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SHORT REPORT
Pandemic-related health behavior: repeat episodes of influenza-like illness related to the 2009 H1N1 influenza pandemic

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SUMMARY

The Houston Health Department (HHD) in Texas tracks influenza-like illness (ILI) in the community through its Influenza Sentinel Surveillance Program, which began in 2008. After the influenza A(H1N1) pandemic (pH1N1) in 2009, investigators sought to assess the feasibility of this program as a non-traditional data source for tracking and monitoring care-seeking activities. Through the process of characterizing and describing patients who had 'return visits', or who were considered the heaviest ILI-related care-utilizers, the investigators sought to understand the strengths and limitations of this data source. Data used for this study were obtained from a multispecialty clinic in Houston, Texas between August 2008 and January 2011 across three phases: pre-pH1N1, pH1N1, and post-pH1N1. The data, which comprised of 4047 patient visits, yielded 150 return visits. We found an increase in the number of visits for ILI and proportion of return visits during the pandemic phase (pH1N1), as well as differences in the likelihood of a return visit between genders and age groups. More broadly, the findings of this study provide important considerations for future research and expose important gaps in using surveillance data to assess sick-role behaviors.

Key words: Influenza-like illness, H1N1, care-seeking behavior, care utilization, Sentinel Surveillance.

In an era of budget cuts to local and state governments, particularly in the field of public health, health departments are increasingly being asked to do more with less – resulting in the use of creative ways to gather data. It is important, therefore, to take a closer look at the feasibility of leveraging the assistance of external healthcare partners to collect and use community-level surveillance data. Beyond monitoring epidemiological trends, surveillance data may offer untapped opportunities by simultaneously providing more value to partners through better understanding of macro-level factors and drivers related to human health, behavior, and the healthcare systems of the USA.

One such opportunity emerged in Houston, Texas with the advent of the influenza A(H1N1) (pH1N1) pandemic in April 2009. In August 2008, the

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Houston Health Department (HHD) instituted a new local sentinel surveillance system that engaged the assistance of private medical providers to enhance existing influenza monitoring processes, similar in scope to but distinct from the national-level ILInet Program administered by the Centers for Disease Control and Prevention [1]. Thus, when the pH1N1 influenza pandemic arose a year later in 2009, the ongoing existence of this program provided a potential avenue for HHD to evaluate the local impact of the pandemic on influenza-related healthcare-seeking behavior. Some of the noticeable mitigation measures of the pandemic had included not only community-level social-distancing interventions [2, 3], but also increased individual healthcare seeking behavior [4, 5].

While the Influenza-like illness (ILI) data from the program were captured for the purpose of monitoring syndromic activity within the context of each influenza season, the robust nature of Houston's sentinel surveillance program has allowed researchers to look beyond each individual season, and provided information on how influenza-related care-seeking behavior might change during and after an outbreak. Previous research has explored various factors related to healthcare seeking and receipt of influenza antiviral drugs during a pandemic [6], including previous experience with ILI [7] and personal beliefs about vaccination [8]. Our study describes the changes in care-seeking behavior between phases based on actual facility-level data obtained from the HHD Sentinel Surveillance program rather than usual patients' self-reported survey data.

The decision of a patient to seek care may vary for a variety of reasons. Only about half of individuals who had symptoms of ILI during the pH1N1 pandemic period sought treatment [9], which could reflect individual variation in symptom severity, but may also be influenced by external factors such as perception of severity of the pandemic. Influenza often manifests in an individual as a collection of symptoms, which are collectively known in public health and clinical settings as ILI. During a typical influenza season, public health officials may collect epidemiologic data on ILI, often in conjunction with the result of a rapid influenza test and a confirmatory test such as PCR or culture. A confirmatory test is necessary to determine the pathogen causing illness. However, ILI can be caused by a variety of microbial agents other than influenza viruses, and the range of symptoms observed with influenza virus infections is non-specific and resembles the clinical picture of a variety of other pathogens [10]. This uncertainty poses challenges both when diagnosing influenza and when doing influenza surveillance and requires an integration of virological and epidemiological surveillance in order for the data to be most useful [11]. Therefore, using an existing ILI dataset generated for surveillance purposes, our study sought to track care-seeking behavior between phases, placing an emphasis on understanding characteristics of individuals who sought care more frequently.

Using data from the HHD Sentinel Surveillance program, we created a metric to capture aggregate changes in patient visit behavior through time. This metric was designed to reduce bias from an increase in sheer volume of one-time patients, as would be expected during a pandemic period. The resulting metric, 'return visits,' includes only non-initial visits made by a given individual within a specific phase: pre-pH1N1, pH1N1, or post-pH1N1, and is intended as a method to characterize changes in care-utilization through time. The main objective of this study was to evaluate any differences in the proportion of return visits made by patients with ILI-related conditions to a multispecialty clinic in Houston, Texas during the pre-pH1N1, pH1N1, and post-pH1N1 periods.

The HHD Sentinel Surveillance Program in Houston, Texas was initially aimed at providing a system to help detect ongoing local ILI activity, monitor morbidity and trends, and provide information that may assist providers in patient care management [12]. Data used for this study were obtained from two multispecialty Kelsey-Seybold Clinic (KSC) locations (West and Main Campuses), and represent a subset of the larger HHD Influenza Sentinel Surveillance Program. KSC was chosen because it provided the largest pool of data with the most complete information covering the period of interest. The data comprised of 4047 healthcare visits for ILI made by 3776 individual patients, yielding a total of 150 return visits between August 2008 and January 2011. If a patient visited a KSC provider exhibiting symptoms of ILI (a fever of at least 37·8 °C and a cough and/or a sore throat in the absence of a known cause other than influenza [5]), the patient was given a rapid flu test and their visit was recorded in the dataset. Information in the dataset, abstracted from KSC electronic records, included age, gender, and most recent record of influenza vaccination at time of visit. This study was based on data collected as public health surveillance, and thus received an exempt status from the HHD Investigative Review Council.

The study period was divided into three intervals or phases: pre-pH1N1 (7 August 2008–16 April 2009); during pH1N1 (17 April 2009–1 March 2010); and post-pH1N1 (2 March 2010–18 January 2011). The start date (17 April 2009), when the first two children in Southern California were diagnosed with pH1N1, was chosen for its potential importance in signaling the emergence of a novel influenza A virus in the USA. The second interval/phase began 2 March 2010, marked the end of the pH1N1 interval, and was determined by a general decrease in local influenza activity as determined through surveillance reports in Houston. Given that the data in this study examined local care-seeking patterns, which could be influenced by both regional media coverage and community-level disease activity, we opted to not use externally set dates such as those corresponding to the World Health Organization's declarations on 11 June 2009 of an official worldwide influenza pandemic [13] or on 10 August 2010 that the pandemic had ended [14].

Previous research has demonstrated that the general public may have a heightened reaction to an outbreak or incident of public health importance by disproportionately seeking medical assistance [15, 16]. To control for such surges and better compare overall changes in patient behavior from one interval to another, the first visit of every set of visits by a patient within a given interval was excluded. This study focuses primarily on the resulting 'return visits', which were chosen as a metric to reduce skewness from spikes or drops in visits. The authors defined 'return visits' as the second, third, or fourth visit where a rapid influenza test was ordered for a given individual within the same interval. If a patient visited the clinic twice during the study period but the first visit was during the pre-pH1N1 interval and the second was in the pH1N1 interval, then the second visit in this case would not be considered a 'return visit' and was excluded from the study to facilitate clean comparisons across intervals. A very small number of individuals made third or fourth visits within the same interval. Based on these criteria, a total of 150 return visits were identified, and the proportion of all ILI-related visits represented by return visits was determined for each interval. Patients' ages were categorized using CDC-defined ILINet age groupings: 0–4 years, 5–24 years, 25–49 years, 50–64 years, or 65 years and older [5].

Descriptive statistics were performed and inferential analyses were conducted using the Chi-square (χ^2) test and the Fisher's exact test, where expected cell sizes were <5, to compare the number of return and non-return visits by age, gender, and vaccination history. These analyses provided a general and overall description of the return visits in each individual time period. Furthermore, comparisons of the independent associations of return visits between and within the phases (pre-pH1N1, pH1N1, and post-pH1N1) were made. All tests were two-tailed, with a probability value of $\alpha = 0{\cdot}05$ used as the significance level. In addition, Poisson modeling using the number of months in each phase as a denominator was used to compare actual returns from the post-pH1N1 interval (10 months) to the number of returns expected based on data from the pre-pH1N1 interval (8·5 months). All data management and statistical analyses were conducted using STATA IC 12 (Stata Corp, College Station, Texas).

Compared with the overall sample population, the return visits represented a relatively small proportion (3·7%). The returns accounted for only 1·21% ($n = 8$) of the visits during the pre-pH1N1 phase, increased to 4·56% ($n = 135$) during the pH1N1 phase, and later decreased to 1·65% ($n = 7$) during the post-pH1N1 phase.

The distribution of visits by age group, gender, and vaccination status between the return group and the group that did not have return visits is presented in Table 1. Large differences between the two groups were noted in the distribution of visits across age group and vaccination history. Patients with age category 0–4 and 5–24 years represented 88% of all return visits. Subsequently, the number of return visits decreased with increasing age category.

A comparison of the returns *vs.* the non-returns with regard to vaccination history yielded a highly significant difference ($P < 0{\cdot}001$). Almost two-thirds of return visits were made by patients with documented vaccination history (61·3%), while the proportion of non-returns was only about half of that (36·2%). Amid patients who were vaccinated, 63·0% received seasonal and 37·0% received pH1N1 as their most recent influenza vaccinations. Within patients with vaccine history and return visits, the majority received a seasonal influenza vaccine rather than a pH1N1 pandemic vaccine (63·0% *vs.* 37·0%, $P < 0{\cdot}05$); among those who had non-return visits, 60·9% received only a seasonal vaccine in comparison to 39·1% who received a pH1N1 pandemic vaccine ($P < 0{\cdot}001$). When comparing the relative risk of having a return visit, females were about 12% (RR = 0·879) less likely

Table 1. *Return visits for influenza-like illness (ILI)[a], by demographic and vaccination characteristics*

Characteristic	Total ILI visits	No. (%) of returns	Relative risk[b]	Between returns and non-returns[c]	
				χ^2 (df)	*P*-value
Overall	4047	150 (3·71)	–		
Gender					
Male (*Ref*)	1761	70 (3·98)	1·000		
Female	2286	80 (3·50)	0·879	0·6300 (1)	0·427[ns]
Age group (years)					
0–4 (*Ref*)	679	60 (8·84)	1·000		
5–24	1679	72 (4·29)	0·485		
25–49	1171	14 (1·20)	0·136		
50–64	422	3 (0·71)	0·080		
65 and up	96	1 (1·04)	0·118	84·87 (4)	<0·001***
Vaccination history					
Yes (*Ref*)	1504	92 (6·12)	1·000		
No	2543	58 (2·28)	0·373	38·69 (1)	<0·001***
Vaccine type[d]					
Seasonal (*Ref*)	918	58 (6·32)	1·000		
pH1N1	586	34 (5·80)	0·918	0·166 (1)	0·741[ns]

χ^2 (df), Chi-square (degrees of freedom); ns, not significant ($P > 0·05$).
Ref: Reference category for relative risk assessment.
[a] Influenza-like illness defined as a visit where the provider ordered a rapid influenza test.
[b] Relative risk of return visits.
[c] Compares independent associations of the proportions from return and non-return visits.
[d] Based on patients with vaccination history.
***Significant at $P \leqslant 0·001$.

than males to have return visits. Patients who were aged 5–24 years were almost 52% (RR = 0·485) less likely to have return visits than the reference group of patients aged 0–4 did. Patients who were aged 50–64 years were almost 92% (RR = 0·080) less likely to have return visits than the reference group did.

Visits attributable to younger patients less than 24 years old were more likely to be return visits (4·29%) during the pH1N1 period ($P < 0·001$). Both the pH1N1 and post-pH1N1 phases had more return visits attributable to patients with a history of vaccination, although the association was more significant in the pH1N1 phase ($P < 0·001$) than it was in the post-pH1N1 phase ($P < 0·05$). Furthermore, the proportion of return visits attributed to someone who had recorded influenza-related vaccination history was noted to increase from 37·5% before pH1N1 to 61·4% during the pH1N1 period, and 85·7% during the post-pH1N1 phase, though this difference was not statistically significant. Although the majority of return visits occurred during the pH1N1 phase, only 37·3% of returning patients during this phase reported having been vaccinated against pH1N1 (*Result not presented*).

The monthly trends for the numbers of ILI-related visits and the percentage of those visits that were returns were also examined (Fig. 1). A rate of 0·94 return visits per month was observed during the pre-pH1N1 phase (eight visits over 8·5 months), while the rate fell to 0·7 visits per month during the post-pH1N1 phase (seven visits over 10 months). However, Poisson probability modeling of the distribution using the pre-pH1N1 phase rate as the base value indicated that the observed difference in rate of return was not statistically significant ($P = 0·602$).

In this study, we found that most (90%) return visits for ILI symptoms from 2008 to 2010 happened during the pH1N1 pandemic phase. In addition, return visits were significantly more common among individuals who were 0–4 years of age (8·84%) and for those with a history of influenza vaccination (6·53%). However, these associations were not observed during the pre-pH1N1 and post-pH1N1 phases, although the small number of return visits during these phases limited the comparisons.

We observed that the overall volume of ILI-related visits and proportion of return visits peaked during the

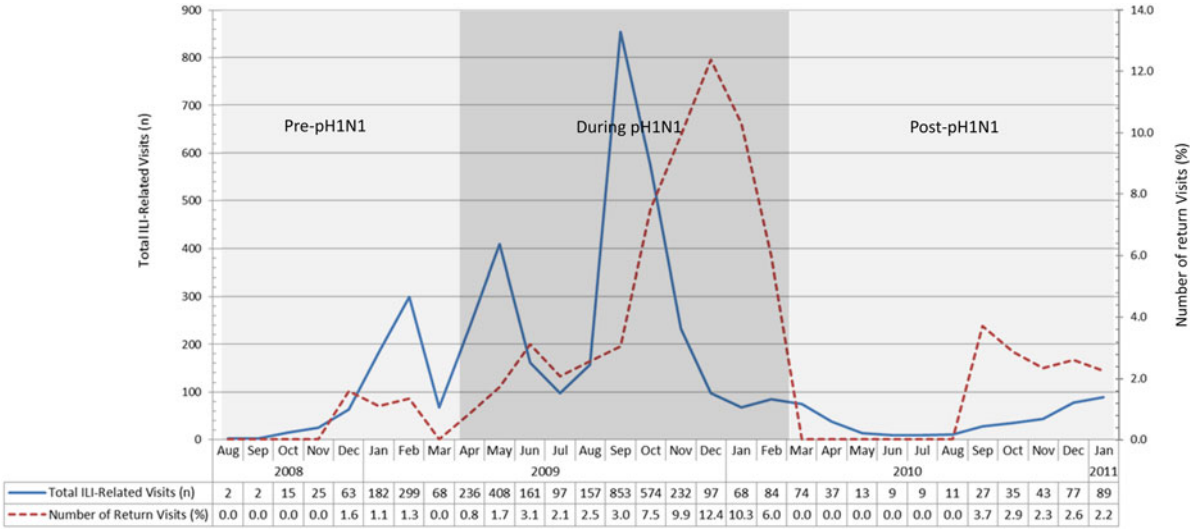

Fig. 1. Trends in ILI-related visits and return visits at a Multispecialty Clinic in Houston, Texas, USA – 2008–2011 ($N = 4047$).

pH1N1 interval, before returning to almost baseline levels the year after, following the waning of local pH1N1 activity. This would seem to suggest that population-level changes in care-seeking behavior for ILI, if any, were relatively fleeting during the period in question.

Utilizing data originally collected for surveillance purposes, and not research, yielded a variety of limitations. As such, certain variables not originally captured in the surveillance dataset provided to HHD, which include patients' reasons for returning to the clinic, and whether the patient or the physician recommended the return, would have been beneficial in providing contexts to our results. Additional limitations of the data include incomplete data such as vaccination history. It is also possible that some patients were initially misdiagnosed or mistreated and therefore had to return, that some patients became ill because of another pathogen causing ILI symptoms, or that some patients may have been exposed to pH1N1 during an initial visit. The surveillance data did not show whether patients' levels of exposure to information about influenza or pH1N1 from traditional or social media sources had any influence on their decision to seek care. Individual variation may have also existed between healthcare workers who administered rapid influenza tests; while the definition of ILI is well understood, the decision to administer the test is at the discretion of the individual healthcare worker. Additional variations may have occurred in the frequency of testing between phases. Another related limitation is the asymmetric nature of the phases. The 2009 pH1N1 epidemic took place from April 2009 through March 2010, while typical seasonal influenza outbreaks generally run from October through May of the following year [13]. The cutoffs for the pre-pH1N1 and post-pH1N1 phases were chosen based on specific milestones at the national and local levels related to pH1N1 disease activity. Under ideal conditions, the length of the pre- and post- phases would have matched the April through March timeline of the epidemic itself. Furthermore, using local data to define cutoffs for the pre-pH1N1 and post-pH1N1 phases limits the generalizability of our findings to other geographic locales that may have had differing pandemic conditions.

Furthermore, the original influenza sentinel surveillance program involved a sample of 30 providers, but the use of only one set of clinics out of the selected providers for this study means that the outcomes should not be interpreted as representative of the ILI activities in the Houston metropolitan area. Despite the large number of individuals involved in the current study, the population that frequents the two facilities in our data may be economically or ethnically different from people who seek care in other facilities or areas within the city. Also, information on socioeconomic status, race/ethnicity, and health insurance coverage of the patients visiting the clinics was not collected for this study. Such data would have enabled identification of more demographic-specific healthcare utilization patterns in the context of pH1N1. As noted previously, definitive data regarding the specific causes

of patients' ILI in this study could not be obtained. Similarly, it was also not possible to determine whether patient visits were linked by family or household. Some additional return visits may have been due to clustering effects associated with common factors such as shared living space and similar access to information, which may have had a direct impact on both disease transmissions [17] and beliefs regarding care utilization. However, this study's return visits metric was designed to capture patients' healthcare seeking behavior and did not seek to identify specific virologic influences [11] or social ties guiding such behavior.

Despite finding significance with respect to certain comparisons, the extent to which we can interpret the current findings based only on surveillance data without supplementary information is limited. Differences were observed between returning patients and non-returning patients with regard to vaccination history and age group. Younger children who had received vaccination were more likely to have returned, but only during the pandemic period. Based on the findings of this study, it would seem that the outbreak left little, if any, significant lasting impact on the population's probability of seeking care for ILI in the future, but this assertion is limited by certain crucial pieces of information that were considered only after the institution of the surveillance program that sourced these data. In seeking to 'do more with less', other local health departments might find it more feasible to assess care-seeking behavior by leveraging their existing ILI sentinel surveillance program infrastructure while keeping in mind the few key variables not captured in the current study. Ostensibly, future sentinel surveillance programs, including those involving public–private partnerships that that seek to analyze patient visit patterns, may maximize their returns through improving the data management and collection within existing systems.

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DECLARATION OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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