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Getting the size right: Are clinicians ready for it?

Joanna C. Roper [a], Madhu Naidu [b], Ranee Thakar [a,c], Abdul H. Sultan [a,c,*]

[a] *Department of Obstetrics and Gynaecology, Croydon University Hospital, 530, London Road, Thornton Heath CR7 7YE, UK*
[b] *Gynaaecare, Bangalore 560037, Karnataka, India*
[c] *St George's University of London, London, United Kingdom*

Introduction

Digital examination plays an important role in obstetric and gynaecological practice. For midwives and physicians, a digital vaginal examination is an essential skill that is required to assess a labouring woman. The assessment must be accurate, as this will influence the management. Vaginal examination is one of the most difficult skills for educators to teach midwifery students [1]. Learning to assess cervical dilatation requires repeated practice and feedback [1]. Although various methods of training have been used, the use of simulation aids (like the models used in this study), in current practice has improved the skills of clinicians [2]. In the absence of visual stimuli, the perception of limb position and movement is vital for coordination [3]. The ability to achieve refinement of this skill improves with experience.

In clinical practice, digital assessment is also used for accurate diagnosis of anal sphincter defects [4], as part of performing assisted vaginal delivery [5], to determine the size of vaginal pessaries [6] and for grading of prolapse using pelvic organ prolapse quantification (POPQ) [7].

Studies have reported poor accuracy in cervical dilatation estimation [8–10]. Some studies have compared ultrasound assessment with digital assessment [11] and others have used a spatial tracking ruler [12]. Transperineal ultrasound was found to be comparable to the digital assessment of cervical dilatation in the latent and early active stages of labour [11]. Accuracy, when compared to a tracking ruler, was better at 0–4 cm and >8 cm compared to 4–8 cm [12].

Our aims were to evaluate the accuracy of the estimated length of the index finger, cervical dilatation assessment at two different dilatations (7 cm and 9 cm) by visual assessment and estimated length of the anal sphincter in a model amongst obstetricians and midwives [13]. Second, to establish any relationship between accuracy and seniority or job role. Lastly, to look at the correlation between the accuracy of finger length and the accuracy of the other measurements (cervical dilatation and sphincter length).

Materials and methods

Participants were recruited at two perineal trauma training events in 2019 and 2020. Physicians and midwives attending a hands-on training course and midwives attending an annual mandatory training day were invited to participate in the three estimation exercises.

Firstly, the participant's index finger (with the hand supine) was marked on the blank side of a disposable paper measuring tape. Three markings were made on the back of the tape corresponding to the digital creases of their finger and the participant was asked to estimate the length of these markings (Fig. 1). At the end of the exercises, the actual measurements were obtained by correlating with the ruler on the reverse side of the tape.

Secondly, using a standardised anal sphincter model (Fig. 2) (3.5cms in length), participants were asked to examine and estimate the length of the anal sphincter using their index fingers.

Finally, participants were asked to estimate the diameter of two paper cut circles (7 cm and 9 cm), representing cervical dilatation, using the midwife's cervical dilatation training pocket guide [14] (Fig. 3). For each participant job role and level of training were recorded.

The data was analysed using SPSS v27. We calculated the number of participants who correctly estimated (accurate to within 0.1 cm- due to the ruler being accurate to the nearest millimetre) for all lengths. We also calculated the number of participants within 0.5 cm and within 20 % accuracy for finger measurements, within 1 cm for dilatation at 7 cm and 9 cm, and within 0.5 cm for sphincter length of the actual measured length. A value of 20 % was chosen because this equates to around 1.4 cm for the average finger in the study.

Further analysis examined if there was a significant difference between estimated and actual measurements. This suggests whether, on average, clinicians tended to over or under-estimate. Differences between estimated and actual measurements were all normally distributed, and thus the paired *t*-test was used.

The t-tests measure only the 'average' difference. The agreement

* Corresponding author at: Department of Obstetrics and Gynaecology, Croydon University Hospital, 530, London Road, Thornton Heath CR7 7YE, UK.
E-mail address: asultan@sgul.ac.uk (A.H. Sultan).

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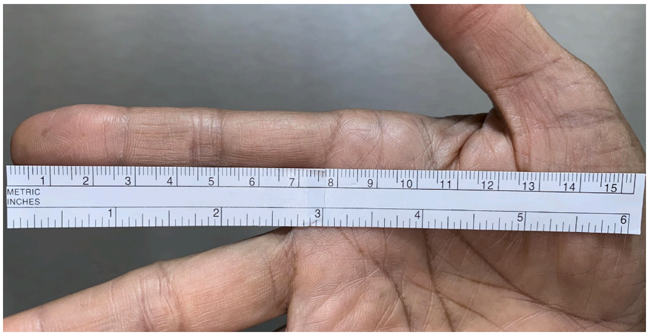

Fig. 1. Finger measuring- Example of a finger being measured with a paper ruler.

Fig. 2. Sultan anal sphincter repair trainer – Model used for measuring the anal sphincter length (https://www.laerdal.com/hk/doc/4441/Anal-Sphincter-Repair-Trainer).

Fig. 3. Pocket guide used to assess cervical dilatation [14]- Tool used in measuring activity for estimating dilatation. (https://cascadehealth.com/labor-progress-pocket-guide-visual-training-aid).

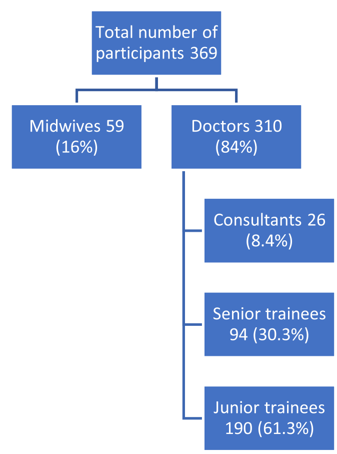

Fig. 4. Number of participants based on level of training- Flow chart showing the breakdown of participants.

between estimated and actual values for individual measurements was assessed using the Bland-Altman limits of agreement method.

Comparisons were made between physicians and midwives, and by the level of training for the physician's group only. The absolute difference between estimated and actual measurements was used for these calculations. Due to the skewed distribution, the Mann-Whitney test was used to compare midwives and physicians. Physicians were split into three groups (Consultant, Senior trainee (ST3-ST7), and Junior trainee (ST1-2)) and therefore the Kruskal-Wallis test was used.

Finally, we examined whether the difference between estimated and actual measurements of the whole finger was associated with differences between estimated and actual measurements for sphincter length and cervical dilatation using the Pearson Correlation.

A $p < 0.05$ was considered statistically significant for all results in this study.

Results

In total there were 369 participants comprising 59 midwives and 310 obstetric and gynaecology physicians (Fig. 4). The mean measured length of the index finger was 7.2 cm (Standard deviation 0.57).

Only 4.6 % (0 % of midwives and 5.5 % of physicians) of participants estimated correctly the whole length of their index finger, and 25.5 % (13.6 % of midwives and 27.7 % of physicians) were within 0.5 cm above or below their actual index finger length (Table 1). The trend was towards underestimation for all the estimated lengths. Correct estimation was similar for each of the three lengths measured on the index finger, with a higher percentage of physicians compared to midwives within 0.5 cm and 20 %. The correct estimation of dilatation at 7 cm by the participants was 17.1 %, while 29.6 % correctly estimated dilatation at 9 cm. Interestingly, a higher percentage of midwives than physicians were correct at both 7 cm (22 % vs 16.1 %) and 9 cm (30.5 % vs 29.5 %). More than 50 % of physicians and midwives were within 1 cm when estimating dilatation at 7 cm and 9 cm. Only 7 % of participants correctly estimated the length of the anal sphincter model.

With regards to average differences between estimated and actual measurements, the results (Table 2) suggest that for almost all measurements there were significant differences for all participants. The only exception was for sphincter length where a significant difference was found for midwives.

Table 3 shows the Bland-Altman limits of agreement for each measurement. The figures quantify the observed levels of difference between estimated and actual measurements. For the whole finger (Fig. 5), most

Table 1

Summary of percentage of estimates within pre-defined limits.

Variable	Estimates	All (n = 369)	Physicians (n = 310)	Midwives (n = 59)
1st crease	Underestimated*	277 (75.1 %)	233 (75.2 %)	44 (74.6 %)
(distal end)	Correct	29 (7.8 %)	24 (7.7 %)	5 (8.5 %)
	Overestimated*	63 (17.1 %)	53 (17.1 %)	10 (16.9 %)
	Within 0.5 cm	228 (61.8 %)	200 (64.5 %)	28 (47.5 %)
	Within 20 %	210 (56.9 %)	185 (59.7 %)	25 (42.4 %)
2nd crease	Underestimated*	255 (69.1 %)	209 (67.4 %)	46 (77.9 %)
	Correct	26 (7.1 %)	22 (7.1 %)	4 (6.8 %)
	Overestimated*	88 (23.8 %)	79 (25.5 %)	9 (15.3 %)
	Within 0.5 cm	147 (39.8 %)	132 (42.6 %)	15 (25.4 %)
	Within 20 %	236 (64.0 %)	211 (68.1 %)	25 (42.4 %)
Whole finger	Underestimated*	248 (67.2 %)	202 (65.2 %)	46 (78.0 %)
	Correct	17 (4.6 %)	17 (5.5 %)	0 (0.0 %)
	Overestimated*	104 (28.2 %)	91 (29.4 %)	13 (22.0 %)
	Within 0.5 cm	94 (25.5 %)	86 (27.7 %)	8 (13.6 %)
	Within 20 %	241 (65.3 %)	211 (68.1 %)	30 (50.9 %)
7 cm dilation	Underestimated*	282 (76.4 %)	242 (78.1 %)	40 (67.8 %)
	Correct	63 (17.1 %)	50 (16.1 %)	13 (22.0 %)
	Overestimated*	24 (6.5 %)	18 (5.8 %)	6 (10.2 %)
	Within 1.0 cm	223 (60.4 %)	184 (59.4 %)	39 (66.1 %)
9 cm dilation	Underestimated*	189 (51.4 %)	162 (52.4 %)	27 (45.8 %)
	Correct	109 (29.6 %)	91 (29.5 %)	18 (30.5 %)
	Overestimated*	70 (19.0 %)	56 (18.1 %)	14 (23.7 %)
	Within 1.0 cm	299 (81.3 %)	248 (80.3 %)	51 (86.4 %)
Sphincter	Underestimated*	204 (55.3 %)	162 (52.3 %)	42 (71.2 %)
	Correct	26 (7.0 %)	22 (7.1 %)	4 (6.8 %)
	Overestimated*	139 (37.7 %)	126 (40.6 %)	13 (22.0 %)
	Within 0.5 cm	237 (64.2 %)	201 (64.8 %)	36 (61.0 %)

*Of those who were not 'correct' (within 0.1 cm) the numbers indicate if the estimate was higher (overestimate) or lower (underestimate) than the measured length. (Percentage is of all participants).

values range from an underestimate of 3.7 cm up to an overestimate of 2.5 cm. Similarly, for dilatation, at 7 cm most values range from an underestimate of 3.5 cm to an overestimate of 1 cm (for 9 cm dilatation; −2.8 cm to 1.7 cm).

In Table 4 we compare absolute differences between estimated and actual measurements between groups, based on job role. There was a significant difference between physicians and midwives in all finger measurements with midwives having a larger difference between estimated and actual measurements.

Table 5 shows that no significant difference was found between the three groups of physicians, based on level of training, for any of the measurements.

Finally, in Table 6 we found that there was a significant association between the difference between estimated and actual whole finger length, and the difference between estimated and actual lengths for all variables when all were clinicians combined, and for physicians only. The positive correlations suggest a positive relationship between the size of the differences. A positive correlation was also found for midwives for sphincter measurement.

Table 2

Average differences between estimated and actual measurements.

Measurement	Profession	n	Mean difference (95 % CI) (*)	P-value[a]
1st crease (distal end)	All	369	−0.35 (−0.41, −0.29)	**<0.001**
	Doctors	310	−0.34 (−0.40, −0.28)	**<0.001**
	Midwives	59	−0.38 (−0.57, −0.19)	**<0.001**
2nd crease	All	369	−0.48 (−0.58, −0.38)	**<0.001**
	Doctors	310	−0.46 (−0.56, −0.36)	**<0.001**
	Midwives	59	−0.59 (−0.94, −0.25)	**0.001**
Whole finger	All	369	−0.64 (−0.80, −0.48)	**<0.001**
	Doctors	310	−0.60 (−0.76, −0.44)	**<0.001**
	Midwives	59	−0.86 (−1.40, −0.32)	**0.002**
7 cm dilation	All	369	−1.24 (−1.37, −1.13)	**<0.001**
	Doctors	310	−1.29 (−1.42, −1.17)	**<0.001**
	Midwives	59	−1.03 (−1.37, −0.68)	**<0.001**
9 cm dilation	All	368	−0.57 (−0.69, −0.45)	**<0.001**
	Doctors	309	−0.60 (−0.73, −0.47)	**<0.001**
	Midwives	59	−0.42 (−0.70, −0.13)	**0.006**
Sphincter	All	369	−0.10 (−0.22, 0.01)	0.06
	Doctors	310	−0.02 (−0.15, 0.10)	0.69
	Midwives	59	−0.53 (−0.76, −0.29)	**<0.001**

(*) Difference calculated as estimated value minus actual value.
[a] Paired T Test.

Table 3

Bland Altman limits of agreement results.

Measurement	Profession	Mean difference (*)	SD difference	95 % Bland-Altman limits of agreement
1st crease (distal end)	All	−0.35	0.56	(−1.46, 0.76)
	Doctors	−0.34	0.53	(−1.39, 0.70)
	Midwives	−0.38	0.72	(−1.79, 1.03)
2nd crease	All	−0.48	1.01	(−2.45, 1.49)
	Doctors	−0.46	0.93	(−2.29, 1.37)
	Midwives	−0.59	1.33	(−3.20, 2.01)
Whole finger	All	−0.64	1.58	(−3.73, 2.45)
	Doctors	−0.60	1.46	(−3.47, 2.27)
	Midwives	−0.86	2.07	(−4.91, 3.18)
7 cm dilation	All	−1.24	1.16	(−3.53, 1.03)
	Doctors	−1.29	1.13	(−3.51, 0.92)
	Midwives	−1.03	1.31	(−3.59, 1.54)
9 cm dilation	All	−0.57	1.16	(−2.84, 1.71)
	Doctors	−0.60	1.17	(−2.89, 1.69)
	Midwives	−0.42	1.11	(−2.58, 1.75)
Sphincter	All	−0.10	1.08	(−2.23, 2.02)
	Doctors	−0.02	1.10	(−2.18, 2.13)
	Midwives	−0.53	0.88	(−2.26, 1.21)

(*) Difference calculated as estimated value minus actual value.

Comment

The main finding of this study is that physicians and midwives have poor accuracy in estimating the length of their index finger, cervical dilatation and anal sphincter length. Only 4.6 % of participants correctly estimated the length of their index finger. 17.1 % and 29.6 % of participants correctly estimated the cervical dilatation at 7 cm and 9 cm respectively. Although more than 50 % of participants were within 20 % of the measured length of their index finger (Table 1), with a median size of the index finger of 7.2 cm, this equates to 1.4 cm of the measured length. When evaluating dilatation in labour, an error of 1.4 cm from the actual dilatation could change the decision-making process, and

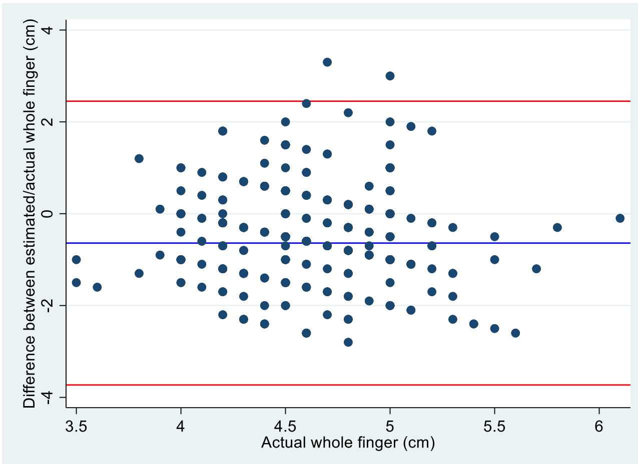

Fig. 5. Bland Altman plot for the whole finger (all clinicians) showing the majority of participants were within the upper and lower limits of agreement (red lines), around the mean difference (blue line)- needs colour in printing. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 4
Absolute difference between estimated and actual lengths by profession.

Measurement	Doctors (n = 310)	Midwives (n = 59)	P-value[b]
1st crease (distal)	0.5 [0.3, 0.7]	0.6 [0.3, 0.9]	**0.04**
2nd crease	0.7 [0.4, 1.1]	1.2 [0.5, 1.7]	**<0.001**
Whole finger	1.0 [0.5, 1.8]	1.5 [0.8, 2.4]	**0.002**
7 cm dilation	1.0 [1.0, 2.0]	1.0 [1.0, 2.0]	0.41
9 cm dilation	1.0 [0.0, 1.0]	1.0 [0.0, 1.0]	0.41
Sphincter	0.5 [0.5, 1.5]	0.5 [0.5, 1.5]	0.80

Summary statistics are median [inter-quartile range] absolute difference between estimated and actual lengths (i.e. magnitude of difference, regardless of underestimate or overestimate).
[b] Mann-Whitney test.

Table 5
Absolute difference between estimated and actual lengths by level of training (doctors only).

Measurement	Consultants (n = 26)	Senior trainees (n = 94)	Junior trainees (n = 190)	P-value[c]
1st crease (distal)	0.5 [0.2, 0.8]	0.5 [0.3, 0.7]	0.5 [0.2, 0.7]	0.56
2nd crease	0.8 [0.5, 1.0]	0.6 [0.4, 1.0]	0.8 [0.3, 1.2]	0.74
Whole finger	1.0 [0.5, 1.4]	1.0 [0.5, 1.7]	1.0 [0.5, 2.0]	0.31
7 cm dilation	1.0 [0.0, 1.0]	1.0 [1.0, 2.0]	1.0 [1.0, 2.0]	0.20
9 cm dilation	1.0 [0.0, 1.0]	1.0 [0.0, 1.0]	1.0 [0.0, 1.0]	0.20
Sphincter	0.5 [0.5, 1.5]	0.5 [0.5, 1.5]	0.5 [0.5, 1.5]	0.85

Summary statistics are median [inter-quartile range] absolute difference between estimated and actual lengths (i.e. magnitude of difference, regardless of underestimate or overestimate).
[c] Kruskal Wallis Test.

therefore the outcome for a woman in labour. Only 25.5 % of participants were within 0.5 cm for whole finger length, which is much lower than for estimating lengths to the 1st and 2nd crease. This suggests participants are more accurate with smaller lengths.

Table 6
Associations with the difference between estimated and actual whole finger length.

Measurement	Profession	n	Correlation Coefficient	P-value[d]
Difference estimated/ actual 7 cm dilation	All	369	0.25	**<0.001**
	Doctors	310	0.31	**<0.001**
	Midwives	59	0.08	0.57
Difference estimated/ actual 9 cm dilation	All	368	0.19	**<0.001**
	Doctors	309	0.25	**<0.001**
	Midwives	59	0.01	0.97
Difference estimated/ actual sphincter	All	369	0.38	**<0.001**
	Doctors	310	0.38	**<0.001**
	Midwives	59	0.39	**0.002**

Summary statistics are median [inter-quartile range] absolute difference between estimated and actual lengths (i.e. magnitude of difference, regardless of underestimate or overestimate).
[d] Pearson Correlation.

Our results for measuring dilatation showed that 60.4 % of participants were within 1 cm at 7 cm, and 81.3 % of participants were within 1 cm at 9 cm. Interestingly a higher percentage of midwives than physicians correctly estimated dilatation at 7 cm and 9 cm. This may be because the midwives were more experienced in measuring dilatation than the physicians, with most of the physicians (61.3 %) being junior. Although all participants were better at estimating dilatation, than other measurements, there is still room for improvement. In a study evaluating the accuracy of cervical dilatation assessment using standardised models, it was found that the accuracy of measurements improved from 56.3 % to 89.5 % when an error of +/− 1 cm was allowed [9]. This is higher than our study, but it could be due to a potential lack of experience in our participants. It can also be argued that an error of +/- 1 cm may still change decision-making in labour and the error margin should be less than this.

The Bland Altman limits in Table 3 also suggest that when estimating dilatation most participants found it difficult. The limits into which most participants' results fell were between −3.5 cm and 1 cm for 7 cm dilatation. These are large values to be inaccurate by when making clinical decisions.

Studies have shown that the accuracy of cervical dilatation improves with training [15]. Thiagamoorthy et al. also found that the use of a learned finger to complete a POPQ assessment was as good as the standard technique, using POPstix® [7]. Therefore, training in these exercises should improve practice.

When the results were compared in groups based on job role or level of training (Tables 4 and 5) there was only a significant difference between physicians and midwives for finger length. One would expect that greater years of experience should correlate with increased accuracy in estimated measurement, but this was not clear from our results. A possible explanation for this could be that consultants may be doing less 'hands-on' clinical work and therefore their accuracy may be affected [9]. For dilatation, all the median differences were the same (1.0 cm), which supports the calculations showing higher percentages of participants within 1 cm accuracy. The midwife group had the highest median difference at the second crease and the whole finger measurements. The midwifery group contained an unknown level of seniority therefore, we cannot comment on their experience. If the group had mostly participants with little experience this may be an explanation for the higher median difference between estimated and measured lengths.

We found a significant positive relationship for physicians between the size of the difference between the estimated and measured length of their whole finger and the size of difference for the other measurements. This implies that the more accurately you know the length of your finger, the more accurate you are likely to be with other measurements. This supports the idea that knowing the length of one's finger improves the accuracy of other estimations of measurement.

However, for midwives we found a significant positive correlation between the size of the difference between the estimated and measured length of their whole finger and anal sphincter length, but not for cervical dilatation. This, again, supports the idea that knowing the length of one's finger improves the accuracy of other estimations of measurement. Midwives are well practised at measuring dilatation but may not have much experience with measuring other lengths, such as anal sphincter length. Therefore, those who were aware of finger length were better at estimating anal sphincter length. Also, physicians are more likely to have been taught the anatomy of the anal canal and therefore know the length of the anal sphincter.

Further clinical implications for these study findings are with reference to the diagnosis of obstetric anal sphincter injury (OASI). Digital rectal examination is the cornerstone in the diagnosis of OASI [16]. The clinical location of the anal sphincter on digital rectal examination will be made easier with the anatomical knowledge that the sphincter is located (in females) within 2.5–3 cm of the distal end of the anal canal [17], which corresponds to the length of the finger to the distal crease for most people. Without this knowledge, OASIs can be missed or overdiagnosed as it is known that compared to males, the anal sphincter is shorter in the female [18,19]. Therefore, when OASIs is suspected, a pill-rolling action, during the examination, is required between the index finger (up to the distal crease) in the anal canal and the thumb on the perineum or vaginal tear (Fig. 6) [20].

As estimating measurements is so vital in obstetrics it is important to look at how physicians and midwives can improve their skills. Simulation is found to aid risk reduction by providing education and training, that is both immersive and experiential [2]. A study investigating the accuracy of cervical assessment using cervical models found that physicians and nurses were more accurate when hard models (non-malleable plastic), compared to soft models (malleable- more like real tissue), were used [8]. As soft models are more realistic, both models could be used for training.

The strengths of this study include that, to our knowledge, (following a MEDLINE search) it is the only study which describes self-awareness of length of finger among obstetricians and midwives. The study included many participants with a range of experience. The exercises were standardised for each participant.

We acknowledge the major limitation of our study was the small number of senior clinicians. We planned to have a much larger sample but due to Covid we could not proceed with further recruitment. We based experience on the level of training, which is not always equivalent, as some junior trainees have more years of experience than senior trainees. Also, midwives were grouped together, therefore their experience was not taken into consideration. Furthermore, the exercises evaluated are mostly based on visual assessment. This is different to clinical work, which is mostly digital, without visual assessment. As there were only two different cervical dilatations assessed in this study, results may have been different with a wider range of dilatations included. Further studies could look at whether awareness of finger length (after measuring) influences the accuracy of other measuring exercises.

The importance of digital assessment in obstetrics and gynaecology cannot be underestimated. This study has found that accuracy in digital assessment for clinical practice needs to be improved. We suggest that as part of routine obstetric skills training, self-awareness of the length of the index finger should be included in training for these healthcare professionals to improve accuracy and provide better care to our patients. We would go further to say that this should be included during the training of medical students, as the perception of size needs to be reasonably accurate in every branch of medicine.

Conclusion

We found that accuracy of obstetric and gynaecology physicians and midwives was poor when asked to estimate the length of their index finger, estimate the diameter of circles representing cervical dilatation and estimate anal sphincter length in a model. We suggest that awareness of finger length and training in cervical dilatation measurements will improve the accuracy of digital examination in its many uses in this speciality.

Fig. 6. Pill rolling technique between the index finger (up to the distal crease) in the anal canal and the thumb in the perineal wound.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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