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Survey highlights important discrepancies between definitions of paediatric abnormal growth taught to medical students in 23 European countries

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ABSTRACT

Aim: This study compared the definitions of abnormal growth that are taught across Europe to explain previously reported variations in growth-monitoring practices.

Methods: We developed two online surveys in 2016 to obtain the definitions of abnormal growth in European countries and approached the national chairs of the European Confederation of Primary Care Paediatricians in 18 countries and the International Federation of Medical Students' Associations in 33 countries.

Results: We obtained definitions from 10 of 18 paediatricians and 18 of 33 students, covering 23 of the 33 European countries surveyed. Abnormal faltering growth was always defined, either by a single parameter (24%) or combined parameters (76%). Four static parameters were used: standardised height (100%), standardised weight (60%), standardised body mass index (12%) and distance to target height (20%). Two dynamic parameters were used: growth deflection (28%) and growth velocity (32%). The thresholds used to define abnormal faltering growth varied slightly in some cases and widely in others. Abnormal accelerated growth appeared in 52% of the definitions, with important variations in parameters and thresholds.

Conclusion: There were important between-country discrepancies in the definitions of paediatric abnormal growth that were taught in 23 European countries. Standardisation is vital.

INTRODUCTION

Growth monitoring of apparently healthy children aims to detect serious health conditions at an early stage, using both clinical expertise and algorithms that define abnormal growth (1). It is a very specific clinical screening activity, because it is repeated from birth to adulthood and almost universally implemented. An example of a similar activity in adult medicine is hypertension screening, which relies on procedures and definitions that are highly standardised at an international level, as recommended by the World Health Organization (WHO) for any mass screening programme (2).

Substantial empirical evidence shows that the current practices of growth monitoring are suboptimal worldwide, with long diagnostic delays for target conditions such as Turner syndrome, growth hormone deficiency, Crohn's disease, cystic fibrosis, precocious puberty or hypothalamic-pituitary lesions (3–11) and large numbers of futile referrals for children with normal growth variations (11–13). The potential cause of this suboptimal monitoring

Abbreviations
BMI, Body mass index; SD, Standard deviation; WHO, World Health Organization.

Key Notes

- This study compared the definitions of abnormal growth that are taught across Europe using online surveys completed by the national chairs of associations covering primary care paediatricians and medical students.
- We obtained definitions that covered 23 European countries, including static and dynamic parameters and thresholds for abnormal faltering growth and abnormal accelerated growth.
- There were important between-country discrepancies in the definitions of paediatric abnormal growth, and standardisation is vital.

could be the lack of standardisation in the definition of abnormal growth. Indeed, we have shown, as have others, that there are important variations in growth-monitoring practices in Europe, both at primary care and hospital levels, notably for the auxological parameters and thresholds used to define abnormal growth (14,15). Seven structured definitions have been proposed for abnormal growth (1). These definitions used simple criteria such as standardised height of less than −2 standard deviations (SD) or complex combinations of auxological parameters, such as distance to standardised target height or height growth velocity. None of these proposals have been fully validated according to methodological standards for clinical decision rules (1). Moreover, we previously showed that none of these definitions were used for monitoring growth by a panel of 1198 European paediatricians (15).

The aim of this 2016 survey was to explore the current definitions of abnormal growth taught during initial and postgraduate medical curricula in Europe. We wanted to decipher the reasons for suboptimal growth-monitoring practices and to gather evidence to support the need for their standardisation.

MATERIALS AND METHODS

The authors developed two European surveys for the potential targets of initial and postgraduate medical teaching activities, medical students and primary care paediatricians, to gather the definitions of abnormal growth currently taught in each European country. Then, we contacted the national chairs of the 18 member countries covered by the European Confederation of Primary Care Paediatricians, which is the medical society for primary care paediatricians in Europe. We also contacted the national chairs of the 33 countries covered by the International Federation of Medical Students' Associations, which is the world's largest organisation for medical students.

Potential participants were contacted by e-mail to participate in the survey between January and August 2016. They were asked to provide the definition of abnormal growth taught in their country, the growth charts recommended for growth monitoring and auxological parameters and the thresholds proposed to define abnormal faltering or accelerated growth. They were also asked to document the definitions with precise references, such as textbook and publications. The responses provided by the representative primary care paediatricians and medical students were independently analysed by two authors (PS and NH), and another author (MC) was consulted in case of discrepancies. If there was any discordance between the primary care paediatrician and the medical student for a given country, each one was contacted to reach consensus or to provide further information on the reason for the discrepancy. Definitions of abnormal growth were initially classified and compared according to the auxological parameters that were used: the static ones included standardised height, weight, body mass index (BMI) or distance to standardised target height, and the dynamic ones included growth deflection or growth velocity. Then, these factors were compared according to proposed thresholds used to define abnormal growth, after being converted from percentile to Z-scores, and expressed as SDs if needed.

RESULTS

We received complete responses from 10 (55%) of the 18 representative primary care paediatricians and 18 (54%) of the 33 representative medical students we contacted, and these included at least one definition of abnormal growth taught in 23 different European countries, resulting in a 70% response rate. For five countries, Germany, Italy, Lithuania, Spain and Switzerland, we received definitions of abnormal growth from both representative primary care paediatricians and medical students. In three of these cases, the two representatives agreed, and in two cases, they did not (Table 1). As a result, the following analyses were based on 25 distinct definitions of abnormal growth, with two each for Germany and Spain (Tables 1 and 2). In 18 (72%) of the 25 responses, these definitions involved the use of national growth charts, in six (24%) cases, they used the WHO Multicentre Growth Reference Study, and in the remaining two (8%) cases, they used the US Centres for Disease Control and Prevention growth charts.

All 25 taught definitions made reference to abnormal faltering growth (Table 1), based on a single parameter (n = 6, 24%) or a combination of parameters (n = 19, 76%). Four static parameters were used to define abnormal growth: standardised height (n = 25, 100%), standardised weight (n = 15, 60%), standardised BMI (n = 3, 12%) and distance to target height (n = 5, 20%). Two dynamic parameters were used: growth deflection (n = 7, 28%) and growth velocity (n = 8, 32%). At least one dynamic parameter was used in 13 of 23 (57%) countries. Thresholds used to define abnormal growth varied slightly in some cases, for example, for standardised BMI (from −2.05 to −2 SD). In other cases, they varied widely, for example, for standardised height (from −2.67 to −1.64 SD) and growth deflection (from −2.32 to −0.5 SD).

Of the 25 taught definitions, 12 addressed the definition of abnormal accelerated growth (Table 2), based on a single parameter (n = 4, 33%) or a combination of parameters (n = 8, 67%). Three static parameters were used to define abnormal accelerated growth: standardised height (n = 12, 100%), standardised weight (n = 7, 58%) and standardised BMI (n = 2, 17%) (Table 2). Two dynamic parameters were used: growth acceleration (n = 3, 25%) and growth velocity (n = 1, 8%). At least one dynamic parameter was used in half of the countries. There were important variations in the thresholds used to define abnormal accelerated growth (Table 2).

DISCUSSION

We found important between-country differences in definitions of abnormal growth taught during medical curricula in

Table 1 Definitions of abnormal faltering growth in children that were taught during the medical curriculum in Europe in 2016, by country

	Auxological parameters					
	Static				Dynamic	
Country and growth charts used	Height (SD)*	Weight (SD)*	BMI (SD)*	Distance to TH (SD)*	Growth deflection (SD)	Growth velocity (SD)
Austria, national	<−2					
Belgium, national	<−2					
Bulgaria, CDC	<−1.64					
Cyprus, WHO-MGRS/CDC	<−2	<−2	<−2			NC[†]
Czech Republic, national	<−2					
Finland, national	<−2	<−2				
France, national	<−2	<−2		<−2		NC
Germany[¶], national						
Medical students	<−2				<−0.67	
Primary care paediatricians	<−2	<−2				
Hungary, national	<−2	<−2				
Ireland, national/WHO-MGRS	<−2.67	<−2.67	<−2.05		<−2.05*	
Israel, no response	<−2					
Italy, national	<−2	<−2				
Lithuania, no response	<−2	<−2				
Malta, no response	<−2.05	<−2.05			NC	
Norway, national	<−1.96				<−2.05 or <−2.32[‡]	<−2.05
Poland, national/WHO-MGRS	<−2	<−2	<−2	<−1.5		<−1
Slovakia, national	<−2	<−2				<−0.67
Slovenia, national/WHO-MGRS	<−2	<−2		<−2		NC
Spain[¶], national						
Medical students	<−2	<−2		<−2		<−1
Primary care paediatricians	<−2					<−1.27
Sweden, national	<−2.5			<−1.5	<−1 or <−0.5[§]	
Switzerland, national/WHO-MGRS	<−2					
Turkey, national	<−2	<−2			NC	
United Kingdom, national/WHO-MGRS	<−2.67	<−2.67			<−2.05	
% of use	100	60	12	20	28	32
Threshold range	−2.67; −1.64	−2.67; −2	−2.05; −2	−2; −1.5	−2.32; −0.5	−2.05; −0.67

BMI = Body mass index; CDC = Centres for Disease Control and Prevention; WHO-MGRS = World Health Organization -Multicentre Growth Reference Study; SD = Standard deviation; TH = Target height.

*Standardised height, weight, BMI and TH.

[†]The parameter was used, but the thresholds of abnormality were not communicated.

[‡]The cut-off of <−2.05 SD was applicable before the age of five years, and <−2.32 was applicable after five years.

[§]Deflection growth <−1 SD in three months during the first year of life, deflection growth <−1 SD in six months and between 12 and 24 months, deflection growth <−0.5 SD per year after the age of 24 months, and deflection growth <−1 SD regardless of period after 24 months.

[¶]For these countries, definitions obtained from primary care paediatricians were based on fewer parameters than medical students and, or, they disagreed on the threshold of some parameters.

23 European countries. These differences were related to the auxological parameters used. Despite the fact that all the definitions used standardised height, the frequency that other static parameters were used, such as standardised weight and BMI or distance to standardised target height, varied widely, from 0% to 60%. The frequency of use of dynamic parameters to define abnormal faltering growth was also highly inconsistent, from 28% for growth deflection to 32% for growth velocity. Differences were also related to the thresholds used to define abnormal growth for each parameter. For the definition of abnormal faltering growth, threshold variations were narrow for some parameters, such as from −2.05 to −2 SD for standardised BMI. In contrast, they were wide for the static parameter of standardised height (−2.67 to −1.64 SD) and the dynamic parameter of growth deflection (−2.32 to −0.5 SD). Similar results were found for the definition of abnormal accelerated growth.

Such discrepancies in the definitions of abnormal growth taught during the medical curriculum in Europe could be scientifically explained by variations in conditions targeted by growth monitoring in each country. Indeed, some parameters are used for the early detection of particular conditions. For example, standardised BMI and height are used for the early detection of coeliac disease and Turner syndrome, respectively (16). Variations in targeted conditions could be related to regional epidemiologic variations, the existence of a biological screening programmes for

Table 2 Definitions of abnormal accelerated growth in children that are taught during the medical curricula in Europe, by country

	Auxological parameters				
	Static			Dynamic	
Country	Height (SD)*	Weight (SD)*	BMI (SD)*	Growth acceleration (SD)	Growth velocity (SD)
Austria	>2				
Czech Republic	>2				
Finland	>2	>2			
Germany	>2	>2		>0.67	
Hungary	>2				
Ireland	>2.3		>1.35†		
Lithuania	>2	>2			
Poland	>2	>2	>2		
Slovakia	>2	>2			>0.67
Switzerland	>2				
Turkey	>2	>2		NC	
United Kingdom	>2.67	>2.67		>2.05	
% of use	100	58	17	25	8
Threshold range	2; 2.67	2; 2.67	1.35; 2	0.67; 2.05	0.67

BMI = Body mass index; NC = Not communicated; PCPs = Primary care paediatricians; SD = Standard deviation; TH = Target height.
*Standardised height, weight, BMI and TH.
†The cut-off of >1.35 SD is applicable after age two years.

coeliac disease or the extension of the prenatal screening for Down syndrome using karyotype for Turner syndrome (1). However, we have shown that the consensus on target conditions of growth monitoring was rare at a national level in Europe, and this cannot explain between-country discrepancies in taught definitions (1). Such discrepancies could also be explained by different targeted performances. For example, in the United Kingdom, the definition of abnormal growth that was taught, namely standardised height of less than −2.67 SD, is used to provide specificity rather than sensitivity, which explains the very low threshold chosen (1). However, we have also shown that, for other European countries, no hierarchy between sensitivity and specificity has been defined (1). In conclusion, these variations only seemed to be related to the lack of effort to standardise the main aspects of the growth-monitoring screening activity, that is, the auxological parameters and thresholds for defining abnormal growth.

A definition of abnormal accelerated growth was rare and was only found in 12 of the 23 countries. Monitoring of abnormal growth acceleration has the potential to early detect obesity and several conditions as serious as central or peripheral puberty or late-onset congenital adrenal hyperplasia (17). Early detection is associated with better clinical outcome for these diseases. Sankilampi et al. (11) showed that the implementation of an algorithm to define abnormal growth was associated with a better detection rate of conditions responsible for abnormal accelerated growth. Thus, the lack of a definition of abnormal accelerated growth in half of the medical curriculum of the 23 European countries we surveyed may expose affected children to delayed diagnosis and treatment and should be corrected.

Our European surveys had some limitations. First, we used the directory of national representative of medical students and primary care paediatricians because no directory of Departments of Paediatrics of European universities was available. Second, our sample was not representative of all European medical students and primary care paediatricians from 33 European countries because they participated on a voluntary basis. However, our study did not aim to be representative because we had planned to collect national definitions from nationally representative members. Third, we did not study within-country variations because we included a single representative paediatrician and medical student in each country, assuming that taught definitions were based on national sources such as websites or handbooks, as confirmed by the representatives from many of the studied countries. We acknowledge that this identification strategy may have underestimated regional variations in the definitions that were taught. Thus, the variations in definitions taught in Europe may be much greater than reported, which strengthens our conclusion that there is a need for standardisation.

CONCLUSION

We believe that the discrepancies in definitions of abnormal growth taught during medical curricula in Europe that we observed contribute to the variability in growth-monitoring practices between countries, along with other variations such as growth charts. A lot is at stake with regard to growth monitoring, such as the early detection of several severe conditions and an increase in referrals for non-pathological growth variations, and this is not compatible with the variations that our study detected. In addition, such variations are not compatible with the methodological standards for massive screening programmes (18). It is unclear why growth-monitoring programmes do not follow international guidelines for screening tools, with identified target conditions and validated auxological parameters and thresholds to define abnormality. Standardising growth-monitoring strategies and practices is an urgent priority.

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CONFLICT OF INTERESTS

The authors have no conflict of interest to declare.

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APPENDIX

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