Clinical evidence tables for review question: Is there an association between sleep position on going to sleep and still birth or having a small for gestational age baby?

Table 5: Clinical evidence tables for IPD meta-analyses

Study details	Participants	Factors	Results	Comments
Full citation Anderson NH, Gordon A, Li M, Cronin RS, Thompson JMD, Raynes-Greenow CH, Heazel AEP, Stacey T, Culling VM, Wilson J, Askie LM, Mitchell EA. McCowan LME **Ref Id** 1121708 **Country/ies where the study was carried out** NA **Study type** Systematic Review **Study dates** Searches to January 2018 **Consecutive recruitment** No	4 eligible case control studies. Eligible participants comprised 1,760 women **Inclusion criteria** Control participants from 4 case control studies with gestational age at birth collected in weeks and days, gestation at study interview of 28 days and 0 days or more, gestation at birth less than or equal to 42 weeks and 6 weeks and data for usual going-to-sleep position up to 4 weeks before the interview. **Exclusion criteria** A further case-control study that was included in the CRIBBS IPD was excluded from the current analysis as this online survey collected gestational age in completed weeks only. Individual participants were also excluded if they had missing variables required for calculation of birth weight centiles **Statistical method**	Adjusted for study site and maternal age, height, weight, parity, ethnicity, preexisting diabetes, preexisting hypertension, antepartum hemorrhage, gestational hypertensive disorder, gestational diabetes, cigarette smoking, and recreational drug use.	**Adjusted odds ratio (95% CI), vs left, INTERGROWTH-21st, <10th centile** Other – 1.14 (0.62, 2.09) Right – 1.05 (0.58, 1.90) Supine - 3.23 (1.37, 7.59) Results also available for customised growth charts where supine is no longer statistically significantly associated with <10th centile (adjusted odds ratio 1.55 (0.72 to 3.35)) Sleep position defined as usual position over the previous week/2 weeks or month (whichever was longest and available from study).	**Limitations** **ROBIS** No concerns over relevance Study eligibility criteria: low concern Identification and selection of studies: low concern Data collection and study appraisal: low concern (although not all eligible studies were included this was due to a lack of data appropriate for IPD meta-analysis and researchers made reasonable efforts to contact authors) Synthesis and findings: low concern (no formal efforts to consider between study variation or incorporate biases in primary studies but risk of bias assessment was done and as this was an IPD meta-analysis, between study heterogeneity was less relevant). Overall: low risk of bias

Study details	Participants	Factors	Results	Comments
Funding Funding for this research was provided by a Trans-Tasman Research Funding Grant by Cure Kids and Red Nose Australia in 2016 (grant 6601).	Birth weight and birth weight centiles were compared by maternal going-to-sleep position and adjusted for infant gestational age at birth and at time of interview, infant sex, and maternal age, height, weight, parity, ethnicity, preexisting diabetes, preexisting hypertension, antepartum hemorrhage, gestational hypertensive disorder, gestational diabetes, cigarette smoking, and recreational drug use. To account for possible study differences, multivariable analyses were also adjusted for individual studies as a covariate. For continuous outcomes (birth weight and birth weight centiles), a generalized linear model was used with predicted adjusted means obtained using least-squares means. For binary outcomes (birth weight centile <10th, <50th, and >90th) logistic regression was used, stratified by study, and aORs and 95% confidence intervals were reported. **Demographics** Age years Supine: 29.6 (5.5) years; Nonsupine: 30.3 (5.5) years Ethnicity: White: Supine 31 (2.8%); Nonsupine 1,074 (97.2%) Black: Supine 35 (97.2%); Nonsupine 1 (2.8%) South Asian: Supine 9 (4.3%); Nonsupine 202 (95.7%)			

Study details	Participants	Factors	Results	Comments
	South East/East Asian: Supine 5 (4.6); Nonsupine 104 (95.4) Maori: Supine 2 (1.9); Nonsupine 104 (98.1) Pacific: Supine 9 (5.9); Nonsupine 143 (94.1) Others: Supine 0 (0%); Nonsupine 41 (100%) Parity: 0: 19 (2.5%) supine; 749 (97.5%) nonsupine 1: 32 (5.0%) supine; 604 (95.0%) nonsupine ≥2: 6 (1.7%); 350 (98.3%) Education: Primary and/or secondary school: 26 (4.5%) supine; 554 (95.5%) nonsupine Trade school: 6 (2.7%) 220 (97.3%) nonsupine Tertiary (university and postgraduate): 25 (2.6%); 929 (97.4%) Earliest pregnancy BMI (kg/m^2): 24.0 (21.0, 28.7) supine; 24.6 (22.0, 29.0) nonsupine			
Full citation Cronin RS, Li M, Thompson JMD, Gordon A, Raynes-Greenow CH, Heazell AEP, Stacey T, Culling VM, Bowring V, Anderson NH, O'Brien LM,	6 eligible case control studies; 5 provided individual level data (note the study that did not provide data, Lakshmi 2017 – did not meet the NGA protocol criteria for inclusion). Eligible	Adjusted for: • Maternal age • Earliest pregnancy BMI • Ethnicity	**Going to sleep position (last recorded, within 2 weeks of estimated fetal death in cases) and the odds of late stillbirth**	**Limitations** **ROBIS** No concerns over relevance

Study details	Participants	Factors	Results	Comments
Mitchell EA, Askie LM, McCowan LME. An Individual Participant Data Meta-analysis of Maternal Going-to-Sleep Position, Interactions with Fetal Vulnerability, and the Risk of Late Stillbirth. The Lancet 2019; 10:49-57. **Ref Id** 1242569 **Country/ies where the study was carried out** NA **Study type** Systematic Review **Study dates** Searches to January 2018 **Consecutive recruitment** No **Funding** Funding reported as funding for the individual studies included in the review from NHMRC Career Development Fellowship #1087062; NHMRC Early Career Fellowship #1089898; Cure Kid; American Sleep	participants comprised in 851 cases and 2,257 controls **Inclusion criteria** Eligible participants (stillbirth cases and pregnant controls) were extracted from the identified studies that provided maternal going-to-sleep position and late stillbirth data. **Exclusion criteria** Participant level exclusion criteria (multiple pregnancy, major congenital abnormality, gestation <28 weeks' when going-to-sleep position data during pregnancy was collected, termination of pregnancy at ≥28 weeks', and receiving a study intervention that may have affected going-to-sleep position) were applied during the analysis. **Statistical method** Potential confounders were all prespecified (maternal age, earliest pregnancy body mass index (BMI kg/m2), ethnicity, parity, education level, marital status, pre-existing hypertension or diabetes, smoking, recreational drug use, going-to-sleep position, fetal movements, and infant birthweight by customised centiles). A one-stage approach to IPD meta-analysis was used, so that the data from all the eligible studies were included in a single model. Logistic	• Parity • Education level • Marital status • Obesity • Pre-existing hypertension or diabetes • Smoking • Recreational drug use • Fetal movements • Infant birthweight by customised centiles • Small for gestational age infant (<10th infant birthweight customised centile) • Term (≥37 weeks) vs preterm (<37 weeks) infant Three confounders (going-to-sleep duration, frequency of overnight toilet use, and day-time napping) analysed in sensitivity models	Reference group was left-side going-to-sleep position. **Adjusted OR (95% CI)** Supine: 2.63 (1.72, 4.04) Right side: 1.04 (0.83, 1.31) Prone: 0.63 (0.12, 3.25) Variable sides: 0.97 (0.70, 1.35) Propped up: 1.30 (0.68, 2.49) Don't remember: 2.26 (1.48, 3.46)	Study eligibility criteria: low concern Identification and selection of studies: low concern Data collection and study appraisal: low concern (although not all eligible studies were included this was due to a lack of data appropriate for IPD meta-analysis and researchers made reasonable efforts to contact authors) Synthesis and findings: low concern (no formal efforts to consider between study variation or incorporate biases in primary studies but risk of bias assessment was done and as this was an IPD meta-analysis, between study heterogeneity was less relevant). Overall: low risk of bias

Study details	Participants	Factors	Results	Comments
Medicine Foundation and ResMed	regression models were used for the binary outcome. A fixed study effect and study site effect were included in the model specification as strata. Univariable analysis was performed to evaluate the association between going-to-sleep position and the odds of late stillbirth. During data acquisition, one prespecified confounder, alcohol intake during pregnancy, was found to be inconsistently collected across the studies and unable to be merged, and consequently omitted from the analysis. A multivariable model was developed incorporating prespecified confounders available in all the studies. Three confounders (going-to-sleep duration, frequency of overnight toilet use, and day-time napping) were only available in some of the studies, and were therefore analysed in sensitivity models. A sensitivity analysis was also conducted after exclusion of controls who reported their pregnancy going-to-sleep position after they had given birth. The interaction between going-to-sleep position and prespecified factors indicating a vulnerable pregnancy were assessed in bi-variable regression models. Estimates of risk of late stillbirth were reported as odds ratio (OR) with 95% confidence intervals. For missing data in each individual study, no imputation was undertaken. The population attributable risk (PAR) was calculated using the unadjusted OR for the primary outcome for supine going-to-sleep position and for other			

Study details	Participants	Factors	Results	Comments
	modifiable risk factors that were significant in multivariable analysis. Statistical analyses were performed using SAS, version 9.4 (SAS Institute Inc., Cary NC USA). **Demographics** Age years <20 yrs: 38 (4.5) cases; 78 (3.5) controls 20–29 yrs: 343 (40.3) cases; 905 (40.1) controls 30-39 yrs: 425 (49.9); 1190 (52.7) controls ≥40 yrs: 45 (5.3) cases; 84 (3.7) controls Ethnicity: White: 522 (61.3) cases; 1545 (68.5) controls Black: 22 (2.6) cases; 42 (1.9) controls South Asian: 90 (10.6) cases; 219 (9.7) controls South East/East Asian: 40 (4.7) cases; 111 (4.9) controls Maori: 46 (5.4) cases; 107 (4.7) controls Pacific: 91 (10.7) cases; 154 (6.8) controls Others: 40 (4.7) cases; 79 (3.5) controls Parity: Nulliparous: 446 (52.4) cases; 930 (41.2) controls 1-2: 292 (34.3) cases; 1110 (49.2) controls			

Study details	Participants	Factors	Results	Comments
	3-4: 87 (10.2) cases; 176 (7.8) controls ≥5: 26 (3.1) cases; 41 (1.8) controls Education: Primary: 187 (22.0) cases; 348 (15.4) controls Secondary: 161 (18.9) cases; 343 (15.2) controls University: 328 (38.5) cases; 1069 (47.4) Postgraduate: 73 (8.6) cases; 240 (10.6) controls Non-University Trade: 93 (10.9) cases; 249 (11.0) controls Earliest pregnancy BMI (kg/m^2): 26.0 (22.5, 31.4) cases; 24.8 (22.0, 29.3) controls			

Table 6: Clinical evidence tables for primary studies

Study details	Participants	Factors	Results	Comments
Full citation Heazell, A. E. P., Li, M., Budd, J., Thompson, J. M. D., Stacey, T., Cronin, R. S., Martin, B., Roberts, D., Mitchell, E. A., McCowan, L. M. E., Association between maternal sleep practices and late stillbirth - findings from a stillbirth case-control study, BJOG: An International Journal of Obstetrics and Gynaecology, 125, 254-262, 2018	**Cases** N=291 **Diagnostic criteria** ReCoDe classification system. **Controls** N=733 **Inclusion criteria**	**Factors** **Sleeping practices:** Maternal going-to-sleep position in the last 4 weeks and on the night prior to stillbirth for cases and night before interview for controls (left side, supine, right side, tummy, variable side, propped up, or unknown); Duration of sleep;	**Adjusted odds ratio** **Late stillbirth and supine going-to-sleep position on last night** Data adjusted for: Last night going-to-sleep position, maternal age group, ethnicity, parity, level of education, BMI, birthweight centile, gestation, sleep duration, duration of daytime nap, study site. Reference group was left-side going-to-sleep position.	**Limitations** **QUIPS tool - modified version** Study population: High risk of bias (multicentre (41 maternity units); >50% for cases and controls did not participate, although authors reported that women in participation and non-participant groups had similar profiles of maternal age and ethnicity; sufficient information provided on flow of participants) Study attrition: Low risk of bias (>80% seen at assessment; reasons for non-completion provided)

Ref Id 936669 **Country/ies where the study was carried out** UK **Study type** Prospective population-based case-control study **Study dates** April 2014 to March 2016 **Consecutive recruitment** No **Funding** Funded by Action Medical Research, Cure Kids, and Sands.	• Cases: Women who had a stillbirth after 28 weeks' gestation with no known congenital anomaly; • Controls: Women with an ongoing pregnancy at the time of interview. **Exclusion criteria** • Women with multiple pregnancies; • Controls: Women who subsequently delivered an infant with congenital abnormality or who had a stillborn baby; • Maternal age <16 years; • Women unable to provide consent. **Statistical method** **Power analysis** To achieve 80% power and assuming 30% non-participation, 415 cases and 830 controls were required. **Statistical analyses** Differences between cases and controls for categorical data were analysed using chi-squared test. Continuous variables were compared using Wilcoxon rank-sum tests as the data were not normally distributed. Univariable logistic regression was conducted to evaluate the association between sleep practices and risk of late stillbirth.	Number of times up to the toilet during the last night; Daytime napping in the last 4 weeks. **Other factors:** Small for gestational age (<10th centile); Smoking during pregnancy; Obesity; Overweight. <u>Still birth - OR (95% CI)</u> On last night before stillbirth for cases or night before interview for controls, women with late stillbirth more likely to report sleeping in supine position on last night before stillbirth: 2.17 (1.15 to 4.08) Women with late stillbirth had increased likelihood of not being able to recall going-to-sleep position: 3.73 (1.67 to 8.32) Women with late stillbirth more likely to report right-side going-to-sleep position: 0.91 (0.65 to 1.26) <u>SGA - OR (95% CI)</u> 7.01 (33.6% to 56.8%) <u>Sleep duration previous night (hours) - number (%)</u> <u><5.49</u> Cases: 129 (44.3)	<u>Maternal going-to-sleep position previous night (before stillbirth/interview) - number (%)</u> <u>Left</u> Cases: 140 (48.1) Controls: 383 (53.3) <u>Right</u> Cases: 73 (25.1) Controls: 220 (30.0) Adjusted odds ratio (aOR)=0.67 (95% CI 0.44 to 1.02) <u>Back</u> Cases: 19 (6.5) Controls: 24 (3.3) aOR=2.31 (95% CI 1.04 to 5.11) <u>Tummy</u> Cases: 3 (1.0) Controls: 4 (0.5) aOR=1.01 (95% CI 0.13 to 7.81) <u>Propped</u> Cases: 9 (3.1) Controls: 15 (2.0) aOR=0.44 (95% CI 0.13 to 1.49) <u>Variable</u> Cases: 32 (11.0) Controls: 76 (10.4) aOR=0.93 (95% CI 0.51 to 1.69) <u>Unknown</u> Cases: 15 (5.2) Controls: 11 (1.5) aOR=3.33 (95% CI 1.13 to 9.84) <u>c-statistic for final multivariable model</u> 0.827 *Reference	Prognostic factor measurement: Moderate risk of bias (prospective data collection; definition of risk factors provided; validated measurement tool used, but potential for recall bias; adequate proportion of study sample completed data for prognostic factors; no imputation performed for missing data) Outcome measurement: Low risk of bias (validated measurement tool administered by research midwives and same for all participants; questionnaires included maternal health so blinding not possible) Confounding measurement and account: Low risk of bias (cases and controls matched and adjustments made for confounding variables) Analysis and reporting: Low risk of bias (statistical model appropriate and results reported in final multivariable model with point estimates and measures of variance) **Other information** Notes: 50 cases and 119 controls reported receiving advice about sleep; obtained from the internet, health professionals, literature, and friends and family.

	A multivariable logistic model was developed to incorporate ethnicity and level of education, variables associated with increased risk of stillbirth based on previous literature (age, BMI, parity, smoking, small-for-gestational-age (SGA) status), other sleep related variables significant in univariable analysis, and variables used to select cases and controls (gestation and maternity unit). Unconditional logistic regression was used to adjust for potential confounders. No imputation for missing data was undertaken. The c statistic was used to assess the area under the curve. **Demographics** Maternal age (years) - median (interquartile range; IQR) Cases: 30.2 Controls:30.5 Ethnicity - number (%) White Cases: 234 (80.4) Controls: 594 (81.0) Black Cases: 12 (4.1) Controls: 29 (4.0) South Asian Cases: 39 (13.4) Controls: 95 (13.0) Others Cases: 6 (2.1) Controls: 15 (2.0) Parity - number (%) 0 Cases: 167 (57.4) Controls: 296 (40.4) 1 to 2 Cases: 92 (31.6)	Controls: 227 (31.0) 5.5 to 8.49 Cases: 121 (41.6) Controls: 413 (56.3) 8.5 to 9.49 Cases: 20 (6.9) Controls: 55 (7.5) 9.5+ Cases: 19 (6.5) Controls: 36 (4.9) Number of times up to the toilet previous night - number (%) One or less Cases: 91 (31.3) Controls: 120 (16.4) Two or more Cases: 199 (68.4) Controls: 613 (83.6) Maternal daytime naps in previous 4 weeks - number (%) Never Cases: 58 (19.9) Controls: 157 (21.4) Occasionally Cases: 49 (16.8) Controls: 153 (20.9) 1 to 2 per week Cases: 47 (16.1) Controls: 180 (24.6) 3 to 4 per week Cases: 44 (15.1) Controls: 110 (15.0) 5 to 6 per week Cases: 22 (7.6) Controls: 39 (5.3) Everyday Cases: 71 (24.4) Controls: 93 (12.7) Unknown Cases: 0 (0.0)		

	Controls: 386 (52.7) 3+ Cases: 32 (11.0) Controls: 51 (7.0) Level of Education - number (%) Graduate Education Cases: 99 (34.0) Controls: 326 (31.84) Further Education Cases: 112 (38.5) Controls: 278 (27.15) Secondary education to 16 years Cases: 56 (19.2) Controls: 100 (9.77) No formal educational qualification Cases: 23 (7.9) Controls: 29 (2.83) Body mass index - mean (IQR) Cases: 26.91 (15.44 to 47.87) Controls: 26.02 (15.41 to 48.59) Gestational age (for cases, gestational age at diagnosis of stillbirth; for controls at time of interview) - median (IQR) Cases: 37 weeks 4 days (33 weeks 4 days to 39 weeks 5 days) Controls: 36 weeks 3 days (32 weeks 6 days to 38 weeks 5 days)	Controls: 1 (0.1)		
Full citation Stacey, T., Thompson, J. M. D., Mitchell, E. A., Ekeroma, A. J., Zuccollo, J. M., McCowan, L. M. E., Association between maternal sleep practices and risk of late stillbirth: A case-control study, Bmj, 342 (7811) (no pagination), 2011 **Ref Id**	**Cases** N=155 **Diagnostic criteria** PSANZ classification system **Controls** N=310 **Inclusion criteria**	**Factors** **Sleeping practices:** Maternal sleep position at the time of going to sleep and on waking (left side, right side, back, and other (front, sitting up, both sides, and unsure or don't remember)) in the last month, week, and night of pregnancy;	**Adjusted odds ratio** Maternal sleeping position in last night of pregnancy and risk of late stillbirth Results adjusted for age, ethnicity, overweight or obesity, parity, social deprivation level, smoking, regular sleep in daytime in last month of pregnancy; hours of night time sleep in last month of pregnancy; number of times up	**Limitations** **QUIPS tool - modified version** Study population: Moderate risk of bias (multicentre (all maternity units in Auckland region); recruitment rate 72% for cases and controls and although no significant differences in age, parity, or ethnicity between those who did and did not consent, there was potential for selection bias; sufficient information provided on flow of participants) Study attrition: Low risk of bias (>80% seen at assessment; authors reported

936670 **Country/ies where the study was carried out** New Zealand **Study type** Prospective population-based case-control study **Study dates** July 2006 to June 2009 **Consecutive recruitment** No **Funding** Cure Kids, the Nurture Foundation, and the Auckland District Health Board Trust Fund.	• Women who gave birth to stillborn baby at or after 28 weeks of gestation in the Auckland region; • Controls were selected from the pregnancy registration list of the district health board, matched for gestation to cases. **Exclusion criteria** • Women whose baby died from a congenital abnormality; • Multiple pregnancies; • Women who had not been booked to deliver their baby within the Auckland region. **Statistical method** **Power analysis** The authors reported that the study was powered to detect an odds ratio of 2 with 80% power and significance level of 5%, with a prevalence of the risk factor of ≥20% in the control population. **Statistical analyses** Continuous data were compared using Student's *t*-test, and the Pearson correlation coefficient was used to assess the correlation between variables. A multivariable regression model was used to include maternal variables reported to be associated with increased risk of stillbirth, based on previous literature (age, BMI, ethnicity, parity, smoking, and socioeconomic status).	Sleeping regularly during the daytime in the last month; Usual duration of sleep at night during the last month; Frequency of getting up to the toilet. <u>Changes in sleeping position on last night of pregnancy and risk of late stillbirth - number (%)</u> <u>Left on going to sleep; left on waking up</u> Cases: 29 (19) Controls: 95 (31) Univariable OR (95% CI): 1.00 <u>Left on going to sleep; other on waking up</u> Cases: 13 (8) Controls: 37 (12) Univariable OR (95% CI): 1.15 (0.54 to 2.45) <u>Other on going to sleep; left on waking up</u> Cases: 2 (1) Controls: 11 (4) Univariable OR (95% CI): 0.60 (0.13 to 2.84) <u>Other on going to sleep; other on waking up</u> Cases: 111 (72) Controls: 167 (54) Univariable OR (95% CI): 2.28 (1.35 to 3.52) <u>Regular sleep in daytime (last month of</u>	to the toilet during last night of pregnancy. Left side sleeping position used as reference group, OR=1.00 <u>Right side</u> adjusted odds ratio (aOR)=1.74 (95% CI 0.98 to 3.01)*** <u>Back (supine)</u> aOR=2.54 (95% CI 1.04 to 6.18);p=0.005 <u>Other</u> aOR=2.32 (95% CI 1.28 to 4.19)	that there was no missing data for variables included in the paper) Prognostic factor measurement: Moderate risk of bias (prospective data collection; definition of risk factors provided; validated measurement tool used, but potential for recall bias due to length of time between stillbirth and interview, 25 days on average, compared with controls who were asked about sleep practices on the previous night; adequate proportion of study sample completed data for prognostic factors; no missing data) Outcome measurement: Low risk of bias (cases selected from clinicians in participating centres and hospital birth records, with confirmation through use of New Zealand national registry; controls selected from pregnancy registration list of district health board of participating centre). The authors stated that it was not always possible to be certain as to the exact timing of fetal death, and in some cases the 'last night' was not the final night before fetal death or during which the baby died. Confounding measurement and account: Low risk of bias (cases and controls matched and adjustments made for confounding variables) Analysis and reporting: Low risk of bias (statistical model appropriate and results reported in final multivariable model with point estimates and measures of variance) **Other information** Auckland Stillbirth Study

	Chi-squared statistics were used to assess the significance of variables in the models, and individual level odds ratios were estimated for each category and compared to a reference category. **Demographics** Maternal age (years) - number (%) <20 Cases: 10 (6) Controls: 24 (8) 20 to 34 Cases: 113 (73) Controls: 216 (70) ≥35 Cases: 32 (21) Controls: 70 (23) Ethnicity - number (%) Maori Cases: 19 (12) Controls: 46 (15) Pacific Cases: 48 (31) Controls: 67 (22) European Cases: 55 (35) Controls: 139 (45) Other Cases: 33 (21) Controls: 58 (19) Parity - number (%) 0 Cases: 77 (50) Controls: 144 (46) 1 to 3 Cases: 62 (40) Controls: 156 (51) ≥4 Cases: 16 (10) Controls: 10 (3) Social deprivation level - number (%)	pregnancy - number (%) Yes Cases: 78 (50) Controls: 116 (37) No Cases: 77 (50) Controls: 194 (63) Hours of nighttime sleep (last month of pregnancy) - number (%) <6 Cases: 30 (19) Controls: 46 (15) 6 to 8 Cases: 82 (53) Controls: 205 (66) >8 Cases: 43 (28) Controls: 59 (19) Number of times getting up to toilet during night last night of pregnancy- number (%) >1 Cases: 86 (55) Controls: 207 (67) ≤1 Cases: 69 (45) Controls: 103 (33)		

	1 to 4 Cases: 91 (59) Controls: 218 (70) 5 (most deprived) Cases: 64 (41) Controls: 92 (30) BMI at booking - number (%) <25 Cases: 55 (35) Controls: 156 (50) 25 to 29.9 Cases: 39 (25) Controls: 67 (22) ≥30 Cases: 61 (39) Controls: 87 (28) Smoking during pregnancy - number (%) Cases: 46 (30) Controls: 66 (21)			
Full citation McCowan, L. M. E., Thompson, J. M. D., Cronin, R. S., Li, M., Stacey, T., Stone, P. R., Lawton, B. A., Ekeroma, A. J., Mitchell, E. A., Going to sleep in the supine position is a modifiable risk factor for late pregnancy stillbirth; Findings from the New Zealand multicentre stillbirth case-control study, Plos one, 12 (6) (no pagination), 2017 **Ref Id** 929927 **Country/ies where the study was carried out**	**Cases** N=164 **Diagnostic criteria** PSANZ classification system **Controls** N=569 **Inclusion criteria** • Cases: consenting women with a stillbirth at ≥28 weeks of gestation; • Controls: women with ongoing pregnancies in each participating health region.	**Factors** **Maternal sleeping practices:** Self-reported going-to-sleep position on last night (left side, right side, restless, supine (lying on the back), on the front, or propped); Self-reported usual going-to-sleep position in last week (left side, right side, variable side, supine (lying on the back), on the front or propped; Getting up to go to the toilet during the night on the last night; How many hours slept on last night;	**Adjusted odds ratio** Results adjusted for gestation at interview in controls and at diagnosis of stillbirth for cases, district health board, maternal age, ethnicity, parity, social deprivation level, earliest pregnancy BMI, marital status, smoking in pregnancy, baby birthweight centile, hours of night time sleep on the last night, getting up to toilet during the last night, sleep during the daytime in the last week, going to sleep position on last night and in the last week). Going-to-sleep position on last night and pre-term stillbirth (≥28 to 36 weeks' gestation) Note: One pre-term case and one pre-term control had an unknown sleep position on the	**Limitations** **QUIPS tool - modified version** Study population: High risk of bias (multicentre (all maternity units across 7 New Zealand health regions); rate of recruitment 65.9% for cases and 62.2% for controls, further information on flow of participants not provided; women of high parity were underrepresented in both groups, while Indian women were over-represented and Maori women under-represented in cases compared with eligible controls) Study attrition: Low risk of bias (>80% seen at assessment; no imputation performed for missing data) Prognostic factor measurement: Moderate risk of bias (prospective data collection; definition of risk factors provided; validated measurement tool used, but potential for recall bias due to length of time between

New Zealand **Study type** Prospective population-based case-control study **Study dates** February 2012 to December 2015 **Consecutive recruitment** No **Funding** Health Research Council of New Zealand, Cure Kids, Mercia Barnes Trust, Nurture Foundation, and the University of Auckland Faculty Research Development Fund.	**Exclusion criteria** • Women with multiple pregnancies; • Babies with major congenital abnormalities at any stage of the study. **Statistical method** **Power analysis** To achieve 80% power and based on 70% participation, 415 cases and 830 controls were required for recruitment. **Statistical analyses** Chi-squared tests were used to compare differences between categorical data. Continuous data were compared using Wilcoxon rank-sum tests. Univariable analysis was conducted to assess the association between sleep practices and risk of late stillbirth. A multivariable model was used to incorporate ethnicity and deprivation index, variables associated with increased risk of stillbirth based on previous literature (age, BMI, parity, smoking, SGA status), other sleep variables significant in univariable analysis, and variables used to select cases and controls (gestation and District Health Boards). Unconditional logistic regression was used to adjust for potential confounders. No imputation was performed for missing data (women who could not recall their going-to-sleep position on the last night were excluded from the multivariable model). Stratified analysis was carried out by term (≥37 weeks') and pre-term (≥28 to	Frequency of sleeping during the daytime in the last week. Going to sleep position on the last night - number (%)# Left side Cases: 78 (47.6) Controls: 328 (57.6) Adjusted OR (95% CI): 1.00 Right side Cases: 44 (26.8) Controls: 187 (32.9) Adjusted OR (95% CI): 0.92 (0.58 to 1.44) Restless Cases: 14 (8.5) Controls: 22 (3.9) Adjusted OR (95% CI): 1.98 (0.87 to 4.50) Supine Cases: 19 (11.6) Controls: 22 (3.9) Adjusted OR (95% CI): 3.67 (1.74 to 7.78) Propped Cases: 4 (2.4) Controls: 9 (1.6) Adjusted OR (95% CI): 1.11 (0.30 to 4.06) Going to sleep position on the last week - number (%)## Left side Cases: 85 (51.8) Controls: 302 (53.1) Adjusted OR (95% CI): - Right side Cases: 42 (25.6)	last night and was excluded from the multivariable model. Left side (reference group) Cases, n (%): 34 (50.0) Controls, n (%): 147 (58.3) Odds ratio: 1.00 Right side Cases: 22 (32.4) Controls: 86 (34.1) Adjusted odds ratio (aOR)=0.96 (95% CI 0.48 to 1.94) Restless Cases: 4 (5.9) Controls: 4 (1.6) aOR=3.50 (95% CI 0.61 to 19.97) Back (Supine) Cases: 6 (8.8) Controls: 13 (5.2) aOR=3.12 (95% CI 0.97 to 10.05) Propped Cases: 1 (1.5) Controls: 1 (0.4) aOR=4.37 (95% CI 0.11 to 178.86) Going-to-sleep position on last week and pre-term stillbirth (≥28 to 36 weeks' gestation) Note: One pre-term control did not recall their sleep position in last week and was excluded from the multivariable model. Left side (reference group) Cases, n (%): 38 (55.9) Controls, n (%): 137 (54.4) OR: 1.00 Right side Cases: 19 (27.9) Controls: 75 (29.8) aOR=0.73 (95% CI 0.34 to 1.54)	stillbirth and interview, 24 days on average; adequate proportion of study sample completed data for prognostic factors) Outcome measurement: Low risk of bias (clear definition of outcome provided, validated measurement tool administered by research midwives, setting and measurement similar for all participants; authors state that possible in some cases 'last night' was not the night before fetal death, or the night during which the baby died.) Confounding measurement and account: Low risk of bias (cases and controls matched and adjustments made for confounding variables) Analysis and reporting: Low risk of bias (statistical model appropriate and results reported in final multivariable model with point estimates and measures of variance) **Other information**

	36 weeks') gestation. The c statistic was calculated to assess model performance. **Demographics** Maternal age (years) - number (%) <20 Cases: 9 (5.5) Controls: 17 (3.0) 20 to 39 Cases: 141 (86.0) Controls: 532 (93.5) ≥40 Cases: 14 (8.5) Controls: 20 (3.5) Ethnicity - number (%) Maori Cases: 26 (16.0) Controls: 58 (10.0) Pacific Cases: 38 (23.2) Controls: 86 (15.1) Indian Cases: 17 (10.4) Controls: 77 (13.5) Other Asian Cases: 13 (7.9) Controls: 72 (12.7) European Cases: 65 (39.6) Controls: 263 (46.2) Other Cases: 5 (3.1) Controls: 13 (2.3) Parity - number (%) 0 Cases: 76 (46.3) Controls: 245 (43.1) 1 to 3 Cases: 80 (48.8) Controls: 308 (54.1) ≥4	Controls: 171 (30.1) Adjusted OR (95% CI): 0.82 (0.52 to 1.30) Variable side Cases: 15 (9.2) Controls: 72 (12.7) Adjusted OR (95% CI): 0.85 (0.44 to 1.65) Supine Cases: 15 (9.2) Controls: 72 (12.7) Adjusted OR (95% CI): 3.46 (1.49 to 8.03) Propped Cases: 5 (3.1) Controls: 7 (1.2) Adjusted OR (95% CI): 2.10 (0.57 to 7.71) On front Cases: 1 (0.6) Controls: 0	Variable side Cases: 4 (5.9) Controls: 27 (10.7) aOR=0.63 (95% CI 0.18 to 2.19) Supine Cases: 5 (7.4) Controls: 11 (4.4) aOR=2.25 (95% CI 0.65 to 7.84) Propped Cases: 1 (1.5) Controls: 1 (0.4) aOR=4.01 (95% CI 0.08 to 210.43) On front Cases: 1 (1.5) Controls: 0 Going-to-sleep position on last night and term stillbirth (≥37 weeks' gestation) Note: Four term cases had an unknown sleep position on the last night and was excluded from the multivariable model. Left side Cases, n (%): 44 (45.8) Controls, n (%): 181 (57.1) OR=1.00 Right side Cases: 22 (22.9) Controls: 101 (31.9) aOR=0.98 (95% CI 0.48 to 1.99) Restless Cases: 10 (10.4) Controls: 18 (5.7) aOR=2.00 (95% CI 0.64 to 6.21) Back (Supine) Cases: 13 (13.5) Controls: 9 (2.8)	

	Cases: 8 (4.9) Controls: 16 (2.8)		aOR=10.26 (95% CI 3.01 to 35.04) Propped Cases: 3 (3.1) Controls: 8 (2.5) aOR=1.02 (95% CI 0.17 to 5.97) Going-to-sleep position on last week and term stillbirth (≥37 weeks' gestation) Note: One term case did not recall sleep position in the last week and was excluded from the multivariable model. Left side (reference group) Cases, n (%): 47 (49.0) Controls, n (%): 165 (52.1) OR=1.00 Right side Cases: 23 (24.0) Controls: 96 (30.3) aOR=0.95 (95% CI 0.48 to 1.89) Variable side Cases: 11 (11.5) Controls: 45 (14.2) aOR=1.11 (95% CI 0.49 to 3.01) Back (Supine) Cases: 10 (10.4) Controls: 5 (1.6) aOR=12.73 (95% CI 2.92 to 55.46) Propped Cases: 4 (4.2) Controls: 6 (1.9) aOR=2.64 (95% CI 0.47 to 14.81) c statistic for final multivariable model 0.736	

			Non-left versus left positions in the multivariable model resulted in non-significant increase in late stillbirth risk compared with the combined non-left positions: 1.35 (0.92 to 1.99).	
Full citation Gordon, A., Raynes-Greenow, C., Bond, D., Morris, J., Rawlinson, W., Jeffery, H., Sleep position, fetal growth restriction, and late-pregnancy stillbirth: The sydney stillbirth study, Obstetrics and Gynecology, 125, 347-355, 2015 **Ref Id** 938535 **Country/ies where the study was carried out** Australia **Study type** Prospective population-based case-control study **Study dates** January 2006 to December 2011 **Consecutive recruitment** No	**Cases** N=103 **Diagnostic criteria** PSANZ classification system **Controls** N=192 **Inclusion criteria** • Cases: women with singleton pregnancies who experienced stillbirth at ≥32 weeks of gestation • Controls: pregnant women at 32 weeks of gestation with singleton pregnancies who were matched for booking hospital and gestation (by estimated date of delivery) and recruited during the same period of time as women in the case group. **Exclusion criteria** • Women identified as Aboriginal or Torres Strait Islander;	**Factors** **Maternal sleeping practices:** Sleep position: left; right; back; other. **Suspected fetal growth restriction:** <10th percentile; <3rd percentile. **Other factors:** Maternal age; Maternal BMI; Primiparous; Not in paid work; Sleep apnoea symptoms; Smoking; Education to high school or less. <u>SGA and stillbirth - OR (95% CI)</u> Fetuses who were stillborn were significantly more likely to be SGA using the 10th percentile: 3.8 (1.8 to 8.2) and less than the third percentile: 3.6 (1.2 to 10.9). **Univariate analysis** <u>Stillbirth and suspected fetal growth</u>	**Adjusted odds ratio** <u>Stillbirth and supine sleep position in the last month</u> Multivariate model adjusted for maternal age group; maternal BMI; primiparous; not in paid work; sleep apnoea symptoms; smoking; suspected fetal growth restriction; education to high school or less; sleep position (left, right, back, other). Left-side going-to-sleep position is reference group. <u>Left side</u> Cases: 32 (31) Controls: 48 (25) Odds ratio=1 <u>Right side</u> Cases: 14 (13.6) Controls: 25 (13) Adjusted odds ratio (aOR)=1.1 (95% CI 0.43 to 2.6) <u>Back</u> Cases: 10 (9.7) Controls: 4 (2.1) aOR=6.26 (95% CI 1.2 to 34) <u>Other</u> Cases: 47 (45.6) Controls: 115 (60) aOR=0.69 (95% CI 0.36 to 1.3)	**Limitations** **QUIPS tool - modified version** Study population: Low risk of bias (multicentre (9 hospitals in the Sydney metropolitan area); rate of recruitment 86% for cases and 84.6% for controls, further information on flow of participants provided) Study attrition: Low risk of bias (>80% seen at assessment; reasons for non-participation reported) Prognostic factor measurement: Moderate risk of bias (prospective data collection; definition of risk factors provided; interviewer-administered questionnaires used, but potential for recall bias due to time delay between recruitment and interview; adequate proportion of study sample completed data for prognostic factors) Outcome measurement: Low risk of bias (clear definition of outcome; Cases recruited using clinicians/research staff at participating hospitals and confirmed through perinatal mortality review committees of these hospitals; controls identified using hospital databases) Confounding measurement and account: Low risk of bias (cases and controls matched and adjustments made for confounding variables) Analysis and reporting: Moderate risk of bias (statistical model appropriate and results reported in final multivariable

Funding Stillbirth Foundation, Australia.	• Fetuses that had known lethal or chromosomal anomalies; • Terminations of pregnancy. **Statistical method** **Power analysis** To achieve 80% power, based on prevalence of 10% small for gestational age (SGA) to detect an odds ratio (OR) of 25 between cases and controls, approximately 100 women were required in the case group and 200 women in the controls group. **Statistical analyses** Univariate analysis was conducted using chi-squared tests for categorical data and Student's t-test for continuous variables. Conditional logistic regression was used to calculate adjusted ORs for a priori-specified risk factors and to account for matching within stratification. Risk factors identified as significant on univariate analysis, or associated with stillbirth in previous literature (even if non-significant), were included in the multivariate models. However, if previously known risk factors were present in too few patients as to make no difference to the multivariate model, they were not included. Reference categories for the multivariable models were defined as the groups likely to have the lowest risk. **Demographics** **Maternal age (years) - number (%)** <u><35</u> Cases: 73 (70.9)	<u>restriction - OR (95% CI)</u> 8.3 (2.3 to 30) <u>Stillbirth and supine sleeping over the last month - OR (95% CI)</u> 5.0 (1.5 to 16.5)		model with point estimates and measures of variance; however, study underpowered to assess interactions between risk factors) **Other information**

	Controls: 121 (63) 35 to 39 Cases: 22 (21.4) Controls: 53 (27.6) ≥40 Cases: 8 (9.4) Controls: 18 (7.8) **BMI (kg/m^2) - number (%)** <25 Cases: 62 (62.6) Controls: 129 (67.9) 25 to 29.9 Cases: 22 (22.2) Controls: 44 (23.2) ≥30 Cases: 15 (15.2) Controls: 17 (8.9) **Primiparous - number (%)** Cases: 53 (51.5) Controls: 104 (54.2) **Not in paid work - number (%)** Cases: 26 (25.2) Controls: 18 (9.4) **Smoker - number (%)** Cases: 14 (13.6) Controls: 25 (13) **Education to high school or less - number (%)** Cases: 43 (41.7) Controls: 49 (25.5)			
Full citation O'Brien, Louise M., Warland, Jane, Stacey, Tomasina, Heazell, Alexander E. P., Mitchell, Edwin A., Maternal sleep practices and stillbirth: Findings from an international case-control study, BirthBirth, 0 **Ref Id**	**Cases** N=153 **Diagnostic criteria** Not reported **Controls** N=480	**Factors** **Sleeping practices:** Maternal going-to-sleep position in the month and on the night prior to stillbirth for cases and last month and last night before their pregnancy for controls (left side, supine, right side,	**Adjusted odds ratio** **Late stillbirth and supine going-to-sleep position on last night** Maternal going-to-sleep position previous night (before stillbirth/interview) - number (%) Left-hand going-to-sleep position used as reference group. Left	**Limitations** **QUIPS tool - modified version** Study population: High risk of bias (international retrospective online survey so potential for self-selection bias) Study attrition: Low risk of bias (<20% missing data; prior sample size calculation which was fulfilled) Prognostic factor measurement: Moderate risk of bias (retrospective data collection; definition

967090 **Country/ies where the study was carried out** Various (see other information) **Study type** Nested case-control study in uncontrolled cohort **Study dates** September 2012 to August 2014 **Consecutive recruitment** No **Funding** Not reported	**Inclusion criteria** • Cases: Women who had a singleton stillborn baby ≥ 28 weeks gestation within 1 month of completing the survey; • Controls: Women with an ongoing pregnancy (≥ 28 weeks gestation) or had delivered a living baby within the month before survey completion **Exclusion criteria** • Women with multiple pregnancies; • Women whose fetus with known congenital abnormality ; • Maternal age <18 years; • Women unable to provide consent. **Statistical method** **Power analysis** Sample size was calculated based on the anticipated exposure of supine sleep. To achieve 80% power and assuming an exposure frequency of 20%, 144 cases and controls were required to detect the odds of stillbirth 3.0 among cases compared to controls. **Statistical analyses** Data were cleaned by two authors. Data analyses were performed using SPSS using cross-tabulations, chi-squared tests and logistic regressions to find unadjusted and adjusted odds ratio with	tummy, variable side, propped up); Duration of sleep; Number of times up to the toilet during the last night; Daytime napping in the last 4 weeks. **Other factors:** Small for gestational age (<10th centile); Smoking during pregnancy; Obesity; Overweight. <u>Still birth - OR (95% CI)</u> On last night before stillbirth for cases or night before interview for controls, women with late stillbirth more likely to report sleeping in supine position on last night before stillbirth: 2.17 (1.15 to 4.08) Women with late stillbirth had increased likelihood of not being able to recall going-to-sleep position: 3.73 (1.67 to 8.32) Women with late stillbirth more likely to report right-side going-to-sleep position: 0.91 (0.65 to 1.26) <u>SGA - OR (95% CI)</u> 7.01 (33.6% to 56.8%)	Cases: 75 (49) Controls: 193 (40.2) Odds ratio=1 <u>Right</u> Cases: 45 (29.4) Controls: 111 (23.1) Adjusted odds ratio (aOR)=1.11 (95% CI 0.70 to 1.77) <u>Back (Supine)</u> Cases: 4 (2.6) Controls: 11 (2.3) aOR=1.11 (95% CI 0.70 to 1.77) <u>Tummy</u> Cases: 0 (0) Controls: 4 (0.8) <u>Propped</u> Cases: 4 (2.6) Controls: 15 (3.1) aOR=0.71 (95% CI 0.22 to 2.30) <u>Variable</u> Cases: 10 (6.5) Controls: 39 (8.1) aOR=0.75 (95% CI 0.34 to 1.64)	of risk factors provided; validated measurement tool used, but potential for recall bias; adequate proportion of study sample completed data for prognostic factors; no imputation performed for missing data) Outcome measurement: Moderate risk of bias (all outcomes self-reported via online form so potential for false reporting) Confounding measurement and account: High risk of bias (cases and controls not matched - women in case group were more likely to be non-Caucasians and nullip; but adjustments made for confounding variables) Analysis and reporting: Low risk of bias (statistical model appropriate and results reported in final multivariable model with point estimates and measures of variance) **Other information** Participants recruited using anonymous online survey 'Study of Trends and Risk Factors for Stillbirth' (STARS), which was developed during first Stillbirth Summit in Minneapolis in 2011 by international consortium of clinicians and academics, Star Legacy Foundation and other stillbirth/parental support groups. International online survey included respondents from following countries: Australia (n=21), Bahrain (n=1), Canada (n=44), Finland (n=1), Germany (n=2), Greece (n=2), India (n=2), Israel (n=1), Italy (n=1), New Zealand (n=2), Philippines (n=2), South Africa (n=2), Sweden (n=1), Switzerland (n=1), UK (n=95), USA (n=448).

	95% confidence interval. Univariable logistic regression was conducted to evaluate the association between sleep practices and risk of late stillbirth. A multivariable logistic model was developed to incorporate maternal age, education level, smoking, body mass index, parity, country of respondant, ethnicity. **Demographics** Maternal age (years) - mean±standard deviation Cases: 31 ± 5.4 Controls:30±4.8 Ethnicity - number (%) Caucasian Cases: 122 (79.7)* Controls: 430 (90.2) Non-Caucasian Cases: 31 (20.3) Controls: 47 (9.8) Parity - median (interquartile range) Cases: 1(0-6) Controls: 1(0-10)* Level of Education - number (%) Graduate Education Cases: 35 (22.9) Controls: 129 (26.9) College-level Education Cases: 81 (52.9) Controls: 242 (50.4) High school or lower Cases: 37 (24.2) Controls: 106 (22.1) Body mass index - median (IQR) Cases: 27 (23-32) Controls: 25 (23-31)	Sleep duration last month (hours) - number (%) </=6 Cases: 15 (9.8) Controls: 47 (9.8) 6.5 to 8.5 Cases: 86 (56.2) Controls: 283 (59) 9.0+ Cases: 45(29.4) Controls: 79 (16.5) Number of times getting up previous month - number (%) One or less Cases: 47 (30.7) Controls: 129 (26.9) Two or more Cases: 98(64.1) Controls: 270 (56.3) Maternal daytime naps in previous 4 weeks - number (%) Never Cases: 38 (24.8) Controls: 125 (26) Occasionally Cases: 41 (26.8) Controls: 108 (22.5) Often/almost always Cases: 67 (43.8) Controls: 168 (35) Excessive daytime sleepiness last month Cases: 42 (27.5) Controls: 107 (22.3)		

	Gestational age (for cases, gestational age at diagnosis of stillbirth; for controls at time of interview) - median (IQR) Cases: 37 weeks (34 - 39) Controls: 37 (32 - 39)			

Abbreviations: aOR: adjusted odds ratio; BMI: body mass index; CI: confidence interval; IPD MA: individual patient data meta-analysis; IQR: interquartile range; N: total number of participants in the study or case or control; OR: odds ratio; SGA: small for gestational age; vs: versus;