

# Centre for Biostatistics, University of Manchester

## MiNESS 20-28

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## Statistical Analysis Plan

SAP Version 1.0

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## Administrative Information

This document is the Statistical Analysis Plan (SAP) for the MiNESS 20-28 study. It is to be read alongside the most recent version of the study protocol. At time of writing, the current protocol version is v2.3, dated 27/06/2025.

The organisation of this document loosely follows the SAP Guidance template of Gamble et al (1). Numbered references in square brackets [ ] denote specific numbered checklist items. Additional items are included to reflect the case-control nature of the study, and template items relevant only to clinical trials are marked as not applicable.

A list of changes between different number SAP versions can be found after the table of contents, starting on page **Error! Bookmark not defined..** The relevant contributors and their affiliations [1] are given on the cover page. The signature page is located on page 54. [6a, 6b, 6c]



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## Introduction

### Background and rationale [7]

The detailed study background is given in the study protocol.

Briefly: The MiNESS study identified a number of risk factors associated with stillbirth after 28 weeks gestation, including maternal sleeping position. While these recommendations have been put into practice, and a reduction in neonatal mortality observed, no reduction has been seen in pregnancy loss between 20 - 27+6 weeks of pregnancy, legally comprising late miscarriage, early stillbirth and immediate neonatal death (collectively referred to as early stillbirth for brevity). The MiNESS 20-28 study therefore aims to identify factors associated with early stillbirth, focussing on earlier pregnancies.

### Objectives [8]

The overall aim of the study is to identify modifiable risk factors for early stillbirth that are amenable to public health campaigns or adaptation of antenatal care.

Specific study objectives:

- Confirm or refute whether modifiable behavioural factors associated with late stillbirth are also independently associated with early stillbirth.
- Explore interactions between maternal characteristics (especially those relating to health inequalities including ethnicity and socioeconomic deprivation), fetal factors (including fetal growth restriction, reduced fetal movements) and early stillbirth risk.
- Determine differences in risk factor profiles by cause of death.

None of the study objectives have been designated as primary/secondary or otherwise.

## Study Methods

### Study Design [9]

MiNESS 20-28 is an observational case-control study (1 case per 2 controls) study, with cases and controls to be recruited separately.

Cases are recruited prospectively, with controls being recruited contemporaneously from among those with ongoing pregnancy.

## Randomisation [10]

Not applicable, as MiNESS 20-28 is not a randomised controlled trial.

## Sample Size [11]

Early stillbirth occurs in approximately 0.3% of births (2). Recruiting 316 cases and 632 controls (two controls per case) will detect associations with an odds ratio of 1.5 or greater (i.e. a difference in associated fetal death rates of between 0.3% and 0.45% or more) with 80% power and 5% significance level, where 30-60% of participants are exposed.

Individual early stillbirth subtypes (preterm delivery, unexplained in utero, explainable in utero) are expected to occur in a 1:1:1 ratio. If these are differentially affected by certain exposures, the sample size is adequate to detect subtype-specific associations with an odds ratio of 2 or greater (same power and significance level, assuming 30-60% exposure). Larger effect sizes are expected in relation to subtype-specific risk factors compared to overall analyses, as subgroup effects will be attenuated by patient heterogeneity in the latter.

## Framework [12]

All objectives are to be tested using a superiority framework. Should any hypothesis test fail to reject a null hypothesis, no testing of non-inferiority or equivalence hypotheses will be performed. No a priori equivalence/non-inferiority margins have been specified.

## Interim Analyses and Stopping Guidance [13a, b, c]

There were no interim analyses of the data. Consequently, there are no plans to adjust the significance level of analyses to maintain overall Type I error rates, nor are there any stopping boundaries to describe.

## Timing of final analysis [14]

Final analysis of the MiNESS 20-28 study will begin when the final participant has been recruited and the final control participant has reached at least 28 weeks of pregnancy,

provided data and all data-cleaning activities have been completed. Database release to the study statisticians is not permitted before all outstanding data items are either received or confirmed not available upon the date of database lock.

## Timing of outcome assessments [15]

Table 1

	Screening	Interview	Case Note Review	Pregnancy Outcome
Confirmation of eligibility	X			
Local approach of participant	X			
Informed Consent		X		
Questionnaire		X		
Demographics		X	X	
Medical History		X	X	
Outcome Assessment				X

## Statistical Principles

### Confidence Intervals and P-values

#### Level of statistical Significance [16]

The significance level of 5% will be used for all analyses.

#### Adjustments for multiplicity [17]

No adjustments for multiplicity are planned.



## Confidence Intervals to be reported [18]

All confidence intervals for effects will be 2-sided at the 95% level.

## Adherence and Protocol Deviations

### Adherence definition and reporting [19a,b]

Not applicable

### Protocol deviation definitions and reporting [19c, d]

We will report the numbers of participants not interviewed within the required timelines. (Split into being interviewed too early, and being interviewed too late.)

Any other protocol deviations will be summarised descriptively.

## Analysis Populations [20]

All participants (cases and controls) who consent to taking part will be included in the analysis population and analysed according to their “case-ness” or “control-ness”.

In the rare occurrence that a control participant with ongoing pregnancy at the time of recruitment and interview as a control experiences early stillbirth and is then recruited for a second time as a case, then the participant will be analysed as a case, and their responses as a control participant not included in the control analysis population.

## Study Population

### Non-recruitment data [21]

No data on non-recruited participants is available.

### Eligibility [22]

The full eligibility criteria for cases and controls are detailed in the current version of the study protocol. In brief, all participants (cases and controls) must satisfy the overall inclusion criteria:

- People receiving pregnancy care and/or giving birth in a participating maternity unit during the study period;
- Singleton pregnancy/birth;
- Baby without (evident) serious congenital abnormality;
- Between 20-27+6 weeks of pregnancy

Additional eligibility criteria for recruitment as a case:

- Where baby was diagnosed to have died before/during or immediately after labour
- Where baby was diagnosed to have died between 20-27+6 weeks of pregnancy

Additional criterion for recruitment as a control:

- Ongoing pregnancy at the target gestation (as specified by the control identification tool between 20 to 27+6 weeks of pregnancy), even if no longer pregnant at the time of interview.

### Recruitment [23]

Cases: identified as meeting the inclusion criteria by clinical teams within participating hospitals. All potentially eligible patients were to be approached by the direct care team and referred to the study if providing consent to contact.

Controls: identified randomly from hospital patient lists with target gestations to match the gestation distribution of bereaved individuals in the same hospital in the preceding three years. Approached directly by local research teams.

All case and control participants were to be interviewed within 6 weeks of the death/target gestation.

### Withdrawal and Follow-up [24]

Since recruitment and interview happen in rapid succession, no loss to follow-up is anticipated for the majority of the data. An exception might be for sensitive questions where the participant might need to be interviewed alone, and no opportunity is available.

### Study Population characteristics [25]

All questions answered at the interview will be summarised, both overall, and among the cases and the controls.

## Analysis

### Outcome Measures [26]

Table 2 below gives the outcome measures of interest, and their relation to the study objectives.

*Table 2 Relations between study objectives and outcome measures and analyses*

Objectives	Outcome Measures	Analysis Pages
Identify modifiable risk factors for early stillbirth that are amenable to public health campaigns or adaptation of antenatal care	[Case/Control variable] Occurrence or non-occurrence of pregnancy loss between 20 <sup>+0</sup> and 27 <sup>+6</sup> weeks of pregnancy	Pages 16 to 29
Confirm or refute whether the range of factors associated with late stillbirth are independently associated with early stillbirth, including (but not limited to) supine sleep position, caffeine intake and reduced fetal movement.	As above	Pages 16 to 29
Explore interactions between maternal/parental characteristics (especially those relating to health inequalities including ethnicity and socioeconomic deprivation), fetal factors (including fetal growth restriction, reduced fetal movements) and early stillbirth risk.	As above	Page 29
Determine whether exposures associated with early stillbirth vary by cause of death.	As above	Page 29

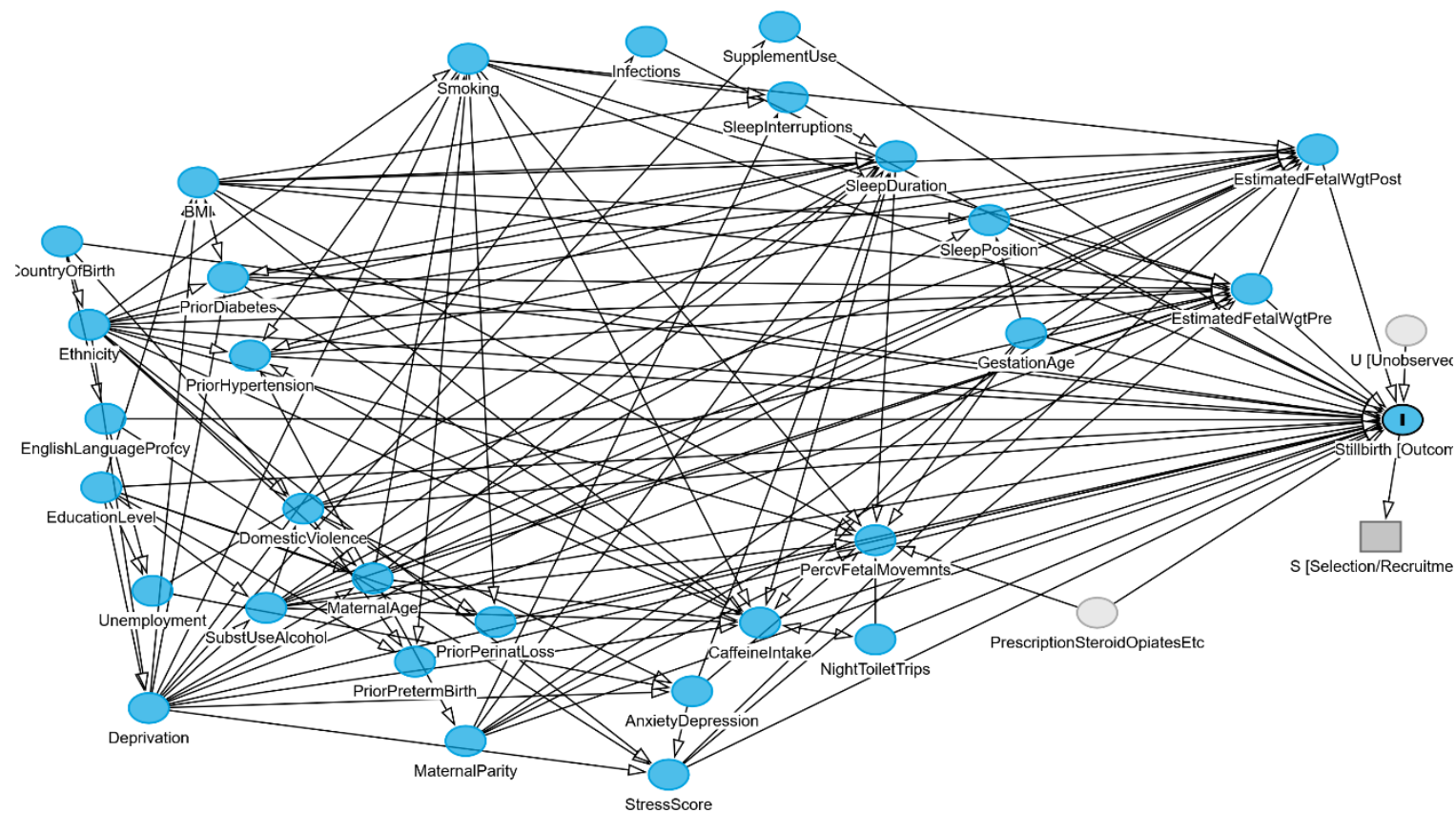
### Analysis Methods [27]

The data arises from a case-control study design. Cases and controls are not directly matched, so there is no pairing variable that identifies participants that are similar, save for case-ness/control-ness. However, controls are sampled concurrently from a sampling frame based on historical data so as to encourage the recruitment of controls with similar characteristics to cases.

### General Principles

To identify sets of variables to adjust for in our analyses, we have constructed the following Directed Acyclic Graph (DAG) which illustrates hypothesised relations between variables, including exposures, outcome and selection into the study

Figure 1 - Directed Acyclic Graph of relations between variables and stillbirth outcome



For each exposure of interest, the DAG will be used to identify the minimum set of potentially confounding variables to be conditioned on in order to obtain an estimate of the causal effect of exposure on outcome. However, a number of variables are considered – a priori – to be predictive of early stillbirth may be added to the minimal sufficient adjustment set, where their inclusion does not appear to be indicated:

- Body Mass Index;
- Deprivation [IMD quintile AND unemployment];
- Ethnicity;
- Maternal Age at onset of pregnancy;
- Maternal Parity ;
- Smoking (never, stopped pre-pregnancy, stopped before 16 weeks, current as of 16 weeks);
- Alcohol use (never, stopped pre-pregnancy, stopped during pregnancy, current);
- Site

In addition, there is an expectation in this field that estimates adjusted for gestational age will be presented. Conversely, there are concerns that adjustment for gestational age may lead to selection bias. We will present all analyses with and without adjustment for gestational age. Importantly, if a variable in this list is deemed to be a mediator (by occurring downstream on the causal path between exposure and outcome) it will not be adjusted for, since conditioning on a mediating variable is not appropriate. For example, if the gestation age were the exposure of interest, then conditioning on either estimated fetal weight variable would amount to conditioning on a mediator of stillbirth, since changes in these variables are caused by changes in gestation age. Thus it would not be appropriate to adjust for either variable if we were to estimate the effect of gestation age on stillbirth.

A further important consideration for the study is that since the study conditions on the outcome (ie early stillbirth vs non-early stillbirth outcomes are likely predictive of being selected into the study) this potentially introduces a form of collider bias into the study. However, it is not possible to resolve this: we do not have external survey data to re-weight the study sample, and no other study designs were feasible to investigate this question. Our analyses therefore must assume that selection is not conditioned on pregnancy outcome in order to have a causal interpretation, regardless of the adjustment sets used.

For each DAG presented in this SAP, the underlying Dagitty code is included in the Appendix.

### *Hypothesis testing*

Wherever possible, any hypothesis testing will make use of likelihood ratio tests, rather than any other approach.

### *Continuous-valued confounders*

Variables that are continuously valued (even where values may have been recorded as discrete values) will be included in analysis models using multivariate fractional polynomial to allow for departures from linearity. The Multivariate Fractional Polynomial (MFP) method (3) will be used to select the best-fitting 2-degree polynomial relationship for the variable based on the data. We will not use this method (or any other) to exclude a variable from analysis models based on lack of statistical significance: all variables specified for inclusion will be included, regardless of strength of association. The sole criterion for deviating from our adjustment set will be failure of model fit / computational infeasibility.

### *Missing data*

When reporting the summaries of the levels of missing data, we will include the proportions of participants with unknown values of the variable(s) being summarised. Missing data will be assessed, incorporated, and reported in line with recent guidance from the Strengthening Analytical Thinking for Observational Studies (STRATOS) Initiative. (4) Where appropriate, we will consider multiple imputation as a means of producing completed datasets for analysis under the assumption that data is missing at random. If this is necessary, we will use a minimum of 20 imputations, and employ fully conditional specification (also known as MI by chained equations – MICE) with predictive mean matching for incomplete variables that are continuous in nature.

### *Table 2 bias (avoidance thereof)*

When reporting an adjusted estimate of the effect of exposure on outcome, the full regression model table must be read with care. The estimated exposure effect on outcome *may* be interpreted as the causal effect estimate, *provided that the correct set of confounders has been adjusted / conditioned on*. However, the remaining coefficient values for the confounders should not be automatically interpreted as unbiased estimates of the causal effect of confounder on outcome. Most likely, those estimates will be biased estimates of their effect on the outcome.

Therefore, where an estimated effect of a confounder, such as (for example) diabetes on outcome (early stillbirth) is desired, the analysis model will adjust for variables that are hypothesised to cause diabetes, and other factors causing the outcome, but not other variables caused by diabetes.

### Analysis 1 – Identify modifiable risk factors for early stillbirth that are amenable to public health campaigns or adaptation of antenatal care

As precursor to the more detailed analyses below, we will summarise the occurrence of early stillbirth according to various factors considered amenable to intervention:

- Smoking (Cigarette vs vaping)
- Caffeine intake
- Sleep Position
- Perception of fetal movements
- Social Factors
- Provision of care in pregnancy.

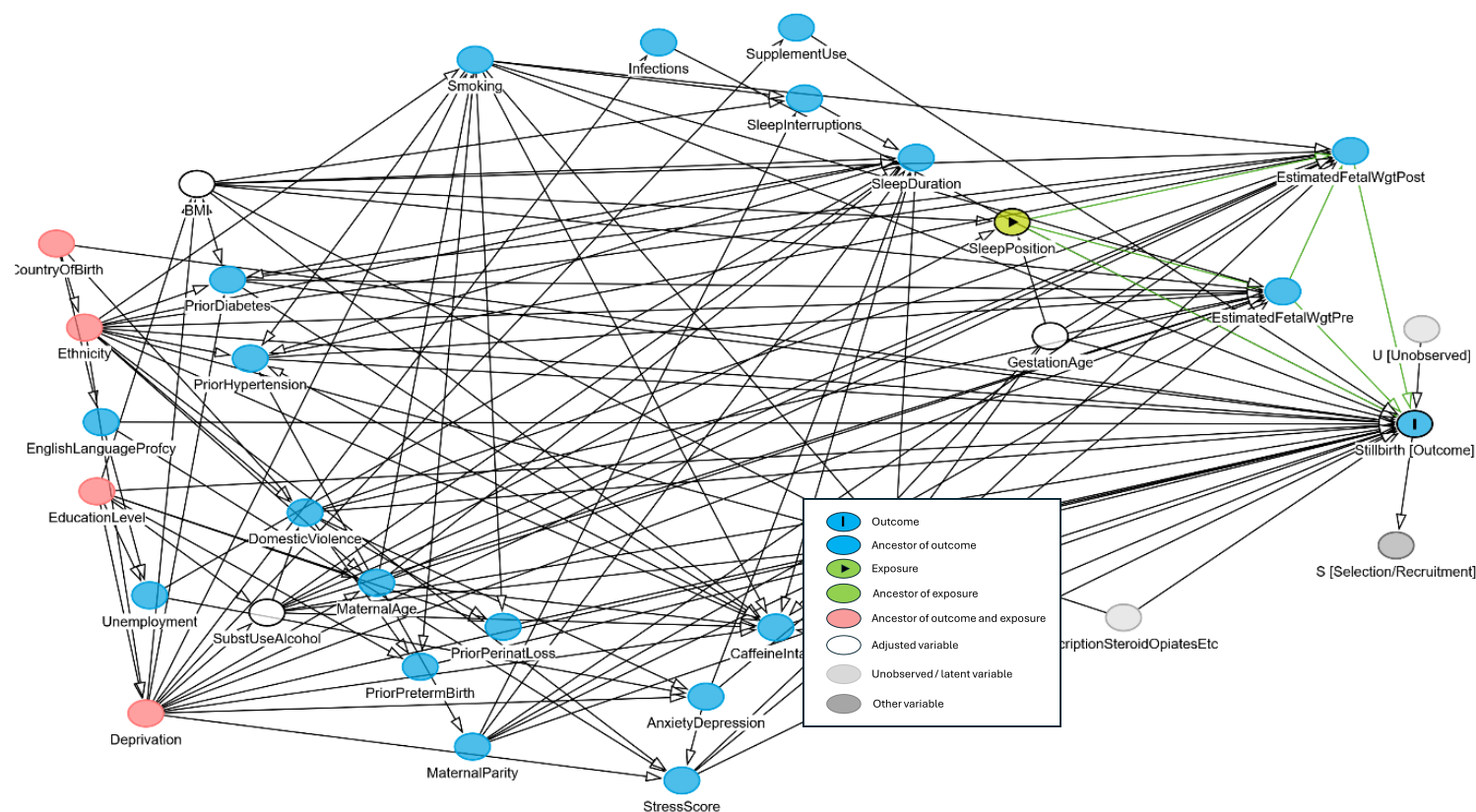
### Analysis 2 - Confirm or refute whether the range of factors associated with late stillbirth are independently associated with early stillbirth [...]

#### *Sleeping Position*

Figure 2 below gives the version of the main DAG where the Sleeping Position is marked as the exposure, and the minimum set of variables are adjusted / conditioned on to permit unbiased estimation of the causal relationship.



Figure 2 Directed Acyclic Graph showing minimum variables to adjust for to permit unbiased estimation of effect of sleeping position on stillbirth (Subject to caveats previously described)



Self-reported sleeping position (fall asleep and waking up) before pregnancy, during last 4 weeks and “last night” will be summarised among the cases and controls, both in the original recorded categories (side, back, front, other).

For the proposed DAG of relationships between the variables in the study, the minimum adjustment set of variables to permit unbiased estimation of the causal relationship (under the assumption that selection is not conditional on outcome) is Body Mass Index, Gestation Age and Use of Alcohol in the past four weeks. To this set of variables, we will add the remaining clinically important variables to form the set of variables for our primary analysis model.

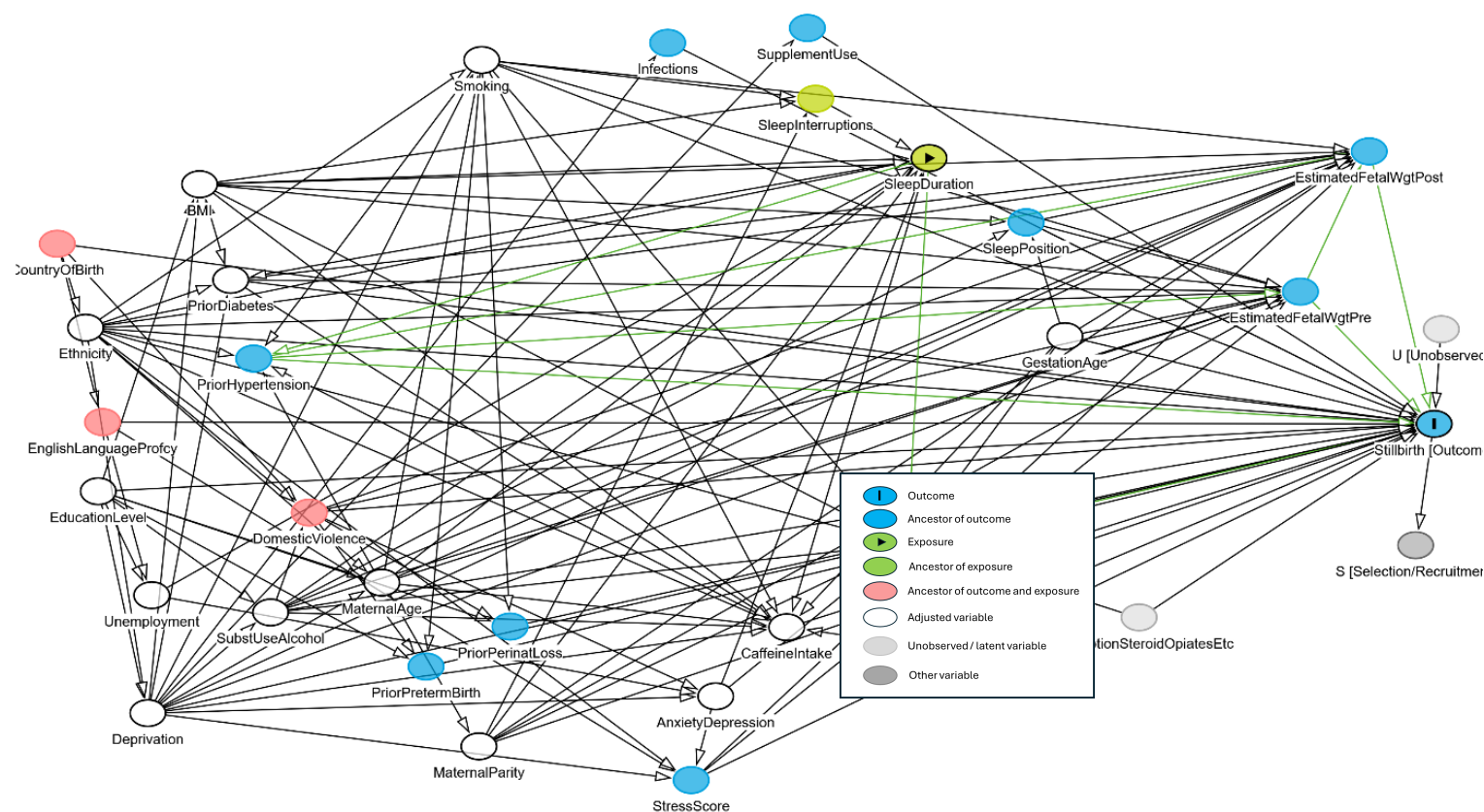
For each sleeping position variable, the effect of that variable on early stillbirth outcome will be estimated by binary logistic regression, adjusting for the aforementioned set of variables. When assessing effect of sleeping position in past four weeks and last night, we will additionally adjust for pre-pregnancy sleeping position. Gestation Age, Maternal Age, Deprivation score and Body Mass Index will be modelled using fractional polynomial relationships (maximum two terms) to allow for departures from linearity. All polynomial terms will be included, regardless of statistical significance.

Estimated Odds Ratios and 95% confidence intervals will be presented for the effect of Sleeping Position (only) on early stillbirth using the set of confounders described above.

### *Sleeping Duration*

Figure 3 below illustrates the hypothesised relationships between Sleep Duration and Stillbirth, and the minimum set of variables are adjusted / conditioned on to permit unbiased estimation of the causal relationship.

Figure 3 - Directed Acyclic Graph showing minimum variables to adjust for to permit unbiased estimation of effect of sleeping duration on stillbirth (Subject to caveats previously described)



Self-reported sleeping duration before pregnancy, during last 4 weeks, during last 1 week and “last night” will be summarised among the cases and controls.

For the proposed DAG of relationships between the variables in the study, the minimum adjustment set of variables to permit unbiased estimation of the causal relationship (under the assumption that selection is not conditional on outcome) is Anxiety and Depression (ever/never for reported anxiety and depression, experience of stress using cumulative score on perceived stress scale, MSPSS < 24, BMI, Caffeine Intake (1st 3 months and last 4 weeks as adherence to WHO guideline of 300mg/day), Deprivation, Prior Diabetes, Education Level, Ethnicity, Gestation Age, Maternal Age, Maternal Parity, Night Toilet Trips (in past week), Smoking, Use of alcohol, Unemployment. This minimum sufficient adjustment set includes all of our a priori important clinical variables, and so does not need to be augmented for our primary analysis model.

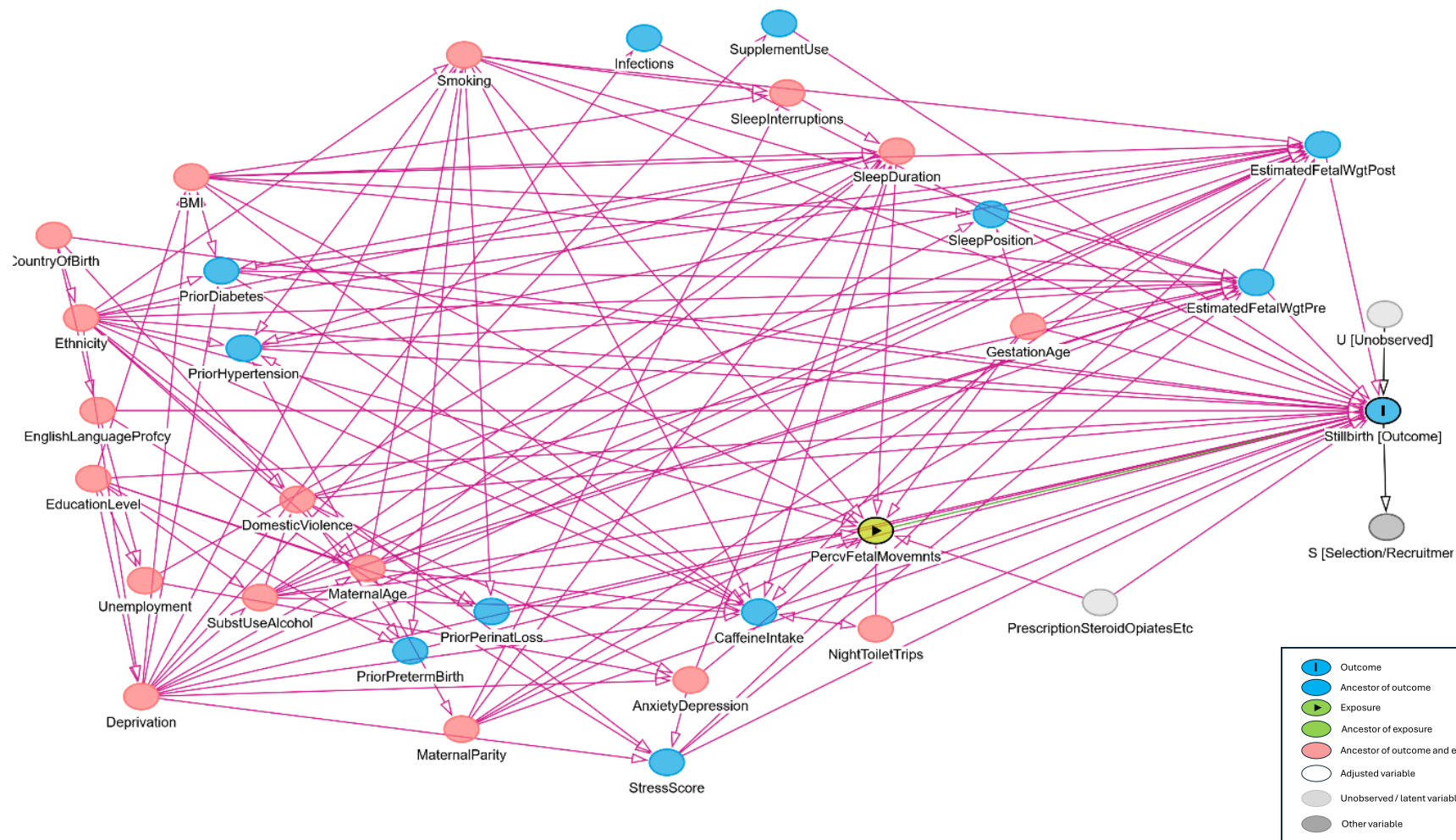
For each sleeping duration variable, the effect of that variable on early stillbirth outcome will be estimated by binary logistic regression, adjusting for the aforementioned set of variables. When assessing effect of sleep duration in past four weeks and last night, we will additionally adjust for pre-pregnancy sleeping duration. Gestation Age, Maternal Age, Deprivation score and Body Mass Index will be modelled using fractional polynomial relationships (maximum two terms) to allow for departures from linearity. All polynomial terms will be included, regardless of statistical significance.

Estimated Odds Ratios and 95% confidence intervals will be presented for the effect of Sleeping Duration (only) on early stillbirth using the set of confounders described above.

### *Perceived Fetal Movements*

Figure 4 below illustrates the hypothesised relationships between perception of fetal movements and early stillbirth, before defining the minimal sufficient set of variables to adjust for.

Figure 4 - Directed Acyclic Graph showing relation between exposure (Perceived fetal movements) and stillbirth (Subject to caveats previously described)



Self-reported timing of first fetal movement perception, establishment of movement pattern, comparison of movements to last baby, perceived less movement than normal, seeking health professional advice, hospital attendance, changing strength, frequency, more vigorous, and hiccups will be summarised among the cases and controls.

The variable “Prescription Steroids, Opiates, tranquilisers etc” (light grey, lower left) is an unmeasured confounder of the relation between perception of fetal movements and early stillbirth. We denote it as unmeasured due to the possibility that the data may not be well-completed for participants, including a possibility that for some categories, respondents may be reluctant to accurately report. This, unfortunately creates a confounding problem that cannot be resolved. For the purposes of our analysis, we will treat this as accurately reported, and attempt to adjust for it accordingly.

As a result, so far as the DAG is concerned, the minimum set of adjustment variables is Body Mass Index, Caffeine Intake (mg/d or  $\geq$ / $\leq$  WHO threshold 300mg/d), Country of Birth, Deprivation, Diabetes, Domestic Violence (no to all vs. yes/prefer not to say for any of hurt/frightened, controlled/criticised, made to do anything sexual, who controls the money not you/joint control with another), Education Level, English Language Proficiency, Ethnicity, Gestation Age, Maternal Age, Maternal Parity, Night Toilet Trips (in past week), /Opiate use (for pain relief – strong opiates any frequency), Sleep Duration, Smoking, Stress Score, Use of Drugs (never/stopped before/stopped in preg/current)/Alcohol. Due to uncertainty around the direction of causation with respect to both Sleep Duration and Night Toilet Trips in relation to perception of fetal movements, we will perform this analysis both with and without adjustment for these variables.

For each perception of fetal movement variable, the effect of that variable on early stillbirth outcome will be estimated by binary logistic regression, adjusting for the aforementioned set of adjustment variables. Body Mass Index, Gestation Age, Maternal Age, Caffeine intake, Deprivation score, Stress score and Body Mass Index will be modelled using fractional polynomial relationships (maximum two terms) to allow for departures from linearity. All polynomial terms will be included, regardless of statistical significance.

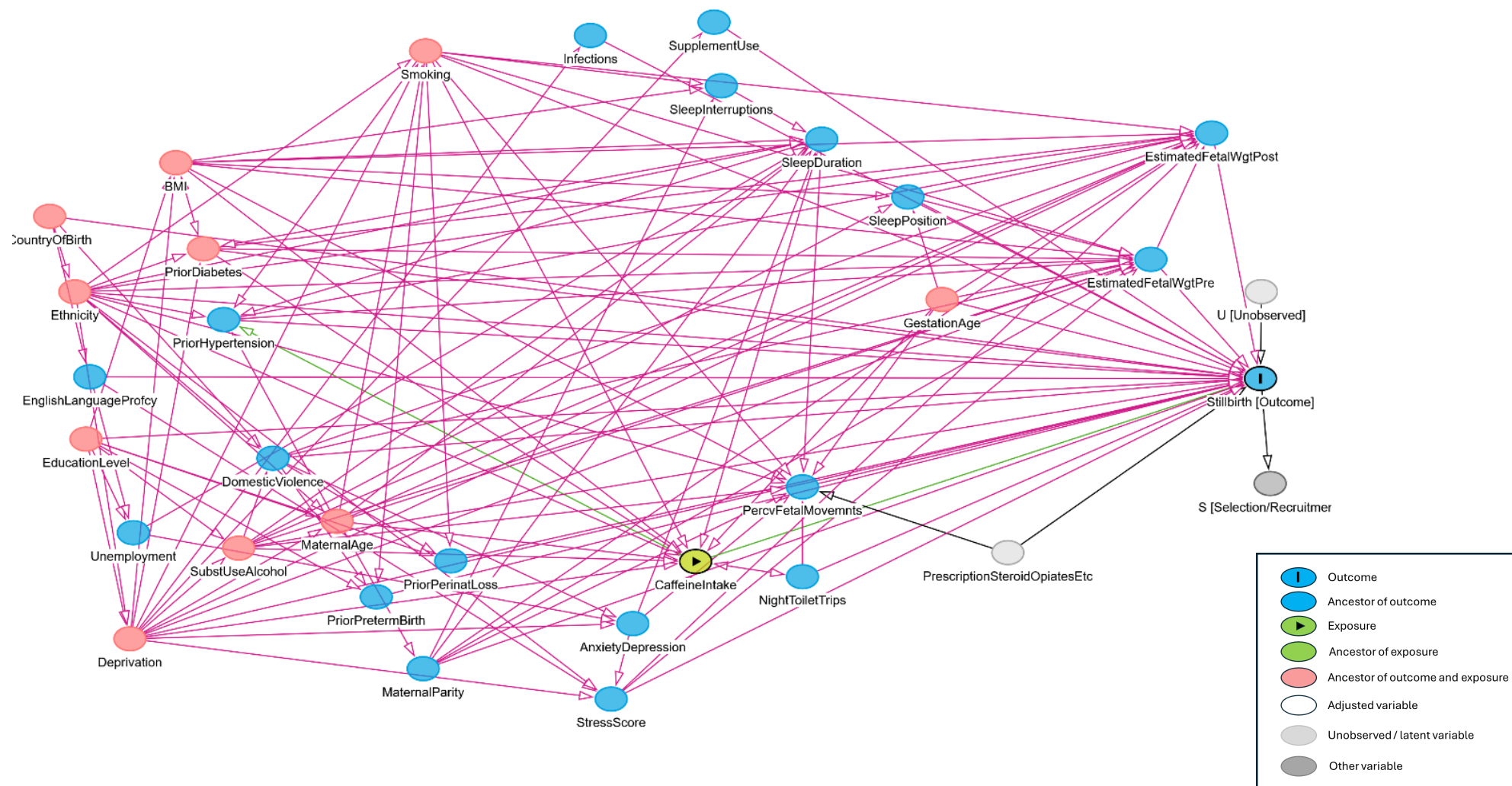
Estimated Odds Ratios and 95% confidence intervals for the effect of perceived fetal movements on early stillbirth will be presented for the minimum adjustment set described above.

### *Caffeine Intake*

Figure 5 below illustrates the hypothesised relationships between Caffeine Intake and early stillbirth, before defining the minimal sufficient set of variables to adjust for.



Figure 5 - Directed Acyclic Graph showing relation between exposure (Caffeine Intake) and stillbirth (Subject to caveats previously described)





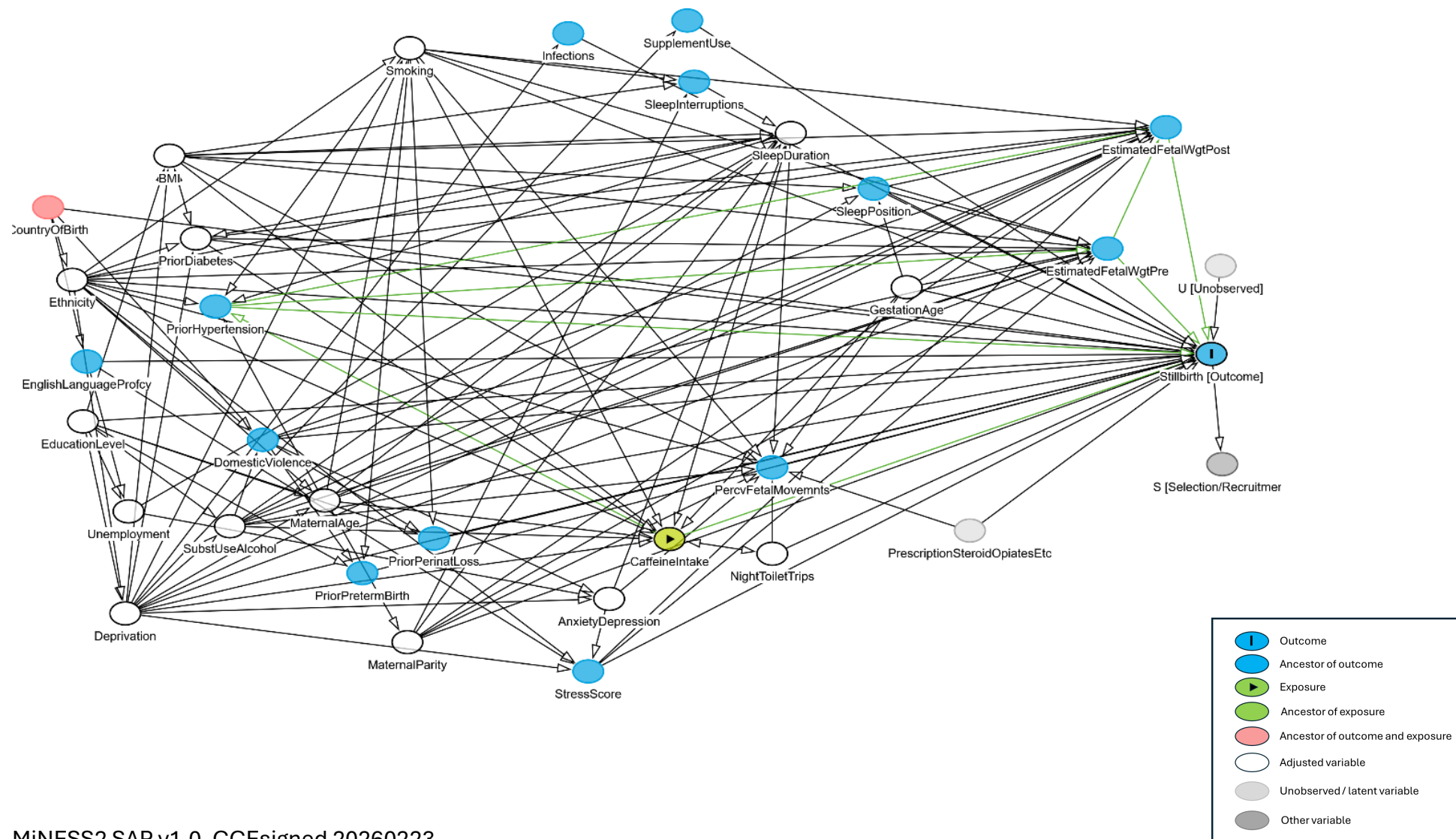
Self-reported caffeine intake variables will be summarised among the cases and controls.

For the proposed DAG of relationships between the variables in the study, the minimum adjustment set of variables to permit unbiased estimation of the causal relationship (under the assumption that selection is not conditional on outcome) is Anxiety/Depression, BMI, Deprivation, Diabetes, Education Level, Ethnicity, Gestation Age, Maternal Age, Maternal Parity, Night Toilet Trips (last 1 week), Sleep Duration (last 1 week), Smoking, Substance use (Alcohol), Unemployment. This minimum sufficient adjustment set includes all of our a priori important clinical variables, and so does not need to be augmented for our primary analysis model.

For each Caffeine Intake variable, the effect of that variable on early stillbirth outcome will be estimated by binary logistic regression, adjusting for the aforementioned set of variables. Gestation Age, Maternal Age, Deprivation score and Body Mass Index will be modelled using fractional polynomial relationships (maximum two terms) to allow for departures from linearity. All polynomial terms will be included, regardless of statistical significance.

Estimated Odds Ratios and 95% confidence intervals will be presented for the effect of caffeine intake (only) on early stillbirth using the set of confounders described above.

Figure 6 showing minimum variables to adjust for to permit unbiased estimation of effect of caffeine intake on stillbirth (Subject to caveats previously described)



### *Domestic Violence*

Figure 7 below illustrates the hypothesised relationships between Domestic Violence and early stillbirth, showing the minimal sufficient set of variables to adjust for.

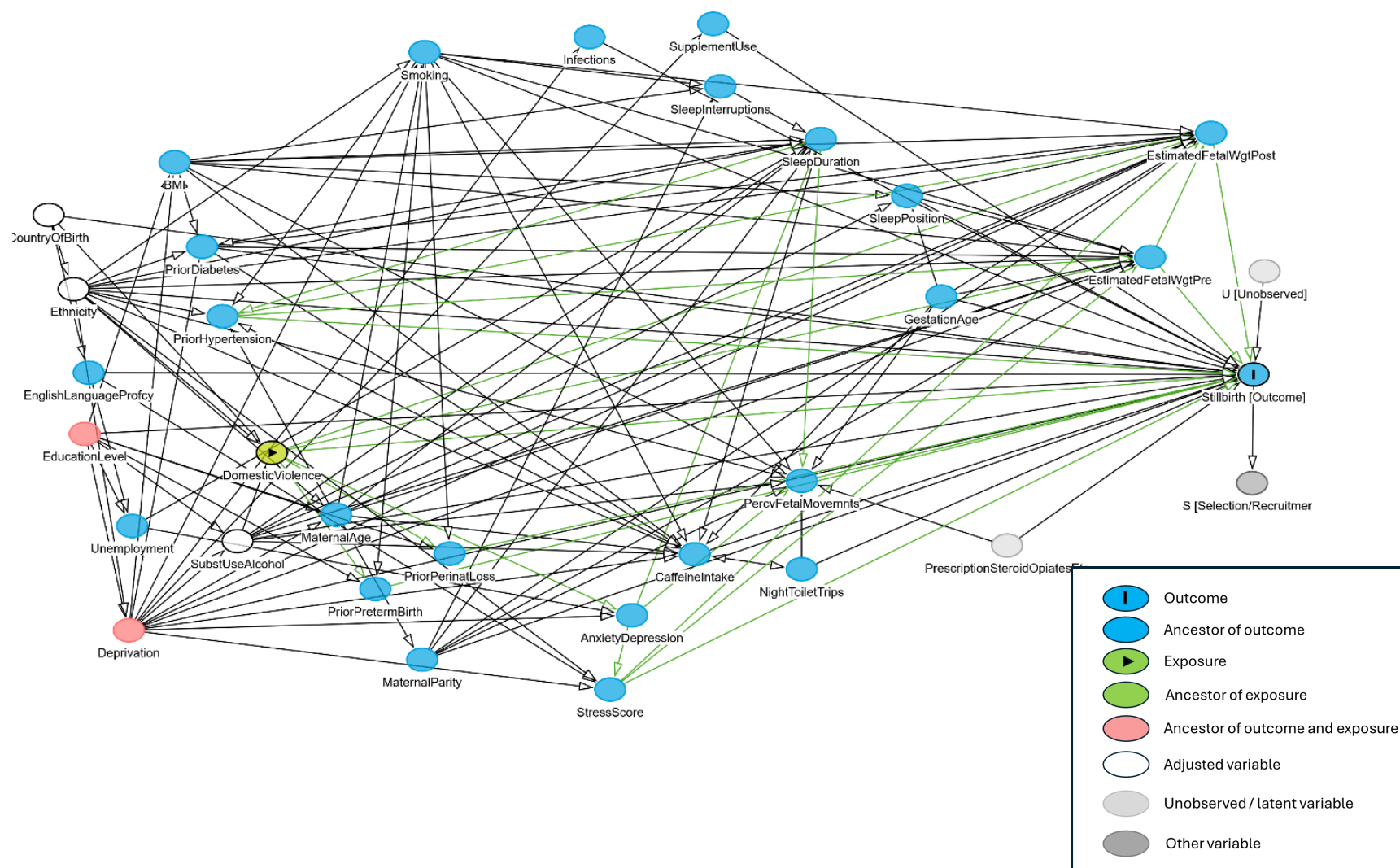
Self-reported domestic violence variables (Been hurt/frightened by someone close, felt controlled or always criticised in relationship, made to do anything sexual unwanted and who controls finances) will be summarised among the cases and controls.

For the proposed DAG of relationships between the variables in the study, the minimum adjustment set of variables to permit unbiased estimation of the causal relationship (under the assumption that selection is not conditional on outcome) is Ethnicity, Country of Birth and use of Drugs/Alcohol. To this set of variables, we will add the remaining clinically important variables (Body Mass Index, Deprivation, Maternal Age, Maternal Parity, Smoking) to form the set of variables for our primary analysis model.

For each Domestic Violence variable, the effect of that variable on early stillbirth outcome will be estimated by binary logistic regression, adjusting for the aforementioned set of variables. Gestation Age, Maternal Age, Deprivation score and Body Mass Index will be modelled using fractional polynomial relationships (maximum two terms) to allow for departures from linearity. All polynomial terms will be included, regardless of statistical significance.

Estimated Odds Ratios and 95% confidence intervals will be presented for the effect of Domestic Violence on early stillbirth using the set of confounders described above.

Figure 7 - Directed Acyclic Graph showing minimum variables to adjust for to permit unbiased estimation of effect of Domestic Violence on stillbirth (Subject to caveats previously described)



### Analysis 3 – Explore interactions between maternal/parental characteristics and early stillbirth risk.

In each of the analysis models previously outlined (estimating the effects of sleep position, sleep duration, perception of fetal movements, caffeine intake and domestic violence) where a particular exposure's effect on early stillbirth is estimated, interaction terms between that characteristic and further defined characteristics will be added to the model. The parameters will estimate the moderating effect of the additional characteristic on the exposures of interest, for which we will report the relative odds ratio and 95% confidence interval for the interaction effect.

We will add interaction terms to the analyses for the following variables:

- Maternal Age;
  - Small-for-gestational-age infant;
  - Infant birthweight customised centile (<25, 25-49.9, 50-74.9, 75+);
  - BMI (<25.0, 25-29.9, 30-34.9 and 35+);
- 
- Smoking
  - Prior hypertension or diabetes;

If the interaction variable is not already included in the analysis model, it will be added along with its interaction term. If doing so results in conditioning on a mediator, then the interaction analysis will not be performed.

### Analysis 4 – Determine whether exposures associated with early stillbirth vary by cause of death.

For each analysis within Analysis 2, a summary of the causes of fetal death will be summarised for each level of each variable of interest and categorised broadly as preterm birth related, explained in utero or unexplained in utero (including without formal investigation but no evident cause clinically). For example, a table will be produced summarising causes of fetal death according to each categorical level of each sleeping position variable.

Since cause of death data is likely to be sparse, and no a priori relations between particular exposures and particular causes of death have been stated, any modelling we undertake will be purely exploratory. Where it is felt that sufficient data exists to undertake any statistical modelling, a nominal multinomial logistic regression model

will be fit to the data. The case-control variable will be replaced with an unordered categorical variable including causes of death (and the control status for those where pregnancy was ongoing)

## References

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2. Silver RM, Hunter S, Reddy UM, Facco F, Gibbins KJ, Grobman WA, et al. Prospective Evaluation of Maternal Sleep Position Through 30 Weeks of Gestation and Adverse Pregnancy Outcomes. *Obstetrics & Gynecology*. 2019;134(4):667-76.
3. Royston P, Sauerbrei W. Multivariable model-building : a pragmatic approach to regression analysis based on fractional polynomials for modelling continuous variables / Patrick Royston, Willi Sauerbrei. Chichester, England ;: John Wiley; 2008.
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## Appendix A: Dagitty code to reproduce DAGs

Table 3 Dagitty code for Main DAG, without denoting exposures and adjustment variables

```
dag{
  "S [Selection/Recruitment]" [selected,pos="0.524,0.393"]
  "Stillbirth [Outcome]" [outcome,pos="0.566,-0.128"]
  "U [Unobserved]" [latent,pos="0.573,-0.526"]
  AnxietyDepression [pos="-0.795,1.083"]
  BMI [pos="-1.741,-1.188"]
  CaffeineIntake [pos="-0.665,0.777"]
  CountryOfBirth [pos="-2.002,-0.924"]
  Deprivation [pos="-1.836,1.158"]
  DomesticViolence [pos="-1.540,0.268"]
  EducationLevel [pos="-1.927,0.174"]
  EnglishLanguageProfcy [pos="-1.919,-0.133"]
  EstimatedFetalWgtPost [pos="0.403,-1.334"]
  EstimatedFetalWgtPre [pos="0.277,-0.712"]
  Ethnicity [pos="-1.950,-0.552"]
  GestationAge [pos="-0.155,-0.514"]
  Infections [pos="-0.883,-1.815"]
  MaternalAge [pos="-1.407,0.579"]
  MaternalParity [pos="-1.229,1.305"]
  NightToiletTrips [pos="-0.444,0.852"]
  PercvFetalMovemnts [pos="-0.444,0.409"]
  PrescriptionSteroidOpiatesEtc [latent,pos="-0.019,0.733"]
  PriorDiabetes [pos="-1.684,-0.764"]
  PriorHypertension [pos="-1.642,-0.415"]
  PriorPerinatLoss [pos="-1.172,0.774"]
  PriorPretermBirth [pos="-1.326,0.951"]
  SleepDuration [pos="-0.404,-1.304"]
  SleepInterruptions [pos="-0.612,-1.567"]
  SleepPosition [pos="-0.226,-1.019"]
  Smoking [pos="-1.224,-1.739"]
  StressScore [pos="-0.840,1.455"]
  SubstUseAlcohol [pos="-1.611,0.711"]
  SupplementUse [pos="-0.627,-1.881"]
  Unemployment [pos="-1.829,0.635"]
  "Stillbirth [Outcome]" -> "S [Selection/Recruitment]"
  "U [Unobserved]" -> "Stillbirth [Outcome]"
  AnxietyDepression -> PercvFetalMovemnts
  AnxietyDepression -> SleepDuration
  AnxietyDepression -> StressScore
  BMI -> CaffeineIntake
  BMI -> EstimatedFetalWgtPost
  BMI -> EstimatedFetalWgtPre
}
```



BMI -> PercvFetalMovemnts  
 BMI -> SleepDuration  
 BMI -> SleepInterruptions  
 BMI -> SleepPosition  
 BMI <-> PriorDiabetes  
 CaffeineIntake -> "Stillbirth [Outcome]"  
 CaffeineIntake -> PriorHypertension  
 CaffeineIntake <-> NightToiletTrips  
 CaffeineIntake <-> SleepDuration  
 CountryOfBirth -> "Stillbirth [Outcome]"  
 CountryOfBirth -> DomesticViolence  
 CountryOfBirth -> EnglishLanguageProfcy  
 CountryOfBirth -> Ethnicity  
 Deprivation -> "Stillbirth [Outcome]"  
 Deprivation -> AnxietyDepression  
 Deprivation -> BMI  
 Deprivation -> CaffeineIntake  
 Deprivation -> EstimatedFetalWgtPost  
 Deprivation -> EstimatedFetalWgtPre  
 Deprivation -> Infections  
 Deprivation -> MaternalAge  
 Deprivation -> PriorDiabetes  
 Deprivation -> Smoking  
 Deprivation -> StressScore  
 Deprivation -> SubstUseAlcohol  
 Deprivation -> SupplementUse  
 DomesticViolence -> "Stillbirth [Outcome]"  
 DomesticViolence -> AnxietyDepression  
 DomesticViolence -> EstimatedFetalWgtPost  
 DomesticViolence -> EstimatedFetalWgtPre  
 DomesticViolence -> PriorPerinatLoss  
 DomesticViolence -> PriorPretermBirth  
 EducationLevel -> "Stillbirth [Outcome]"  
 EducationLevel -> BMI  
 EducationLevel -> Deprivation  
 EducationLevel -> MaternalAge  
 EducationLevel -> PriorPerinatLoss  
 EducationLevel -> PriorPretermBirth  
 EducationLevel -> SubstUseAlcohol  
 EducationLevel -> Unemployment  
 EnglishLanguageProfcy -> "Stillbirth [Outcome]"  
 EnglishLanguageProfcy -> StressScore  
 EnglishLanguageProfcy -> Unemployment  
 EstimatedFetalWgtPost -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> EstimatedFetalWgtPost  
 Ethnicity -> "Stillbirth [Outcome]"

Ethnicity -> CaffeineIntake  
 Ethnicity -> Deprivation  
 Ethnicity -> DomesticViolence  
 Ethnicity -> EstimatedFetalWgtPost  
 Ethnicity -> EstimatedFetalWgtPre  
 Ethnicity -> MaternalAge  
 Ethnicity -> PercvFetalMovemnts  
 Ethnicity -> PriorDiabetes  
 Ethnicity -> PriorHypertension  
 Ethnicity -> SleepDuration  
 Ethnicity -> Smoking  
 Ethnicity -> StressScore  
 GestationAge -> "Stillbirth [Outcome]"  
 GestationAge -> CaffeineIntake  
 GestationAge -> EstimatedFetalWgtPost  
 GestationAge -> EstimatedFetalWgtPre  
 GestationAge -> PercvFetalMovemnts  
 GestationAge -> SleepPosition  
 Infections -> "Stillbirth [Outcome]"  
 MaternalAge -> CaffeineIntake  
 MaternalAge -> EstimatedFetalWgtPost  
 MaternalAge -> EstimatedFetalWgtPre  
 MaternalAge -> MaternalParity  
 MaternalAge -> PriorHypertension  
 MaternalAge -> SleepDuration  
 MaternalAge -> Smoking  
 MaternalParity -> "Stillbirth [Outcome]"  
 MaternalParity -> EstimatedFetalWgtPost  
 MaternalParity -> EstimatedFetalWgtPre  
 MaternalParity -> PercvFetalMovemnts  
 MaternalParity -> SleepDuration  
 MaternalParity -> SleepInterruptions  
 NightToiletTrips -> "Stillbirth [Outcome]"  
 NightToiletTrips -> PercvFetalMovemnts  
 PercvFetalMovemnts -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> PercvFetalMovemnts  
 PriorDiabetes -> "Stillbirth [Outcome]"  
 PriorDiabetes -> CaffeineIntake  
 PriorDiabetes -> EstimatedFetalWgtPost  
 PriorDiabetes -> EstimatedFetalWgtPre  
 PriorDiabetes <-> SleepDuration  
 PriorHypertension -> "Stillbirth [Outcome]"  
 PriorHypertension -> EstimatedFetalWgtPost  
 PriorHypertension -> EstimatedFetalWgtPre  
 PriorPerinatLoss -> "Stillbirth [Outcome]"  
 PriorPretermBirth -> "Stillbirth [Outcome]"

```

SleepDuration -> PercvFetalMovemnts
SleepDuration -> PriorHypertension
SleepInterruptions -> SleepDuration
SleepPosition -> "Stillbirth [Outcome]"
SleepPosition -> EstimatedFetalWgtPost
SleepPosition -> EstimatedFetalWgtPre
Smoking -> "Stillbirth [Outcome]"
Smoking -> CaffeineIntake
Smoking -> EstimatedFetalWgtPost
Smoking -> EstimatedFetalWgtPre
Smoking -> PercvFetalMovemnts
Smoking -> PriorHypertension
Smoking -> PriorPerinatLoss
Smoking -> PriorPretermBirth
Smoking -> SleepInterruptions
StressScore -> "Stillbirth [Outcome]"
StressScore -> EstimatedFetalWgtPost
StressScore -> EstimatedFetalWgtPre
SubstUseAlcohol -> "Stillbirth [Outcome]"
SubstUseAlcohol -> CaffeineIntake
SubstUseAlcohol -> DomesticViolence
SubstUseAlcohol -> EstimatedFetalWgtPost
SubstUseAlcohol -> EstimatedFetalWgtPre
SubstUseAlcohol -> PercvFetalMovemnts
SubstUseAlcohol -> SleepDuration
SubstUseAlcohol -> SleepPosition
SupplementUse -> "Stillbirth [Outcome]"
Unemployment -> AnxietyDepression
Unemployment -> SleepDuration
}

```

Table 4 Dagitty code for Sleep Position DAG – Including minimum adjustment set only

```

dag {
"S [Selection/Recruitment]" [pos="0.488,0.413"]
"Stillbirth [Outcome]" [outcome,pos="0.522,-0.125"]
"U [Unobserved]" [latent,pos="0.535,-0.545"]
AnxietyDepression [pos="-0.795,1.083"]
BMI [adjusted,pos="-1.741,-1.188"]
CaffeineIntake [pos="-0.665,0.777"]
CountryOfBirth [pos="-2.002,-0.924"]
Deprivation [pos="-1.836,1.158"]
DomesticViolence [pos="-1.540,0.268"]
EducationLevel [pos="-1.927,0.174"]
EnglishLanguageProfcy [pos="-1.919,-0.133"]
EstimatedFetalWgtPost [pos="0.403,-1.334"]
EstimatedFetalWgtPre [pos="0.277,-0.712"]
}

```

Ethnicity [pos="-1.950,-0.552"]  
 GestationAge [adjusted,pos="-0.155,-0.514"]  
 Infections [pos="-0.883,-1.815"]  
 MaternalAge [pos="-1.407,0.579"]  
 MaternalParity [pos="-1.229,1.305"]  
 NightToiletTrips [pos="-0.444,0.852"]  
 PercvFetalMovemnts [pos="-0.444,0.409"]  
 PrescriptionSteroidOpiatesEtc [latent,pos="-0.019,0.733"]  
 PriorDiabetes [pos="-1.684,-0.764"]  
 PriorHypertension [pos="-1.642,-0.415"]  
 PriorPerinatLoss [pos="-1.172,0.774"]  
 PriorPretermBirth [pos="-1.326,0.951"]  
 SleepDuration [pos="-0.404,-1.304"]  
 SleepInterruptions [pos="-0.612,-1.567"]  
 SleepPosition [exposure,pos="-0.226,-1.019"]  
 Smoking [pos="-1.224,-1.739"]  
 StressScore [pos="-0.840,1.455"]  
 SubstUseAlcohol [adjusted,pos="-1.611,0.711"]  
 SupplementUse [pos="-0.627,-1.881"]  
 Unemployment [pos="-1.829,0.635"]  
 "Stillbirth [Outcome]" -> "S [Selection/Recruitment]"  
 "U [Unobserved]" -> "Stillbirth [Outcome]"  
 AnxietyDepression -> PercvFetalMovemnts  
 AnxietyDepression -> SleepDuration  
 AnxietyDepression -> StressScore  
 BMI -> CaffeineIntake  
 BMI -> EstimatedFetalWgtPost  
 BMI -> EstimatedFetalWgtPre  
 BMI -> PercvFetalMovemnts  
 BMI -> SleepDuration  
 BMI -> SleepInterruptions  
 BMI -> SleepPosition  
 BMI <-> PriorDiabetes  
 CaffeineIntake -> "Stillbirth [Outcome]"  
 CaffeineIntake -> PriorHypertension  
 CaffeineIntake <-> NightToiletTrips  
 CaffeineIntake <-> SleepDuration  
 CountryOfBirth -> "Stillbirth [Outcome]"  
 CountryOfBirth -> DomesticViolence  
 CountryOfBirth -> EnglishLanguageProfcy  
 CountryOfBirth -> Ethnicity  
 Deprivation -> "Stillbirth [Outcome]"  
 Deprivation -> AnxietyDepression  
 Deprivation -> BMI  
 Deprivation -> CaffeineIntake  
 Deprivation -> EstimatedFetalWgtPost  
 Deprivation -> EstimatedFetalWgtPre

Deprivation -> Infections  
 Deprivation -> MaternalAge  
 Deprivation -> PriorDiabetes  
 Deprivation -> Smoking  
 Deprivation -> StressScore  
 Deprivation -> SubstUseAlcohol  
 Deprivation -> SupplementUse  
 DomesticViolence -> "Stillbirth [Outcome]"  
 DomesticViolence -> AnxietyDepression  
 DomesticViolence -> EstimatedFetalWgtPost  
 DomesticViolence -> EstimatedFetalWgtPre  
 DomesticViolence -> PriorPerinatLoss  
 DomesticViolence -> PriorPretermBirth  
 EducationLevel -> "Stillbirth [Outcome]"  
 EducationLevel -> BMI  
 EducationLevel -> Deprivation  
 EducationLevel -> MaternalAge  
 EducationLevel -> PriorPerinatLoss  
 EducationLevel -> PriorPretermBirth  
 EducationLevel -> SubstUseAlcohol  
 EducationLevel -> Unemployment  
 EnglishLanguageProfcy -> "Stillbirth [Outcome]"  
 EnglishLanguageProfcy -> StressScore  
 EnglishLanguageProfcy -> Unemployment  
 EstimatedFetalWgtPost -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> EstimatedFetalWgtPost  
 Ethnicity -> "Stillbirth [Outcome]"  
 Ethnicity -> CaffeineIntake  
 Ethnicity -> Deprivation  
 Ethnicity -> DomesticViolence  
 Ethnicity -> EstimatedFetalWgtPost  
 Ethnicity -> EstimatedFetalWgtPre  
 Ethnicity -> MaternalAge  
 Ethnicity -> PercvFetalMovemnts  
 Ethnicity -> PriorDiabetes  
 Ethnicity -> PriorHypertension  
 Ethnicity -> SleepDuration  
 Ethnicity -> Smoking  
 Ethnicity -> StressScore  
 GestationAge -> "Stillbirth [Outcome]"  
 GestationAge -> CaffeineIntake  
 GestationAge -> EstimatedFetalWgtPost  
 GestationAge -> EstimatedFetalWgtPre  
 GestationAge -> PercvFetalMovemnts  
 GestationAge -> SleepPosition  
 Infections -> "Stillbirth [Outcome]"

MaternalAge -> CaffeineIntake  
 MaternalAge -> EstimatedFetalWgtPost  
 MaternalAge -> EstimatedFetalWgtPre  
 MaternalAge -> MaternalParity  
 MaternalAge -> PriorHypertension  
 MaternalAge -> SleepDuration  
 MaternalAge -> Smoking  
 MaternalParity -> "Stillbirth [Outcome]"  
 MaternalParity -> EstimatedFetalWgtPost  
 MaternalParity -> EstimatedFetalWgtPre  
 MaternalParity -> PercvFetalMovemnts  
 MaternalParity -> SleepDuration  
 MaternalParity -> SleepInterruptions  
 NightToiletTrips -> "Stillbirth [Outcome]"  
 NightToiletTrips -> PercvFetalMovemnts  
 PercvFetalMovemnts -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> PercvFetalMovemnts  
 PriorDiabetes -> "Stillbirth [Outcome]"  
 PriorDiabetes -> CaffeineIntake  
 PriorDiabetes -> EstimatedFetalWgtPost  
 PriorDiabetes -> EstimatedFetalWgtPre  
 PriorDiabetes <-> SleepDuration  
 PriorHypertension -> "Stillbirth [Outcome]"  
 PriorHypertension -> EstimatedFetalWgtPost  
 PriorHypertension -> EstimatedFetalWgtPre  
 PriorPerinatLoss -> "Stillbirth [Outcome]"  
 PriorPretermBirth -> "Stillbirth [Outcome]"  
 SleepDuration -> PercvFetalMovemnts  
 SleepDuration -> PriorHypertension  
 SleepInterruptions -> SleepDuration  
 SleepPosition -> "Stillbirth [Outcome]"  
 SleepPosition -> EstimatedFetalWgtPost  
 SleepPosition -> EstimatedFetalWgtPre  
 Smoking -> "Stillbirth [Outcome]"  
 Smoking -> CaffeineIntake  
 Smoking -> EstimatedFetalWgtPost  
 Smoking -> EstimatedFetalWgtPre  
 Smoking -> PercvFetalMovemnts  
 Smoking -> PriorHypertension  
 Smoking -> PriorPerinatLoss  
 Smoking -> PriorPretermBirth  
 Smoking -> SleepInterruptions  
 StressScore -> "Stillbirth [Outcome]"  
 StressScore -> EstimatedFetalWgtPost  
 StressScore -> EstimatedFetalWgtPre  
 SubstUseAlcohol -> "Stillbirth [Outcome]"

```

SubstUseAlcohol -> CaffeineIntake
SubstUseAlcohol -> DomesticViolence
SubstUseAlcohol -> EstimatedFetalWgtPost
SubstUseAlcohol -> EstimatedFetalWgtPre
SubstUseAlcohol -> PercvFetalMovemnts
SubstUseAlcohol -> SleepDuration
SubstUseAlcohol -> SleepPosition
SupplementUse -> "Stillbirth [Outcome]"
Unemployment -> AnxietyDepression
Unemployment -> SleepDuration
}

```

Table 5 Dagitty code for Sleep Duration DAG – Including minimum adjustment set only

```

dag {
"S [Selection/Recruitment]" [pos="0.488,0.413"]
"Stillbirth [Outcome]" [outcome,pos="0.522,-0.125"]
"U [Unobserved]" [latent,pos="0.535,-0.545"]
AnxietyDepression [adjusted,pos="-0.795,1.083"]
BMI [adjusted,pos="-1.741,-1.188"]
CaffeineIntake [adjusted,pos="-0.665,0.777"]
CountryOfBirth [pos="-2.002,-0.924"]
Deprivation [adjusted,pos="-1.836,1.158"]
DomesticViolence [pos="-1.540,0.268"]
EducationLevel [adjusted,pos="-1.927,0.174"]
EnglishLanguageProfcy [pos="-1.919,-0.133"]
EstimatedFetalWgtPost [pos="0.403,-1.334"]
EstimatedFetalWgtPre [pos="0.277,-0.712"]
Ethnicity [adjusted,pos="-1.950,-0.552"]
GestationAge [adjusted,pos="-0.155,-0.514"]
Infections [pos="-0.883,-1.815"]
MaternalAge [adjusted,pos="-1.407,0.579"]
MaternalParity [adjusted,pos="-1.229,1.305"]
NightToiletTrips [adjusted,pos="-0.444,0.852"]
PercvFetalMovemnts [pos="-0.444,0.409"]
PrescriptionSteroidOpiatesEtc [latent,pos="-0.019,0.733"]
PriorDiabetes [adjusted,pos="-1.684,-0.764"]
PriorHypertension [pos="-1.642,-0.415"]
PriorPerinatLoss [pos="-1.172,0.774"]
PriorPretermBirth [pos="-1.326,0.951"]
SleepDuration [exposure,pos="-0.404,-1.304"]
SleepInterruptions [pos="-0.612,-1.567"]
SleepPosition [pos="-0.226,-1.019"]
Smoking [adjusted,pos="-1.224,-1.739"]
StressScore [pos="-0.840,1.455"]
}

```

SubstUseAlcohol [adjusted,pos="-1.611,0.711"]  
 SupplementUse [pos="-0.627,-1.881"]  
 Unemployment [adjusted,pos="-1.829,0.635"]  
 "Stillbirth [Outcome]" -> "S [Selection/Recruitment]"  
 "U [Unobserved]" -> "Stillbirth [Outcome]"  
 AnxietyDepression -> PercvFetalMovemnts  
 AnxietyDepression -> SleepDuration  
 AnxietyDepression -> StressScore  
 BMI -> CaffeineIntake  
 BMI -> EstimatedFetalWgtPost  
 BMI -> EstimatedFetalWgtPre  
 BMI -> PercvFetalMovemnts  
 BMI -> SleepDuration  
 BMI -> SleepInterruptions  
 BMI -> SleepPosition  
 BMI <-> PriorDiabetes  
 CaffeineIntake -> "Stillbirth [Outcome]"  
 CaffeineIntake -> PriorHypertension  
 CaffeineIntake <-> NightToiletTrips  
 CaffeineIntake <-> SleepDuration  
 CountryOfBirth -> "Stillbirth [Outcome]"  
 CountryOfBirth -> DomesticViolence  
 CountryOfBirth -> EnglishLanguageProfcy  
 CountryOfBirth -> Ethnicity  
 Deprivation -> "Stillbirth [Outcome]"  
 Deprivation -> AnxietyDepression  
 Deprivation -> BMI  
 Deprivation -> CaffeineIntake  
 Deprivation -> EstimatedFetalWgtPost  
 Deprivation -> EstimatedFetalWgtPre  
 Deprivation -> Infections  
 Deprivation -> MaternalAge  
 Deprivation -> PriorDiabetes  
 Deprivation -> Smoking  
 Deprivation -> StressScore  
 Deprivation -> SubstUseAlcohol  
 Deprivation -> SupplementUse  
 DomesticViolence -> "Stillbirth [Outcome]"  
 DomesticViolence -> AnxietyDepression  
 DomesticViolence -> EstimatedFetalWgtPost  
 DomesticViolence -> EstimatedFetalWgtPre  
 DomesticViolence -> PriorPerinatLoss  
 DomesticViolence -> PriorPretermBirth  
 EducationLevel -> "Stillbirth [Outcome]"  
 EducationLevel -> BMI  
 EducationLevel -> Deprivation  
 EducationLevel -> MaternalAge



EducationLevel -> PriorPerinatLoss  
 EducationLevel -> PriorPretermBirth  
 EducationLevel -> SubstUseAlcohol  
 EducationLevel -> Unemployment  
 EnglishLanguageProfcy -> "Stillbirth [Outcome]"  
 EnglishLanguageProfcy -> StressScore  
 EnglishLanguageProfcy -> Unemployment  
 EstimatedFetalWgtPost -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> EstimatedFetalWgtPost  
 Ethnicity -> "Stillbirth [Outcome]"  
 Ethnicity -> CaffeineIntake  
 Ethnicity -> Deprivation  
 Ethnicity -> DomesticViolence  
 Ethnicity -> EstimatedFetalWgtPost  
 Ethnicity -> EstimatedFetalWgtPre  
 Ethnicity -> MaternalAge  
 Ethnicity -> PercvFetalMovemnts  
 Ethnicity -> PriorDiabetes  
 Ethnicity -> PriorHypertension  
 Ethnicity -> SleepDuration  
 Ethnicity -> Smoking  
 Ethnicity -> StressScore  
 GestationAge -> "Stillbirth [Outcome]"  
 GestationAge -> CaffeineIntake  
 GestationAge -> EstimatedFetalWgtPost  
 GestationAge -> EstimatedFetalWgtPre  
 GestationAge -> PercvFetalMovemnts  
 GestationAge -> SleepPosition  
 Infections -> "Stillbirth [Outcome]"  
 MaternalAge -> CaffeineIntake  
 MaternalAge -> EstimatedFetalWgtPost  
 MaternalAge -> EstimatedFetalWgtPre  
 MaternalAge -> MaternalParity  
 MaternalAge -> PriorHypertension  
 MaternalAge -> SleepDuration  
 MaternalAge -> Smoking  
 MaternalParity -> "Stillbirth [Outcome]"  
 MaternalParity -> EstimatedFetalWgtPost  
 MaternalParity -> EstimatedFetalWgtPre  
 MaternalParity -> PercvFetalMovemnts  
 MaternalParity -> SleepDuration  
 MaternalParity -> SleepInterruptions  
 NightToiletTrips -> "Stillbirth [Outcome]"  
 NightToiletTrips -> PercvFetalMovemnts  
 PercvFetalMovemnts -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> "Stillbirth [Outcome]"

```

PrescriptionSteroidOpiatesEtc -> PercvFetalMovemnts
PriorDiabetes -> "Stillbirth [Outcome]"
PriorDiabetes -> CaffeineIntake
PriorDiabetes -> EstimatedFetalWgtPost
PriorDiabetes -> EstimatedFetalWgtPre
PriorDiabetes <-> SleepDuration
PriorHypertension -> "Stillbirth [Outcome]"
PriorHypertension -> EstimatedFetalWgtPost
PriorHypertension -> EstimatedFetalWgtPre
PriorPerinatLoss -> "Stillbirth [Outcome]"
PriorPretermBirth -> "Stillbirth [Outcome]"
SleepDuration -> PercvFetalMovemnts
SleepDuration -> PriorHypertension
SleepInterruptions -> SleepDuration
SleepPosition -> "Stillbirth [Outcome]"
SleepPosition -> EstimatedFetalWgtPost
SleepPosition -> EstimatedFetalWgtPre
Smoking -> "Stillbirth [Outcome]"
Smoking -> CaffeineIntake
Smoking -> EstimatedFetalWgtPost
Smoking -> EstimatedFetalWgtPre
Smoking -> PercvFetalMovemnts
Smoking -> PriorHypertension
Smoking -> PriorPerinatLoss
Smoking -> PriorPretermBirth
Smoking -> SleepInterruptions
StressScore -> "Stillbirth [Outcome]"
StressScore -> EstimatedFetalWgtPost
StressScore -> EstimatedFetalWgtPre
SubstUseAlcohol -> "Stillbirth [Outcome]"
SubstUseAlcohol -> CaffeineIntake
SubstUseAlcohol -> DomesticViolence
SubstUseAlcohol -> EstimatedFetalWgtPost
SubstUseAlcohol -> EstimatedFetalWgtPre
SubstUseAlcohol -> PercvFetalMovemnts
SubstUseAlcohol -> SleepDuration
SubstUseAlcohol -> SleepPosition
SupplementUse -> "Stillbirth [Outcome]"
Unemployment -> AnxietyDepression
Unemployment -> SleepDuration
}

```

Table 6 Dagitty code for perceived fetal movements DAG – Including minimum adjustment set only

```
dag {
```

```

"S [Selection/Recruitment]" [pos="0.524,0.393"]
"Stillbirth [Outcome]" [outcome,pos="0.517,-0.132"]
"U [Unobserved]" [latent,pos="0.521,-0.568"]
AnxietyDepression [pos="-0.795,1.083"]
BMI [adjusted,pos="-1.741,-1.188"]
CaffeineIntake [adjusted,pos="-0.665,0.777"]
CountryOfBirth [pos="-2.002,-0.924"]
Deprivation [adjusted,pos="-1.836,1.158"]
DomesticViolence [adjusted,pos="-1.540,0.268"]
EducationLevel [adjusted,pos="-1.927,0.174"]
EnglishLanguageProfcy [adjusted,pos="-1.919,-0.133"]
EstimatedFetalWgtPost [pos="0.403,-1.334"]
EstimatedFetalWgtPre [pos="0.277,-0.712"]
Ethnicity [adjusted,pos="-1.950,-0.552"]
GestationAge [adjusted,pos="-0.155,-0.514"]
Infections [pos="-0.883,-1.815"]
MaternalAge [adjusted,pos="-1.407,0.579"]
MaternalParity [adjusted,pos="-1.229,1.305"]
NightToiletTrips [adjusted,pos="-0.444,0.852"]
PercvFetalMovemnts [exposure,pos="-0.444,0.409"]
PrescriptionSteroidOpiatesEtc [adjusted,pos="-0.019,0.733"]
PriorDiabetes [adjusted,pos="-1.684,-0.764"]
PriorHypertension [pos="-1.642,-0.415"]
PriorPerinatLoss [pos="-1.172,0.774"]
PriorPretermBirth [pos="-1.326,0.951"]
SleepDuration [adjusted,pos="-0.404,-1.304"]
SleepInterruptions [pos="-0.612,-1.567"]
SleepPosition [pos="-0.226,-1.019"]
Smoking [adjusted,pos="-1.224,-1.739"]
StressScore [adjusted,pos="-0.840,1.455"]
SubstUseAlcohol [adjusted,pos="-1.611,0.711"]
SupplementUse [pos="-0.627,-1.881"]
Unemployment [pos="-1.829,0.635"]
"Stillbirth [Outcome]" -> "S [Selection/Recruitment]"
"U [Unobserved]" -> "Stillbirth [Outcome]"
AnxietyDepression -> PercvFetalMovemnts
AnxietyDepression -> SleepDuration
AnxietyDepression -> StressScore
BMI -> CaffeineIntake
BMI -> EstimatedFetalWgtPost
BMI -> EstimatedFetalWgtPre
BMI -> PercvFetalMovemnts
BMI -> SleepDuration
BMI -> SleepInterruptions
BMI -> SleepPosition
BMI <-> PriorDiabetes
CaffeineIntake -> "Stillbirth [Outcome]"

```

CaffeineIntake -> PriorHypertension  
 CaffeineIntake <-> NightToiletTrips  
 CaffeineIntake <-> SleepDuration  
 CountryOfBirth -> "Stillbirth [Outcome]"  
 CountryOfBirth -> DomesticViolence  
 CountryOfBirth -> EnglishLanguageProfcy  
 CountryOfBirth -> Ethnicity  
 Deprivation -> "Stillbirth [Outcome]"  
 Deprivation -> AnxietyDepression  
 Deprivation -> BMI  
 Deprivation -> CaffeineIntake  
 Deprivation -> EstimatedFetalWgtPost  
 Deprivation -> EstimatedFetalWgtPre  
 Deprivation -> Infections  
 Deprivation -> MaternalAge  
 Deprivation -> PriorDiabetes  
 Deprivation -> Smoking  
 Deprivation -> StressScore  
 Deprivation -> SubstUseAlcohol  
 Deprivation -> SupplementUse  
 DomesticViolence -> "Stillbirth [Outcome]"  
 DomesticViolence -> AnxietyDepression  
 DomesticViolence -> EstimatedFetalWgtPost  
 DomesticViolence -> EstimatedFetalWgtPre  
 DomesticViolence -> PriorPerinatLoss  
 DomesticViolence -> PriorPretermBirth  
 EducationLevel -> "Stillbirth [Outcome]"  
 EducationLevel -> BMI  
 EducationLevel -> Deprivation  
 EducationLevel -> MaternalAge  
 EducationLevel -> PriorPerinatLoss  
 EducationLevel -> PriorPretermBirth  
 EducationLevel -> SubstUseAlcohol  
 EducationLevel -> Unemployment  
 EnglishLanguageProfcy -> "Stillbirth [Outcome]"  
 EnglishLanguageProfcy -> StressScore  
 EnglishLanguageProfcy -> Unemployment  
 EstimatedFetalWgtPost -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> EstimatedFetalWgtPost  
 Ethnicity -> "Stillbirth [Outcome]"  
 Ethnicity -> CaffeineIntake  
 Ethnicity -> Deprivation  
 Ethnicity -> DomesticViolence  
 Ethnicity -> EstimatedFetalWgtPost  
 Ethnicity -> EstimatedFetalWgtPre  
 Ethnicity -> MaternalAge

Ethnicity -> PercvFetalMovemnts  
 Ethnicity -> PriorDiabetes  
 Ethnicity -> PriorHypertension  
 Ethnicity -> SleepDuration  
 Ethnicity -> Smoking  
 Ethnicity -> StressScore  
 GestationAge -> "Stillbirth [Outcome]"  
 GestationAge -> CaffeineIntake  
 GestationAge -> EstimatedFetalWgtPost  
 GestationAge -> EstimatedFetalWgtPre  
 GestationAge -> PercvFetalMovemnts  
 GestationAge -> SleepPosition  
 Infections -> "Stillbirth [Outcome]"  
 MaternalAge -> CaffeineIntake  
 MaternalAge -> EstimatedFetalWgtPost  
 MaternalAge -> EstimatedFetalWgtPre  
 MaternalAge -> MaternalParity  
 MaternalAge -> PriorHypertension  
 MaternalAge -> SleepDuration  
 MaternalAge -> Smoking  
 MaternalParity -> "Stillbirth [Outcome]"  
 MaternalParity -> EstimatedFetalWgtPost  
 MaternalParity -> EstimatedFetalWgtPre  
 MaternalParity -> PercvFetalMovemnts  
 MaternalParity -> SleepDuration  
 MaternalParity -> SleepInterruptions  
 NightToiletTrips -> "Stillbirth [Outcome]"  
 NightToiletTrips -> PercvFetalMovemnts  
 PercvFetalMovemnts -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> PercvFetalMovemnts  
 PriorDiabetes -> "Stillbirth [Outcome]"  
 PriorDiabetes -> CaffeineIntake  
 PriorDiabetes -> EstimatedFetalWgtPost  
 PriorDiabetes -> EstimatedFetalWgtPre  
 PriorDiabetes <-> SleepDuration  
 PriorHypertension -> "Stillbirth [Outcome]"  
 PriorHypertension -> EstimatedFetalWgtPost  
 PriorHypertension -> EstimatedFetalWgtPre  
 PriorPerinatLoss -> "Stillbirth [Outcome]"  
 PriorPretermBirth -> "Stillbirth [Outcome]"  
 SleepDuration -> PercvFetalMovemnts  
 SleepDuration -> PriorHypertension  
 SleepInterruptions -> SleepDuration  
 SleepPosition -> "Stillbirth [Outcome]"  
 SleepPosition -> EstimatedFetalWgtPost  
 SleepPosition -> EstimatedFetalWgtPre

```

Smoking -> "Stillbirth [Outcome]"
Smoking -> CaffeineIntake
Smoking -> EstimatedFetalWgtPost
Smoking -> EstimatedFetalWgtPre
Smoking -> PercvFetalMovemnts
Smoking -> PriorHypertension
Smoking -> PriorPerinatLoss
Smoking -> PriorPretermBirth
Smoking -> SleepInterruptions
StressScore -> "Stillbirth [Outcome]"
StressScore -> EstimatedFetalWgtPost
StressScore -> EstimatedFetalWgtPre
SubstUseAlcohol -> "Stillbirth [Outcome]"
SubstUseAlcohol -> CaffeineIntake
SubstUseAlcohol -> DomesticViolence
SubstUseAlcohol -> EstimatedFetalWgtPost
SubstUseAlcohol -> EstimatedFetalWgtPre
SubstUseAlcohol -> PercvFetalMovemnts
SubstUseAlcohol -> SleepDuration
SubstUseAlcohol -> SleepPosition
SupplementUse -> "Stillbirth [Outcome]"
Unemployment -> AnxietyDepression
Unemployment -> SleepDuration
}

```

Table 7 Dagitty code for Caffeine Intake DAG – Including minimum adjustment set only

```

dag {
"S [Selection/Recruitment]" [pos="0.524,0.393"]
"Stillbirth [Outcome]" [outcome,pos="0.501,-0.172"]
"U [Unobserved]" [latent,pos="0.521,-0.623"]
AnxietyDepression [adjusted,pos="-0.795,1.083"]
BMI [adjusted,pos="-1.741,-1.188"]
CaffeineIntake [exposure,pos="-0.665,0.777"]
CountryOfBirth [pos="-2.002,-0.924"]
Deprivation [adjusted,pos="-1.836,1.158"]
DomesticViolence [pos="-1.540,0.268"]
EducationLevel [adjusted,pos="-1.927,0.174"]
EnglishLanguageProfcy [pos="-1.919,-0.133"]
EstimatedFetalWgtPost [pos="0.403,-1.334"]
EstimatedFetalWgtPre [pos="0.277,-0.712"]
Ethnicity [adjusted,pos="-1.950,-0.552"]
GestationAge [adjusted,pos="-0.155,-0.514"]
Infections [pos="-0.883,-1.815"]
MaternalAge [adjusted,pos="-1.407,0.579"]
}

```

MaternalParity [adjusted,pos="-1.229,1.305"]  
 NightToiletTrips [adjusted,pos="-0.444,0.852"]  
 PercvFetalMovemnts [pos="-0.444,0.409"]  
 PrescriptionSteroidOpiatesEtc [latent,pos="-0.019,0.733"]  
 PriorDiabetes [adjusted,pos="-1.684,-0.764"]  
 PriorHypertension [pos="-1.642,-0.415"]  
 PriorPerinatLoss [pos="-1.172,0.774"]  
 PriorPretermBirth [pos="-1.326,0.951"]  
 SleepDuration [adjusted,pos="-0.404,-1.304"]  
 SleepInterruptions [pos="-0.612,-1.567"]  
 SleepPosition [pos="-0.226,-1.019"]  
 Smoking [adjusted,pos="-1.224,-1.739"]  
 StressScore [pos="-0.840,1.455"]  
 SubstUseAlcohol [adjusted,pos="-1.611,0.711"]  
 SupplementUse [pos="-0.627,-1.881"]  
 Unemployment [adjusted,pos="-1.829,0.635"]  
 "Stillbirth [Outcome]" -> "S [Selection/Recruitment]"  
 "U [Unobserved]" -> "Stillbirth [Outcome]"  
 AnxietyDepression -> PercvFetalMovemnts  
 AnxietyDepression -> SleepDuration  
 AnxietyDepression -> StressScore  
 BMI -> CaffeineIntake  
 BMI -> EstimatedFetalWgtPost  
 BMI -> EstimatedFetalWgtPre  
 BMI -> PercvFetalMovemnts  
 BMI -> SleepDuration  
 BMI -> SleepInterruptions  
 BMI -> SleepPosition  
 BMI <-> PriorDiabetes  
 CaffeineIntake -> "Stillbirth [Outcome]"  
 CaffeineIntake -> PriorHypertension  
 CaffeineIntake <-> NightToiletTrips  
 CaffeineIntake <-> SleepDuration  
 CountryOfBirth -> "Stillbirth [Outcome]"  
 CountryOfBirth -> DomesticViolence  
 CountryOfBirth -> EnglishLanguageProfcy  
 CountryOfBirth -> Ethnicity  
 Deprivation -> "Stillbirth [Outcome]"  
 Deprivation -> AnxietyDepression  
 Deprivation -> BMI  
 Deprivation -> CaffeineIntake  
 Deprivation -> EstimatedFetalWgtPost  
 Deprivation -> EstimatedFetalWgtPre  
 Deprivation -> Infections  
 Deprivation -> MaternalAge  
 Deprivation -> PriorDiabetes  
 Deprivation -> Smoking

Deprivation -> StressScore  
 Deprivation -> SubstUseAlcohol  
 Deprivation -> SupplementUse  
 DomesticViolence -> "Stillbirth [Outcome]"  
 DomesticViolence -> AnxietyDepression  
 DomesticViolence -> EstimatedFetalWgtPost  
 DomesticViolence -> EstimatedFetalWgtPre  
 DomesticViolence -> PriorPerinatLoss  
 DomesticViolence -> PriorPretermBirth  
 EducationLevel -> "Stillbirth [Outcome]"  
 EducationLevel -> BMI  
 EducationLevel -> Deprivation  
 EducationLevel -> MaternalAge  
 EducationLevel -> PriorPerinatLoss  
 EducationLevel -> PriorPretermBirth  
 EducationLevel -> SubstUseAlcohol  
 EducationLevel -> Unemployment  
 EnglishLanguageProfcy -> "Stillbirth [Outcome]"  
 EnglishLanguageProfcy -> StressScore  
 EnglishLanguageProfcy -> Unemployment  
 EstimatedFetalWgtPost -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> EstimatedFetalWgtPost  
 Ethnicity -> "Stillbirth [Outcome]"  
 Ethnicity -> CaffeineIntake  
 Ethnicity -> Deprivation  
 Ethnicity -> DomesticViolence  
 Ethnicity -> EstimatedFetalWgtPost  
 Ethnicity -> EstimatedFetalWgtPre  
 Ethnicity -> MaternalAge  
 Ethnicity -> PercvFetalMovemnts  
 Ethnicity -> PriorDiabetes  
 Ethnicity -> PriorHypertension  
 Ethnicity -> SleepDuration  
 Ethnicity -> Smoking  
 Ethnicity -> StressScore  
 GestationAge -> "Stillbirth [Outcome]"  
 GestationAge -> CaffeineIntake  
 GestationAge -> EstimatedFetalWgtPost  
 GestationAge -> EstimatedFetalWgtPre  
 GestationAge -> PercvFetalMovemnts  
 GestationAge -> SleepPosition  
 Infections -> "Stillbirth [Outcome]"  
 MaternalAge -> CaffeineIntake  
 MaternalAge -> EstimatedFetalWgtPost  
 MaternalAge -> EstimatedFetalWgtPre  
 MaternalAge -> MaternalParity



MaternalAge -> PriorHypertension  
 MaternalAge -> SleepDuration  
 MaternalAge -> Smoking  
 MaternalParity -> "Stillbirth [Outcome]"  
 MaternalParity -> EstimatedFetalWgtPost  
 MaternalParity -> EstimatedFetalWgtPre  
 MaternalParity -> PercvFetalMovemnts  
 MaternalParity -> SleepDuration  
 MaternalParity -> SleepInterruptions  
 NightToiletTrips -> "Stillbirth [Outcome]"  
 NightToiletTrips -> PercvFetalMovemnts  
 PercvFetalMovemnts -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> PercvFetalMovemnts  
 PriorDiabetes -> "Stillbirth [Outcome]"  
 PriorDiabetes -> CaffeineIntake  
 PriorDiabetes -> EstimatedFetalWgtPost  
 PriorDiabetes -> EstimatedFetalWgtPre  
 PriorDiabetes <-> SleepDuration  
 PriorHypertension -> "Stillbirth [Outcome]"  
 PriorHypertension -> EstimatedFetalWgtPost  
 PriorHypertension -> EstimatedFetalWgtPre  
 PriorPerinatLoss -> "Stillbirth [Outcome]"  
 PriorPretermBirth -> "Stillbirth [Outcome]"  
 SleepDuration -> PercvFetalMovemnts  
 SleepDuration -> PriorHypertension  
 SleepInterruptions -> SleepDuration  
 SleepPosition -> "Stillbirth [Outcome]"  
 SleepPosition -> EstimatedFetalWgtPost  
 SleepPosition -> EstimatedFetalWgtPre  
 Smoking -> "Stillbirth [Outcome]"  
 Smoking -> CaffeineIntake  
 Smoking -> EstimatedFetalWgtPost  
 Smoking -> EstimatedFetalWgtPre  
 Smoking -> PercvFetalMovemnts  
 Smoking -> PriorHypertension  
 Smoking -> PriorPerinatLoss  
 Smoking -> PriorPretermBirth  
 Smoking -> SleepInterruptions  
 StressScore -> "Stillbirth [Outcome]"  
 StressScore -> EstimatedFetalWgtPost  
 StressScore -> EstimatedFetalWgtPre  
 SubstUseAlcohol -> "Stillbirth [Outcome]"  
 SubstUseAlcohol -> CaffeineIntake  
 SubstUseAlcohol -> DomesticViolence  
 SubstUseAlcohol -> EstimatedFetalWgtPost  
 SubstUseAlcohol -> EstimatedFetalWgtPre

```

SubstUseAlcohol -> PercvFetalMovemnts
SubstUseAlcohol -> SleepDuration
SubstUseAlcohol -> SleepPosition
SupplementUse -> "Stillbirth [Outcome]"
Unemployment -> AnxietyDepression
Unemployment -> SleepDuration
}

```

Table 8 Dagitty code for Domestic Violence DAG – adjusting for the minimum set of adjustment variables only

```

dag{
"S [Selection/Recruitment]" [pos="0.488,0.420"]
"Stillbirth [Outcome]" [outcome,pos="0.491,-0.124"]
"U [Unobserved]" [latent,pos="0.513,-0.642"]
AnxietyDepression [pos="-0.795,1.083"]
BMI [pos="-1.741,-1.188"]
CaffeineIntake [pos="-0.665,0.777"]
CountryOfBirth [adjusted,pos="-2.002,-0.924"]
Deprivation [pos="-1.836,1.158"]
DomesticViolence [exposure,pos="-1.540,0.268"]
EducationLevel [pos="-1.927,0.174"]
EnglishLanguageProfcy [pos="-1.919,-0.133"]
EstimatedFetalWgtPost [pos="0.403,-1.334"]
EstimatedFetalWgtPre [pos="0.277,-0.712"]
Ethnicity [adjusted,pos="-1.950,-0.552"]
GestationAge [pos="-0.155,-0.514"]
Infections [pos="-0.883,-1.815"]
MaternalAge [pos="-1.407,0.579"]
MaternalParity [pos="-1.229,1.305"]
NightToiletTrips [pos="-0.444,0.852"]
PercvFetalMovemnts [pos="-0.444,0.409"]
PrescriptionSteroidOpiatesEtc [latent,pos="-0.019,0.733"]
PriorDiabetes [pos="-1.684,-0.764"]
PriorHypertension [pos="-1.642,-0.415"]
PriorPerinatLoss [pos="-1.172,0.774"]
PriorPretermBirth [pos="-1.326,0.951"]
SleepDuration [pos="-0.404,-1.304"]
SleepInterruptions [pos="-0.612,-1.567"]
SleepPosition [pos="-0.226,-1.019"]
Smoking [pos="-1.224,-1.739"]
StressScore [pos="-0.840,1.455"]
SubstUseAlcohol [adjusted,pos="-1.611,0.711"]
SupplementUse [pos="-0.627,-1.881"]
Unemployment [pos="-1.829,0.635"]
"Stillbirth [Outcome]" -> "S [Selection/Recruitment]"
}

```

"U [Unobserved]" -> "Stillbirth [Outcome]"  
 AnxietyDepression -> PercvFetalMovemnts  
 AnxietyDepression -> SleepDuration  
 AnxietyDepression -> StressScore  
 BMI -> CaffeineIntake  
 BMI -> EstimatedFetalWgtPost  
 BMI -> EstimatedFetalWgtPre  
 BMI -> PercvFetalMovemnts  
 BMI -> SleepDuration  
 BMI -> SleepInterruptions  
 BMI -> SleepPosition  
 BMI <-> PriorDiabetes  
 CaffeineIntake -> "Stillbirth [Outcome]"  
 CaffeineIntake -> PriorHypertension  
 CaffeineIntake <-> NightToiletTrips  
 CaffeineIntake <-> SleepDuration  
 CountryOfBirth -> "Stillbirth [Outcome]"  
 CountryOfBirth -> DomesticViolence  
 CountryOfBirth -> EnglishLanguageProfcy  
 CountryOfBirth -> Ethnicity  
 Deprivation -> "Stillbirth [Outcome]"  
 Deprivation -> AnxietyDepression  
 Deprivation -> BMI  
 Deprivation -> CaffeineIntake  
 Deprivation -> EstimatedFetalWgtPost  
 Deprivation -> EstimatedFetalWgtPre  
 Deprivation -> Infections  
 Deprivation -> MaternalAge  
 Deprivation -> PriorDiabetes  
 Deprivation -> Smoking  
 Deprivation -> StressScore  
 Deprivation -> SubstUseAlcohol  
 Deprivation -> SupplementUse  
 DomesticViolence -> "Stillbirth [Outcome]"  
 DomesticViolence -> AnxietyDepression  
 DomesticViolence -> EstimatedFetalWgtPost  
 DomesticViolence -> EstimatedFetalWgtPre  
 DomesticViolence -> PriorPerinatLoss  
 DomesticViolence -> PriorPretermBirth  
 EducationLevel -> "Stillbirth [Outcome]"  
 EducationLevel -> BMI  
 EducationLevel -> Deprivation  
 EducationLevel -> MaternalAge  
 EducationLevel -> PriorPerinatLoss  
 EducationLevel -> PriorPretermBirth  
 EducationLevel -> SubstUseAlcohol  
 EducationLevel -> Unemployment

EnglishLanguageProfcy -> "Stillbirth [Outcome]"  
 EnglishLanguageProfcy -> StressScore  
 EnglishLanguageProfcy -> Unemployment  
 EstimatedFetalWgtPost -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> "Stillbirth [Outcome]"  
 EstimatedFetalWgtPre -> EstimatedFetalWgtPost  
 Ethnicity -> "Stillbirth [Outcome]"  
 Ethnicity -> CaffeineIntake  
 Ethnicity -> Deprivation  
 Ethnicity -> DomesticViolence  
 Ethnicity -> EstimatedFetalWgtPost  
 Ethnicity -> EstimatedFetalWgtPre  
 Ethnicity -> MaternalAge  
 Ethnicity -> PercvFetalMovemnts  
 Ethnicity -> PriorDiabetes  
 Ethnicity -> PriorHypertension  
 Ethnicity -> SleepDuration  
 Ethnicity -> Smoking  
 Ethnicity -> StressScore  
 GestationAge -> "Stillbirth [Outcome]"  
 GestationAge -> CaffeineIntake  
 GestationAge -> EstimatedFetalWgtPost  
 GestationAge -> EstimatedFetalWgtPre  
 GestationAge -> PercvFetalMovemnts  
 GestationAge -> SleepPosition  
 Infections -> "Stillbirth [Outcome]"  
 MaternalAge -> CaffeineIntake  
 MaternalAge -> EstimatedFetalWgtPost  
 MaternalAge -> EstimatedFetalWgtPre  
 MaternalAge -> MaternalParity  
 MaternalAge -> PriorHypertension  
 MaternalAge -> SleepDuration  
 MaternalAge -> Smoking  
 MaternalParity -> "Stillbirth [Outcome]"  
 MaternalParity -> EstimatedFetalWgtPost  
 MaternalParity -> EstimatedFetalWgtPre  
 MaternalParity -> PercvFetalMovemnts  
 MaternalParity -> SleepDuration  
 MaternalParity -> SleepInterruptions  
 NightToiletTrips -> "Stillbirth [Outcome]"  
 NightToiletTrips -> PercvFetalMovemnts  
 PercvFetalMovemnts -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> "Stillbirth [Outcome]"  
 PrescriptionSteroidOpiatesEtc -> PercvFetalMovemnts  
 PriorDiabetes -> "Stillbirth [Outcome]"  
 PriorDiabetes -> CaffeineIntake  
 PriorDiabetes -> EstimatedFetalWgtPost

```

PriorDiabetes -> EstimatedFetalWgtPre
PriorDiabetes <-> SleepDuration
PriorHypertension -> "Stillbirth [Outcome]"
PriorHypertension -> EstimatedFetalWgtPost
PriorHypertension -> EstimatedFetalWgtPre
PriorPerinatLoss -> "Stillbirth [Outcome]"
PriorPretermBirth -> "Stillbirth [Outcome]"
SleepDuration -> PercvFetalMovemnts
SleepDuration -> PriorHypertension
SleepInterruptions -> SleepDuration
SleepPosition -> "Stillbirth [Outcome]"
SleepPosition -> EstimatedFetalWgtPost
SleepPosition -> EstimatedFetalWgtPre
Smoking -> "Stillbirth [Outcome]"
Smoking -> CaffeineIntake
Smoking -> EstimatedFetalWgtPost
Smoking -> EstimatedFetalWgtPre
Smoking -> PercvFetalMovemnts
Smoking -> PriorHypertension
Smoking -> PriorPerinatLoss
Smoking -> PriorPretermBirth
Smoking -> SleepInterruptions
StressScore -> "Stillbirth [Outcome]"
StressScore -> EstimatedFetalWgtPost
StressScore -> EstimatedFetalWgtPre
SubstUseAlcohol -> "Stillbirth [Outcome]"
SubstUseAlcohol -> CaffeineIntake
SubstUseAlcohol -> DomesticViolence
SubstUseAlcohol -> EstimatedFetalWgtPost
SubstUseAlcohol -> EstimatedFetalWgtPre
SubstUseAlcohol -> PercvFetalMovemnts
SubstUseAlcohol -> SleepDuration
SubstUseAlcohol -> SleepPosition
SupplementUse -> "Stillbirth [Outcome]"
Unemployment -> AnxietyDepression
Unemployment -> SleepDuration
}

```

## Signatures TO BE COMPLETED

This analysis plan for the MiNESS 20-28 study has been reviewed and approved by the following personnel:

Table 9

Chief Investigator

23 02 2026
Study Statistician

23 02 2026
Supervising Statistician

03 12 2025

