

Different standards in growth centiles for fetuses and newborns: a survey in Europe

Tabelas de crescimento diferentes para fetos e recém nascidos: um questionário na Europa

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Abstract

Overview and aims: We aimed to characterize fetal growth/birthweight reference charts and standards use throughout Europe.

Study Design: Observational descriptive cross-sectional

Population: European hospitals with over 1500 births per year

Methods: We randomly selected 20 hospitals matching inclusion criteria from each of 17 European countries. We contacted the Neonatology and Obstetrics departments in each hospital to answer a short online questionnaire.

Results: We received a response rate of 19%, which corresponds to 89 answered questionnaires. Most specialists use birthweight reference charts and agree they are important. 95% of departments recommend only one chart. 72% of all respondents believe the reference charts they use are adequate, and only 21% adjust them for specific characteristics such as gender. Less than 1/3 of departments use reference charts produced for or validated in the local population. Neonatologists and obstetricians do not use the same charts in 12 out of 14 valid pairs.

Conclusions: There is a wide variety of reference tables used throughout Europe and within most countries. The lack of validation and adjustment of important variables, such as sex and ethnicity, is the rule, added to the fact neonatologists and obstetricians often use different charts, which may lead to confusion. This also has impact in the diagnosis of important conditions such as Fetal Growth Restriction (FGR) and macrosomia.

Keywords: Reference charts; Reference standards; Birthweight; Fetal development.

INTRODUCTION

Since the seminal work by Lubchenco *et al*¹, which arguably introduced the concept of fetal growth po-

tential, many fetal references and standards were created to define normal or abnormal growth, either based on ultrasound estimates or birthweight². By their nature, it is not possible to recommend a universal standard/reference, as fetal growth is affected by multiple variables, and its selection rests with the health professionals. These charts impact the sensibility and specificity in finding abnormal growth³. Various papers have shown the inadequacy of multiple reference charts classifying specific European populations⁴⁻⁷. Thus, diagnoses that rely on this classification, such as Fetal Growth Restriction (FGR), Small for Gestational Age (SGA) or macrosomia, may be wrongly attributed. The use of customized charts is a more recent trend that has shown merit⁸, and projects such as Inter-growth-21st⁹ aimed to develop global biometric charts.

We sought to find which charts are used and how are

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they used in obstetrics and neonatology departments throughout Europe.

MATERIALS AND METHODS

Observational, descriptive, cross-sectional study. We reviewed the number of hospitals and births per year in Western European countries where this information was publicly available in official web pages or after contact with the respective national statistics office. We selected a maximum of 20 Hospitals, with over 1500 births per year, from each of the included countries. This number was selected in order to ensure a representative sample while being manageable in the contact gathering phase. Whenever a country had a superior number of candidate hospitals they were randomly selected. This number of births was chosen to increase the chances that any given hospital would also have a neonatology (and Neonatal Intensive Care Unit – NICU) department, as well as to ensure a relatively homogeneous sample.

We inquired the institutions for contact information of Obstetrics and Neonatology departments, when this was not readily available. We sent an e-mail explaining the purpose of this study as well as providing a unique link to a web based questionnaire to be answered by the chief doctor of the department or someone designated by him. Each department was contacted independently and the answers were assured as confidential. When no answer was received within two weeks, a new e-mail was sent, and a third e-mail after one additional week.

The questionnaire was written in English, mainly closed format, with multiple-choice questions. It characterized the hospital (Country, number of births per year), the use of fetal growth standards (use, charts, adjustment for fetal/maternal variables, validation, thoughts on appropriateness of said tables and reasons for its particular use). The questionnaire allowed for comments and additional input where needed (e.g. if the chart or charts used were not in the possible choices). We scanned all “other”, “National” and “local” answers, which warranted explanation and a comment in free text, grouping them whenever possible. These questions were presented in an online page created with the Medquest tool¹⁰. This webpage was only accessible via the provided unique links, each respondent could only see its own answers, and was open between March and September 2011. There were no ethical is-

sues to consider.

Data was analyzed in Excel 2013 (Microsoft Corp, Redmond, Washington) and IBM SPSS 21 (IBM Corp, Armonk, NY, USA), using descriptive statistics.

RESULTS

We gathered contact data from 17 countries: Austria; Belgium; Czech Republic; Denmark; England; Finland; France; Luxembourg; Northern Ireland; Norway; Portugal; Republic of Ireland; Scotland; Spain; Sweden; Switzerland; Wales. We subsequently contacted 480 departments from 240 Hospitals (Neonatology/Pediatrics and Obstetrics). On completion of the survey, we attained a global response rate of 19%, ranging from 0% to 65% (Figure 1). We obtained a sample of 89 completed questionnaires.

In order to characterize fetal growth 99% of respondents claimed their department regularly uses reference charts. In 95% of departments only one reference is recommended to the department, and in 92% of cases it is believed that this reference is used by all staff.

81% of respondents consider it is important to choose and appropriate fetal growth standard/reference chart and 72% consider the one in use adequate.

Some answers regarding the most used chart did not refer the paper reference when selecting “other” or “National”, but a colloquial reference: “Child Growth foundation” and “Royal college of Pediatrics and Child Health” were interpreted as the charts endorsed by these entities: UK-WHO Charts¹¹; “Astraia Software” was interpreted as the default reference for birthweight: Yudkin *et al*⁷; Perinatal Institute and Gestation.net were changed to the reference behind these customised curves: Gardosi *et al*¹².

Figure 2 depicts the main reference charts chosen by the respondents, in which they are further divided by specialty. The most selected charts among obstetricians were Hadlock’s¹³ and Maršál’s¹⁴ (the latter selected exclusively in Denmark and Sweden). Among neonatologists, the Lubchenco chart¹ was more often selected, followed by the UK-WHO¹¹. Five respondents claimed not being able to identify the publications used, while stating they used one.

Figure 3 depicts the main reason for the use of the reference chosen.

There were 14 valid answer pairs (14 hospitals in which we received a response from both obstetrics and neonatology departments). There was disagreement in

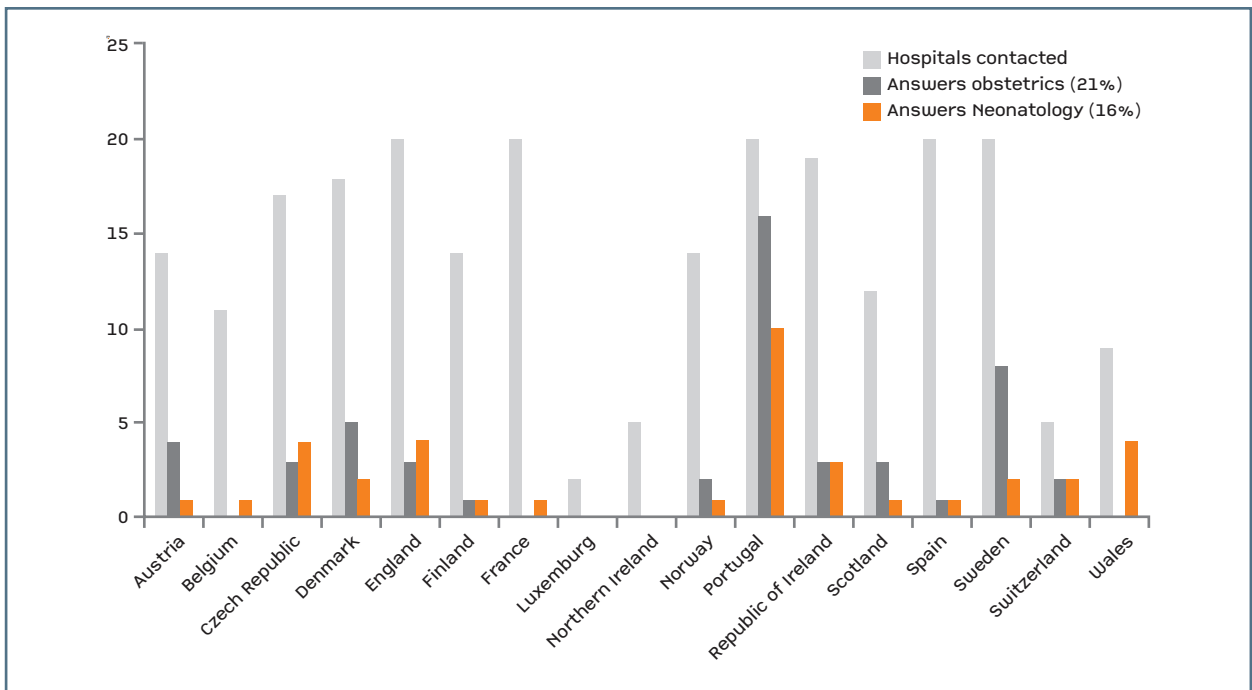


FIGURE 1. List of countries, questionnaires sent and responses received

12 of these pairs regarding the reference chart used, and both hospitals which stated the same answer were from Sweden.

Twenty-one percent of respondents use different tables in order to adjust for at least one maternal or fetal variable.

DISCUSSION

E-mail response rate is invariably low and has been declining over the years, probably because people are overwhelmed with such requests¹⁵. We tried to personalize contacts as much as possible, and contacted the departments at least three times, but our response rate was, still, low. Portuguese response rate was significantly higher, possibly because of the survey origin in a Portuguese university, but it was also easier for the authors to gather the appropriate (more direct) contacts. This low overall response rate limits extrapolation, especially outside Portugal, but some of the findings still warrant assessment.

Almost all departments inquired seem to use some sort of table/chart to plot the weight fetuses and/or newborns and assess risk regularly, and the number of departments that recommend or use a single reference

chart is very high. Roughly, over two thirds of respondents consider the chart they use as adequate, leaving a significant part of departments with inadequate choices (or lack of good possible choices) which may be considered as awareness to the issues discussed in this paper. There are however 19% that do not consider the selection of a chart important.

These tables, whether in the form of standards or population based references, whether birthweight or ultrasound based, are widely distributed, and various authors contributed throughout the years with new ones. The discussion of whether to select an in utero (ultrasound) or birthweight, as well a standard (normal, healthy) or population reference (population based) chart is controversial and outside the scope of this work, but it should be noted in our study data that doctors seem divided in this matter, given the range of choices in figure 3. This overwhelming number of individual papers with reference charts for birthweight, which limited the multiple choice in this question to charts that the authors considered more widely used may be another limitation to this work, although mitigated by the inclusion of free text options, and its subsequent scanning and grouping.

The plethora of publications with new charts is supported by the evidence, in which time and ethnicity, as

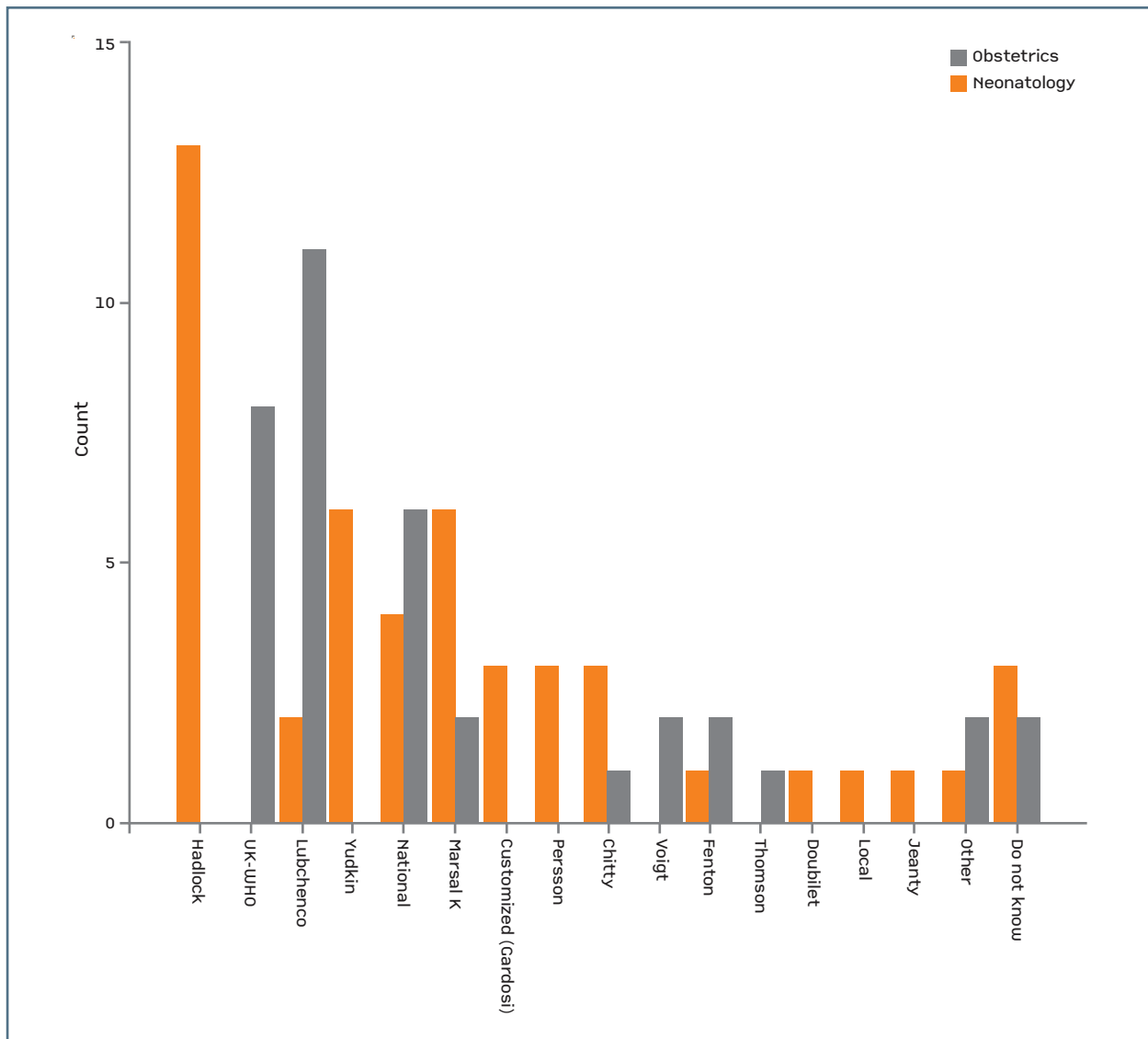


FIGURE 2. Primary growth/birth weight reference chart used in the department^{1,13,14,7,26,27,29-32}

well as a number of other variables, both constitutional and environmental^{12,16}, account for changes throughout years and regions. Adding to this, different methodologies may contribute for yet another source of variability among these publications¹⁷. This leads to a variety of references/standards and the need for validation for a particular population^{17,18}, which will probably reflect the described differences and allow for a better selection of charts^{4,19}. Yet it seems this is seldom done in Europe as only 17 % of respondents claimed this as the main reason for choosing a reference. An additional 23% selected the reference because it was produced for the local/national population,

but 17% claimed tradition (“It has been used for many years”). Simple validation would not be too hard: A set of birth data with gestational age (GA) and birth-weight would easily yield, for instance, the 10th and 90th actual centiles for 39 weeks, which could then be compared with multiple reference chart values for the same GA. This would give a broad picture of adequacy, which could be further explored. Recently, the inter-growth study⁹ was published, aiming to provide tools for global characterization of fetal anthropometric variables. These charts, which do not include birth-weight, are based in a multinational, multiethnic population. This “one size fits all” approach is, however, very

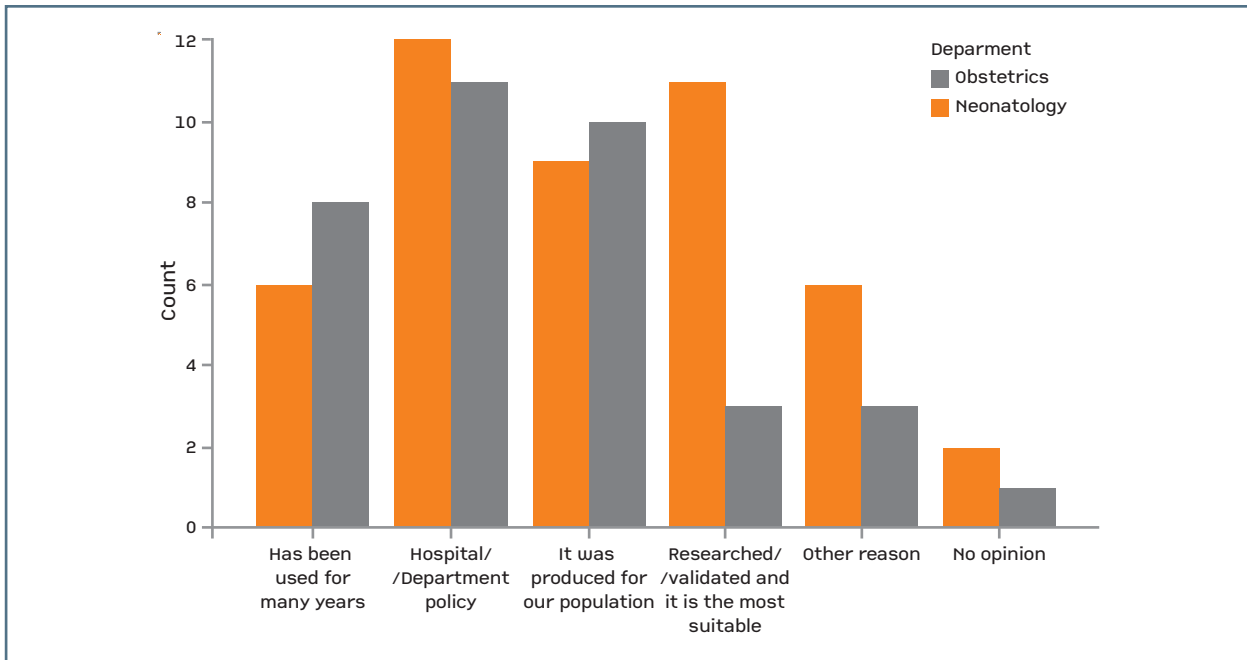


FIGURE 3. Main reason for use of a particular reference

different from the one advocated by customized charts⁸.

Many European neonatologists use the Lubchenco charts, produced with data from 5635 births within a middle class white population, 50 years ago, at an altitude of 1600m, in Denver, Colorado, USA¹. This paper, although a landmark one, is dismissed by current and larger data in the USA, which points its inadequacies characterizing contemporaneous and multiple region births^{20,21}. Studies in Europe reached the same conclusions, while trying to validate its data for local populations⁴⁻⁷.

Regarding adjustment for fetal or maternal variables, it is used routinely in less than one third of respondent departments (21,4%). It may be open to dispute whether or not accounting for these differences will impact outcomes^{2,22,23}, but it is certain that variables such as fetal sex or ethnicity have an important impact on growth patterns^{17,24,25}, and there are many charts that present these different reference charts for boys and girls^{7,14,21}. This reduces the difficulty in selecting and assessing multiple charts and/or making adjustments in a computer program (in the case of customized charts). In line with this answer, many reference charts selected as primary for growth/birthweight in the department (Figure 2), only present values for both sexes combined (Hadlock *et al*¹³; Lub-

chenco *et al*¹; Fenton *et al*²⁶; Jeanty *et al*²⁷).

Concerning charts used by obstetricians, Maršál *et al*¹⁴ and Hadlock *et al*¹³ are the ones most frequently used. They are both ultrasound based charts, and both quite small studies, compared to birthweight based papers (Hadlock's with 392 single measurements in different women, and Maršál's with 759 measurements in 86 women). They are both longitudinal, although the choice of using multiple scans for the same women may be methodologically flawed in the Maršál *et al* study, as it introduces a source of bias²⁸. Other references used, such as Yudkin's⁷ and Lubchenco's¹, are birthweight based, and this shows a rather divided specialty regarding the subject of in utero (US based) charts versus birthweight based.

It is striking to observe the low number of neonatology and obstetrics departments that, in the same institution, use the same reference (only 2 of a possible 14 pairs/hospitals). As both specialties use the most selected references in one instance or another, and there are almost no references produced solely for one specialty (in this setting), this is rather surprising and may lead to some problems in perinatal care. When different reference charts are used, doctors will often disagree on diagnosis regarding fetal/birthweight, as charts are bound to plot different centiles for the same input data. This, in turn, makes clinical discussion dif-

difficult when terms such as 10th centile are used (with different objective meanings for each reference chart - specialty), has an impact on clinical conduct, and may strike preoccupied parents as unacceptable (given differences in clinical conduct before and after birth).

Some of the respondents (5 out of 89) were not able to characterize or give a name to the reference that they stated was used in their department, and others provided vague hints to the source of the chart (such as the endorser). This happened in both specialties and may hint to the need to properly discuss, validate and then choose the references for use, in a way that doctors will understand where they come from, the help they may present, and, especially, their limitations.

CONCLUSION

There is a wide variety of reference tables used throughout Europe and within most countries, with the exception of Sweden and Denmark, which use mostly charts created within their borders, in both specialties. The lack of validation is an issue worth pondering, as it is feasible to sample the institution's births and plot them on one or more charts for a subjective, graphical analysis, or even comparing the extrapolated centiles for a few gestational ages in a table. The lack of adjustment of important variables, such as fetal sex or ethnicity, is the norm, and this practice will certainly change if validation is performed. Neonatologists and obstetricians, at least in each institution, should discuss the use of these reference charts and agree on them, to avoid confusion to professionals and parents. Validation may be the key in achieving consensus, as understanding the biases associated with an inadequate reference chart may lead to the selection of a more suitable one.

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