

# Routine Infant Growth Monitoring: Variations in Practice Among Primary Care Providers

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## ABSTRACT

**Background:** Paediatric routine growth monitoring (RGM) is widely practiced despite little evidence in the literature to support it. The objective of this study was to better understand RGM practices during infancy among primary care providers in British Columbia to inform policy, practice and future research.

**Methods:** A cross-sectional mixed methods design using an electronic survey with Likert-type and open text responses was used to study routine growth monitoring practices by family physicians, nurses and midwives.

**Results:** 212 respondents. Key findings: duplication of RGM during infancy among disciplines; only 39% used the recommended metric (weight-for-length); 28% did not use EMRs to plot RGM data. Many believe RGM to be important but others question its necessity and report challenges and potential harms.

**Conclusion:** This study highlights several ways that RGM during infancy could be improved through transdisciplinary policy, education and research to mitigate potential harms and improve efficiency.

**KEYWORDS:** Infant, Growth, Monitoring

## BACKGROUND

Routine growth monitoring (RGM) is the practice of regularly weighing and measuring apparently healthy, asymptomatic children and has traditionally been used to identify children exhibiting otherwise unsuspected poor growth or “failure to thrive” resulting from malnutrition or underlying medical problems.<sup>1</sup> More recently, RGM has also been recommended as a screening tool for early identification of childhood obesity.<sup>2,3</sup> Although RGM during infancy is almost universally conducted at periodic “well baby visits” by registered midwives (RMs), public health nurses (PHNs), nurse practitioners (NPs) and family physicians (FPs),<sup>1</sup> “evidence demonstrating the benefits of growth monitoring on clinical outcomes is quite limited”.<sup>4-6</sup> Current guidelines suggest regular assessment of growth at well-health visits “within one to two weeks of birth, at one, two, four, six, nine, 12, 18 and 24 months”.<sup>7</sup> Unlike most other routine screening maneuvers, RGM fails to meet the standard criteria for an effective screening test<sup>8-10</sup> in part because it attempts to screen for multiple different conditions at different ages using one tool. According to the

British Columbia Lifetime Prevention Schedule, screening for childhood obesity using RGM carries a relatively high cost with minimal impact on long-term health outcomes.<sup>11</sup> The specific benefits and costs of RGM as a screening test for other indications remain unclear. A number of authors have raised concerns about potential harms of RGM including parental confusion and anxiety, inappropriate changes to feeding, weight stigma and the time and cost of growth monitoring visits for parents and the health care system.<sup>5, 6, 9, 12, 13</sup>

The goal of this study is to better understand current patterns of RGM during infancy (0-2 years) in British Columbia to help inform policy and identify areas for quality improvement and future research. The study was designed to answer the question: “Among a provincial sample of healthcare providers (RMs, PHNs, NPs, and FPs) in British Columbia, Canada, what are the current routine growth monitoring practices from birth to age two?” The specific objectives were to identify frequency, timing, tools and methods used for RGM and how these compare within and between professional groups.

## METHODS

### Study Design

We used a cross-sectional, concurrent, mixed-methods design, combining both qualitative and quantitative data collected in an on-line survey.<sup>14,15</sup> Quantitative data were used to identify disciplinary or regional patterns, while the qualitative data allowed for a deeper understanding of these findings, and individual variation.

### Participants

Family physicians, midwives and nurse practitioners were recruited through advertisements posted in regular electronic newsletters sent by their respective professional organizations and public health nurses were recruited by direct email through the regulatory college. The invitation to participate in the advertisement included a link to the online survey. Surveys were completed between October 2019 and April 2020. The survey was advertised to approximately 6000 healthcare providers. Based on similar research<sup>16</sup> the target size was calculated by estimating a response rate of at least 5% for each group (n = 300 total).

### Data Collection and Analysis

The survey was adapted from a previously-developed 10-item instrument that was pilot-tested and used in a similar study.<sup>16</sup> It was modified for a multi-disciplinary population with a focus on infancy and open text boxes were added to allow for participants to provide qualitative responses (see Appendix 1). Confidence in the instrument was also gained by having FP and PHN providers in the field assess the first version of the instrument for clarity and appropriateness to the setting.

Quantitative survey data were exported from the Qualtrics platform into Excel for analysis. Survey submissions that did not include a response to at least one non-demographic question were excluded from analysis. Descriptive statistics were calculated to show the frequency distribution of participant responses for each of the primary and secondary outcomes.

The qualitative data from all of the open text responses were analyzed using qualitative description, a pragmatic approach described by Sandelowski.<sup>17</sup> A widely accepted method for thematic analysis was used to better understand the shared experiences and thoughts across the data set.<sup>18</sup> This included a six-step process of two researchers familiarizing themselves with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, then producing the report.

The initial analysis of qualitative (open text responses) and quantitative (closed-ended questions) data was performed separately. Data from one strand that could complement, corroborate or deepen our understanding of data from the other strand were integrated in the discussion and identified as the key findings of the study. An interdisciplinary approach was used, with each investigator applying the lens of their respective disciplines, medicine and nursing, to form a more holistic interpretation.<sup>19</sup>

### Ethical Consideration and Approval

Ethical approval for the study was obtained through two academic research ethics boards in the province,

including the University of British Columbia Research Ethics Board harmonized with provincial health authorities. Full information was provided as part of the survey instrument, with completion being accepted as implied consent.

## RESULTS

### Participant Characteristics

The survey was completed by 212 primary healthcare providers. Target recruitment rates of >5% per profession were met for all groups except FPs. Participant characteristics are summarized in Table 1.

**Table 1: Survey Participant Characteristics (n=212)**

Demographic Characteristics	n	%
Profession		
Public Health Nurse	121	57
Registered Midwife	32	15
Family Physician	31	15
Nurse Practitioner	26	12
Not specified	2	1
Gender*		
Female	200	94
Male	8	4
Other	1	0
Not specified	3	1
Age		
20-29	23	11
30-39	62	29
40-49	63	30
50-59	48	23
60-69	15	7
Not specified	1	0
Years of Practice		
1-5 years	48	23
6-10 years	54	25
11-15 years	35	17
16-20 years	21	10
21+ years	54	25

\* Total does not add up to 100% because of rounding

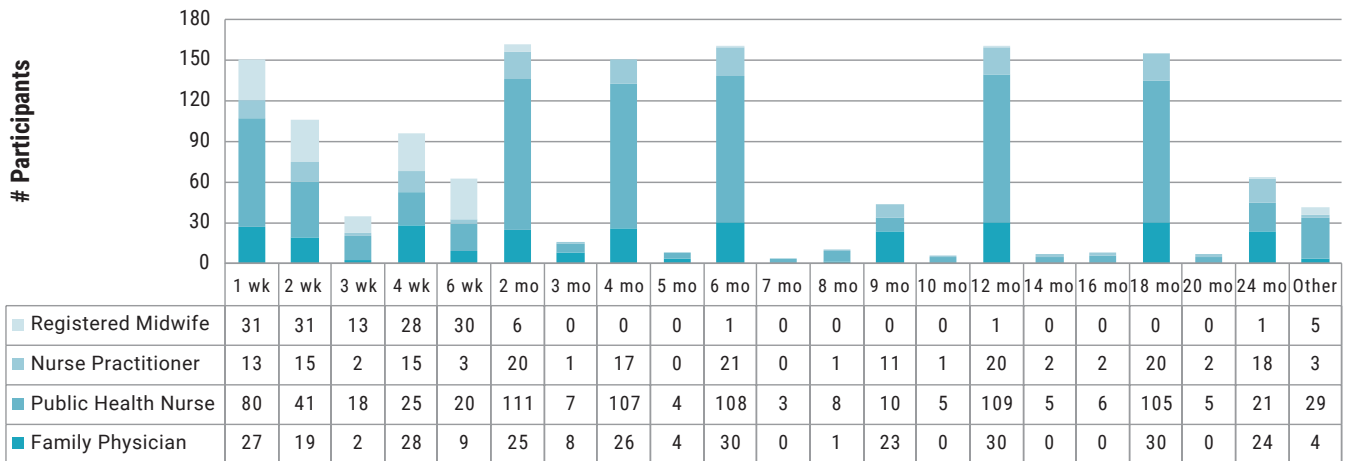
### Quantitative Survey Results

A majority of survey participants indicated that they aimed to perform growth monitoring at 1 week, 2, 4, 6, 12 and 18 months (Figure 1). Registered midwives typically discharge patients at 6 weeks.

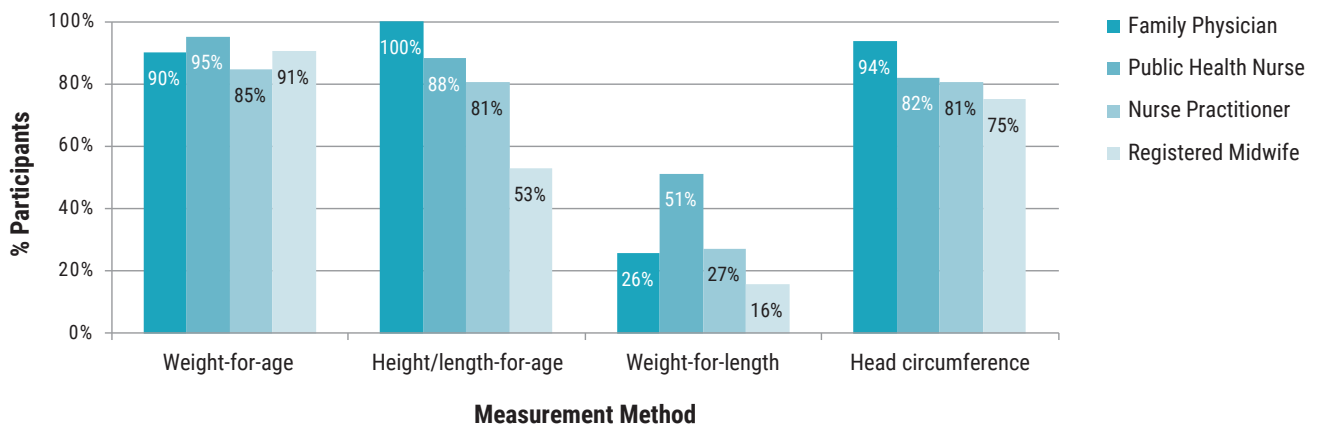
While weight-for-age, height/length-for-age, and head circumference were all commonly used to assess infant growth, weight-for-length (WFL) was used much less frequently (Figure 2). Across all health professions, only 39% (n=82) of participants indicated using WFL.

A total of 88% of survey respondents (n=187) reported using an EMR in their practice. Of those who used EMRs, 81% (n=152) indicated using their EMR for plotting paediatric growth monitoring data (Figure 3). The use of EMRs to plot RGM data among midwives was noticeably less than the other groups (22%).

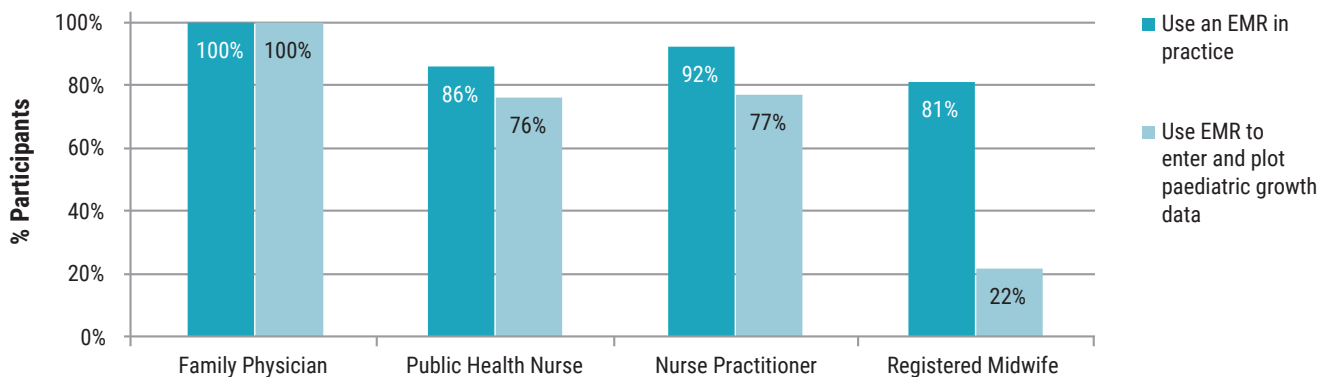
**Figure 1. Timing of Routine Growth Monitoring during infancy by profession**



**Figure 2. Methods of measurement by profession**



**Figure 3. Use of EMR in practice compared with use of EMR for plotting paediatric growth monitoring data by health profession**



## Qualitative Findings

Open text responses to all of the questions largely fell into five overarching themes. A selection of representative participant quotes is found in Table 2.

### Theme 1 – Perceived Benefits of RGM

Many participants said that they believed RGM to be important for identifying growth issues. Two participants reported specific examples of RGM helping to identify underlying medical issues (iron-deficiency and a cardiac condition). A common comment was that having parents attend for RGM gives healthcare providers an opportunity to discuss topics related to growth, such as breastfeeding, nutrition, food security and other topics, such as immunizations, parenting and social supports.

### Theme 2 – Importance of Other Assessment Methods

Many participants emphasized the importance of evaluating growth measurements within the larger clinical, social, developmental and family context and not putting too much emphasis on the numbers alone. Several participants questioned the value of RGM and felt they could use their professional judgment to determine which infants require growth assessment.

### Theme 3 – Challenges Associated with RGM

Several participants mentioned the difficulty of providing explanations to avoid inducing anxiety in parents when interpreting RGM. One participant identified the challenges of explaining growth charts to those with low health-literacy and also applying trauma-informed or culturally sensitive practices.

Theme	Quote
Benefits of RGM	"[RGM is] useful to reassure parents that growth is appropriate and following the curve, decreases anxiety in parents who are questioning themselves."
	"Growth monitoring is important, both to ensure adequate nutrition in the early days (milk transfer) and as an opportunity to discuss routine immunization and parenting."
	"It's an excellent, consistent tool that captures parents' interest and allows for further open dialogue."
	"Infant growth monitoring at my office has helped identify a 4-month-old who had an undiagnosed cardiac condition"
Importance of other assessment methods	"I think growth charts are a great tool but only when used in collaboration with an overall assessment. I've seen kids with very interesting growth chart patterns who are healthy and well despite the unusual pattern."
	"Parent concern, breastfeeding issues or challenges, height and weight of parents are all factors I consider."
	"I try not to put too much emphasis on the numbers, go with developmental milestones and healthy feeding relationship, good nutrition information and balance of activity and fuel."
	"My preference would be to stop the routine measurements, and focus more on development, nutrition and family activity levels".
	"Unsure as to the benefit of routine growth monitoring. I feel that using professional nursing judgment would be adequate in determining who and who not to measure and assess."
	"I wish we would stop the routine weight and measure and do so only if parents are concerned or if there is an indication of poor health/well-being."
	"Although I do keep an eye on growth, I do keep in mind that this is analogous to a screening test with high sensitivity but low specificity"
"I try to emphasize to parents that growth charts/percentiles are not a 'report card', and that unless their child's measurements are extremely high/low, knowing the trends over time is more important so that we know what's normal for their individual child."	
Challenges of EMR	"It would be so helpful to have good recommendations and guidelines on which tool to use. We literally use the CDC tool because that was what was previously existing on our EMR system (OSCAR)."
	"Measuring length and HC manually provides an array of different measurements which is unreliable. Babies measurements are all over the place. 9/10 times there is nothing wrong with the babe's growth & we have to explain that it's probably just a mis-measurement."
	"The population I work with frequently has low health literacy. Difficult to explain growth chart in trauma informed and culturally sensitive lens."
	"Our charting system allows us to chart the growth data, but it doesn't plot it on a graph, rather it gives us the growth percentile. We manually plot growth on growth charts."
	"We also use the PARIS Online Charting System ... which I believe is based on the WHO Growth Charts ... though seems to have some discrepancies when I do both the paper growth chart for families and chart in PARIS"
	"If it's not actually helpful we could be causing a lot of stress for no reason!"
	"I would love to have an easier way to chart growth in our EMR."

**Table 2: cont'd.**

Uniqueness of Postpartum Period	"For midwives, we only monitor growth for such a short period (6 weeks), that weight gain/d is more useful than curves".
	"I think focusing on weight and birth weight is undermining to infant health. Birth weight should be delayed until 24 hours to allow for IV diuresis and this would prevent unnecessary early intervention with formula when there really isn't true 7 to 10% weight loss but in fact just diuresis."
	"I feel newborns are weighed more often than necessary when feeding, output, and behaviour are normal"
	"Routine growth monitoring and feeding support is an essential part of public health nursing. During this time of limited client contact [during the pandemic], I am concerned that many babies/children may not have optimal support around growth and nutrition."
	"I co facilitate an infant group for 0-6 week babies. Weights are done each week."
Interdisciplinary Collaboration	"there is duplication with the PHNs doing the same thing at the same time – we probably shouldn't both be doing it."
	"This should be a physician role and the PHN should move away from monitoring to release PHN time for other prevention initiatives."
	[RGM by PHNs] "gave families false sense that a thorough exam of their child had taken place... A medical exam should take place at certain developmental intervals, by physician, not a nurse."
	"I have had a few cases where PHNs have been concerned but the FP is not concerned as long as babe consistently tracks and does not appear to be further declining. It would be nice to have more info about this, especially knowing what info the FPs use when identifying those babes that have poor weight gain."
	"As a public health nurse, I do not routinely assess infants' growth development anymore due to the recent changes in public health. We now encourage families to visit their physicians for well-baby visits. Often, if we see a client and have concerns, we may offer to assess growth, but then will refer to the physician if there are any concerns.
	"Difficult to communicate growth concerns between public health" [and physicians]
	"Routine growth monitoring has been dropped by the employer"

The measurement and plotting of data was viewed by some as cumbersome. Several participants indicated that their EMR does not automatically chart height, weight, and head circumference, or that the growth charts were outdated so growth data is plotted manually on paper and is not necessarily incorporated into the EMR, making it difficult to compare to previous measurements. Some participants commented that there is not enough training and they would like additional resources to help them with RGM. Others noted that measurements in infants can be inaccurate (especially length) and therefore misleading.

#### **Theme 4 – Uniqueness of the Early Postpartum Period**

Comments regarding the first six weeks, mostly from midwives, emphasized that growth charts were often less helpful than daily weight gain (grams per day) or return to birth-weight. Some also suggested that there was too much emphasis on weight in the early postpartum period. There were many comments that said growth monitoring was important in order to support breastfeeding.

#### **Theme 5 – Interdisciplinary Collaboration**

Many participants noted that in health authorities where PHNs perform immunizations there is a significant duplication of RGM during infancy among providers. Several participants in one health authority reported that PHNs are no longer conducting RGM, which they suggested was appropriate given the duplication. Some reported difficulties communicating growth data between disciplines. One participant identified a need for shared education to ensure consistency of messaging among providers.

## **Discussion**

This study of infant RGM practice patterns among primary healthcare providers in British Columbia produced a number of interesting findings. In most cases, the quantitative and qualitative data generated complementary results.

The most striking finding in terms of healthcare system efficiency was the frequency and duplication of RGM by different professions, especially within the early postpartum period and at times coinciding with immunization. In most health regions in the province, PHNs provide most immunizations and conduct RGM at the same visit. Most FPs appear to be following the standard growth monitoring schedule that was designed to coincide with immunization visits even if another professional is also doing RGM at similar intervals. This results in considerable duplication of service, with time and human resource implications for both parents and healthcare providers. Repeating measurements and their interpretation can also be confusing for parents who may receive different messages from different healthcare providers.<sup>12</sup> Particularly in light of the uncertain value of RGM suggested by the sparse literature on the topic,<sup>4-6,20</sup> the high frequency and duplication of RGM is significant.

Although many participants reported that they believed RGM was important, only a small number of participants gave specific examples of cases where they felt it led them to identify otherwise undetected medical conditions. It may be that the belief in the importance of RGM simply reflects what we have been taught. Although many participants reported that doing RGM was useful to support

breastfeeding and nutrition education it seems possible that this information could still be shared if RGM were not performed. As many participants suggested, RGM may not always be necessary and using clinical judgement to determine if growth assessment is necessary may be appropriate in some cases. Coincidentally, towards the end of the study, during the beginning of the COVID-19 pandemic, many practitioners reduced or completely stopped doing RGM. It will be interesting to see if this natural experiment has any long-term effect on the infants or on RGM practice in the future.

The reported frequency of growth monitoring during the first six weeks varied considerably among disciplines and individuals, reflecting the lack of standard recommendations for the neonatal period.<sup>7</sup> When establishing feeding, many practitioners weigh frequently to reassure parents about adequate growth; however, one study found that babies who were weighed on day 3-4 instead of waiting for day 7 had a significantly increased rate of formula supplementation.<sup>21</sup>

Another key finding is the use of predominantly age-based measurements (weight-for-age [WFA] and length-for age [LFA]) without the recommended weight-for-length (WFL) among all professions, especially physicians. Previous studies have similarly found that most FPs in the study evaluate infants using WFA rather than WFL (92 vs 36%).<sup>16</sup> Although age-based weight or length reporting is more intuitive and easier to explain to parents, proportional measures such as WFL (similar to body mass index [BMI] for older children) are recommended to avoid mislabeling short or long infants as under- or overweight. WFL is also more strongly correlated to later obesity<sup>22</sup> than WFA. Misinterpretation based on inappropriate choice of measurement tool can result in unnecessary anxiety and potential for inappropriately altered feeding practices, investigations or referrals.

Few existing RGM guidelines acknowledge the complexity of interpreting RGM data. Growth interpretation, particularly during infancy, is a subjective intellectual task that fails to be easily reduced to a standard set of rules. Considerable clinical judgment is involved in the interpretation of a growth chart, such as when a child appears to be crossing growth lines or plotting above or below the normal range. This is complicated by the fact that growth rates vary significantly over time and among individuals especially during infancy. Appropriate interpretation needs to incorporate the broader genetic, social, health and developmental context of the infant and can be affected by an individual clinician's personal or professional experience and practice style. As several participants in this study noted, perfectly normal healthy babies often fall outside the "normal" growth parameters. One study of infants found that 38% of all infants will cross two growth percentile lines at some point during the first year (thereby meeting the official definition of "failure to thrive") reflecting the typical "surfing" over the chart seen with many healthy babies.<sup>23</sup> Unfortunately, growth curves represent only population averages – they do not actually reflect how real babies grow which is often more in spurts and pauses rather than by following a smooth line. Careful, evidence-informed communication about RGM with parents is particularly important during infancy when RGM is performed frequently, parents are most at risk for anxiety around feeding and infants are in a critical period of development where inappropriate feeding practices resulting from misinterpretation of RGM could have significant long-term consequences.<sup>12</sup>

Use of EMRs to record growth was relatively widespread but many EMRs are not optimized to plot the data leaving practitioners to plot data manually. Those without fully functional EMRs recognized the importance of this feature for ease and accuracy of reporting and sharing patient information. Other studies have found that even among highly skilled health professionals, the accuracy of plotting and interpreting growth data was surprisingly poor.<sup>24,25</sup> Multiple points of entry for patients and lack of shared EMRs with the recommended WHO growth charts in our healthcare system has the potential to lead to inconsistencies between healthcare providers, confusion for parents and inefficient data management.

As evidenced by duplicated efforts and differences amongst health disciplines performing RGM noted in this study, there appears to be a lack of interdisciplinary collaboration related to RGM. Clear and consistent, evidence-based provincial RGM policies and guidelines are needed to address inconsistencies and improve health care efficiency. Ideally, such interdisciplinary education around these guidelines would begin during post-secondary education, fostering a culture of teamwork and broader understanding of public health issues such as RGM.

### Limitations

Family Physicians were under-represented in the study, however, there was little inter-provider variation within the sample of physicians and findings from other studies of FPs performing RGM were consistent with the responses obtained from the small FP sample in this study.<sup>16</sup> Males represented only 4% of the participants, likely reflecting the composition of the population doing RGM, many of whom are members of female-dominated disciplines (nurses and midwives). The health regions were not equally represented which may have affected the data, and the study is geographically limited to the province of British Columbia. The comments and responses from midwives were limited to the first six weeks, the time when infants are usually discharged from midwifery care. The research team did not include a member from midwifery.

### CONCLUSION

This study demonstrated widespread utilization of RGM but also revealed intra- and inter-disciplinary knowledge gaps, duplication, challenges and inconsistencies in practice among primary care providers. These findings reflect the lack of evidence to support the practice and more research is required to inform consistent trans-disciplinary guidelines, policies and education. There is also a need for more research regarding potential harms, costs and benefits from the parents' perspective and a cost-benefit evaluation of paediatric RGM and its impact on long-term health outcomes.

Several changes should be considered based on the findings of this study. Practitioners should recognize the inherent challenges associated with RGM, particularly with interpretation and communication of results to parents and the potential associated risks. To start to mitigate these risks, practitioners should ensure that they are using primarily proportional measures (weight-for-length) and should have EMRs that automatically plot growth on appropriate charts. Policy-makers and individual practitioners should re-evaluate the frequent duplication of RGM among different providers at similar intervals as some health authorities have already done. The issue of RGM presents an example of how improved interdisciplinary collaboration could improve the efficiency of our primary healthcare system.

The data underlying this article will be shared on reasonable request to the corresponding author.

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## Appendix A: Questions Included in the Survey

### 1. Profession

- Family physician
- Public health nurse/Registered nurse
- Nurse practitioner
- Registered midwife
- Other (please specify...) \_\_\_\_\_  
\_\_\_\_\_

### 2. Gender

- Male
- Female
- Other (please specify...) \_\_\_\_\_  
\_\_\_\_\_

### 3. Please indicate the age group to which you belong

- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70 or above

### 4. How many years have you been practicing?

- 1-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21+ years

### 5. In what Health Authority region do you primarily practice?

- Northern Health
- Interior Health
- Vancouver Island Health
- Vancouver Coastal Health
- Fraser Health
- Provincial Health Services Authority
- Other (please specify...) \_\_\_\_\_  
\_\_\_\_\_
- Prefer not to answer

### 6. At what ages between 0-24 months do you routinely aim to perform growth monitoring?

(Check all that apply)

- |  |                                 |
|--|---------------------------------|
| <input type="radio"/> 1 week                                   | <input type="radio"/> 7 months  |
| <input type="radio"/> 2 weeks                                  | <input type="radio"/> 8 months  |
| <input type="radio"/> 3 weeks                                  | <input type="radio"/> 9 months  |
| <input type="radio"/> 4 weeks                                  | <input type="radio"/> 10 months |
| <input type="radio"/> 6 weeks                                  | <input type="radio"/> 12 months |
| <input type="radio"/> 2 months                                 | <input type="radio"/> 14 months |
| <input type="radio"/> 3 months                                 | <input type="radio"/> 16 months |
| <input type="radio"/> 4 months                                 | <input type="radio"/> 18 months |
| <input type="radio"/> 5 months                                 | <input type="radio"/> 20 months |
| <input type="radio"/> 6 months                                 | <input type="radio"/> 24 months |
| <input type="radio"/> Other (please specify...) _____<br>_____ |                                 |
| <input type="radio"/> Not applicable                           |                                 |

### 7. What method do you primarily use to assess/monitor infant growth between birth and 2 years of age?

(Check all that apply)

- Weight-for-age
- Height/length-for-age
- Weight-for-length
- Head circumference
- BMI-for-age
- Other (please specify...) \_\_\_\_\_  
\_\_\_\_\_
- Not applicable

Additional Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### 8. Do you use an Electronic Medical Record (EMR) system in your practice?

- Yes
- No

#### a) If YES, do you use it to enter and plot paediatric growth data?

- Yes
- No

### 9. Please identify which methods you use in your practice to assess/monitor infant growth between birth and 2 years of age. (Check all that apply)

- 2000 Centers for Disease Control and Prevention (CDC) Growth Charts
- 2006/2007 World Health Organization (WHO) Growth Charts
- I use standard growth charts but I'm not sure which ones.
- I use my own professional judgment to assess/monitor paediatric growth patterns.
- Other (please specify...) \_\_\_\_\_  
\_\_\_\_\_

Additional Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### 10. Is there any further feedback or information you wish to add about the usefulness of infant growth monitoring?

Additional Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_