



# Are rural general practitioner – obstetricians performing too many prenatal ultrasound examinations? Evidence from western Labrador

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## Abstract

**Objective:** To determine the frequency of prenatal ultrasonography (PNU) in western Labrador in 1994, assess the appropriateness of the ultrasound examinations according to current guidelines and determine whether there was any relation between number of PNU examinations and patient management and obstetric outcomes.

**Design:** Review of all obstetric charts and PNU requisition forms for all deliveries in one hospital in 1994.

**Setting:** Labrador City and Wabush, Newfoundland.

**Results:** During the study period, there were 103 singleton deliveries, and these mothers underwent a total of 225 PNU studies (mean 2.16 studies per delivery). More than half (53.3%) of the examinations were classified as inappropriate. There were no significant differences in the number of studies between low- and high-risk pregnancies or between uncomplicated deliveries and those in which induction or instrumental or operative delivery occurred, nor was there any relation between number of PNU examinations and maternal or neonatal outcome.

**Conclusion:** Compared with PNU use as recommended by the Canadian Task Force on the Periodic Health Examination, this type of examination was overused in Labrador City and Wabush, although the rate of use was comparable to that reported in other Canadian studies. This overuse was not associated with any identifiable effect on maternal or neonatal outcome or on the management of pregnancy and labour. More judicious use of PNU, in accordance with evidence-based guidelines, is recommended.

## Résumé

**Objectif :** Déterminer la fréquence des échographies prénatales dans l'ouest du Labrador en 1994, évaluer la pertinence des examens échographiques selon les lignes directrices actuelles et déterminer s'il y a un lien entre le nombre d'échographies, le traitement des patientes et les résultats obstétricaux.

**Conception :** Examen de tous les dossiers obstétricaux et des commandes d'échographies prénatales pour tous les accouchements réalisés à un hôpital en 1994.

**Contexte :** Labrador City et Wabush, Terre-Neuve.

**Résultats :** Au cours de la période d'étude, il y a eu 103 accouchements d'un fœtus unique et les mères en cause ont subi au total 225 échographies prénatales (moyenne de 2,16 par accouchement). Plus de la moitié (53,3 %) des examens ont été jugés inappropriés. Il n'y avait aucune différence significative dans le nombre d'examen entre les grossesses à faible risque et à risque élevé ou entre les accouchements sans complication et ceux qu'il a fallu provoquer ou pour lesquels il a fallu utiliser des instruments ou pratiquer une intervention chirurgicale, pas plus qu'il n'y avait de lien entre le nombre d'échographies prénatales et le résultat pour la mère ou le nouveau-né.

**Conclusion :** Comparativement à l'utilisation des échographies prénatales recommandées par le Groupe d'étude canadien sur l'examen médical périodique, on a eu recours excessivement à ce type d'examen à Labrador City et à Wabush,

## Evidence

## Études

At the time this article was submitted, Dr. Thompson was a resident, Rural Additional Skills — Anaesthesia, University of Alberta, Edmonton, Alta.; she is now a physician practising in Barrhead, Alta. Mr. Freake is a Research Assistant and Dr. Worrall is Director at the Centre for Rural Health Studies, Whitbourne, Nfld.

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même si le taux d'utilisation était comparable à ceux qu'on a signalés dans le cadre d'autres études canadiennes. On n'a pas établi de lien entre cette utilisation excessive et tout effet identifiable sur les résultats pour la mère ou le nouveau-né ou sur la gestion de la grossesse et de l'accouchement. On recommande l'utilisation plus judicieuse de l'échographie prénatale conformément aux lignes directrices fondées sur des données probantes.

**I**dentification of high-risk pregnancies early in prenatal care is widely used to anticipate and, when possible, prevent maternal and fetal morbidity.<sup>1,2</sup> Most risk assessment systems, including those primarily developed and refined in Canada, seek to identify demographic features, the aspects of the patient's obstetric history and events in the current pregnancy that put either the mother or the fetus, or both, at risk.<sup>3,4</sup> These risk assessment systems form the basis for risk-scoring on provincial prenatal forms.<sup>5,6</sup> In addition, certain screening procedures, including prenatal ultrasonography (PNU), are suggested to aid physicians in following the pregnancy to term.<sup>7-9</sup> In Canada, rural patients and physicians are often far removed from specialist and diagnostic services, and it could be argued that screening is more important in this setting than in urban areas. However, there is little current data on the utilization of PNU in rural Canada.<sup>10</sup> A review of the literature revealed only 2 studies based on Newfoundland obstetric practice, both from Baie Verte — one performed in 1976<sup>11</sup> and the other in 1981.<sup>12</sup> No Newfoundland data have been published since the introduction, in 1981, of standardized prenatal record-keeping and risk-scoring, nor are there data reflecting recent shifts in prenatal and intrapartum management, such as continuous fetal monitoring or use of vacuum extractors.

In current Canadian practice, PNU is used for 2 different types of screening. In the first type, a single ultrasound examination is done in the second trimester for the purposes of estimating gestational age and detecting major malformations or multiple fetuses. In the second type, 2 serial examinations are performed, one each in the second and third trimesters, to screen for intrauterine growth retardation (IUGR). The Canadian Task Force on the Periodic Health Examination,<sup>9</sup> using meta-analysis of the published trials, determined that there is fair evidence to support a single screening PNU examination in normal pregnancy without a specific clinical indication (class B recommendation). While giving this tentative support for routine screening, the task force recognized that such a guideline might lead to increased utilization of PNU.<sup>9</sup> Greater controversy surrounds the use of routine serial ultrasonography to screen for IUGR. Given that the evidence demonstrating improved outcomes with serial ultrasonography is poor,<sup>13,14</sup> the task force recommendation is a class C recommendation, i.e., there is no evidence to include or not include such screening in prenatal care in

low-risk pregnancy.<sup>9</sup> The choice of whether to perform serial ultrasonography has so far been left to the attending physician.

It appears that even the most experienced obstetricians are moving toward greater use of diagnostic tests to support their management decisions.<sup>15,16</sup> One would expect, then, that in an isolated rural location such as western Labrador, there would be even more conservative management of potentially high-risk pregnancies. At the same time, fiscal restraints dictate that health care resources be selectively allocated and that ineffective techniques and practices be identified and eliminated. Although each rural site is different and each is bound by the availability of diagnostic and support services, an attempt is needed to determine what resources are best used to manage both high- and low-risk obstetric patients in the rural setting, so that both the patient and the health care system are better served.

The objectives of this study were, first, to determine the frequency of PNU in western Labrador in 1994; second, to assess the appropriateness of these examinations according to current guidelines for the use of ultrasonography in pregnancy; and third, to assess the relation between PNU and the management of the pregnancy and labour, as well as that between PNU and maternal and neonatal outcomes.

## Methods

Labrador City and Wabush, Nfld., constitute an isolated community of approximately 11 000 people. The community is located 3 hours by air from St. John's, about 90 minutes by air from Quebec City, more than 8 hours by gravel highway from Baie Comeau, Que., and 12 hours by road from Happy Valley — Goose Bay, Nfld. Obstetric care is provided by 3 of the 5 local GPs, and cesarean sections are performed by the staff general surgeon. Obstetric anesthesia is administered by the staff anesthetist and occasionally by one of the GPs, who has anesthesia training. An obstetrician-gynecologist flies in for outpatient clinics and gynecologic surgery approximately once every 6 weeks. Two of the 3 physicians who do obstetrics have local obstetric consultative privileges for some high-risk procedures such as induction and augmentation of labour and forceps delivery; they are also authorized to make the decision to proceed to cesarean section. A high proportion of



deliveries are attended by second-year residents in family practice from Memorial University, and the patient's family physician attends when there are difficulties with the delivery or neonatal complications. The hospital serves as a regional site for delivery for patients referred by the physician in Churchill Falls, as well as for emergency or elective cesarean sections for patients from neighbouring Fermont, Que. Ultrasound imaging is done on site by radiology technicians; the films are sent to St. John's by mail for reading by a radiologist and are then returned by mail. It takes 1 to 2 weeks for reports to be returned to Labrador City.

### Data collection

For the period Jan. 1 to Dec. 31, 1994, we reviewed all requisitions for obstetric ultrasonography and all delivery reports from the Captain William Jackman Memorial Hospital, Labrador City. From the requisition slips, we recorded the reasons for each ultrasound examination, and from the subsequent reports, we recorded the calculated gestational age, any abnormalities of the fetus or placenta that were reported, and whether suggestions were made by the radiologist.

Data were also abstracted from the charts of both the mother and the newborn, including the Newfoundland Prenatal Record (or Quebec equivalent) and live-birth records. These data included maternal age, parity, gestational age at delivery, use of ultrasonography, results of gestational diabetes screening, presence or absence of hypertension, other risk factors, whether labour was induced or augmented, type of delivery, use of episiotomy, maternal complications at delivery and whether the mother saw an obstetrician. Fetal Apgar scores at 1 and 5 minutes, birth weight (normal range 2500–4500 g), any fetal complications and mode of infant feeding were also recorded. In addition, the number of and indications for interhospital transfers were documented. Each physician was asked to supply data for patients who had been transferred out on a nonurgent basis for further obstetric management during the study period. Any missing data were found by searching through the corresponding physician's office chart.

### Classification of ultrasound examinations

All PNU studies were classified by the investigators as "appropriate" or "inappropriate," as follows.

#### Appropriate

- Any PNU ordered for specific medical reasons, i.e., bleeding, abdominal pain, obvious size–date discrepancies, results of biophysical profile or inability to

determine fetal position clinically, regardless of gestational age.<sup>17</sup>

- Any PNU ordered between 10 and 20 weeks gestational age for the purposes of dating and screening for congenital abnormalities. The literature supports the use of PNU for determination of gestational age, and, depending on the size of the fetus, either crown–rump length (CRL) or biparietal diameter (BPD) with femur length is measured. There is no increase in accuracy for CRL measurements obtained before 11.5 weeks gestational age relative to later CRL measurements (up to 14 weeks) or BPD measurements before 18 weeks.<sup>18</sup> Furthermore, optimal information on fetal morphologic features and placental position is obtained later, between 16 and 18 weeks. Therefore, given that the optimum amount of information can be obtained between 12 and 18 weeks gestation,<sup>18</sup> our generous time frame of 10 to 20 weeks allowed for scheduling difficulties and some errors in estimation of gestational age based on menstrual history.

#### Inappropriate

- Any PNU ordered for dating before 10 weeks or between 20 and 28 weeks gestational age. Before 10 weeks little information can be gained about fetal morphologic features, and after 20 weeks dates based on menstrual history are generally as accurate for assessment of gestational age.<sup>18</sup> We also recorded whether additional PNU studies were required because of this suboptimal examination.
- Any PNU ordered beyond 20 weeks gestational age for the indication of routine monitoring of growth (with no clinical evidence of IUGR). Such imaging was classified as inappropriate because current Canadian guidelines<sup>9</sup> suggest a lack of evidence to support this indication.
- Any PNU performed as a result of a suggestion by the radiologist to repeat the scan because of the *technical* inability to conclusively demonstrate placental position. It can be very difficult to detect the true frequency of placenta previa by ultrasound before the third trimester (in one study,<sup>19</sup> 64 of 1000 pregnancies had ultrasound diagnosis of marginal or complete placenta previa, whereas the incidence of placenta previa at birth was 1 in 1000); however, with an adequate scan the diagnosis of placental position should be possible, especially in complete placenta previa.<sup>7,19</sup> Consequently, for reports of follow-up examinations that recorded normal placental position, the subset of additional scans was classified as inappropriate. This group did not include any reports with a conclusive diagnosis of placenta previa.

## Statistical methods

Data were analysed with Epi-Info (version 5.0, USD Inc., Stone Mountain, Ga., 1990). Descriptive statistics were compiled for PNU use, patient demographics and other medical information about the management of the pregnancies. One-way analysis of variance was used to test differences between means. An  $\alpha$  value of 0.05 was specified for all statistical tests.

## Results

During the study period, 107 women from Labrador City and vicinity had babies. Of these, 103 women delivered babies beyond 26 weeks gestational age in Labrador City; the other 4 were urgently transferred to a tertiary care centre before delivery. No patients were electively transferred by their family physicians for continuing specialist management during the study period. Information about the study population is presented in Table 1. The overall mean age was 26 years, that for primigravida women 24.2 (range 15 to 36) years and that for multigravida women 28.3 (range 18 to 41) years.

Of the 102 women for whom risk level had been recorded, 69 (67.6%) were considered at low risk at the onset of pregnancy, and 33 (32.4%) were identified as being at potentially high risk, on the basis of factors identified in the Newfoundland Prenatal Record. In our study population, the factors leading to an initial designation of high risk included prior cesarean section (in 9 women), previous complicated obstetric history (in 8), pre-existing medical problems (in 6), age of primigravida less than 16 years or greater than 35 years (in 5) and morbid obesity (in 5). Some women initially designated as low risk were reclassified as being at high risk because of the development of pregnancy-induced hypertension (in 7), gestational diabetes (in 6) and premature labour (in 5).

In cases in which active management of labour was required, augmentation was accomplished by amniotomy or infusion of oxytocin, and induction was accomplished by one of these methods with or without prostaglandin E<sub>2</sub> cervical gel.

In 12 cases (11.6%) postpartum complications developed, specifically hemorrhage (6 cases), infection (3), extensive perineal damage (2) and retained products (1), but there were no maternal deaths. There were no stillbirths or major congenital abnormalities, and no infants had to be transferred for intensive neonatal care, although 15 (14.6%) had one or more of the following complications: weight less than 2500 g or greater than 4500 g (3 cases), Apgar score less than 7 at 5 minutes (7), Erb's paralysis (2), admission to a special care nursery because of a respiratory condition (3) or presumed infection (3).

## PNU results

The ultrasound data set was complete, with the exception of the records for one mother, who underwent a total of 7 examinations (all in St. John's, while the patient was under the care of an obstetrician), for which only 3 reports could be located. She returned to Labrador City for the delivery. A total of 225 scans were ordered for the 103 women, an average of 2.16 scans per delivery (range 0 to 7).

One hundred (97.1%) of the women underwent at least 1 PNU examination, 87 (84.5%) underwent at least 2, and 31 (30.1%) had 3 or more, accounting for an additional 38 PNU examinations (Table 2).

Of the 225 PNU examinations, 120 (53.3%) were classified as inappropriate (Table 2). Of these, 61 (50.8%) were ordered for serial monitoring of growth, 37 (30.8%)

**Table 1: Characteristics of the 103 singleton deliveries that occurred in Labrador City, Nfld., in 1994 in relation to frequency of prenatal ultrasonography (PNU)**

Characteristic	No. (and %) of cases	No. of PNU studies, mean (and SD)*
<b>Gravidity</b>		
Primigravida	58 (56.3)	2.22 (0.73)
Multigravida	45 (43.7)	2.07 (0.89)
<b>Risk†</b>		
Low	69 (67.6)	2.20 (0.76)
High	33 (32.4)	2.12 (0.82)
<b>Length of gestation‡</b>		
Pre-term (< 37 weeks)	3 (2.9)	2.00 (1.00)
Full term (37–41 weeks)	94 (91.3)	2.22 (0.75)
Post-term (> 41 weeks)	6 (5.8)	1.17 (0.98)
<b>Type of labour</b>		
Spontaneous	70 (68.0)	2.14 (0.82)
Augmented	26 (25.2)	2.23 (0.82)
Induced	7 (6.8)	2.00 (0.58)
<b>Type of delivery</b>		
Vaginal	57 (55.3)	2.16 (0.86)
Forceps or vacuum	16 (15.5)	2.19 (0.66)
Cesarean section	30 (29.1)	2.13 (0.78)
<b>Postpartum (maternal) complications</b>		
Present	12 (11.6)	2.25 (0.45)
Absent	91 (88.3)	2.14 (0.84)
<b>Neonatal complications</b>		
Present	15 (14.6)	2.20 (0.68)
Absent	88 (85.4)	2.15 (0.83)

\*Standard deviation.

†Risk score was not available for one woman.

‡Significantly fewer PNU examinations for women with post-term delivery (one-way analysis of variance,  $p < 0.05$ ).



were inappropriately timed, and 22 (18.3%) were ordered because of a technical problem (Table 3).

One-way analysis of variance revealed no significant differences in the number of PNU examinations between the various categories for gravidity, risk level, type of labour, type of delivery, maternal postpartum complications and neonatal complications (for all comparisons,  $p > 0.05$ ) (Table 1). However, for the length of gestation, patients with post-term delivery underwent significantly fewer PNU examinations ( $p < 0.05$ ) (Table 1).

## Discussion

Although this data set was relatively small, the overall demographics of our study population, including age and parity, compared well with those of other maternal studies in Canada.<sup>6,20-27</sup> The prevalence of risk factors in this group was similar to that for the Canadian obstetric population, as was the frequency of intrapartum interventions such as induction and augmentation.<sup>6,20-27</sup>

### Prenatal ultrasonography

Allowing for compliance with the class B recommendation of the Canadian Task Force on the Periodic Health Examination for routine second-trimester PNU, we judged the appropriateness of the 100 first PNU examinations for patients in our study population. Even with the generous time limit that we allowed for the first PNU (10 to 20 weeks gestational age, compared with the usual recommendation of 12 to 18 weeks), we found that 24 of these initial PNU examinations had been done at a suboptimal time. This is a relatively minor problem that could easily be addressed through physician education.

However, the situation with regard to second and subsequent PNU examinations seemed worse. Of 125 such studies, we judged that 96 were unnecessary or inappropriate. A solution to this apparent overuse is not obvious.

The situation in western Labrador does not seem different or worse than that in the rest of Canada. Despite the lack of strong evidence, the use of at least one PNU examination is nearly universal across Canada. In fact, PNU use is increasing rapidly and for 1989-90 averaged

2.19 examinations per delivery in Ontario and 1.75 in British Columbia, up from 1.06 in Ontario and 0.88 in British Columbia in 1981-82.<sup>10</sup> Such imaging adds a significant cost to each pregnancy. Our study confirmed this trend for Labrador: 97.1% of the women underwent at least 1 PNU examination, 84.5% underwent at least 2, and 30.1% had 3 or more.

### Relation between PNU and maternal and neonatal outcomes

If PNU is being performed in the hope of detecting abnormalities in either the baby or the mother, it might reasonably be expected that more such examinations would be performed in cases in which maternal or neonatal complications subsequently developed. We found no evidence to support this supposition: the number of PNU examinations ordered was not significantly different between mothers who remained at low risk and experienced no complications and women who underwent cesarean section, who had induced or augmented labour, who had originally been classified by the prenatal risk-scoring system as being at high risk, who experienced complications during or after labour or whose babies experienced complications. These results agree with those reported for larger multicentre trials.<sup>13,14</sup> Interestingly, in our population, significantly fewer PNU examinations were performed for women who delivered post-term, a group for whom biophysical profiles are commonly ordered. The reason for this difference is unclear. The results of biophysical profiles are a recognized indication for late-trimester PNU,<sup>17</sup> although no profiles were ordered by requisition in Labrador City. One possible reason for the difference is the fact that there was no radiologist on site to officially report results, whereas the results of non-stress tests, which are read immediately by the family physician, are readily available as an indicator of fetal well-being.

### Why so many PNU examinations?

Several factors may have contributed to the high rates of multiple PNU examinations in Labrador.

The first would seem to be the apparent high rate (22

**Table 2: Appropriateness of first, second and subsequent PNU examinations in each pregnancy\***

PNU	Appropriate	Inappropriate	Total
First	76	24	100
Second	10	77	87
Subsequent	19	19	38
Total	105	120	225

\*Appropriateness criteria are outlined in the Methods section.

**Table 3: Reasons for designating PNU studies as inappropriate**

PNU	Suboptimal timing	PNU ordered for technical reasons	PNU ordered for "serial" monitoring	Total
First	24	0	0	24
Second	13	14	50	77
Subsequent	0	8	11	19
Total	37	22	61	120



cases or 9.8%, compared with 6.5% in other studies<sup>14,19</sup>) of second-trimester PNU reports that stated that “an abnormality in the fetus or placental position cannot be ruled out with this scan; suggest a repeat scan in later pregnancy” (paraphrased). The medicolegal environment in the 1990s has put more pressure on both radiologists and family physicians to protect themselves as much as possible from litigation, a situation that has led to greater reliance on technology to confirm diagnoses. In addition, the PNU examinations were performed by the local radiology technicians and could not be reviewed immediately by a radiologist, a practice more common in larger centres. Because the information obtained from PNU depends both on fetal gestational age and on operator-dependent technical accuracy,<sup>7</sup> this situation may have led to more requests for repeat imaging from the radiologist reading the films in St. John’s. The suggestion to repeat imaging was carried out in 21 (96%) of the 22 cases, and the results of all follow-up studies were normal. We wonder whether the repeat scans could have been avoided if the patients had undergone imaging at 14 to 18 weeks gestational age at a larger centre with radiologists on site. It could be argued that an increase in the use of PNU in rural settings such as western Labrador is appropriate and that it represents a trade-off that the health care system must make to maintain competent obstetric care by family physicians, especially in locations where there is no obstetric or radiology specialist back-up.

A possible second factor was the use of PNU at inappropriate times. Even with a liberal definition of “second trimester” (between 10 and 20 weeks gestational age), we found that 16 dating scans were performed too early to yield optimal information on gestational age or fetal and placental abnormalities; furthermore, the screening PNU was performed somewhat late (between 20 and 26 weeks) in 21 cases. Limiting such “screening ultrasonography” to the recommended period of 14 to 18 weeks after the last menstrual period would certainly yield more accurate information and would obviate the need for a second “growth confirmation” scan.

Another factor that might have influenced the rate of multiple PNU examinations was patient expectation. If third-trimester PNU is commonplace in the community, then it might seem to the patient that the management of her pregnancy is abnormal if the second scan is not ordered.

### **Limitations of the study**

This was a retrospective observational study. As such, the data were amenable to only weak inferences. We assumed that all of the relevant information needed for our study had been recorded in the charts of mothers and newborns and on the imaging requisition forms, although

we recognize that these forms are often not fully completed (the date of the last menstrual period is most frequently omitted). Menstrual history and age as determined by PNU were not compared, although this might have clarified the indications for some of the “inappropriately” ordered examinations. In addition, only one hospital site was selected for the study, with 103 women serving as the study population. We cannot be sure that this group was representative of the general maternity population of Canada. However, we have no reason to suspect that it was not.

### **Conclusions**

According to our criteria, which were based on recommendations of the Canadian Task Force on the Periodic Health Examination, too many PNU examinations were ordered, with no identifiable effect on outcomes or the management of labour. However, the rate of PNU use in Labrador appears similar to that of other areas in Canada. We suggest more judicious use of PNU, according to current evidence-based guidelines.

This study has identified issues for future research and has perhaps shown where better physician education might lead to a reduction in “routine” PNU, with attendant decreases in the costs to the health care system. Labrador physicians apparently use good clinical judgement for risk management and obstetric referral: the antenatal consultation rate to obstetricians based on identified prenatal risk factors is already very low, with no apparent detrimental effect on patient outcomes. We suggest that routine use of a second PNU examination could be discontinued in favour of its use by clinical indication only. This could be accomplished without compromising the safe obstetric care that Labrador physicians are already providing, despite their geographic and professional isolation.

We thank the family physicians in Labrador City for access to prenatal records. Staff in the medical records and diagnostic imaging departments were of great assistance in finding data for the study.

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## LOGIE MEDICAL ETHICS ESSAY CONTEST DEADLINE: JUNE 1, 1998

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