# Tracking the effects of COVID-19 using data on symptoms reported by Veterans on calls to VA Clinical Call Centers

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# Background & Research Question

Starting in 2015, the Greater Los Angeles (GLA) Call Center began a program in which calls could be forwarded to a Nurse Practitioner (NP)

We conducted an evaluation of the effect of this program on face-to-face health care use (Kaboli et al, 2021). This involved mining the text notes that are created when a Veteran calls the GLA Call Center.

When the pandemic hit, we explored whether the same text-mining scripts can be used to tract symptoms of COVID-19 reported on calls to VA call centers.

**Research question:** What can calls to the VA Clinical Call Centers tell us about the COVID-19 pandemic?

Kaboli, Peter J., Matthew R. Augustine, Danielle E. Rose, Neetu Chawla, Maria Bouchard, and Paul Hebert. "Call Center Remote Triage by Nurse Practitioners Was Associated With Fewer Subsequent Face-to-Face Healthcare Visits." *Journal of General Internal Medicine* (2021): 1-8.
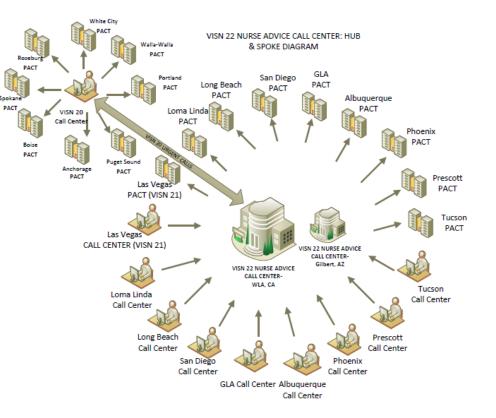
# Today's presentation

1.  Overview of VA Clinical Call Centers and the data that are stored from calls in CDW.

2.  Tracking COVID-19 related calls over time and geography

3.  Differences in COVID-19 related symptoms by race and ethnicity

4.  Calls for symptoms unrelated to COVID-19 that have increased since the pandemic.
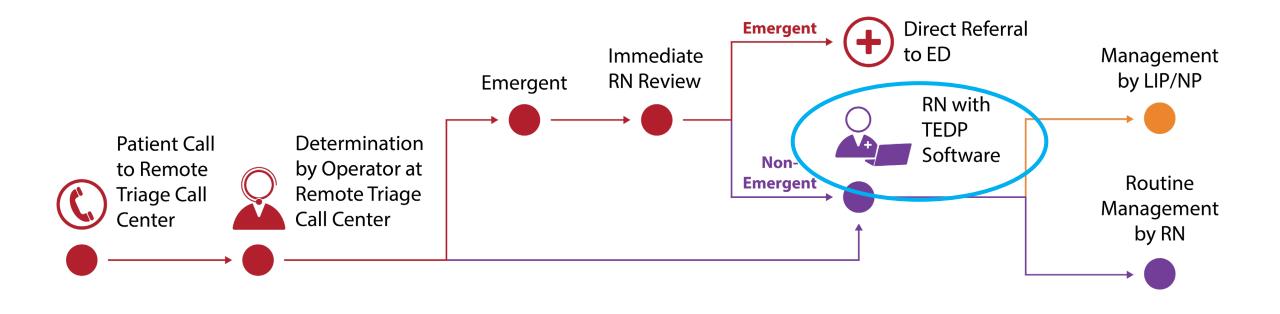
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# Overview of VA Clinical Call Centers

1. VA Clinical Call Centers are a decentralized service

   • Some like the VISN 20 Calls Center are large and cover several VA Medical Centers

   • Others can be very small. We do not know the number of VA clinical call centers at the VA.

2. Fortunately, all call centers use the same TEDP software to handle the calls. Data from calls are recorded as text in TIU notes in CDW

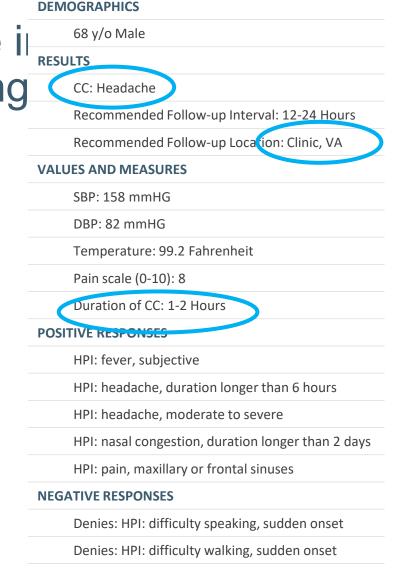3. Unfortunately, the TIU Note Titles are not standardized.



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# Flow Diagram of Patient Experience when Contacting Call Center



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# TEDP Software Creates a Text Note in Electronic Health Records Containing

- Chief Complaint (CC)

- Measures of the severity of the symptoms
  - Recommended Follow-up interval and location
  - Duration of symptoms
  - Day of the week of the call (365 days/year)
  - Time of day of the call (24hrs/day)

- Values and Measures Specific to CC
  - Biometrics (e.g., pain scale, BP, pulse)

- History of Present Illness (HPI)

**DEMOGRAPHICS**
68 y/o Male

**RESULTS**
CC: Headache
Recommended Follow-up Interval: 12-24 Hours
Recommended Follow-up Location: Clinic, VA

**VALUES AND MEASURES**
SBP: 158 mmHG
DBP: 82 mmHG
Temperature: 99.2 Fahrenheit
Pain scale (0-10): 8
Duration of CC: 1-2 Hours

**POSITIVE RESPONSES**
HPI: fever, subjective
HPI: headache, duration longer than 6 hours
HPI: headache, moderate to severe
HPI: nasal congestion, duration longer than 2 days
HPI: pain, maxillary or frontal sinuses

**NEGATIVE RESPONSES**
Denies: HPI: difficulty speaking, sudden onset
Denies: HPI: difficulty walking, sudden onset
Denies: HPI: eye pain

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# Methods

**Jorge Rojas:**
- Identify text fragments in the TIU document that identify it as output from TEDP software.
- Link the call to other CDW-based information for the caller (e.g., demographics, comorbid conditions, Area Deprivation Index for Census Tract of residence, etc)

**2 Ryan Laundry:**
- Parse the text of the TIU note to identify the <u>chief complaint</u> and other data from the call.

**Eric Gunnink:**
- Link the caller to COVID-19 related databases within the VA (VINCI COVID resources) and outside (CDC national tracking of COVID-19 tests and deaths)
- Weighted the CDC data by VA Medical Center population so that we can compare COVID-related calls to other non-VA measures of COVID-19 activity at the VAMC level.

**Emily Ashmore:**
- Design weekly Brief Reports to share with VA leadership.

# Methods (continued)

- Group the chief complaints of the calls into 15 major categories and 99 subcategories.

- Identify calls that were for COVID-19 related symptoms as defined by the CDC
  - NOTE THAT THESE ARE <u>JUST SYMPTOMS</u>
  - Just because the caller had symptoms does NOT NECESSARILY MEAN they had COVID-19.

- Collect data from Jan 2016 through last week.

- Estimate sinusoidal ARIMA models to separate the COVID-19 excess calls from the seasonal trend in influenza related calls.

- Report on tends in calls for COVID-19 related symptoms at the national and VAMC level.
  - Report the 7-day moving average in calls to smooth variation in calls over the weekend and holidays

- Compare to other COVID-19-related data from CDC and VA at the national and VAMC-level

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COVID-19 Symptoms

- Cough,

- Shortness of breath

- Difficulty breathing

- Fever

- Fatigue

- Myalgia

- Loss of taste/smell

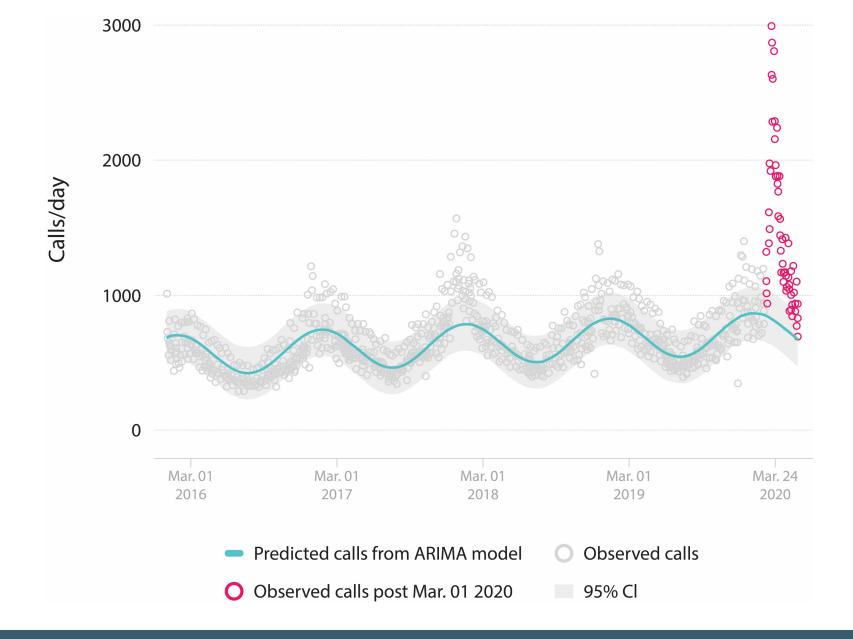- Diarrhea, nausea, vomiting

- Sore throat

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# Total calls and calls for COVID-19 related symptoms, Jan 1, 2016-Jan 30, 2021

|  | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Total calls (000s) | 629.9 | 743.6 | 816.3 | 834.9 | 1088.7 | 80.6 |
| COVID-19 related symptoms (000s) | 139.0 | 171.6 | 185.4 | 185.9 | 301.2 | 22.0 |
| % COVID-related | 22% | 23% | 23% | 22% | 28% | 27% |

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Legend:
- Predicted calls from ARIMA model
- Observed calls
- Observed calls post Mar. 01 2020
- 95% CI

# At the start of the pandemic, COVID calls anticipated hospitalizations and deaths



Mar. 16 2020

Apr. 01 2020

Apr. 21 2020

4000

2000

1000

0

150

100

50

0

VA Calls and US Deaths

VA Hospitalizations

Mar. 01 2020

May 27 2020

● VA COVID-related Calls     ● VA COVID Hospitalizations     ○ US COVID Deaths

- The peak in calls for COVID-19 related symptoms was March 16, 2020.

- The peak in VA COVID hospitalizations (as of May 2020), was on April 1, 2020.

- Thus, calls to VA call centers anticipated VA hospitalizations by 2 weeks.

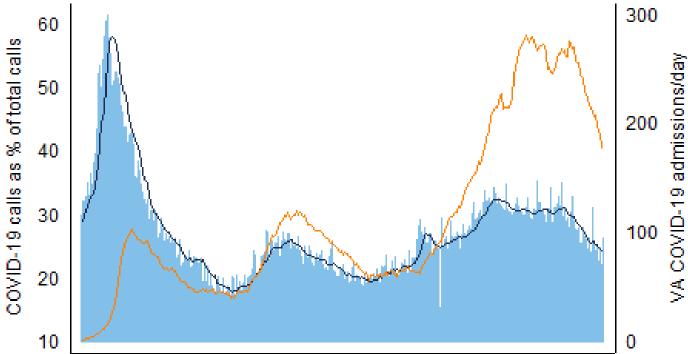VA | U.S. Department of Veterans Affairs

- The relationship between calls and COVID tests changed over time

- Calls to the VA for COVID-19 symptoms increased during each of the three phases of the pandemic.

- However, none matched the peak in March.

- Calls in December for COVID-19-related symptoms were at the highest level since March, but did not match the spike in COVID-positive tests as reported by the CDC.
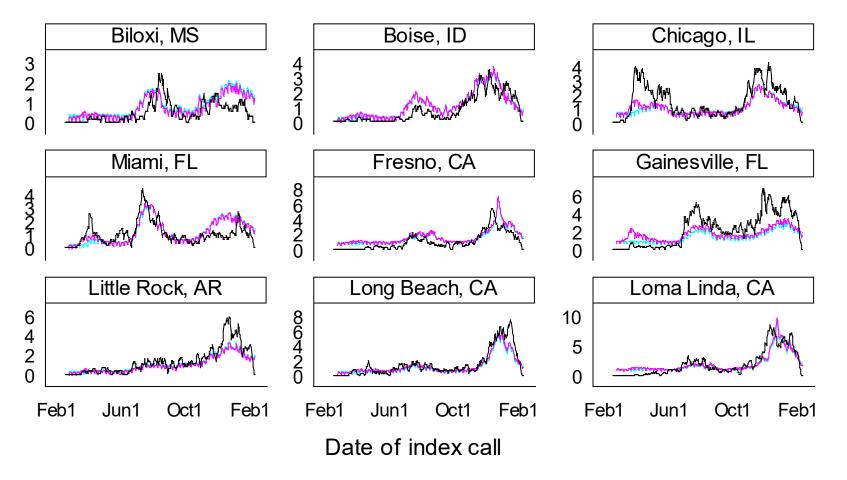


Legend:
- COVID-19 calls as % of total calls
- 7-day rolling avg COVID-19 calls as % of total calls
- 7-day rolling avg VA COVID-positive tests/1000 Veterans
- 7-day rolling avg CDC COVID-positive tests/1000 pop

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- The relationship between COVID-19 calls and hospitalizations was especially vexing

- Calls anticipated hospitalizations early in the pandemic, but not by the end of 2020

- This maybe due to geographic nature of COVID-19 outbreaks

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- These data are for March 1, 2020 through Jan 30, 2021.

- They are actual vs predicted hospitalizations for COVID.

- The prediction is from ARIMA models of hospitalization on a given day as a function of prior week COVID-19 positive tests in the VAMC catchment area and calls to VA call centers for COVID conditions in the prior week.

- For some VA Medical Centers (VAMCs) we were able to predict hospitalizations fairly well using calls in the prior week as explanatory variables.

- In general, models that included calls performed better than models that only used publicly available data on COVID positive tests, but not by much.

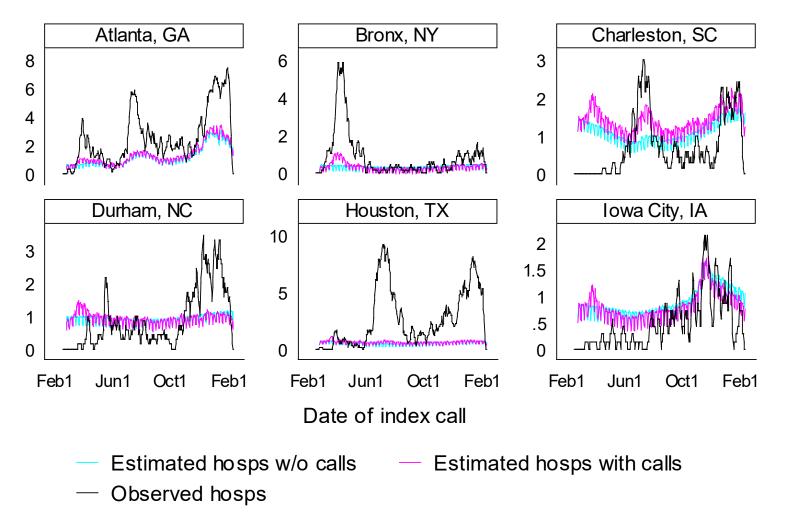# 7-day moving average VA COVID hospitalizations per day



Date of index call

Estimated hosps w/o calls    Estimated hosps with calls

Observed hosps

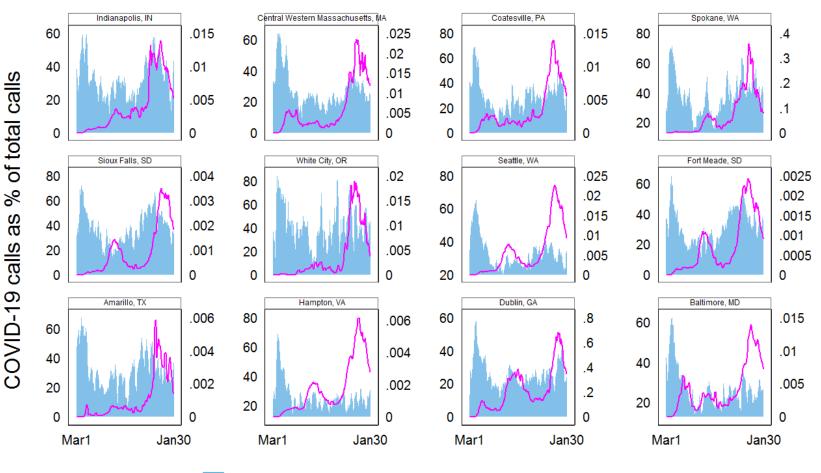VA | U.S. Department of Veterans Affairs

# 7-day moving average VA COVID hospitalizations per day

- However, these models were not especially helpful for the great majority of medical centers.

- For many of these models, the estimated coefficients on lagged calls were close to zero.

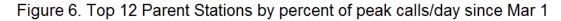- Something else was influencing whether a veteran was hospitalized at the VA.



Date of index call

— Estimated hosps w/o calls   — Estimated hosps with calls
— Observed hosps

- Rather than predict hospitalizations, we chose to present the trends in calls for COVID-19 symptoms along side CDC-reported COVID-positive tests.

- These are the sites with the largest increase in calls for COVID-19 related symptoms over the last week of January.

- Since calls have been decreasing, these are the sites that are decreasing the slowest.



Figure 5. Top 12 Parent Stations by change in calls/day over last week as % of mean calls/day in 2019

COVID-19 calls as % of total calls

7-day rolling avg COVID-19 calls as % of total calls

7-day rolling avg CDC COVID-positive tests/1000 pop

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- Here is the same information except ranked by the level of calls relative to the peak in calls.

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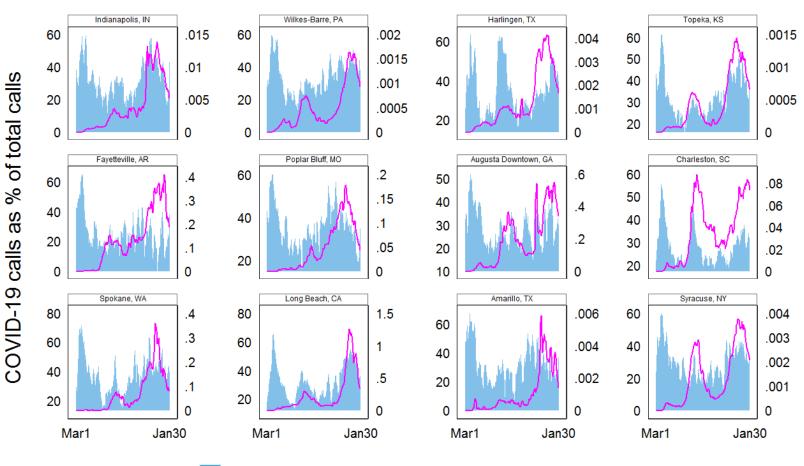


Figure 6. Top 12 Parent Stations by percent of peak calls/day since Mar 1

7-day rolling avg COVID-19 calls as % of total calls

7-day rolling avg CDC COVID-positive tests/1000 pop

# Relationship between symptoms on calls and subsequent positive tests for COVID-19

- The pervious slides were aggregate data (by day and/or by VAMC).

- We also have individual-level data.

- We can track how characteristics of a call and caller are associated with subsequent:

  - Receipt of a VA COVID-19 test within 2 weeks of a call with a chief complaint of a COVID-19 symptom.
  - Getting a positive COVID-19 test result given that you were tested.
  - Being hospitalized in the VA for COVID-19 after making a call with a chief complaint of a COVID-19 symptom.

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# Relationship between symptoms, testing, and hospitalization

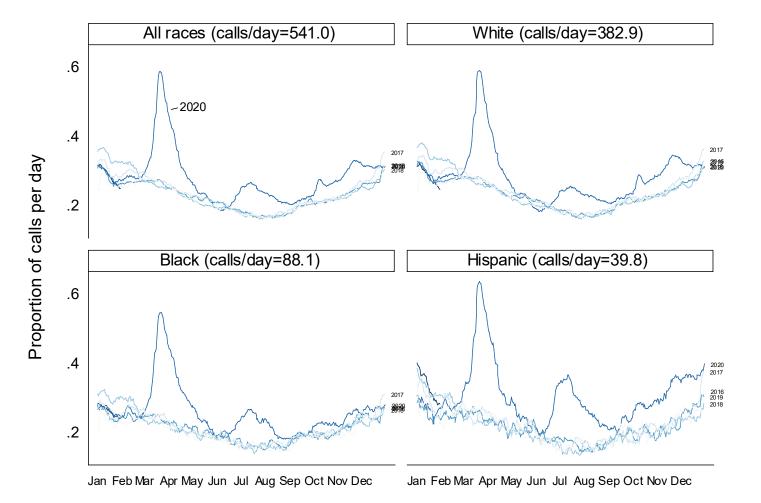| Symptom | Percent of symptoms on calls with COVID-related symptoms | Probability of being tested given COVID-related symptom | Probability of testing positive given symptom, tested | Probability of being hospitalized given symptom and positive test |
|---|---|---|---|---|
| Dyspnea | 22.8 | 29 | 22.4 | 24.2 |
| Cough | 21.0 | 30.3 | 35.8 | 12.8 |
| Rhinorrhea | 10.1 | 21.3 | 31 | 6.9 |
| Headache | 7.7 | 19.4 | 25.2 | 10.4 |
| Diarrhea | 7.2 | 22.7 | 14.8 | 17.3 |
| Sore throat | 7.0 | 25.1 | 14.3 | 8.7 |
| Fever | 5.5 | 38.4 | 40.2 | 19.9 |
| Nausea | **5.1** | 20.5 | 13.1 | 25.6 |
| Influenza | 4.3 | 30.6 | 24.1 | 16.9 |
| Fatigue | 2.7 | 24.9 | 27.8 | 14.4 |
| Myalgia | 2.7 | 40.9 | 44.7 | 12.1 |
| Chills | 1.5 | 30.4 | 30.8 | 15.9 |
| Taste | **0.1** | 27.4 | 40.7 | **2.8** |
| N (000) | **280** | 76 | 21 | **6.7** |

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# Research questions

- Were Black and Hispanic Veterans more likely than white Veterans to <u>call the VA call centers with COVID symptoms?</u>

- Among Veterans who called with symptoms, were Black and Hispanic Veterans more likely than white Veterans to <u>get a COVID-19 test</u> from the VA.

- Among Veterans who called and got tested, were Black and Hispanic Veterans more likely than white Veterans to get a <u>positive COVID-19</u> test result.

- Among Veterans who called and got a positive tests, were Black and Hispanic veterans more likely than white veterans to be <u>hospitalized at the VA</u>.

## Study Sample: Callers with COVID-19 related symptoms March 2020-Jan 2021.

|  | Total | White | Black | Hispanic | Multi-race | Other/Unk |
|---|---|---|---|---|---|---|
| Count | 280,213 | 189,082 | 50,139 | 24946 | 4506 | 11540 |
| Age, mn (sd) | 58.1 (16.2) | 59.7 (16.2) | 57.3 (14.3) | 51.1 (16.8) | 58.1 (16.2) | 51.3 (16.2) |
| Female, % (n) | 15.3 (42846) | 13.0 (24504) | 22.3 (11200) | 16.9 (4216) | 20.8 (935) | 17.3 (1991) |
| Symptom, % (n) | | | | | | |
| Cough | 21.0 (58754) | 20.7 (39208) | 21.2 (10629) | 22.0 (5485) | 19.7 (886) | 22.1 (2546) |
| diarrhea | 7.25 (20328) | 7.82 (14788) | 5.95 (2982) | 6.02 (1502) | 7.83 (353) | 6.09 (703) |
| dyspnea | 23.5 (65737) | 24.2 (45747) | 22.3 (11187) | 20.9 (5211) | 24.6 (1107) | 21.5 (2485) |
| headache | 7.67 (21496) | 6.51 (12310) | 10.9 (5481) | 9.2 (2300) | 7.52 (339) | 9.2 (1066) |
| influenza | 17.4 (48629) | 17.5 (33173) | 15.9 (7997) | 18.8 (4693) | 16.7 (752) | 17.5 (2014) |
| nausea | 5.12 (14357) | 5.10 (9651) | 5.54 (2776) | 4.38 (1093) | 5.64 (254) | 5.05 (583) |
| rhinorhea | 10.2 (28450) | 10.3 (19549) | 10.4 (5205) | 8.71 (2174) | 9.9 (447) | 9.3 (1075) |
| sore throat | 7.76 (21752) | 7.55 (14273) | 7.34 (3680) | 9.6 (2405) | 7.88 (355) | 9.0 (1039) |
| taste | 0.132 (369) | 0.107 (203) | 0.207 (104) | 0.176 (44) | 0.133 (6) | 0.104 (12) |
| Comorbidity | 0.566 (1.52) | 0.591 (1.53) | 0.598 (1.61) | 0.390 (1.28) | 0.651 (1.55) | 0.369 (1.21) |
| Rurality | | | | | | |
| Highly rural | 3.46 (9567) | 4.54 (8494) | 0.602 (298) | 0.875 (214) | 3.24 (356) | 4.59 (205) |
| Rural | 26.6 (73523) | 32.5 (60767) | 12.4 (6158) | 12.8 (3119) | 20.0 (2194) | 28.8 (1285) |
| Urban | 69.9 (193189) | 62.9 (117639) | 87.0 (43019) | 86.4 (21117) | 76.8 (8440) | 6.6 (2974) |

- Methods: estimate age and gender adjusted odds of calling the VA with a COVID symptom during CDC-defined influenza weeks
  - Five previous flu season 2016-Feb 2020.
  - Pandemic: March 2020-yesterday
  - Logit regression conditional on VAMC to account for regional differences in race
- Results:
  - Small differences by race in odds of calling with a COVID symptom in any year. Generally, Black and Hispanic Veterans were less likely than white Veterans to call the VA call centers with a chief complain of a COVID-related symptom in every flu season.
  - Nothing special about COVID

| | Flu season | | | | | |
|---|---|---|---|---|---|---|
| | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/2020 | COVID-19 |
| **Black** | 0.82 | 0.78 | 0.78 | 0.78 | 0.83 | 0.85 |
| **Hispanic** | 0.94 | 0.91 | 0.89 | 0.89 | 0.96 | 1.03 |
| **Multi-race** | 1.04 | 1.04 | 0.92 | 0.95 | 0.94 | 0.98 |
| **Other/Unk** | 1.07 | 0.96 | 0.95 | 0.94 | 1.00 | 0.99 |

# The percentage of veterans who call with symptoms and get tested

- Of the 280k callers with COVID-related symptoms since March 1, 2020,
  - 27% got a COVID-19 test at the VA.
  - 20% got a negative test (n=54,855)
  - 7% got a positive test (n=20,998)

COVID-19 TESTS AMONG CALLERS WITH SYMPTOMS (N=280K)

■ No test  ■ Negative test  ■ Positive tests



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# Methods: Probability of test/hospitalization

- Estimate 3 logistic regressions conditional on VAMC
  - Probability of getting a VA-administered COVID test given that you called with symptoms
  - Probability that the test was positive given that you got a test (and called with symptoms)
  - Probability that you were admitted to a VA hospital for COVID given you got a positive test (and called with symptoms)

- Independent variables
  - Characteristics of the Veteran: Age, gender, race, comorbidity, rurality,
  - Characteristics of the call: COVID-related symptom, day of the week, time of day, recommended follow-up location and time, duration of symptoms
  - Conditional on VAMC to adjust for geographic differences in COVID outbreaks and race

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# Results

| | Probability of test given call with symptom | | Probability of positive test given test | | Probability of hospitalization given positive | |
|---|---|---|---|---|---|---|
| | odds-ratio | p-value | odds-ratio | p-value | odds-ratio | p-value |
| Black | 1.02 | 0.118 | 1.36 | 0.000 | 1.81 | 0.000 |
| Hispanic | 1.12 | 0.000 | 1.63 | 0.000 | 1.48 | 0.000 |
| Multi-race | 0.97 | 0.354 | 0.89 | 0.144 | 0.82 | 0.367 |
| Other/Unk | 0.99 | 0.733 | 1.38 | 0.000 | 1.74 | 0.000 |
| Observations | 280120 | | 74720 | | 20645 | |

# Conclusion:

- Black and Hispanic Veterans were no more likely than white Veterans to <u>call the VA</u> with COVID symptoms during the pandemic.

- Among those who did call, Hispanic veterans were somewhat more likely to get a COVID-19 test from the VA than were white veterans

- Black and Hispanic Veterans were significantly more likely to receive a positive test result and to be hospitalized if they received a positive test.

- Limitation:
  - We have no data on non-VA tests or hospitalizations.
  - Unclear how much of this racial difference represents increased burden of COVID-19 on Black and Hispanic Veterans versus increased reliance on the VA rather than community providers by Black and Hispanic Veterans.
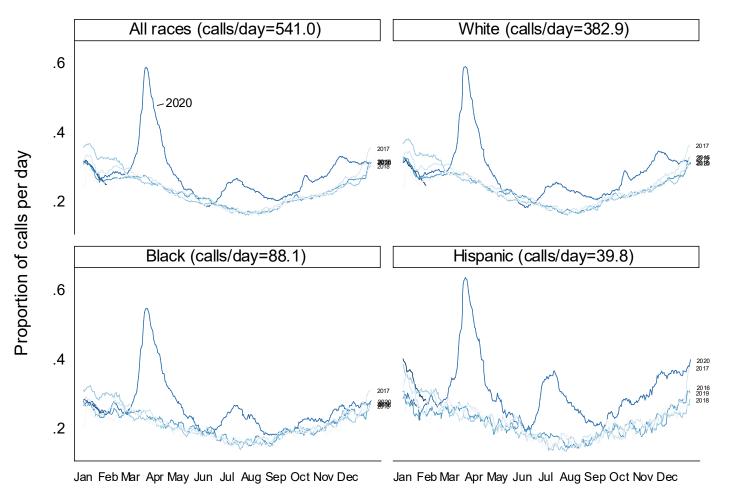
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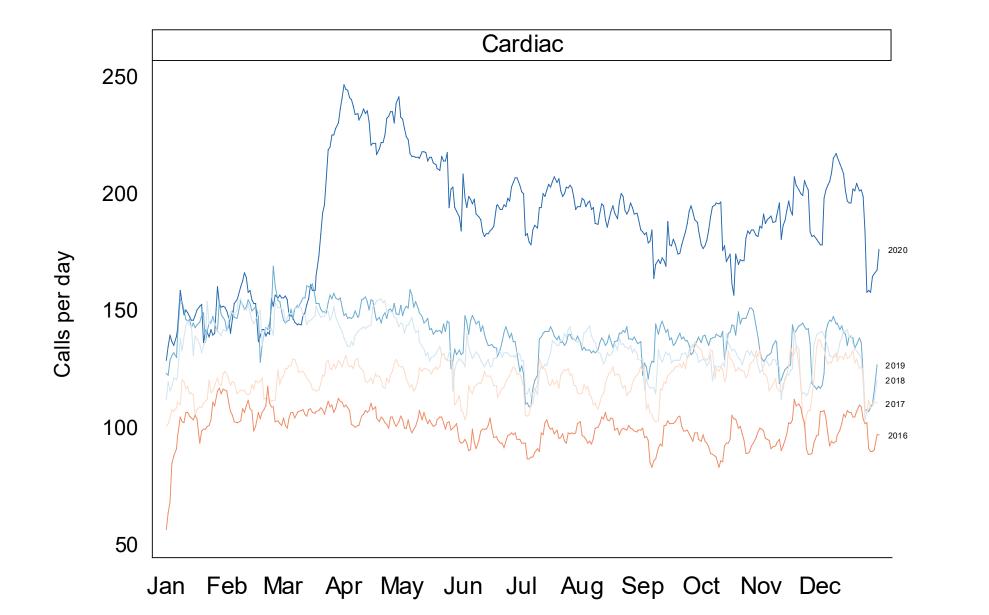4. Calls Symptoms unrelated to COVID-19 that have increased since the pandemic.

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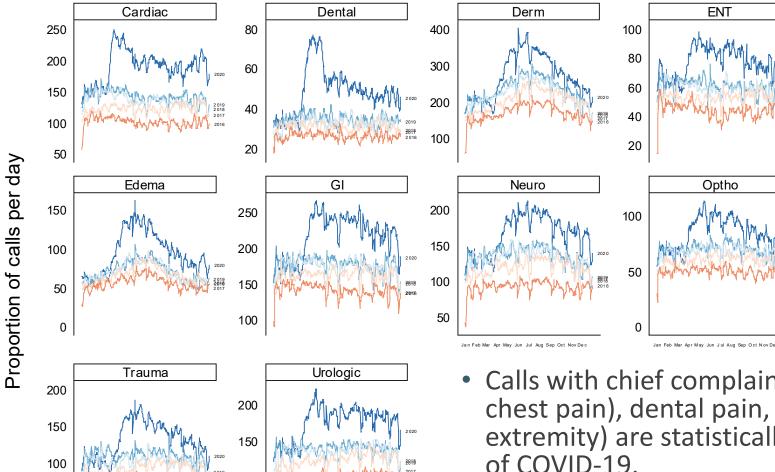
# Methods: non-COVID symptoms

- Classify all 1500 chief complaints on calls into 15 major categories and 99 subcategories.

- Estimate the percentage of calls for each category on each day for each year Jan 2016-Jan 2021.

- Estimate sinusoidal regressions to identify the categories of chief complaints that are elevated relative to the seasonal trend in those calls and the growth in calls in general over time.

- Basically, redo the graphs to the right but substitute the major categories of chief complaints for race.

Cardiac

# RESULTS

- Calls with chief complaints for cardiac conditions (especially chest pain), dental pain, and edema (especially lower extremity) are statistically significantly higher since the start of COVID-19.

- These could might reflect unmet need for care or poor self care during the pandemic.

# Summary

- Tracking COVID-19 using call center data is feasible
  - Predicting hospitalizations is difficult at the VAMC level
  - Calls basically track what you read in the NY Times about cases and hospitalizations.

- More concerns about racial differences in the effect of COVID-19
  - Black and Hispanic Veterans are not more likely to call with symptoms of COVID
  - Types of symptoms vary little by Race
  - But, Black and Hispanic Veterans who call the VA with symptoms are more likely to test positive <u>at the VA</u> and more likely to be hospitalized <u>at the VA</u>.

- Symptoms that are not known to be COVID related show disturbing elevated frequencies since COVID-19, which may reflect inadequate preventative care.

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# Limitations

- These data do not reflect testing or hospitalization outside the VA.

THANK YOU!