# Multicenter Study Investigating The Impact Of Deep Learning-Based UIP Classifier On Identifying Undiagnosed Idiopathic Pulmonary Fibrosis And Non-IPF Progressive Pulmonary Fibrosis

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## PURPOSE

Idiopathic pulmonary fibrosis (IPF), the most common form of interstitial lung disease (ILD), historically carries a poor prognosis. Early identification of IPF can improve patient outcomes. AI-based CT analysis helps interpret biomedical images by abstracting objective, quantitatively assessed data, potentially alerting clinicians to undiagnosed disease[1].

**The goal of this study was to compare quantitative CT analysis using a deep learning-based UIP classifier, IQ-UIP (Imbio, Inc.), with traditional visual CT analysis and assess the algorithm's effectiveness in identifying undiagnosed IPF.**

## METHODS

All non-contrast chest CT scans performed at Lahey Hospital & Medical Center (LHMC) and Mt. Auburn Hospital (MAH) from June 1 to August 31, 2023, were analyzed using IQ-UIP. Expert reader ground truth was established by review of all IQ-UIP-positive studies for UIP per ATS/Fleischner criteria[2] (2 pulmonologists with a radiologist as third reader for discrepant reads), and for interstitial lung abnormalities (ILA) per Fleischner guidelines[3]. Individuals with IQ-UIP-positive scans were classified as true positive if typical/probable UIP by expert read, as IPF if typical/probable UIP on CT and no known cause of ILD, and as non-IPF progressive pulmonary fibrosis (PPF) per ATS criteria[4]. All individuals with IPF and PPF were considered eligible for antifibrotics. EMRs were reviewed for clinical ILD diagnosis, PFTs, pulmonary care, and antifibrotic use.

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## RESULTS

**LHMC Cohort**:

- 2824 non-contrast chest CT scans processed on IQ-UIP >> **4.2% (119) IQ-UIP-positive** (Table 1).
- **48 true positive scans**: 38 classified as IPF, 3 as PPF (Figure 1) and 7 as other ILD
- **71 false positives** with 37 having no ILA or ILD
- 47 patients eligible for antifibrotics (IPF + PPF):
  - 43% (20/47) currently or previously prescribed
  - 23% (11/47) offered therapy
  - **34% (16/47) eligible but not offered therapy**
- 14 of 38 patients classified as IPF **were not clinically recognized** (Table 2, Figure 2).
- 91.5% (75/82) patients with ILA/ILD were under care of a pulmonologist.
- 69% (33/48) true positive scans called or described as typical/probable UIP on radiology reports and 4.2% (2/48) did not describe any ILA or ILD.

## RESULTS

**MAH Cohort**:

- 872 scans processed on IQ-UIP >> **3.2% (28) IQ-UIP-positive** (Table 1).
- **18 true positive scans**: 13 classified as IPF, 3 as PPF, and 2 as other ILD.
- 10 false positives
- 16 patients eligible for antifibrotics (IPF + PFF):
  - 63% (10/16) currently prescribed
  - 19% (3/16) offered therapy
  - **19% (3/16) eligible but not offered therapy**
- 3 of 13 patients classified as IPF **were not clinically recognized** (Table 2).
- 67% (12/18) of IQ-UIP true positive scans called or described as typical/probable UIP on radiology reports.

**FIGURE 1:** Patient with IQUIP true positive scan, RA-ILD diagnosis, meets PPF criteria, not on antifibrotic

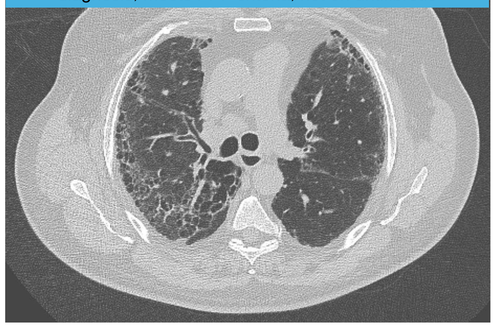

**FIGURE 2:** Patient with IQUIP true positive scan, not referred to pulmonary, no diagnosis of ILD

| TABLE 1 | LHMC | MAH |
|---|---|---|
| **Total IQ-UIP Positive** | 119 | 28 |
| **Total # scans reviewed** | 2824 | 872 |
| Age | 75.8+/-11.7 yrs | 75.4+/-11.0 yrs |
| IQUIP False Positive | 71 | 10 |
| False Positive, No ILA | 37 | 5* |
| IQUIP True Positive | 48 | 18 |
| True Positive but not clinical IPF | 10 | 5 |
| IPF by Criteria | 38 | 13 |
| Non-IPF PPF by Criteria | 9** | 3 |
| UIP Pattern (expert read) | | |
| Typical | 20 | 13 |
| Probable | 28 | 5 |
| Indeterminate | 11 | 4 |
| Alternative | 23 | 1 |
| None | 37 | 5 |
| Antifibrotic Eligibility/Use | | |
| Eligible for AF | 47 | 16 |
| Eligible AF and ON | 16 | 10 |
| Failed all appropriate AF | 4 | 0 |
| Eligible and Offered | 11 | 3 |
| Eligible and Not Offered | 16 | 3 |

* ILA not scored by Fleischner criteria
** Not all PPF were IQ-UIP True Positive

| TABLE 2 | LHMC | MAH |
|---|---|---|
| Unrecognized IPF*** | | |
| Followed by pulmonologist | 13 | 3 |
| Not followed by pulmonologist | 1 | 0 |
| Under Pulmonary Care | | |
| With ILA or ILD on CT | 91.5% (75/82) | 95.7% (22/23) |
| Radiologist Reads on IQUIP True Positive Scans | | |
| UIP / Probable UIP | 33 | 12 |
| Indeterminate UIP / Alternative | 13 | 6 |
| No ILD | 2 | 0 |

*** Of those with IPF by investigational/research criteria, how many did not have clinical IPF dx

## CONCLUSION and CLINICAL IMPLICATIONS

A deep learning-based UIP classifier (IQ-UIP) identified chest CT scans that exhibited patterns not previously classified as UIP in standard CT reports. As a result, processing of CT data uncovered cases of IPF and PPF and highlighted patients who were eligible for but not yet prescribed/offered antifibrotic therapy.

*AI-driven technologies show promise in supporting ILD management by complementing current diagnostics to flag potential cases for review. Integrated into care pathways, they could standardize diagnostics, reduce delays, and personalize treatment. Further evaluation is needed to assess their broader applicability across diverse populations.*

## REFERENCES

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