VA | U.S. Department of Veterans Affairs

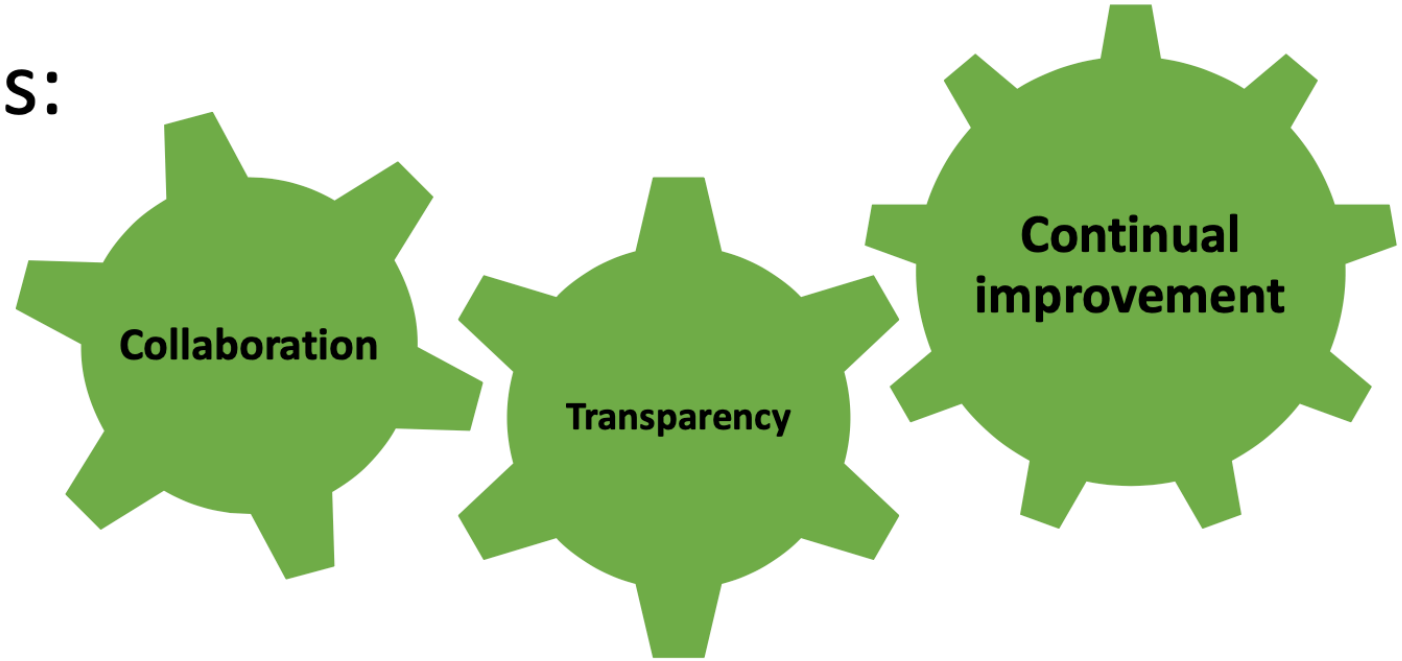
# VA COVID-19 Shared Data Resource

VINCI
VA Informatics and Computing Infrastructure

# VA COVID-19 Shared Data Resource

- Goal:
  - Provide value as **quickly** and **consistently** as possible

- Process:



# Collaboration

pre index observations

post index observations

conditions

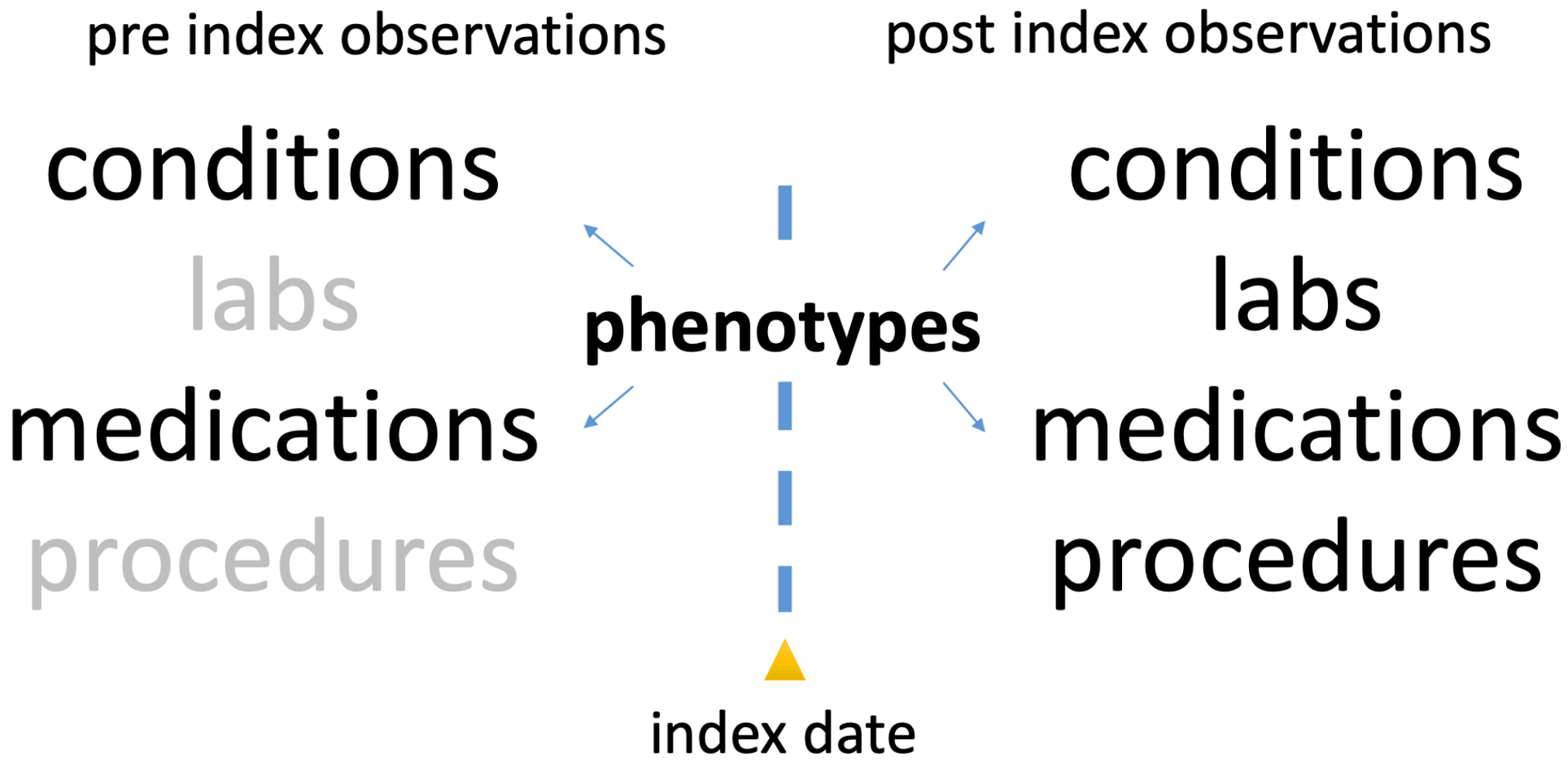
labs

medications

procedures

index date

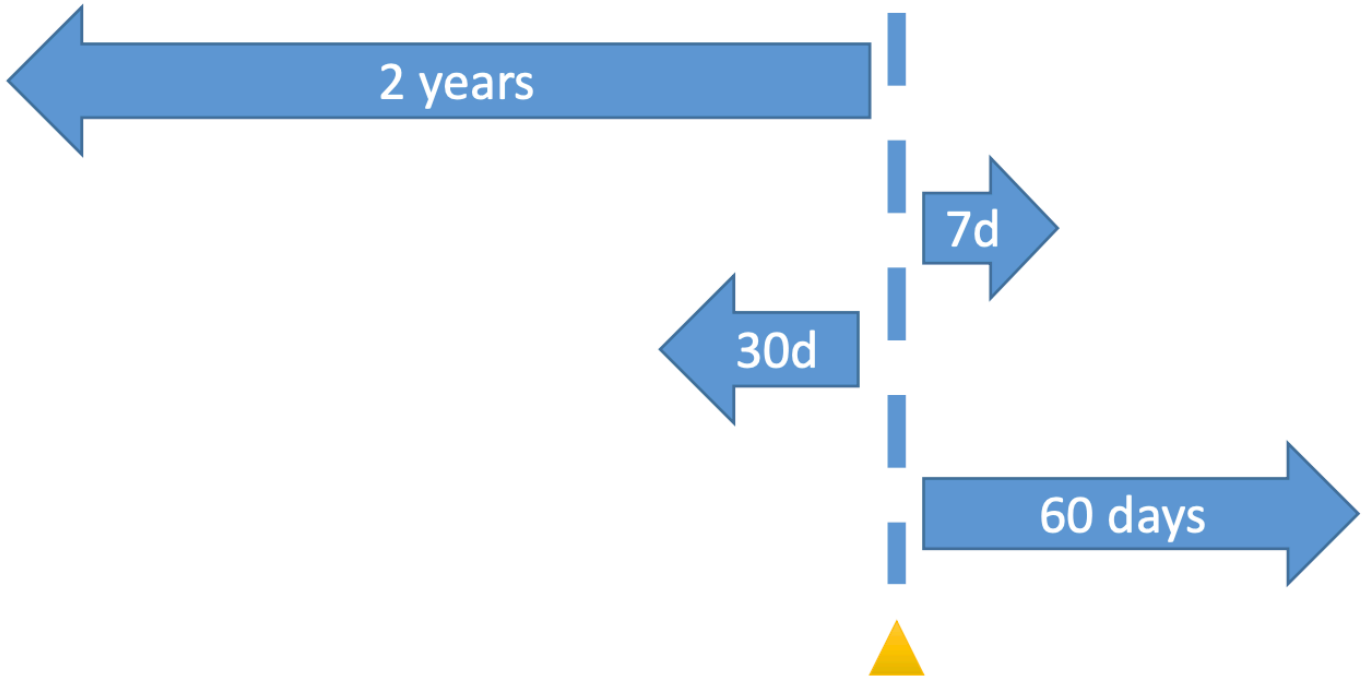
# Collaboration



# Collaboration

pre index observations

post index observations



# Collaboration


## Acknowledgements [edit]

- Kristine Lynch, VINCI
- Craig Kreisler, CSDE, National Biosurveillance Team Intelligence Team
- Evan Carey, RAPID, National Biosurveillance Team Intelligence Team
- Tom Glorioso, CART
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- Elise Gatsby, VINCI
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- Olga Patterson, VINCI
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- Dr. Makoto Jones, Director, Biosurveillance, Antimicrobial Stewardship & Infection Control (VHA)

**OIT BISL Team Leads**

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- Data Lead: Dan Hardan
- Visualization Lead: Jeremy Gebhard

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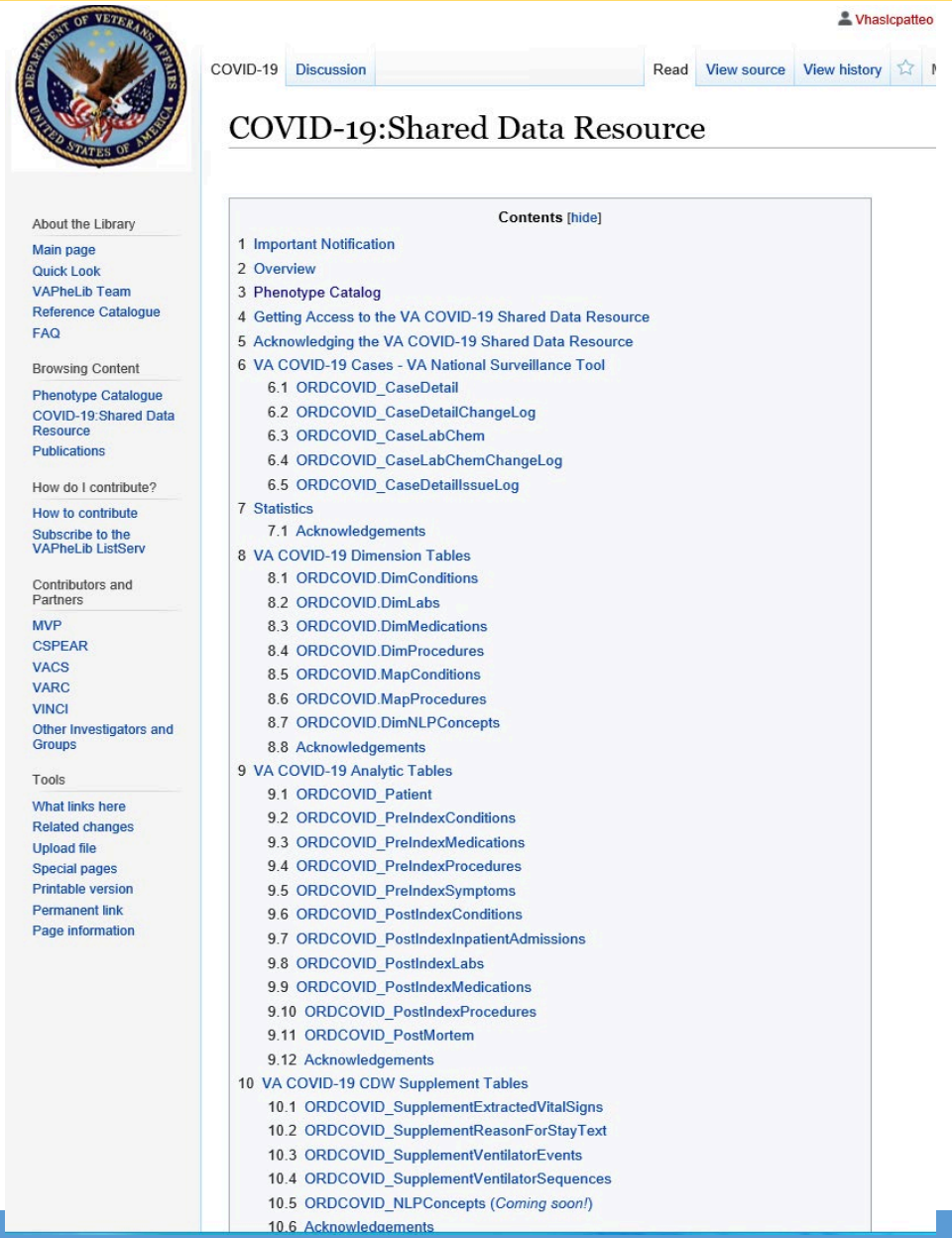
- Data Management: Steve Martin, Andy Kelly
- Data Integration: Dan Hardan, Tom Huneke, David Burkhart, Dan Pina, Phil Woubshet
- VistA Data Integration: Augie Turano, Mike Baker
- Geospatial Data Integration: Michael Villenueve
- Data Infrastructure: Ken Fuchsel
- Data Visualization: Jeremy Gebhard, Carrie Ruckdeschel, Shabnam Watson, Daniel Chang, Lyla Goldstein, Aaron Barth, Jeff Lyttle, Pankaj Surti, Haley Vingsness, Theresa Baamonde

- Kelly Peterson, BASIC, VA Salt Lake City Health Care System
- Barbara Jones, VA Salt Lake City Health Care System
- Evan Carey, RAPID, National Biosurveillance Team Intelligence Team
- Craig Kreisler, CSDE, National Biosurveillance Team Intelligence Team

# Phenotype documentation and support

- Internal wiki pages
- Data access instructions
- Customer support



Vhaslcpatteo

COVID-19 | Discussion | Read | View source | View history

## COVID-19:Shared Data Resource

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10.5 ORDCOVID_NLPConcepts (*Coming soon!*)
10.6 Acknowledgements

# Cohort statistics

## Statistics [edit]

| CaseDefinition | Distinct PatientICNs with CaseDefinition | |
|---|---|---|
| VA Confirmed Positive | 67,010 | Total Positives 183,197 |
| VA Presumptive Positive | 116,187 | |
| VA Negative | 942,245 | |
| VA Respiratory Illness Seen | 37,941 | |
| VA Pending | 66,309 | |

*** Figures from CaseDetail table as of January 12, 2021**

## VA COVID-19 Fact Sheets [edit]

**Sex by EverPositive flag**
**As of Dec 29, 2020**

| Sex | EverPositive = 1 Patient Count (N = 143,432) | EverPositive = 1 Patient Percentage | EverPositive = 0 Patient Count (N = 899,371) | EverPositive = 0 Patient Percentage | OMOP* Patient Count (N = 8,226,053) | OMOP* Patient Percentage |
|---|---|---|---|---|---|---|
| F | 24,407 | 17.02 % | 176,682 | 19.65 % | 1,035,200 | 12.58 % |
| M | 119,015 | 82.98 % | 722,602 | 80.35 % | 7,190,167 | 87.41 % |

# What is its purpose?

# Phenotypes derived through NLP

- Vital signs
- Reason for Stay
  - emergency department triage entries,
  - inpatient admit diagnoses
- Mechanical ventilation
  - Initial intubation
  - Ventilator stop
  - Reintubation
- Supplemental Oxygen(coming soon)

## VA COVID-19 CDW Supplement Tables [edit]

These are tables that enrich and supplement CDW data through NLP extraction or other curation methods. All COVID-19 Supplement tables in the VA COVID-19 Shared Data Resource are created by a research and operations collaboration, which includes effort from VINCI led by Kristine Lynch with NLP efforts led by Olga Patterson, CSDE led by Craig Kreisler, and RAPID led by Evan Carey.

Table Refresh Rate: We are working toward weekly refreshes on Wednesdays

### ORDCOVID_SupplementExtractedVitalSigns [edit]

**Overview**

NLP output extracted from notes recording respiratory rate, pulse oximetry, temperature, blood pressure, heart rate, height, weight, and BMI.

### ORDCOVID_SupplementReasonForStayText [edit]

**Overview**

Chief complaints mapped to standard vocabulary based on EDIS, EDIS Discharge, and Inpatient data.

### ORDCOVID_SupplementVentilatorEvents [edit]

**Overview**

NLP output extracted from notes recording ventilator status, intubation, extubation, reintubation, ventilator settings, and patient position.

### ORDCOVID_SupplementVentilatorSequences [edit]

**Overview**

Variables detailing events related to ventilated patients. This table contains output for patients classified as having been mechanically ventilated

# Vital Signs

- Patterson OV, Jones M, Yao Y, Viernes B, Alba PR, Iwashyna TJ, et al. Extraction of Vital Signs from Clinical Notes. Stud Health Technol Inform. 2015;216:1035.

```
VITAL SIGNS:  Temperature 98.1, pulse 64,
respirations 20,
blood pressure 144/69, height 6’1",
weight 229 pounds, saturation O2 stats are 97
percent on room air.
```

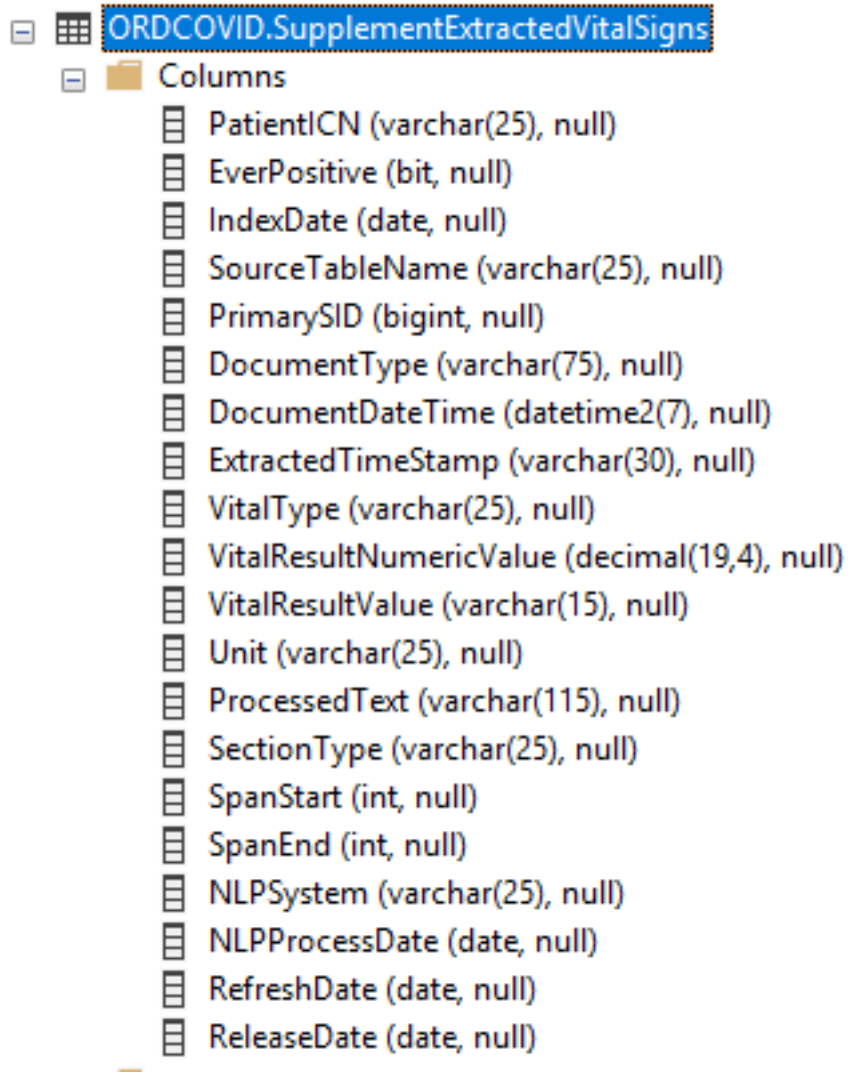
```
VITALS:
T:  98.2
RR:  20
Pulse:  88
BP: 126/50
Weight: 217.2
Height: 66
BMI:  35.1
```

```
 VITALS-
153/68-80-20-95.8
```

```
Physical Exam
Vitals 97.9 F [36.6 C]
70 in [177.8 cm]
229 lb [104.1 kg]
```

```
VS 152/94 98.3 85 16
```

```
VS 150-160/90-100 98-98.5 80-85 16-22
```

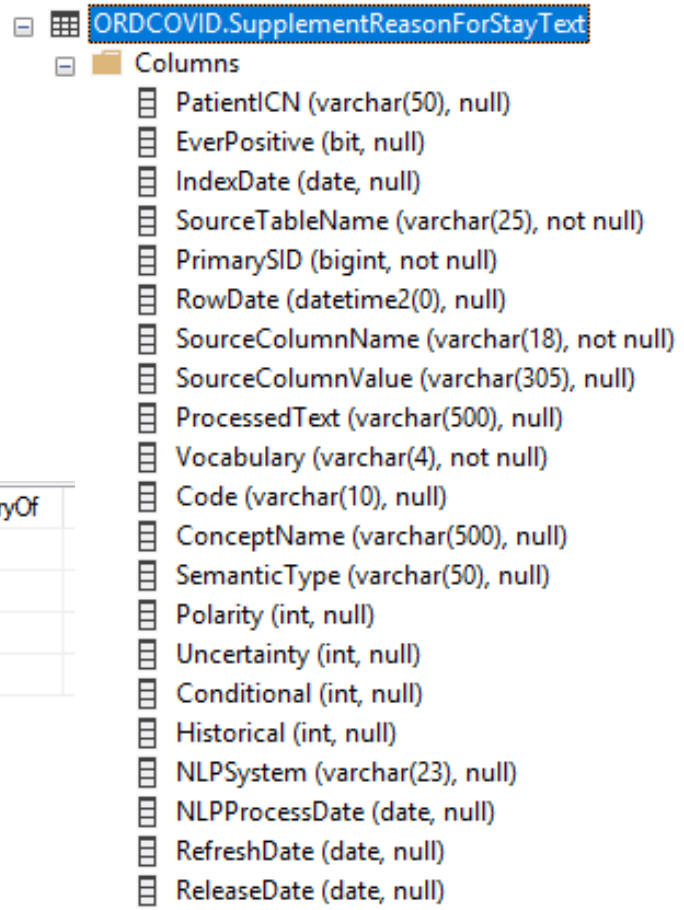


# Reason for Stay

- Inpatient.[AdmitDiagnosis]
- EDISLog.[PatientVisitReason]
- EDISDischargeDiagnosis.[DischargeDiagnosis]

| | AdmitDiagnosis | Snippets | CUI | STR | STY | polarity | uncertainty | historyOf |
|---|---|---|---|---|---|---|---|---|
| 1 | n/v/d | nausea | C0027497 | Nausea | Sign or Symptom | 1 | 0 | 0 |
| 2 | n/v/d | vomiting | C0042963 | Vomiting | Sign or Symptom | 1 | 0 | 0 |
| 3 | n/v/d | diarrhea | C0011991 | Diarrhea | Sign or Symptom | 1 | 0 | 0 |

| PatientVisitReason | Snippets | CUI | STR | STY | polarity | uncertainty | historyOf |
|---|---|---|---|---|---|---|---|
| Si, Detox, Fevers, SOB . | detoxification | C0150543 | Detoxification procedure | Therapeutic or Preventive Procedure | 1 | 0 | 0 |
| Si, Detox, Fevers, SOB . | suicidal ideation | C0424000 | Feeling suicidal (finding) | Finding | 1 | 0 | 0 |
| Si, Detox, Fevers, SOB . | fever | C0015967 | Fever | Sign or Symptom | 1 | 0 | 0 |
| Si, Detox, Fevers, SOB . | shortness of breath | C0013404 | Dyspnea | Sign or Symptom | 1 | 0 | 0 |

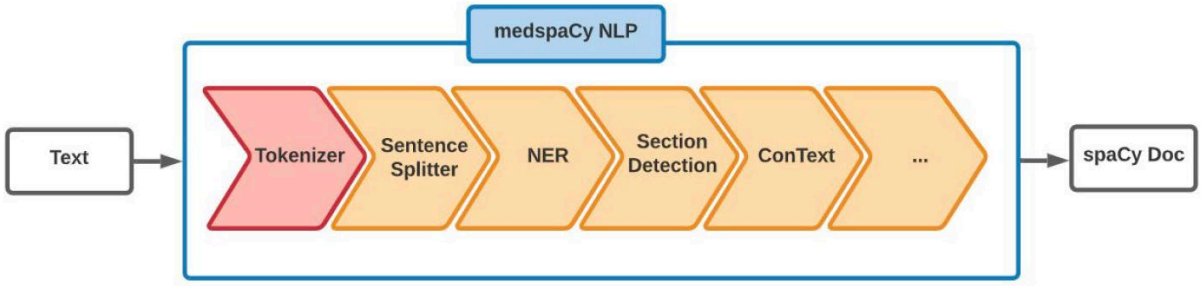


# COVID-19 Screening

## Usage Statistics

*Last updated December 18, 2020*

| Number of Documents | Number of Patients | Number of Stations | Number of Document Definitions |
|---|---|---|---|
| 4,916,258 | 670,458 | 129 | 7,114 |




Coronavirus Disease 2019 (COVID-19) CLC Screen << COVID_SCREEN >>

---

The resident does not have a new or worsening cough COUGH , shortness of breath SOB ,

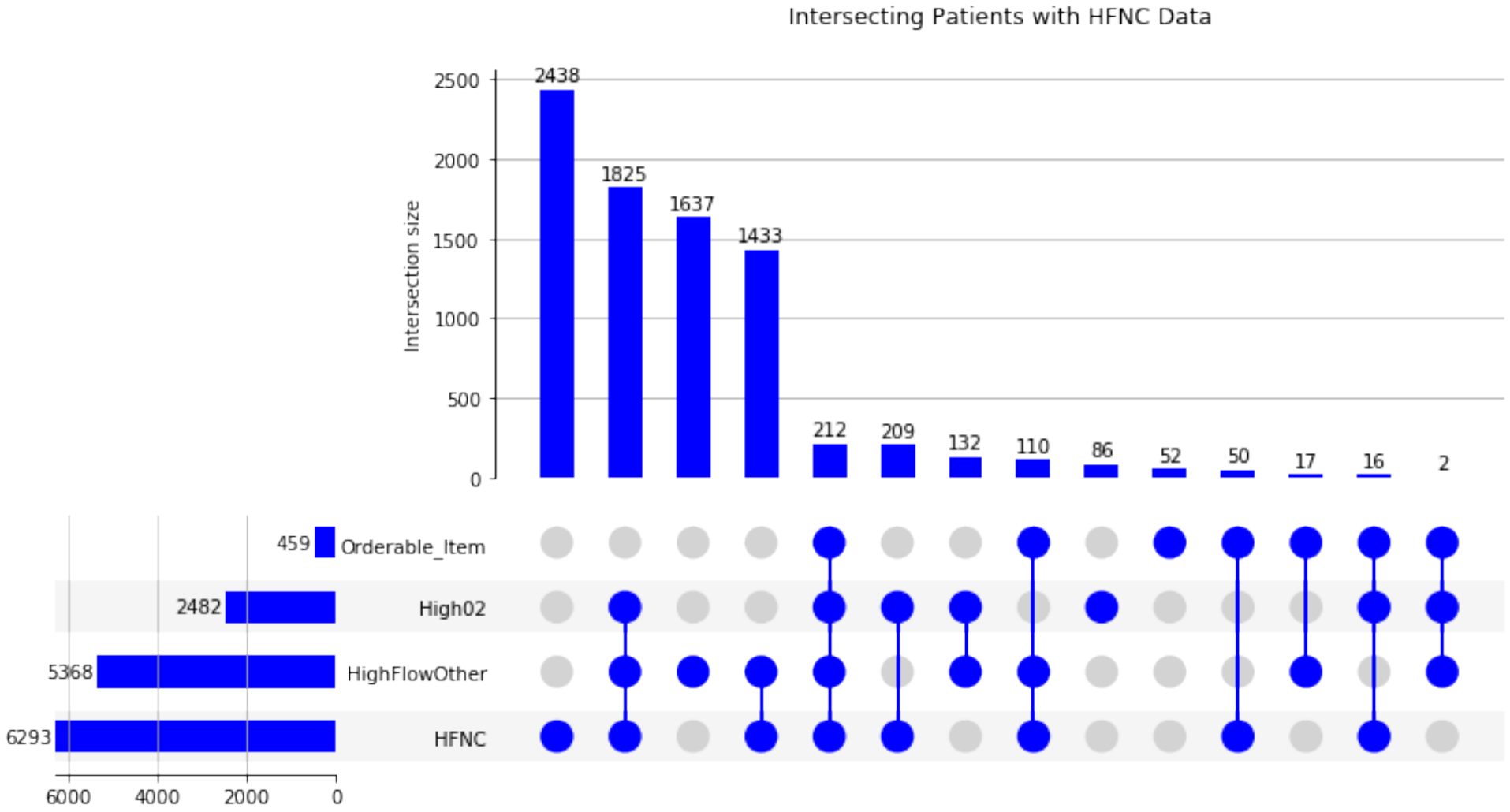
or sore throat THROAT .

The resident does not have any cold or flu-like symptoms COLDFLU .

The resident does not have new onset of diarrhea DIARRHEA .

Results: << RESULTS >> Screen is negative.

# Identifying the need for NLP – Supplemental Oxygen



# Identifying the need for NLP – Mechanical Ventilation

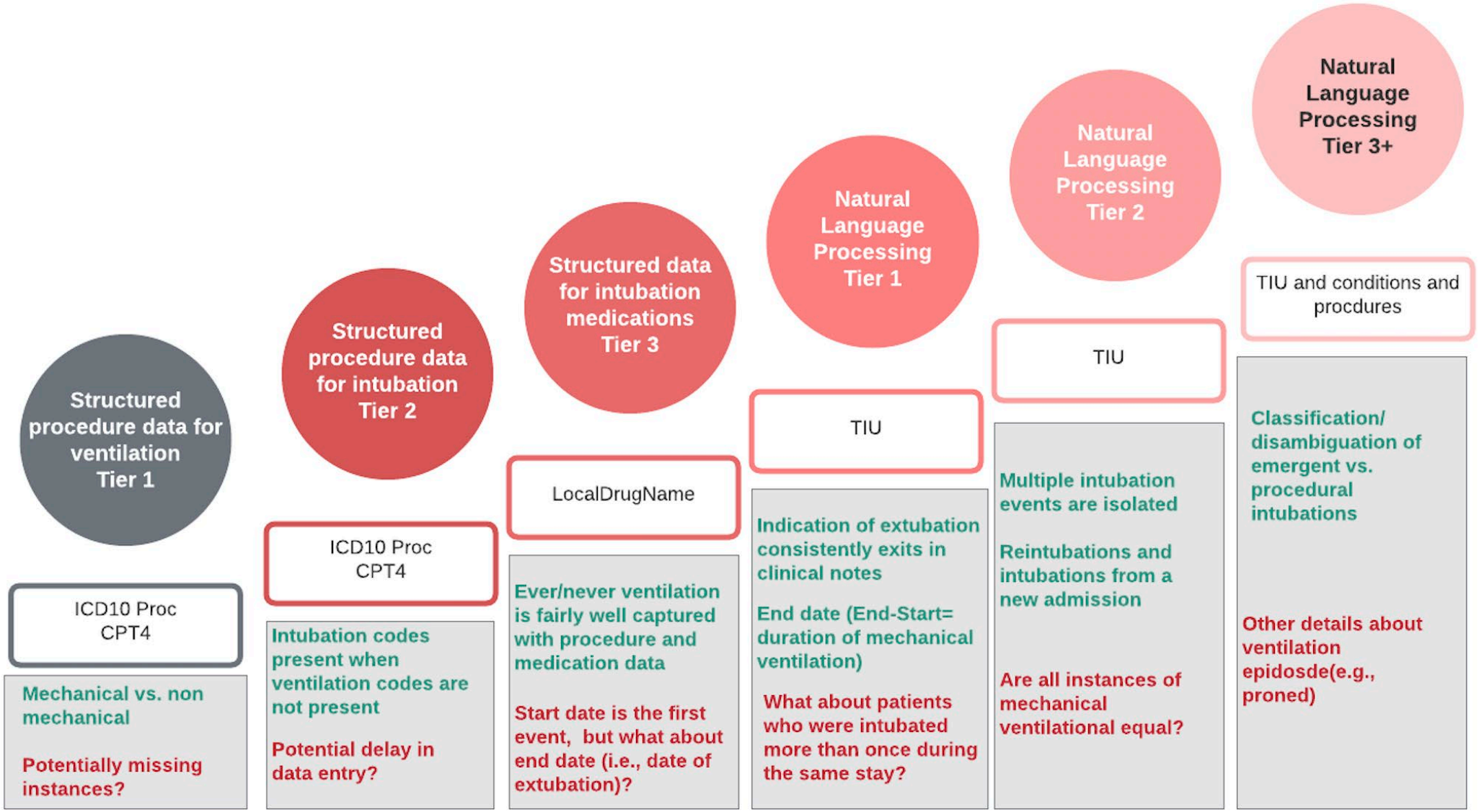
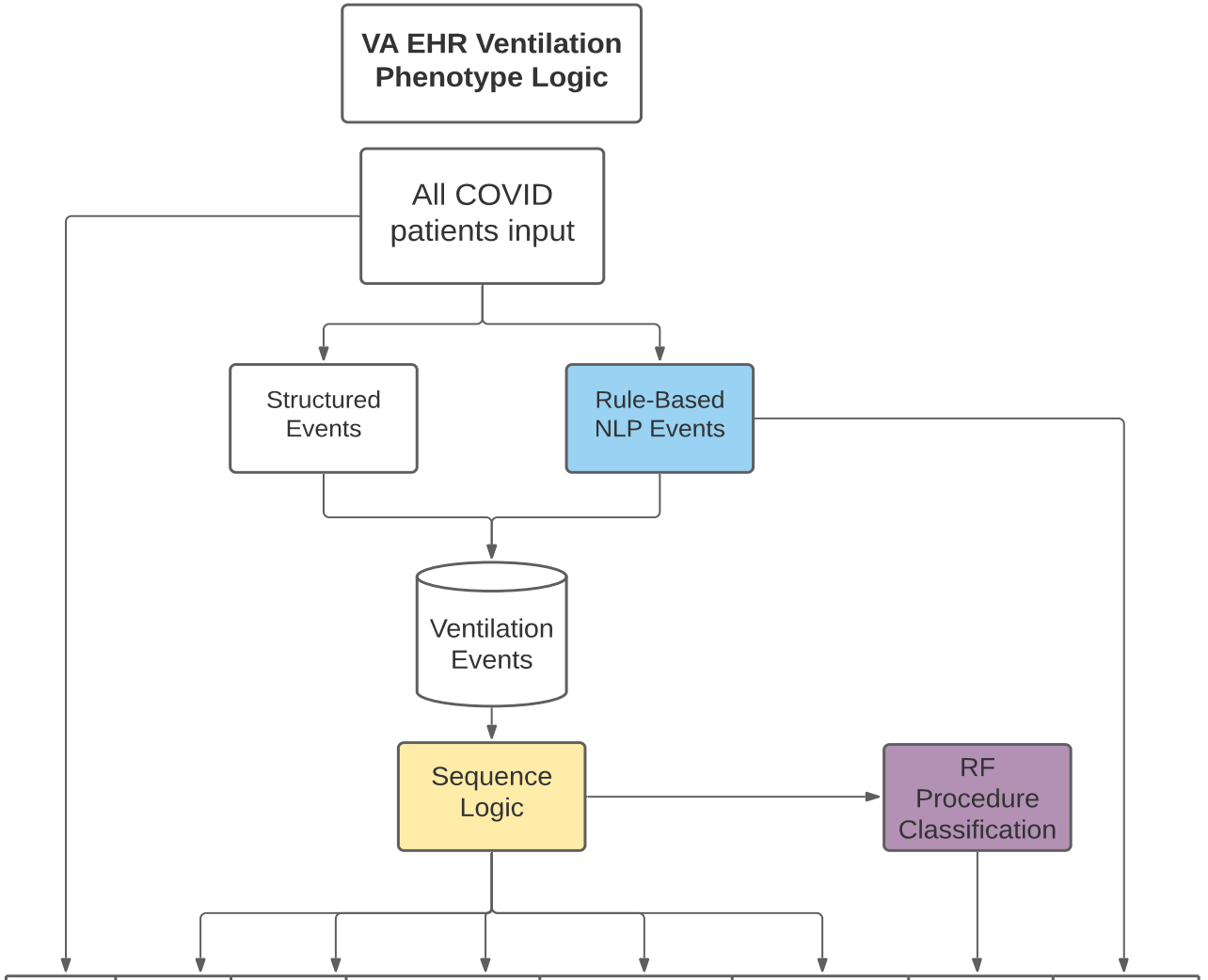



Image Courtesy: Kristine Lynch, VINCI

# Mechanical intubation events

- Structured data
  - Medication
  - Intubation procedure code
  - Discharge date
  - Death date
- Unstructured data - Clinical notes
  - Intubation date
  - Ventilation status
  - Prone status
  - Extubation date



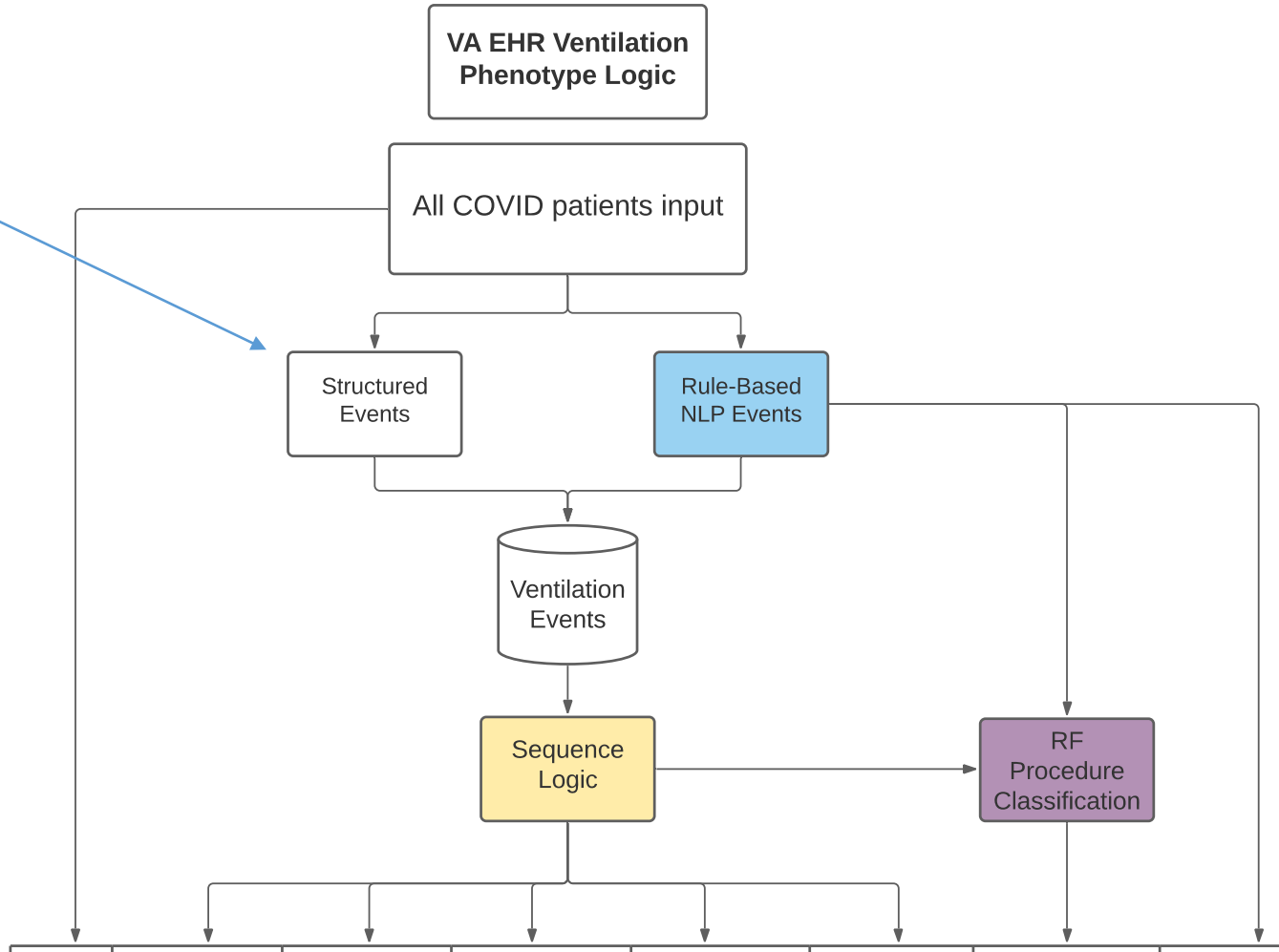

| PatientICN | StartDate | StopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureFlag | ProneFlag |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 0 | 1 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | Death | 2 | 0 | 1 |

# Structured Events

Induction Vent Medication

Intubation Code

Ventilation Code




| PatientICN | VentilatorStartDate | VentilatorStopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureVentilation | ProneVentilation |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 1 | 0 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | Death | 2 | 0 | 1 |

# NLP Events

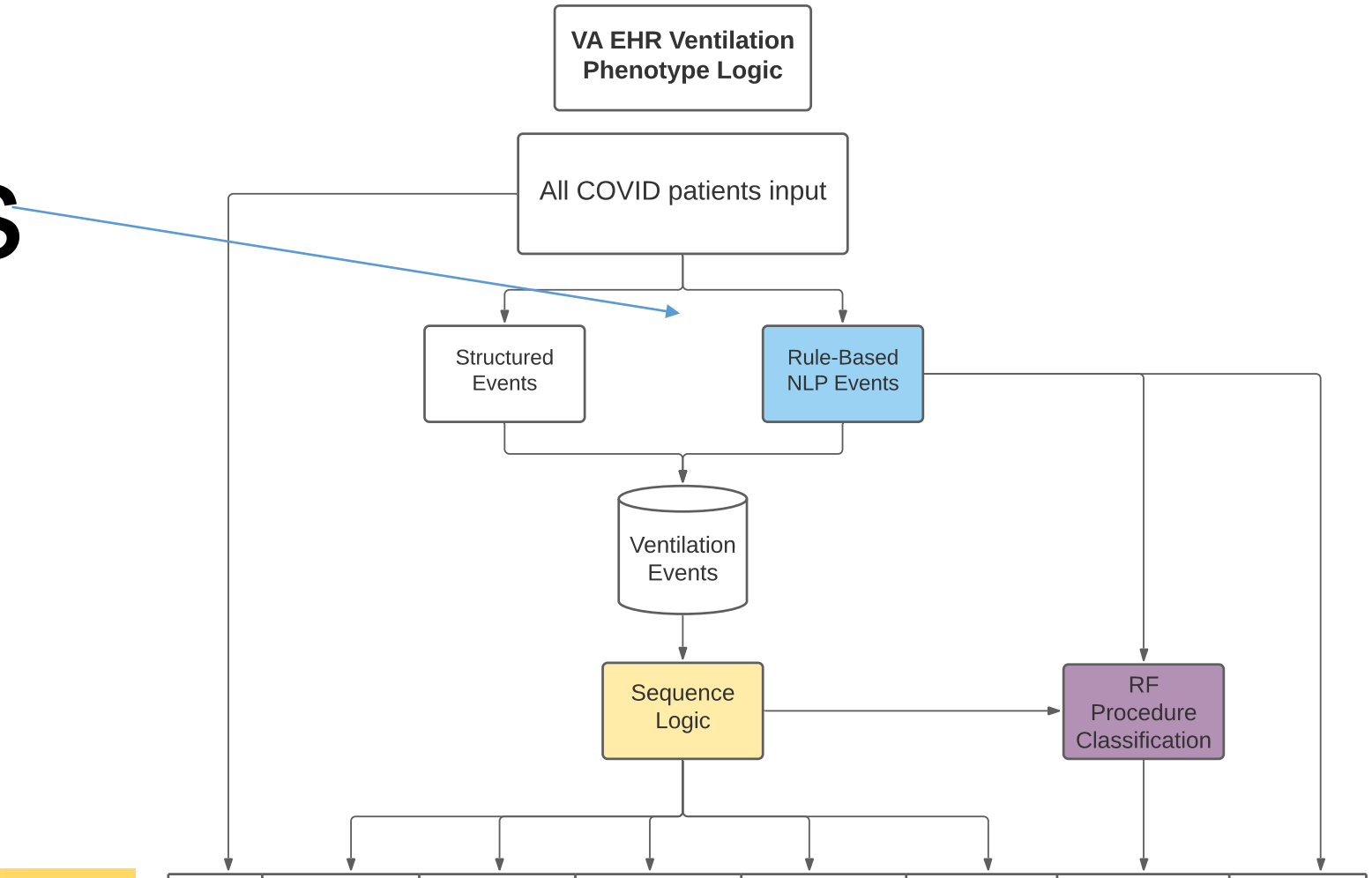
EMR Note Data

Intubations

Extubation

On Ventilator

Off Ventilator




| PatientICN | VentilatorStartDate | VentilatorStopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureVentilation | ProneVentilation |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 1 | 0 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | Death | 2 | 0 | 1 |

# NLP Anchor Term types

Extubation:

”extubated”
“extubation”

Intubation:

“reintubation”

”intubated”

Ventilation:

“ventilated”
“ventilator”

# NLP Modifier Term types

**Temporality**

”yesterday”
“today”
“on 4/16”

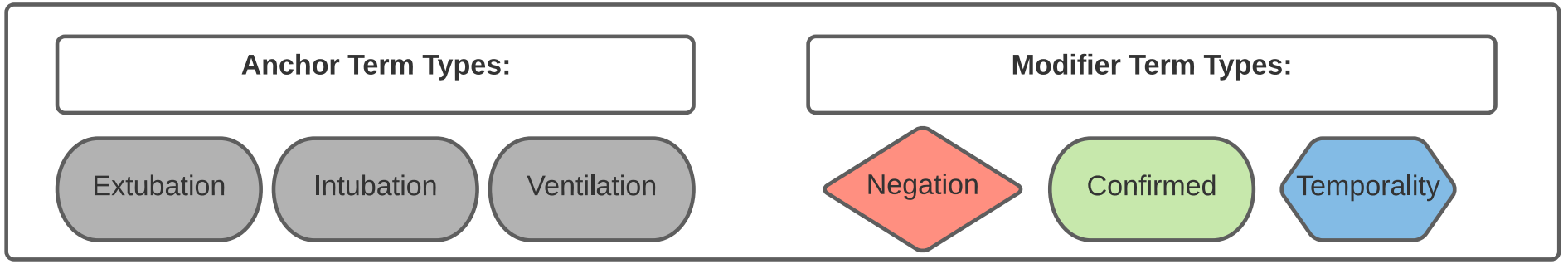
**Confirmed/Treatment**

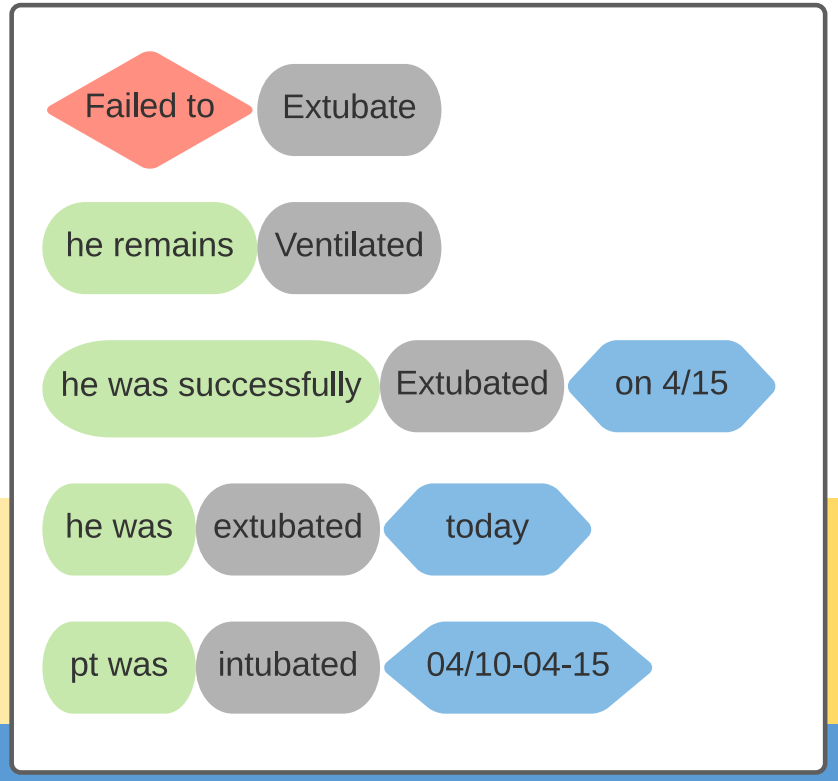
“currently on”
”is”

**Negation**

“not”
“unable to”

# NLP Patterns

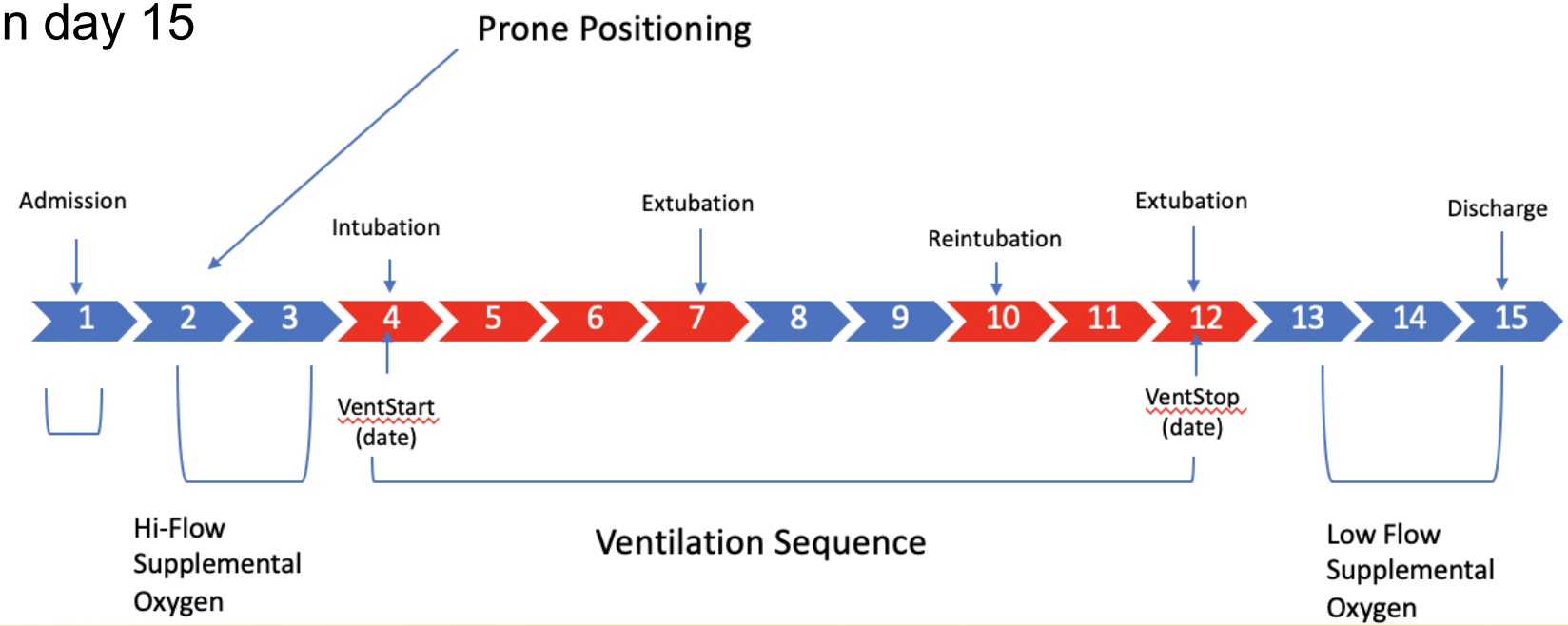



| Term | EventType | EventDetail | Date |
|---|---|---|---|
| extubate | - | Negated | - |
| ventilated | Start | Document Date | 04/11 |
| extubated | Stop | Extracted Date | 04/15 |
| extubated | Stop | Document Date | 04/15 |
| Intubated | Start | Extracted Date | 04/10 |
| Intubated | Stop | Extracted Date | 04/15 |

# Hypothetical patient description

- Admitted into the hospital on day 1
- Placed in prone position on day 2 with supplemental oxygen
- Intubated and ventilated on day 4
- Successfully extubated on day 7
- Condition worsens on day 10 and they are reintubated
- Successfully extubated again on day 12
- Discharged on day 15



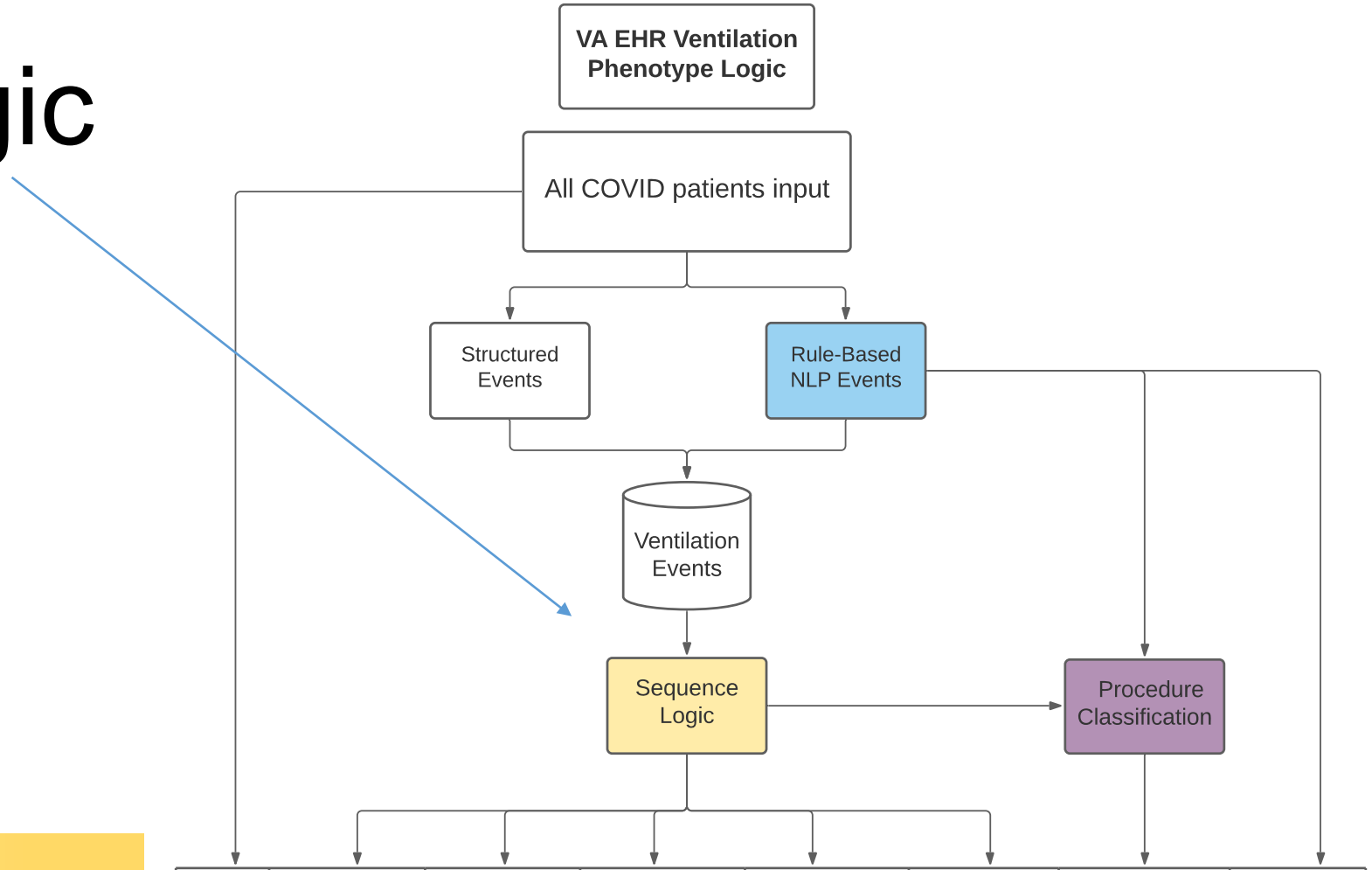
# Sequence Logic

Start Date

Stop Date

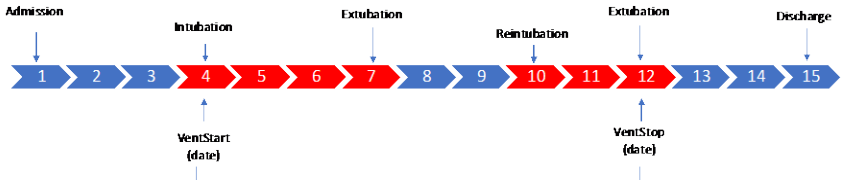
Multiple Intubations

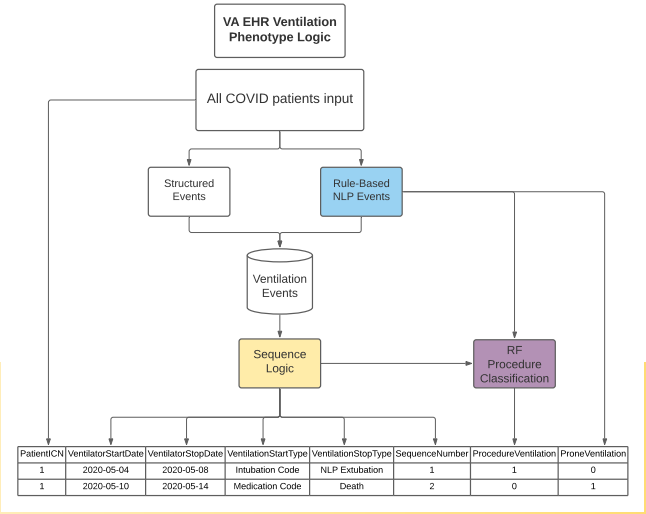
Reintubation




| PatientICN | VentilatorStartDate | VentilatorStopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureVentilation | ProneVentilation |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 1 | 0 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | NLP Extubation | 2 | 0 | 1 |

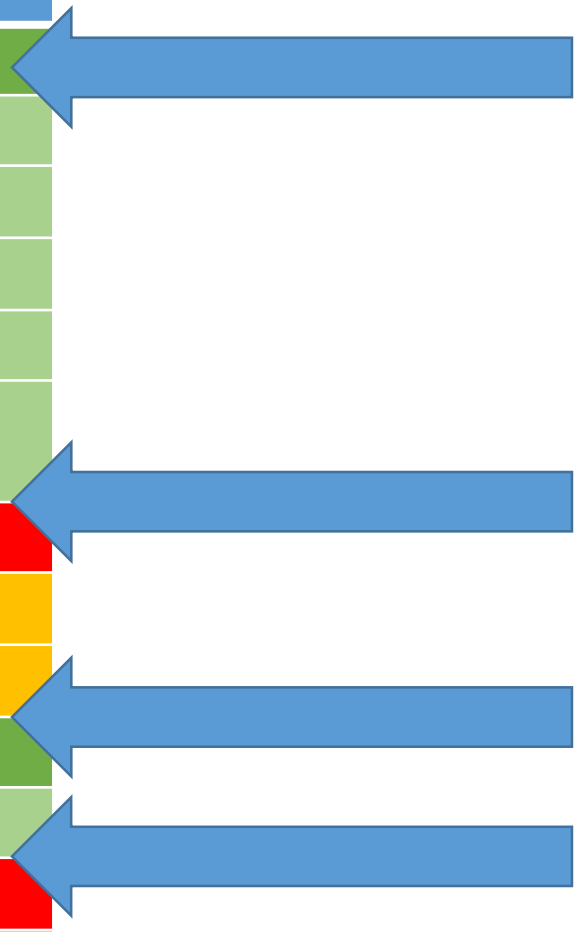
# Sample Patient Events Table Output



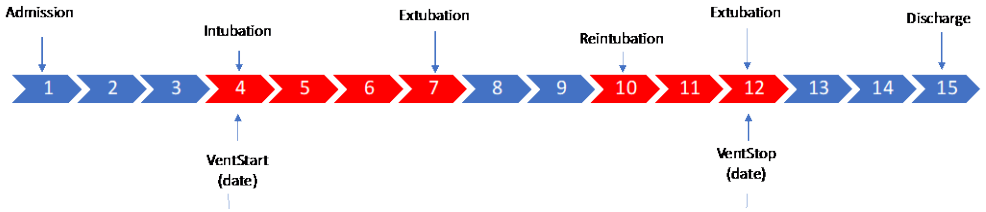




| Event Date | Event Type | Detail |
|---|---|---|
| 2020-05-04 | Start | Induction Medication |
| 2020-05-05 | Start | Induction Medication |
| 2020-05-05 | Start | NLP : “Patient was Intubated yesterday” |
| 2020-05-06 | On | NLP: “Patient remains Intubated” |
| 2020-05-06 | Start | Induction Medication |
| 2020-05-07 | On | NLP: “Pt is intubated and in a prone position” |
| 2020-05-07 | Stop | NLP: Patient was Extubated today |
| 2020-05-08 | Stop | Patient was extubated Yesterday |
| 2020-05-08 | Off | Patient was Intubated 05/04-05/08 |
| 2020-05-10 | Start | Pt reintubated |
| 2020-05-11 | On | Pt remains intubated |
| 2020-05-12 | Stop | He was successfully extubated |
| 2020-05-13 | Off | Pt was extubated yesterday |
| 2020-05-15 | Off | He is no longer intubated |
| 2020-05-15 | Stop | Discharge |

| Event Date | Event Type | Detail | SequenceLogic |
|---|---|---|---|
| 2020-05-04 | Start | Induction Medication | 1 |
| 2020-05-05 | Start | Induction Medication | 0 |
| 2020-05-05 | Start | NLP : “Patient was Intubated yesterday” | 0 |
| 2020-05-06 | On | NLP: “Patient remains Intubated” | 0 |
| 2020-05-06 | Start | Induction Medication | 0 |
| 2020-05-07 | On | NLP: “Pt is intubated and in a prone position” | 0 |
| 2020-05-07 | Stop | NLP: Patient was Extubated today | 1 |
| 2020-05-08 | Stop | Patient was extubated Yesterday | 0 |
| 2020-05-08 | Off | Patient was Intubated 05/04-05/08 | 0 |
| 2020-05-10 | Start | Pt reintubated | 1 |
| 2020-05-11 | On | Pt remains intubated | 0 |
| 2020-05-12 | Stop | He was successfully extubated | 1 |
| 2020-05-13 | Off | Pt was extubated yesterday | 0 |
| 2020-05-15 | Off | He is no longer intubated | 0 |
| 2020-05-15 | Stop | Discharge | 0 |



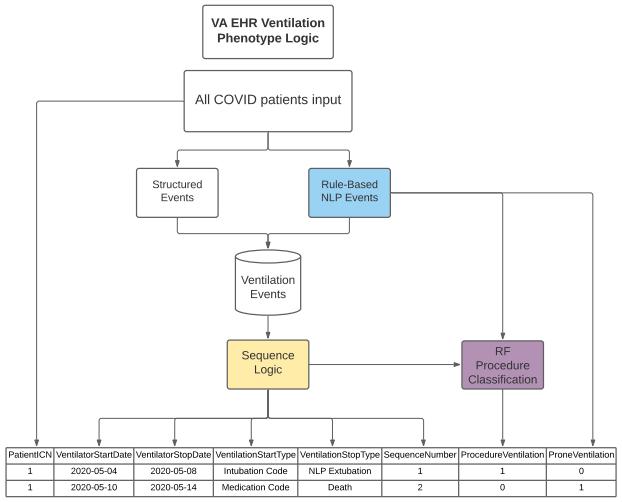
# Supplemental Ventilator Sequences




| Event Date | Event Type | Detail | SequenceLogic | |
|---|---|---|---|---|
| 2020-05-04 | Start | Induction Medication | 1 | Start |
| 2020-05-05 | Start | Induction Medication | 0 | |
| 2020-05-05 | Start | NLP : "Patient was Intubated yesterday" | 0 | |
| 2020-05-06 | On | NLP: "Patient remains Intubated" | 0 | |
| 2020-05-06 | Start | Induction Medication | 0 | |
| 2020-05-07 | On | NLP: "Pt is intubated and in a prone position" | 0 | |
| 2020-05-07 | Stop | NLP: Patient was Extubated today | 1 | Stop |
| 2020-05-08 | Stop | Patient was extubated Yesterday | 0 | |
| 2020-05-08 | Off | Patient was Intubated 05/04-05/08 | 0 | |
| 2020-05-10 | Start | Pt reintubated | 1 | Start |
| 2020-05-11 | On | Pt remains intubated | 0 | |
| 2020-05-12 | Stop | He was successfully extubated | 1 | Stop |
| 2020-05-13 | Off | Pt was extubated yesterday | 0 | |
| 2020-05-15 | Off | He is no longer intubated | 0 | |
| 2020-05-15 | Stop | Discharge | 0 | |

| PatientICN | VentilatorStartDate | VentilatorStartType | VentilatorStopDate | VentilatorStopType | SequenceNumber |
|---|---|---|---|---|---|
| 1 | 2020-05-04 | InductionMedication | 2020-05-07 | NLPDocumentDate | 1 |
| 1 | 2020-05-10 | NLPDocumentDate | 2020-05-12 | NLPDocumentDate | 2 |

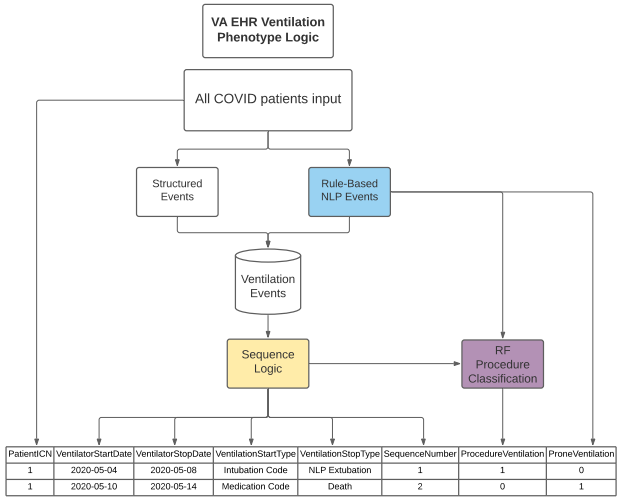
# More Sample Patients




| PatientICN | VentilatorStartDate | VentilatorStopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureVentilation | ProneVentilation |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 1 | 0 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | Death | 2 | 0 | 1 |

| Patient | Event Date | Event Type | Detail |
|---|---|---|---|
| 2 | 2020-07-06 | Start | Propofol INJ 10 mg |
| 2 | 2020-07-06 | Stop | IPT was extubated successfully |
| 2 | 2020-07-07 | Stop | Discharge |

| Patient | Event Date | Event Type | Detail |
|---|---|---|---|
| 3 | 2020-09-27 | Start | Intubation on 09/27 |
| 3 | 2020-07-06 | Stop | Extubation was successful |
| 3 | 2020-07-07 | Stop | Discharge |




| PatientICN | VentilatorStartDate | VentilatorStopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureVentilation | ProneVentilation |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 1 | 0 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | Death | 2 | 0 | 1 |

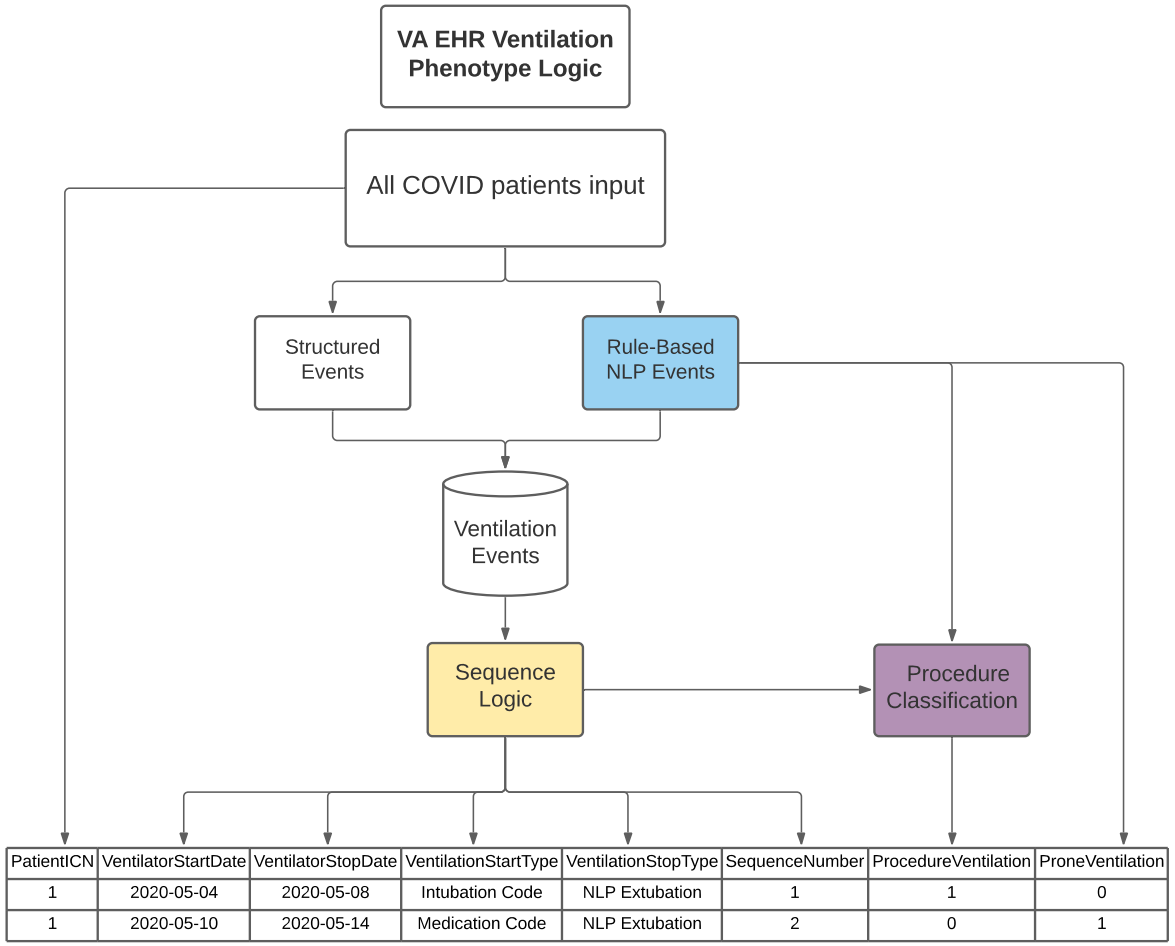
Hip disarticulation

| PatientICN | Event Date | Event Type | Detail |
|---|---|---|---|
| 2 | 2020-07-06 | Start | Propofol INJ 10 mg |
| 2 | 2020-07-06 | Stop | IPT was extubated successfully |
| 2 | 2020-07-07 | Stop | Discharge |

Coronary Artery Bypass

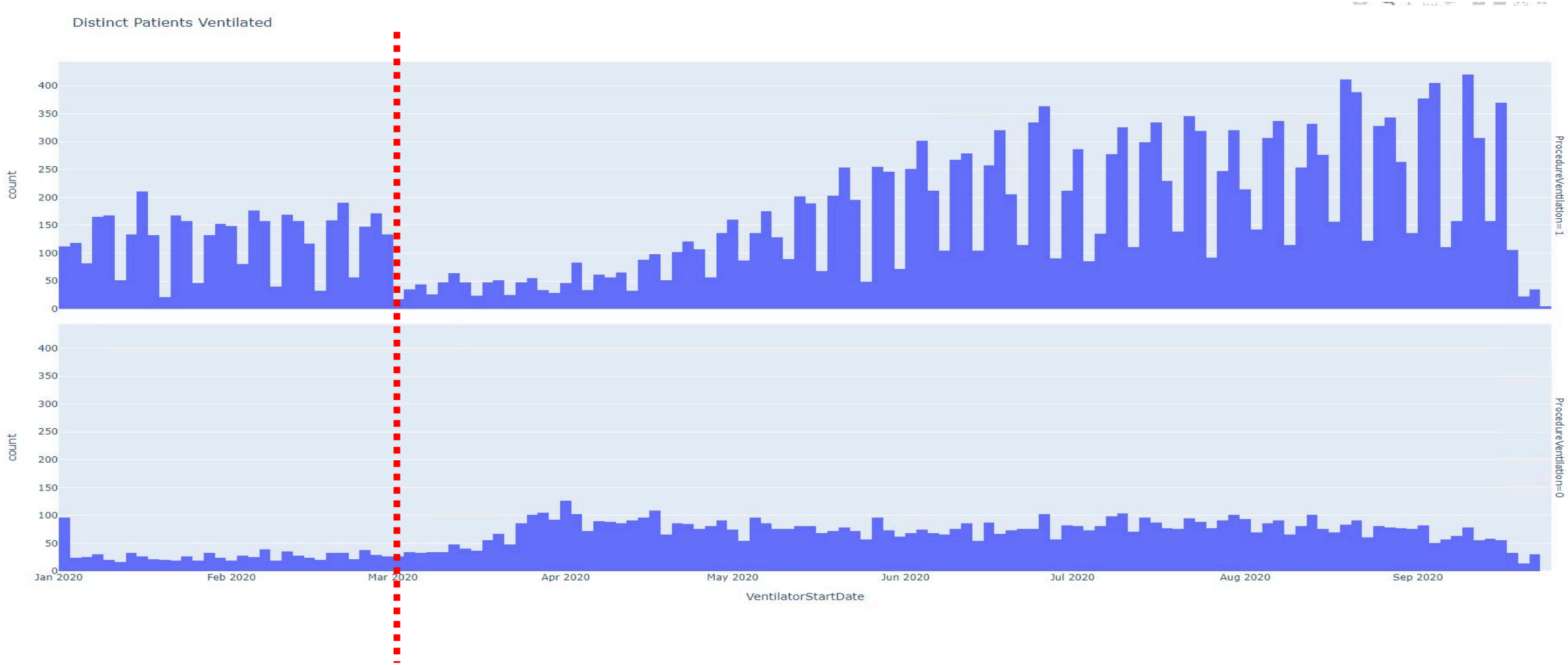
| PatientICN | Event Date | Event Type | Detail |
|---|---|---|---|
| 3 | 2020-09-27 | Start | “Intubation on 09/27” |
| 3 | 2020-09-27 | Stop | Extubation was successful |
| 3 | 2020-07-07 | Stop | Discharge |

# Procedure Classification

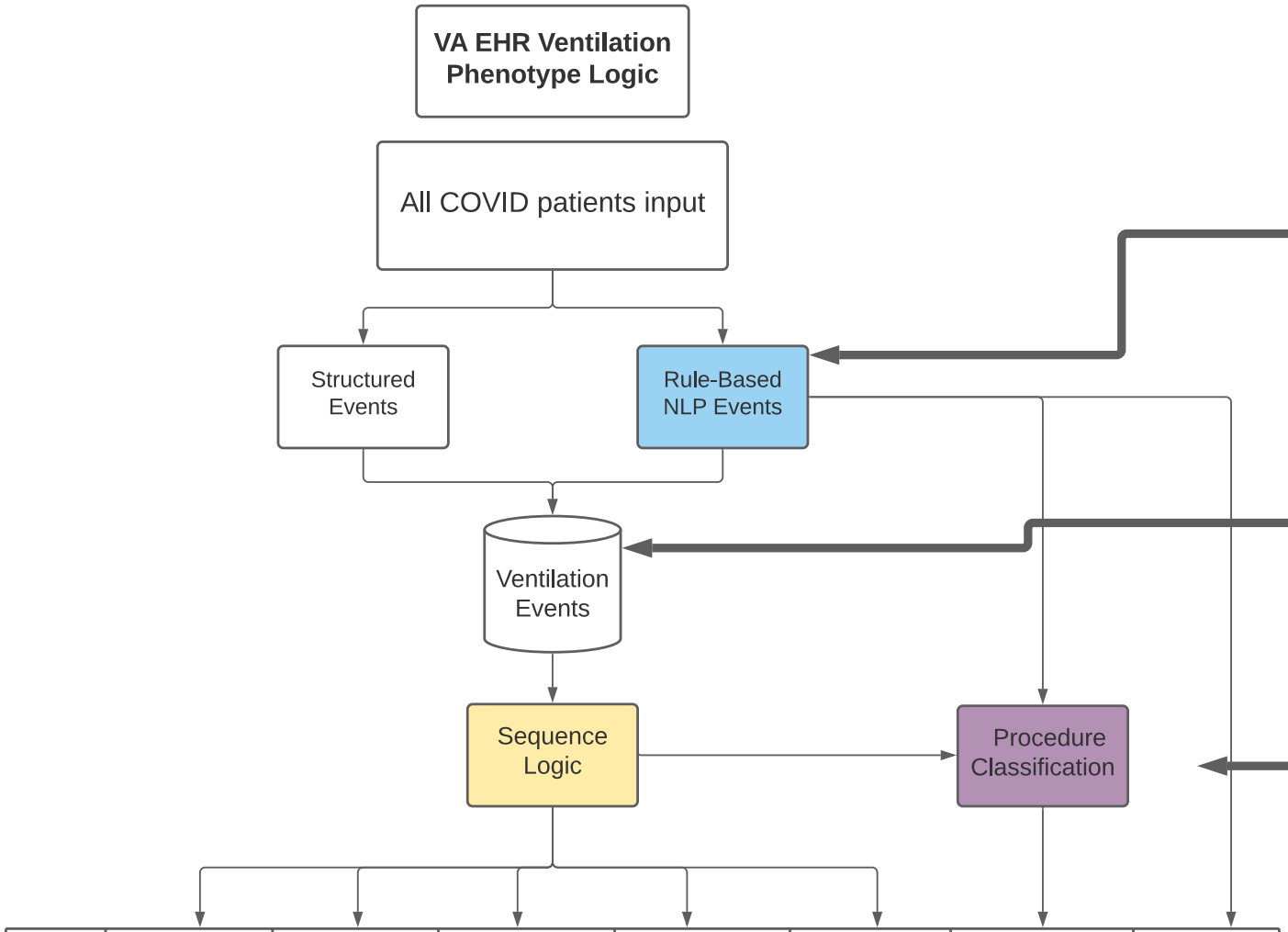



| PatientICN | VentilatorStartDate | VentilatorStopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureVentilation | ProneVentilation |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 1 | 0 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | NLP Extubation | 2 | 0 | 1 |

# Elective Procedure Intubations



# System Performance




| PatientICN | VentilatorStartDate | VentilatorStopDate | VentilationStartType | VentilationStopType | SequenceNumber | ProcedureVentilation | ProneVentilation |
|---|---|---|---|---|---|---|---|
| 1 | 2020-05-04 | 2020-05-08 | Intubation Code | NLP Extubation | 1 | 1 | 0 |
| 1 | 2020-05-10 | 2020-05-14 | Medication Code | NLP Extubation | 2 | 0 | 1 |

**Validation at Each Stage of Development**

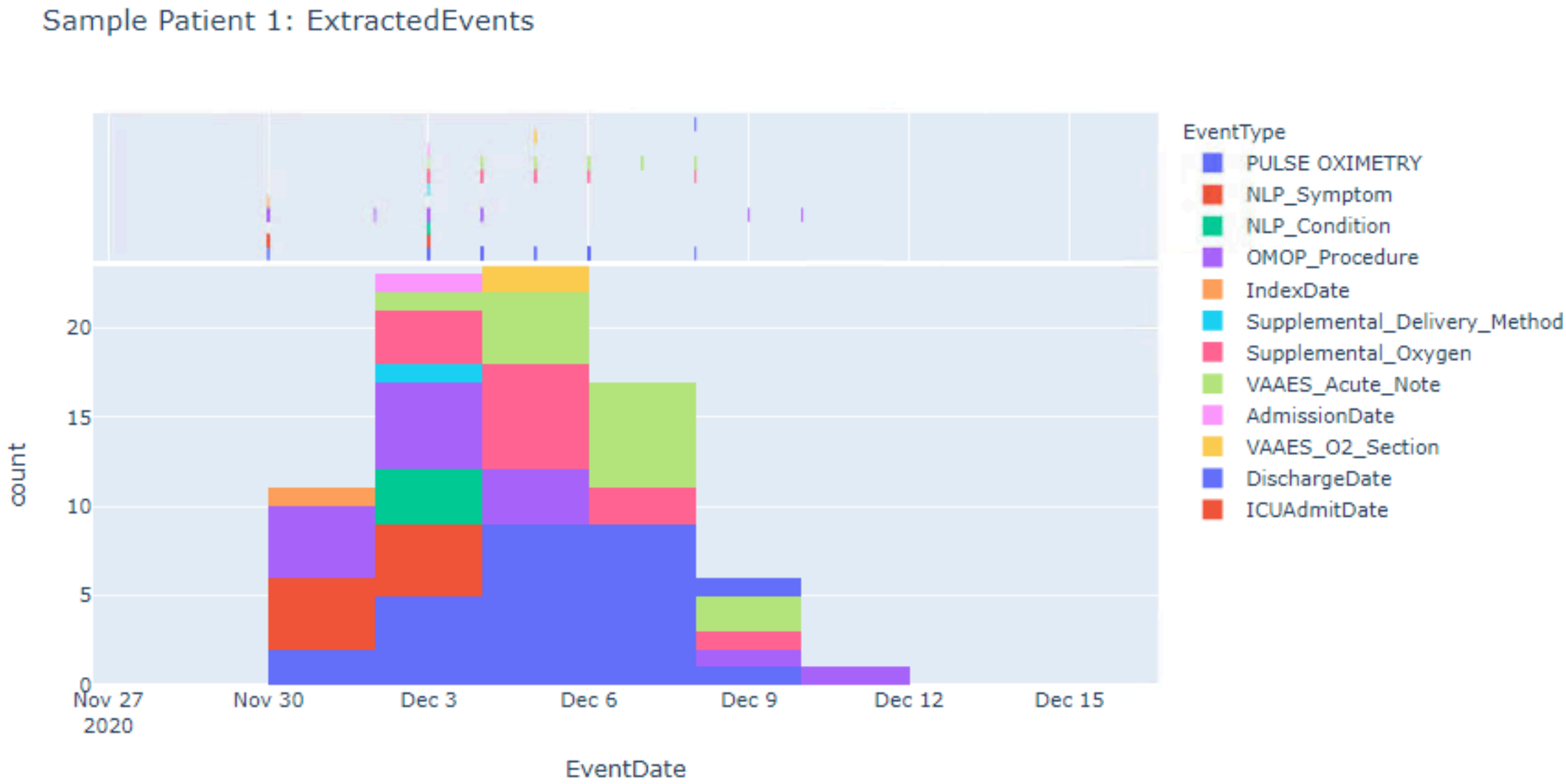
NLP Intubations: **96%** Precision
NLP Extubations: **97%** Precision

Identification of Ventilated Patients(Ever/Never)*:

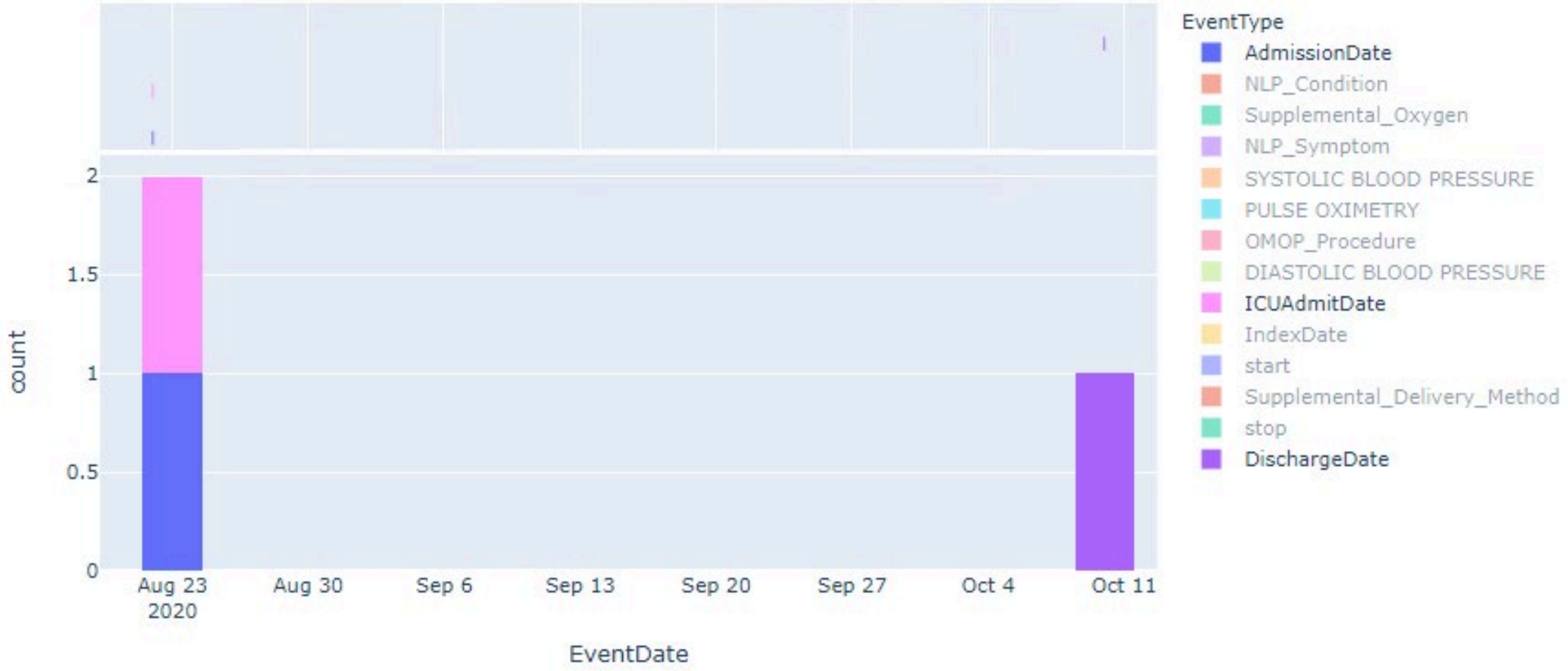
Accuracy: **94.4%**
PPV: **97.28**
Sensitivity: **93.46%****

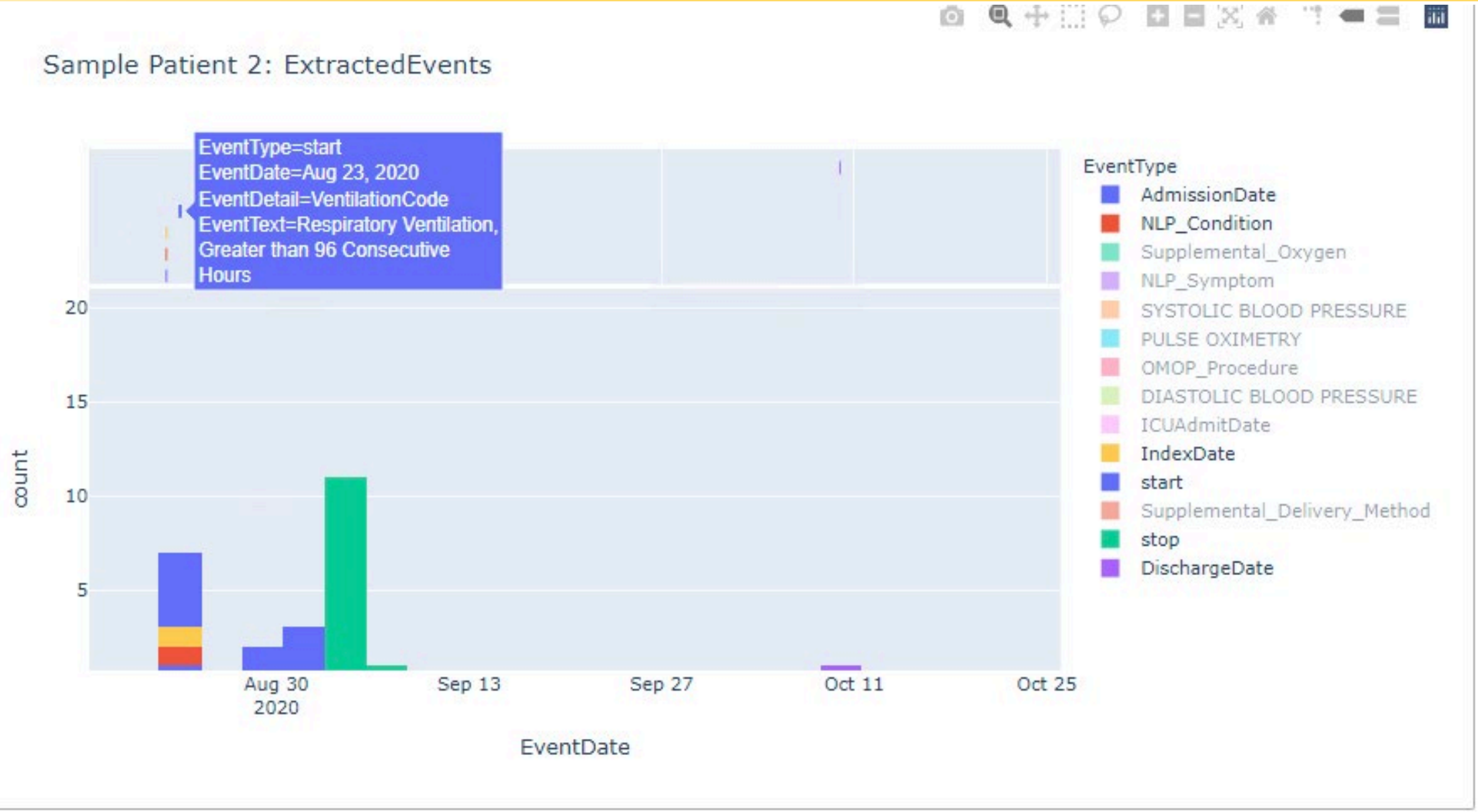
Classification of Elective Procedure Intubations:
**96% Precision**
**90% Recall**

# Bringing it all together

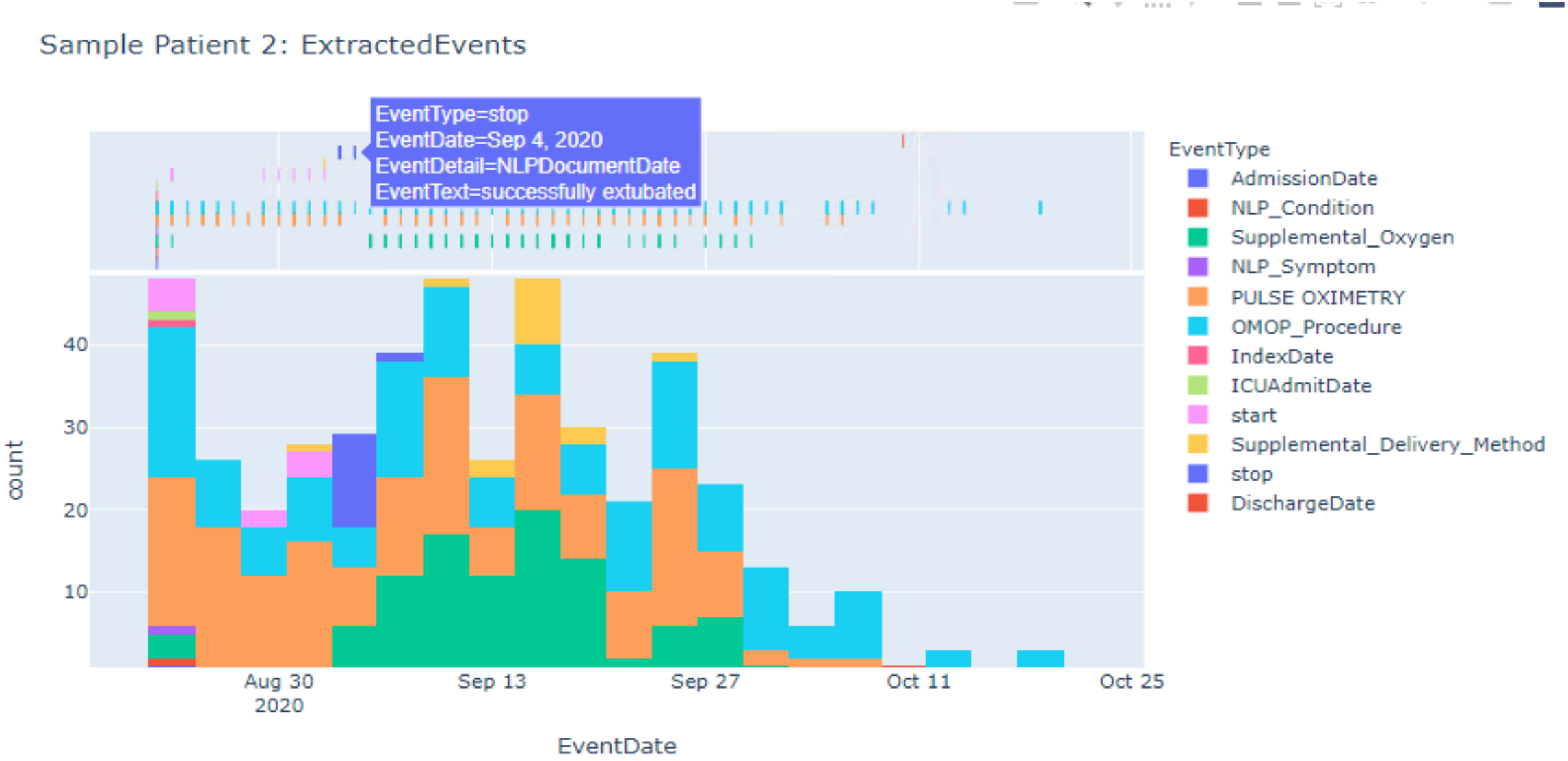


## Sample Patient 2: ExtractedEvents

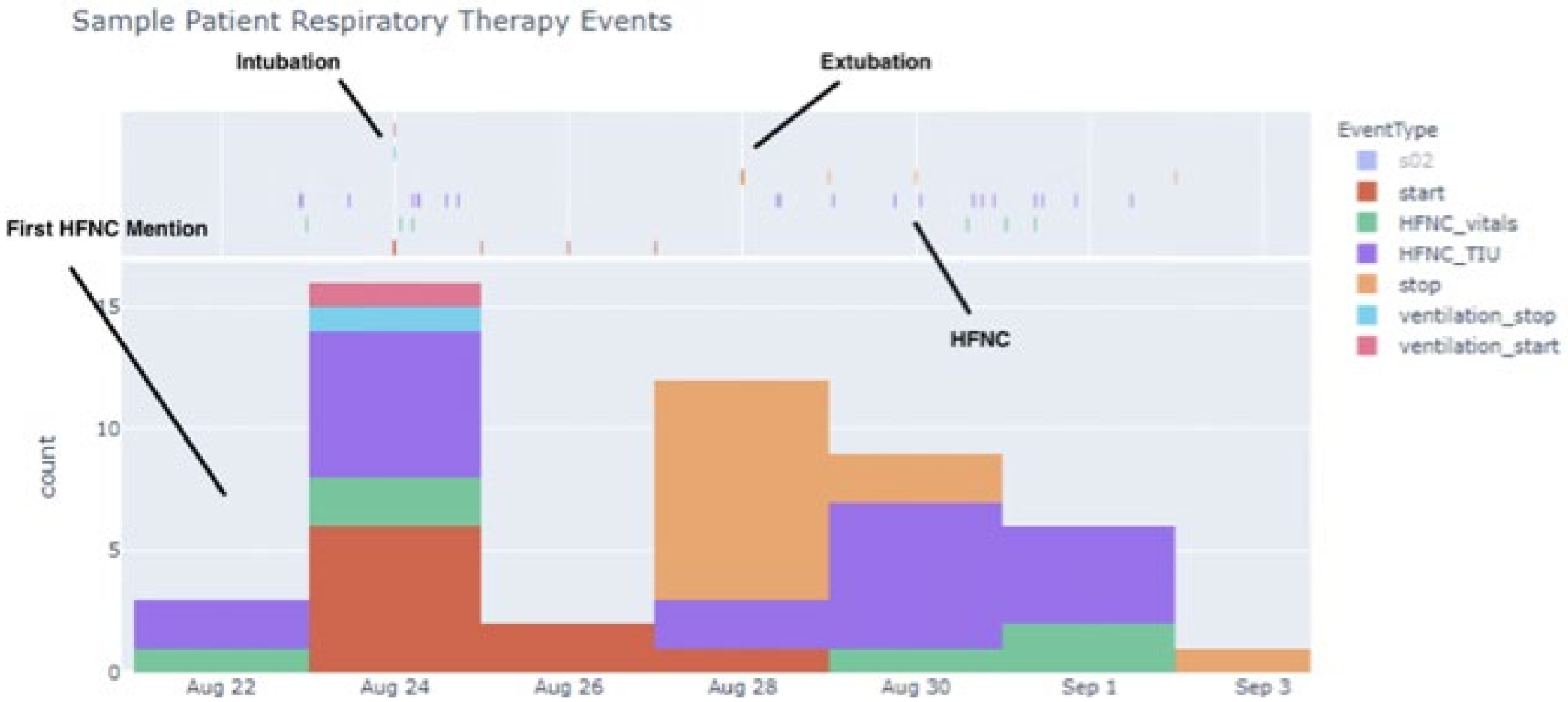



Sample Patient 2: ExtractedEvents
EventType=start
EventDate=Aug 23, 2020
EventDetail=VentilationCode
EventText=Respiratory Ventilation, Greater than 96 Consecutive Hours
Count
20
15
10
5
Aug 30
2020
Sep 13
Sep 27
Oct 11
Oct 25
EventDate
EventType
AdmissionDate
NLP_Condition
Supplemental_Oxygen
NLP_Symptom
SYSTOLIC BLOOD PRESSURE
PULSE OXIMETRY
OMOP_Procedure
DIASTOLIC BLOOD PRESSURE
ICUAdmitDate
IndexDate
start
Supplemental_Delivery_Method
stop
DischargeDate

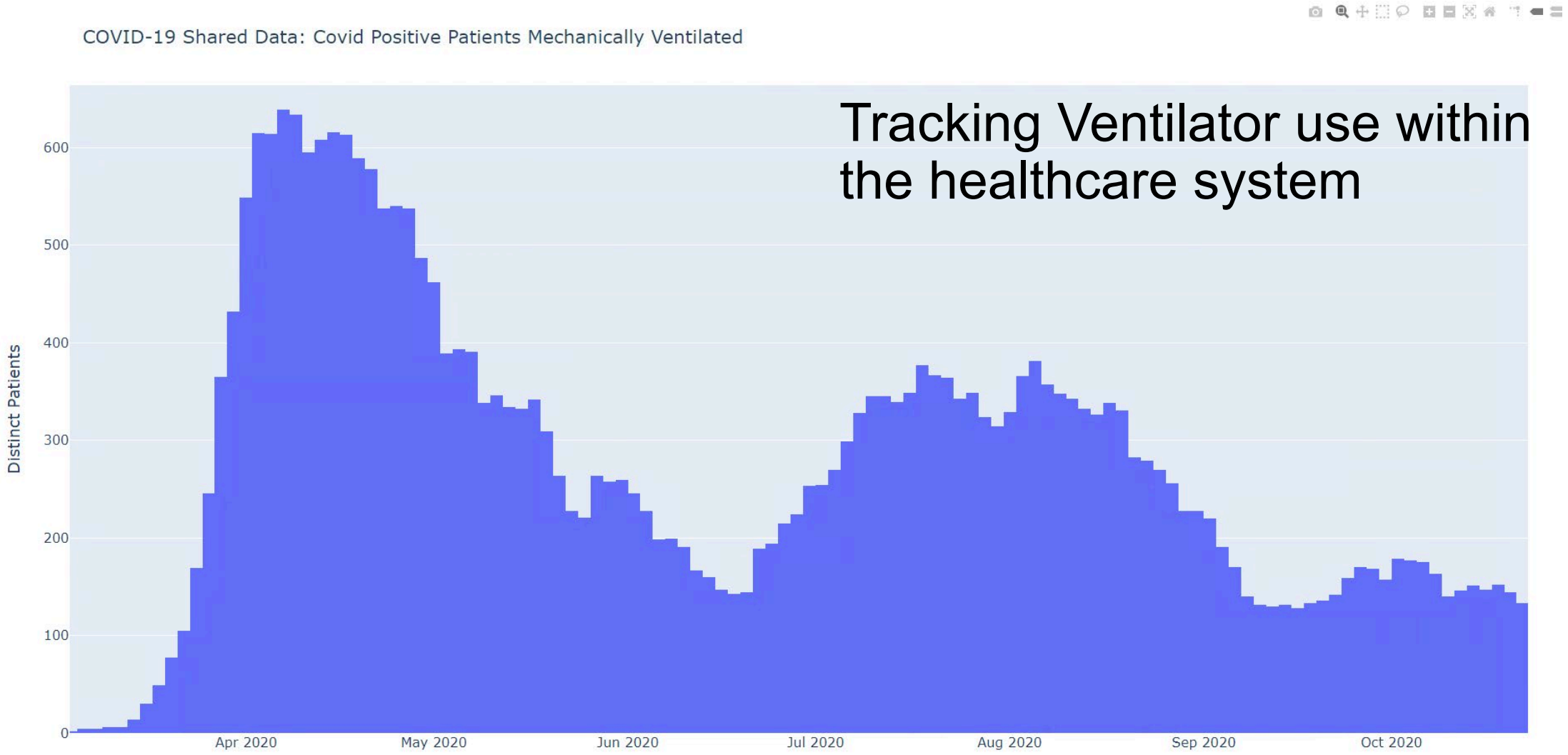
Sample Patient 2: ExtractedEvents
EventType=Supplemental_Oxygen
EventDate=Sep 14, 2020
EventDetail=5
EventText= Patient was found on nasal cannula 5 lpm without respir
count
20
15
10
5
Aug 30
2020
Sep 13
Sep 27
Oct 11
Oct 25
EventDate
EventType
AdmissionDate
NLP_Condition
Supplemental_Oxygen
NLP_Symptom
SYSTOLIC BLOOD PRESSURE
PULSE OXIMETRY
OMOP_Procedure
DIASTOLIC BLOOD PRESSURE
ICUAdmitDate
IndexDate
start
Supplemental_Delivery_Method
stop
DischargeDate


Sample Patient 2: ExtractedEvents
EventType=stop
EventDate=Sep 4, 2020
EventDetail=NLPDocumentDate
EventText=successfully extubated
count
40
30
20
10
Aug 30
2020
Sep 13
Sep 27
Oct 11
Oct 25
EventDate
EventType
AdmissionDate
NLP_Condition
Supplemental_Oxygen
NLP_Symptom
PULSE OXIMETRY
OMOP_Procedure
IndexDate
ICUAdmitDate
start
Supplemental_Delivery_Method
stop
DischargeDate

# Example Patient timeline



# How can we use this data:




Tracking Ventilator use within the healthcare system

# More Info, help, questions

- Additional Trainings and Cyberseminars:
  - Vinci Central
  - HSR&D Cyberseminars
    - Introduction to NLP
    - Introduction to the Covid-19 Shared resource

- Helpdesk: VINCI@va.gov