PPE Kits and Its availability using Data Mining Technique

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Abstract **- In this study, the difficulties related to the PPE Kits and its availability have been briefly discussed for research and literature. The coronavirus disease 2019 (COVID-19) pandemic in India has been raging at a rapid rate, providing a daunting challenge to the country's healthcare system after a delayed start due to an effective lockdown. Personal protective equipment (PPE) is unquestionably a barrier of safety for healthcare workers (HCWs) who are fighting the disease as an asset to the country. Data mining approach was utilised to forecast a surge in corona cases so that PPE Kits could be prepared ahead of time and frontline employees could be protected. The Decision Tree technique was used to the data set received from the hospitals to determine the locations where covid cases are most likely to occur.**

Index Terms **- PPE Kits, Health care workers (HCWs), Data Mining, Decision Tree.**

INTRODUCTION

The corona virus disease (COVID 19) has been a global emergency, posing a serious threat to the health-care sector around the world. India is the second-worst afflicted country, with around 4.8 billion cases. In the early 2020s, the first documented instance of COVID-19 occurred in China. The challenges with Personal Protective Equipment (PPE) were not well known at the time. As a result, frontline workers encountered a slew of problems and became more susceptible to COVID-19. According to the official estimate, 87,000 health care workers (HCW) have been infected with the disease, with 573 COVID-related deaths confirmed up through September 2020. As a result, protecting the employees from the epidemic has become a challenge. PPE kits have come a long way from being utilised by beekeepers in ancient literature to 16th-century plague doctors in Europe to present times.

As the world grapples with the COVID-19 pandemic, health-care providers are short on face masks, personal protective equipment, medicines, ventilators, and, most importantly, a robust strategy for managing a COVID-19 patient. The World Health Organization's rules changed multiple times in a short period of time, leaving many countries perplexed. HCWs in India were up against a significant hurdle. Limited personal protective equipment (PPE), a lack of proper training, and constantly changing protocols put their health at danger.

As a result, knowing and addressing the immediate requirements of these caregivers by detecting gaps and bottlenecks in the arrangements becomes unavoidable. Considering this, the study's goal was to analyse the preparation of the country's health-care institutions involved in COVID-10 management, as well as to identify and highlight the concerns of frontline doctors working during the epidemic.

MATERIALS AND METHODS

A quick cross-sectional survey of allopathic medical practitioners currently working in the government or private sector was done. A questionnaire with 34 questions was created, with questions about the participant's place of practise or service, whether they were serving in COVID special hospitals, the facilities available, including PPE kits, COVID-19 training, and facilities for stay or quarantine after attending to such patients. Those who did not work in COVID special hospitals were also requested to complete the form, which included questions about PPE kits, social distancing in outpatient departments and waiting areas, and more. Those who did not work in COVID special hospitals were also requested to complete the questionnaire, which included questions about personal protective equipment (PPE), social

distancing in outpatient departments and waiting rooms, and infection control measures in their local healthcare facilities.

The questionnaire was created using Google Forms and pilot tested on 20 doctors (10 from private clinics and 10 from government health-care facilities), with adjustments made as needed. The questionnaire was accompanied with a consent form that guaranteed the participant's complete anonymity throughout the study and thereafter. The form was then distributed for 5 days on various social media platforms and by email. The e-form was closed for further answers after collecting 405 responses. According to the Krejci and Morgan model, 384 replies would be sufficient for the current study, which considers almost 12 lakh registered allopathic doctors in the country and allows for a 5% margin of error. Due to the country's unexpected lockdown and suspension of all academic operations in all educational institutions, the study's ethical approval could not be obtained.

Table 1: Responses from doctors working in institutions with COVID-19 management facilities

Question theme	Response (%)
Formal training in COVID-19 management	Training received: 126 (56.8) No training received: 96 (43.2)
Satisfaction with the content/ level of training received	Satisfied: 51 (40.5) Not satisfied: 75 (59.5)
Availability of standard PPE kits at their health institution	Available: 105 (47.3) Not available: 78 (35.1) Do not know: 39 (17.6)
Presence of a dedicated task force involved in COVID-19 management	Present: 129 (58.1) Not present: 45 (20.3) Do not know: 48 (21.6)
Having attended to a suspected COVID patient without PPE	Yes: 69 (31.1) No: 153 (68.9)
View about preparedness of their institution in COVID-19 management	Fully prepared: 48 (21.6) Not fully prepared: 126 (56.8) Do not know: 48 (21.6)
Provision of alternative/ exclusive place to stay while on COVID-19 duties	Provided: 102 (45.9) Not provided: 120 (54.1)
Places of stay of those who have not been provided an exclusive place during COVID duties	Staying alone at residence: 45 (37.5) Staying with family: 63 (52.5) In a hostel: 9 (7.5) At private accommodation with colleagues: 3 (2.5)
Whether quarantined after COVID duties	Quarantined: 36 (16.2) Not quarantined: 186 (83.8)
Period of stay away from family due to COVID duties	1-60 days (average: 21 days)

PPE: Personal protective equipment

Table 2: Responses from doctors working in institutions with COVID-19 management facilities

Question theme	Response (%)
Formal training in COVID-19 management	Training received: 126 (56.8) No training received: 96 (43.2)
Satisfaction with the content/ level of training received	Satisfied: 51 (40.5) Not satisfied: 75 (59.5)
Availability of standard PPE kits at their health institution	Available: 105 (47.3) Not available: 78 (35.1) Do not know: 39 (17.6)
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RESULTS

1. Provision of PPE Kits in areas where COVID POSITIVE cases are more prevalent.

Data mining is the process of extracting meaningful information from enormous data warehouses. The input data can be stored in flat files, relational table structures, key-value pairs, and possibly in distributed data repositories. The goal of pre-processing is to convert the raw input data into a format that can be analysed later. Summing up data, cleaning data to reduce noise, and choosing features that are relevant for data mining are all phases in data pre-processing. The two most common types of data mining tasks are descriptive and predictive. The descriptive task focuses on a full explanation of the data and the model's complete design, whereas the predictive task predicts the outcome of previously available data.

2. COVID-19 trajectory analysis and prediction utilising a decision tree data mining approach

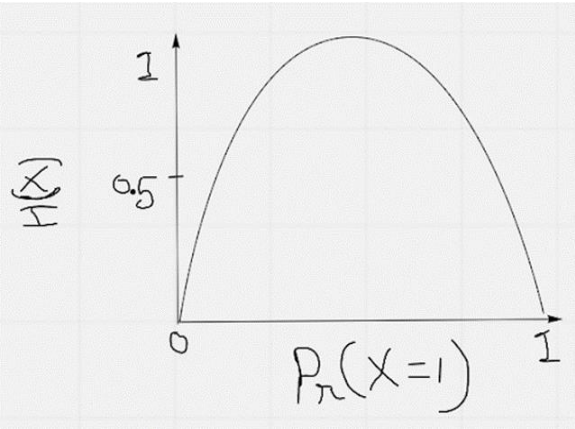
Decision Tree Analysis is a general-purpose predictive modelling tool with applications in a variety of fields. In general, decision trees are built using an algorithm that determines multiple ways to segment a data set

based on certain conditions. It is one of the most popular and practical supervised learning algorithms. Decision Trees are a supervised non-parametric learning method that may be utilised for both classification and regression applications. The goal is to learn simple decision rules from data attributes to develop a model that predicts the value of a target variable.

3. Construction of decision tree

Let's look at various phrases connected to root node before we choose one:

The Gini index is a measure of impurity or purity used in the CART (Classification and Regression Tree) technique to create a decision tree. In comparison to a high Gini index, a low Gini index attribute should be favoured. It only makes binary splits, and the CART method creates binary splits using the Gini index. The formula 1-(P(k))2 can be used to obtain the Gini index. The entropy of a dataset is used to determine its impurity or unpredictability. -P(yes)log2 P(yes)- P(no) log2 P(no) log2 P(no) log2 P(no) log2 P(no) log2 P(no) log2 P(no) log2 P(no) (no). The assessment of changes in entropy after segmenting a dataset using an algorithm is known as information gain. The assessment of changes in entropy after segmenting a dataset based on an attribute is known as information gain. It determines how much data a feature offers about a class. We split the node and built the decision tree based on the value of information gained. The highest information gain node/attribute is split first in a decision tree method, which always strives to maximise the value of information gain. The formula below can be used to compute it. Entropy(S)- [(Weighted Avg) *Entropy] = Information Gain (each feature).



Decision Tree Algorithm will be applied on the below dataset to predict the rise of covid-19 cases in the specific location: -

Columns	Description	Values
Aadhar ID	Aadhar card number for verification	Number
Location	Location of the person	String
Country	Country of the person	String
Age	Age of the person	Number
Hospital visit-date	Day when the patient visited the hospital.	Date
Gender	Gender of the person	String
Death	Whether the patient passes away due to covid 19	Boolean
Recovery	Whether the patient recovers from covid 19	Boolean
Symptoms	Symptoms of the patient	String

The places identified by the above algorithm will have the highest likelihood of a covid surge, hence PPE kits should be in plentiful supply in these areas. The use of data mining to process patient data is critical for effective treatment options. In this research, we provided a model for predicting which places will have a higher need for PPE kits. The Decision tree algorithm, which delivers reliable predictions even on unbalanced datasets, has been discovered.

CONCLUSION

We believe that this non-funded, first-of-its-kind survey of HCWs, conducted in a country that has borne some of the brunt of the COVID-19 pandemic's burdens, should serve as a guide for health administrators and other HCWs in adopting ways and means to mitigate the problems encountered in the use of PPE kits.

The places identified by the above algorithm will have the highest likelihood of a covid surge, hence PPE kits should be in plentiful supply in these areas. The use of data mining to process patient data is critical for effective treatment options. In this research, we provided a model for predicting which places will have a higher need for PPE kits.

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REFERENCES

[1] World Health Organization. Newsroom; March 2020. Available from: https://www.who.int/ news-room/detail/03-03-2020-short age-of-personal-protective-equipment-endangering-health-workers- worldwide.
[2] World Health Organization. Strategic Preparedness and Response Plan for COVID-19. Available from: https://www.who.int/ publications-detail/strategic-preparedness-and-response-plan-f or-the- new-coronavirus
[3] Concerns of Frontline Doctors in India during COVID-19: A Cross-Sectional Survey. Available on: https://www.ijph.in/article.asp?issn=0019-557X;year=2020;volume=64;issue=6;spage=237 ;epage=239;aulast=Singh
[4] Difficulties Encountered While Using PPE Kits and How to Overcome Them: An Indian Perspective. Available on: https://www.ncbi. nlm.nih.gov/pmc/articles/PMC7686919/#REF4
[5] Wikipedia: personal protective equipment. [Sep; 2020]; https://en.wikipedia.org/w/index.php?title =Personal_protective_equipment&oldid=971886 294
[6] Health world. 87k health staff infected with Covid, 573 dead: 74% cases from six states. [Sep; 2020]; https://health.economictimes.indiatimes .com/news/industry/87k-health-staff-infected-with-covid-573-dead-74-cases-from-six-states/77814807
[7] Pham QV, Nguyen DC, Hwang WJ, Pathirana PN. Artificial intelligence (AI) and big data for coronavirus (COVID-19) pandemic: a survey on the state-of-the-arts. https://www.preprints.org/ manuscript/202004.0383/v1
[8] Quinlan, J. R., “Induction of decision trees. Machine learning”, 1: 81-106, Kluwer Academic Publishers, 1986.
[9] Lin N, Noe D, He X. Tree-based methods and their applications in: Pham H.Springer Handbook of Engineering Statistics. London: Springer-Verlag; 2006. p. 551-570. https://scholar. google.com/scholar_lookup?title=Springer+Handbook+of+Engineering+Statistics&author=N+Lin&author=D+Noe&author=X+He&publication_ year=2006&