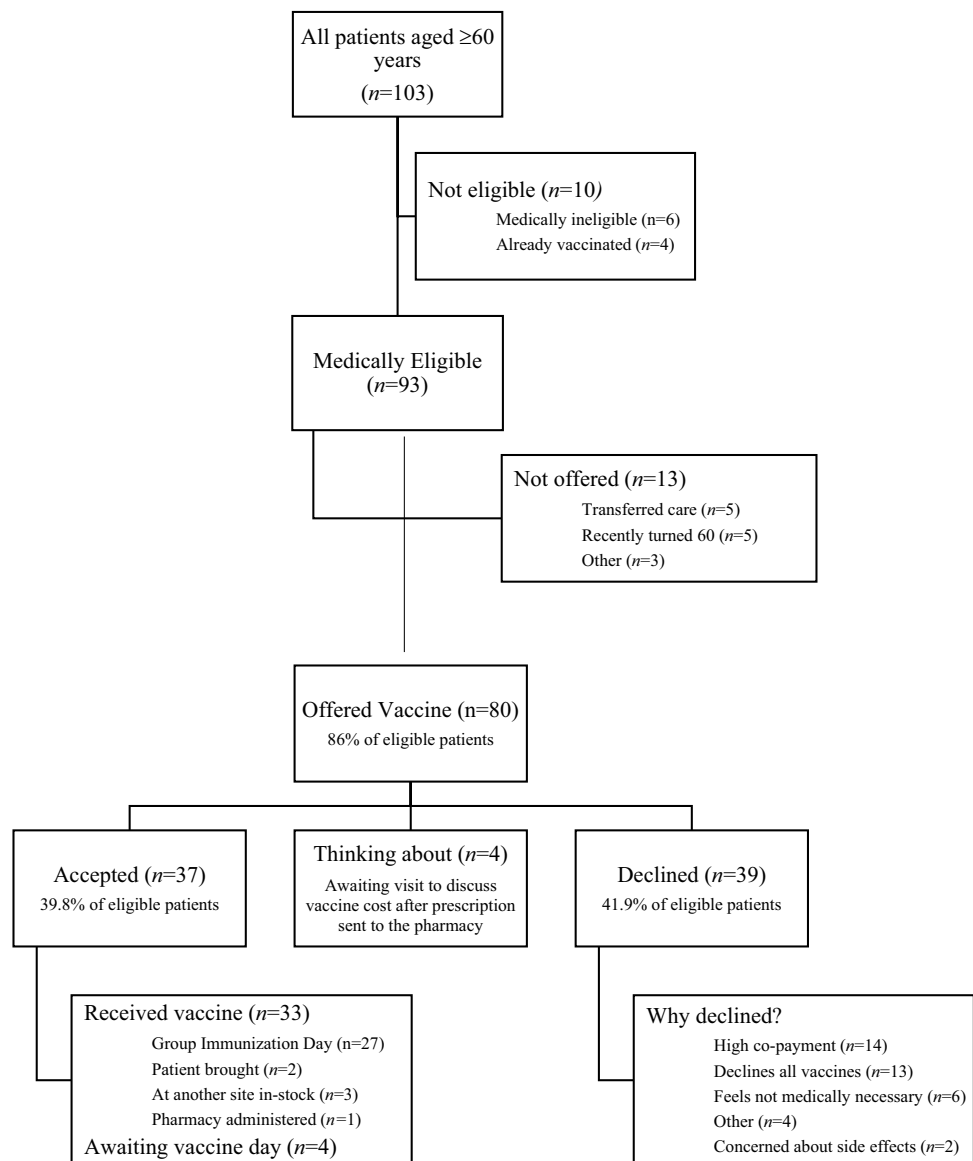
^bIncludes life-threatening medical, non-psychiatric comorbidities, including history of CAD, CVA, PAD, systolic CHF, atrial fibrillation/flutter, arrhythmias requiring pacemaker, hyperlipidemia, diabetes, malignancy, rheumatologic conditions, COPD, asthma, AIDS, hepatitis, osteoporosis, hypothyroidism, seizure disorder, blindness, recurrent VTE, CKD stage IV or more advanced. Excludes overweight, obesity, prediabetes, CKD III or less advanced, gout, minor BPH, mild anemia, underweight, diastolic dysfunction

^cPer patient’s age and comorbidities based on 2017 CDC Adult Immunization Schedule

^dCounted as up to date if patient received influenza immunization during the last flu season in which they presented for care

^eOur organization has found insufficient evidence to vaccinate all adults aged ≥ 65 years with PCV13 unless they have other indications; pneumococcal rate includes PPSV23 only

Fig. 1 Study flow diagram



accepted the zoster vaccine, which is substantially higher than the vaccination rates of 13.6% of African-Americans and 16% of Hispanic adults reported in the 2015 NHIS [7].

Rates of influenza, tetanus, and pneumonia vaccination were significantly higher than that of zoster vaccination in the same patient population, reflecting the unique challenges

Table 2 Adjusted odds ratios for associations between patient characteristics and zoster vaccine acceptance

Variable	Odds ratio (CI)	P value
Age (< 65 referent)	0.66 (0.16–2.69)	0.56
Gender (male referent)	1.40 (0.39–5.03)	0.61
Race (non-African-American referent)	2.81 (0.78–10.21)	0.12
Shelter resident (“no” referent)	0.37 (0.09–1.51)	0.17
≥ 3 medical co-morbidities (< 3 referent)	5.71 (1.23–26.48)	0.03
Mental illness/dementia (“no” referent)	1.49 (0.44–5.05)	0.52
Tobacco use history (“no” referent)	2.12 (0.58–7.72)	0.26
Alcohol abuse history (“no” referent)	4.16 (0.64–26.93)	0.14
Other substance use history (“no” referent)	0.27 (0.04–1.78)	0.17
Declined at least one other vaccine (“no” referent)	0.08 (0.02–0.40)	<0.01

Odds ratios are adjusted for all variables listed in the table

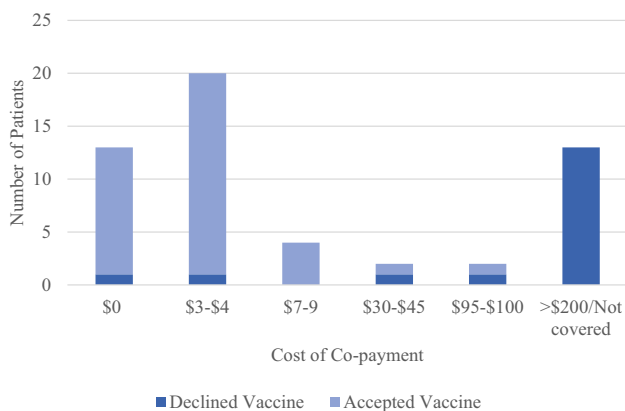


Fig. 2 Zoster vaccine cost (if known)

presented by the zoster vaccine in adults who have experienced homelessness, as in the general population (Table 3).

No adverse effects of the zoster vaccine were reported aside from mild arm pain in some recipients. Only one

patient was known to develop zoster during the study period and this occurred while awaiting immunization. Seven patients died during the study period, but none in the three months following zoster immunization.

Discussion

To our knowledge, this is the first study to examine the rate of and barriers to zoster vaccination in adults who have experienced homelessness and assess an intervention to increase zoster vaccine uptake in this population. Partnering an on-site primary care clinic in a homeless shelter with a local pharmacy to administer the vaccine on specific vaccine days eliminated many barriers to zoster vaccination, including lack of a freezer for storage, upfront purchasing costs and shipping fees, lack of an efficient system to determine individual PDP cost, and need for patient travel outside the clinic for vaccination. However, this model was unable to overcome a lack of zoster PDP coverage in certain patients

Table 3 Vaccination rates for active patients aged ≥ 60 years during the study period

Vaccine	Tetanus	Pneumococcal ^a	Influenza ^b	Zoster
Eligible patients	103	93	102	97
Number of patients up to date on vaccination at end of study period	83	71	71	37
IFH vaccination rate	80.6%	76.3%	69.6%	38.1%—age ≥ 60 37.1%—age 60–64 38.7%—age ≥ 65
National Health Interview Survey 2015	56.9% ^c	63.6% ^c	73.5% ^c	30.6%—age ≥ 60 21.7%—age 60–64 34.1%—age ≥ 65

Patient eligibility determined by 2017 CDC Adult Immunization Schedule

^aOur organization has found insufficient evidence to vaccinate all adults aged ≥ 65 years with PCV13 unless they have other indications; pneumococcal rate includes PPSV23 only

^bCounted as up to date if patient received influenza immunization during the last flu season in which they presented for care

^cRates are for patients aged ≥ 65 years for tetanus, pneumococcal, influenza vaccines as data for those ≥ 60 years are not presented in 2015 NHIS

or patient-held beliefs about the vaccine necessity or risks. It is also significantly more time-consuming than typical workflows for other vaccines recommended for older adults as evidenced by appreciably higher rates of tetanus, pneumococcal, and influenza vaccination in the same population. Unique barriers to zoster vaccination are also reflected in the 2015 NHIS, in which 34.2% of adults aged ≥ 65 years self-reported ever receiving the zoster vaccine compared to 63.6% for pneumonia and 56.9% for tetanus vaccines [7].

Importantly, the present study demonstrates that adults who have experienced homelessness, including underrepresented minorities and those with histories of mental illness and substance abuse, are interested in zoster and other routine vaccination. We hope that these results will spark others to develop effective models to improve vaccination rates in this vulnerable population in other settings. Though not the primary focus of our study, the limited published evidence on tetanus, pneumococcal, and influenza vaccination among homeless adults in the U.S. [1–3, 38, 45], has prompted calls to develop new models to reduce disparities in immunization rates [46]. Our reported rates for tetanus and pneumococcal vaccination in adults who have experienced homelessness are higher than reported rates in the general U.S. population, suggesting that homeless adults are also accepting of routine vaccination. A model of comprehensive primary care located in a homeless shelter with an on-site refrigerator to store vaccines can effectively achieve high levels of routine immunization among homeless adults.

We also found that patients with three or more medical co-morbidities had more than a fivefold odds of accepting the zoster vaccine. Possible explanations include that patients with increased co-morbidities are generally more interested in preventative care, have higher levels of trust in the health care system and/or their medical team, or have more medical appointments in which vaccination is discussed and therefore more opportunities to accept. Additional studies will be needed to confirm and further elucidate this finding.

Poor and disparate PDP coverage of the zoster vaccine was a substantial barrier in our study population. Unlike most vaccines, the zoster vaccine is classified as a prescription drug, not a vaccine. Therefore, it is not covered under Medicare Part B, which covers vaccines for most adults aged ≥ 65 years but not prescription drugs. For prescription drug coverage, seniors select a PDP among many choices offered by insurance companies. Since there is currently no generic zoster vaccine, PDPs generally classify it as a Tier 3 or Tier 4 drug, which costs more than generic Tier 1 and 2 drugs. Though the zoster vaccine is covered with a co-payment $< \$10$ under the Medicare Part D PDP, co-payment cost in other PDPs varies widely and this information is not available to prescribers and patients in the point-of-care setting [16, 17, 20]. If the vaccine could be stored and dispensed

on-site, 30–60 min of valuable clinical time would be needed to call a patient's insurance company to determine coverage and co-payment cost. Using online or print formularies can be problematic as it can be difficult to identify a patient's specific plan within an insurance company's options and formularies are often not up to date with the latest coverage information [47, 48]. Interestingly, lack of insurance coverage was not a barrier for zoster immunization as there is no cost for uninsured patients and minimal paperwork through the manufacturer's Patient Assistance Program [44]. Reclassification of the zoster vaccine as a vaccine covered without co-payment under Medicare Part B or improved PDP coverage would likely significantly improve zoster vaccination rates.

The present study has a few limitations. First, the patient population was relatively small, which may make it easier to achieve higher vaccination levels and a lower rate of adverse events than in larger populations. Factors unique to the study shelter may also have contributed to higher vaccine uptake and affect generalizability to other settings. For example, patients may have been more available for on-site medical appointments compared to other shelters because unlike other New York City shelters, this shelter permits patients to stay in their room and common areas of the building during the day. Furthermore, due to high levels of medical and psychiatric comorbidities, many patients have difficulty going outside of the shelter independently. The shelter and its staff provide extensive assistance with medical appointments and managing medications that can continue even after patients move out, which could increase compliance with medical care and immunization. Because the shelter manages medications for many patients who have difficulty with ambulation and/or navigating the healthcare system independently, patients at this shelter may be less likely to go to a pharmacy for a vaccination. Zoster vaccine acceptance may also be different in a sheltered homeless vs. street homeless population. Additional larger studies will be needed to replicate our workflow or develop other models to improve uptake of this important vaccine.

The new inactive herpes zoster subunit vaccine (HZ/su) Shingrix™ was approved by the FDA and recommended for administration by the ACIP in October 2017 for adults aged ≥ 50 years [49]. In large Phase 3 trials, the inactive subunit vaccine has significantly improved effectiveness and duration of action in reducing rates of zoster and PHN compared to the live attenuated vaccine [50–52]. Because it is inactive, it is expected to be safe for patients with compromised immune systems in whom live vaccine is contraindicated [53, 54]. However, the inactive subunit vaccine has its own set of challenges, including the need for two doses of the vaccine 2–6 months apart (though this schedule may change) and a significantly increased risk of injection site reaction (79.0% compared to 29.5% for placebo) [50–52]. Storage

in a refrigerator (rather than freezer) is recommended, thus reducing a significant barrier to the live zoster vaccine [55]. However, there are currently a number of unanswered questions, in particular cost, insurance coverage, and patient acceptance, that will influence use of this vaccine [6, 49].

Our results show that poor insurance coverage of the zoster vaccine is a significant barrier to vaccine uptake for prevention of zoster and PHN in adults who have experienced homelessness. We recommend that the zoster vaccine be classified as a vaccine, not a prescription drug, and covered under Medicare Part B like other vaccines. Physicians, pharmacies, and patients would have significantly fewer challenges to navigate and would be more likely to purchase or recommend the vaccine if it were covered or the cost were known upfront. We hope that the current trend of poor zoster immunization in the U.S. and in vulnerable populations can be reversed with improved coverage of the live attenuated zoster vaccine or higher uptake of the new inactive zoster vaccine.

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Compliance with Ethical Standards

Conflict of interest The authors declare we have no conflict of interest.

Ethical Approval This study was approved by the Institute for Family Health Institutional Review Board, protocol 2222. Patients were not compensated for their participation in this study. Participant informed consent was obtained prior to administering the zoster vaccine but was not required for the retrospective chart review as this study used only de-identified secondary data.

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