Evaluating Real World Impact: A Computer Vision CT Algorithm Improves Emphysema Detection and Averts Acute Care Utilization

Dandelion Health

Alexandra Macdonald, PharmD, MPH, MS; Jamie Dermon, MD; Shivaani Prakash, MSc., PhD

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INTRODUCTION

COPD imposes a significant operational and financial burden accounting for approximately 700k hospitalizations and 1M emergency department visits annually in the U.S. [1].

Prevalence	Missed Cases	Projected 2029 Costs
15.7M	**>50%**	**$61B**
Of Americans have a COPD diagnosis [2]	Of Americans with impaired lung function are undiagnosed [2]	In COPD medical costs to U.S. health plans expected to double from $31B in 2019 [3]

Objective: Assess the potential impact of improving incidental emphysema detection on clinical and economic outcomes using a computer vision algorithm that analyzes CT scans.

METHODS

ClearRead CT Lung Tissue Analysis (LTA) Prototype by Riverain Technologies is a computer vision algorithm that detects emphysematic tissue on chest CT scans.

1. Run the Algorithm

ClearRead CT LTA algorithm was run on all chest CT scans from eligible patients within the **Dandelion Health environment.**

- **7,575 Eligible Patients**
  All chest CT scans from adults ≥50 years old without prior emphysema diagnosis, performed between 01/01/17 and 12/31/23.
- **6,274 Patients with an Algorithm Prediction**
  Only unique patients with an Algorithm predictions were retained; the 1,301 without predictions were excluded.
- **375 Patients with Emphysema**
  True Negatives (5,782), False Positives (30) and False Negatives without third-party radiologist confirmation (87) were excluded [4].
- **302 Patients with Pre and Post Index Data**
  Patients lacking continuous data availability in the 6 months prior (39) and after (34) to the index chest CT were excluded.
- **302 Final Cohort**
  Early and Delayed Detection patients
  - **212 Early Detection Cohort**
    Patients who were first diagnosed with emphysema within 120 days of their CT scan, identified by ICD-10 code (J43%) or radiology report mention, regardless of algorithm output.
  - **90 Delayed Detection Cohort**
    Patients with emphysema not detected at the time of the index chest CT but later detected by the ClearRead CT | LTA Prototype algorithm and confirmed by a radiologist panel [4].

2. Retrospective Assessment on Respiratory Outcomes

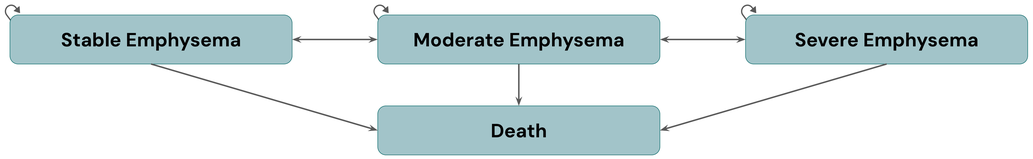
Patients' real-world respiratory-related healthcare resource utilization were compared after balancing cohorts on baseline characteristics using inverse probability treatment weighting.

Index Date
Chest CT Scan
01/01/2017 - 12/31/2023

Pre-Index Period (6+ months)
Baseline Characteristics:
Age, Sex, Race & Ethnicity, Median Income Decile, Social Vulnerability Index, Charlson Comorbidity Index, Tobacco Use History

Post-Index Period (6 months- 5 years)
Respiratory-Related Outcomes Assessed:
Encounters (outpatient, emergency department, and inpatient visits), Procedures, Medications

3. Run Markov Model to Assess Cost-Effectiveness



Time Horizon

- 5 Year Horizon
- 90 day cycle lengths
- Half-cycle corrections applied
- 3% Discount applied to costs & utilities

Key Assumptions

- Algorithm largely differed from conventional radiology in enhanced early detection.
- Willingness-to-pay threshold of $150,000/QALY.
- Adoption Costs: Assumed to be $235,000 over 5 years and reimbursement of $300 per scan.

Model Inputs

- **Transition Probabilities & Resource Utilization:** Directly derived from retrospective cohort in Dandelion Health platform
- **Mortality Rates:** US Census Data (Stable & Moderate Emphysema) & Published meta-analysis for Severe Emphysema [5, 6]
- **Utility Values:** Published literature review derived from COPD exacerbation severity [7]
- **Costs:** Mapped from retrospective cohort utilization to HCUPnet, CMS Physician Fee Schedule, and National Average Drug Acquisition Cost [8 - 10]. All costs were adjusted to the 2025 USD.

RESULTS

Ground Truth	Algorithm Prediction: Positive	Algorithm Prediction: Negative
Positive	**286** True Positives	**176** False Negatives
Negative	**30** False Positives	**5,782** True Negatives

	ClearRead CT LTA Algorithm	Conventional Care [11]
Sensitivity	61.9%	40.6%
Specificity	99.5%	86.9%

Validation Data: Dandelion Health Data July 11, 2024

Ground Truth: Established by retrospective EHR labels or, when predictions disagreed with EHR labels, by a panel of board-certified radiologists [4]

Figure 1. ClearRead CT LTA Algorithm Performance Metrics.

ClearRead CT LTA Algorithm has 21% absolute improvement in early detection compared to conventional care.

Key Clinical Outcomes Attributable to Earlier Diagnosis of Emphysema from the ClearRead CT LTA Algorithm.

2,100
Additional diagnoses
Per 10,000 patients with emphysema

51.7
Avoided ER & hospital visits annually
Per 10,000 newly diagnosed patients with emphysema

31.7%
Reduction among Non-White Patients [12]
In ER or Hospital visits for Acute Respiratory Failure

Subgroups	Deterministic Result	Net Monetary Benefit	Probability of Cost-Effectiveness
Base Case	$122,714/QALY	$624	53%
Sex			
Male	Dominant	$4,388	68%
Female	$1.3M/QALY	-$1,155	45%
Age			
< 65 Years Old	Dominant	$3,665	64%
>= 65 Years Old	$278K/QALY	$132	47%
Race & Ethnicity			
White, Non-Hispanic	$67,218/QALY	$957	53%
Non-White [12]	Dominant	$5,763	71%
COVID-19 Timeframes			
Pre-COVID-19 (<2020)	Dominant	$3,290	66%
COVID-19 Era (2020+)	$3.3M/QALY	-$3,429	34%

Table 1. Probabilistic Cost-Effectiveness Results

The Algorithm was cost-effective in the Base Case and most sub-population analyses, with ≥50% probability of staying below the $150,000 / QALY threshold. The highest-value sub -populations were Non-White patients, male patients, patients < 65 years old, and patients screened before the COVID-19 pandemic.
Note: Willingness-to-pay threshold of $150,000 / QALY

Cost-effectiveness was most sensitive to Severe Emphysema state costs.

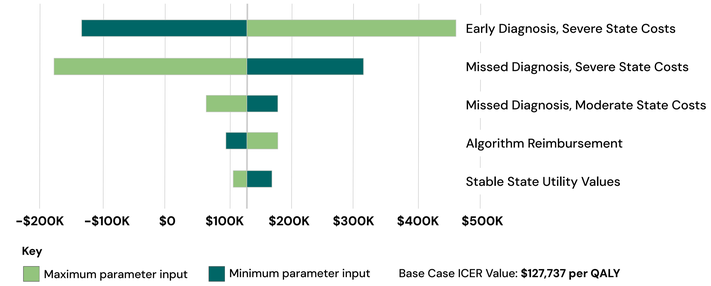


Figure 2. One-Way Sensitivity Analysis
In the above figure, the five factors most influencing the cost effectiveness of the base case are displayed.

CONCLUSIONS

Literature has reported a limitation of prior AI diagnostic economic evaluations is the insufficient inclusion of downstream outcomes data [13-16].

This study demonstrates a novel real-world evidence methodology that retrospectively applies AI algorithms to historical imaging data and tracks subsequent patient outcomes within the same dataset.

ClearRead CT LTA offers improved performance on detecting emphysema on CT scans compared to literature-reported standard of care.

- **2,100 more patients** could potentially receive a timely diagnosis of emphysema among 10,000 patients screened.

The Algorithm was likely cost-effective in the base case (53% of 1,000 simulations showed evidence of cost-effectiveness) with the strongest evidence in non-white and male subpopulations.

Favorable cost-effectiveness driven by earlier intervention preventing progression to costly severe disease.

This study establishes a framework for evaluating real-world value of AI through retrospective application of algorithms to imaging data that are linked to longitudinal outcomes.

ACKNOWLEDGEMENTS & REFERENCES

Algorithm and payment for analysis provided by Riverain Technologies.

1. Press VG, et al. Chest. 2021.
2. CDC. COPD in Adults. 2025.
3. Mannino DM, et al. Chest. 2024.
4. Panel of blinded board-certified radiologists from Centaur labs were given a random sample of False Positive and False Negative scans to establish ground truth when retrospective EHR labels and Algorithm outputs were incongruent.
5. Arias E, et al. N CHS. 2025 .
6. Waeijen-Smit K, et al. E R J Open Res. 2024 .
7. Einarson T R, et al. J Med Econ. 2015 .
8. HCUP CCSR. AHRQ . 2021 .
9. CMS. Physician Fee Schedule. 2025 .
10. CMS. Medicaid Data. 2025 .
11. Nardini S, et al. Respir Med. 2018.
12. Asian, non-Hispanic; Black or African American, non-Hispanic; Hispanic; Other or Multiple Race; Unknown / Declined
13. Voets M, et al. Value Health. 2022.
14. Vithlani J, et al. Front Pharmacol. 2023.
15. Longhurst A, et al. NEJM AI. 2024.
16. Von Gerich H, et al. Int J Med Inform. 2026.