Exploring patient safety disparities in a diverse English city: a retrospective two cohort study (2015–2019, 2022–2023) using the Connected Bradford data warehouse

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Background: Patient safety incidents affect around 12% of hospitalised patients and contribute to 14,000 avoidable deaths annually in England. While structural factors such as language barriers, deprivation, and mistrust are known to affect safety outcomes, disparities in patient safety across marginalised groups remain underexamined in the UK. Systemic factors likely underpin persistent risks, but robust data from diverse populations are scarce.

Objectives: This study aimed to examine associations between social characteristics (e.g. ethnicity, language, deprivation, mental illness, learning difficulties, homelessness, transgender identity) and patient safety outcomes in surgical inpatients. We asked: (1) Do safety outcomes differ systematically by group? (2) Have disparities changed between pre- and post-pandemic periods? (3) Can routine linked data support equity monitoring?

Methods: A retrospective cohort analysis was conducted using Connected Bradford data. We included 636,723 surgical spells (240,214 patients) from two time periods: 2015–2019 and 2022–2023. Outcomes included in-hospital patient safety indicators (PSIs) and post-discharge events within 30 days: emergency readmissions and ambulance use. Logistic regression models were used, adjusting for clinical and demographic covariates. Estimates were pooled across cohorts via random-effects meta-analysis. Sensitivity analyses tested robustness.

Results: Safety disparities were widespread and persistent. Homelessness was associated with higher odds of ambulance use (pooled OR 3.76, 95% CI 3.50 to 4.04), PSIs (OR 1.99 pre-pandemic), and readmissions (OR 1.66), with slight post-pandemic attenuation. Mental illness and learning difficulty were consistently linked to increased risk. Versus majority white British, South Asian patients had lower odds of PSIs (OR 0.90, 95% CI 0.87 to 0.94) and ambulance use (OR 0.82, 95% CI 0.80 to 0.85), while Black African patients showed elevated risk. Deprivation showed strong gradients for post-discharge events but weaker associations with PSIs. Transgender estimates were inconclusive due to small samples.

Conclusion: Disparities in patient safety were substantial and largely unchanged over time, suggesting enduring structural causes. Outcomes were consistent across metrics, underlining that safety inequity is measurable and patterned. Routine linked data can help identify such patterns, but more granular data and inclusive methods are needed.

Exploring patient safety disparities in a diverse English city
A retrospective cohort study using Connected Bradford data

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1 | Background

- Annually, safety incidents cost £15b and cause 14k deaths in England.
- Socioeconomically disadvantaged and minoritised ethnic groups may face greater medication harm, infections, poor care continuity, and more.
- Disparities are driven by systemic barriers: structural racism, language difficulties, low health literacy, deprivation, and mistrust.
- Major gaps in safety inequities research include a lack of: UK studies, studies using large linked data, focus on many groups (e.g. the homeless) and outcomes (e.g. safety indicators), and analysis of post-pandemic impacts.
- Bradford is diverse with high deprivation and strong data infrastructure via *Connected Bradford*, a large data linkage project (see Figure below).
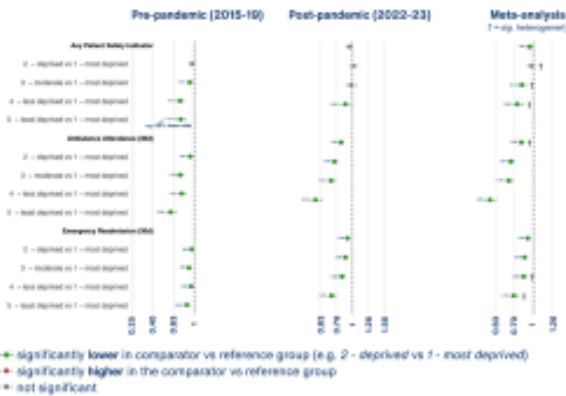
3 | Method

- **Design:** Retrospective cohort study.
- **Population:** Adults having theatre procedures at Bradford hospitals.
- **Exposure variables:** ethnicity, deprivation quintiles, primary language, learning difficulty, mental illness, homelessness (identified through GP records).
- **Outcomes** (*more in our preprint*):
  - *Any AHRQ patient safety indicator (PSI)*
  - *Any 30-day post-discharge unplanned:*
    - Ambulance conveyance to hospital
    - Readmission to hospital
- **Analysis:** Logistic regression with covariate adjustment (e.g. age, gender, comorbidities); random-effects meta-analysis across cohorts; many sensitivity analyses.

Flow diagram of eligible spells

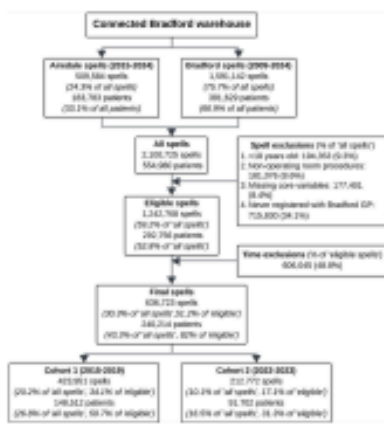### cBradford data overview

2 | Aims

- Examine associations between social factors & safety outcomes in Bradford surgical inpatients.
- Compare pre- (2015–2019) and post-pandemic (2022–2023) cohorts.

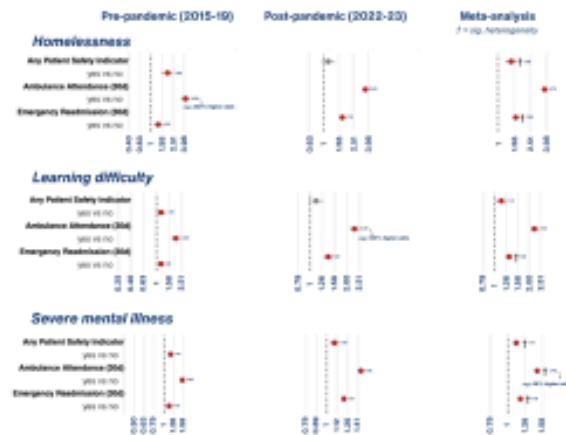### Odds ratios for deprivation quintiles on binary outcomes

→ significantly **lower** in comparator vs reference group (e.g. 2 - deprived vs 1 - most deprived)
→ significantly **higher** in the comparator vs reference group
→ not significant

OR = a measure of the strength of association: the ratio of odds of an outcome between two groups;
OR > 1 suggests higher odds in the exposed group, OR < 1 lower odds.

All models are adjusted for various demographic and clinical factors. Significant heterogeneity indicates pre/post pandemic differences in estimates.

Odds ratios for selected variables on binary outcomes

4 | Results

- **Composition:** 636k spells (240k patients); mean age 51; ~64% female; 46% White British, 23% South Asian; ~45% in most deprivation quintile.
- **Deprivation:** Strong gradient; the less deprived the lower odds of any PSI, post-discharge ambulance conveyance or emergency readmission.
- **Ethnicity/language** (vs White British/English speakers): South Asian groups had lower odds of any PSI and ambulance conveyance. Black groups had increased risk. Other groups mixed. Language results largely similar.
- **Homelessness:** Strong increased odds of ambulance conveyance, any PSI and emergency readmissions.
- **Mental illness:** Moderate increased odds of ambulance conveyance, any PSI and emergency readmissions.
- **Learning difficulties:** Moderate increased odds of ambulance conveyance, any PSI and emergency readmissions.

5 | Conclusions

- Safety inequities were substantial and persistent before and after the pandemic, indicating entrenched systemic causes.
- Consistent patterns across outcomes show that disparities are predictable and measurable, enabling routine data to be used for targeted discharge planning and follow-up.
- PSIs were more volatile than healthcare use metrics, underscoring data and clinical coding limitations. Validation of our PSI algorithms are needed.
- Future work needs hypothesis-driven designs and more granular data to
  - find underlying mechanisms (which may be modifiable)
  - study hard-to-reach at-risk groups (e.g. transgender patients),
- Research could also build on this work via intersectionality modelling (e.g. MAIHDA) to evaluate any *compounding* impacts of having *multiple* group identities (e.g. being homosexual and from a minoritised group).

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