Identifying Key Facilities for Texas Influenza Surveillance

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Outline

- Texas Influenza Surveillance

- Gaps in Influenza Surveillance

- Research Project

- Selection Stages

- Outreach

- Limitations

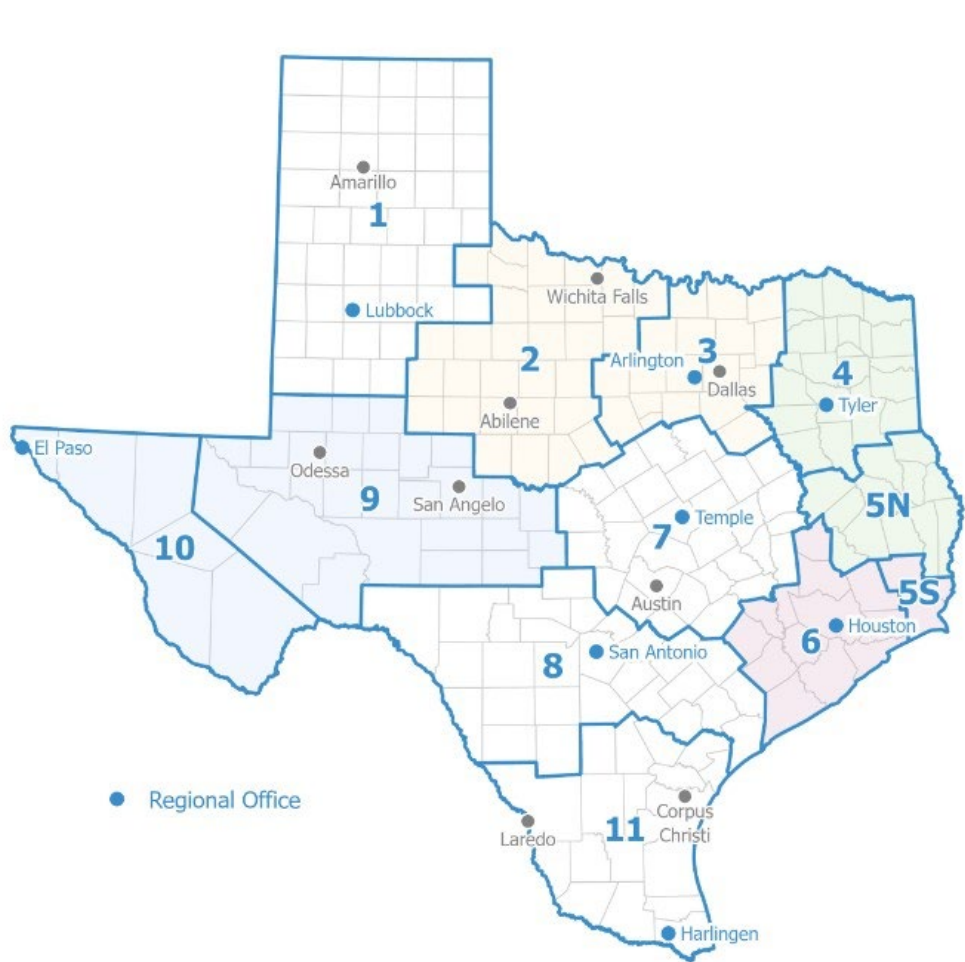- References

Texas Influenza Surveillance

Texas gathers influenza data, for the purposes of **tracking** and **assessing** flu activity, from a multitude of surveillance systems with **voluntary reporters**

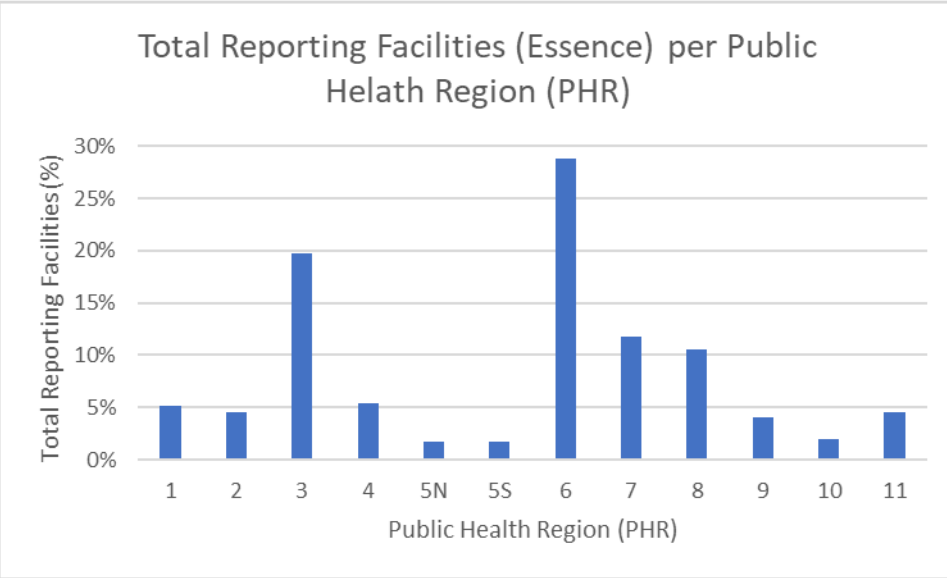| Influenza Surveillance Systems			
Essence/TX2S	ILINet	NREVSS (National Respiratory and Enteric Virus Surveillance System)	Qualtrics
Automated reporting from hospital outpatient facilities	Weekly manual entry by outpatient facilities	Weekly reporting by laboratory facilities	Short survey responses by providers and school facilities

Influenza like Illness (ILI)

- a fever ≥ 100 °F and cough and/or sore throat
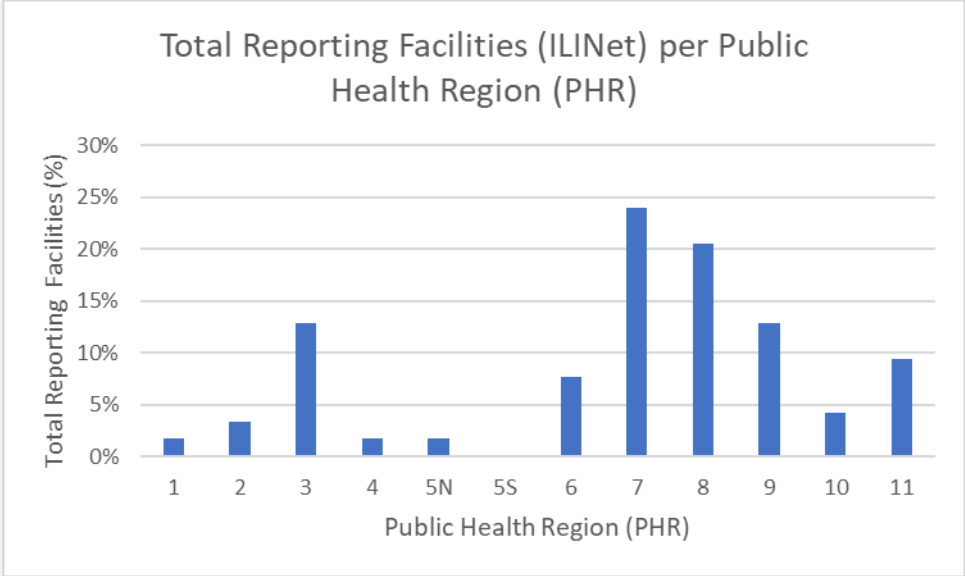
Current Status of Influenza Surveillance in Texas

Accessed 04/16/2024 from https://www.dshs.texas.gov/center-health-statistics/center-health-statistics-texas-county-numbers-public-health-regions

Total Reporting Facilities:

- 465 providers reporting to Essence, 22 providers are validated by CDC to be included in flu surveillance reports.

Total Reporting Facilities (Essence) per Public Health Region (PHR)

Data obtained 3/5/2024 from Essence, Data covers January 2019- December 2023 study period, Texas Syndromic Surveillance (TxS2), https://txessence.dshs.texas.gov/texas (not publicly accessible).
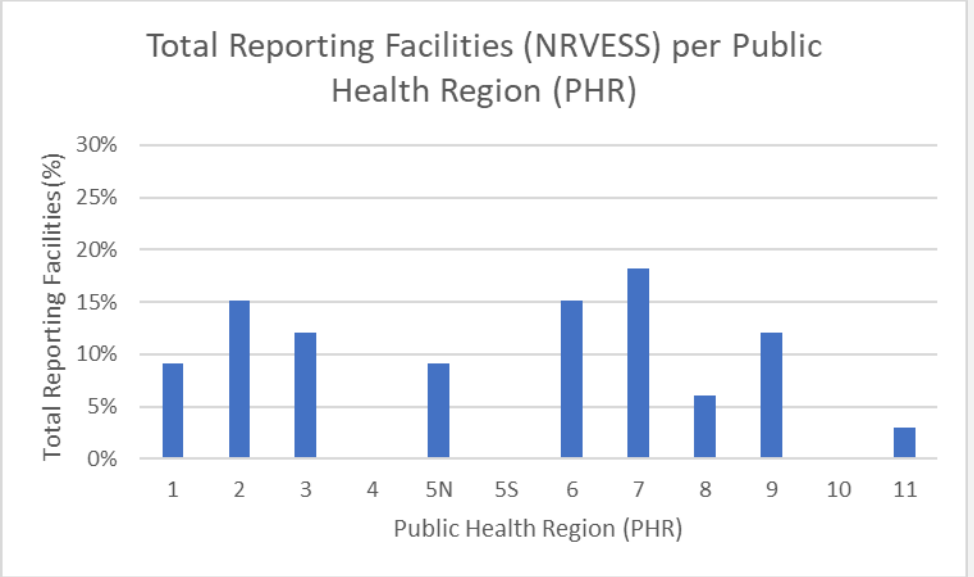
Current Status of Influenza Surveillance in Texas

Total Reporting Facilities:

- 117 providers reporting to ILINet

- 33 laboratories reporting to NRVESS

Total Reporting Facilities (ILINet) per Public Health Region (PHR)

Data obtained 4/5/2024 from ILINet, https://wwwn.cdc.gov/ILINet/ (not publicly accessible).

Total Reporting Facilities (NRVESS) per Public Health Region (PHR)

Data obtained 4/5/2024 from NRVESS, https://nrevss.cdc.gov/ (not publicly accessible).

Research Project

Goals:

- To identify key facilities that enrich the ESSENCE system based on population served and ILI visits.

- To target key facilities and encourage participation in our other influenza reporting systems

Timeline:

- January 2018 – December 2023

Sources of Data:

- ESSENCE
  - Facility geographical information
  - Facility level ILI and all Emergency Department visits per MMWR week
  - Average ILI patient travel distances (miles) to each facility

- Texas Data Center
  - County and state population estimates per year

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Selection Stages

- **Stage 1 Selection**

  - Selection of facilities that serve a maximal number of patients over their county and state populations.

    - This stage is used to significantly reduce the number of key facilities to under 15, to ensure a multiple linear regression (Stage 2) can take place using SAS software.

- **Stage 2 Selection**

  - Multiple linear regression to see if a facility's rate of ILI's ($\frac{ILI\ visits}{General\ ED\ visits}$) significantly impacts the total number of ILIs in Texas.

    - Multiple linear regression is prioritized as it has been used as an analysis method to optimize influenza networks in past studies. Multiple linear regression has been successful in creating models which are best fit to predict current data while selecting data from various networks, mock data, and historical data. In past studies it has also created models that allow for geographically diverse climates representing populations of all sizes and densities.

- **Stage 3 Selection**

  - Mapping of identified key facilities using buffer maps to show average patient travel distances to key facilities.

    - Good measure of the impact a key facility has on its community.

Stage 1 Selection

Calculation of Rates per Facility:

1. $\dfrac{\text{ILIs per MMWR week}}{\text{County Population}}$

2. $\dfrac{\text{All ED visits per MMWR week}}{\text{County Population}}$

3. $\dfrac{\text{ILIs per MMWR week}}{\text{State Population}}$

4. $\dfrac{\text{All ED visits per MMWR week}}{\text{State Population}}$

Each facility can have up to 290 (52 MMWR weeks x 5 yr study period) unique values per each rate

Calculation of Means (μ) and Standard Deviations (s): Summary statistics are calculated, resulting in a different mean and standard deviations for each rate

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Stage 1 Selection (cont.)

Facilities must serve their population, above (or equal to) expected metric at least one MMWR week during their surveillance period, per each of the four rates.

Expected Metric: (μ+0.5s)

- Reasoning for using the mean value plus a half standard deviation is to get the number of selected facilities as close to 15.

11 facilities selected in Stage 1 Selection

Stage 1 Selection (cont.)

Facilities must serve population above (or equal to) expected metric per each of the four rates.

Example:

	Facility 1	Facility 2
Rate 1	1	0
Rate 2	1	1
Rate 3	1	1
Rate 4	1	1

1: Met or exceeded metric
0: Did not meet metric

Only Facility 1 would be selected during Stage 1, as it met or exceeded the metric for all four rates.

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Stage 2 Selection

Calculation of Rates per Facility:

1. $$\frac{\text{ILIs per MMWR week}}{\text{All ED visits per MMWR week}}$$

Multiple linear regression of the 11 facilities identified in stage 1.

Where each facility is treated as an independent variable, to see if a facility's rate of ILI's ($\frac{ILI\ visits}{General\ ED\ visits}$) significantly impacts the total number of ILIs in Texas.

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Stage 2 Selection (cont.)

The following least squares regression equation was used to fit the model:

$$Total\ \#\ of\ ILIs\ in\ Texas\ (5yr) = \frac{ILIs}{All\ ED\ admissions}_{Facility\ 1} (x_{Facility\ 1}) ... + \frac{ILIs}{All\ ED\ admissions}_{Facility\ 11} (x_{Facility\ 11})$$

Forward stepwise selection was performed in which:

- Facilities are removed from the model if their removal yields the smallest SBC (Schwarz Bayesian information criterion) statistic.

- When removing facilities increases the SBC statistic, SAS assumes that adding facilities lowers the SBC statistic. Therefore, the model with the lowest SBC statistic is used, and additional facilities within that model are added.

6 facilities selected in Stage 2 Selection

Stage 3a & 3b Selection

Mapping of identified key facilities using buffer maps to show average patient travel distances to key facilities.
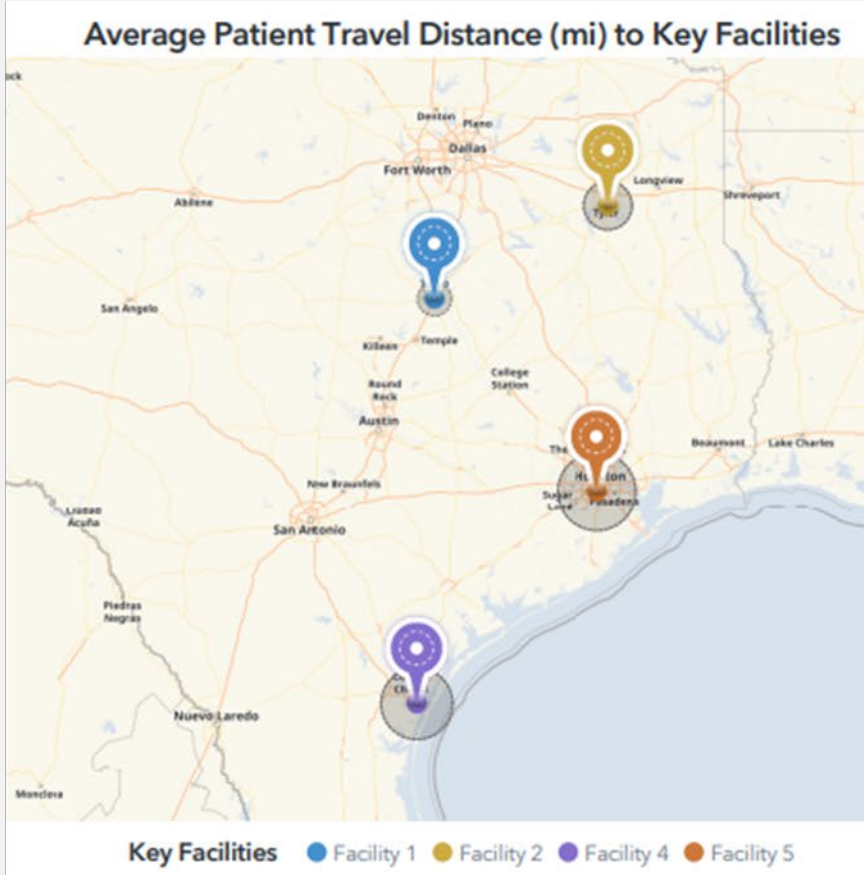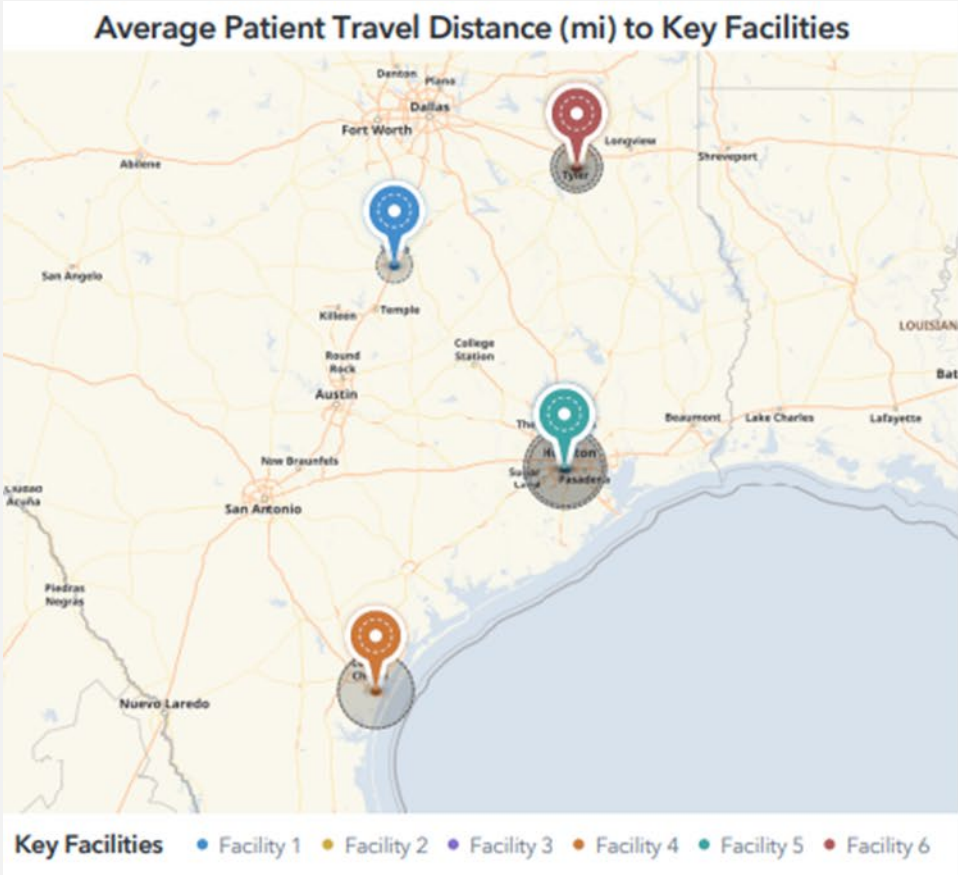
Carried out in two stages (3a & 3b):

- 3a: Six key facilities are on the map; however, two key facilities (and their average patient travel distances) are completely encapsulated within the travel distances of another two key facilities. When looking at the maps it looks as though there are pairs of key facilities that serve the same patient population.
- 3b: Removal of two overshadowed key facilities. Four key facilities are on the map where each facility and their travel distance serves entirely separate patient populations.

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Stage 3a & 3b Selection

Average Patient Travel Distance (mi) to Key Facilities

Key Facilities ● Facility 1 ● Facility 2 ● Facility 3 ● Facility 4 ● Facility 5 ● Facility 6

Key Facilities ● Facility 1 ● Facility 2 ● Facility 4 ● Facility 5

Data obtained 3/5/2024 from Essence, Data covers January 2019- December 2023 study period, Texas Syndromic Surveillance (TxS2), https://txessence.dshs.texas.gov/texas (not publicly accessible).
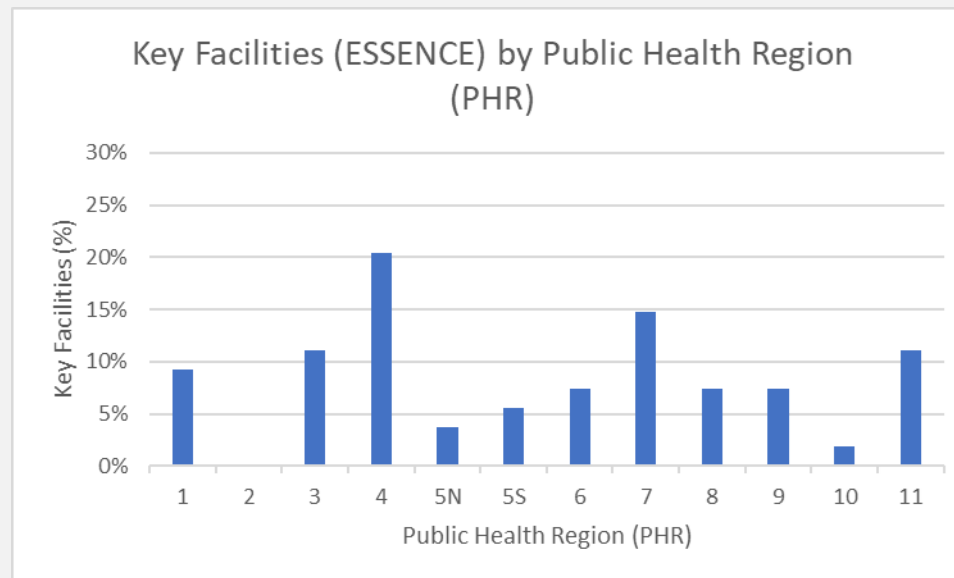
Expanded Stage 1 Selection

An additional Stage 1 Selection was added to the study as a new goal of finding 5 Key Facilities per each Public Health region was created.

- The methods of this selection stage reflect methods found in the initial Stage 1 selection, but by lowering the criteria for selection (equal to or above the mean) this selection stage is more accepting.

- The following slides display results of Additional Stage 1 Selection and outreach material has been based off the results from Additional Stage 1 Selection.

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Expanded Stage 1 Selection

Facility served the population n, above metric (μ) at least one MMWR week during their surveillance period, per four different rates.

Key Facilities (ESSENCE) by Public Health Region (PHR)

54 facilities selected in Additional Stage 1 Selection

Materials Given to PHRs for Outreach

Background document for health departments
- Why the study was created
- Recommendations for bolstering flu surveillance in your region
- Tips for choosing facilities to contact for recruitment

Influenza surveillance recruitment handout for facilities
- Why the facility is being contacted
- Benefits of reporting flu and current flu surveillance systems
- Breakdown of a facility's impact on their community

Facility information to fill out community impact section

Map of their PHR's key facilities
- Average distance patients travel to key facilities for ILI treatment

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Handout for Facilities

Handout to be given to key facilities by health departments for recruitment into additional influenza reporting systems or reengagement with current influenza reporting systems.

Influenza Surveillance Recruitment

A study was conducted at DSHS central office to determine key facilities that enrich Texas's automatic influenza reporting system, Essence. We are happy to announce that your facility was identified as a key facility, meaning you serve a large proportion of your community, and you often have patients visit you for ILIs (Influenza Like Illnesses). We thank you for your service to the Texas population and encourage you to participate in our other Influenza reporting systems.

Benefits

By enrolling in influenza reporting systems, facilities can:

- Contribute to maintaining a comprehensive and cohesive flu surveillance system.
- Achieve better awareness for providers on community health.
- Obtain free Viral Transport Media (VTM) and testing (only ILINet)

Influenza Reporting Systems

- **Essence**: Hospital outpatient facilities qualify to report, reporting is automated.
- **ILINet**: Outpatient facilities qualify to report, reports are manually entered on a weekly basis into the ILINet system, and facilities receive free VTM and testing of samples.
- **NREVSS**: Laboratory facilities qualify to report, weekly reporting of flu and other respiratory diseases.
- **Qualtrics**: Providers and school facilities qualify to report, reporting is through DSHS region, and the reporting style allows for more flexible enrollment and short survey responses.

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How to Fill in Ghost Table for Recruitment

Facility Level Influenza Impact (2019-2023)

Facility Name	Total ILI Admissions	Total ED Admissions	Average Patient Travel Distance (mi)	Influenza Participation Status
				☐ILINet ☐NREVSS ☐Qualtrics

De-identified Facility Impact Information for Region 9/10

Facility	County	PHR	Study Period	Total ILI Admissions	Total ED Admissions	Prevelance of ILI	Average Travel Distance (mi) to Facility	Influenza Participation
Facility 1	County 1	9	2020-2023	14,276	219,724	6.50%	16.11	NRVESS
Facility 2	County 2	9	2019-2023	7,426	145,312	5.11%	16.03	
Facility 3	County 2	9	2019-2023	10,925	229,478	4.76%	14.50	
Facility 4	County 3	10	2019-2023	10,219	757,850	1.35%	11.06	
Facility 5	County 4	9	2021-2023	2,623	126,765	2.07%	4.06	ILINet

Data obtained 3/5/2024 from Essence, Data covers January 2019- December 2023 study period, Texas Syndromic Surveillance (TxS2), https://txessence.dshs.texas.gov/texas (not publicly accessible).

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Key Facilities

Region 1 had 5 facilities that could be targeted. On average, key faculties in region 1 had 2.30% of patient's visits reporting symptoms of ILIs which covered a range of about 13.86 miles on average.

Region 2/3 had 6 facilities that could be targeted. On average, key faculties in region 2/3 had 5.46% of patient's visits reporting symptoms of ILIs which covered a range of about 11.72 miles on average.

Region 4/5N had 13 facilities that could be targeted. On average, key faculties in region 4/5N had 3.34% of patient's visits reporting symptoms of ILIs which covered a range of about 13.50 miles on average.

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Key Facilities (cont.)

Region 6/5S had 7 facilities that could be targeted. On average, key faculties in region 6/5S had 3.09% of patient's visits reporting symptoms of ILIs which covered a range of about 16.24 miles on average.

Region 7 had 8 facilities that could be targeted. On average, key faculties in region 7 had 2.46% of patient's visits reporting symptoms of ILIs which covered a range of about 10.26 miles on average.

Region 8 had 4 facilities that could be targeted. On average, key faculties in region 8 had 2.77% of patients visit reporting symptoms of ILIs which covered a range of about 8.38 miles on average.

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Key Facilities (cont.)

Region 9/10 had 5 facilities that could be targeted. On average, key faculties in region 9/10 had 3.96% of patient's visits reporting symptoms of ILIs which covered a range of about 12.35 miles on average.

Region 11 had 6 facilities that could be targeted. On average, key faculties in region 11 had 4.18% of patient's visits reporting symptoms of ILIs which covered a range of about 20.54 miles on average.

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Limitations

Only registered facilities (not all facilities in Texas) send data to Essence (Texas Syndromic Surveillance system) so there can be multiple unrecorded cases.

- Texas Syndromic Surveillance system includes:
  - 80% of hospitals in the state
  - 50% of all possible eligible facilities when including hospitals, stand alone ERs, clinics, etc.

Study period took place over COVID-19

- Reporting of ILIs decreased

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Thank you!

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