

PASSIVE DIGITAL MONITORING FOR EARLY INFECTION DETECTION IN PEOPLE LIVING WITH DEMENTIA: PROSPECTIVE COHORT STUDY

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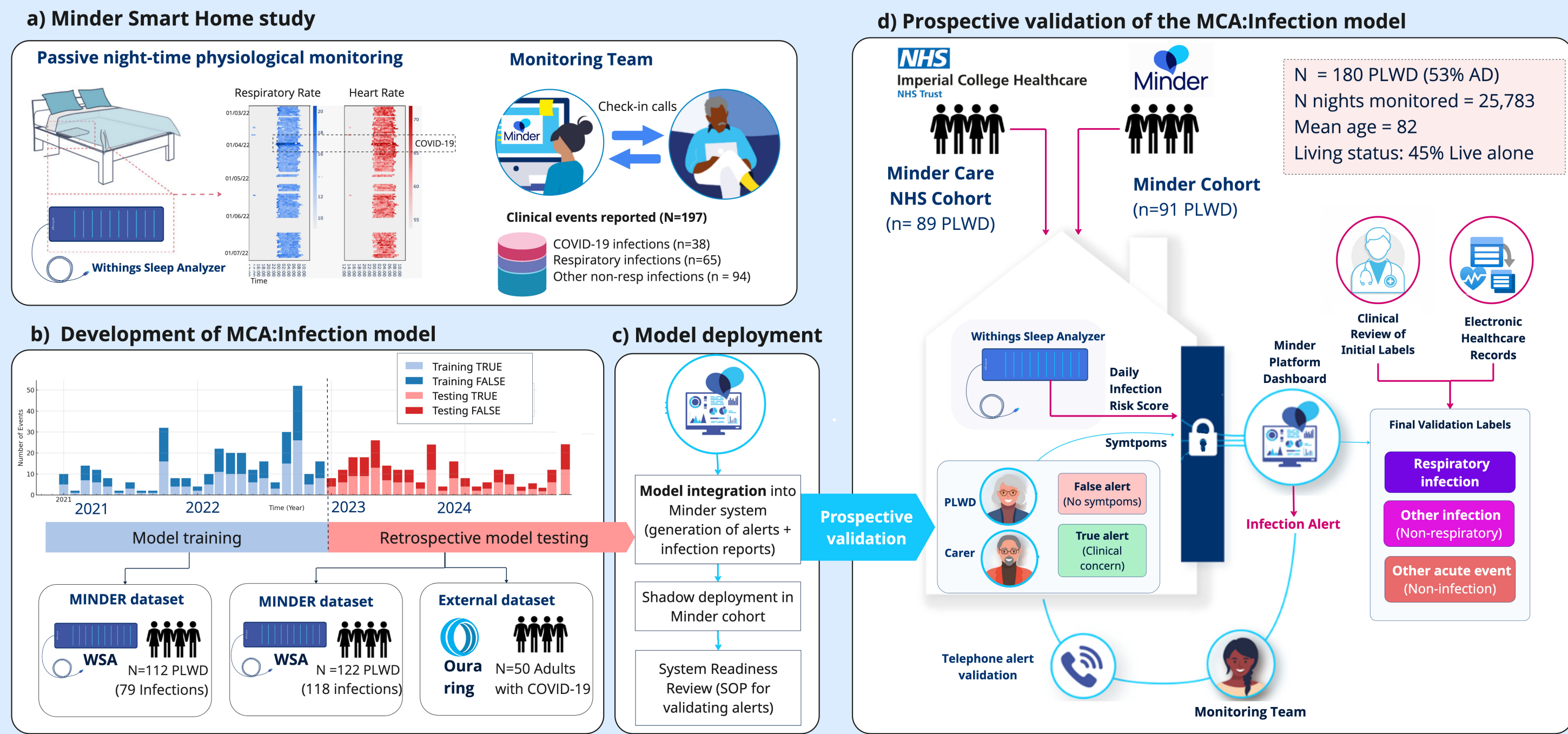
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BACKGROUND

- Infections are a major cause of acute deterioration and avoidable hospital admission in people living with dementia (PLWD)¹.
- Atypical presentations and under-reporting of symptoms can delay diagnosis in PLWD.²
- Wearable devices can capture early signs of infection³, but poor adherence and charging demands limit their use in PLWD and elderly⁴.
- Under-mattress nearable sensors offer passive, contactless monitoring,⁵ yet have not been evaluated for infection detection.
- We developed and prospectively evaluated an individualised machine-learning system using nocturnal physiological data from the Withings Sleep Analyzer to support early infection detection at home.**

METHODS

- Over 5 years (01/01/2021-31/10/2025), 255 PLWD underwent continuous night-time monitoring with Withings Sleep Analyzer (WSA), contributing 99,587 nights of WSA data in total
- Minder Clinical Algorithm (MCA): Infection** was trained on labelled infection events from the MINDER cohort (n=112). The model uses explainable gradient boosting to detect infection-related deviations in nocturnal HR and RR.
- Performance was assessed in a temporally independent retrospective MINDER test set (n=122) and externally in Oura Ring dataset (n=50)
- Model was prospectively evaluated within an alert-based monitoring system deployed in MINDER and MinderCare studies. Daily risk scores were generated from the previous night's data. High risk scores triggered alerts, which were reviewed and clinically validated by the Monitoring teams.

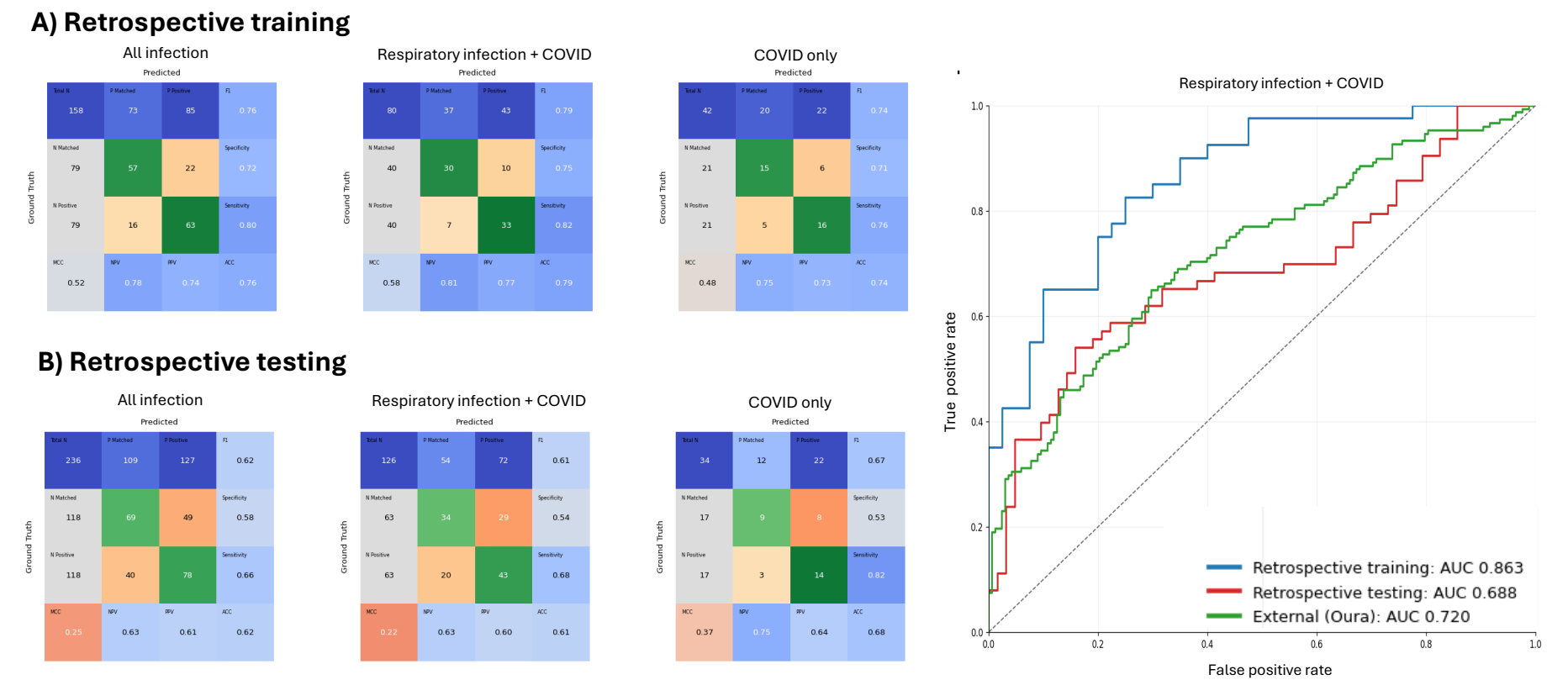


255
PLWD with passive night-time monitoring data collected over nearly 5 years

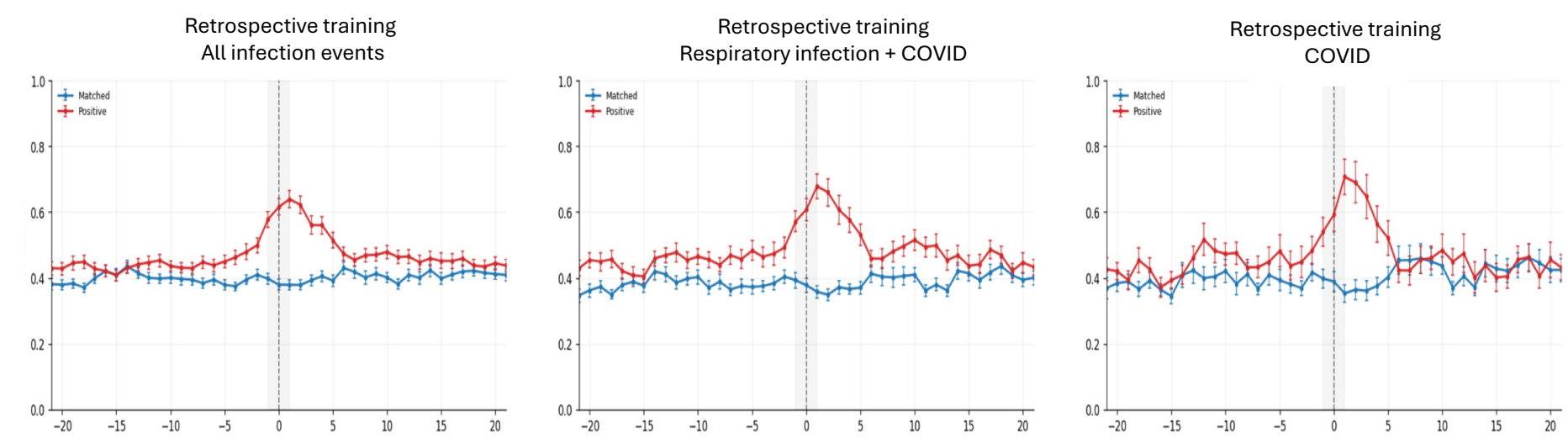
99,587
nights of Withings Sleep Analyzer data

180
PLWD in prospective deployment, 45% living alone

RETROSPECTIVE ANALYSIS



COVID detection: AUROC 0.83 in training and 0.74 in held-out test set
All Respiratory Infection: AUROC 0.86 in training and 0.69 in test set
External validation (Oura Ring COVID dataset): AUROC 0.72

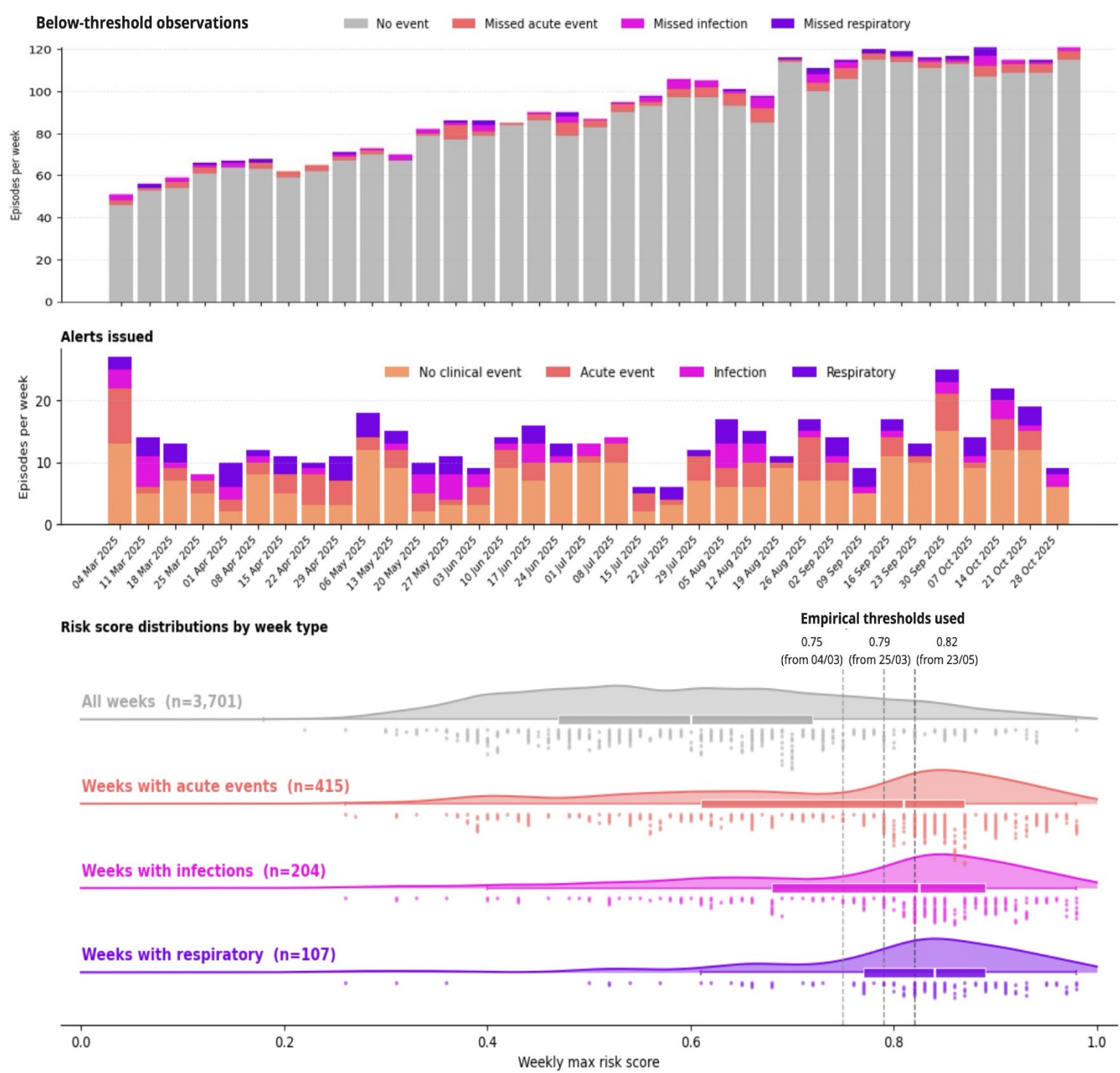


The daily risk score reflects dynamic changes that track the development and resolution of infection in all three groups (all infection, respiratory infection only, COVID-19 infection only)

PROSPECTIVE VALIDATION

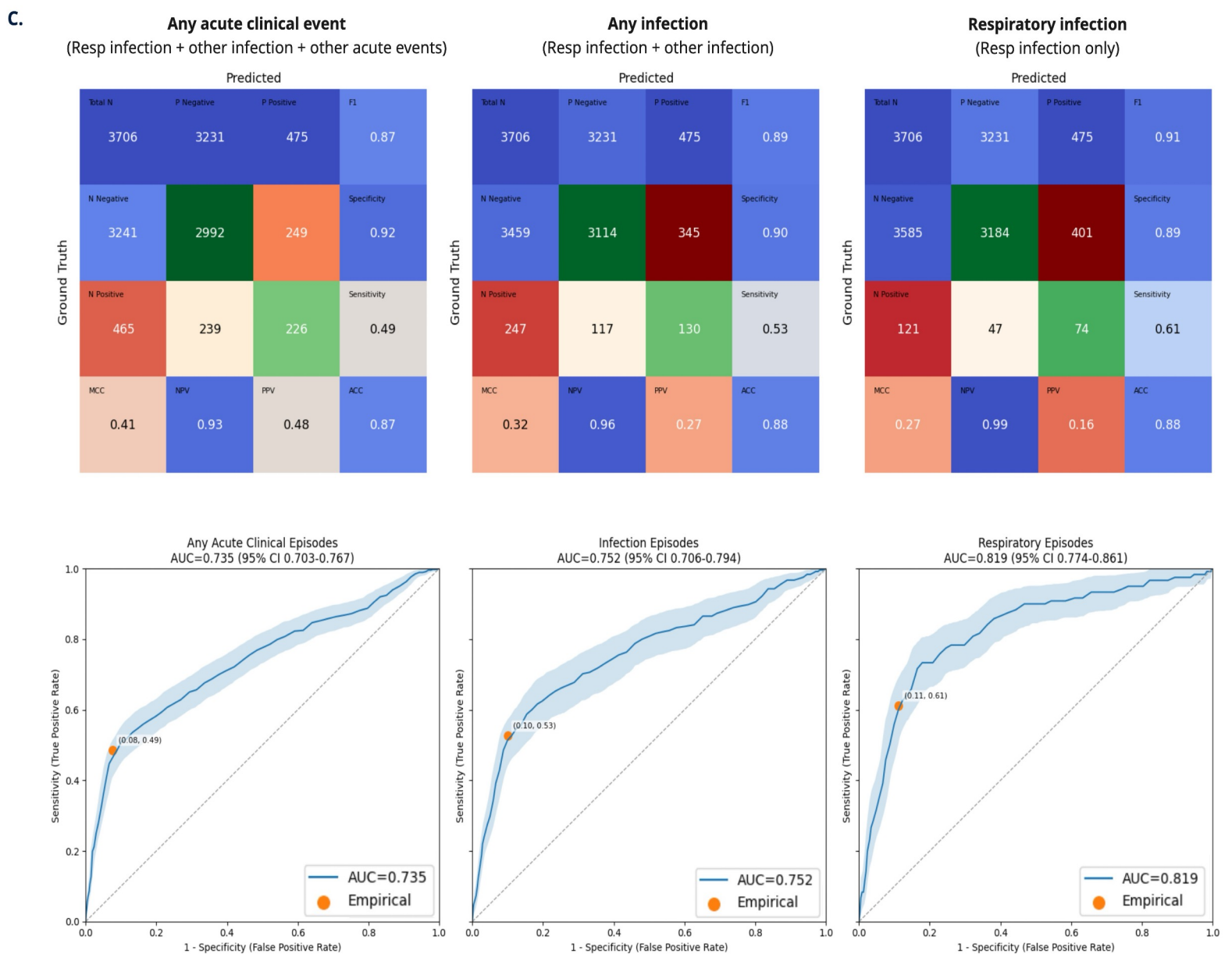
Monitoring overview

- 3,701 participant-weeks with available sensor data
- 415 participant-weeks with clinically validated acute events
- 204 infection weeks, including 107 with respiratory illness
- 501 alerts validated by the monitoring team over 34 weeks

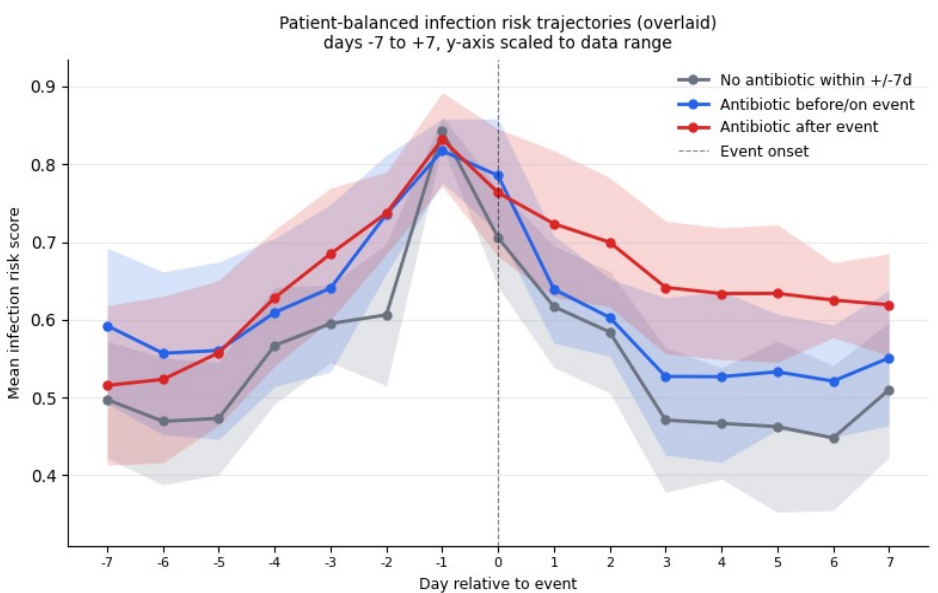


Prospective MCA: Infection model performance

- MCA:Infection model discriminated any infection episode with AUROC of 0.752, achieving 53% sensitivity and 90% specificity.
- The strongest performance was seen in respiratory infection: AUROC=0.819, 61% sensitivity and 89% specificity**
- Approx. 1 in 2 alerts corresponded to an acute clinical event.
- PPV was 27% for infection episodes (1 in 4 alerts) and 16% for respiratory infections, reflecting their lower prevalence.



Real-world infection signal



- Mean infection risk rose in the days preceding the clinical event. Scores subsequently declined but remained elevated for longer when antibiotics were initiated after the event, consistent with more prolonged or later-treated illness.

KEY MESSAGE:

This is the first prospective, real-world validation of a passive nearable system for detecting infections in people living with dementia. Contactless nocturnal monitoring with a sleep-mat detected infection-related changes in HR and RR with good discrimination (AUROC 0.82 for respiratory infections) — enabling real-time alerts without wearable burden.