Published in final edited form as:

Clin Pediatr (Phila). 2016 October ; 55(12): 1100–1106. doi:10.1177/0009922815614352.

Electronic Health Record Mid-Parental Height Auto-Calculator for Growth Assessment in Primary Care

Terri H. Lipman, PhD, CRNP^{1,2}, Pamela Cousounis, MEd¹, Robert W. Grundmeier, MD^{1,2}, James Massey², Andrew J. Cucchiara, PhD², Virginia A. Stallings, MD^{1,2}, and Adda Grimberg, MD^{1,2}

¹The Children's Hospital of Philadelphia, Philadelphia, PA, USA

²University of Pennsylvania, Philadelphia, PA, USA

Abstract

Primary care providers are charged with distinguishing children with an underlying growth problem from those with healthy variant short stature. Knowing the heights of the biological parents aids in making that decision. This study sought to determine the feasibility and functionality of an electronic mid-parental height (MPH) auto-calculator in the clinical assessment of child growth in a pediatric primary care setting. Clinicians completed surveys for 62% of 6803

Reprints and permissions: sagepub.com/journalsPermissions.nav

Corresponding Author: Adda Grimberg, Diagnostic and Research Growth Center, Division of Pediatric Endocrinology and Diabetes, The Children's Hospital of Philadelphia, 3401 Civic Center Boulevard, Suite 11NW30, Philadelphia, PA 19104, USA, grimberg@email.chop.edu.

Author Contributions

THL wrote the first draft of the manuscript, which was extensively revised by AG and reviewed by all co-authors. Each author listed on the manuscript has seen and approved the submission of this version of the manuscript and takes full responsibility for the manuscript. The contributions of each author are as follows: THL presented CME- and CNU-certified education sessions related to growth assessment and use of the MPH tool to participating practices, assisted with design of the MPH tool and survey, participated in monthly MPH tool performance review meetings, wrote the first draft, critically reviewed the manuscript, and approved the final manuscript as submitted. PC assisted with design of the MPH tool and survey, participated in monthly MPH tool performance review meetings, served as study liaison to the participating practices, performed the quarterly visits to the participating practices, critically reviewed the manuscript, and approved the final manuscript as submitted. RWG assisted with design of the MPH tool and survey, participated in monthly MPH tool performance review meetings, programmed the electronic health record (EHR) MPH tool and survey, critically reviewed the manuscript, and approved the final manuscript as submitted. JM assisted with recruitment of the participating practices, assisted with design of the MPH tool and survey, participated in monthly MPH tool performance review meetings, critically reviewed the manuscript, and approved the final manuscript as submitted. AJC assisted with design of the MPH tool and survey, participated in monthly MPH tool performance review meetings, performed biostatistical analyses, critically reviewed the manuscript, and approved the final manuscript as submitted. VAS assisted with design of the MPH tool and survey, participated in monthly MPH tool performance review meetings, critically reviewed the manuscript, and approved the final manuscript as submitted. AG conceptualized and designed the study, obtained grant funding for the study, presented CME- and CNU-certified education sessions related to growth assessment and use of the MPH tool to participating practices, oversaw data management, performed data analyses, revised the initial manuscript, and approved the final manuscript as submitted.

Authors' Note

The content is solely the responsibility of the authors and does not necessarily represent the official view of National Center for Advancing Translational Sciences or the National Institutes of Health, the funding agencies. The funding organizations had no role in the study design; the collection, analysis, and interpretation of data; the writing of the report; and the decision to submit the article for publication. No payment was given to anyone to produce the manuscript.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Robert Grundmeier is a co-inventor of the "Care Assistant" software that was used in part to implement the mid-parental height auto-calculator for this study. He holds no patent on the software and has earned no money from this invention. No licensing agreement exists. Adda Grimberg serves on the Steering Committee for the Pfizer International Growth Study Database. The other authors have indicated they have no financial relationships relevant to this article to disclose.

children (mean height 13 ± 7 percentile) with recorded parent heights. Collecting parent height data required <30 seconds in 91% of encounters. The MPH tool confirmed clinicians' initial growth assessment in 79% of cases and changed it in 4%; the remainder did not use the tool. Clinicians who changed assessment were more likely ($P < .0001$) to pursue more comprehensive evaluation. The MPH tool was a quick, functional resource as a component of an electronic health record system in actual, busy, pediatric primary care practices.

Keywords

endocrinology; clinical decision making; electronic medical records; short stature; general pediatrics

James Tanner observed, "Linear growth is the single most important indication of the health of a child."¹ Growth failure can be the first or only sign of serious disorders that include psychosocial, nutritional, genetic, and disease processes.² Primary care providers (PCPs) are charged with distinguishing children with an underlying growth problem from those with healthy variant short stature and deciding which patients need further evaluation and/or referral for subspecialist care.

Knowing the heights of the biological parents aids in making that decision. In general, tall parents produce tall children and short parents short children. Therefore, a child at the 5th percentile for height is probably growing as expected if the parents are themselves 5th percentile or likely pathologically small if parents are above average in height.³ A caveat is the misclassification of familial short stature for a short child who shares a dominantly inherited growth problem with their abnormally short, undiagnosed parent; a more extended family history will reveal the parent's height also to be atypical for their genetic background.

Thus, calculation of mid-parental height (MPH) has been recommended for assessing growth in individual children since it was first described in 1970.³ Formulae (in cm) for calculating gender adjusted MPH are the following: for girls (father's height – 13 + mother's height)/2; and for boys (father's height + mother's height + 13)/2. Results of both formulae are reported ± 10 cm (ie, ± 2 SD). Using MPH to guide clinical decisions requires obtaining parental heights, *making the calculation*, and considering the results for the individual patient.

With the advent of electronic health record (EHR) systems, multiple tools have been developed to guide and facilitate clinical decision making. The use of EHR systems increased from 18% in 2001 to 57% in 2011 estimates among office-based physicians.⁴ A 2009 nationwide survey of the American Academy of Pediatrics members practicing in office or clinic-based settings found that although 54% reported using electronic medical records and 41% an EHR system, only 3% used a fully functional system that was pediatric supportive.⁵ Pediatric-supportive EHR systems require additional functionality from those in adult medicine, such as growth monitoring, immunization tracking, and weight-based medication dosing support.⁶

The purpose of this study was to determine the feasibility and functionality of an EHR tool using MPH auto-calculation to support clinical decision making in the pediatric primary care setting. This study was performed in a network of primary care practices affiliated with a tertiary care pediatric hospital. A tool for calculating MPH was not previously available in the network EHR (EpicCare; Epic Systems Inc, Verona, WI), and the network leadership deemed that such an auto-calculator, by obviating the clinician's need to manually calculate MPH, in the least would improve practice by not requiring PCPs to remember correctly the 2 formulae, decreasing the time it took PCPs to obtain the results, and preventing arithmetic errors.

Methods

Approval for this study was obtained from the Children's Hospital of Philadelphia Institutional Review Board.

MPH Tool Development

The MPH tool was developed through a series of discussions that included pediatric PCPs, endocrine providers, computer programmers, a gastroenterologist, and biostatistician. To maximize tool and survey use, consideration of minimizing the time required by PCPs and practice staff was paramount in study design. To target the most pertinent patient encounters, the tool was programmed for well visits for patients with height below the 25th percentile. The study was limited to patients aged 2 years through 15 (girls) or 17 (boys) years, since older patients were likely to have stopped growing. Although measured height is recognized as more accurate than self-reported height, parent-reported heights were used to decrease impact on clinic flow. In practice, the MPH tool will more realistically and feasibly be used with reported heights as that is less time consuming than measuring heights and often only one parent is present at the visit. Finally, the survey was designed to be brief, with multiple-choice questions and responses ordered to facilitate ease of finding the appropriate choice.

The MPH calculator was created by our team using web-based technology. This approach permitted embedding of the calculator into the commercial EHR so it was easy to access by the clinicians in their standard preventive health care visit workflow. JavaScript (Oracle Corporation, Redwood City, CA) and Python (Python Software Foundation, Wilmington, DE) were used to implement the graphical user interface and height percentile calculations, respectively. Although clinicians perceived the calculator to be a part of the EHR, it was functionally independent and can be embedded in any of the growing number of EHRs that provide mechanisms for connecting externally developed web-based tools to their products.^{7,8}

Subjects

Thirteen pediatric primary care practices in Pennsylvania and New Jersey affiliated with a tertiary care children's hospital were invited to participate in this study. Nine practices volunteered, while 4 declined due to prior commitment to other research projects or a temporary staff shortage. Participating practices included both urban and nonurban locations. Each participating site received a new stadiometer and recumbent length board

(both from Weigh and Measure, LLC, Olney, MD), as well as CME-and CNU-certified education sessions related to accurate measurement techniques,⁹ growth assessment, and use of the MPH tool. Informed consent was obtained from the PCPs (physicians and nurse practitioners).

Intervention and Follow-up Evaluation

The MPH tool was programmed to appear in the EHR of the practices from September 1, 2010, to September 1, 2011, for patients meeting inclusion criteria; once completed, the tool would not reappear for that patient at subsequent visits within the study period. Prompted by the tool, the staff person measuring the child asked the accompanying adult to report the heights of the biological parents in either English or metric units. If only one parent was present, the parent self-reported their height and also reported the height of the absent parent. Measurers were asked to rate their confidence in the accuracy of the parent-reported heights based on observation of the parent and their difficulty in responding to the question. “Very confident” was selected in cases when a single height was quickly and assuredly provided, “close estimate” referred to episodes wherein a parent said their height was within a 2-inch range (eg, “I am 5’3” or 5’4”.”), or “large guess” was selected for responses such as, “I am 5’2”. My husband is taller than me. Therefore, he must be 6’ tall.” There was also an option to enter “height not known,” such as for adopted or foster children. Clinic staff was also asked to indicate the length of time required to obtain the parental height data. The program auto-calculated both the gender-adjusted MPH and its corresponding percentile (Figure 1A).

The well visits proceeded per routine. However, PCPs had access during the visits to the MPH tool, including parent heights, MPH calculations, and confidence ratings (Figure 1A), to use as they deemed appropriate. At the completion of the visit, PCPs were asked to complete a brief electronic survey about their use of the tool and their assessment and disposition related to the child’s growth (Figure 1B).

Once the tool was launched, the study team met monthly to review implementation of the tool, confirm that it was triggered only for children meeting inclusion criteria, and to address any performance concerns as needed. Participating practices were emailed monthly updates on the aggregated survey response rates of their PCPs as well as rates for the other anonymized participating practices. Study personnel visited the primary care sites quarterly to provide assistance, and were also available by telephone and email throughout the study.

Data Collection and Analyses

In addition to data entered in the tool and survey, data extracted from the EHR included the patient’s height percentile, gender, age, race/ethnicity, and type of insurance. Descriptive statistics, contingency tables, and logistic regression model parameters were estimated using JMP Software (SAS Institute, Carey, NC). For continuous variables, mean, standard deviation (SD), 95% confidence interval (CI), median, and interquartile range are reported, and for discrete categories, frequency counts and percentages are tabulated. For multivariable logistic regression models, odds ratio (OR) and 95% CI indicate the

contributions of candidate explanatory variables to the outcome; range odds ratios are presented for continuous variables in the model.

A priori, feasibility of the tool was defined as the ability to complete the MPH assessment (as the tool auto calculates the MPH values instantaneously, this corresponds to the time needed to collect parental height data) in less than 1 minute for at least 90% of patients. Functionality of the tool was defined as clinician use of the MPH tool data in clinical decision making for at least 75% of patients who had parental height data collected. Clinician use was assessed by self-report in real time and included options for the clinician to indicate whether the tool confirmed or changed their initial clinical assessments.

Results

Patient Population

A total of 6803 patients of 70 PCPs met age inclusion criteria and were measured as below the 25th percentile, thereby activating the MPH tool. The study patient population was 54% male, with mean age 8.9 ± 4.5 years, and distributed 60% white, 24% African American, 13% Other, 4% Hispanic, and 3% Asian. Private insurance was held by 71%, 27% received Medicaid, and 2% were self-pay.

Collecting Reported Parental Heights

Parental heights were available for 6338 (93%) mothers, 6197 (91%) fathers, and 6173 (91%) parental pairs. Clinic staff collecting the data gave “very confident” ratings to the reliability of heights reported for 76% of mothers and 58% of fathers. Logistic regression modeling indicated that a very confident rating was associated with patient race/ethnicity and age, insurance coverage, and parental height; patient gender was also a significant explanatory variable in modeling the confidence ratings of reported maternal heights (Table 1). Clinic staff reported that it took less than 30 seconds to obtain the parental height data for 91% of encounters. The time required was 30 to 60 seconds for 6%, and more than 60 seconds for 3% of encounters.

Distributions of Patients’ and Parents’ Heights

As expected from our inclusion criteria, patient heights ranged from the 1st to 24th percentile. Mean $\pm$ SD percentile height of the children was 13 ± 7 , while median and interquartile range was 14 [7–20]. MPH ranged from the 1st to 95th percentiles. Mean $\pm$ SD percentile MPH was 39 ± 24 , while median and interquartile range was 35 [18–56].

MPH Tool Use by PCP

Providers completed surveys on 62% of the encounters of children who had MPH recorded, reporting in real-time the impact of the tool on their clinical decision-making (Table 2). Eighty-three percent of those who completed the survey reported use of the MPH tool. Providers reported not using the MPH tool because they viewed the data as unreliable (10%) or for other reasons (7%). Based on multivariable logistic regression (odds ratio [95% confidence limits]) estimates, PCPs were more likely ($P < .0001$) to use the tool if the child was Black (2.39 [1.82–3.15]) or Hispanic (3.55 [2.16–5.67]) compared to White, and had

taller parents (2.73 [1.69–4.39]). The MPH tool was more likely ($P < .0001$) to change PCP assessment of the child's growth for shorter patients (0.22 [0.12–0.39]) and taller parents (20.77 [10.44–41.78]) but less likely ($P < .05$) for female patients (0.66 [0.48–0.91]). Providers' assessment of children with height below the 25th percentile was that 54% were short but normal height and velocity for their family, 35% had a normal height and velocity for the population, 4% were short or had decreased velocity likely due to socioeconomic or dietary factors, and 7% were short or had decreased velocity, possibly due to an underlying disease process.

Disposition by MPH Tool Use

PCPs who reported using the tool, and for whom the tool confirmed their assessment, were most likely to continue routine growth-related surveillance only (Table 2). Although routine growth-related surveillance was also the disposition most frequently selected by PCPs who changed their assessment or did not use the MPH tool, this was decreased relative to PCPs whose assessments were confirmed by the MPH tool. PCPs who reported changing their assessment were more likely to have made the decision to monitor growth more frequently ($P < .0001$), recommend nutritional changes ($P < .0001$), order diagnostic tests ($P < .0001$), or refer to endocrinology ($P < .0001$) or to gastroenterology ($P < .005$) when compared to PCPs who stated that the tool confirmed their decision making or to PCPs who did not use the tool. PCPs who indicated that they did not use the tool for reason other than unreliable or incomplete parental height data were most likely to select, "previously diagnosed condition, ± under treatment, continue current treatment."

Discussion

In summary, the MPH tool was both a feasible and functional component of an EHR in actual, busy, pediatric primary care settings. In 97% of the encounters (study target 90%), clinic staff collected and rated the reported parental height data needed for calculating MPH in less than 1 minute. PCPs utilized the MPH tool information to assess 83% (study target 75%) of the patients for whom parental heights were entered, either changing or confirming their clinical assessment. Tool use affected clinical decision making, as evident in differences in PCP dispositions for the patients.

When the tool changed PCP decision making (4% of patients), it led to increased monitoring, nutritional care change, diagnostic tests, and subspecialist referrals. Thus, it seemingly alerted PCPs to a potential problem. Patients for whom the MPH tool changed their PCP's assessment were shorter and had taller parents, congruent with the traditional teaching that children who are short relative to their genetic potential are more likely to have an underlying growth problem. PCPs were also more likely to change their assessment and pursue more comprehensive evaluation for male patients. Similarly, previous studies reported a greater frequency of diagnostic testing of growth hormone system function by PCPs for male rather than female patients with growth faltering,¹⁰ and a male predominance among children referred to endocrine centers for evaluation of short stature.¹¹ Conversely, when MPH tool use confirmed the clinical assessment of PCPs (79% of patients), they were most likely to pursue only routine growth surveillance (83%) compared with PCPs who

chose routine monitoring but did not use the tool because of issues with parental heights (72%), or did not use for other reasons (66%). Thus, the tool seemed to provide a mechanism of reassurance, possibly preventing unnecessary testing and referrals.

The 2 common reasons for not using the MPH tool were incomplete or unreliable parental height data and cases where the clinician was aware of a previously diagnosed condition under treatment. Parental heights are most commonly obtained by self-report. Studies have shown that self-reported height data may be inaccurate.^{12–14} Males were more likely to overestimate height by an average of 1.6 to 2.5 cm and women by an average of 0.5 to 1.0 cm.^{12–14} Partner reported height of fathers was overestimated even more.¹⁴ The factor most associated with reported inaccuracies was age, with older adults (>45 years) significantly more unreliable.¹³ Interestingly, practice staff in our study were least confident in the reported heights of white parents with private insurance. Data have shown that individuals in positions of power overestimate their own height¹⁵ and that parents of white pediatric primary care patients reported higher acceptable height thresholds than parents of other races/ethnicities.¹⁶

Although self- or partner-reported heights may be inaccurate, the study design was based on reported, rather than measured, parental heights in consideration of the time constraints of the primary care practice settings. The study protocol reflected current clinical practice; hence, the results are likely more generalizable. We also asked the clinic staff to rate their confidence in the reliability of the reported parent heights. This quick observation alerted PCPs to heights that were more suspect and, therefore, allowed better interpretation of the data without impeding clinic flow. Inaccurate parental height reporting was a limitation of data collected, rather than with the MPH calculator itself and its clinical interpretation. For those providers who do not have confidence in the reported heights of parents, or if accuracy of parental heights is integral to decision making, parental heights should be measured with a stadiometer at the clinic visit.

Beyond the issue of parental height collection, there are other limitations of this study. We do not have data on why some PCPs chose not to use the tool. All pediatric practices in the study were associated with a research-intensive tertiary care center. However, diversity of practice cultures within this network ranges from suburban practices that follow a private practice model to urban academic practices that provide resident education. Nevertheless, degree of MPH tool utilization may be different in other types of primary care practices. Also, in this study setting, it was not possible to determine if the PCPs' assessments of the short children, or their dispositions, were appropriate. The MPH tool resulted in an altered plan for 4% of the patients, but it is not known if the change resulted in better clinical care. The purpose of this study was to determine the feasibility and functionality of the tool, and future research will focus on whether altered decisions based on consideration of the MPH tool result are appropriate.

In conclusion, our study demonstrated the feasibility and functionality of an EHR-based MPH auto-calculator in pediatric primary care, so much so that it contributed to the implementation of MPH auto-calculation functionality in a vendor-supplied EHR system. Use of the MPH calculator tool negligibly affected patient flow, requiring less than 30

seconds to complete, and such data collection need occur only once in the care history of each patient since MPH does not change over time. These data are the first to demonstrate that use of an EHR-based MPH calculator affected clinical decision-making. To our knowledge, this is also the first evidence that calculated gender-adjusted MPH was used by PCPs as it was originally proposed by Tanner—both to prompt further evaluation for children at highest risk (ie, identify children with a height deficit relative to their genetic potential) and to provide reassurance for children who may not need additional monitoring. Auto-calculation of MPH that was integrated into the EHR system was helpful to pediatric PCPs and has the potential to improve growth evaluation in children.

Acknowledgments

We want to thank Ryan O'Hara and Mark Jason Ramos for their assistance programming and querying the MPH tool, survey and EHR data, and collecting the monthly performance and patient-level study data. We also want to thank the network of primary care clinicians, their patients and families for their contribution to this project and clinical research facilitated through the Pediatric Research Consortium (PeRC) at the Children's Hospital of Philadelphia, which is funded in part by the Agency for Healthcare Research and Quality.

Funding: The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by Grant R01 HD057037 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (AG). We are grateful to the University of Pennsylvania Institute for Translational Medicine and Therapeutics for biostatistical support by Grant Number UL1TR000003 from the National Center for Advancing Translational Sciences of the National Institutes of Health.

References

1. Tanner JM. Normal growth and techniques of growth assessment. *Clin Endocrinol Metab*. 1986; 15:411–451.
2. Grimberg A., Lifshitz, F. Worrisome growth. In: Lifshitz, F., editor. *Pediatric Endocrinology*. 5th. Vol. 2. New York, NY: Informa Healthcare; 2007. p. 1-50.
3. Tanner JM, Goldstein H, Whitehouse RH. Standards for children's height at ages 2–9 years allowing for heights of parents. *Arch Dis Child*. 1970; 45:755–762. [PubMed: 5491878]
4. Hsiao CJ, Hing E, Socey TC, Cai B. Electronic health record systems and intent to apply for meaningful use incentives among office-based physician practices: United States, 2001–2011. *NCHS Data Brief*. 2011; (79):1–8.
5. Leu MG, O'Connor KG, Marshall R, Price DT, Klein JD. Pediatricians' use of health information technology: a national survey. *Pediatrics*. 2012; 130:e1441–1446. [PubMed: 23166335]
6. Spooner SA, Council on Clinical Information Technology. Special requirements of electronic health record systems in pediatrics. *Pediatrics*. 2007; 119:631–637. [PubMed: 17332220]
7. Turvey C, Klein D, Fix G, et al. Blue Button use by patients to access and share health record information using the Department of Veterans Affairs' online patient portal. *J Am Med Inform Assoc*. 2014; 21:657–663. [PubMed: 24740865]
8. Mandl KD, Mandel JC, Murphy SN, et al. The SMART platform: early experience enabling substitutable applications for electronic health records. *J Am Med Inform Assoc*. 2012; 19:597–603. [PubMed: 22427539]
9. Lipman TH, Hench KD, Benyi T, et al. A multicentre randomized controlled trial of an intervention to improve the accuracy of linear growth assessment. *Arch Dis Child*. 2004; 89:342–346. [PubMed: 15033843]
10. Grimberg A, Feemster KA, Pati S, et al. Medically underserved girls receive less evaluation for short stature. *Pediatrics*. 2011; 127:696–702. [PubMed: 21422085]
11. Grimberg A, Kutikov JK, Cucchiara AJ. Sex differences in patients referred for evaluation of poor growth. *J Pediatr*. 2005; 146:212–216. [PubMed: 15689911]
12. Cizmecioglu F, Doherty A, Paterson WF, Young D, Donaldson MD. Measured versus reported parental height. *Arch Dis Child*. 2005; 90:941–942. [PubMed: 16113129]

13. Rowland ML. Self-reported weight and height. *Am J Clin Nutr.* 1990; 52:1125–1133. [PubMed: 2239790]
14. Braziuniene I, Wilson TA, Lane AH. Accuracy of self-reported height measurements in parents and its effect on mid-parental target height calculation. *BMC Endocr Disord.* 2007; 7:2. [PubMed: 17407570]
15. Duguid MM, Goncalo JA. Living large: the powerful overestimate their own height. *Psychol Sci.* 2012; 23:36–40. [PubMed: 22173738]
16. Cousounis PA, Lipman TH, Ginsburg K, Cucchiara AJ, Grimberg A. How short is too short according to parents of primary care patients. *Endocr Pract.* 2014; 20:1113–1121. [PubMed: 24936551]

(A)

	Height	%ile	My confidence in parent response			height not known
			very confident	close estimate	large guess	
✓ Mother:	160 cm (5' 3")	= 30%	☒	☐	☐	☐
✓ Father:	170 cm (5' 7")	= 18%	☐	☒	☐	☐
Mid-Parent:	159 cm (5' 2.4")	= 23%				
Patient:	127 cm (4' 2")	= 19%				

(B)

1: Did you use the mid-parental height information in assessing this patient's linear growth?

☐ Did not use the data; parental height incomplete or unreliable

☐ Did not use the data; for another reason

☒ Used the data; confirmed my assessment

☐ Used the data; changed my assessment

2: What is your assessment of your patient's linear growth?

☐ Normal height and velocity for population

☒ Short, but normal height and velocity for family

☐ Short or reduced growth velocity, likely due to socioeconomic or dietary factors

☐ Short or reduced growth velocity; an underlying disease process (e.g. celiac disease, GH deficiency) is under consideration

3: What is your plan for this patient's linear growth? (can choose >1 answer for only the last 3)

☒ Routine growth-related surveillance only

☐ Enhanced growth surveillance only

☐ Previously diagnosed condition +/- under treatment; continue current treatment

☐ Recommend nutritional changes now

☐ Obtain diagnostic tests now (laboratory and/or radiologic studies)

☐ Refer now to:

☐ endocrinology; ☐ gastroenterology; ☐ other specialist

Figure 1.

(A) Mid-parental height (MPH) tool and (B) survey as they appeared in the EHR for providers, with illustrative answers entered. The tool was generally completed by the staff measuring the patients, but could be completed or corrected by the PCP during the clinic visit. The survey appeared for only the PCP after the clinic visit. Parent heights could be entered in either English or metric units.

Table 1

Logistic Regression Modeling of “Very Confident” Rating of Reported Biological Parent Heights According to Patient Characteristics^a.

Patient Characteristic	Comparison Group	Reference Group	Odds Ratio	Confidence Interval	P Value	Overall P Value
Rating of maternal height						
Height (percentile)	—	—	0.95	[0.75, 1.21]	—	.7008
Gender	Female	Male	0.85	[0.74, 0.97]	.0187	.0187
Race/ethnicity	Asian	White	1.57	[1.02, 2.34]	.0405	.0019
	Black		1.21	[1.01, 1.44]	.0332	
	Hispanic		1.67	[1.20, 2.30]	.0029	
	Other		1.33	[1.06, 1.67]	.0148	
Age	—	—	1.84	[1.44, 2.34]	—	<.0001
Insurance	Medicaid	Private	1.48	[1.25, 1.74]	<.0001	<.0001
	Self-pay		1.59	[0.95, 2.55]	.0755	
Maternal height (percentile)	—	—	1.59	[1.25, 2.02]	—	.0002
Rating of paternal height						
Height (percentile)	—	—	1.13	[0.93, 1.38]	—	.2096
Gender	Female	Male	1.10	[0.98, 1.23]	.0900	.0900
Race/ethnicity	Asian	White	0.70	[0.47, 1.01]	.0553	<.0001
	Black		1.35	[1.16, 1.56]	<.0001	
	Hispanic		1.42	[1.06, 1.91]	.0191	
	Other		1.04	[0.85, 1.26]	.6959	
Age	—	—	1.72	[1.40, 2.12]	—	<.0001
Insurance	Medicaid	Private	1.78	[1.54, 2.05]	<.0001	<.0001
	Self-pay		1.41	[0.90, 2.19]	.1299	
Paternal height (percentile)	—	—	0.45	[0.37, 0.55]	—	<.0001

^aWhile measuring patients, clinic staff collected parental heights by self- or partner-report and rated their confidence in the accuracy of the heights as “very confident,” “close estimate,” or “large guess”; “height not known” was also an option.

Table 2

Percentage of Primary Care Providers in Each Mid-Parental Height Tool (MPH) Utilization Category That Selected the Specific Plan^a.

Plan	Used MPH Data		Did Not Use MPH Data		Pearson χ^2
	Changed Assessment (n = 170)	Confirmed Assessment (n = 3700)	Heights Incomplete or Unreliable (n = 447)	For Another Reason (n = 349)	
Routine surveillance	45%	83%	72%	66%	<.0001
Enhanced growth monitoring	17%	7%	2%	5%	<.0001
Continue current treatment	1%	3%	1%	10%	<.0001
Recommend nutritional changes	5%	1%	0.2%	0.3%	<.0001
Diagnostic tests	22%	2%	1%	1%	<.0001
Refer to any subspecialist	12%	2%	2%	1%	<.0001
Endocrinology	9%	1%	1%	1%	<.0001
Gastroenterology	2%	0.4%	1%	0.3%	.0029
Other subspecialist	1%	0.5%	0.2%	0%	.2385

^aMore than one plan could be selected for a given patient.