**Understanding Trends in E. coli and MSSA Bacteraemia: A Population-Level Analysis in England**

**Background and Rationale**

The increasing incidence of bloodstream infections (BSIs) in England presents a significant public health challenge, particularly concerning Escherichia coli and Methicillin-Susceptible Staphylococcus aureus (MSSA) bacteraemia. According to recent government surveillance data, E. coli bacteraemia cases reached 42,224 in financial year (FY) 2023 to 2024, marking an 8.9% increase from the previous year and the largest annual increase since surveillance began (UKHSA, 2023). While hospital-onset cases have remained relatively stable at around 22.7 cases per 100,000 bed-days, community-onset infections have shown a marked increase to 59.5 cases per 100,000 population (UKHSA, 2023). The reasons for this increase are unclear and a number of factors such a poor treatment of UTI’s, antibiotic resistance and demographic changes have been suggested to have contributed (Deeny et al., 2015). Similarly, MSSA bacteraemia has demonstrated a concerning upward trajectory, with 13,476 cases reported in FY 2023 to 2024, representing a 53.7% increase since FY 2011 to 2012 (UKHSA, 2023). The rate of all MSSA cases has risen from 16.4 to 23.5 per 100,000 population during this period, with an 8.3% increase compared to pre-pandemic levels (UKHSA, 2023).

**Demographic and Socioeconomic Dimensions**

Infection rate is influenced by many sociodemographic determinants and key risk factors can be determined to get a understanding of trends in E coli and MSSA. The age and gender distributions of these infections reveal intriguing patterns that warrant further investigation. E. coli bacteraemia shows its highest burden in the 75-84 age group, with a notable female predominance in younger adults (15-44 years) (UKHSA, 2023). In contrast, MSSA demonstrates a consistent male predominance across all age groups, with the highest burden in the 45-64 age group (UKHSA, 2023) . These distinct demographic patterns suggest different risk factors and transmission dynamics that require targeted research approaches.

Antibiotic resistance is a rapidly increasing global health problem with the increasing consumptions of antibiotics and their improper use accelerating this problem (Allocati et al., 2013). E coli is resistant to many classes of antimicrobial drugs leading to the emergence of multi drug resistant strains of E Coli further complicating treatment of serious infections (Allocati et al., 2013). Infection patterns also differ by age group and geographic area with the global south carrying a greater burden of disease. Studies have shown that E coli is the most common cause of diarrhoea in infants and children under 2, accounting for over 70% of cases in Egypt (Qadri et al., 2005). Susceptibility to infection in this age group in developing countries is due to poor public health and hygiene conditions (Qadri et al., 2005).

Current data shows significant variations in infection rates by age and deprivation level across the UK(UKHSA, 2023). The Covid pandemic led to a significant decline in cases of both E coli and MSSA followed by a rapid rebound. Disruption of the healthcare system during the pandemic may have lead to under reporting of community onset cases and increased hygiene standards in hospitals may have reduced hospital onset cases. Through analysis of data collected by the UKHSA and a review of past literature we have identified factors that may influence E coli and MSSA trends which we will review in this article.

**Research Objectives**

**Primary Objective**

To determine whether demographic factors (age), socioeconomic indicators (ONS deprivation indices), and geographical distribution can explain the observed trends in both E. coli and MSSA bacteraemia rates.

**Secondary Objectives**

1. To evaluate whether antibiotic prescribing patterns and GP appointment availability influence both E. coli and MSSA bacteraemia rates in community settings
2. To analyse how COVID-19 pandemic trends strengthen our understanding of infection patterns
3. To determine whether similar population-level factors explain parallel trends in both infections

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