

Predicting and preventing avoidable urgent and emergency care: measuring impact across activity, mortality and cost benefits

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Problem

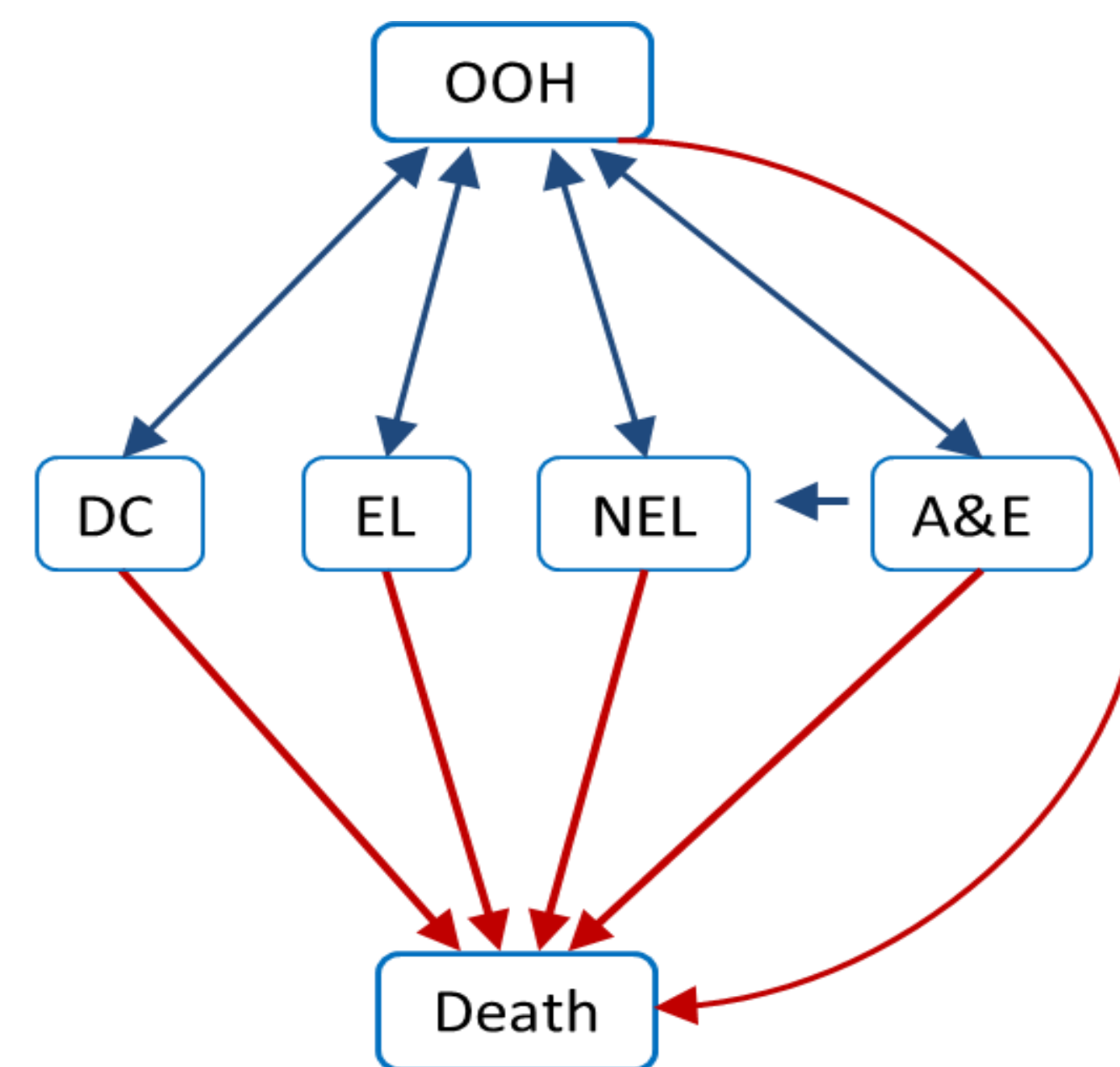
- 24-35% of Urgent and Emergency care (UEC) is avoidable¹. This means compromised care for many of our most vulnerable patients, a cost to the NHS of £6bn per year.
- Measuring the impact of interventions capable of addressing this significant problem remain largely unexplored.
- Limitations in study design, analytical methodologies and data scientific skillsets impact current understanding of high intensity UEC prevention.

Solution

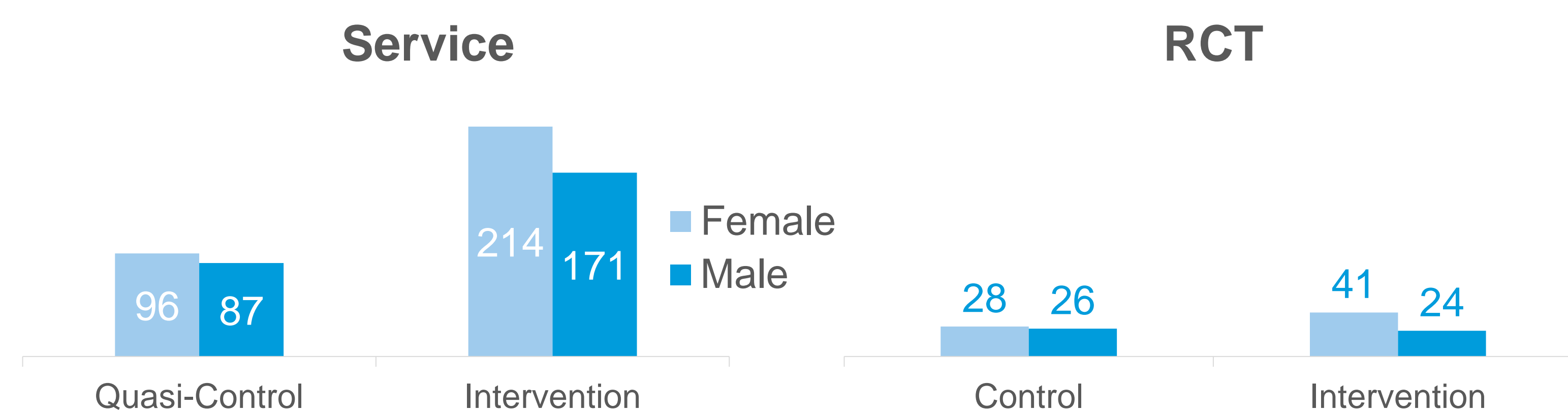
- We deployed a locally trained AI predictive algorithm to identify patients with high probability of non-elective bed day consumption.
- High-risk patients were then recruited to a nurse-led health coaching programme as part of a multicentre RCT led by the Nuffield Trust and industry experts.
- The intervention impacted patient reported outcomes, UEC consumption, hospitalisation costs and patient mortality.
- Here we overview an analytical approach to holistically evidence impact across elective and non-elective hospital functions.
- We are reporting on PROMS, activity, costs and patient mortality.

Methodology

- Multi-state Markov models describe patient activity, which at any time can occupy one of possible few states. This enables the modelling across urgent and emergency care.
- The evaluation covers transition rates between the following states: out of hospital (OOH), day case (DC), elective (EL), non-elective (NEL) admission, A&E attendance or Death.

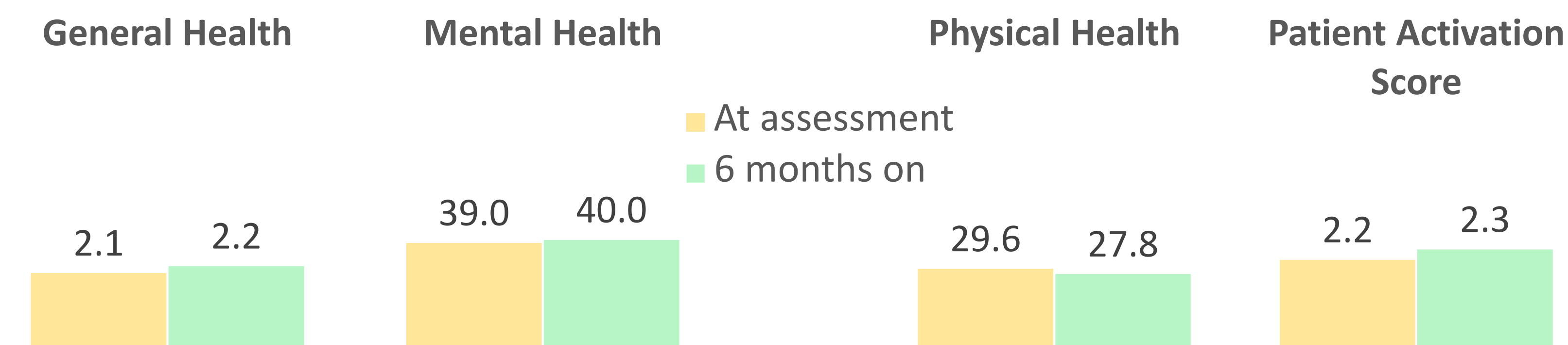


- The evaluation assesses two groups of UEC consumers. There were **568 patients** in the Service and **119** in the RCT group, both with an intervention and control group.



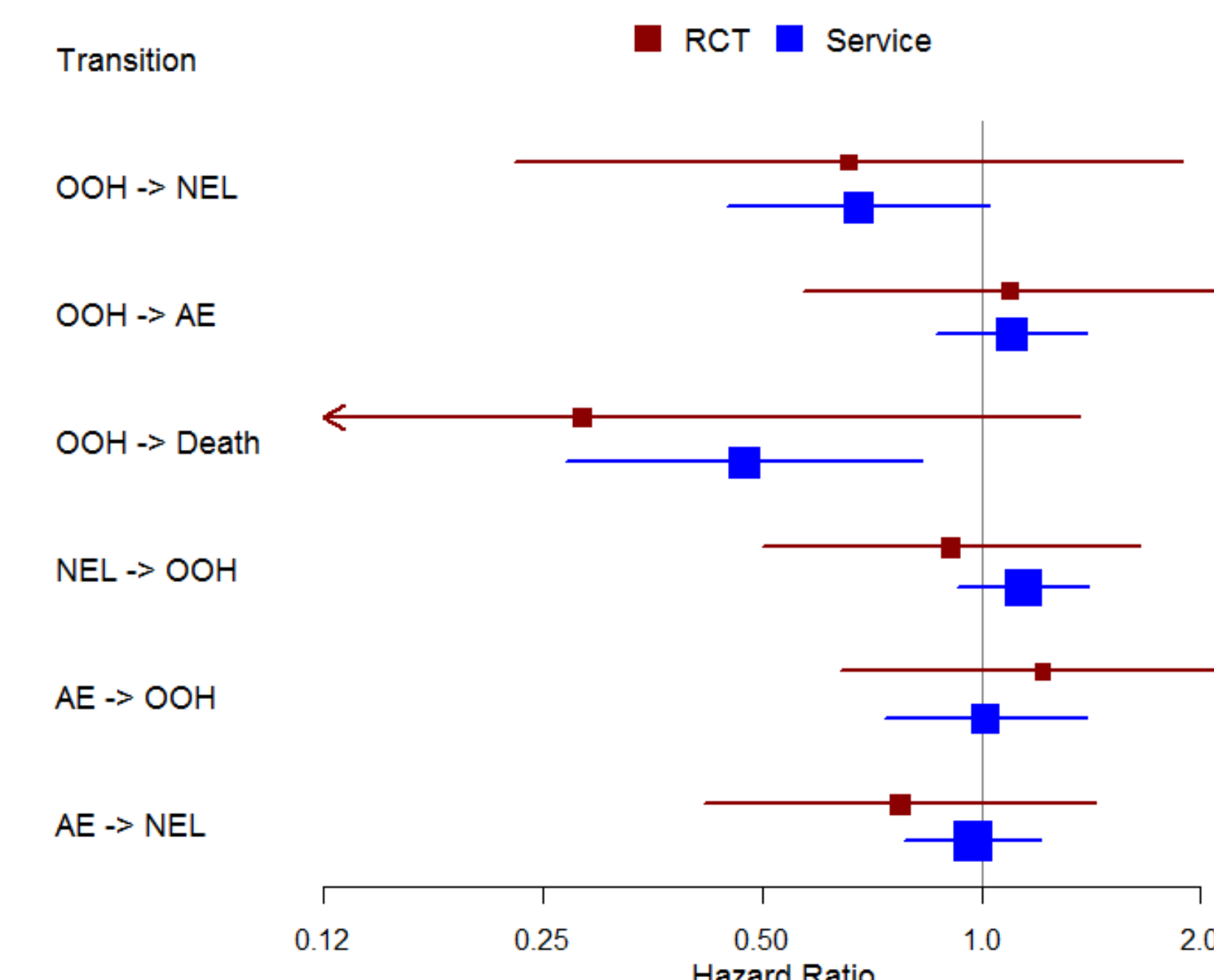
Patient Reported Metrics

- Patients were asked to self-report upon first assessment and again 6 months after, using SF-12 quality of life and PAM13 patient activation surveys. At the time of measurement only 16 6-month questionnaires had been logged.
- The SF12 scores range from 1-5 for General Health and 1-100 for Mental and Physical health. The PAM13 patient activation scores ranges from 1-4.



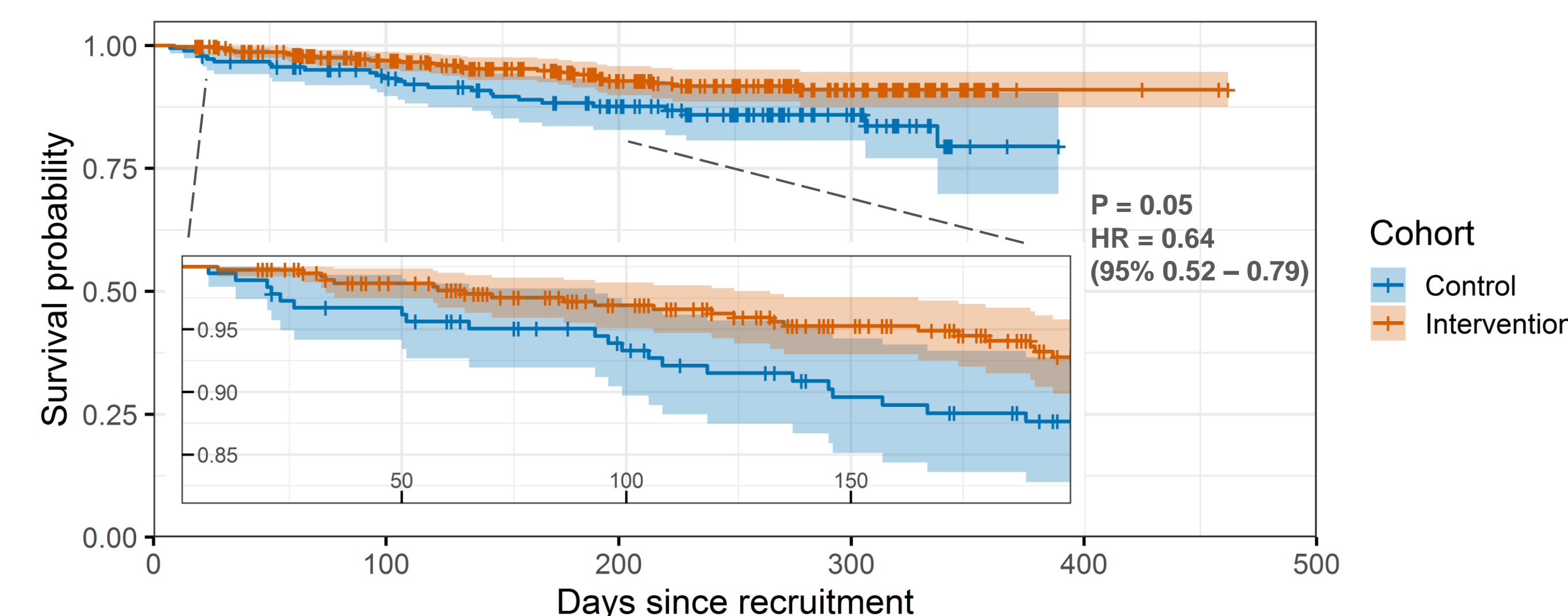
Activity savings

- Hazard Ratios (HR) express the potential for a transition between UEC states for the intervention group relative to the control.
- For the Service, the intervention group had two times higher chance of survival (HR 0.47, 95% CI 0.27 – 0.83) and lower probability of non-elective admissions, albeit the latter statistically significant at 10% (HR 0.68, 95% CI 0.45 – 1.02).
- Similar findings were reported for the RCT, but with higher uncertainty and variance.



Mortality

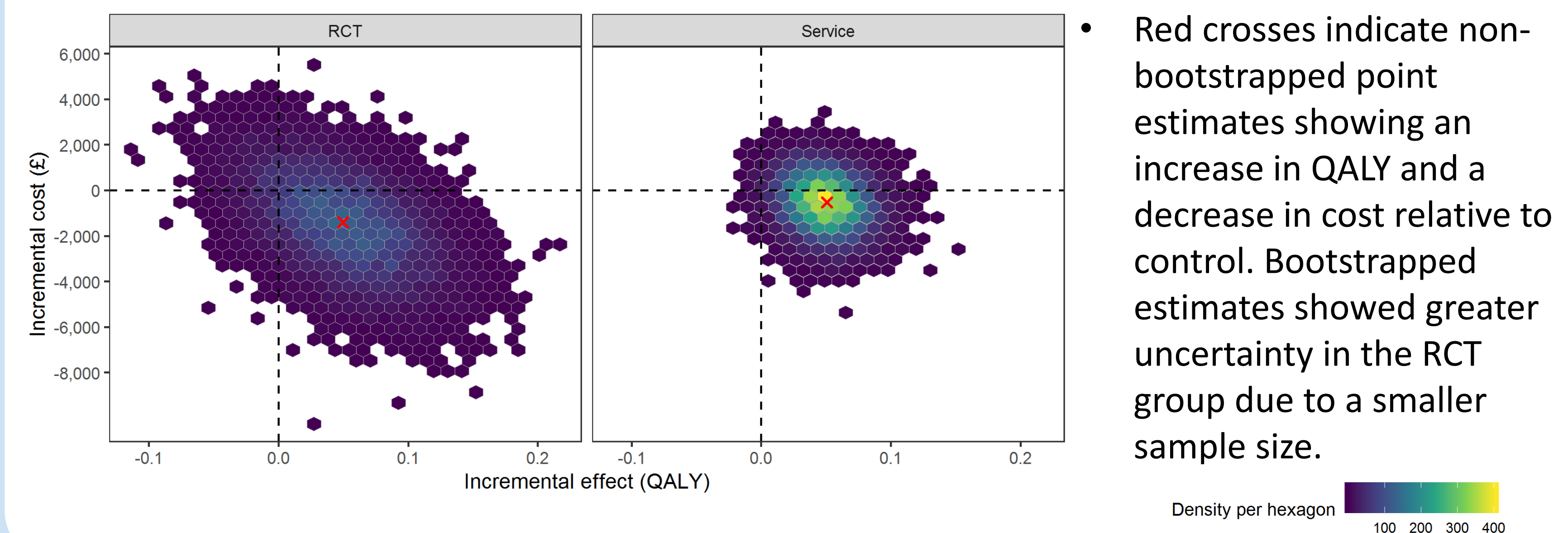
- The intervention group had lower mortality rates for both Service and RCT. For service there was a 49% reduction with 6-month cumulative survival probability of 94%.
- Stratification by age band and sex showed a varied pattern, but the sample size in each group was not large enough for conclusive findings.



Cost Savings and QALYs

- Average cost was lower in both the Service (£515) and RCT (£1,390) intervention groups compared to the controls. Including QALYs (Quality Adjusted Life Years) effects from evidenced reduced mortality, the RCT was more effective as it had a higher incremental cost-effectiveness ratio (ICER) than Service.
- Cost to the CCG was measured by income to the Trust, including the cost of Proactive Health Coaching intervention.
- Additional non-acute costs were not taken into account.
- Effectiveness was measured by QALYs. Both costs and QALYs were standardised per patient year.

	Incremental Cost	Incremental Effect (QALY)	ICER
RCT	-£ 1,390	0.049 (17.8 days)	-£ 28,375
Service	-£ 515	0.050 (18 days)	-£ 10,307



Conclusions

- Combining AI with health coaching for the prediction and prevention of avoidable Urgent and Emergency care can improve patient outcomes and deliver system savings.
- Out of hospital mortality decreased by 49% an effect that was statistically significant for the service but not RCT.
- The intervention impacted hazard ratios between UEC states, reducing the chance for patient transitions from out of hospital to non-elective admissions by up to 32% (p=0.06) with differing magnitude between service and RCT.
- Reduced UEC consumption meant lower hospital costs. Taking into account increased QALY the theoretical benefit of the intervention, beyond secondary care, was considerable.
- Multi state Markov models are useful in measuring costs and benefits.
- The average intervention time was approximately 0.3 years for RCT and 0.5 for service. Larger cohorts and time spent in the intervention are needed for a more robust estimate of impact.
- Assessing the impact of innovative care models requires advanced analytical skills, dedicated resource, careful study design and often NHS-industry collaboration.

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References:

1. National Audit Office. *Reducing Emergency Admissions*. National Audit Office, 2018.