Validation of CORONA VIRUS Emergency Triage Tool (CorVETT) among adults in the emergency department of a low resource setting

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Abstract

Background:

In this study we aim to validate corona virus emergency triage tool (CorVETT) for accurate triaging and disposition in adults presenting to the emergency department with suspected corona virus symptoms.

Observational prospective cohort study conducted in the emergency department. Methodological framework of Transparent Reporting of multivariable prediction model for individual Prognosis and Diagnosis (TRIPOD) type I was adopted. Algorithm tested consists of four sequential stages; presenting features, vitals, associated features and high-risk conditions. Cumulative score of four stages categorizes patient as COVID or non-COVID and was assigned non isolation or isolation beds. Prediction model for presence of relevance (event) was obtained by dividing data into two parts; training (n = 450) and validation (n = 115). Probability of event was estimated using linear logistic regression with training data. Predictive capacity of model was assessed using a receiver operative curve (ROC) curve through set of validation data. The discriminative capacity was evaluated using area under curve (AUC), estimated by a 95% confidence interval. P-value less than 0.05 was considered statistically significant. The statistical analysis was performed on "R" (version 3.4.1, 2017) and Statistical Package for Social Science (SPSS, version 21.0, 2016).

Results:

595 patients were enrolled, 349 (59%) were male and 246 (41%) female. Mean age of study sample was 55.35 ± 17.08. Majority of patients were admitted in the emergency department isolation facility 412 (69%). The patients who were discharged from Emergency department (ED) with quarantine instructions were 183 (31%). 381(64%) of our patients were COVID 19 PCR positive and 214(36%) were negative. Out of 381 positive patients 238(62%) were males and 143(37%) females. The mean prediction score for CorVETT was 4.57 ± 3.12 with 5.91 ± 2.38 in COVID positive patients and 2.2 ± 2.86 in COVID negative patients with a p-value of <0.001. AUC of the tool was 0.819 (0.786 to 0.849) with p-value <0.001. Sensitivity was 86.61 (82.8 to 89.9) and specificity 71.96 (65.4 to 77.9) with a LR of 3.09 (2.5 to 3.8).

Conclusion:

Corona virus emergency triage tool was accurate as a screening triage tool and subsequent disposition in the emergency department.

Background:

The COVID 19 pandemic and its ongoing effect on overburdening healthcare system of developing countries places considerable strain on the emergency departments (ED)(1). The disease with its high transmission rate has the potential to weaken our already fragile healthcare systems(2). ED are acting as front line in this pandemic and can play a pivotal role by appropriately triaging suspected COVID patients.
Further, ED role in this pandemic has been to evaluate risk of adverse outcomes and need for critical interventions, appropriate disposition to isolation and non-isolation beds and using data to make accurate decisions around admission to hospital or outpatient management (3). Additionally, problem is considerable in dealing with suspected or unsuspected cases where mandatory testing may place additional burden on both patient and family as healthcare is borne by the family in our country (4). Stratification of critical vs non-critical COVID 19 positive and negative 19 patients has been a challenge as inaccurate triaging may pose risk to patients who don't have the virus in contracting it (5). COVID 19 triage tools used in ED are based either on a score, which assign points to predictors to stipulate risk of adverse outcome, or a rule, which utilizes risk predictors to come to a decision of discharge or hospital admission (5–7). Disease characteristics and severity is markedly different among children and adults in terms of adverse outcomes and in-hospital admission (8). The increasing burden of adult patients with COVID symptoms and due to severity of illness, we focused on an adult COVID emergency triage tool in this study.

Two currently available tools are: the World Health Organization (WHO) COVID decision making algorithm that recommends admission for severe pneumonia, and the National Institute of Health Care and Excellence (NICE) suggests National Early Warning Score 2 (NEWS2) for predicting severity of disease with good sensitivity but poor specificity (5). Tools that were developed during the influenza pandemic can be adapted for the ED triage protocol but they have not been validated in our setting and they do not share their approach on accurate disposition to isolation beds (5). The Pandemic Modified Early Warning Score (PMEWS) utilizes physiological variables but is not based on screening of symptoms, risk factors and history. The Pandemic Respiratory Infection Emergency System Triage (PRIEST) tool assess severity of COVID at triage but not catering risk stratification which is a major issue in low resource settings with limited hospital isolation beds (5). In this paper we describe Corona Virus Emergency Triage Tool (CorVETT), an algorithm-based approach with primary objective to correctly allocate suspected COVID 19 patients in timely manner within busy emergency departments to isolation areas to prevent cross contamination.

COVID 19 being a relatively new disease with high fatality and transmissibility, needs a tool to help predict disease early, so that patients can be isolated quickly to prevent its transmission and then have treatment initiated. The primary objective of this study was therefore to validate CorVETT in adult patients presenting with suspected COVID 19 characteristics and positive COVID 19 nasopharyngeal PCR. Our secondary objective was to predict CorVETT in accurate disposition to Respiratory and Non-respiratory COVID 19 unit from triage.

**Results:**

A total of 595 participants with suspected COVID-19, admitted from the ED were included in the study. Of those, 349 (58.7%) were male and 246 (41.3%) females. The mean age was $55.35 \pm 17.08$ (range 19–96 yrs.), with majority 427 (71.7%) between 36–75 years. Average prediction score of CorVETT was $4.57 \pm 3.12$. The mean triage vitals were systolic blood pressure, $129.8 \pm 21.43$ mmHg, respiratory rate $24.94 \pm$
8.36 breaths per minute, oxygen saturation 89.02 ± 10.33% and heart rate 89.61 ± 21.74 beats per minute respectively. Amongst those enrolled, 203 (34%) were of P1 category (this P1 category is given to patients at the time of triaging who require immediate attention due to life or limb threatening findings, and this is as per the Emergency Severity index- [ESI] triage tool used in triaging patients in the emergency department). Fever and cough were the commonest major symptoms identified. In terms of risk stratification with one, two or more components along with associated features, 117(70%) patients had respiratory distress and 208(62%) had diabetes in their high-risk profile. Nasopharyngeal PCR for COVID 19 was positive in 381 and negative in 214. Of those who were COVID 19 positive, 183(30%) were discharged with quarantine instructions and majority 412(69%) were admitted either in ED Respiratory Covid Unit (RCU) or in hospital isolation beds (see Table No. 1). There was an association between CorVETT and high-risk conditions and related features as shown in Table No. 2.

Out of 595 patients 335 (56%) were from high risk profile. Patients who suffered from high-risk conditions had positive COVID 19 PCR results. High risk conditions include asthma, Chronic Obstructive Pulmonary disease (COPD), interstitial lung disease (ILD), chronic bronchitis, heart disease, obesity, malignancy, neurocognitive or neuromuscular diseases and immunocompromised disease states showing an association with COVID 19 positive results. 17(7.9%) of the COVID 19 patients were significantly associated with chest pain (p value 0.015). The accuracy of physician clinical judgement using CorVETT in identifying COVID 19 patients demonstrated an AUC of 0.819 (95% CI 0.786 to 0.849, p value < 0.001) as shown in Fig. 1. A significant association was found between CorVETT and prediction of COVID 19 with a very high discriminative power. CorVETT score > 4 was related with good outcome (in identifying Covid19 positive patients correctly) with a sensitivity of 86.6% (CI 82.8–89.9), specificity 71.96% (CI 65.4–77.9) and an AUC of 0.819. The CorVETT shows a likelihood ratio (LR+) of 3.09, for Covid-19 positive patients Figure-2.

The COVID 19 positive results were more common in males (62.5%) compared to females (37.5%), OR 1.54 (1.10–2.16) p = 0.012. In presenting symptoms fever had 3.74 [95% C.I 2.61–5.35] times higher association with Covid-19 positive rate of 76.6% vs. 46.7%, p-value < 0.001* Table No. 3. Patients in young or middle age were found to be less COVID 19 positive compared to elderly OR 0.30 [95% C.I 0.16–0.56], p-value < 0.001. We also found that household contacts of a confirmed COVID-19 patient, regardless of symptoms, had a significant risk of 6.49 [1.51–27.9] to develop Covid-19 compared to others (p value = 0.004). Patients admitted to hospital with unexplained pneumonia were found to be associated with Covid-19 pneumonia with an OR of 0.43 [0.20–1.64], p = 0.027. Covid-19 was significantly different by triage category and ER disposition status (69.2% vs.30.8%, p-value = 0.013) for COVID and non- COVID patients.

**Discussion:**

There are no standardized COVID triage systems and protocols focusing on ED prognostication of COVID 19 patients in Pakistan. CorVETT provides a standardized approach for evaluating patients in the ED or other clinical settings. Our tool was sensitive enough to accurately screen suspected respiratory and non-
respiratory COVID 19 adult patients. It has shown to be both sensitive and specific in early identification of suspected COVID 19 patients and their subsequent disposition to the Respiratory COVID Unit (RCU), our ED’s isolation facility. The tool helps in having a planned approach during this pandemic in dealing with patients at the level of triage. Accurate triaging and appropriate allocation of limited resources are essential components as a coordinated response to the pandemic. The tool also offers feasibility to healthcare staff by its simplicity and relevance to the population where it is developed.

Males were in the majority for COVID 19 positive results, in accordance with some other studies (1, 4, 8). This may be due to their risk of contracting the virus at the workplace or during travel. Majority of our study participants were in the high risk profile which is expected given the higher likelihood of their immunocompromised state making them more susceptible to the virus. Our findings are similar to those from studies in other countries (9–11). Similarly, patients in their younger or middle age had less risks of contracting the virus or developing symptoms. This might be due to their strong immune system as shown in other studies in which prevalence of infection was less in the young and middle age group(10, 11). The tool provided a sensible approach of using PPE during the pandemic which was sparse and not readily available in most hospitals. The tool is currently used in one of the largest tertiary care hospitals of the city, serving as a standardized triage tool for the ED. Our algorithm is validated in our ED population. ED’s of lower middle income countries (LMICs) due to rapid influx and fragile healthcare systems may suffer numerous pitfalls like poor triaging, mixing of non-COVID 19 patients with COVID 19 patients, and overuse of personal protective equipment’s (PPEs) (12, 13), to name just a few. Our algorithm is comprehensive as it utilizes variables gathered from published literature as well as our own local practice. It is not meant to replace clinical gestalt and medical decision making but to augment it. As the disease is evolving, symptom presentation is therefore nonuniform, creating difficulty for healthcare staff in doing a good triage. We still recommend that emergency room physicians should follow strict airborne and contact precautions in this pandemic at the triage.

Majority of the COVID triaging tools that are in use are from developed countries; they do not give enough consideration to risk factors and healthcare dynamics, an issue that is more prevalent in low resource settings (3, 5, 14). Additionally, the tools rely mostly on laboratory and radiologic findings which make it difficult for the triage staff due to time constraints and overcrowding, a common occurrence during the pandemic(12). Our study results suggest that CorVETT provides good sensitivity and specificity compared to WHO algorithm or PMEWS (Sensitivity 80% and specificity 95% for PMEWS ≥ 5)(15) and makes it a good current pandemic ED triaging tool.

Limitations:

A major limitation of our study is that it is from just a single healthcare organization, and thus it might miss some of the other presentation characteristics of COVID 19 in adults. Another limitation is that the data was collected on a predefined form and assessment was done by triage nurses; this may have led to lack of important historical and clinical features that clinicians may be better at picking up, hence leading to a lower estimation of the performance of our triage tool. Further, our tool may be too lengthy, placing
additional burden on the triage staff, and possibly resulting in over-crowding in a busy ED. However, considering its impact on prevention through early screening and appropriate disposition, CorVETT may prove beneficial in additional studies enrolling more patients in different EDs across the city and country.

**Conclusion:**

CorVETT was designed to facilitate timely evaluation of suspected COVID-19 in a step wise approach that optimizes the triage process, lessens unnecessary clinical exposure, and improves patient care and resource allocation in EDs of LMICs. With good sensitivity and specificity, the tool is likely to facilitate ED teams of low resource settings in their response to the ongoing pandemic.

**Methods:**

**Study Design and Site:**

This was a cohort study conducted in the emergency department of Aga Khan University Hospital, which is a 550 bedded large tertiary care teaching facility located in Karachi, Pakistan. The ED is a 62-bedded facility that receives 60,000 patients annually. In the COVID 19 pandemic we divided our ED into two major areas; COVID and non-COVID. The COVID area was further stratified into respiratory and non-respiratory unit based on patients requiring interventions like high flow oxygen, nebulization, noninvasive or invasive mechanical ventilation. The Clinical Decision Unit (CDU), an eight-bedded unit was modified into negative pressure unit specifically for suspected COVID patients having respiratory symptoms and named as RCU. The study was conducted and reported in accordance with TRIPOD recommendations(16). The type of prediction model study that was used for this study was type 1 as per the TRIPOD statement in which same data is used for validation and evaluation of performance(16).

**Participants (inclusion & exclusion criteria)**

**Inclusion Criteria:**

All adults (age 18 years and above) presenting to the emergency department filter triage and were admitted with suspected COVID-19 in the emergency department and subsequently in the hospital will be included.

**Exclusion Criteria:**

Patients who are directly admitted in ward and are tested positive prior to presentation /in the emergency department from test done either from AKU or outside.

**Sampling Method:**

Convenience (Non-probability) Sampling

**Sample Size:**
With 95% confidence interval, and 4% margin of error, a minimum of \( n = 585 \) assigned patients with suspected COVID 19 patients admitted from Emergency department. Sample size for the study, based on AUC, was calculated using method define by Hajian-Tilaki K et al\(^{(17)}\). Using Microsoft Excel. Formula using for the sample size calculation is as below;

\[
\frac{Z^2}{\left(1 - \frac{\alpha}{2}\right) V \left(\hat{AUC}\right)} \frac{1}{\epsilon^2} \leq n = (1 + d)
\]

Where, \( V \left(\hat{AUC}\right) = \left(0.0099e^{-\frac{\alpha^2}{2}}\right)(6\varnothing^2 + 16) \) and \( \varnothing = 1.414Z_{AUC} \)

Data Collection:

Data collection was done after following the Standard Operating Procedures which our ED and hospital adopted for conducting research during these special circumstances. A standardized data collection form was developed that included predictor variables incorporated into our triage tool. The data collection form was pilot tested on 10 participants before actual data collection was started. Information about study was provided to ED staff prior to start of the data collection. The data was collected at filter triage that was an area restructured during pandemic to screen patients at triage before being either transferred to normal triage or direct transfer to RCU. The patients at triage were given a unique serial number to prevent those with multiple presentations from being included more than once. The study received Institutional Review Board approval (ERC 2020-5222-11403).

The CorVETT Algorithm:

The CorVETT tool consists of four sequential steps: presenting features, vitals, associated features (chest pain, cyanosis, respiratory distress, coma or convulsions) and high-risk conditions, as shown in Figure-1. The score was developed based on above variables and categorized by assigning a number to each variable in presenting complaint, a minimum score of two was needed to get a score of four. Similarly, in associated features a score of two is given to a single associated feature. In high-risk conditions a score of six was given for three or more characteristics. The overall score ranges from zero to 10 with 10 being the highest score. Validity and discriminate parameter for CorVETT calculated include sensitivity, specificity, positive and negative predictive value or related proportions for over and under triage. Sensitivity of the tool was calculated to correctly identify patients with COVID 19 infection and percentage/proportion for individuals to get admission in RCU or in-hospital isolation facility. Specificity was calculated to identify patients which the tool could correctly classify as not needing admission and owing to low triage priority. Additionally, positive predictive value (PPV) was calculated for patients admitted to hospital and those who were triaged to high importance. Negative predictive value (NPV) was calculated for those not admitted to hospital and triaged to low priority.

Statistical Analysis:
Qualitative variables were reported as means with standard deviation (SD) or medians with Interquartile Range (IQR) and categorical variables as frequencies and percentages. Mean (SD) or median (IQR) differences in scores were assessed by paired t-test or Wilcoxon signed rank test. Significant difference of continuous outcomes with normal distribution was compared using t-test or Mann-Whitney U test as appropriate. The probability of event was estimated using linear logistic regression. Selection of variables was based on complete enumeration algorithm and Akaike Information Criteria (AIC). It was assumed that the optimal model is one that minimizes AIC value. The model obtained was summarized in coefficients and standard errors (SE). AIC values resulting from suppression of variable and odds ratio (OR) was estimated using 95% confidence intervals. In order to evaluate predictive capacity of the model, a ROC analysis was carried out using set of validation data. The discriminating capacity was evaluated using ROC curve AUC estimation by a 95% confidence interval. It was considered as a point of optimal cut that minimizes the function: (1-sensitivity) 2+ (1-specificity) 2. Finally, for predictive rule the parameters of sensitivity, specificity and predictive values were estimated through confidence intervals of 95%. A hypothesis contrast was considered statistically significant when corresponding p-value was less than 0.05. Data was analyzed on “R” (version 3.42, 2017) and Statistical Package for Social Sciences (SPSS, version 21.0, 2016).

**Abbreviations**

CorVETT  
corona virus emergency triage tool  
TRIPOD  
Transparent Reporting of multivariable prediction model for individual Prognosis and Diagnosis  
AUC  
Area under curve  
ED  
Emergency Department  
WHO  
World Health Organization  
NICE  
National Institute of Health Care and Excellence  
NEWS2  
National Early Warning Score 2  
PMEWS  
Pandemic Modified Early Warning Score  
PRIEST  
Pandemic Respiratory Infection Emergency System Triage  
ESI  
Emergency severity index  
RCU
Declarations

- Ethics approval and consent to participate

- The study received Institutional Review Board approval (ERC 2020-5222-11403). As there was no direct intervention in patient's management, consent exemption was also approved. Ethical review committee of the AgaKhan University hospital Karachi.

- The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

- Consent for publication

- The study was reviewed by the Ethical Review Committee of the AgaKhan University Hospital and was approved as an exemption. (letter attached in related files)

- Availability of data and materials

- All data generated or analysed during this study are included in this published article [and its supplementary information files].

- Competing interests
  - No competing interests to declare

- Funding
  - Not applicable

- Authors' contributions
  - SW has contributed to the conception, design of the work, have drafted the work & substantively revised it
  - NNK has contributed in design of the work, data collection, have drafted the work or substantively revised it
AR has done acquisition, analysis, and interpretation of data.
BA has substantively revised it
AIM has drafted the work & substantively revised it
All authors read and approved the final manuscript.

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Tables

Table 1: Demographics and other baseline characteristics of patients
| Characteristics                      | Total (n = 595) |
|--------------------------------------|---------------|
| **Gender**                           |               |
| Male                                 | 58.7% (349)   |
| Female                               | 41.3% (246)   |
| **Age (Years)**                      |               |
| Mean ± SD                            | 55.35 ± 17.08 (19- 96) |
| **Age Groups**                       |               |
| 19-35 Years                          | 114 ( 19) (95% C.I: 16-23) |
| 36-55 Years                          | 207 ( 35) (95% C.I: 31-39) |
| 56-75 Years                          | 220 ( 37) (95% C.I: 33-41) |
| >75 Years                            | 54 ( 9) (95% C.I: 7-12) |
| **Prediction Score of Conventt**     |               |
| Mean ± SD                            | 4.57 ± 3.12   |
| **Triage Vitals**                    |               |
| Blood Pressure                       | 129.8 ± 21.43 (50- 200) |
| Respiratory rate                     | 24.94 ± 8.36 (10- 118) |
| Oxygen saturation                    | 89.02 ± 10.33 (33- 100) |
| Heart Rate                           | 89.61 ± 21.74 (46- 220) |
| **GCS (Mean ± SD)**                  | 14.5 ± 1.84 (3- 16) |
| **Triage Category**                  |               |
| P1                                   | 203 ( 34) (95% C.I: 30-38) |
|   |   |   |
|---|---|---|
| P2 | 157 (26) | (95% C.I: 23-30) |
| P3 | 117 (20) | (95% C.I: 17-23) |
| P4 | 75 (13) | (95% C.I: 10-16) |
| P5 | 43 (7) | (95% C.I: 5-10) |

**Disposition**

|   |   |   |
|---|---|---|
| Admit in ED in covid19 isolation | 412 (69) | (95% C.I: 65-73) |
| Discharge home with isolation/quarantine | 183 (31) | (95% C.I: 27-35) |

**Test Results**

|   |   |   |
|---|---|---|
| Positive | 381 (64) | (95% C.I: 60-68) |
| Negative | 214 (36) | (95% C.I: 32-40) |

**Major Symptoms**

|   |   |   |
|---|---|---|
| Fever | 392 (66) | (95% C.I: 62-69) |
| Cough | 273 (46) | (95% C.I: 42-50) |
| Shortness of Breath | 319 (54) | (95% C.I: 50-58) |
| Sore throat flu like symptoms | 84 (14) | (95% C.I: 12-17) |
| Generalized weakness | 183 (31) | (95% C.I: 27-35) |

**Risk Stratification**

|   |   |   |
|---|---|---|
| Close contact with lab confirmed or suspected COVID (15 min face to face within 1m) | 42 (7) | (95% C.I: 5-9) |
| Description                                                                 | Count (Percentage) | CI: 95%                        |
|----------------------------------------------------------------------------|--------------------|--------------------------------|
| Healthcare worker involved in direct care of Covid-19 patient OR patient with pneumonia of unknown aetiology/ HCW involved in ED and outpatient | 33 (6)             | 4-8                            |
| History of in international, intercity Travel/ Frequent use of public transport, household contact with intercity/ international traveller. | 22 (4)             | 2-6                            |
| Engaged in Public dealings / General Physicians                             | 15 (3)             | 1-4                            |
| Domestic Staff (Labour/ maids) contact                                      | 1 (0)              | 0-1                            |
| Participated in congregations, resident of nursing home                     | 13 (2)             | 1-4                            |
| Patients admitted to the hospital with unexplained pneumonia or respiratory failure (regardless of other risk factors) | 29 (5)             | 3-7                            |
| Household contacts of a confirmed COVID-19 patient, regardless of symptoms  | 24 (4)             | 3-6                            |

**Associated Features**

| Description               | Count (Percentage) | CI: 95%                        |
|---------------------------|--------------------|--------------------------------|
| Chest Pain                | 30 (18)            | 15-21                          |
| Coma/ Convulsion          | 48 (29)            | 25-32                          |
| Respiratory Distress      | 117 (70)           | 66-73                          |
| Total                     | 168 (100)          | 0-0                            |

**High Risk Conditions**

| Description                                                                 | Count (Percentage) | CI: 95%                        |
|----------------------------------------------------------------------------|--------------------|--------------------------------|
| Asthma, COPD, Interstitial Lung Disease (ILD), Chronic Bronchitis, On home oxygen | 62 (19)            | 15-22                          |
| Heart Disease (Congenital/Acquired) or Congestive Heart Failure (CHF)       | 72 (22)            | 18-25                          |
| Diabetes                    | 208 (62)           | 58-66                          |
| Pregnant or recently pregnant (2 weeks)                                    | 3 (1)              | 0-2                            |
| Morbidly Obese              | 3 (1)              | 0-2                            |
| Organ Transplant Recipient   | 4 (1)              | 0-2                            |
| Renal Dialysis or chronic kidney disease                                   | 51 (15)            | 95%                            |
| Comorbidity                                      | Positive Cases | Percentage | 95% CI |
|------------------------------------------------|----------------|------------|--------|
| Malignancy (Receiving Chemotherapy or radiation in past 30 days) | 52 (16)     | (95%)      | 12-18 |
| Chronic Liver Disease                          | 11 (3)       | (95%)      | 2-5   |
| Blood Disorders (Blood thinners, Sickle Cell disease) | 7 (2)        | (95%)      | 1-3   |
| Neurocognitive and/or neuromuscular disease    | 16 (5)       | (95%)      | 3-7   |
| Immuno-compromised state                       | 21 (6)       | (95%)      | 4-8   |
| Inherit metabolic disorders                    | 4 (1)        | (95%)      | 0-2   |
| **Total**                                      | **100% (335)**|            |       |

Table-2: Percentage positivity of COVID 19 PCR test results with CorVETT triage tool disposition status among patients with different comorbid.
| Variables                                                                 | CorVETT Test Results | P-value |
|---------------------------------------------------------------------------|----------------------|---------|
|                                                                           | Total                | Negative| Positive |
| Total                                                                     | 56.3% (335)          | 64% (137)| 52% (198)| 0.004*   |
| Asthma, COPD, Interstitial Lung Disease (ILD), Chronic Bronchitis, On home oxygen | 10.4% (62)           | 7.9% (30)| 15% (32)| 0.007*   |
| Heart Disease                                                             | 12.1% (72)           | 10% (38)| 15.9% (34)| 0.034*   |
| Diabetes                                                                  | 35% (208)            | 33.6% (72)| 35.7% (136)| 0.615 |
| Pregnant or recently pregnant                                            | 0.5% (3)             | 0.5% (2)| 0.5% (1)| 0.924 |
| Morbidly Obese                                                            | 0.5% (3)             | 0% (0)| 1.4% (3)| 0.021*   |
| Organ Transplant Recipient                                               | 0.7% (4)             | 0.5% (2)| 0.9% (2)| 0.557 |
| Renal Dialysis or Chronic Kidney Disease                                 | 8.6% (51)            | 8.1% (31)| 9.3% (20)| 0.613 |
| Malignancy                                                                | 8.7% (52)            | 5% (19)| 15.4% (33)| <0.001* |
| Chronic Liver Disease                                                    | 1.8% (11)            | 1.8% (7)| 1.9% (4)| 0.978 |
| Blood Disorders                                                           | 1.2% (7)             | 0.8% (3)| 1.9% (4)| 0.240 |
| Neurocognitive and/or Neuromuscular disease                              | 2.7% (16)            | 1.8% (7)| 4.2% (9)| <0.001* |
| Immuno-compromised state                                                 | 3.5% (21)            | 1.3% (5)| 7.5% (16)| <0.001* |
| Inherit metabolic disorders                                              | 0.7% (4)             | 0.5% (2)| 0.9% (2)| 0.557 |

**Associated Features**

|                                                                           | Total                | Associated Features |
|---------------------------------------------------------------------------|----------------------|---------------------|
|                                                                           | 28.2% (168)          |                      |
| Chest Pain                                                                | 5% (30)              | 36% (77)| 23.9% (91)| <0.001* |
| Coma/ Convulsion                                                         | 8.1% (48)            | 5% (19)| 13.6% (29)| <0.001* |
| Respiratory Distress                                                     | 19.7% (117)          | 18.1% (69)| 22.4% (48)| 0.203 |

**Table-3: Association of COVID 19 PCR test positivity with CorVETT and ESI Triage Tool**

**Figures**
| Characteristics                                      | Total | Covid Test Results | p-value | OR [95% C.I] |
|-----------------------------------------------------|-------|--------------------|---------|--------------|
|                                                     | N     | Positive           |         |              |
|                                                     | 595   | 381                | 214     |              |
| Male                                                | 58.7% | 62.5%              | 51.9%   | 0.012*       |
|                                                     | (349) | (238)              | (111)   | 1.54 [1.10 - 2.16] |
| Female                                              | 41.3% | 37.5%              | 48.1%   |              |
|                                                     | (246) | (143)              | (103)   |              |
| Major Symptoms                                      |       |                    |         |              |
| Fever                                               | 65.9% | 76.6%              | 46.7%   | <0.001*      |
|                                                     | (392) | (292)              | (100)   | 3.74 [2.61 - 5.35] |
| Cough                                               | 45.9% | 54.6%              | 30.4%   | >0.99        |
|                                                     | (273) | (208)              | (65)    | 2.72 [1.91 - 3.88] |
| Shortness of Breath                                 | 53.6% | 54.1%              | 52.8%   | 0.767        |
|                                                     | (319) | (206)              | (113)   | 1.05 [0.75 - 1.47] |
| Sore throat flu like symptoms                       | 14.1% | 13.9%              | 14.5%   | 0.847        |
|                                                     | (84)  | (53)               | (31)    | 0.95 [0.59 - 1.53] |
| Generalized weakness                                | 30.8% | 31.8%              | 29%     | 0.480        |
|                                                     | (183) | (121)              | (62)    | 1.14 [0.79 - 1.64] |
|Risk Stratification                                  |       |                    |         |              |
| Close contact with lab confirmed or suspected COVID | 7.1%  | 5.5%               | 9.8%    | 0.049*       |
|                                                     | (42)  | (21)               | (21)    | 0.53 [0.28 - 0.85] |
| Healthcare worker involved in direct care of Covid-19 patient | 5.4%  | 4.7%               | 6.5%    | 0.346        |
|                                                     | (32)  | (18)               | (14)    | 0.70 [0.34 - 1.45] |
| History of in international, intercity Travel/      | 3.7%  | 5.2%               | 0.9%    | 0.007*       |
| House hold contact with intercity/                   | (22)  | (20)               | (2)     | 5.87 [1.35 - 25.37] |
| international traveler.                             |       |                    |         |              |
| Engaged in Public dealings / General Physicians      | 2.4%  | 3.1%               | 0.9%    | 0.087        |
|                                                     | (14)  | (12)               | (2)     | 3.44 [0.76 - 15.54] |
| Domestic Staff (Labor/ maids) contact                | 0.2%  | 0%                 | 0.5%    | 0.182        |
|                                                     | (1)   | (0)                | (1)     | 1.05 [0.99 - 1.014] |
| Participated in congregations, resident of           | 2.2%  | 2.9%               | 0.9%    | 0.118        |
| Nursing home                                        | (13)  | (11)               | (2)     | 3.15 [0.69 - 6.69] |
Patients admitted to the hospital with unexplained pneumonia | 4.9% (29) | 3.4% (13) | 7.5% (16) | **0.027** | 0.43 [0.20 - 1.64]

Household contacts of a confirmed COVID-19 patient, regardless of symptoms | 4% (24) | 5.8% (22) | 0.9% (2) | **0.004** | 6.49 [1.51 - 27.9]

**Disposition**

| Disposition |  |  |  |  |  |
|---|---|---|---|---|---|
| Admit in ED in covid19 isolation | 69.2% (412) | 66.9% (255) | 73.4% (157) | **0.103** | 0.73 [0.50 - 1.06]
| Discharge home with isolation/quarantine | 30.8% (183) | 33.1% (126) | 26.6% (57) |  |  |

**Triage Category**

| Triage Category |  |  |  |  |  |
|---|---|---|---|---|---|
| P1 | 34.1% (203) | 31.5% (120) | 38.8% (83) | **0.227** | 0.96 [0.49 - 1.87]
| P2 | 26.4% (157) | 26.8% (102) | 25.7% (55) |  | 0.74 [0.37 - 1.49]
| P3 | 19.7% (117) | 21.3% (81) | 16.8% (36) |  | 0.61 [0.3 - 1.27]
| P4 | 12.6% (75) | 13.9% (53) | 10.3% (22) |  | 0.57 [0.26 - 1.26]
| P5 | 7.2% (43) | 6.6% (25) | 8.4% (18) |  |  |

**Age Groups**

| Age Groups |  |  |  |  |  |
|---|---|---|---|---|---|
| 19-35 Years | 19.2% (114) | 14.7% (56) | 27.1% (58) | **<0.001** | 0.96 [0.50 - 1.83]
| 36-55 Years | 34.8% (207) | 40.9% (156) | 23.8% (51) |  | 0.30 [0.16 - 0.56]
| 56-75 Years | 37% (220) | 37.5% (143) | 36% (77) |  | 0.50 [0.27 - 0.91]
| >75 Years | 9.1% (54) | 6.8% (26) | 13.1% (28) |  |  |
CorVETT Triage Tool

| S.No | Symptoms (Major)          | Tick |
|------|---------------------------|------|
| 1    | Fever (>38°C)             |      |
| 2    | Cough (Dry/Productive)    |      |
| 3    | Shortness of Breath       |      |
| 4    | Sore throat / Flu like symptoms |  |
| 5    | Generalized weakness/Headache/ abdominal pain/ Diarrhea |  |

**Risk Stratification Points (High level of suspicion)**

1. Close contact with lab confirmed or suspected COVID (15 min face to face within 1m)
2. Healthcare worker involved in direct care of Covid-19 patient OR patient with pneumonia of unknown etiology/ NEW involved in ED and outpatient
3. History of international Travel/ Frequent use of public transport, house hold contact with intercity/international traveler.
4. Engaged in Public dealings / General Physicians
5. Domestic Staff (Labor/ maids) contact
6. Participated in congregations, resident of nursing home
7. Patients admitted to the hospital with unexplained pneumonia or respiratory failure (regardless of other risk factors)
8. Household contacts of a confirmed COVID-19 patient, regardless of symptoms

**1 Major only**

No risk stratification point (Test on Physician discretion)
Advised self-isolate for 7 days and follow the home care instructions[If vitaly stable]

**2 Major**

And any point from risk stratification (High level of suspicion)
Apply Surgical Facemask to patient and attendant

**Vitals**

Systolic BP < or = 100
Diastolic BP < or = 60
Heart Rate > 120
Oxygen Saturation < 90% (RA)
Drowsy/Altered Mental Status
Respiratory Rate > 24

**Unstable**

| S.No | Associated Features          | Tick |
|------|------------------------------|------|
| 1    | Chest pain                   |      |
| 2    | Convulsions / Coma           |      |
| 3    | Respiratory distress         |      |

**If any Positive**

**None**

If none of the associated features evaluate for High Risk Condition/s

**High Risk Conditions**

- Asthma, COPD, Interstitial Lung Disease (ILD), Chronic Bronchitis, On home oxygen
- Heart Disease (Congenital/Acquired) or Congestive Heart Failure (CHF)
- Diabetes
- Pregnant or recently pregnant (2 weeks)
- Morbidly Obese
- Organ Transplant Recipient
- Renal Dialysis or Chronic Kidney Disease
- Malignancy (Receiving Chemotherapy or radiation in past 30 days)
- Chronic Liver Disease
- Blood Disorders (Blood thinners, Sickle Cell disease)
- Neurocognitive and/or Neuromuscular disease
- Immuno-compromised state
- Inherited metabolic disorders

**If ONE or MORE of the High Risk Condition Present**

- High Risk (P1 – P2)/ Moderate Risk (P3) (Shift to RCU/ Non Resp Covid in ED) Send N/S or Oral swab for COVID 19 Admit in ICU/ SCU in covid unit

**If none of the High risk conditions are present**

- Stable patients (P4: P5) Discharge Advise Home care and Home isolate Instructions Test (N/P or Oral swab) as Outpatient

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**Figure 1**

COVID Emergency Triage Tool (CorVETT)
Figure 2

ROC curve of CorVETT (area under the curve=0.819; 95% CI 0.786 to 0.849, p-value<0.001)