



MEMO

To: BC/YT Radiology facilities, radiologists and sonographers

RE: **Change of BCW Ultrasound fetal biometry chart from Lessoway to WHO growth charts**

From: Dr Chantal Mayer, Medical lead BCW Ultrasound

Date: **UPDATED December 7 2023**

Changes to OB ultrasound biometry chart at BC Women's starting October 23rd 2023

1. **WHO fetal growth chart**² will be the new standard for reporting fetal biometry
2. Pregnancy dating by CRL will be assigned according to **Robinson chart**³

Why is this change happening?

Change from Lessoway(1) to WHO fetal growth chart as reference fetal biometry chart:

As per 2015 PSBC standards, most units in BC have been using the 1998 Lessoway fetal growth charts.¹ Provincial implementation and clinical application has been challenging due to the lack of a widely available, published equation that could be inputted directly into an ultrasound machine or reporting package. Consequently, many facilities have not been able to easily and accurately report biometry measurements where the percentile measures less than the 10th percentile, which is required for clinical care.

To facilitate clinical care, and after careful consideration, the BC MFM group has selected the WHO fetal growth chart.² as their new reporting standard (see **Appendix A** for details). The WHO fetal growth chart will facilitate implementation of the [Provincial MFM small fetus pathway](#) introduced in 2021 as the pathway requires specific estimated fetal weight centile and abdominal circumference percentile calculation for identification and management of small and growth restricted fetuses.

Perinatal Services BC (PSBC) has also recently endorsed the initiative; a date for implementation of WHO fetal growth chart as new Provincial standard will be posted in the upcoming weeks.

In addition, BCW rounds on WHO growth chart RE accessible [online](#). The password to access the rounds is "obgynrounds".

Change from Lessoway to Robinson as reference CRL chart for early pregnancy dating:

The WHO fetal growth chart uses the Robinson chart for dating³. While the Lessoway CRL chart does not have a publically available, non-proprietary equation, the Robinson chart is available in the basic package of many ultrasound machines.

Accordingly, BCW will also be moving to the Robinson chart for CRL dating. This will replace the Lessoway chart in our reporting template. Our local practice is to round the CRL to the nearest mm prior to inputting into the report. There is an [online calculator](#) available for dating by the Robinson CRL chart. A copy of the [Robinson CRL quick reference table](#) provided to us by our FHA colleagues is also available on the [BC Women's ultrasound web page](#).

As this transition occurs, pregnancies with previous ultrasound at BCW will not be re-dated or assigned a new EDD. However, pregnancies entered for the first time in our reporting package as of November 6 2023 are dated according to the Robinson chart.

This should not create a clinically significant change in assigned EDD as both charts yield the same estimated due date (EDD) for a given crown rump length (CRL) measurement in most cases with the rest of measurements yielding +/- 0.5 to 1 day difference.

Please note that the Robinson CRL equation used is that including a 3.7% systematic error³. We noted that our GE machines have both "Robinson" and "Robinson 93" as part of factory calculation packages. For GE, the correct CRL equation is under "**Robinson 93**". This may be different for other machines; the correct equation is:

Robinson CRL equation:

$$GA \text{ (days)} = 8.052 \times (CRL \times 1.037)^{1/2} + 23.73$$

Practical aspects: Switching to WHO fetal growth chart at your site:

1. How do we expect the WHO chart to compare to other charts with respect to predicting perinatal morbidity and/or mortality?

Using local data,⁴ the WHO chart was compared to other commonly used fetal growth charts: Intergrowth (another contemporary, international chart) and Hadlock⁵ (an older but widely used chart) fetal growth charts. In our sample, all charts performed similarly in predicting perinatal morbidity and mortality (see Appendix B).

2. Where do we obtain the reference chart?

The [WHO fetal growth calculator](#) is available online as a quick reference tool. It provides percentile for measurements between the 2.5th to the 97.5th %ile for GA 14 weeks and over.

A link to the coefficients used by the calculator are also publically available for those who wish to upload them in their reporting package. The link to the coefficients is on the WHO calculator page, just above the fetal information section.

Estimated fetal weight (EFW) is calculated by including HC, AC and FL in [Hadlock 1985's](#) third formula⁹. EFW and percentile for GA are also available on the online calculator.

3. Sonographers: How is biometry measured?

Imaging standards for biometry are describe in the original [WHO fetal growth chart publication](#). The difference with the Lessoway chart is that an “*ellipse function*” is used for the head and abdominal circumference with WHO while Lessoway used a “trace method”. Anatomical landmarks for measurements are unchanged.

4. How should a pregnancy with a first ultrasound at GA >14 weeks be dated?

Recommendations to date a pregnancy by according to the first ultrasound available is unchanged. At BCW, when the first ultrasound is at gestational age >14 weeks, gestational age is assigned as the average gestational age values of BPD, HC, AC and FL measurements.

The WHO chart and published material do not provide average gestational age values for any given percentiles. We are hoping that we can share our GA chart created for our ultrasound template for this purpose via the PSBC website in the near future. In the mean time, we suggest using average gestational age for biometry derived from Hadlock or Lessoway chart to date the now rare pregnancy that has a first ultrasound after 14 weeks.

5. How will pregnancies with serial ultrasounds be affected during the transition?

As the growth charts slightly differ in terms of specific percentile for a given measurement at a given gestational age, some pregnancies will be re-classified as small, normal or large for gestational age for equivalent measurements (see Appendix B).

Where deemed clinically relevant and at the discretion of the reporting physician, interval growth will be assessed and reported using the online calculator.

6. How do we expect the WHO chart to compare to other charts with respect to predicting perinatal morbidity and/or mortality?

Using local data⁴ WHO chart was compared to other commonly used fetal growth charts: Intergrowth (another contemporary, international chart) and Hadlock⁵ (an older but widely used chart) fetal growth charts. In our sample, all charts performed similarly in predicting perinatal morbidity and mortality (see Appendix B).

7. Our site will not be able to roll out WHO biometry chart for a while. What **interim guidance** are you able to provide?

Robinson CRL dating: even if the WHO biometry chart can't be implemented right away at your site, we suggest implementation of the Robinson chart as soon as technically possible to harmonize pregnancy dating across the province and YT.

WHO biometry chart: It will likely take several months for all units to be able to upload this chart in their reporting packages or ultrasound machines.

During the transition, our recommendations are the following:

- Continue to report biometry using the previous chart (i.e. Lessoway).
- EFW is not available on the Lessoway chart. When AC measures less than the 15thile, we recommend plotting biometry against the WHO calculator to identify fetuses with AC and/or EFW <10th %ile and report whether the measurement is between the 3rd and the 10th %ile, or les than the 3rd %ile.

- Fetuses with either AC or EFW <10th %ile should have umbilical artery Doppler studies performed with PI reported as per [Provincial MFM small fetus pathway](#).
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Appendix A: Why switch to the WHO fetal growth chart in British Columbia?

How is the WHO chart different from our current standard?

- The WHO chart is derived from multi-country, multi-ethnic populations compared with Lessoway which was from a small Caucasian population.
- The WHO study aimed to describe fetal growth under optimal conditions, so only included pregnancies without health, environmental, or economic risk factors for fetal growth restriction. While the Lessoway study excluded pregnancies with some complications, the WHO study had more extensive criteria.
- The WHO study followed the same cohort of fetuses from <13 weeks gestation over serial ultrasounds every 4 weeks, while Lessoway only included data from each fetus once.
- The WHO chart was derived from a larger sample of pregnancies, which makes the data more reliable.

What did we do to investigate which chart we should use?

We evaluated 10,605 fetuses with an ultrasound at BC Women's Hospital \geq 28 weeks' gestation. We converted their estimated fetal weights to percentiles on multiple fetal growth charts. We linked these percentiles with perinatal outcomes to see which charts and cut-points would best discriminate between low- and high-risk fetuses. We found that:⁴

- The WHO chart fit our population better than the Lessoway and other charts (Hadlock and Intergrowth).
- The four charts examined (WHO, Intergrowth, Hadlock, and Lessoway) performed similarly in terms of discriminating between low- and high-risk fetuses.

Why switch to the WHO fetal growth chart?

Even though the WHO fetal growth chart is not better than other charts at identifying fetuses that will ultimately have poor outcomes, there are several benefits to switching to the WHO chart provincially:

- It fits our population better than other charts, and was created by following the same cohort of fetuses over time. This helps clinicians and patients understand what the charts represent.
- It was derived from a multi-ethnic, multi-country population that more closely reflects BC's multi-cultural population of pregnant women.
- The charts are open-access (not proprietary), so can be easily implemented across BC.
- It is being used by other jurisdictions and upcoming multi-centre trials, which means the results from these trials can be directly applied to our patients.

What about other charts?

The Hadlock chart performs similarly to the other charts when applied to our population. However, it was derived from 392 middle class white women from one center in Houston, Texas, almost 30 years ago⁵ so it has similar methodological limitations as Lessoway. The Intergrowth chart had similar methodology⁶ as the WHO chart, but it only identifies an extreme proportion of our population as at-risk for growth restriction (i.e., it does not fit our population well).

Although some charts plot fetal growth according to certain characteristics such as race/ethnicity, we do not recommend the use of customized fetal growth charts in BC for the following reasons:

- We have a high percentage of multi-ethnic unions in BC⁷, and it would not be possible to easily account for these fetuses on ethnicity-specific charts.
- Customized fetal growth charts are not better at discriminating between high- and low-risk fetuses compared to non-customized fetal growth charts.⁸

Appendix B: Comparison of WHO to Intergrowth and Hadlock charts

WHICH CHART AND WHICH CUT-POINT

Deciding on the INTERGROWTH, World Health Organization, or Hadlock fetal growth chart

Fetal growth charts are one of the main tools available to screen for fetal growth restriction. In recent years, several new fetal growth charts have been published, and it is not clear which chart best identifies high-risk fetuses in our British Columbia population.

Researchers at the University of British Columbia compared the INTERGROWTH-21st (INTERGROWTH), World Health Organization (WHO), and Hadlock fetal growth charts to determine how well different weight percentile cut points on each of the charts predict perinatal morbidity/mortality.



The study linked antenatal ultrasound measurements for 10,366 fetuses >28 weeks' gestation from the British Columbia Women's hospital ultrasound unit with birth records in the provincial perinatal database.

All charts performed similarly in predicting perinatal morbidity/mortality, even when evaluating multiple cut points. For example, the **10th percentile cut-point** had a sensitivity of 11% [95% CI: 8 to 14], 13% [95% CI 10 to 16], and 12% [95% CI 10 to 16] to detect fetuses with perinatal morbidity/mortality on the INTERGROWTH, WHO, and Hadlock charts, respectively. Deciding which cut-point and chart to use may be guided by other considerations such as impact on workflow and how the chart was derived.

	INTERGROWTH	WHO	Hadlock
Proportion of population \leq 10th centile	345 (3.3)	466 (4.5)	398 (3.9)
Absolute risk of morbidity/mortality for fetuses on the 10th centile, per 100 (95%CI)	10.5 (7.6, 12.9)	9.0 (6.7, 11.0)	10.1 (7.9, 12.2)
Increase in absolute risk of morbidity/mortality for fetuses on the 10th centile compared to those on the 50th centile (95% CI)	7.1 (4.0, 9.7)	5.5 (2.8, 7.7)	6.6 (4.4, 8.9)
Sensitivity of 10th centile cut point, %(95%CI)	11 (8, 14)	13 (10, 16)	12 (10, 16)
Specificity of 10th centile cut point, %(95% CI)	97 (97, 97)	96 (95, 96)	97 (96, 97)
Positive predictive value for the 10th centile cut point, %(95%CI)	15 (11, 19)	13 (10, 16)	15 (11, 18)
Negative predictive value for the 10th centile cut point, %(95%CI)	96 (95, 96)	96 (95, 96)	96 (95, 96)

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Access the paper: <https://rdcu.be/cEIsj>

References:

1. Lessoway VA, Schulzer M, Wittmann BK, Gagnon FA, Wilson RD. Ultrasound fetal biometry charts for a north american caucasian population. *J Clin Ultrasound*. 1998;26(9):433-453.
2. Kiserud T, Piaggio G, Carroli G, et al. The world health organization fetal growth charts: A multinational longitudinal study of ultrasound biometric measurements and estimated fetal weight. *PLoS Med*. 2017;14(1):e1002220.
3. Robinson H, Fleming J. A critical evaluation of sonar ^acrown±rump length^o measurements. *Br J ObstetGynaecol*. 1975; 82(9):702±10. PMID: 1182090
4. Liauw J, Mayer C, Albert A, Fernandez A, Hutcheon JA. Which chart and which cut-point: deciding on the INTERGROWTH, World Health Organization, or Hadlock fetal growth chart. *BMC Pregnancy Childbirth*. 2022;22(1):25.
5. Hadlock FP, Harrist RB, Martinez-Poyer J. In utero analysis of fetal growth: A sonographic weight standard. *Radiology*. 1991;181(1):129-133.
6. Papageorghiou AT, Ohuma EO, Altman DG, et al. International standards for fetal growth based on serial ultrasound measurements: The fetal growth longitudinal study of the INTERGROWTH-21st project. *Lancet*. 2014;384(9946):869-879.
7. Statistics canada: Mixed unions in canada. https://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-010-x/99-010-x2011003_3-eng.pdf. Updated 2014.
8. Chiossi G, Pedroza C, Costantine MM, Truong VTT, Gargano G, Saade GR. Customized vs population-based growth charts to identify neonates at risk of adverse outcome: Systematic review and bayesian meta-analysis of observational studies. *Ultrasound Obstet Gynecol*. 2017;50(2):156-166.
9. Hadlock F, Harrist R, Sharman R, Deter R, Park S. Estimation of fetal weight with the use of head, body, and femur measurements—a prospective study. *Am J Obstet Gynecol*. 1985;151(3):333–7. pmid:3881966