

Supplementary Methods

Gestation was initially divided into two-week periods and, for women who had more than one blood pressure measurement available in any two-week period, one blood pressure measurement was selected at random per two-week period for each woman. This was to prevent women who had many measurements during pregnancy, who may represent less-healthy women, having a disproportionately high influence on the multilevel models.

Separate multilevel models with systolic blood pressure (SBP) and diastolic blood pressure (DBP) as outcomes were used to model the trajectory of change in SBP and DBP with gestational age. Several possible parameterisations of the shape of the curve were considered and the fit compared using the BIC and the difference between each individual's predicted values and their actual blood pressure measurements across gestation. These included: fractional polynomial curves with up to two powers of gestational age, using the set of powers (-2, -1, -0.5, 0, 0.5, 1, 2, 3);[1] linear splines with up to 3 knots and restricted cubic splines with up to 5 knots. Linear splines have been fitted previously to these data, and the best-fitting knot point locations were found to be at 18, 30 and 36 weeks gestation.[2] The restricted cubic spline with 5 knots were fitted using knots selected by the percentile method of Harrell[3] and also using the 3 knots found to be optimum for the linear splines (18, 30 and 36 weeks) for the middle 3 knots and the 5th and 95th percentiles of the data for the outer 2 knots (11 and 40 weeks). The fractional polynomial curve had a poorer fit compared with the linear or cubic splines. Linear splines and restricted cubic spline models with knots at 18, 30 and 36, and 11, 18, 30, 36 and 40 weeks respectively had the best fit to the data and fitted similarly. However, due to the smooth nature of the restricted cubic spline, reflecting the

expected smooth change in blood pressure, this was selected and used for the normal reference ranges.

The models had two levels: measurement occasions (level1) within women (level2), reflecting the clustering of the data. Individual-level random effects were fitted for the intercept and for each of the cubic spline parameters, allowing the initial level and shape of the trajectory of change in blood pressure across gestation to vary between women. We allowed the within-individual variation in blood pressure to vary with gestational age as there was evidence of increasing variation in blood pressure as gestational age increased. Thus the model without covariates included took the following form:

$$y_{ij} = \beta_0 + u_{0j} + (\beta_1 + u_{1j})spline1_{ij} + (\beta_2 + u_{2j})spline2_{ij} + (\beta_3 + u_{3j})spline3_{ij} + (\beta_4 + u_{4j})spline4_{ij} + e_{0ij} + e_{1ij}(GA_{ij} - 12)$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \\ u_{2j} \\ u_{3j} \\ u_{4j} \end{bmatrix} \sim N(\mathbf{0}, \Omega_u), \quad \begin{bmatrix} e_{0ij} \\ e_{1ij} \end{bmatrix} \sim N(\mathbf{0}, \Omega_e)$$

where, y_{ij} is the value of the i^{th} SBP or DBP measurement on the j^{th} individual, β_0 - β_4 describe the average trajectory of change, u_{0j} - u_{4j} describe how the j^{th} individual's trajectory of SBP or DBP deviates from the average and GA_{ij} is the gestational age in weeks of the i^{th} measurement on the j^{th} individual. It is centred at 12 weeks in order to set the intercept, β_0 , to represent blood pressure at 12 weeks. The e_{0ij} and e_{1ij} terms describe the deviation of the i^{th} measurement of SBP or DBP on the j^{th} individual from the individual's trajectory. These are residual error terms.

The splines are defined as:[3]

$$spline1_{ij} = GA_{ij} - 12$$

$$spline2_{ij} = \frac{(GA_{ij} - 11)_+ - (40 - 36)^{-1} \{ (GA_{ij} - 36)_+^3 (40 - 11) - (GA_{ij} - 40)_+^3 (36 - 11) \}}{(40 - 11)^2}$$

$$spline3_{ij} = \frac{(GA_{ij} - 18)_+ - (40 - 36)^{-1} \{ (GA_{ij} - 36)_+^3 (40 - 18) - (GA_{ij} - 40)_+^3 (36 - 18) \}}{(40 - 11)^2}$$

$$spline4_{ij} = \frac{(GA_{ij} - 30)_+ - (40 - 36)^{-1} \{ (GA_{ij} - 36)_+^3 (40 - 30) - (GA_{ij} - 40)_+^3 (36 - 30) \}}{(40 - 11)^2}$$

$$\text{where } (x)_+ = \begin{cases} 0 & \text{if } x \leq 0 \\ x & \text{if } x > 0 \end{cases}$$

The variance of the individual blood pressure measurements at each gestational age was calculated as the sum of the between-individual-variance and the within-individual variance.[4]

$$\text{The between-individual variance at gestational age } g, V_{bg} = \begin{bmatrix} 1 \\ spline1_g \\ spline2_g \\ spline3_g \\ spline4_g \end{bmatrix}^T \Omega_u \begin{bmatrix} 1 \\ spline1_g \\ spline2_g \\ spline3_g \\ spline4_g \end{bmatrix},$$

where, for example, $spline1_g$ represents the value of the first cubic spline at gestational age g .

$$\text{The within-individual variance at gestational age } g, V_{wg} = \begin{bmatrix} 1 \\ g - 12 \end{bmatrix}^T \Omega_e \begin{bmatrix} 1 \\ g - 12 \end{bmatrix}.$$

Therefore, the value of the 95th percentile for the reference range at gestational age, g , is:

$$\hat{\beta}_0 + \hat{\beta}_1 spline1_g + \hat{\beta}_2 spline2_g + \hat{\beta}_3 spline3_g + \hat{\beta}_4 spline4_g + 1.96 * \sqrt{\hat{V}_{bg} + \hat{V}_{wg}}$$

This gives the reference range for observed measures of blood pressure, rather than for an individual's underlying blood pressure trajectory, as it includes both the between-individual and within-individual variances of blood pressure.

The fit of the model-predicted SBP and DBP across gestation to the observed SBP and DBP values in the nulliparous "low-risk" group (normal pre-pregnancy BMI and non-smoker) is shown in Tables 1 and 2 respectively, and in the multiparous "low-risk" group is shown in Tables 3 and 4. 90% of the predictions for SBP in each gestational period were generally within around 14 mmHg of the observed SBP values and 90% of predictions for DBP in each gestational period were generally within around 11 mmHg of the observed DBP values.

To produce reference ranges by pre-pregnancy BMI category, BMI was entered into the multilevel models as a categorical covariate (underweight, normal weight, overweight, obese) with normal weight as the reference category. A main effect term was included for BMI and also interactions with each of the spline variables. Reference ranges by smoking status were produced similarly, by entering smoking status as a categorical covariate (never smoked, smoked pre-pregnancy/1st trimester, smoked throughout pregnancy), with never smoked as the reference category, as a main effect and also as interactions with each of the splines. The between and within-individual variances were calculated in the same way as for the unadjusted model. Separate multilevel models were fitted for nulliparous and multiparous women.

For the reference ranges which were conditional on SBP or DBP at 12 weeks gestation we used the unadjusted multilevel models as above, fitted only for the low-risk group (normal BMI; non-smokers) of women who had normal pregnancies. We obtained conditional predictions from this using the method described by Tilling et al[4] and Pan and Goldstein.[5]

The covariance between the deviations from the predicted curve at 12 weeks and g weeks is

$$V_{b12,g} = \begin{bmatrix} 1 \\ spline1_{12} \\ spline2_{12} \\ spline3_{12} \\ spline4_{12} \end{bmatrix}^T \Omega_u \begin{bmatrix} 1 \\ spline1_g \\ spline2_g \\ spline3_g \\ spline4_g \end{bmatrix}$$

Therefore, the predicted SBP or DBP at gestational age g , conditional on the value at 12 weeks gestation is:

$$y_g = \frac{\hat{V}_{b12,g}}{\hat{V}_{b12} + \hat{V}_{w12}} (y_{12} - \hat{\beta}_0 + \hat{\beta}_1 spline1_{12} + \hat{\beta}_2 spline2_{12} + \hat{\beta}_3 spline3_{12} + \hat{\beta}_4 spline4_{12}) + \hat{\beta}_0 + \hat{\beta}_1 spline1_g + \hat{\beta}_2 spline2_g + \hat{\beta}_3 spline3_g + \hat{\beta}_4 spline4_g$$

Where y_{12} is the observed value of the outcome (either SBP or DBP) at 12 weeks gestation, V_{b12} is the between-individual variance in the outcome at 12 weeks and V_{w12} is the within-individual variance. Thus, the deviation of the 12-week measurement from the average trajectory was combined with the multilevel model information to predict what trajectory would be seen for the rest of gestation. Conditional predictions were produced for hypothetical SBP values of 100, 110, 120 and 130 mmHg and DBP values of 50, 60, 70 and 80 mmHg at 12 weeks gestation.

The variance of this prediction is $(V_{bg} + V_{wg}) - \frac{V_{b12,g}^2}{(V_{b12} + V_{w12})}$ and is used to calculate the reference ranges.

We tested the fit of the reference ranges conditional on the value of blood pressure at 12 weeks to the measurements in this cohort, by comparing predicted reference ranges conditional on each individual's blood pressure measurement at (or within 3 weeks either side of) 12 weeks gestation against their actual blood pressure measurements from 16 weeks

onwards. The 95% reference ranges for SBP conditional on blood pressure at 12 weeks contained 94.5% of actual blood pressure measurements from 16 weeks gestation onwards for nulliparous women and 94.8% of actual blood pressure measurements for multiparous women. The 95% reference ranges for DBP conditional on blood pressure at 12 weeks contained 95.2% of actual blood pressure measurements for nulliparous women, and 94.6% for multiparous women.

Please note, the following 4 tables are part of the Supplemental Methods and are not referred to in the main text. Thus, they have been labelled as Table X, rather than Web-Table X.

Table 1 Model fit for low-risk SBP model in nulliparous women

Gestational period (weeks)	Number of measurements	Observed SBP Mean (SD)	Predicted SBP Mean (SD)	Observed – Predicted SBP Mean (SD)	90% Limits of Agreement*
Up to 8	192	112.5 (12.83)	113.5 (6.07)	-1.03 (9.21)	(-13.94, 13.91)
9 - 10	420	111.3 (11.52)	112.0 (5.96)	-0.73 (7.97)	(-14.56, 12.20)
11 – 12	739	112.4 (11.37)	112.5 (6.13)	-0.08 (8.33)	(-13.83, 13.95)
13 – 14	817	112.4 (11.96)	111.4 (6.49)	1.04 (8.70)	(-12.76, 15.16)
15 – 16	699	112.4 (11.77)	111.7 (6.61)	0.67 (8.34)	(-13.12, 14.42)
17 – 18	1062	110.9 (12.01)	111.3 (7.01)	-0.46 (8.13)	(-14.42, 13.24)
19 – 20	729	110.8 (11.31)	111.2 (6.93)	-0.38 (7.63)	(-12.68, 13.06)
21 – 22	924	110.9 (11.16)	111.3 (7.04)	-0.35 (7.36)	(-12.48, 11.69)
23 – 24	761	111.9 (11.53)	111.8 (7.30)	0.13 (7.52)	(-11.80, 13.30)
25 – 26	930	112.2 (11.12)	112.0 (7.37)	0.18 (7.01)	(-11.56, 11.37)
27 – 28	962	112.8 (11.27)	112.6 (7.17)	0.20 (7.13)	(-10.89, 12.21)
29 – 30	1343	112.8 (11.31)	112.7 (7.35)	0.05 (7.32)	(-11.30, 11.89)
31 – 32	1452	112.9 (11.35)	112.9 (7.15)	0.02 (7.58)	(-12.02, 12.00)
33 – 34	1588	112.8 (11.14)	113.2 (6.94)	-0.44 (7.76)	(-12.32, 11.92)
35 – 36	1551	114.2 (11.68)	114.1 (7.15)	0.12 (8.10)	(-12.74, 13.09)
37 – 38	1954	115.8 (12.38)	115.5 (7.32)	0.34 (8.27)	(-11.66, 13.87)
39 – 40	1649	117.4 (12.66)	117.5 (7.51)	-0.17 (8.21)	(-13.11, 14.02)
41+	851	119.4 (12.77)	119.5 (7.78)	-0.12 (8.09)	(-13.43, 12.67)

* The range within which 90% of differences between the observed and model predicted values lie.

Table 2 Model fit for low-risk DBP model in nulliparous women

Gestational period (weeks)	Number of measurements	Observed DBP Mean (SD)	Predicted DBP Mean (SD)	Observed – Predicted DBP Mean (SD)	90% Limits of Agreement*
Up to 8	192	66.5 (9.15)	67.0 (3.78)	-0.48 (7.38)	(-12.55, 9.73)
9 - 10	420	65.2 (7.81)	65.8 (3.53)	-0.64 (6.20)	(-10.74, 10.16)
11 – 12	739	66.0 (8.23)	65.8 (3.79)	0.22 (6.46)	(-10.31, 10.66)
13 – 14	817	65.7 (8.13)	65.3 (3.83)	0.42 (6.41)	(-10.19, 11.15)
15 – 16	699	65.3 (7.98)	65.1 (3.95)	0.27 (6.13)	(-9.42, 10.56)
17 – 18	1062	64.5 (8.11)	64.6 (4.02)	-0.12 (6.07)	(-10.07, 10.19)
19 – 20	729	64.5 (7.74)	64.6 (4.09)	-0.18 (5.60)	(-9.74, 9.01)
21 – 22	924	64.2 (7.67)	64.6 (4.23)	-0.33 (5.55)	(-9.05, 8.77)
23 – 24	761	65.2 (7.98)	64.9 (4.20)	0.31 (5.78)	(-9.68, 9.45)
25 – 26	930	65.0 (7.73)	65.0 (4.33)	0.03 (5.61)	(-8.94, 9.39)
27 – 28	962	65.4 (8.07)	65.5 (4.56)	-0.10 (5.47)	(-8.72, 8.82)
29 – 30	1343	66.0 (7.77)	65.8 (4.52)	0.16 (5.46)	(-8.44, 9.20)
31 – 32	1452	66.1 (7.93)	66.2 (4.62)	-0.13 (5.67)	(-9.63, 8.90)
33 – 34	1588	66.7 (8.29)	66.8 (4.66)	-0.12 (6.02)	(-9.29, 9.54)
35 – 36	1551	68.2 (8.64)	68.0 (5.08)	0.16 (6.00)	(-9.47, 10.58)
37 – 38	1954	70.0 (9.17)	69.9 (5.34)	0.13 (6.22)	(-9.99, 10.48)
39 – 40	1649	72.0 (9.89)	72.3 (5.67)	-0.31 (6.41)	(-10.23, 10.56)
41+	851	74.6 (10.11)	74.4 (6.16)	0.25 (6.35)	(-10.04, 10.52)

* The range within which 90% of differences between the observed and model predicted values lie.

Table 3 Model fit for low-risk SBP model in multiparous women

Gestational period (weeks)	Number of measurements	Observed SBP Mean (SD)	Predicted SBP Mean (SD)	Observed – Predicted SBP Mean (SD)	90% Limits of Agreement*
Up to 8	215	110.7 (10.35)	111.9 (5.37)	-1.18 (7.73)	(-14.12, 11.20)
9 - 10	505	110.3 (11.62)	110.5 (5.53)	-0.16 (8.36)	(-13.52, 12.39)
11 – 12	821	110.6 (11.34)	110.5 (6.01)	0.08 (8.12)	(-13.45, 13.66)
13 – 14	985	110.8 (11.58)	109.9 (5.96)	0.89 (8.50)	(-12.79, 15.55)
15 – 16	839	109.5 (11.51)	109.7 (6.24)	-0.19 (7.92)	(-12.98, 13.10)
17 – 18	1257	108.9 (11.32)	109.5 (6.39)	-0.59 (7.95)	(-13.89, 12.92)
19 – 20	858	109.3 (10.78)	109.3 (6.28)	-0.01 (7.66)	(-12.48, 12.39)
21 – 22	1062	109.8 (11.48)	109.6 (6.95)	0.25 (7.49)	(-12.29, 11.77)
23 – 24	916	110.3 (10.55)	110.1 (6.73)	0.22 (7.28)	(-12.30, 11.27)
25 – 26	1080	110.2 (11.62)	110.4 (7.11)	-0.19 (7.53)	(-12.61, 12.55)
27 – 28	1101	110.7 (11.17)	110.6 (7.14)	0.15 (7.23)	(-10.98, 12.20)
29 – 30	1569	111.0 (11.19)	111.1 (7.05)	-0.13 (7.12)	(-11.75, 11.43)
31 – 32	1642	111.4 (11.29)	111.4 (7.05)	0.01 (7.47)	(-11.49, 12.27)
33 – 34	1839	111.7 (11.42)	111.6 (6.98)	0.13 (7.87)	(-12.15, 13.64)
35 – 36	1805	112.3 (11.28)	112.4 (6.91)	-0.05 (7.73)	(-12.48, 12.01)
37 – 38	2213	113.5 (11.39)	113.5 (6.73)	-0.02 (7.68)	(-12.26, 13.20)
39 – 40	2015	115.0 (12.12)	115.1 (7.00)	-0.09 (7.91)	(-12.50, 13.20)
41+	821	116.6 (11.90)	116.5 (6.78)	0.15 (8.01)	(-11.79, 13.85)

* The range within which 90% of differences between the observed and model predicted values lie.

Table 4 Model fit for low-risk DBP model in multiparous women

Gestational period (weeks)	Number of measurements	Observed DBP Mean (SD)	Predicted DBP Mean (SD)	Observed – Predicted DBP Mean (SD)	90% Limits of Agreement*
Up to 8	215	65.8 (7.52)	66.1 (3.19)	-0.30 (6.39)	(-10.05, 11.76)
9 - 10	505	65.0 (8.60)	65.3 (3.43)	-0.25 (6.55)	(-10.65, 10.89)
11 – 12	821	65.2 (7.87)	64.9 (3.61)	0.32 (6.17)	(-9.77, 10.57)
13 – 14	985	64.6 (7.69)	64.4 (3.64)	0.16 (6.12)	(-10.27, 10.30)
15 – 16	839	64.0 (7.95)	64.1 (3.90)	-0.08 (5.96)	(-9.50, 10.30)
17 – 18	1257	63.4 (7.90)	63.7 (4.13)	-0.37 (5.83)	(-10.06, 9.42)
19 – 20	858	63.6 (7.82)	63.6 (4.10)	0.06 (5.63)	(-8.94, 9.41)
21 – 22	1062	63.8 (7.81)	63.7 (4.35)	0.10 (5.48)	(-8.62, 9.34)
23 – 24	916	64.3 (7.64)	63.9 (4.22)	0.33 (5.60)	(-8.88, 9.12)
25 – 26	1080	63.9 (7.84)	64.0 (4.40)	-0.07 (5.54)	(-8.66, 9.30)
27 – 28	1101	64.4 (7.84)	64.3 (4.41)	0.04 (5.33)	(-8.38, 9.33)
29 – 30	1569	64.7 (7.83)	64.7 (4.32)	-0.05 (5.46)	(-8.88, 9.05)
31 – 32	1642	65.1 (7.75)	65.1 (4.42)	-0.04 (5.53)	(-8.99, 8.73)
33 – 34	1839	65.5 (7.89)	65.6 (4.45)	-0.08 (5.69)	(-9.06, 9.50)
35 – 36	1805	66.6 (8.41)	66.5 (4.55)	0.07 (5.98)	(-9.29, 10.39)
37 – 38	2213	68.1 (8.82)	68.0 (4.75)	0.11 (6.14)	(-9.40, 10.47)
39 – 40	2015	69.6 (9.22)	69.7 (4.92)	-0.15 (6.36)	(-10.13, 10.47)
41+	821	71.6 (9.66)	71.5 (5.11)	0.09 (6.47)	(-9.91, 10.90)

* The range within which 90% of differences between the observed and model predicted values lie.

Reference List

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Web-Table 1 List of all subgroups of women for whom reference ranges have been developed*

	Reference Range Group	Parity	Pre-pregnancy BMI	Smoking during pregnancy	Blood pressure at 12 weeks (mmHg)
All pregnancies (Figure 1)		Nulliparous	-	-	-
		Multiparous	-	-	-
Normal pregnancies	All normal pregnancies (Figure 1)	Nulliparous	-	-	-
		Multiparous	-	-	-
	Low-risk women (Figure 2)	Nulliparous	Normal weight	Never smoked	-
		Multiparous	Normal weight	Never smoked	-
	High-risk women (Figure 2)	Nulliparous	Overweight/Obese	Any smoking	-
		Multiparous	Overweight/Obese	Any smoking	-
	Reference ranges by pre-pregnancy BMI category (Figure 3 and Web-Figure 1)	Nulliparous	Underweight	Never smoked	-
		Nulliparous	Normal weight	Never smoked	-
		Nulliparous	Overweight	Never smoked	-
		Nulliparous	Obese	Never smoked	-
		Multiparous	Underweight	Never smoked	-
		Multiparous	Normal weight	Never smoked	-
		Multiparous	Overweight	Never smoked	-
		Multiparous	Obese	Never smoked	-
	Reference ranges by smoking during pregnancy (Figure 4 and Web-Figure 4)	Nulliparous	Normal weight	Never smoked	-
		Nulliparous	Normal weight	Pre-pregnancy/1 st trimester only	-
		Nulliparous	Normal weight	Throughout	-
		Multiparous	Normal weight	Never smoked	-
		Multiparous	Normal weight	Pre-pregnancy/1 st trimester only	-
		Multiparous	Normal weight	Throughout	-
	Reference ranges conditional on blood pressure at 12 weeks (Figure 5 and Web-Figure 7)	Nulliparous	Normal weight	Never smoked	SBP = 100 at 12 weeks
		Nulliparous	Normal weight	Never smoked	SBP = 110 at 12 weeks
		Nulliparous	Normal weight	Never smoked	SBP = 120 at 12 weeks
		Nulliparous	Normal weight	Never smoked	SBP = 130 at 12 weeks
		Nulliparous	Normal weight	Never smoked	DBP = 50 at 12 weeks
		Nulliparous	Normal weight	Never smoked	DBP = 60 at 12 weeks
		Nulliparous	Normal weight	Never smoked	DBP = 70 at 12 weeks
		Nulliparous	Normal weight	Never smoked	DBP = 80 at 12 weeks
Multiparous		Normal weight	Never smoked	SBP = 100 at 12 weeks	
Multiparous		Normal weight	Never smoked	SBP = 110 at 12 weeks	
Multiparous		Normal weight	Never smoked	SBP = 120 at 12 weeks	
Multiparous		Normal weight	Never smoked	SBP = 130 at 12 weeks	
Multiparous		Normal weight	Never smoked	DBP = 50 at 12 weeks	
Multiparous		Normal weight	Never smoked	DBP = 60 at 12 weeks	
Multiparous	Normal weight	Never smoked	DBP = 70 at 12 weeks		
Multiparous	Normal weight	Never smoked	DBP = 80 at 12 weeks		

* Each row represents a subgroup of women for whom a reference range is presented in this paper. Cells marked with – indicate that this characteristic was not part of the criteria for defining the subgroup for this particular reference range

Web-Table 2 Mean and 95% reference ranges for systolic and diastolic blood pressure at three gestational ages across pregnancy for different subgroups of women from multilevel models

Maternal Subgroup		N	Mean (95% reference range)							
			SBP at 12 weeks	SBP at 20 weeks	SBP at 37 weeks	DBP at 12 weeks	DBP at 20 weeks	DBP at 37 weeks		
All women (Figure 1)	Nulliparous	4718	112.7 (88.6, 136.8)	112.4 (88.9, 135.9)	117.2 (91.6, 142.8)	65.9 (48.9, 82.9)	65.1 (48.9, 81.2)	71.2 (51.3, 91.2)		
	Multiparous	5609	111.6 (88.2, 135.0)	111.0 (87.7, 134.3)	115.0 (90.6, 139.3)	65.5 (48.9, 82.1)	64.4 (48.4, 80.5)	68.8 (50.3, 87.2)		
Normal pregnancies*	All normal pregnancies (Figure 1)	Nulliparous	3372	112.1 (88.6, 135.5)	111.9 (89.4, 134.4)	116.0 (92.3, 139.7)	65.4 (48.9, 81.9)	64.6 (49.2, 80.1)	70.0 (52.2, 87.9)	
		Multiparous	4132	111.0 (88.1, 133.9)	110.3 (87.8, 132.8)	114.2 (91.0, 137.4)	65.1 (49.0, 81.1)	64.0 (48.4, 79.6)	68.2 (51.0, 85.3)	
	Low-risk (normal BMI, non-smokers) (Figure 2)	Nulliparous	1832	112.0 (88.9, 135.0)	111.3 (89.0, 133.5)	115.4 (92.0, 138.8)	65.6 (49.5, 81.7)	64.6 (49.4, 79.8)	69.9 (52.0, 87.8)	
		Multiparous	2193	110.2 (88.0, 132.5)	109.4 (87.6, 131.2)	113.5 (90.6, 136.4)	64.7 (49.2, 80.3)	63.6 (48.4, 78.8)	67.9 (50.8, 85.0)	
	High-risk (overweight/ obese, any smoking) (Figure 2)	Nulliparous	205	114.7 (89.4, 139.9)	115.9 (94.3, 137.4)	119.2 (95.5, 143.0)	67.0 (49.4, 84.7)	66.7 (50.2, 83.1)	72.2 (54.0, 90.4)	
		Multiparous	285	114.3 (91.0, 137.6)	113.2 (90.4, 136.0)	117.6 (94.9, 140.3)	66.9 (50.6, 83.3)	65.4 (49.3, 81.6)	69.5 (52.1, 86.9)	
	By BMI (non-smokers only) (Figure 3)	Nulliparous	Underweight	97	109.5 (86.4, 132.5)	110.6 (88.3, 132.8)	113.6 (90.1, 137.2)	64.2 (48.1, 80.3)	63.4 (48.2, 78.6)	68.3 (50.5, 86.2)
			Normal	1832	112.0 (89.0, 135.0)	111.3 (89.0, 133.5)	115.4 (91.9, 138.9)	65.6 (49.5, 81.6)	64.6 (49.4, 79.8)	69.9 (52.1, 87.7)
			Overweight	275	115.9 (92.8, 138.9)	116.0 (93.8, 138.2)	119.8 (96.3, 143.3)	68.4 (52.3, 84.4)	68.2 (53.0, 83.4)	73.2 (55.4, 91.1)
			Obese	66	121.9 (98.8, 144.9)	122.0 (99.8, 144.3)	125.7 (102.2, 149.3)	73.1 (57.0, 89.2)	71.4 (56.2, 86.6)	77.8 (60.0, 95.6)

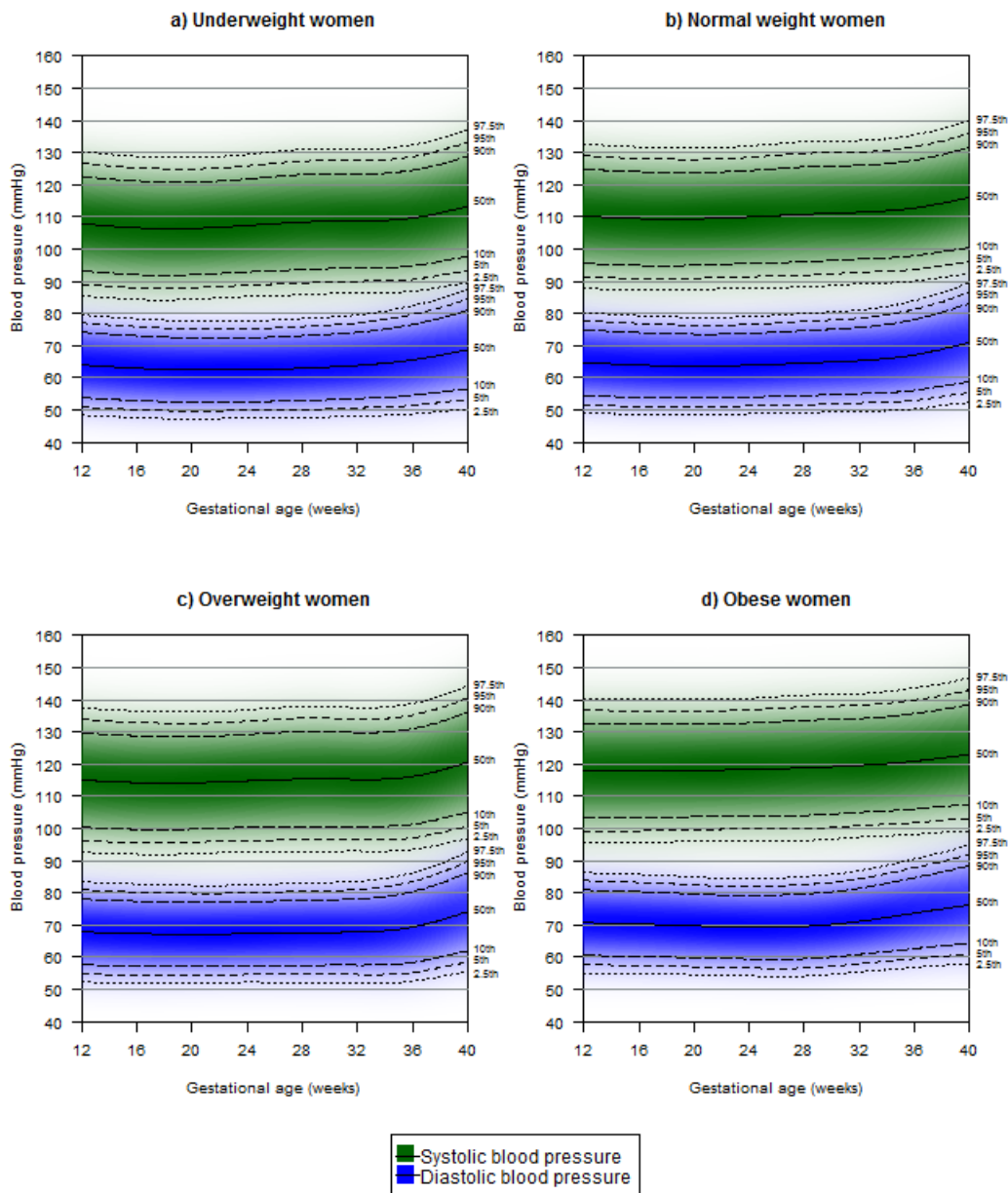
Maternal Subgroup				N	Mean (95% reference range)					
					SBP at 12 weeks	SBP at 20 weeks	SBP at 37 weeks	DBP at 12 weeks	DBP at 20 weeks	DBP at 37 weeks
Normal pregnancies*	By BMI (non-smokers only)	Multiparous (Web-Figure 1)	Underweight	122	107.9 (85.4, 130.4)	106.4 (84.4, 128.5)	110.3 (87.4, 133.2)	64.0 (48.4, 79.6)	62.4 (47.3, 77.6)	66.2 (49.1, 83.4)
			Normal	2193	110.2 (87.7, 132.7)	109.4 (87.4, 131.4)	113.5 (90.6, 136.4)	64.7 (49.1, 80.3)	63.6 (48.5, 78.8)	67.9 (50.8, 85.1)
			Overweight	430	115.1 (92.6, 137.5)	114.2 (92.2, 136.2)	117.0 (94.1, 139.9)	67.8 (52.2, 83.4)	67.1 (52.0, 82.3)	70.3 (53.1, 87.5)
			Obese	161	117.9 (95.4, 140.4)	118.1 (96.0, 140.1)	121.4 (98.5, 144.3)	70.7 (55.1, 86.3)	69.7 (54.6, 84.9)	74.3 (57.2, 91.5)
	By smoking in pregnancy (normal weight women only)	Nulliparous (Figure 4)	Never smoked	1832	112.0 (89.1, 134.9)	111.3 (89.2, 133.3)	115.4 (91.9, 138.9)	65.6 (49.6, 81.5)	64.6 (49.6, 79.6)	69.9 (52.5, 87.2)
			1 st trimester	443	110.4 (87.5, 133.3)	110.5 (88.4, 132.6)	115.5 (92.0, 139.0)	63.8 (47.9, 79.8)	63.3 (48.3, 78.3)	69.0 (51.6, 86.3)
			Throughout	379	110.4 (87.5, 133.3)	110.9 (88.8, 133.0)	114.4 (90.9, 137.9)	63.3 (47.3, 79.2)	62.6 (47.6, 77.6)	68.1 (50.7, 85.5)
		Multiparous (Web-Figure 4)	Never smoked	2193	110.2 (88.1, 132.4)	109.4 (87.6, 131.2)	113.5 (90.5, 136.4)	64.7 (49.1, 80.3)	63.6 (48.5, 78.7)	67.9 (51.1, 84.7)
			1 st trimester	302	109.0 (86.8, 131.1)	108.6 (86.8, 130.3)	112.6 (89.6, 135.5)	63.4 (47.8, 79.0)	62.7 (47.6, 77.8)	67.1 (50.2, 83.9)
			Throughout	554	109.8 (87.6, 131.9)	109.3 (87.5, 131.1)	113.3 (90.3, 136.2)	63.3 (47.7, 78.9)	62.3 (47.2, 77.4)	66.4 (49.5, 83.2)

* Normal pregnancies are defined as those where the woman did not have essential hypertension or preeclampsia, pre-existing or gestational diabetes and the pregnancy resulted and gave birth to an appropriate-size-for-gestational-age baby at term

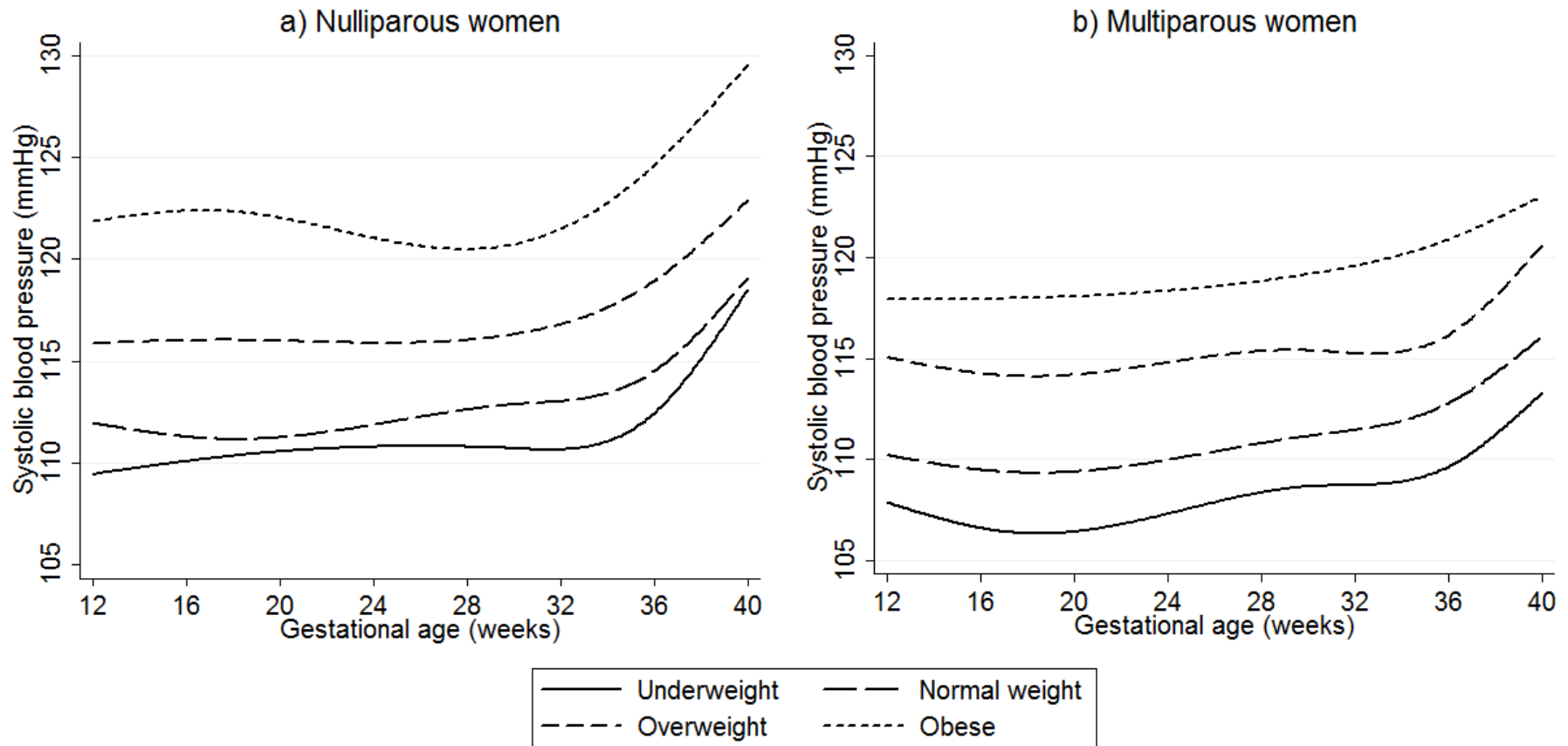
Web-Table 3 Mean and 95% reference ranges for predicted systolic and diastolic blood pressure at 20 weeks and 37 weeks in normal pregnancies for normal weight non-smoking women conditional on hypothetical measurements of SBP and DBP at 12 weeks gestation from multilevel models

	Error prone measurement of SBP at 12 weeks (mmHg)	Mean (95% reference range) SBP prediction		Error prone measurement of DBP at 12 weeks (mmHg)	Mean (95% reference range) DBP prediction	
		20 weeks	37 weeks		20 weeks	37 weeks
Nulliparous women (Figure 5)	100	106.7 (86.2, 127.2)	111.9 (89.5, 134.4)	50	59.7 (45.4, 74.1)	66.2 (48.7, 83.7)
	110	110.5 (90.0, 131.0)	114.8 (92.4, 137.3)	60	62.9 (48.5, 77.2)	68.6 (51.1, 86.0)
	120	114.3 (93.8, 134.8)	117.8 (95.3, 140.2)	70	66.0 (51.6, 80.3)	70.9 (53.5, 88.4)
	130	118.1 (97.6, 138.6)	120.7 (98.2, 143.1)	80	69.1 (54.7, 83.4)	73.3 (55.8, 90.8)
Multiparous women (Web-Figure 7)	100	105.6 (85.4, 125.8)	110.5 (88.5, 132.5)	50	59.0 (44.7, 73.4)	64.1 (47.5, 80.6)
	110	109.3 (89.1, 129.5)	113.4 (91.4, 135.4)	60	62.1 (47.8, 76.5)	66.7 (50.1, 83.3)
	120	113.0 (92.8, 133.2)	116.3 (94.3, 138.3)	70	65.2 (50.9, 79.6)	69.3 (52.7, 85.9)
	130	116.7 (96.5, 136.9)	119.1 (97.1, 141.1)	80	68.4 (54.0, 82.7)	71.9 (55.3, 88.5)

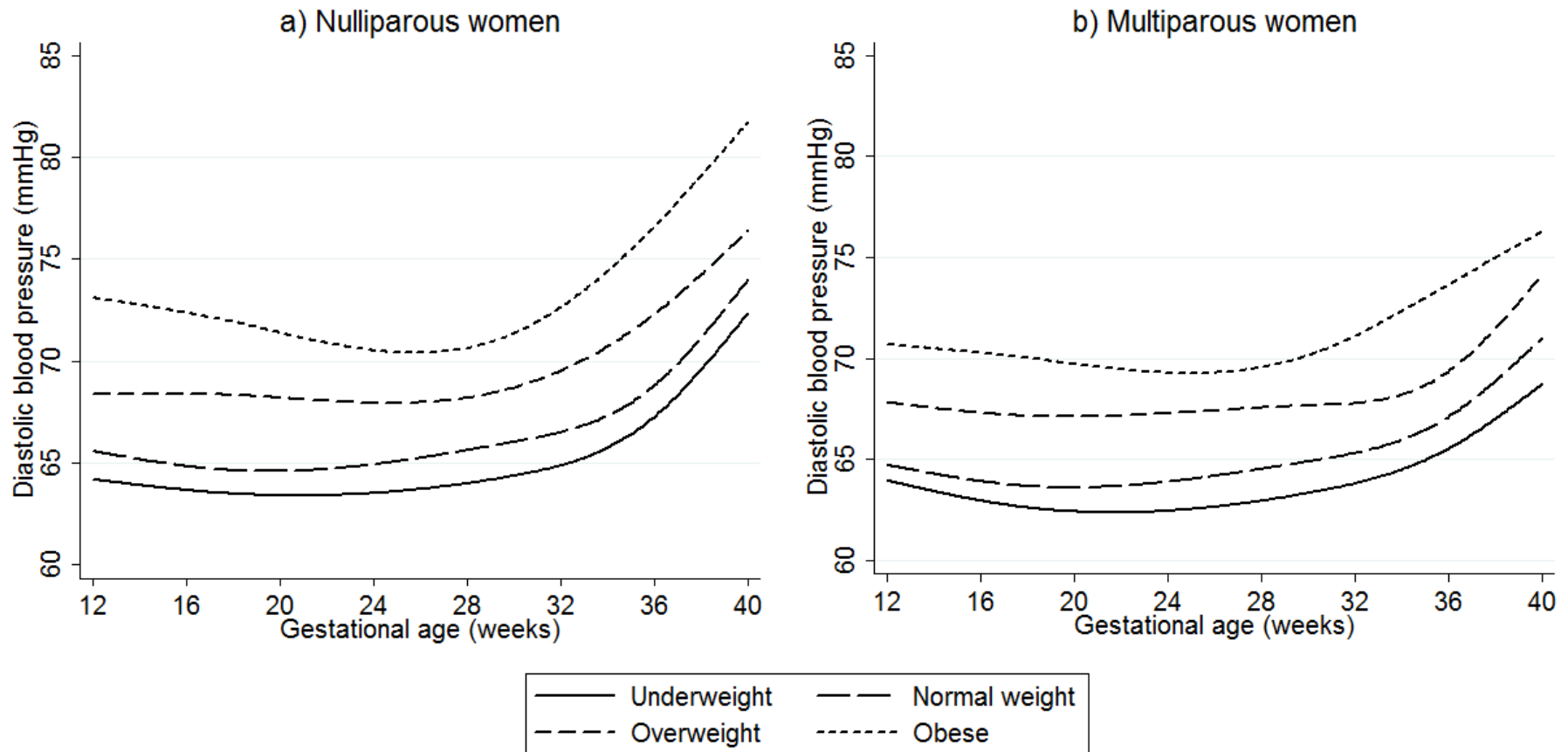
Web-Figure 1 Reference ranges for systolic and diastolic blood pressure by maternal pre-pregnancy BMI category for multiparous non-smokers with normal pregnancies (N=2906)



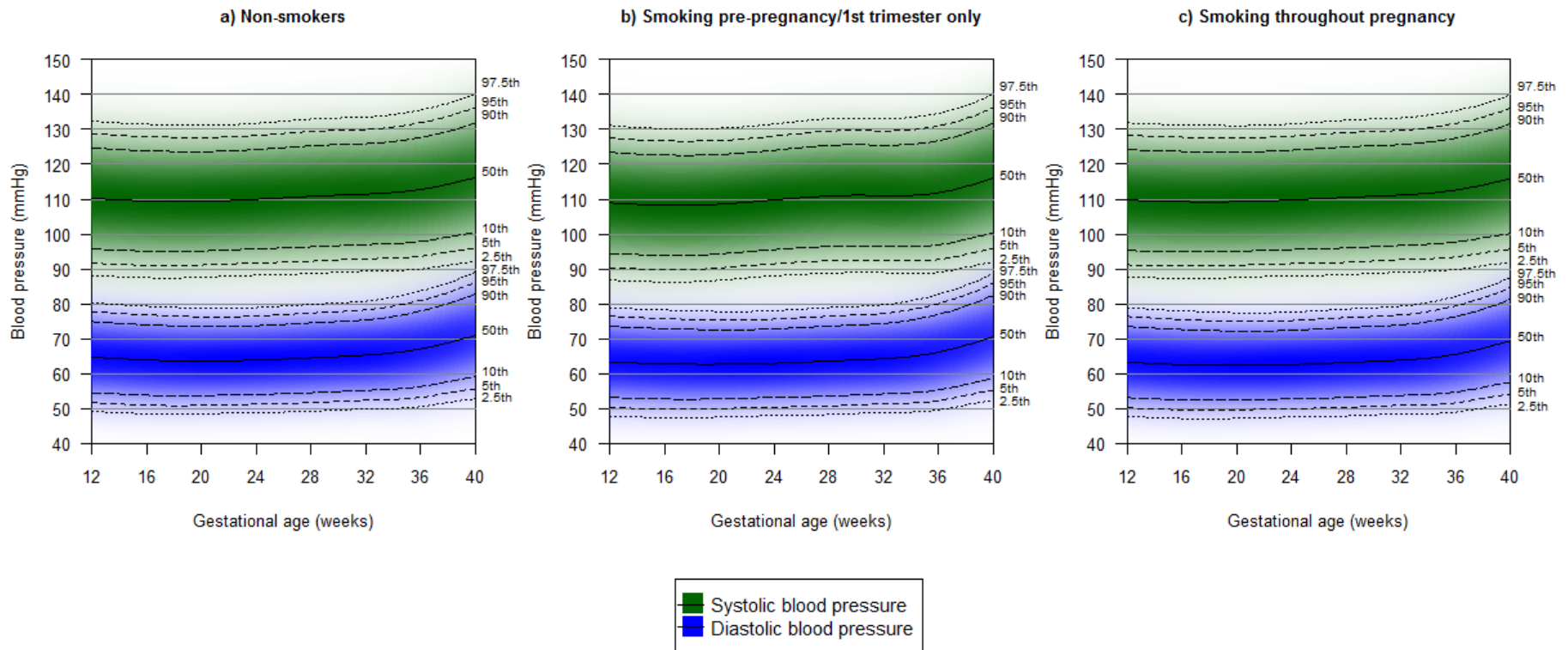
Web-Figure 2 Average trajectories of systolic blood pressure by maternal pre-pregnancy BMI category in a) nulliparous and b) multiparous non-smoking women with normal pregnancies



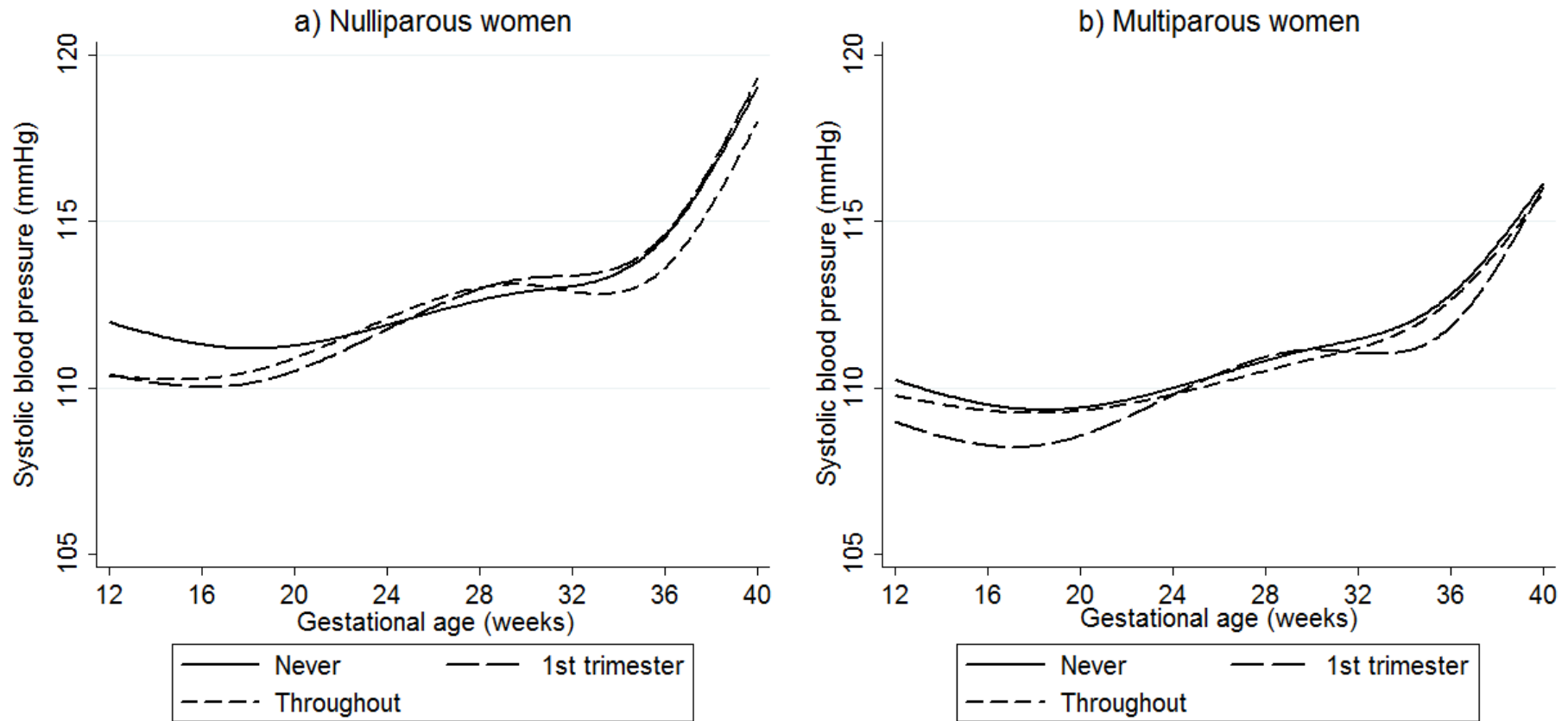
Web-Figure 3 Average trajectories of diastolic blood pressure by maternal pre-pregnancy BMI category in a) nulliparous and b) multiparous non-smoking women with normal pregnancies



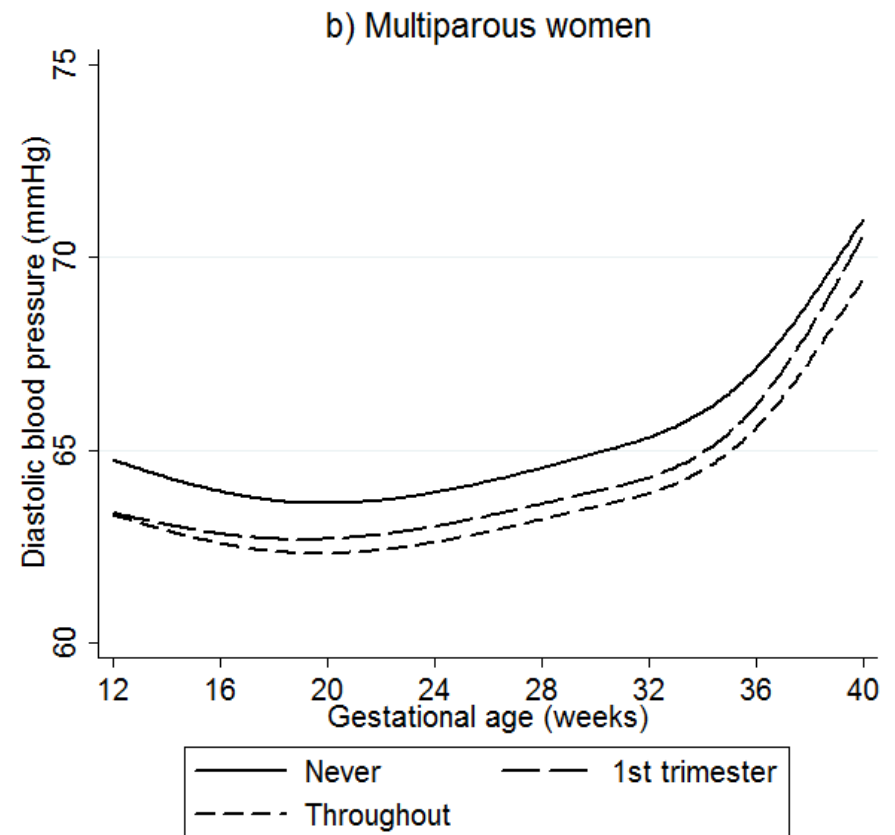
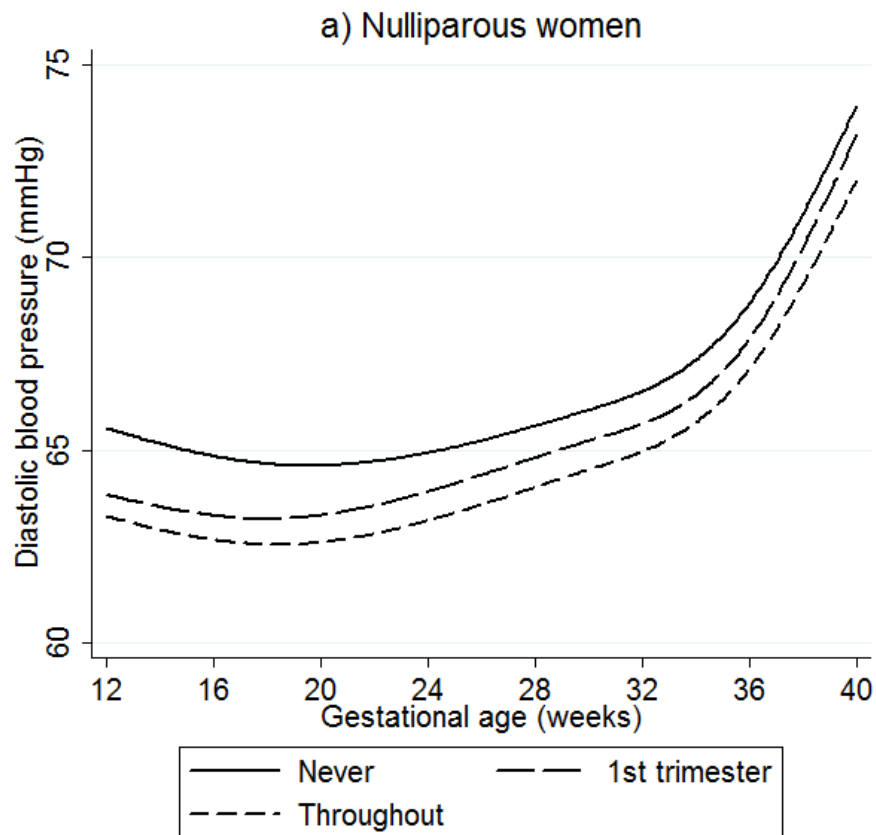
Web-Figure 4 Reference ranges for systolic and diastolic blood pressure by maternal smoking during pregnancy for multiparous normal-weight women with normal pregnancies (N=3049)



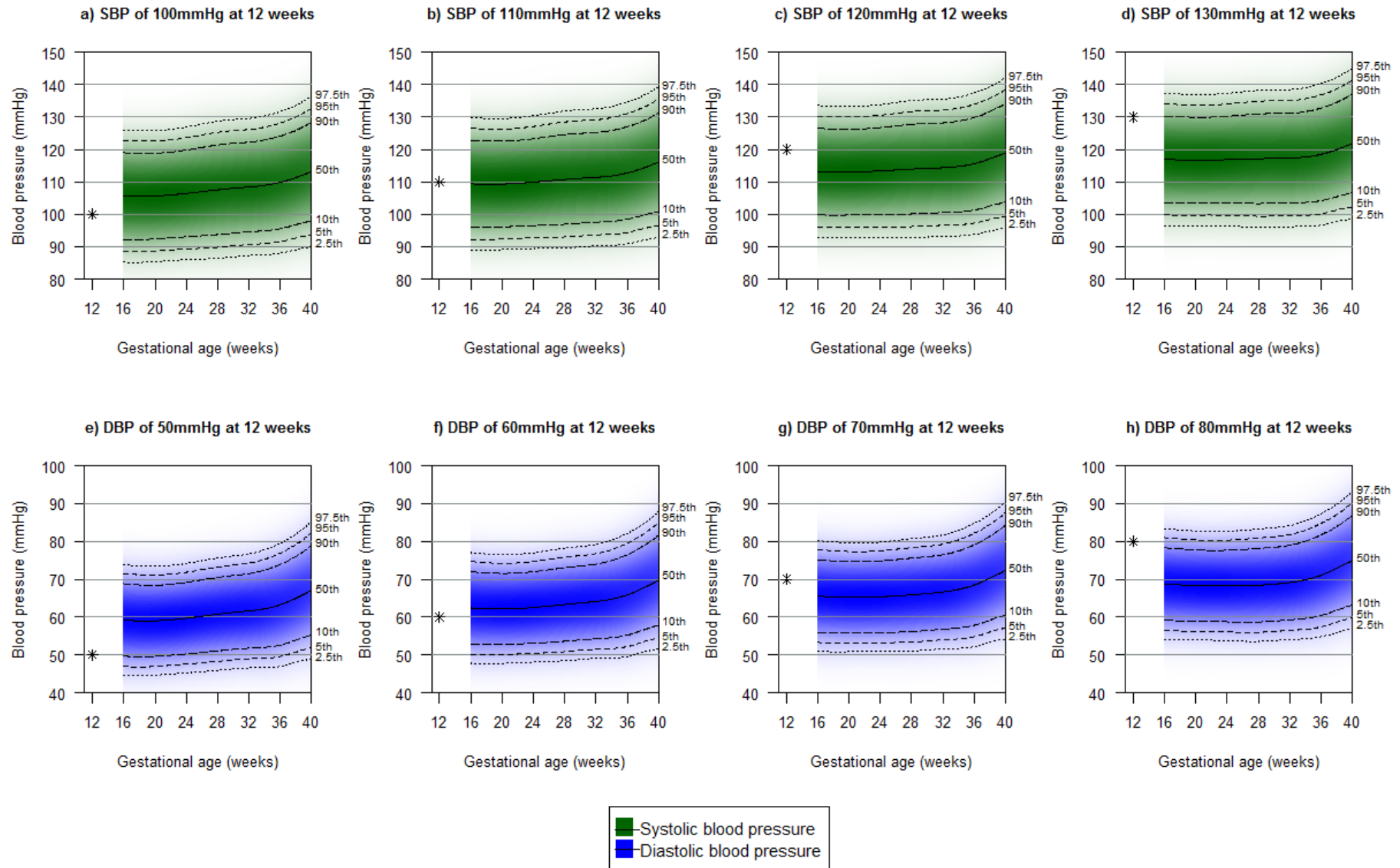
Web-Figure 5 Average trajectories of systolic blood pressure by maternal smoking in pregnancy in a) nulliparous and b) multiparous normal weight women with normal pregnancies



Web-Figure 6 Average trajectories of diastolic blood pressure by maternal smoking in pregnancy in a) nulliparous and b) multiparous normal weight women with normal pregnancies



Web-Figure 7 Reference ranges for systolic and diastolic blood pressure in pregnancy conditional on the level of blood pressure at 12 weeks gestation for multiparous normal-weight non-smoking women with normal pregnancies (N=2193)*



* Note that in each of the plots there is a star that corresponds to the value of SBP/DBP at 12 weeks.