

Introduction

Type 2 diabetes is prevalent in the UK, accounting for approximately 90% of all diabetes cases among adults. With approximately 3.8 million individuals currently affected in England, and about 200,000 new diagnoses yearly, Type 2 diabetes poses a substantial medical and socioeconomic burden. The National Health Service (NHS) spends at least £10 billion annually on managing this condition [1]. The majority of the financial burden goes towards managing the associated complications, which constitutes approximately 80% of total diabetes expenditure.

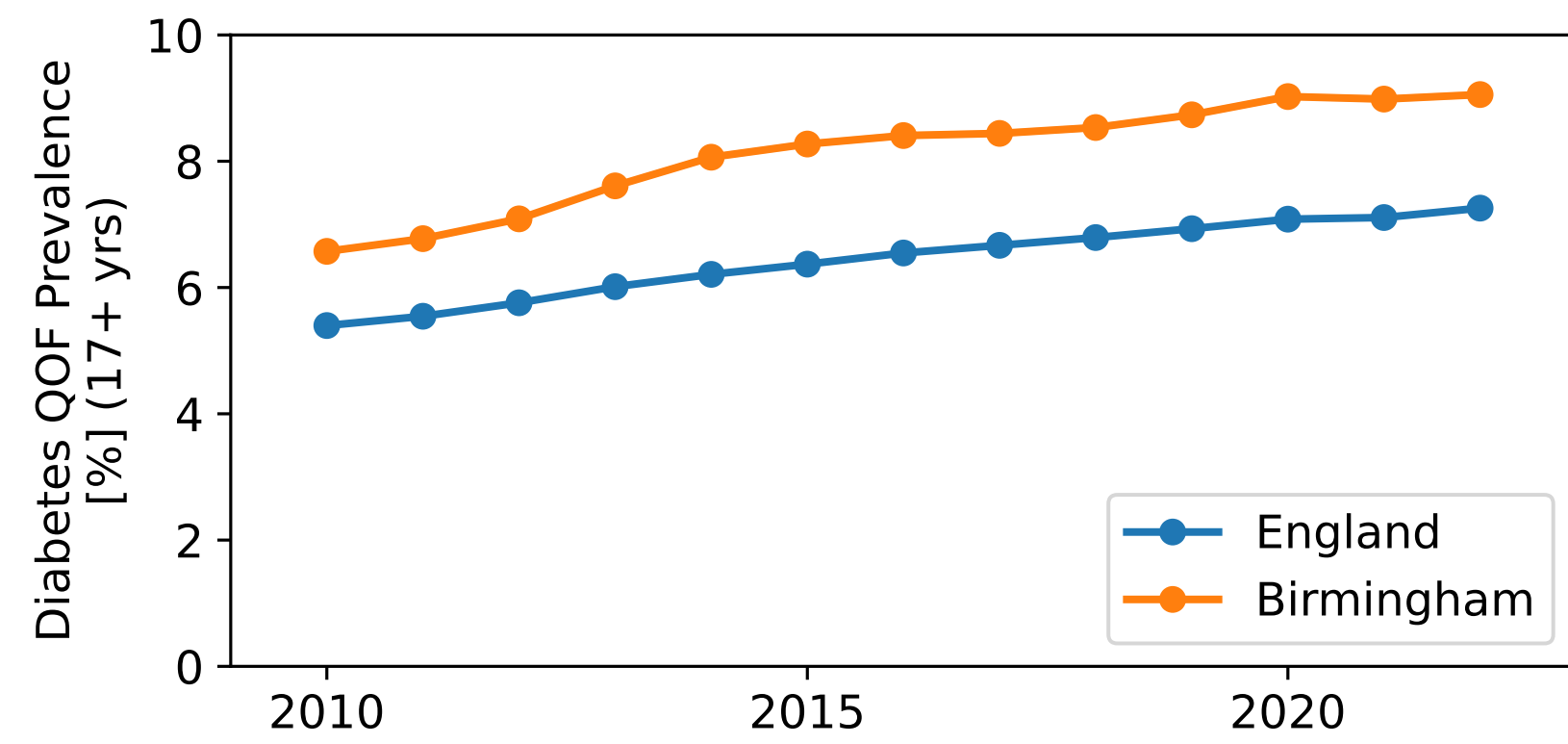


Figure 1. Diabetes QOF prevalence 17+

Diabetes prevalence in Birmingham has been steadily rising over the past decade, mirroring the trend observed across England. The rate in Birmingham consistently surpasses the national average [2]. Birmingham's high levels of deprivation and the super-diverse nature of its ethnic communities in the population have deepened the inequalities in lifestyle and diabetes.

Methods

This study used data from NHS health checks (HCs) [3] completed between 22/06/2018 and 30/06/2023, with a total of 108514 patient-record-level data. The data was extracted and provided by the Midlands and Lancashire Clinical Support Unit (MLCSU). The NHS HCs program in Birmingham offers free check-ups to individuals aged 40-74 without pre-existing cardiovascular conditions or specific risk factors. It aims to detect and manage early signs of health issues, including type 2 diabetes.

The data set does not specifically identify individuals with a diagnosis of diabetes and pre-diabetes. Instead, we used the HbA1c level and followed the diagnostic criteria recommended by the World Health Organisation (WHO) to identify these conditions. According to the WHO criteria, the HbA1c levels are categorised as follows:

Table 1. WHO Diagnostic Guidelines for Diabetes based on HbA1c Levels

HbA1c Level (mmol/mol)	Diagnostic Category
< 42	Non-diabetic
42 - 47	Pre-diabetes
≥ 48	Type 2 diabetes

The unadjusted attributable fraction (AF) of diabetic and pre-diabetic conditions attributed to patients' ethnicity and socioeconomic deprivation was calculated. This gives the proportion of negative events that would have been avoided if exposure to risk factors were diminished to the reference level. It's important to note that the "Other" ethnicity were excluded from the calculation due to the limited number of occurrences.

Multinomial logistic regression was employed to investigate the association between the factors influencing individual and their respective outcomes in terms of diabetic and pre-diabetic HbA1c level. We examined the relative risks associated with a comprehensive set of determinants of health, considering variables beyond ethnicity and IMD. This allowed us to explore the multifaceted relationships between various factors and negative outcomes while adjusting for confounding variables.

Handling of missing data

This study employed the Multiple imputation with chained equations (MICE) to handle the missing values in the data set. The imputation of missing ethnicity data was enhanced by joining information on the ethnic distribution of patients registered to each GP practice.

Descriptive Analysis

Out of the attendees in the dataset, 63% reside in the 20% most deprived areas of England. However, as depicted in Figure 2, the distribution of deprivation varies among different ethnic groups. Notably, the Black and Asian ethnicity cohorts lived in the most deprived area 82% and 79% of the time respectively.

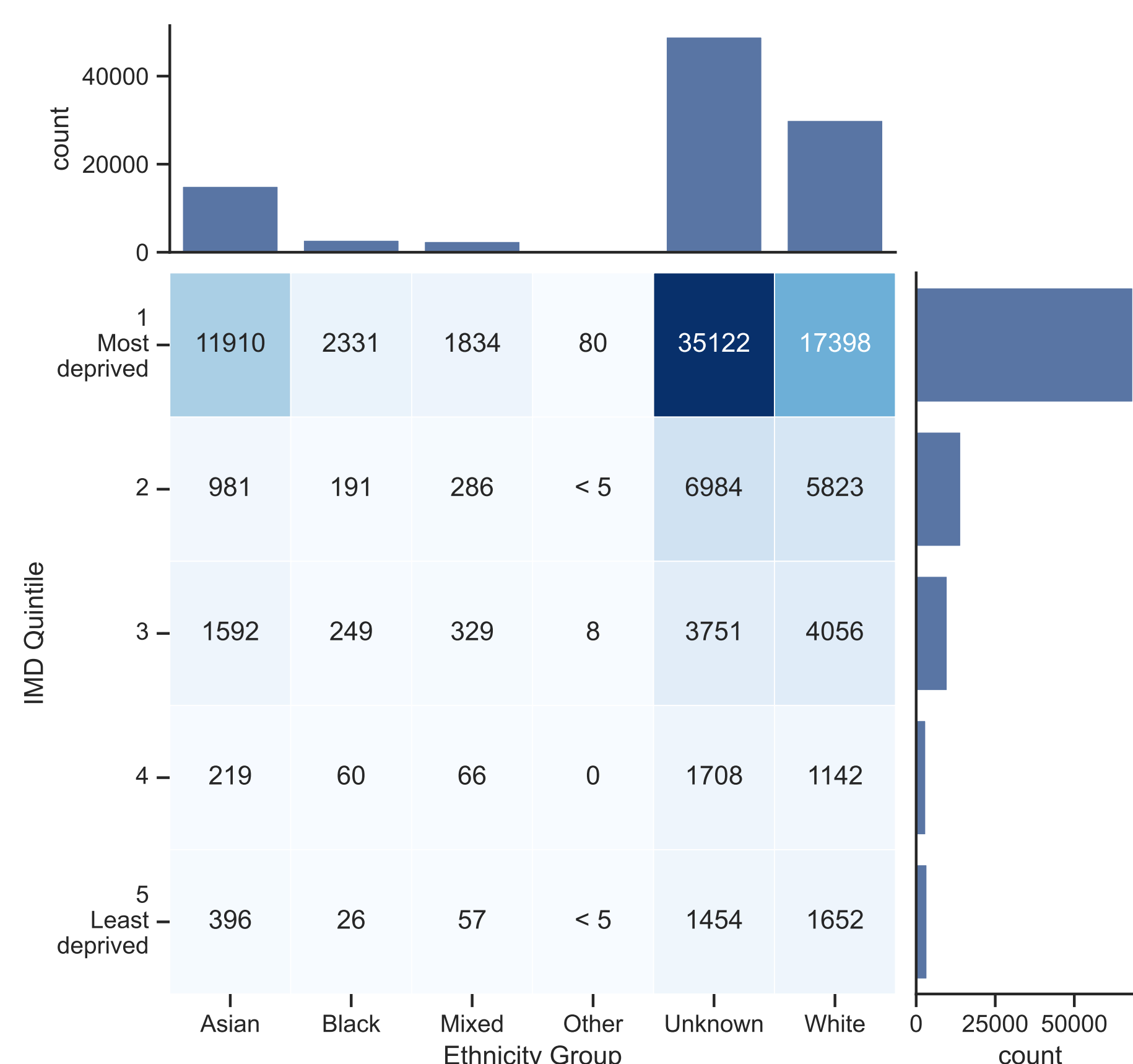


Figure 2. Distribution of Birmingham HC attendees across ethnicity and IMD calculated without imputation.

Results

We calculated the percentage of each negative outcome that can be attributed to the risk associated with the patient's ethnicity and IMD. This measurement represents the reduction in the number of outcomes that would have occurred if individuals had the same level of risk as White ethnicity patients in the least deprived area (IMD quintile 3+).

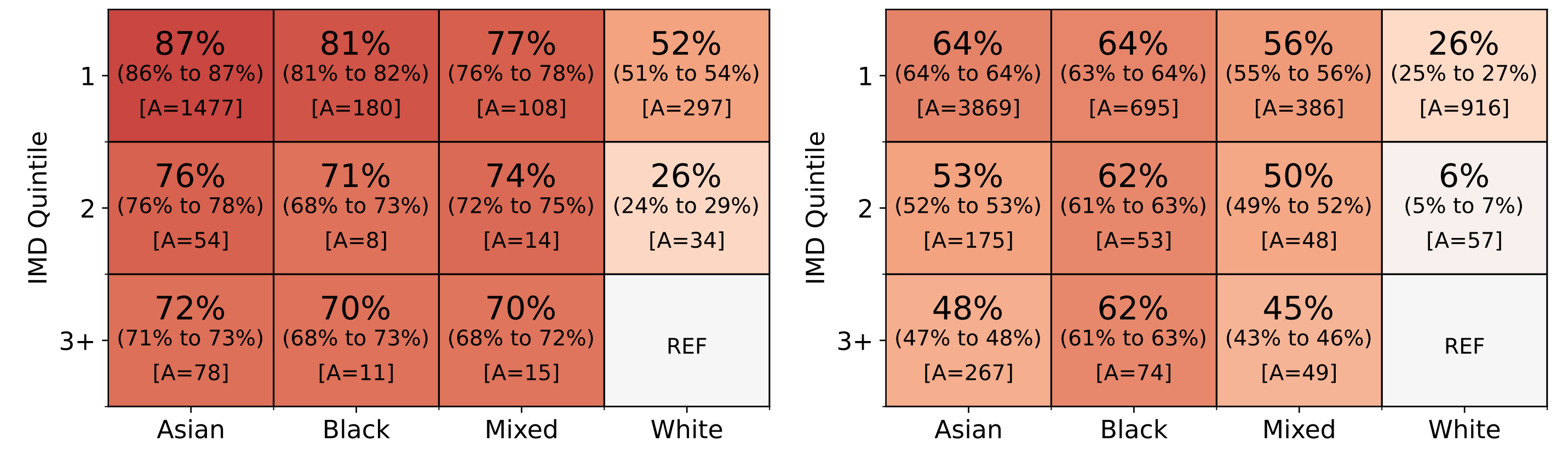


Figure 3. Proportion of diabetic (Left) and pre-diabetic (Right) HbA1c levels across ethnicity and IMD that would not have occurred if the attendees had the same level of risk as White ethnicity attendees in the least deprived area (IMD quintile 3+). A is the number of outcomes in the data set that would have been avoided. 95% CI calculated using bootstrapping.

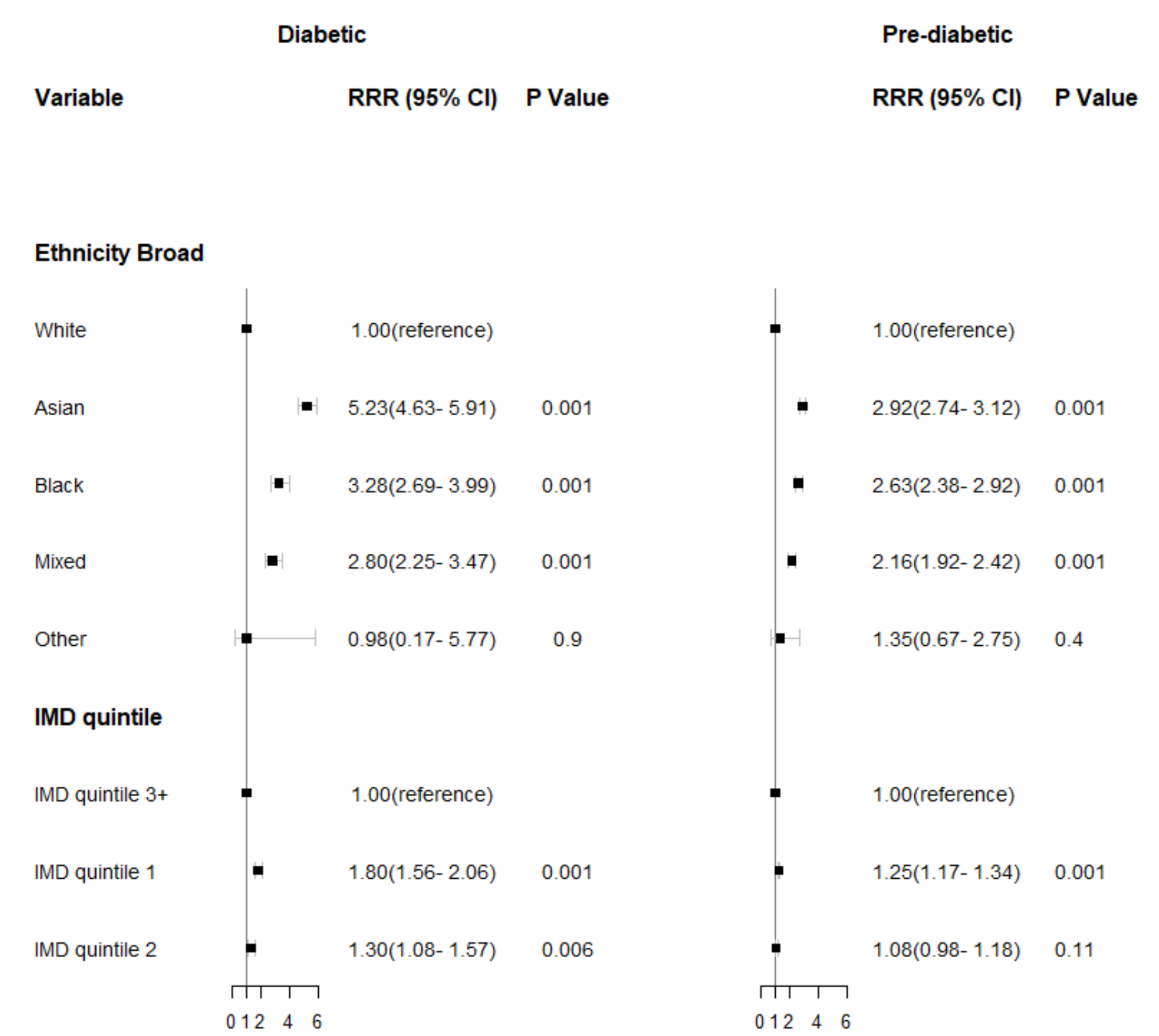


Figure 4. Forest plot of the regression coefficient in relative risk ratios (RRR), 95% confidence interval (CI) and p-value for Diabetic (left) and Pre-diabetic (right) compared to the baseline Normal (omitted).

Ethnicity was found to be a significant predictor for both diabetic and pre-diabetic HbA1c level. In particular, Asian ethnicity showed the strongest association relative to White ethnicity. Individuals residing in socioeconomically disadvantaged areas exhibited an elevated risk of having diabetic and pre-diabetic HbA1c level.

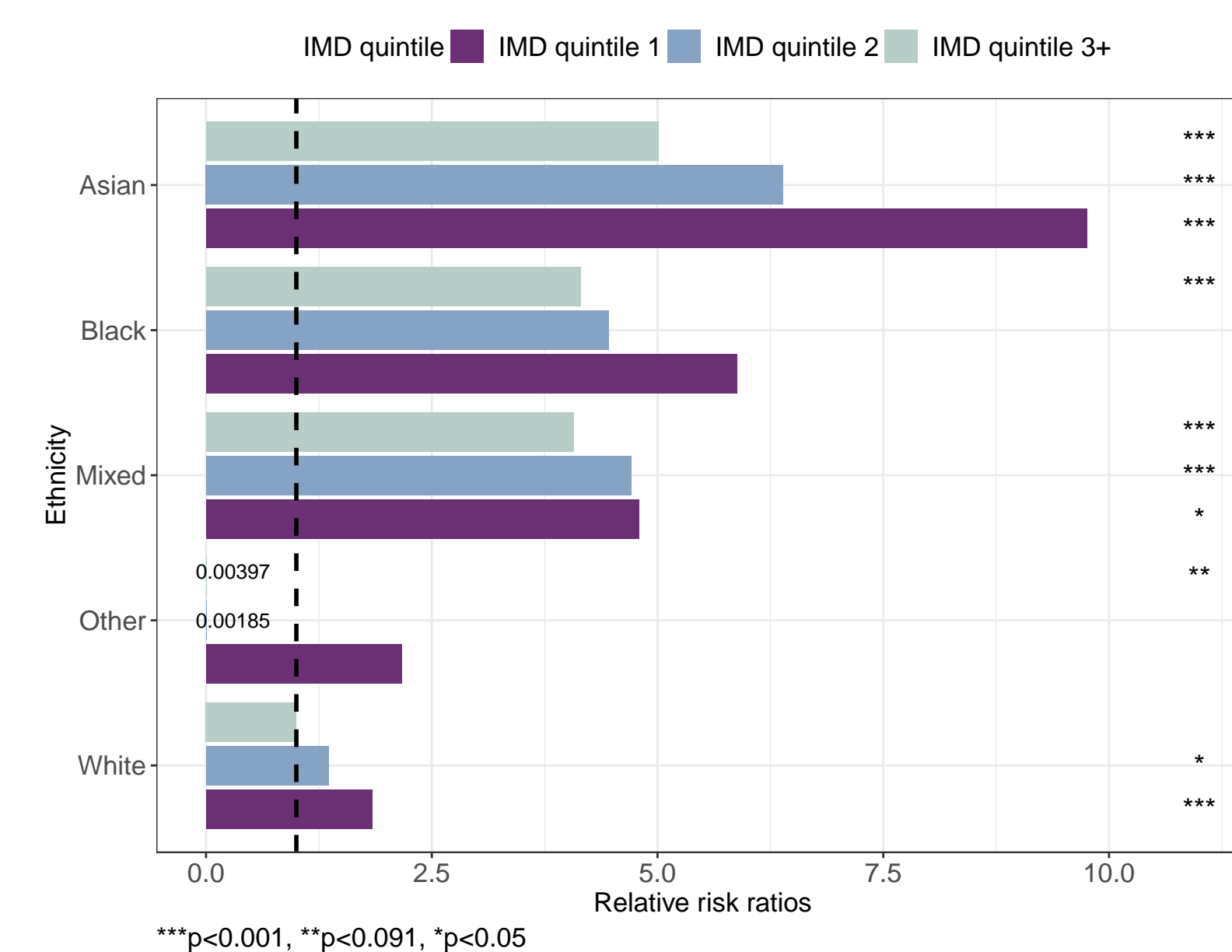


Figure 5. Relative risk ratios of having diabetic HbA1c level, by IMD quintile and ethnicity. Taking into account gender, age, BMI category, smoking status, broad activity term, hypertension and alcohol category.

Asian ethnicity living in IMD quintile 1 areas had the strongest association with a RRR of 9.75 relative to White ethnicity living in the least deprived areas. The effect sizes were followed by Asian ethnicity living in IMD quintile 2 and IMD quintile 3+ areas. This interaction underscores the impact of both factors and highlights the elevated risk experienced by specific ethnicity groups and those living in more deprived areas.

Conclusion

The findings of this study highlight a significant association between ethnicity, socioeconomic deprivation, and various determinants with an increased risk of having related to diabetic and pre-diabetic HbA1c level. Notably, the interaction between ethnicity and socioeconomic deprivation magnifies these effects when ethnicity and socioeconomic deprivation interact together. These findings underline the relevance of racial discrimination and ethnic health disparities within the context of Birmingham, thereby emphasising the need for target interventions and policies aimed at mitigating these disparities.

References

- Diabetes UK. Position Statement Report: Statistics. <https://www.diabetes.org.uk/professionals/position-statements-reports/statistics>. Accessed: 2023-05-24.
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