

Quelle(s) courbe(s) utiliser à la naissance? Le point de vue du pédiatre

Olivier Claris

Néonatalogie et réanimation néonatale, Hospices Civils Lyon
EA 4129, Université Claude Bernard Lyon I

29/01/2020

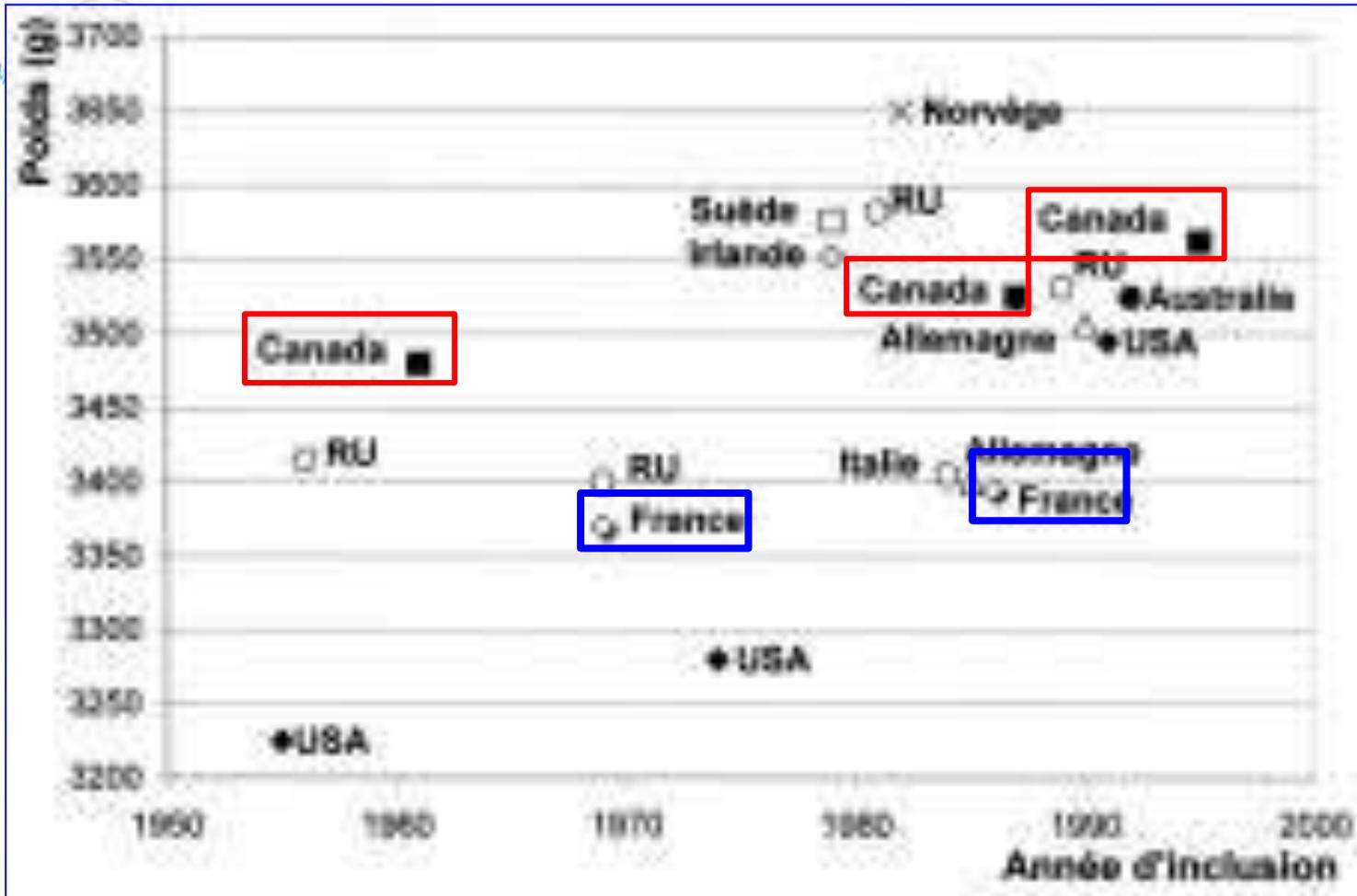
COURBES DE CROISSANCE

- Plus de 80 courbes de poids à la naissance
- Courbes obstétricales, courbes néonatales
- Moyenne, médiane, 50^e P
- La distribution du poids par AG suit une loi normale, 10^e et 3^e P sont éloignés de la moyenne de 1.282 et 1.881 DS
- Intérêt du z-score

$$Z\text{-score} = \frac{(\textit{individual weight} - \textit{cohort mean})}{\textit{cohort standard deviation}}$$

COURBES DE CROISSANCE (2)

- Population de référence
- Critères d'exclusion
- Seuil pathologique
- Méthodes de lissage



Courbe
croissanc
e

29/01/2020

Poids moyen (ou 50e percentile) à 40 semaines d'âge gestationnel suivant les années d'inclusion dans les courbes étudiées.

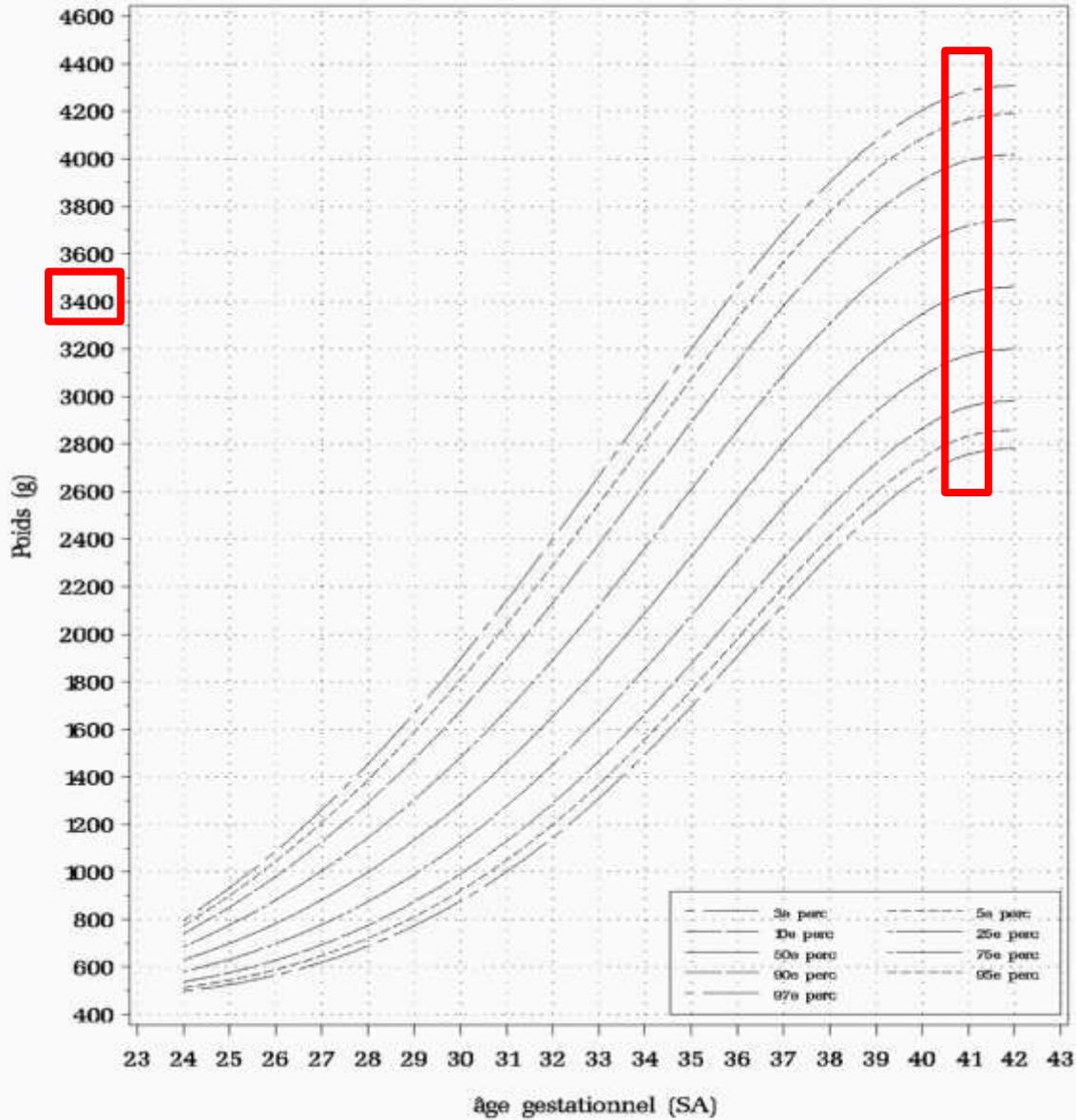
Courbes ajustées individuelles

- Gardosi :
 - ✓ Allure sigmoïde de la croissance fœtale (Hadlock 1991), Pds et AG équation de 3^e d^o
 - ✓ La dispersion des valeurs de poids autour de la moyenne est constante, donc le rapport de l'écart-type sur la moyenne (ou coefficient de variation) est stable → calcul des percentiles par AG

POPULATION ET METHODES

- Modèles statistiques de poids et de taille :
banque de données AUDIPOG
1999-2005
203 062 données pour le poids
172 716 données pour la taille
168 100 données pour le périmètre crânien

Poids des filles



Courbe
croissanc
e

29/01/2020

METHODES STATISTIQUES

Régression linéaire multiple pas à pas descendants,
technique des moindres carrés

variable dépendante : PN, ou TN

variables explicatives : AG, sexe, rang de naissance
âge, taille, poids habituel

maternels

Transformation logarithmique : pour normaliser la
distribution du PN (Log PN), et donner une déviation
standard [DS(Log PN)] raisonnablement

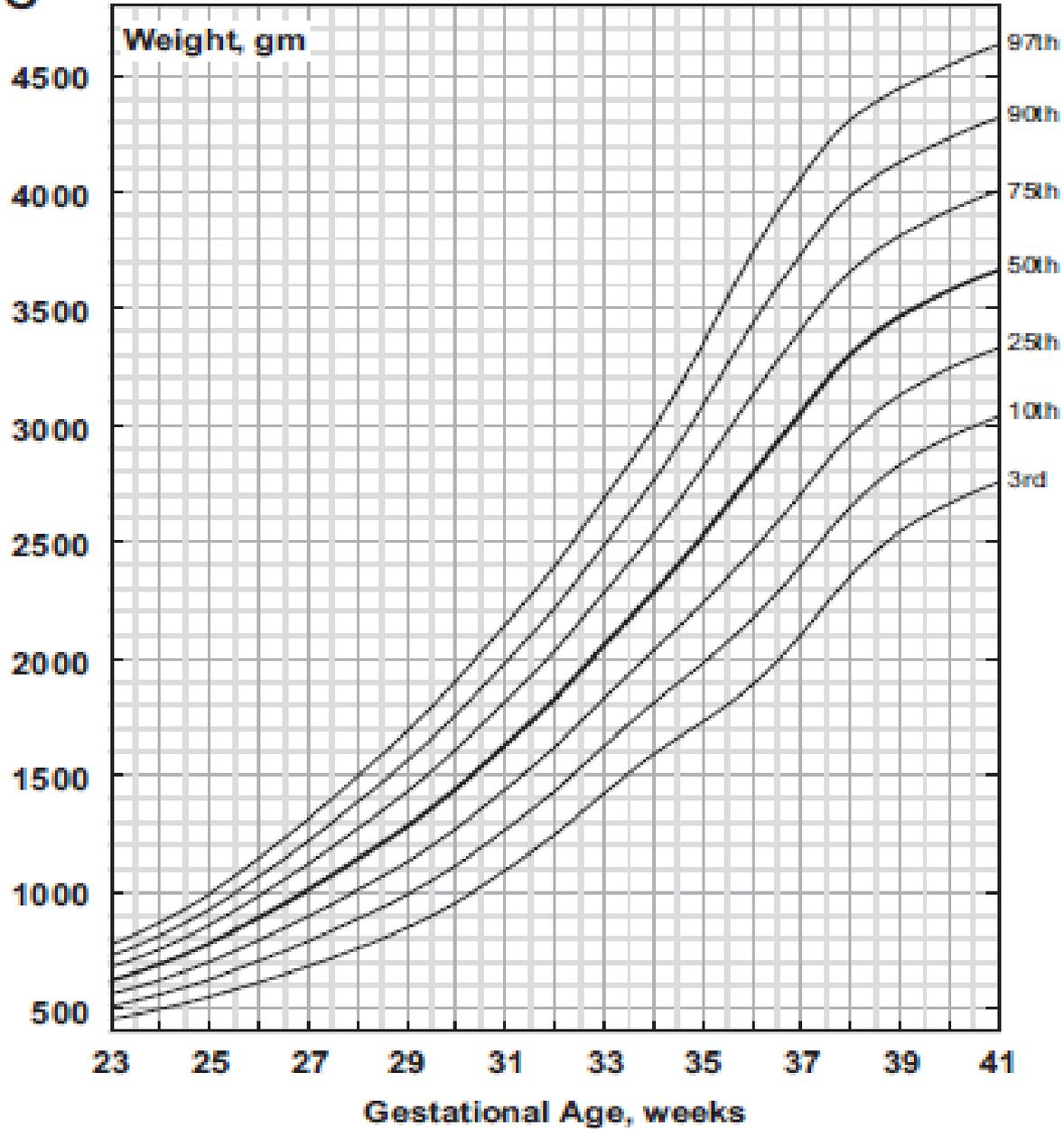
VALIDATION

- Modèle de croissance en poids explique 65% de la variance du PN
- Modèle de croissance en taille explique 55% de la variance de TN
- Pas d'amélioration du modèle avec l'ethnie et le tabac

Courbes Olsen 2010

- Groupe Pediatrx 1998-2006
- 391 681 enfants 22-42 SA, 33 états, 248 hôpitaux
- Exclusions :
 - Grossesses multiples, altération croissance foetale, décès néonatal
- 257 855 enfants, 52% garçons
- 55% blancs, 14% noirs, 24% hispaniques

C



Courbe croissance

29/01/2020



Hospic

GA, wk	n	Birth Size		Percentile						
		Mean	SD	3rd	10th	25th	50th	75th	90th	97th
Weight, g										
23	153	622	74	NA ^a	509	563	621	677	727	NA ^a
24	451	689	96	497	561	623	690	756	813	869
25	722	777	116	550	626	700	780	857	926	992
26	881	888	145	613	704	794	890	983	1065	1145
27	1030	1001	170	680	789	895	1009	1120	1218	1312
28	1281	1138	203	758	884	1007	1141	1271	1385	1496
29	1505	1277	218	845	988	1128	1280	1429	1560	1688
30	1992	1435	261	955	1114	1272	1443	1612	1761	1906
31	2460	1633	275	1093	1267	1441	1631	1818	1984	2147
32	3677	1823	306	1246	1433	1622	1829	2034	2218	2398
33	5014	2058	341	1422	1625	1830	2057	2284	2488	2688
34	7291	2288	364	1589	1810	2035	2285	2536	2763	2987
35	6952	2529	433	1728	1980	2238	2527	2819	3084	3348
36	7011	2798	498	1886	2170	2462	2792	3127	3432	3737
37	6692	3058	518	2103	2401	2708	3056	3411	3736	4060
38	8786	3319	527	2356	2652	2959	3306	3661	3986	4312
39	8324	3476	498	2545	2833	3131	3469	3813	4129	4446
40	7235	3582	493	2666	2950	3245	3579	3919	4232	4545
41	2538	3691	518	2755	3039	3333	3666	4007	4319	4633

Cou
crois:
e
29/01/

the Newborn

Cross-Sectional Study of the INTERGROWTH-21st Project

- 8 zones urbaines (Brésil, Chine, Inde, Italie, Kenya, Oman, Royaume Uni et USA)
- Santé et nutrition maternelles satisfaisantes, soins antenataux
- LCC < 14 SA, anthropométrie < H12
- 2009-2013
- 59137 femmes éligibles, 20486 incluses

the Newborn

Cross-Sectional Study of the INTERGROWTH-21st Project

- Critères exclusion :

- Âge $< 18 > 35$
- Taille $< 1,53\text{m}$, BMI > 30
- Tabac
- Altitude > 1600 m
- ATCD enfant < 2500 g ou > 4500 g
- ATCD 2 FCS, mort-né, mort néonatale malformation
- Au moins 50 données par AG (limite 33 SA)



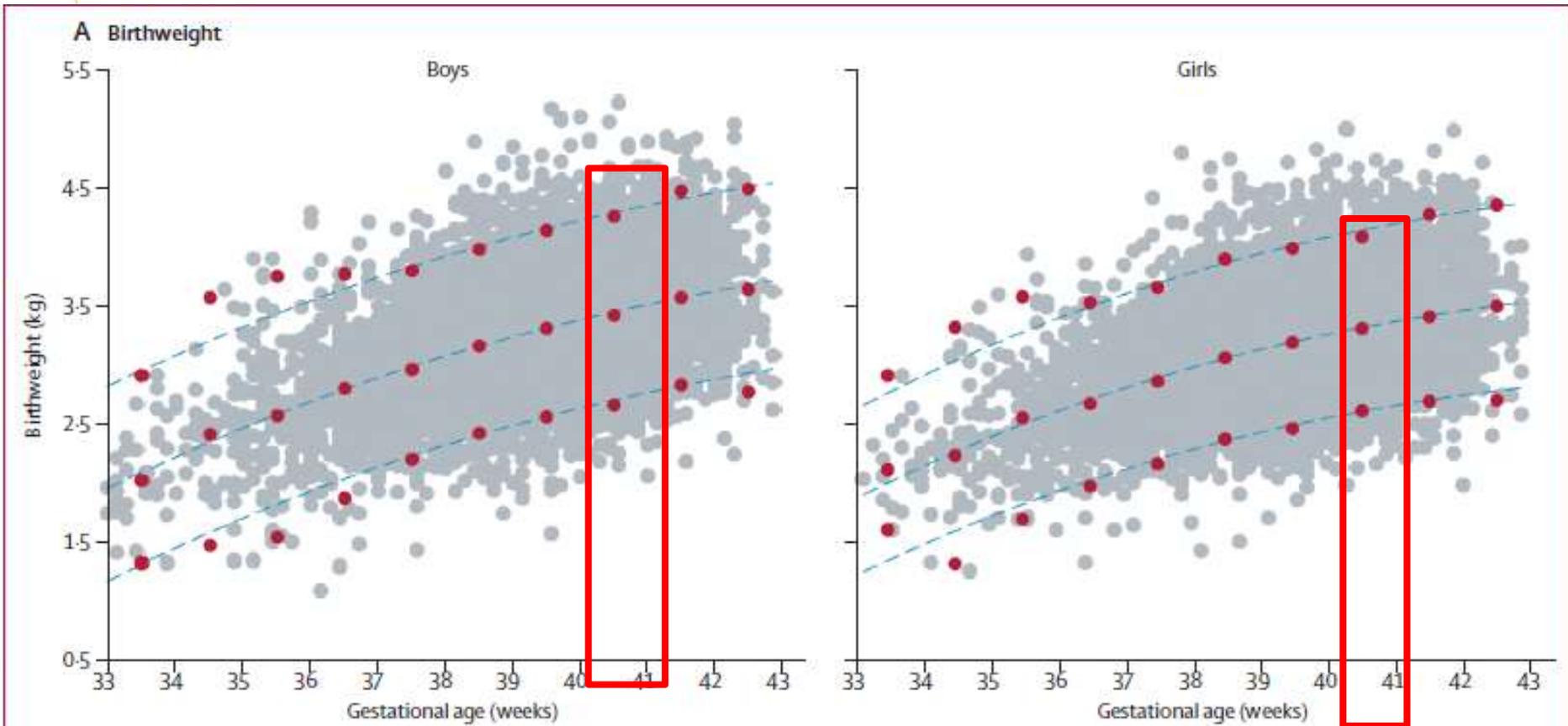
the Newborn

Cross-Sectional Study of the INTERGROWTH-21st Project

- **Résultats:**
 - 51% garçons
 - Pré-éclampsie : 1.2% (0.2-3.5%)
 - c/s : 14-65%
 - Prématurité : 5.5% (3.4-10%)
 - 3300 g, 49.3 cm, 33.9 cm

International standards for newborn weight, length, and head circumference by gestational age and sex: the Newborn Cross-Sectional Study of the INTERGROWTH-21st Project

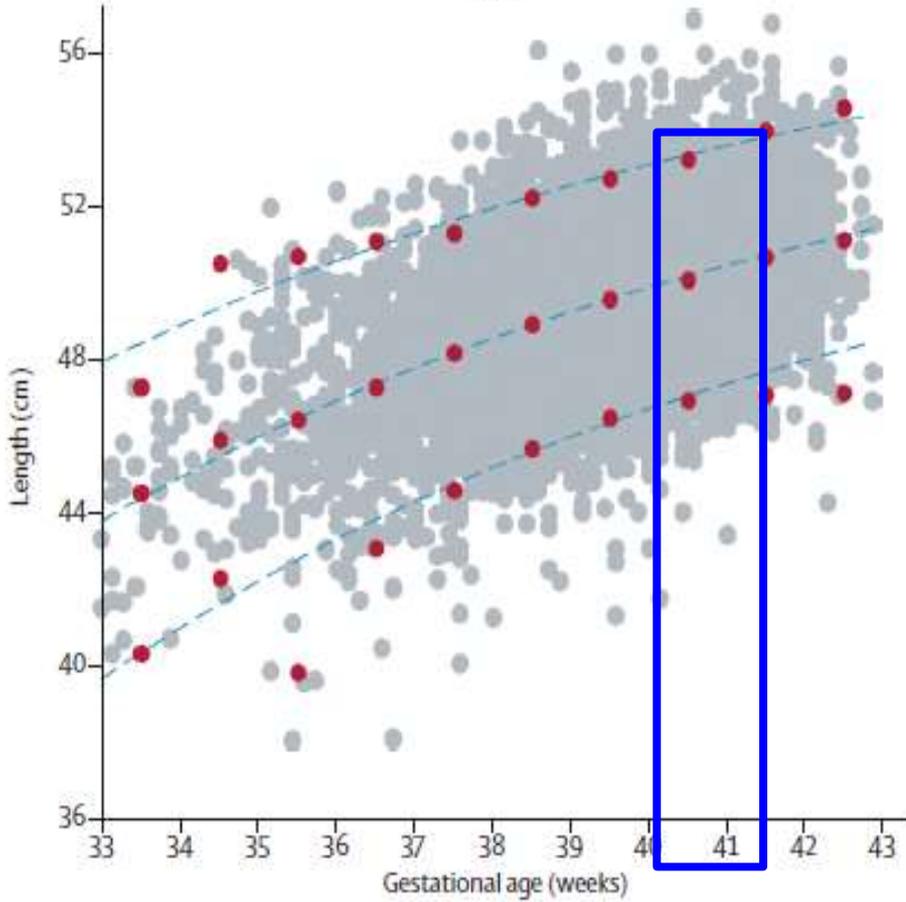
	Brazil (n=1595)	China (n=3551)	India (n=2493)	Italy (n=2358)	Kenya (n=3702)	Oman (n=2821)	UK (n=2939)	USA (n=1027)	Total (n=20 486)
Maternal age (years)	26.4 (4.8)	26.3 (3.0)	27.5 (3.3)	29.9 (4.0)	28.8 (3.5)	26.9 (4.0)	29.1 (4.3)	29.5 (3.9)	28.0 (4.0)
Maternal height (cm)	162.5 (5.4)	161.7 (4.5)	157.6 (3.3)	163.3 (5.6)	162.3 (5.5)	158.8 (4.1)	165.3 (6.1)	164.8 (6.2)	161.8 (5.6)
Maternal weight (kg)	63.2 (8.4)	58.8 (7.6)	57.0 (7.7)	60.4 (7.9)	63.6 (8.5)	60.7 (8.5)	64.4 (8.8)	63.7 (9.0)	61.3 (8.6)
Maternal body-mass index (kg/m ²)	23.9 (2.8)	22.5 (2.7)	22.9 (2.9)	22.6 (2.6)	24.1 (2.9)	24.1 (3.1)	23.5 (2.8)	23.4 (2.8)	23.4 (2.9)



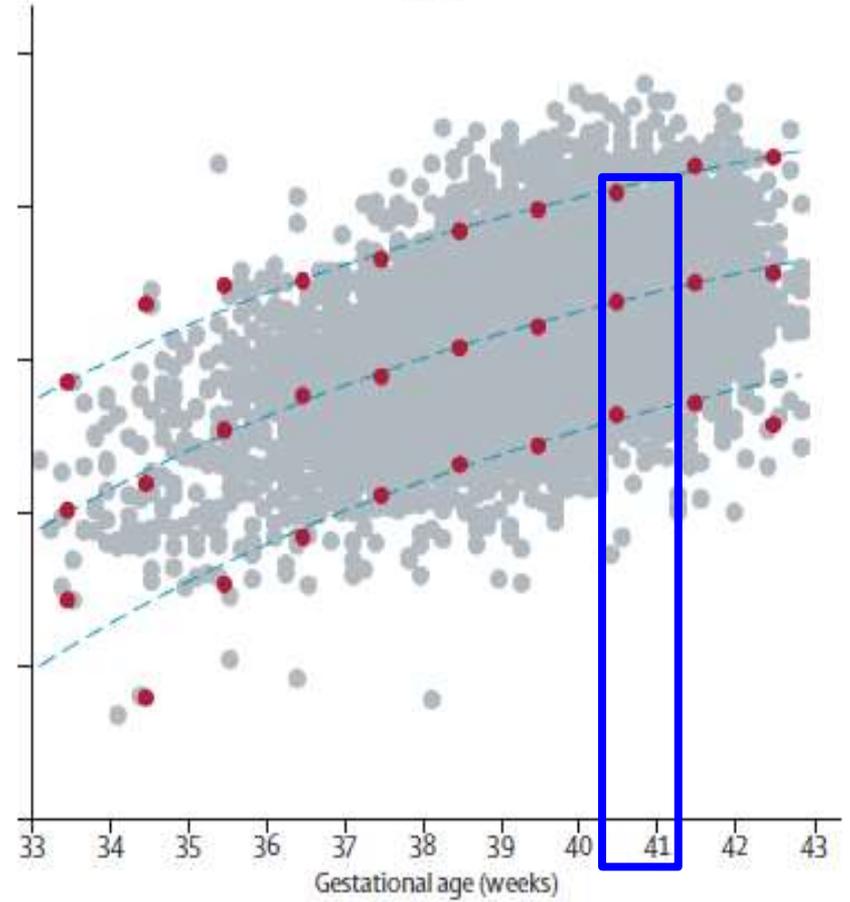
29/01/2020

B Birth length

Boys



Girls

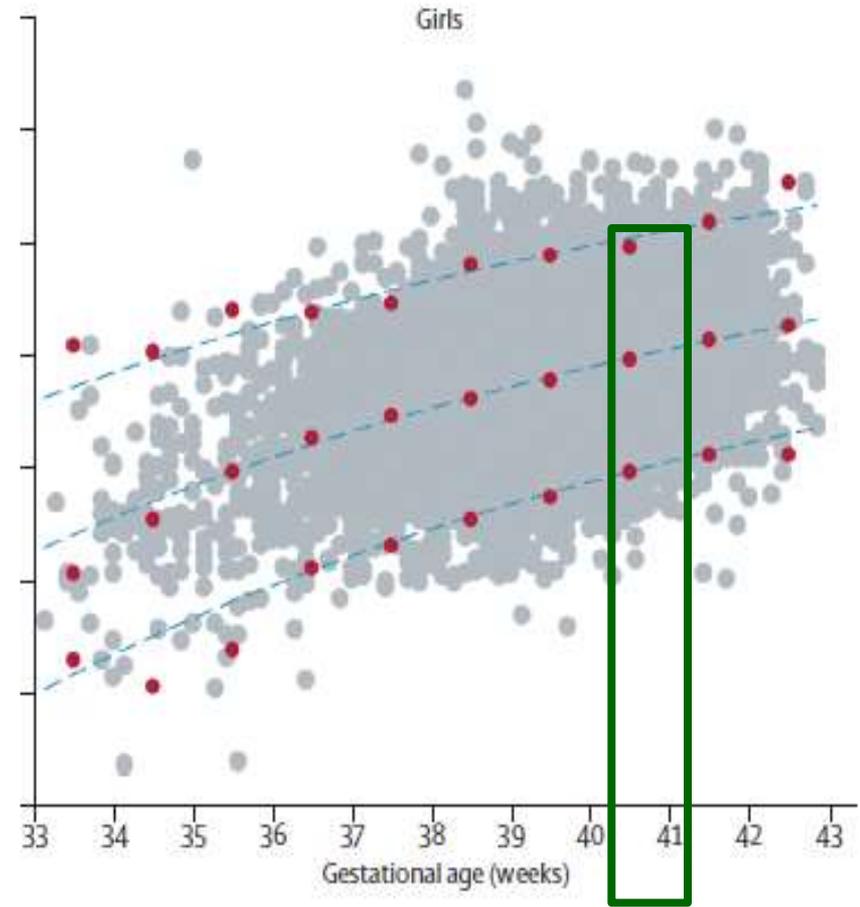
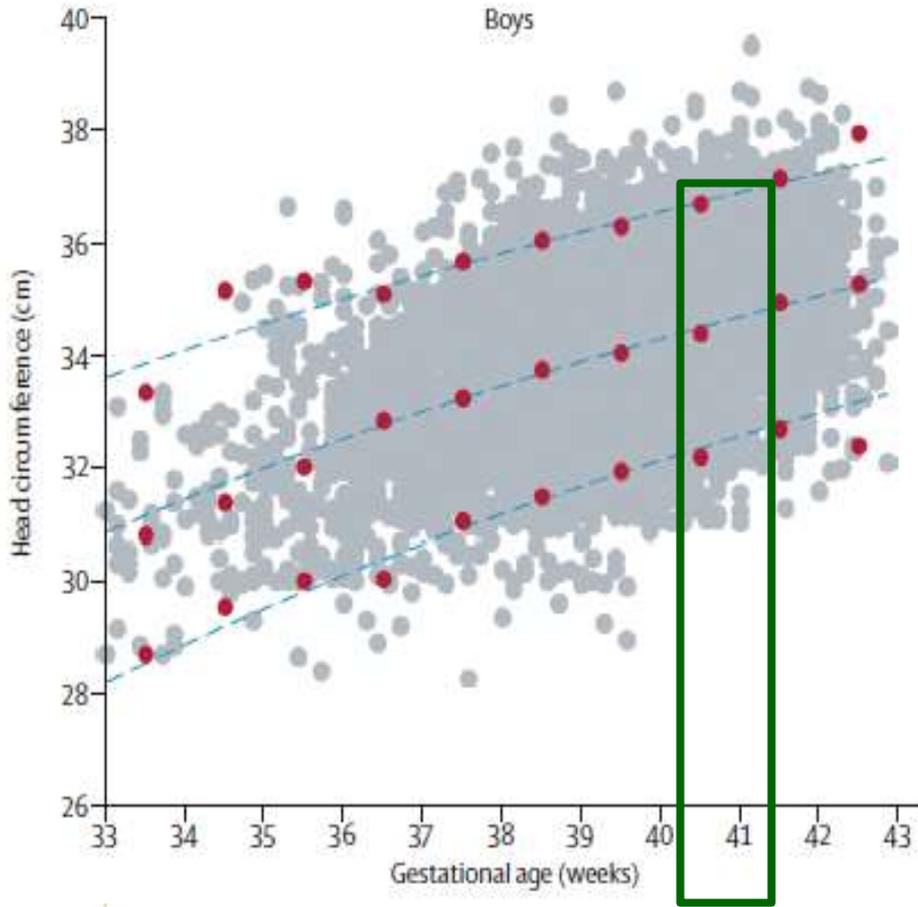


Co
croi

29/0

18

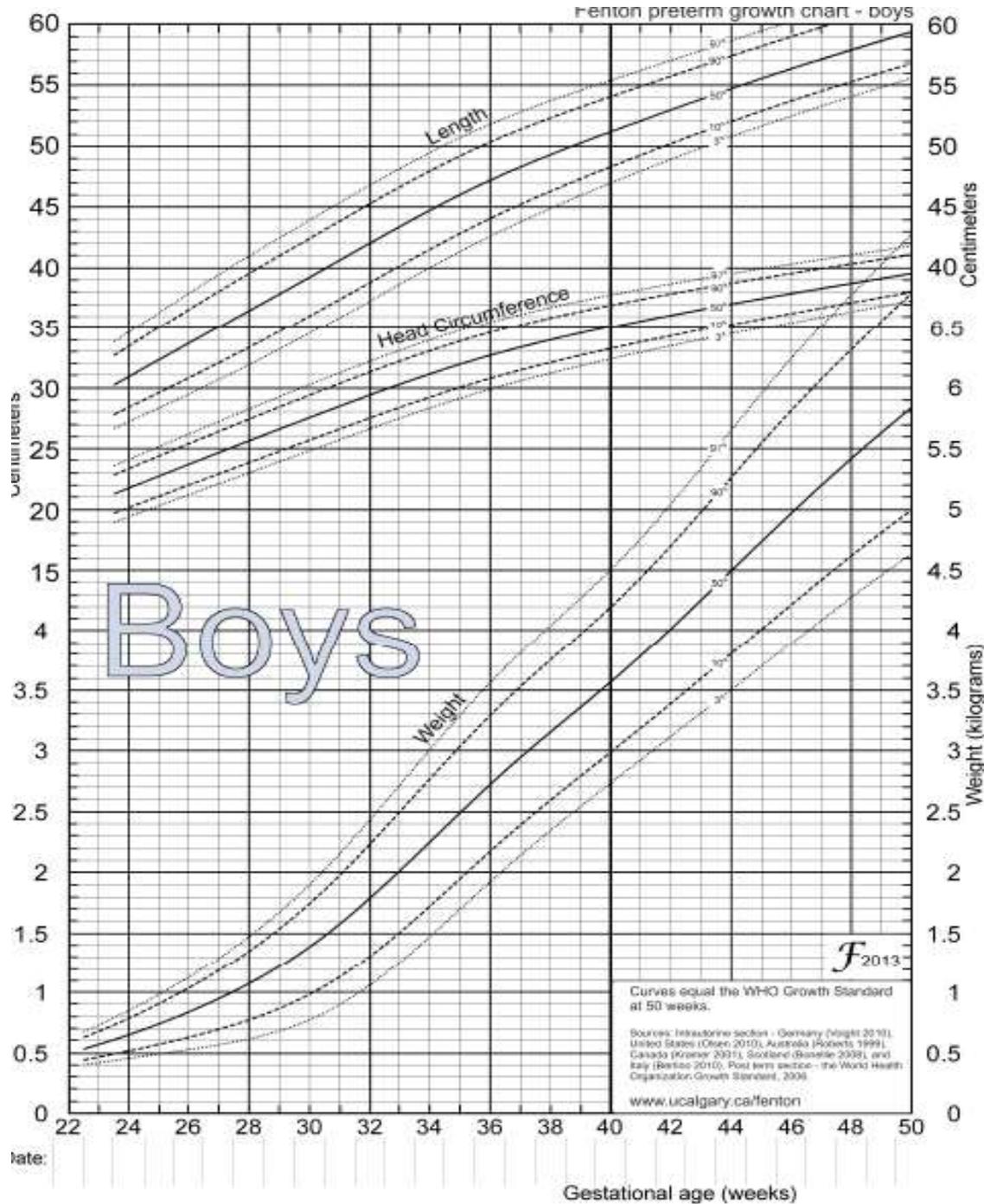
C Head circumference



Cou
crois
(
29/01

	Boys					Girls						
	Number of observations	Centiles for birthweight (kg)					Number of observations	Centiles for birthweight (kg)				
		3rd	10th	50th	90th	97th		3rd	10th	50th	90th	97th
33 weeks	34	1.18	1.43	1.95	2.52	2.82	17	1.20	1.41	1.86	2.35	2.61
34 weeks	48	1.45	1.71	2.22	2.79	3.08	65	1.47	1.68	2.13	2.64	2.90
35 weeks	128	1.70	1.95	2.47	3.03	3.32	114	1.71	1.92	2.38	2.89	3.16
36 weeks	323	1.93	2.18	2.69	3.25	3.54	293	1.92	2.14	2.60	3.12	3.39
37 weeks	857	2.13	2.38	2.89	3.45	3.74	803	2.11	2.33	2.80	3.32	3.60
38 weeks	2045	2.32	2.57	3.07	3.63	3.92	1802	2.28	2.50	2.97	3.51	3.78
39 weeks	3009	2.49	2.73	3.24	3.79	4.08	2869	2.42	2.65	3.13	3.66	3.94
40 weeks	2568	2.63	2.88	3.38	3.94	4.22	2523	2.55	2.78	3.26	3.80	4.08
41 weeks	1179	2.76	3.01	3.51	4.06	4.35	1195	2.65	2.89	3.37	3.92	4.20
42 weeks	206	2.88	3.12	3.62	4.17	4.46	224	2.74	2.98	3.46	4.01	4.30
Total	10397	..	..	..	..	..	9905	..	..	..	..	..

Table 2: Smoothed centiles for birthweight of boys and girls according to gestational age



Courbe
croissance

29/01/2020



Determination of birth-weight centile thresholds associated with adverse perinatal outcomes using population, customised, and Intergrowth charts: A Swedish population-based cohort study

Matias C. Vieira ^{1,2}, Sophie Relph ¹, Martina Persson ³, Paul T. Seed ¹,
Dharmintra Pasupathy ^{1*}

PLOS Medicine | <https://doi.org/10.1371/journal.pmed.1002902> September 20, 2019

Population (n=233,379)

439 missing gestational age or birthweight
12,152 premature birth (before 37 weeks)
296 deliveries at or after 43 weeks

Term pregnancies (n=220,613)

7,309 fetuses with congenital abnormalities
1,250 multiple pregnancies

Study population (n=212,101)



Thresholds for risk in small infants

Adverse outcome ^a	Thresholds for risk in small infants		
	Population	Customised	Intergrowth
All CSs	<5th	<5th	<10th
Emergency CSs	<15th	<10th	<30th
Apgar < 7 at 5 minutes	<15th	<20th	<25th
Neonatal morbidity ^b	-	-	<5th
Perinatal mortality	<15th	<10th	<35th



The performance of these three charts to detect infants with adverse outcomes, such as perinatal mortality, was similar when thresholds that reflect a false-positive rate of 10% were used for each chart.

Our findings suggest that either of the three charts in this study could be used in clinical practice, each having a similar ability to identify babies with adverse outcomes if thresholds that are specific to each individual chart are used.



Identification of the optimal growth charts for use in a preterm population: An Australian state-wide retrospective cohort study

Natasha L. Pritchard^{1,2}, Richard J. Hiscock^{1,2}, Elizabeth Lockie¹,
Michael Permezel^{1,2}, Monica F. G. McGauren², Amber L. Kennedy^{1,2}, Brittany Green¹,
Susan P. Walker^{1,2,3}, Anthea C. Lindquist^{1,2,3}*

PLOS Medicine | <https://doi.org/10.1371/journal.pmed.1002923> October 4, 2019

Courbe
croissanc
e

29/01/2020

26



We performed a state-wide retrospective cohort analysis that included data on 28,968 preterm births from Victoria, Australia, during the period 2005–2015.

Using <10th centile as the cut-off for SGA, our analysis compared the sensitivity and specificity of 5 growth charts—2 birthweight charts and 3 intrauterine charts—for still-birth and other adverse perinatal outcomes.

Our study found that intrauterine charts classify a significantly greater proportion of the preterm population as SGA compared with birthweight charts at this gestation. Of the fetal charts, INTERGROWTH classified a smaller proportion as SGA, but this cohort had the greatest risk of perinatal mortality and morbidity.



WHO and GROW charts classified an additional subgroup that was also at increased risk of perinatal mortality and morbidity, with GROW charts shown to be the most sensitive in the detection of SGA infants at increased risk of adverse perinatal outcomes.

Our findings highlight the trade-off that exists between the greater specificity of INTER-GROWTH fetal charts and the higher sensitivity of WHO and GROW growth charts.

The differences between these growth charts are likely to be the result, at least in part, of differences in the development of the charts and the techniques and assumptions that underpin them.

Cour
croiss
e

29/01/2020

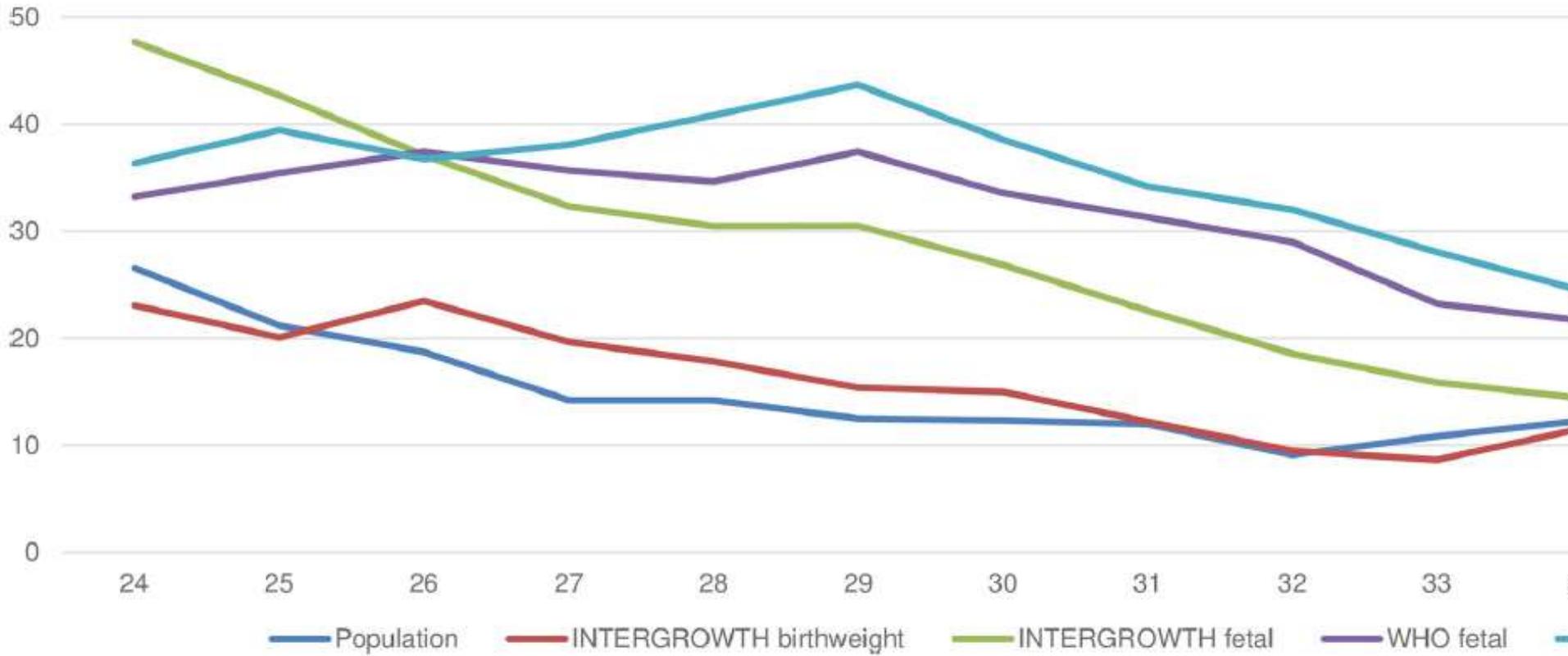


Fig 2. Proportion classified as SGA by each chart by week of gestation. GROW, Gestation Related Optimal Weight; SGA, small for gestational age.

Conclusion

- Nécessité de courbes fiables pour définir une population à risque
- Préciser critères d'exclusion et de validation
- Intérêt des courbes customisées
- Qu'attend-on d'une courbe??