(SHS). In November 2018 comprehensive restrictions on smoking in Scottish prisons were introduced to protect staff and people in custody from SHS exposure. This study compares SHS exposure assessment results six months after implementation of smokefree policy with levels measured in 2016 before the policy was announced.

Methods Setting: Scotland's 15 prisons

In 2016, 128,431 minutes of $PM_{2.5}$ (as a marker of SHS) concentration data were collected from residential halls and 2,860 minutes for 'task-based' measures; equivalent figures for 2019 were 126,777 minutes (residential halls) and 3,073 minutes (task based).

Six days of fixed-site monitoring were conducted in residential halls in each prison over 6 days commencing 22.5.19. Task-based measurements were also conducted to assess SHS in specific locations (e.g. workshops) and during specific activities (e.g. cell searches). Utilising these monitoring data, typical daily $PM_{2.5}$ exposure profiles were constructed for the prison service and time-weighted average exposure concentrations were estimated for typical shift patterns for residential staff pre- and post-implementation of the smokefree policy. Staff self-reports of exposure to SHS were also gathered using online surveys.

Results Measured $PM_{2.5}$ in residential halls declined markedly; median fixed-site concentrations reduced by more than 91% compared to baseline. The changes in the task-based measurements (89% average decrease for high-exposure tasks) and time-weighted average concentrations across shifts (over 90% decrease across all shifts), provide evidence that prison staff exposure to SHS has significantly reduced. The percentage of staff reporting no exposure to SHS rose between from 19% to 74% among all staff in Phase 3.

Discussion To our knowledge, this study is the first comprehensive international study to objectively measure SHS levels before, during and after implementation of a smokefree policy across a country's prison system. The dramatic reduction in SHS exposures confirmed complementary qualitative data and stakeholder reports of the success of the smoking ban in removing tobacco.

The findings demonstrate that SHS exposures can be effectively eliminated through a well-applied smoking ban in the challenging context of prisons; and are highly relevant for other jurisdictions considering changes to prison smoking legislation.

Wednesday 9 September

Health Inequalities

OP19 | **QUANTIFYING MULTI-MORBIDITY IN AN ETHNICALLY-DIVERSE INNER CITY POPULATION: EXPLORING THE HEALTH BURDEN OF HOUSEHOLDS USING A RETROSPECTIVE E-COHORT**

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Background Multi-morbidity is a growing challenge globally. New insights and approaches into the patterns of, and contributing factors to, multi-morbidity, using large routinely-collected patient data resources, are current research priorities. There is evidence that individuals who live with people with a long-term condition are at increased risk of a long-term condition themselves, however to date there has been no assessment of multi-morbidity at a household level.

General practitioner (GP) Electronic Health Records (EHRs) contain rich demographic and clinical data for research to quantify and explore household multi-morbidity. We investigated this by creating and linking GP-EHRs to a unique household identifier based on the patient address.

Methods GP-EHRs for 1,164,736 patients registered with GP practices in four London boroughs at mid-2018 were extracted to create a retrospective e-cohort. Patient addresses were matched to Unique Property Reference Numbers (UPRNs) using a validated deterministic address-matching algorithm, and pseudonymised into Residential Anonymised Linking Fields (RALFs). GP-EHRs were linked to the RALF. Exclusion criteria were selected using sensitivity analyses as per STROBE guidelines, based on GP registration status and date, property type, and data quality.

The main outcome was multi-morbidity in patients aged $\geq$18 years in mid-2018 with two or more chronic long-term conditions identified from their GP-EHRs based on diagnostic criteria and their associated READ codesets developed in the Quality and Outcomes Framework. We assigned individuals to their households on the basis of shared RALFs. We calculated age-specific multi-morbidity prevalences and their ratios by individual-level factors, and estimated the number of adults with multi-morbidity in each household. We investigated the characteristics of households with $\geq$2 adults with multi-morbidity.

Results The e-cohort comprised 923,995 patients (48.6% female, 44.6% Black and Minority Ethnic [BAME] backgrounds, 68% aged 20–64 years) living in 332,661 households (median [IQR] occupancy: 2 [1–3]). Multi-morbidity was identified in 104,082 patients (14%) and was more prevalent in women (53%), those from BAME backgrounds (51%), or those of working age (58% 20–64 years). Overall, 87,889 (26%) households included at least one, and 14,563 (4%) two or more, adults with multi-morbidity. Age-specific prevalence and prevalence ratios will be presented.

Conclusion This is the first time multi-morbidity has been quantified at the household level. We have demonstrated a high burden of multi-morbidity in women, working-age adults and those from BAME backgrounds in a geographically-defined, ethnically diverse, urban population. Factors contributing to multi-morbidity at a household level will be explored and compared to findings from a harmonised dataset for Wales.

OP20 | **USING CROSS-SECTORAL ADMINISTRATIVE DATA LINKAGE TO UNDERSTAND THE HEALTH OF PEOPLE EXPERIENCING MULTIPLE EXCLUSION**

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Background People affected by the intersection of homelessness, drug use, and/or serious mental illness have high rates of mortality and morbidity. However, a recent systematic review found important limitations in the evidence base on this topic,