Real time COVID Command Center


Built with FHIR and Azure with EMR, ADT, HL7 and Workforce mgmt. data.

Solution Overview

2. Current capabilities include
   1. Interactive Surge Capacity Planning
   2. Community risk identifier (cohorts and patients)
   3. Real time Bed and Ventilator Capacity Tracking
3. Releasing soon
   1. Emergency Department census surge
4. Live in 48 hours, data resides with customer.
5. Pulls in data from EMR, HL7, workforce mgmt., ADT in a standard FHIR format. In Real time.
Surge Capacity Planning and Community Risk Management

Worldwide, and local, Daily COVID-19 Case Tracker [Link]

- Daily updates based on John Hopkins data
- Hosted publicly on PowerBI
Surge Planning for County / District and Care facilities

County: Lehigh

<table>
<thead>
<tr>
<th></th>
<th>Base</th>
<th>+ 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Census Day</td>
<td>May 4, 2020</td>
<td>May 5, 2020</td>
</tr>
<tr>
<td>Peak Census</td>
<td>667</td>
<td>867</td>
</tr>
<tr>
<td>Peak ICU Census</td>
<td>252</td>
<td>329</td>
</tr>
<tr>
<td>Peak Ventilation</td>
<td>185</td>
<td>240</td>
</tr>
<tr>
<td>Peak Arrivals</td>
<td>98</td>
<td>128</td>
</tr>
</tbody>
</table>

Overall Market Share Estimated: 25%

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Relative Share</th>
<th>Peak Census (Base)</th>
<th>Peak ICU Census (Base)</th>
<th>Peak Ventilation (Base)</th>
<th>Peak Arrivals (Base)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Luke’s Hospital - Allentown Campus</td>
<td>49%</td>
<td>327</td>
<td>123</td>
<td>91</td>
<td>48</td>
</tr>
<tr>
<td>St. Luke’s Hospital - Sacred Heart Campus</td>
<td>21%</td>
<td>140</td>
<td>53</td>
<td>39</td>
<td>21</td>
</tr>
<tr>
<td>St. Luke’s University Hospital - Bethlehem Campus</td>
<td>21%</td>
<td>140</td>
<td>53</td>
<td>39</td>
<td>21</td>
</tr>
<tr>
<td>St. Luke’s Hospital - Quakertown Campus</td>
<td>3%</td>
<td>20</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>St. Luke’s Hospital - Anderson Campus</td>
<td>3%</td>
<td>20</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>
Scenario planning for key resources based on growth rate

1. Scenario planning with capacity constraints
2. Peak Utilization impact on care facilities
3. Median Scenario based on % hospitalization

<table>
<thead>
<tr>
<th>KenSci Planner: COVID-19 Configuration Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select State</td>
</tr>
<tr>
<td>Select County</td>
</tr>
<tr>
<td>Hospitalization Percentage</td>
</tr>
<tr>
<td>ICU Percentage</td>
</tr>
<tr>
<td>Vent. Percentage</td>
</tr>
<tr>
<td>Average Hospital Length of Stay</td>
</tr>
<tr>
<td>Average ICU Length of Stay</td>
</tr>
<tr>
<td>Average Days on Vent.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Peak Census</th>
<th>Peak ICU Census</th>
<th>Peak Ventilation</th>
<th>Peak Arrivals</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Luke's Hospital - Allentown Campus</td>
<td>521</td>
<td>196</td>
<td>145</td>
<td>76</td>
</tr>
<tr>
<td>St. Luke's University Hospital - Bethlehem Campus</td>
<td>436</td>
<td>166</td>
<td>121</td>
<td>65</td>
</tr>
<tr>
<td>St. Luke's Hospital - Sacred Heart Campus</td>
<td>300</td>
<td>113</td>
<td>84</td>
<td>44</td>
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<tr>
<td>St. Luke's Hospital - Anderson Campus</td>
<td>241</td>
<td>91</td>
<td>67</td>
<td>36</td>
</tr>
<tr>
<td>St. Luke's Hospital - Warren Campus</td>
<td>176</td>
<td>67</td>
<td>49</td>
<td>25</td>
</tr>
<tr>
<td>St. Luke's Hospital - Miners Campus</td>
<td>175</td>
<td>66</td>
<td>48</td>
<td>26</td>
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<tr>
<td>St. Luke's Hospital - Monroe Campus</td>
<td>149</td>
<td>56</td>
<td>42</td>
<td>22</td>
</tr>
<tr>
<td>St. Luke's Hospital - Gnaden Huetten Campus</td>
<td>72</td>
<td>28</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Geisinger St. Luke's Orwigsburg Campus</td>
<td>56</td>
<td>21</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>St. Luke's Hospital - Quakertown Campus</td>
<td>20</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Base Case</th>
<th>+30% Hospitalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalization % (overall)</td>
<td>2.50%</td>
<td>3.25%</td>
</tr>
<tr>
<td>ICU % (overall)</td>
<td>0.75%</td>
<td>0.98%</td>
</tr>
<tr>
<td>Vent % (overall)</td>
<td>0.50%</td>
<td>0.65%</td>
</tr>
<tr>
<td>Average LOS</td>
<td>7.0 days</td>
<td>Same</td>
</tr>
<tr>
<td>Average ICU LOS</td>
<td>9.0 days</td>
<td>Same</td>
</tr>
<tr>
<td>Average Vent Days</td>
<td>10.0 days</td>
<td>Same</td>
</tr>
</tbody>
</table>
Community Risk Management

Population and Cohort Analyzer to identify members in the community that are at greatest risk for community acquired COVID-19, based on early literature (multiple comorbidities, age, etc.)

Risk Stratification and Outreach

Population and Cohort Analyzer to identify members in the community that are at greatest risk for community acquired COVID-19, based on prior history, comorbidity and SDOH.
Real Time Bed, Ventilator and Patient Tracking

COVID Command Center for Hospitals, By KenSci

Real Time Bed Management

Hospital capacity management through HL7 ADT and/or FHIR NRT alerting of hospital Census

Huddle Tool for Case Management and Discharge Planning

Real time views, based on EMR, labs, etc. of COVID cases to manage bed availability, personnel and discharge plans across multi hospital systems

Real Time Ventilator Tracking

Planning and Tracing Ventilators in use through real time HL7 ORM and OSU feeds, as well as EMR Flow sheets
Understand real-time capacity and discharge level metrics to quickly and effectively route patients to the right place.

- Rapidly make patient routing decisions based on real-time data of system-wide patient census, cohort and occupancy levels.
- HL7 ADT feeds blended in real-time providing you with the information you need at your fingertips.
- Multiple views and filters in an intuitive user interface with overall system views and the ability to drill into campus/unit views.

+ SMART on FHIR Census App

Real-time Mobile Command Center
Tracking patients intubated and Ventilators in use

**Real-Time Analytics during a time of crisis**

Ventilator shortages across health systems are providing unique challenges to hospital administrators.

The mobile app shows real time usage of ventilators using existing HL7 feeds.

1. For EMR’s where vent’s are a schedulable resource, the engine consumes SIU feeds
2. For EMR’s where vent’s are an ‘order’, the engine uses HL7 ORM and ORU
3. For EMR’s (like Epic Systems) where vents are tracked via a flowsheet, the engine extracts a custom feed

The resulting stream converts to the FHIR CDM and exposed to the app.

*prolonged usage > 20 days*
In patient COVID Tracker and Discharge planning
Used daily by case management workflow for discharge planning and bed management

Number of patients that are suspect to have COVID-19 based on simple NLP from Chief Complaint.
Can further move this out to include the following: Lab values, Vitals, Etc.

Number of patients where the SARS-COV-2 test was performed.
EMR ID neumonic

Number of patients where the SARS-COV-2 test was performed and result POSITIVE or ICD-10 in U07.1
Reference Architecture for Azure based FHIR infrastructure supporting Command center

- Data Ingestion Agent
- Runtime ML engine
- Data Preparation
- Model Development
- Model Production
- Integration
  - Microsoft Teams
  - Power BI
- Liquid Biology
- EMR
- Claims
- IOMT
- Streaming Data
- Azure Cloud Services
  - Active Directory
  - Key Vault
  - Blob
  - Relational
- KeyVault
- ActiveDirectory
- Relational
- Data Ingress
- ML Ops
- Pipeline Monitoring
- Model Explainability
- Model Experimentation
- Feature Bank
- Variation Analysis
- FHIR
- datalake
- Terraform
- Power BI
- GitHub
- Auth0
Azure Marketplace Offering [Link]

Blog Post [Link]

Contact Sunny@kensci.com or Stephav@Microsoft.com
Technical Requirements

Can be **deployed in 48 hours**, if the customer can provide:

1. Dedicated Azure Sub in Customer Tenant
2. 2 Service Principals & 2 Reg. Applications [Need AAD Global Admin to approve]
3. Deployment of following Azure Services:
   a. Azure SQL
   b. Azure Service Bus Namespace
   c. Azure Service Bus Topic
   d. Azure Functions
   e. Azure Kubernetes Services & Containers
   f. Azure DataBricks
   g. Azure Network Gateway
   h. Microsoft FHIR Service
   i. Azure Virtual Network
   j. Public IPs for Azure Services
   k. Azure Analysis Services
4. B2B access to KenSci DevOps team to install and operate the platform
5. Deployment of On Premise Services (Can be hosted in azure if network connectivity exists)
   a. Minimum 32GB of RAM, 6 Proc(s), RedHat / CentOS Linux 7.2 or Above; For
      windows, Server 2016 or above (VM ok)
      i. (Linux or Windows) Agent Ken Direct Connect Agent (EMR Data
         Warehouse Connector)
      ii. (Linux or Windows) Agent Ken Realtime Agent (HL7)
6. Access to EMR data to ingest into the KenSci Platform.
7. HL7 Feeds to support Mobile Command Center
   i. **HL7 Feeds MUST be compliant w/ HL7 specification for message version sent.** Currently, we support HL7 2.5, 2.6, 2.7 & 2.8.
   b. ADT Feed (w/ all hospital scoped feeds)
   c. Orders Feed (w/ outbound lab orders sufficient for identification of key lab orders)
   d. Results Feed (return resulted labs for targeted labs)
   e. Misc. Feed w/ Information on Travel Screenings (In epic, this is a flowsheet feed)
Thank you

Sunny Neogi. Chief Growth Officer. KenSci. sunny@kensci.com
