Partners in Immunization: 2010 Survey Examining Differences Among H1N1 Vaccine Providers in Washington State

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ABSTRACT

Objectives. Emergency response involving mass vaccination requires the involvement of traditional vaccine providers as well as other health-care providers, including pharmacists, obstetricians, and health-care providers at correctional facilities. We explored differences in provider experiences administering pandemic vaccine during a public health emergency.

Methods. We conducted a cross-sectional survey of H1N1 vaccine providers in Washington State, examining topics regarding pandemic vaccine administration, participation in preparedness activities, and communication with public health agencies. We also examined differences among provider types in responses received ($n=619$, 80.9% response rate).

Results. Compared with other types of vaccine providers (e.g., family practitioners, obstetricians, and specialists), pharmacists reported higher patient volumes as well as higher patient-to-practitioner ratios, indicating a broad capacity for community reach. Pharmacists and correctional health-care providers reported lower staff coverage with seasonal and H1N1 vaccines. Compared with other vaccine providers, pharmacists were also more likely to report relying on public health information from federal sources. They were less likely to report relying on local health departments (LHDs) for pandemic-related information, but indicated a desire to be included in LHD communications and plans. While all provider types indicated a high willingness to respond to a public health emergency, pharmacists were less likely to have participated in training, actual emergency response, or surge capacity initiatives. No obstetricians reported participating in surge capacity initiatives.

Conclusions. Results from this survey suggest that efforts to increase communication and interaction between public health agencies and pharmacy, obstetric, and correctional health-care vaccine providers may improve future preparedness and emergency response capability and reach.

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Responding to a public health emergency involving vaccines requires preparation, training, collaboration, and clear communication between public health and frontline health-care providers. As experienced during the 2009–2010 H1N1 influenza vaccination campaign, large-scale public health emergencies involving vaccines or other countermeasures often require the involvement of a diverse set of health-care providers. In addition to providers who routinely administer vaccines (e.g., pediatricians and family practitioners), nontraditional vaccine providers (e.g., obstetricians and correctional health-care providers) can play a vital role in emergency response. Pharmacists are now permitted to administer vaccines in all states. As such, they serve an increasingly important role as community vaccinators during events requiring mass vaccination and were identified during the H1N1 influenza response as a target group for receiving pandemic vaccine.^{1–3}

Studies conducted to date on practices of health-care providers during public health emergencies have been limited and mainly conducted in homogeneous groups of traditional providers. However, other providers are often called upon during an emergency response.⁴ Pharmacists in particular have been identified as potential first responders, as they often report a willingness to respond in emergency situations.^{5,6} Because of their ubiquitous presence in communities (93% of Americans live within five miles of a community retail pharmacy), pharmacists are uniquely situated to provide swift, broad-reaching care.⁷ Pharmacists also have increased capacity through extended hours of operation as well as established and streamlined access to prophylactics, and they have established themselves as vaccine providers.^{6,8,9}

In addition to pharmacy providers, other unique providers can play important roles during vaccine-related emergencies. Obstetricians can influence maternal immunization, which is particularly important in the context of influenza immunization for both seasonal and pandemic influenza seasons.^{10–12} Correctional facility providers often must contend with dangers posed by crowding, inmates' high mixing ratio with the public, and patients with higher susceptibility to infectious diseases.¹³ We explored differences in provider experiences administering vaccine during a public health emergency.

METHODS

From September to December 2010, we collected data from a stratified random sample of 800 of 2,523 providers in Washington State who administered H1N1 influenza vaccine to patients and/or staff during the 2009 H1N1 influenza pandemic. We determined our

sample size based on an expectation of a 50% response rate, seeking survey estimates accurate within $\pm 5\%$ for all measures. We stratified our sample by the following provider types: traditional family practitioners, nontraditional practitioners, pharmacy providers (including both community and chain pharmacies), women's health providers, government providers, pediatricians, hospital-based providers, and health-care providers at correctional facilities. Descriptions of provider types can be found in Table 1. Based on our desired sample size and research interests, we sampled 100.0% of women's health and correctional facility providers and randomly sampled 27.5% from each strata (provider type) of the remaining providers. The original list of providers who ordered H1N1 influenza vaccine during the 2009 H1N1 influenza pandemic was obtained from the Washington State Department of Health.

Materials

The survey instrument covered the following themes: practice demographics, communication with public health agencies and the public, 2009–2010 H1N1 vaccine administration, staff participation in public health preparedness activities, and use of immunization information systems (IISs). The IIS section pertained specifically to the Washington State Child Profile Immunization Registry.

On September 15, 2010, a fax was sent to all sampled providers informing them about the upcoming survey and outlining the survey goals. Two weeks later, the survey was sent to study participants as a survey kit. Each kit was addressed to the person identified by the Washington State Department of Health as the primary contact for ordering H1N1 vaccine at the practice. Included in the survey kit were a hard copy of the survey instrument, cover letter, frequently asked questions (FAQ) page addressing informed consent topics, postage-paid addressed return envelope, pen, and \$25 gift card to Target®. The cover letter described the contents of the survey kit and the survey objectives, provided contact information for the investigators, and indicated ways that respondents could complete the survey (e.g., mail, fax, or online). The FAQ page addressed gift card use, funding source, and ways to complete the survey. It served as a proxy for informed consent by addressing general concerns about confidentiality, the voluntary nature of the survey, and the risks and benefits of the survey. The online survey tool and paper data entry of faxed and mailed surveys was administered using Feedback Server version 2008.¹⁴ A maximum of three phone calls and two fax reminders to nonresponders was conducted by phone and fax in the nine weeks following the survey mailing.

Table 1. Provider types in a survey of vaccine provider preparedness: Washington State, 2010

Provider type	Description	Number sampled (total) ^a	Number responded (percent) (n=619) ^b	Response rate ^b (overall: 80.9%)
Traditional family	Family practices	221 (795)	147 (23.9)	76.6
Nontraditional	Alternative medicine practices, community vaccinators, rehabilitation practices, occupational health practices, skilled nursing facilities, and specialists	145 (526)	126 (20.5)	84.6
Pharmacy	National or regional chain stores	153 (555)	105 (17.1)	71.4
Women's health	Obstetricians, gynecologists, and women's health/family planning clinics	109 (109)	87 (14.1)	81.3
Government	Department of social and health services facilities, Federally Qualified Health Centers, rural health clinics, community mental health clinics, Indian Health Services facilities, local health jurisdictions, military, Veterans Affairs, and job corps	67 (238)	53 (8.5)	88.3
Pediatric	Colleges, pediatric practices, juvenile group homes, schools, and teen health	39 (141)	45 (7.3)	93.8
Hospital	Emergency medical services (e.g., fire and ambulance responders, hospitals, state hospitals, and urgent care)	35 (125)	28 (4.6)	90.3
Correctional facility	Federal and state prisons, juvenile rehabilitation facilities, and jails	34 (34)	25 (4.1)	80.6

^aSample does not exclude those ultimately eliminated from denominator post-hoc.

^bStratified numbers exclude three practices that did not indicate provider type and providers eliminated from the denominator post-hoc.

Quantitative analysis

Frequencies stratified by provider type were unweighted and, thus, yielded slightly different percentages from aggregated analyses, which were all weighted. We used pre- and post-stratification weights for the aggregated analysis to limit bias in estimates. We determined pre-stratification weights using probability of selection and determined post-stratification weights using response rates for each provider-type stratum. Descriptive and bivariate analyses are presented as weighted frequencies. We performed bivariate crosstabs between provider strata of interest compared with the other provider types aggregated. Statistical significance was tested using the Rao-Scott design-adjusted Chi-square test for weighted frequencies. We performed statistical analyses using SAS[®] version 9.2,¹⁵ and results were considered statistically significant at an alpha level of 0.05. These methods were previously described and nonresponse bias was examined in detail elsewhere.¹⁶

Qualitative analysis

Some survey questions allowed respondents to write in their own answer either to further describe their selection of "other" or in response to a qualitative question. Qualitative answers were compared against answer

choices, then categorized and grouped into themes. To analyze open-ended qualitative questions, two researchers collaboratively developed a codebook and each independently categorized and grouped 100% of the data. For all qualitative variables, researcher agreement was $\geq 70\%$.

RESULTS

Of the original sample of 800 providers, 765 questionnaires were successfully delivered. A total of 619/765 (80.9%) surveys were completed (Table 1). We excluded three respondents who did not indicate provider type, for a final sample of 616/765 (80.5%).

Stratified results from the survey include demographic variables (Table 2), administration of vaccine to health-care personnel (Table 3), communication with public health agencies (Table 4), guidance from public health agencies (Table 5), and surge capacity (Table 6) and preparedness training.

Demographics

On average, pharmacists reported seeing a greater total number of all patients (including pharmacy clinic patients and those filling prescriptions), older children

Table 2. Demographic variables of vaccine providers in a survey of vaccine provider preparedness: Washington State, 2010

Variable	Total N (percent) or mean (SD)	Family medicine Percent or mean	Nontraditional Percent or mean	Pharmacy Percent or mean	Women's health Percent or mean	Government Percent or mean	Pediatrics Percent or mean	Hospital Percent or mean	Corrections Percent or mean
Number of physicians in practice or pharmacy branch									
0	147 (27)	3	16	91	10	8	18	22	4
1-3	249 (39)	50	46	6	41	57	51	19	72
4-6	100 (14)	21	12	0	31	21	22	11	12
7-9	48 (7)	11	8	0	15	4	4	7	12
≥10	70 (13)	16	18	3	2	11	4	41	0
Number of pharmacists in practice or pharmacy branch									
0	411 (63)	84	82	2	95	64	93	46	44
1-2	110 (20)	8	14	49	2	27	5	11	32
3-4	59 (11)	3	3	39	1	2	0	11	20
≥5	33 (6)	4	0	11	1	8	2	32	4
Number of patients seen per day by patient category: mean (SD)									
Children <5 years of age	8.1 (32.5)	7.8	0.9	11.2	0.5	7.2	28.2	3.4	0.0
Children 5-18 years of age	11.4 (34.6)	11.3	2.6	18.2	6.1	10.1	20.5	8.2	6.4
Adults >18 years of age	67.1 (195.4)	52.5	74.5	107.7	34.2	49.1	12.7	97.3	38.8
Pregnant women	4.6 (20.2)	3.8	1.1	4.6	26.3	4.4	0.3	2.5	0.9

SD = standard deviation

Table 3. Administration of vaccine to health-care personnel in a survey of vaccine provider preparedness: Washington State, 2010

Variable	Total N (percent)	Family medicine Percent or mean	Nontraditional Percent or mean	Pharmacy Percent or mean	Women's health Percent or mean	Government Percent or mean	Pediatrics Percent or mean	Hospital Percent or mean	Corrections Percent or mean
Administration of seasonal and H1N1 influenza vaccine to staff									
Both offered	552 (92)	95	88	94	87	92	93	89	64
Only seasonal	9 (1)	0	2	2	1	2	2	0	4
Only H1N1	36 (5)	4	8	2	11	2	4	8	16
Neither offered	11 (1)	1	2	2	1	2	0	0	16
Don't know	2 (0)	0	0	0	0	2	0	4	0
Were staff required to receive seasonal and/or H1N1 influenza vaccine?									
Both required	111 (18)	27	12	6	15	31	32	19	12
Only seasonal	11 (2)	3	2	1	1	0	7	0	0
Only H1N1	24 (4)	4	2	1	11	4	3	0	4
Neither required	464 (76)	66	84	92	73	65	57	82	84
Percentage coverage of staff with vaccine during 2009 influenza season: mean (SD)									
Seasonal	80.4 (47.3)	87.0	77.3	72.8	79.3	88.1	86.4	72.6	70.1
H1N1	76.6 (54.0)	85.7	73.5	62.4	84.1	85.9	82.8	76.3	64.0

SD = standard deviation

Table 4. Communication with public health agencies in a survey of vaccine provider preparedness: Washington State, 2010

Variable	Total N (percent)	Family medicine Percent	Nontraditional Percent	Pharmacy Percent	Women's health Percent	Government Percent	Pediatrics Percent	Hospital Percent	Corrections Percent
Preferred source of information about public health emergencies									
Federal	239 (40)	38	36	51	30	47	42	29	28
News	46 (8)	6	11	12	9	2	0	4	0
Professional societies	49 (7)	5	6	11	17	4	7	4	4
State health department	286 (45)	43	53	39	56	55	36	46	32
Local health department	410 (66)	73	66	49	64	66	82	75	88
Other	43 (7)	3	9	13	7	8	0	4	4
Top methods used to disseminate information received from public health officials to practice or pharmacy staff									
Face-to-face conversations	443 (70)	75	70	61	82	83	80	43	67
E-mail	351 (56)	52	58	50	55	72	42	89	79
Hardcopy fax/flyers	269 (44)	50	34	43	39	55	56	43	38
Posting in common areas	245 (40)	40	49	30	36	40	38	54	38

Table 5. Usefulness of guidance from public health agencies in a survey of vaccine provider preparedness: Washington State, 2010

Variable	Total N (percent)	Family medicine Percent	Nontraditional Percent	Pharmacy Percent	Women's health Percent	Government Percent	Pediatrics Percent	Hospital Percent	Corrections Percent
Usefulness of guidance from state health department									
Very useful	209 (34)	34	38	20	42	46	42	26	24
Useful	228 (38)	37	40	35	37	39	24	56	48
Somewhat useful	96 (16)	15	14	25	12	8	22	11	16
Not useful	18 (3)	1	3	10	2	0	0	4	4
Irrelevant	12 (2)	1	1	6	1	2	2	0	0
Cannot recall	43 (7)	12	5	4	6	6	9	4	8
Usefulness of guidance from local health department									
Very useful	327 (54)	55	56	38	58	59	66	59	68
Useful	184 (31)	32	33	28	31	30	25	26	32
Somewhat useful	62 (11)	8	9	22	7	7	9	15	0
Not useful	4 (1)	0	0	4	0	0	0	0	0
Irrelevant	5 (1)	1	0	2	1	2	0	0	0
Cannot recall	18 (3)	4	3	6	2	2	0	0	0
Ease of adhering to priority group guidelines									
Easy	379 (62)	56	70	59	72	50	67	75	57
Moderate	210 (35)	42	26	38	28	48	31	18	39
Hard	15 (3)	1	4	3	0	2	2	7	4
Barriers to storing and administering H1N1 influenza vaccine									
Storage space for vaccine	105 (16)	18	9	16	26	25	18	15	21
Storage space for supplies	28 (5)	5	3	4	4	14	4	0	8
Staff capacity	56 (10)	7	3	17	5	21	18	12	0
Other	36 (6)	5	10	6	2	12	2	4	0
None	419 (68)	72	82	65	68	46	71	73	79

Table 6. Surge capacity effectiveness of vaccine providers in a survey of vaccine provider preparedness: Washington State, 2010

Variable	Total N (percent)	Family medicine Percent	Nontraditional Percent	Pharmacy Percent	Women's health Percent	Government Percent	Pediatrics Percent	Hospital Percent	Corrections Percent
Willing to work with local and state health departments in a future vaccine-related public health emergency									
Strongly agree	334 (56)	56	48	55	54	66	69	54	63
Agree	217 (36)	39	38	35	39	26	31	39	29
Neutral	43 (7)	5	12	9	6	8	0	0	8
Disagree	3 (0)	0	0	1	1	0	0	4	0
Strongly disagree	4 (1)	0	3	0	0	0	0	4	0
Willing to work with public health in the future to distribute nonvaccine countermeasures in the event of an emergency									
Strongly agree	260 (44)	41	40	47	48	42	52	44	46
Agree	210 (36)	39	34	32	34	38	33	37	38
Neutral	111 (18)	19	19	20	18	19	12	11	17
Disagree	7 (1)	1	2	1	0	2	2	0	0
Strongly disagree	8 (2)	0	5	0	0	0	0	7	0
Participation of staff in training sessions or preparedness drills in response to large-scale public health disaster, in past five years									
Yes	268 (44)	40	45	19	33	74	47	89	83
No	198 (32)	32	36	62	30	8	20	4	8
Not sure	146 (24)	27	19	19	37	19	33	7	8
Participation of staff in actual response to large-scale public health disaster									
Yes	80 (13)	10	14	6	12	29	9	29	21
No	319 (53)	48	57	79	43	31	50	36	50
Not sure	209 (34)	42	29	15	45	40	41	36	29
Participation of medical staff in medical surge capacity initiatives (e.g., Medical Reserve Corps)									
Yes	46 (8)	5	6	2	0	29	11	22	17
No	349 (57)	52	57	85	59	33	52	37	54
Not sure	213 (35)	43	38	14	41	39	36	41	29

(aged 5–18 years), and adult patients than other vaccine providers. Pharmacists saw a mean total of 136.7 patients per day (95% confidence interval [CI] 113.1, 160.2), while the daily mean among other providers was 71.4 patients per day (95% CI 61.3, 81.4) (data not shown). Using an indexed value comparing reported number of patients seen per day with the number of physicians and pharmacist practitioners within each practice, pharmacists saw significantly more patients per practitioner per day on average (44.5, 95% CI 37.8, 51.2) (Figure 1) than other vaccine providers (12.6, 95% CI 10.9, 14.2).

Staff vaccine coverage

Pharmacy providers were less likely (7%) to require staff to receive an influenza vaccination (either H1N1 or seasonal influenza vaccine or both) than other providers (29%) ($p<0.001$) (Figure 2a). Pharmacy providers also reported a lower mean staff coverage with seasonal and H1N1 influenza vaccines (73%, 95% CI 68, 78) than other providers (83%, 95% CI 81, 85) (data not shown). Mean coverage among staff with H1N1 influenza vaccine was 62% (95% CI 56, 68) among pharmacy providers vs. 81% (95% CI 78, 83) among other providers (Figure 2b).

Pediatric (44%) and government (37%) providers were more likely to require staff to receive an influenza vaccination (either H1N1 or seasonal influenza vaccine or both) than other health-care providers

(23%) ($p=0.02$) (Figure 2a). Government providers also reported higher coverage among staff with seasonal and H1N1 influenza vaccines (88%, 95% CI 84, 92) than other health-care providers (80%, 95% CI 78, 82) (data not shown). Mean coverage among staff with H1N1 influenza vaccine was 86% (95% CI 81, 91) among government providers vs. 76% (95% CI 73, 78) among other providers (Figure 2b).

Providers based at correctional facilities reported significantly lower coverage among staff with seasonal and H1N1 influenza vaccines (69%, 95% CI 60, 79) than other providers (81%, 95% CI 79, 83) (data not shown). Mean coverage among staff with H1N1 influenza vaccine was 62% (95% CI 50, 74) among corrections providers vs. 77% (95% CI 74, 79) among other providers (Figure 2b).

Preferred sources of information

There were significant differences in preferred sources of information about public health emergencies between pharmacy providers and other vaccine providers. Compared with other providers, pharmacists were more likely to rely upon information from federal sources (51% vs. 38%, $p=0.01$), more likely to rely upon news media sources (12% vs. 7%, $p=0.04$), less likely to rely on local health departments (LHDs) (49% vs. 71%, $p<0.001$), and more likely to rely on other sources, specifically corporate headquarters, internal thought leaders, and professional organizations, as

Figure 1. Mean number and 95% confidence intervals^a of patients seen daily per practitioner, by provider type, in a weighted analysis of a survey of vaccine provider preparedness: Washington State, 2010^b

^aThe lines that extend from each bar shows the 95% confidence intervals.

^bPharmacy providers were compared with other provider types and had a statistically significant higher mean than each of the other provider types when compared individually.

OB/GYN = obstetrician/gynecologist

Figure 2a. Vaccine requirements among providers in a survey of vaccine provider preparedness: Washington State, 2010

Figure 2b. Staff H1N1 influenza vaccine coverage in a survey of vaccine provider preparedness: Washington State, 2010

indicated in a qualitative analysis of those open-ended responses (13% vs. 5%, $p=0.004$) (Figure 3a). Those who indicated relying on other sources were given the opportunity to comment on their answer choice. From a qualitative analysis of these comments, 15 cited corporate headquarters, 11 cited internal thought leaders,

six cited professional organizations, and three cited public health. Top sources for receipt of emergency-related information among all respondents were LHDs (65.6%), state health departments (45.3%), and federal government agencies (e.g., Centers for Disease Control and Prevention [CDC], 40.2%) (data not shown).

Figure 3a. Preferred sources of public health information in a weighted analysis of a survey on vaccine provider preparedness: Washington State, 2010

^aStatistically significant at $p < 0.05$

^b"Other" sources from qualitative analysis included these themes: "corporate headquarters," "internal thought leaders," and "professional organizations."

CDC = Centers for Disease Control and Prevention

Usefulness of public health guidance

A majority of respondents rated the guidance received from their state health department and LHDs as useful or very useful. Among all respondents, 72% (437/606) rated guidance received from their state health department as useful or very useful, and 85% (511/600) rated guidance received from their LHD as useful or very useful (Table 5). When compared with other providers, pharmacists were less likely to rate the guidance from their LHD as useful or very useful (71% vs. 91%, $p < 0.001$); they were also less likely than other providers to report guidance received from their state health department as useful or very useful (57% vs. 82%, $p < 0.001$) (Figure 3b).

Surge capacity and preparedness training

Respondents overwhelmingly reported a willingness to work with local and state health departments in future vaccine-related public health emergencies (56% strongly agreed and 36% agreed) as well as a willingness to work with public health in the future to distribute nonvaccine countermeasures in the event of an emergency (44% strongly agreed and 36% agreed). Among all respondents, 44% reported staff participation in preparedness training, 13% reported staff responding to an actual large-scale public health disaster, and 8% reported staff participation in medical surge capacity initiatives during the past five years (Table 6).

Providers varied in terms of participation in preparedness training, response to public health emergencies, and surge capacity initiatives (e.g., Medical Reserve Corps). Among all respondents, 43.3% reported staff

participation in training sessions or preparedness drills for large-scale public health disasters within the past five years. Thirteen percent of respondents reported staff participation in actual response(s) to large-scale public health disasters, and 7.9% reported medical staff participation in medical surge capacity initiatives.

Pharmacists were less likely than other providers to participate in all three types of preparedness activities: 19% of pharmacists vs. 50% of all other vaccine providers participated in preparedness training ($p < 0.001$), 6% of pharmacists vs. 14% of other vaccine providers participated in actual response(s) to public health disasters ($p = 0.017$), and 2% of pharmacists vs. 9% of other vaccine providers had medical staff who participated in surge capacity initiatives ($p = 0.014$) (Figure 4). No obstetricians reported participating in surge capacity initiatives.

DISCUSSION

Washington State vaccine providers vary in terms of public health preparedness, especially among pharmacy providers, obstetricians, correctional facilities, and government providers. Our survey provides evidence that pharmacy providers may be able to have a broad impact during a widespread emergency response, especially if they engage in capacity building beforehand.

Pharmacy providers have higher patient volume, lower proportion of respondents with vaccination mandates, lower reliance on LHDs, and less preparedness training and experience compared with other

Figure 3b. Perceived usefulness of guidance from health departments in a weighted analysis of a survey on vaccine provider preparedness: Washington State, 2010

^aStatistically significant at $p < 0.0001$

provider types. Pharmacy providers differ from other types of providers in terms of staff influenza vaccination, communication with local public health, and preparedness training. While pharmacy providers were not the only provider type to report lower proportions of staff receiving influenza vaccine in our survey, it may be a concern—given the large number of people they serve—that pharmacy providers were both less likely to require staff vaccination and less likely to report receiving seasonal or pandemic influenza vaccination themselves. Correctional facilities also reported lower staff receipt of influenza vaccine in contrast with higher participation in surge capacity initiatives. This gap may be important to address given the vulnerabilities specific to the correctional setting, especially in crowded facilities.¹³

By contrast, pediatric and government providers were more likely to require staff to have these influenza vaccines, and government providers reported higher coverage of receiving them. During the H1N1 response, the Advisory Committee on Immunization Practices prioritized health-care providers in their recommendations for who should receive the vaccine due to their potential to further spread the virus and the impact absenteeism among this population would have on surge capacity.¹⁷ Many respondents made comments suggesting that even when not required for staff, vaccination was highly recommended or strongly

encouraged by their employer. In qualitative analysis, providers reported that staff members were sometimes given alternatives to vaccine such as signing a letter or waiver, or wearing a mask and gloves at all times. Although we believe overall self-report of staff vaccination may be overestimated (mean = 80%, median = 90%, mode = 100%), coverage estimates were high, suggesting that these alternatives may be important factors in improving health-care provider vaccination rates in the absence of mandates.

Compared with other providers, pharmacy providers relied more on federal sources for public health information and less on LHDs than other providers. Also, they have a lower perceived usefulness of guidance from state health departments and LHDs. These factors suggest that outreach between pharmacy providers and health departments may be warranted. In the increasingly parsimonious circumstances of local government, traditional providers with long established relationships may be the most adept at garnering information exchange and collaboration. Pharmacy providers' lower perceptions of usefulness of information from state health departments and LHDs may reflect their reliance on other sources for information, such as chain headquarters, which rely on federal sources, and professional organizations such as the American Pharmacists Association and the National Association of Chain Drug Stores.

Figure 4. Training, emergency response, and surge capacity participation for pharmacy providers vs. other providers in a weighted analysis of a survey on vaccine provider preparedness: Washington State, 2010

^aStatistically significant at $p < 0.05$

Although pharmacists can now administer immunizations in all 50 states, laws governing which vaccines may be administered and to whom vary by state.^{1,18} Given pharmacists' ubiquitous presence in communities, improving pharmacy participation in emergency preparedness training may significantly bolster overall emergency response. A multifaceted approach for pharmacy outreach should account for differences in state and local laws and ensure that consistent messages are coordinated through professional organizations and public health partner organizations, such as the Association of State and Territorial Health Officials, the National Association of County and City Health Officials, and CDC.

It is encouraging that attitudes about willingness to respond to future emergencies were comparatively positive and homogenous among all providers, with 92% indicating that they were willing to respond to future disasters. Preparedness training experience indicators were low overall, particularly among pharmacists (19%) and obstetricians (33%). These provider types are prime targets for preparedness training exercises because pharmacists are trusted and have broad reach in their communities.⁵ Similarly, obstetricians have a specific reach among pregnant women, an important vulnerable population to consider during a pandemic.¹¹

Because government providers can constitute a vital on-the-ground delivery system for emergency vaccine, it

was unexpected that government providers were more likely to report having staff capacity barriers to providing mass vaccine. Partnering with pharmacy providers during seasonal influenza vaccination campaigns may be a strategy for health departments to build collaborative relationships for future responses and consequently resolve some of these barriers.

Limitations and strengths

This study was subject to several limitations. As with any survey of this kind, self-report may be a source of recall bias. Our high response rate both overall and among provider types was a predominant strength that limits other sources of bias. Van Otterloo et al. found few significant differences among early and late responders to this survey, which may serve as a proxy for nonresponders.¹⁶ The index we created post-hoc to compare patient volume by provider type may not reflect how many patients each provider sees on a daily basis, but rather an average for a given period of time. Any bias resulting from this calculated variable would likely be nondifferential across provider types.

CONCLUSIONS

The Pharmacists' Guide to Pandemic Preparedness, developed in 2007, advocates for pharmacists to serve as first responders, participate in community planning

and training opportunities, plan for emergency supplies of vaccines and other countermeasures, and plan for unique administrative changes during a pandemic.¹⁹ Our study results suggest that building connections for partnership and communication among public health agencies, professional organizations, and pharmacy providers may have a positive and important impact on preparedness for public health emergencies and leveraging the extensive community reach of pharmacy providers during a response effort. Additionally, our results suggest that increasing preparedness knowledge and participation in training exercises and surge capacity initiatives among pharmacists, obstetricians, and correctional health-care providers may be vital steps toward emergency preparedness improvement.

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The Emory University Institutional Review Board (IRB) approved the study as exempt (#0004491). The Washington State IRB approved the study as non-human subject research (#E-072110-H). The authors obtained informed consent using a frequently asked questions document, delivered with the survey by courier, which addressed the purpose, risks and benefits, confidentiality, incentives, and voluntary nature of the survey.

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REFERENCES

1. Immunization Action Coalition. States authorizing pharmacists to vaccinate [cited 2011 Sep 13]. Available from: URL: <http://www.immunize.org/laws/pharm.asp>
2. American Pharmacists Association. Pharmacists play a vital role in providing immunizations in their communities: increased access to immunizing pharmacists contributes to improving vaccination rates. 2010 Apr 3 [cited 2012 Dec 3]. Available from: URL: <http://www.prweb.com/releases/apa/community-immunizations/prweb3828004.htm>
3. Use of influenza A (H1N1) 2009 monovalent vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2009. *MMWR Recomm Rep* 2009;58(RR-10):1-8.
4. Rosenfeld LA, Etkind P, Grasso A, Adams AJ, Rothholz MC. Extending the reach: local health department collaboration with community pharmacies in Palm Beach County, Florida, for H1N1 influenza pandemic response. *J Public Health Manag Pract* 2011;17:439-48.
5. Thompson CA. HHS redesigns role of pharmacy personnel in disaster preparedness. *Am J Health Syst Pharm* 2010;67:99-102.
6. Woodard LJ, Bray BS, Williams D, Terriff CM. Call to action: integrating student pharmacists, faculty, and pharmacy practitioners into emergency preparedness and response. *J Am Pharm Assoc* (2003) 2010;50:158-64.
7. National Association of Chain Drug Stores. Chain pharmacy industry profile 2011-2012. Arlington (VA): NACDS; 2012.
8. Terriff CM, Newton S. Pharmacist role in emergency preparedness. *J Am Pharm Assoc* (2003) 2008;48:702, 707.
9. Association of State and Territorial Health Officials. Operational framework for partnering with pharmacies for administration of 2009 H1N1 vaccine. Arlington (VA): ASTHO; 2009. Also available from: URL: http://www.naccho.org/topics/H1N1/upload/OpFramework_Pharmacies_STHOS_FINAL_9_16_09.pdf [cited 2012 Dec 3].
10. Zaman K, Roy E, Arifeen SE, Rahman M, Raqib R, Wilson E, et al. Effectiveness of maternal influenza immunization in mothers and infants. *N Engl J Med* 2008;359:1555-64.
11. Siston AM, Rasmussen SA, Honein MA, Fry AM, Seib K, Callaghan WM, et al. Pandemic 2009 influenza A (H1N1) virus illness among pregnant women in the United States. *JAMA* 2010;303:1517-25.
12. Centers for Disease Control and Prevention (US). Guidelines for vaccinating pregnant women: recommendations of the Advisory Committee on Immunization Practices. Updated May 2007 [cited 2012 Dec 3]. Available from: URL: http://www.cdc.gov/vaccines/pubs/downloads/b_preg_guide.pdf
13. Freudenberg N. Jails, prisons, and the health of urban populations: a review of the impact of the correctional system on community health. *J Urban Health* 2001;78:214-35.
14. Data Illusion. Feedback Server: Version 2008. Geneva: Data Illusion; 2008.
15. SAS Institute, Inc. SAS®: Version 9.2. Cary (NC): SAS Institute, Inc.; 2008.
16. Van Otterloo J, Richards JL, Seib K, Weiss P, Omer SB. Gift card incentives and non-response bias in a survey of vaccine providers: the role of geographic and demographic factors. *PLoS One* 2011;6:e28108.
17. Centers for Disease Control and Prevention (US). 2009 H1N1 vaccination recommendations [cited 2012 Dec 3]. Available from: URL: <http://www.cdc.gov/h1n1flu/vaccination/acip.htm>
18. Carpenter L. Pharmacist-administered immunizations: trends in state laws. *Drug Store News* 2009 Sep 15. Also available from: URL: http://www.cedrugstorenews.com/userapp/lessons/page_view_ui.cfm?lessonuid=&pageid=B923321F24938AEE0854C1225838355F [cited 2012 Dec 3].
19. American Pharmacists Association. A pharmacist's guide to pandemic preparedness. 2007 [cited 2012 Dec 3]. Available from: URL: http://www.tnpharm.org/Other_Resources/PandemicPrep.pdf