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What do we need to know about anatomy in gynaecology: A Delphi consensus study

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ABSTRACT

Objective: Determination of the anatomical structures that should be taught to ensure safe and competent practice among general gynaecologists.
Study Design: A two-round Delphi survey, face-to-face meeting in focus groups and an individual interview. Participants were medical doctors and trainees from gynaecology, surgery, urology and radiology from academic, non-academic teaching and non-academic, non-teaching hospitals in the Netherlands. Relevant structures were collected from gynaecology surgery atlas based on most common gynaecological surgeries and diseases. These structures were supplemented and critically viewed in focus groups followed by a Delphi survey. In the Delphi survey gynaecologist and trainee's gynaecology from all over the Netherlands scored the items on a Likert scale between 1 (not relevant) and 5 (highly relevant). Consensus was defined when $\geq$ 70 % of the panellist scored the item as relevant or very relevant and the average rating was $\geq$ 4. Main outcome was clinically relevant anatomical structures.
Results: Consensus on 86 clinically relevant anatomical structures divided by nine categories.
Conclusions: This study identified a core list of anatomical structures that are relevant to the safe and competent practice of general gynaecologists and that can be used to guide gynaecology postgraduate education. This is the first step in a much wider and complex process of becoming a competent gynaecologist.

Introduction

From a historical perspective, anatomy can be considered as one of the basic pillars of medical training [1]. It is one of the oldest branches of medicine and has allowed medical knowledge to develop. However, in the past two decades radical changes have been made to the teaching of anatomy [2,3]. This has resulted in a reduction in teaching hours and a possible decline in anatomy knowledge among medical professionals [4,5]. Whether this reduction in anatomy teaching also leads to a decrease in knowledge, as some studies suggest, remains the subject of debate. Regardless of whether or not the anatomy knowledge of doctors is declining and the debate about how much anatomy should be taught, the relevant question is what constitutes a sufficient amount of anatomical knowledge to ensure safe and competent clinical practice.

In the UK for medical education, the Council and the Education Committee of the Anatomical Society have compiled guidelines on anatomy curriculums with individual structures mentioned. These emphasise the importance of a structure and describe a curriculum 'roadmap', which has the flexibility to accommodate local requirements [6]. In gynaecology, the MRCOG provides a description of anatomy requirements but does not describes individual structures [7]. Making it still subject of debate what is mentioned with for example 'surgical anatomy of the abdomen and pelvis'. In the Netherlands this road map is completly absent when it comes

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to the teaching of anatomy in gynaecology. For example, on completion of the Dutch Society of Obstetrics and Gynaecology (NVOG) training, NVOG expects a gynaecologist to have attained a level of competence in surgery and be able to independently manage a range of common gynaecological conditions and emergencies. However, the training and assessment of anatomy and its application to surgical obstetrics and gynaecology are not defined in the current training programme [8]. In the Standards of care for women's health in Europe, which were recently launched by the European Board and College of Obstetrics and Gynaecology, there is no chapter describing what level of knowledge should be expected of our trainees [9].

Obstetrics and gynaecology is, a broad and diverse branch of medicine, including surgery. Therefore, an adequate understanding of anatomy can be considered to be particularly important in the field of obstetrics and gynaecology. The performed surgical procedures are in anatomically difficult areas (i.e, the pelvis and the retroperitoneal space). An adequate understanding of anatomy is therefore important to limit associated risks of these surgical procedures. Thereby, due to the shift in therapeutic approaches toward more conservative therapy, trainees get less anatomy exposure. Furthermore, in the past most gynaecologists were educated to become generalists. Nowadays a shift is seen into earlier focusing on subspecialties within gynaecology. All of these factors support the need to define the level of anatomical knowledge expected of a general gynaecologist.

Here, we aim to define the anatomical structures that should be taught to ensure safe and competent practice among general gynaecologists.

Material and methods

The Delphi method was used to determine the most valuable anatomical structures for gynaecological practice. Focus group meetings were therefore conducted to obtain relevant input for the Delphi study. The study was conducted in the Netherlands.

Focus groups

The focus group procedure is a research technique that utilises group interviews, during which participants are encouraged to talk to each other, ask questions and comment on each other's experiences and opinions [10]. To guide discussion, a script was developed prior to the meeting comprising 98 essential abdominal and pelvic structures divided into eight categories (Fig. 1). This script was developed on the basis of gynaecology surgery atlas combined with the most common gynaecological surgeries and diseases. An expert panel comprising three gynaecologists, one radiologist and one anatomist has checked the script and supplemented it when necessary. The focus group was facilitated by two trainees and field notes were taken by a medical student; this group is referred to here as the research team. All participants were encouraged to comment on and complete the list of important anatomical structures.

Two focus groups and one individual interview were conducted. The first focus group involved five trainees (years 4 – 6) from four specialties: surgery, urology, obstetrics and gynaecology and radiology. The choice for these specialties was based on the similarities in anatomical context with gynaecology. The second focus group consisted of six medical specialist consultants (a radiologist with special interest in gynaecological anatomy and radiology and five gynaecologists with different subspecialties covering urogynaecology, benign gynaecology, fertility, obstetrics and oncology). The individual interview was conducted with the programme director of surgery and performed by two members of the expert team.

All sessions were recorded and analyses were independently performed by two members of the research team using NVivo 11([11]).

The Delphi procedure

This procedure is a research technique designed to reach consensus on a specific topic among a panel of experts through a process of information feedback and iteration. The Delphi process is complete when consensus is reached [12–15].

Selection of the Delphi panel

For the Delphi procedure, forty gynaecologists and twenty trainees were both, randomly chosen from the Dutch national register of gynaecology and approached from our own network. To create an appropriate and heterogenous sample of panellists, participants were recruited from either 1. gynaecologists of all subspecialties (oncology, benign gynaecology, urogynaecology, fertility and obstetrics) as well as general gynaecologists; or 2. all types of hospitals/workplaces (academic and non-academic teaching hospitals, non-academic non-teaching hospitals). Trainees from years 2 – 6 were asked to participate.

Consensus and feedback

Each panellist received an invitation to participate in an online survey (Survey Monkey®; San mateo, USA). Panellists were asked to rank all items on a 1 – 5 Likert Scale, with 1 being not relevant and 5 being highly relevant. A free text box was included at the end of each category to capture qualitative comments or to add items. Two reminders were sent to participants who did not respond to the first request.

Consensus on item level was achieved when $\geq$ 70 % of the panellists scored the item as relevant or very relevant and the average rating was $\geq$ 4. When only one of these criteria was met, or the item was found to be relevant or very relevant by between 50 – 70 % of the panellists, the item was selected for the second round. In this second round, only the responders from the first round received an invitation to participate. If an item scored < 50 % and $\leq$ 4, it was deemed to be non-relevant for the general gynaecologist.

Results

Focus groups

The original script developed by the expert panel consisted of a list of 98 items classified into eight categories: bones, ligaments, organs, anatomical spaces and structures, general muscles, pelvic floor muscles, arteries and veins, and nerves. After the two focus groups and the individual interview had been completed, the total number of items had increased to 123 and one category (imaging) was added. The results are discussed below by category and an overview is shown in Fig. 1.

Bones

Six new bones were added. The femur was listed by the expert panel but was not deemed to be relevant by the members of the focus groups.

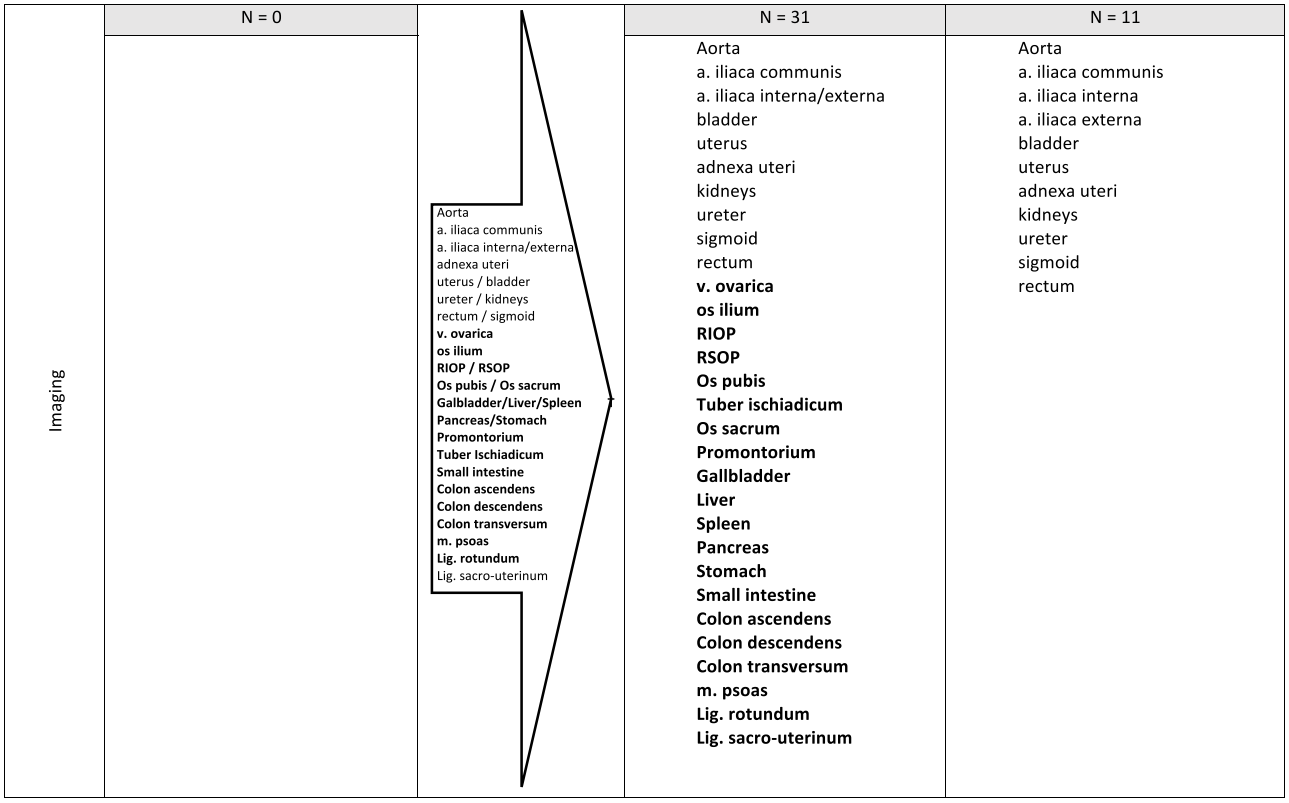
> ***Interviewer:*** *"What are important bones to recognise?"*
> ***Gynaecologist 1****:" You must know the sacral promontory, ramus superior/inferior os pubis, spina ischiadicum, sacroiliac joint, spina*

Category	Startlist/ Focus group script		Results focus group/ Delphi study script	Results Delphi study/ Final list
Bones	N = 9	SI joint SIAS Foramen ischiadicum SIPS RSOP RIOP	N = 14	N = 9
	Symphysis pubica Os pubis Spina ischiadica Os ilium Os coccygis Os sacrum Promontorium Foramum obturatum **Femur**		Symphysis pubica Os pubis Spina ischiadica **Os ilium** **Os coccygis** Os sacrum Promontorium Foramum obturatum **SI joint** Foramen ischiadicum SIAS SIPS **RSOP** **RIOP**	Symphysis pubica Os pubis Spina ischiadica Os sacrum Promontorium Foramum obturatum Foramen ischiadicum SIAS SIPS
Ligaments	N = 10		N = 8	N = 6
	Lig. falciforme Lig. infundibulopelvicum Lig. latum uteri Lig. ovarii proprium Lig. sacro-uterinum Lig. inguinale Lig. sacrospinale Lig. rotundum **Lig. cardinale** **Lig. pubovesicale**		**Lig. falciforme** Lig. infundibulopelvicum Lig. latum uteri Lig. ovarii proprium Lig. sacro-uterinum **Lig. inguinale** Lig. sacrospinale Lig. rotundum	Lig. infundibulopelvicum Lig. latum uteri Lig. ovarii proprium Lig. sacro-uterinum Lig. sacrospinale Lig. rotundum
Organs	N = 21		N = 20	N = 16
	Uterus Adnexa uteri Bladder Liver Gallbladder Stomach Spleen Pancreas Colon transversus Colon descendens Colon ascendens Caecum Sigmoid Rectum Appendix Small intestine Kidney Ureter Peritoneum Omentum **Adrenal glands**		Uterus Adnexa uteri Bladder Liver **Gallbladder** **Stomach** **Spleen** **Pancreas** Colon transversus Colon descendens Colon ascendens Caecum Sigmoid Rectum Appendix Small intestine Kidney Ureter Peritoneum Omentum	Uterus Adnexa uteri Bladder Liver Colon transversus Colon descendens Colon ascendens Caecum Sigmoid Rectum Appendix Small intestine Kidney Ureter Peritoneum Omentum
Anatomical spaces and structures	N = 12	Retropubic space (cave of Retzius) Fascia transversalis	N = 12	N = 6
	Cavum Douglasi Fascia superficialis Bursa omentalis Excavatio vesico-uterina Linea alba Linae semilunaris Linea arcuata Plica umbilicalis mediana		Cavum Douglasi Fascia superficialis **Bursa omentalis** Excavatio vesico-uterina Linea alba **Linae semilunaris** **Linea arcuata** **Plica umbilicalis mediana**	Cavum Douglasi Fascia superficialis Retropubic space (cave of Retzius) Excavatio vesico-uterina Linea alba Fascia transversalis

Fig. 1. Results.

	Plica umbilicalis medialis Plica umbilicalis lateralis **Pararectal space** **Paravesical space**		**Plica umbilicalis medialis** **Plica umbilicalis lateralis** Retropubic space Fascia transversalis	
General muscles	N = 10		N = 7	N = 7
	m. rectus abdominis m. pyramidalis m. psoas m. obliquus internus abdomins m. obliquus externus abdominis m. transversus abdominis m. piriformis **m. iliacus** **m. obturatorius externus** **m. obturatorius internus**		m. rectus abdominis m. pyramidalis m. psoas m. obliquus internus abdomins m. obliquus externus abdominis m. transversus abdominis m. piriformis	m. rectus abdominis m. pyramidalis m. psoas m. obliquus internus abdomins m. obliquus externus abdominis m. transversus abdominis m. piriformis
Pelvic floor muscles	N = 10		N = 10	N = 10
	m. bulbospongiosus m. sphincter ani internus m. sphincter ani externus m. sphincter urethra m. puborectalis m. pubococcygeus m. iliococcygeus m. transversus perinei profundus m. transversus perinei superficialis m. ischiocavernosus		m. bulbospongiosus m. sphincter ani internus m. sphincter ani externus m. sphincter urethra m. puborectalis m. pubococcygeus m. iliococcygeus m. transversus perinei profundus m. transversus perinei superficialis m. ischiocavernosus	m. bulbospongiosus m. sphincter ani internus m. sphincter ani externus m. sphincter urethra m. puborectalis m. pubococcygeus m. iliococcygeus m. transversus perinei profundus m. transversus perinei superficialis m. ischiocavernosus
Arteries and veins	N = 19		N = 13	N = 13
	aorta v. cava **truncus coeliacus** a. epigastrica superficialis a. epigastrica inferior a. mesenterica inferior **a. mesenterica superior** a./v. iliaca communis a./v. iliaca interna a./v. iliaca externa a./v. renalis **a./v. pudenda interna** **a./v. pudenda externa** **a./v. circumflexa iliaca superficialis** **a./v. circumflexa iliaca profundal**		aorta v. cava a. epigastrica superficialis a. epigastrica inferior a. mesenterica inferior a./v. iliaca communis a./v. iliaca interna a./v. iliaca externa a./v. uterine a./v. obturatoria a./v. umbilicalis a./v. femoralis a./v. renalis	aorta v. cava a. epigastrica superficialis a. epigastrica inferior a. mesenterica inferior a./v. iliaca communis a./v. iliaca interna a./v. iliaca externa a./v. uterine a./v. obturatoria a./v. umbilicalis a./v. femoralis a./v. renalis
Nerves	N = 7	n. cutaneus femoris n. peroneus/fibularis	N = 8	N = 8
	Plexus hypogastricus n. pudendus n. ischiadicus n. genitofemoralis n. femoralis **n. levator ani** n. obturatorius		Plexus hypogastricus n. pudendus n. ischiadicus n. genitofemoralis n. femoralis n. obturatorius n. cutaneus femoris n. peroneus/fibularis	Plexus hypogastricus n. pudendus n. ischiadicus n. genitofemoralis n. femoralis n. obturatorius n. cutaneus femoris n. peroneus/fibularis

Fig. 1. (Continued)



SI joint = sacroiliac joint
SIAS = spina iliaca anterior superior
SIPS = spina iliaca posterior superior
RSOP = ramus superior os pubis
RIOP = ramus inferior os pubis

Bold = not important by focus group or delphi study

Fig. 1. (Continued)

iliaca anterior superior, spina iliaca posterior superior; and also, the foramen ischiadicum because of the nervus pudenda in this area".

Ligaments

A total of ten ligaments were listed by the expert panel. Eight ligaments were considered useful for a general gynaecologist by the members of the focus group. The median umbilical ligament was mentioned by the members of the focus groups in this section. However, the expert panel considered it more as a structure and listed this ligament in the section structures and spaces.

Organs

The original list included 21 organs and 20 organs were mentioned by the members of the focus group. The adrenal glands were listed by the expert panel but were not considered to be relevant by the members of the focus groups.

Anatomical spaces and structures

Although 12 structures/spaces were listed and 12 structures were mentioned by the focus groups, there were two discrepancies. The members of both focus groups did not find the paravesical and pararectal space to be clinically relevant for a general gynaecologist as most gynaecologist do not perform surgery in this area. They pointed out that this is important for gynaecologists specialising in oncology. The retropubic space, also known as cave of Retzius, and the fascia transversalis were found to be relevant by the focus groups but had not been listed by the expert panel.

General muscles

Ten general muscles were listed in advance, seven of which were considered to be relevant by the members of the focus groups. The m. iliacus, m. obturatorius externus and m. obturatorius internus were deemed to be irrelevant by the members of the focus groups as they are outside the field of gynaecological surgery.

Pelvic floor muscles

In the category of pelvic floor muscles, there was no discrepancy between the items listed by the expert panel and the items considered to be relevant by the members of the focus groups.

Arteries and veins

Nineteen arteries and veins were listed in this category. Thirteen of them were graded as relevant by the members of the focus groups. In both focus groups, the members agreed that the posterior division of the internal iliac artery was too specific for a general gynaecologist.

Nerves

Seven nerves were listed. Eight were considered relevant by the members of the focus groups. The nervus levator ani was included by the expert panel but was not considered relevant by the members of the focus group. Two nerves that were not included by the expert panel were added and considered relevant by the members of the focus groups, namely, the nervus cutaneus femoris and the n. peroneus, also known as the nervus fibularis.

> ***Gynaecologist 1****: "The nervus cutaneus femoris is also important. We do see patients with compression of the nervus cutaneus femoris. They complain of a dead spot in the skin. It happens mainly when they lay in bed for a long time. If you do not know it is the innervation area of the nervus cutaneus femoris you might miss the right diagnosis."*
>
> ***Gynaecologist 1: "****Also, the nervus peroneus!"*
> ***Gynaecologist 2: "****Yes,* very *good you are mentioning that one. It is important when you do a laparoscopy. You must know how to position a patient to prevent damage to the nervus peroneus."*

Imaging

This subdivision had not been included by the expert panel and was added by the focus groups.

Delphi study results

Across the nine categories, the 123 items identified as relevant by the focus groups were subsequently evaluated in a National Delphi study. The demographic characteristics of participants in both rounds are shown in Table 1.

In the first round, 60 panellists were invited to participate. Over a period of 3 months (April – June 2018), 46 people responded (76.7 %). Of the 123 items, 74 were accepted (60.2 %), 24 were denied (19.5 %) and 25 were selected for a second round (20.3 %). Comments on why each panellist found a structure relevant were captured as part of the process. No new structures were added (Fig. 1).

In the second round, 35 of the 46 panellists responded (78.3 %) during a period of 3 months (October – December 2018). Of the 25 structures that were disputed in the first round, ten were accepted (40.0 %). Thirteen structures were denied based on our criteria of a mean score of ≥ 4 and ≥ 70 %. Two structures, the spina iliaca posterior superior (77.2 %, 3.8) and the foramen ischiadicum (86.6 %, 3.9) reached ≥ 70 % but scored ≤ 4. As it was not considered appropriate to set up a third Delphi round, the two structures were accepted. Therefore, a total of twelve structures were added (Fig. 1).

After completing the two Delphi rounds, a list of 86 clinically relevant structures was compiled (Fig. 1).

Table 1
Demographic composition.

		Round 1 N (%)	Round 2 N (%)
Gender			
	Female	33 (71.7)	25 (67.6)
	Male	13 (28.3)	12 (32.4)
Medical Doctor			
	Residents	19 (41.3)	13 (35.1)
	Specialists	27 (58.7)	24 (64.9)
Workplace			
	Academic hospital	22 (48.9)	14 (37.8)
	Non-academic teaching hospital	20 (44.4)	23 (62.2)
	Non-academic, non-teaching hospital	3 (6.7)	0 (0.0)
Specialty			
	Obstetrics	12 (29.1)	7 (18.9)
	Fertility	7 (15.2)	8 (21.6)
	Oncology	6 (13.0)	8 (21.6)
	Urogynaecology	5 (10.9)	2 (5.4)
	No subspecialty / resident	16 (34.8)	12 (32.4)

Comment

Main findings

The aim of this study was to determine the anatomical structures that are relevant to the safe and competent practice of a general gynaecologist. Two focus groups, an individual interview and two Delphi rounds were performed, resulting in consensus on 86 clinically relevant anatomical structures.

Interpretation

Bergman et al. (2011) described eight factors that are considered to have a negative influence on anatomical knowledge, one of which is the absence of a core anatomy curriculum [16]. The curriculum time devoted to teaching anatomy has decreased over the years and the significant increase in scientific knowledge means that the amount of basic scientific information is too large to accommodate. In addition, technological advancements and social and health policy developments are influencing anatomy education. Therefore, it is important that informed decisions are made about which subjects are taught. The lack of a core curriculum may also contribute to confusion about whether too much or too little is taught for certain disciplines. In this study, we utilised the focus group and Delphi approaches to obtain a collective opinion on core content that would help to improve clinically relevant teaching. Previous literature has emphasised the importance of such a core curriculum to ensure topics of real clinical relevance are covered and to equip students with a good grasp of the relationship between structure and function [5,17]. The importance was also emphasised by Friedman et al. (2006), who recommended that the basic science component of medical education should move away from the acquisition of large amounts of detailed information. Instead it should focus on mastering more general concepts relevant to the practice of medicine and the process through which this conceptual material is used to solve medical problems [18]. The clinical relevance has also been emphasised by Smith et al. (2011), who described an exploratory case study demonstrating that students and alumni exhibited a positive change in motivation when anatomy was linked to the clinical context. Around half of the alumni reported that they used > 70 % of the anatomy they had been taught during the anatomy courses in an average year of practice. This supports not only the importance and relevance of anatomy in clinical practice, but also the positive effects on learning anatomy when it is in a clinically relevant context [5]. In addition to professional anatomists and medical students, laypersons (i.e., patients and potential patients) also report a very positive attitude towards the clinical importance of anatomy. As we now live in a consumer society, we cannot ignore the opinion of this group. Moxham et al.(2016) performed a survey of laypersons to find out their opinion on the relevance of anatomy in medicine, demonstrating that they strongly believe that gross anatomy is crucial for medical education and that the esteem in which medical professionals are held would be diminished if anatomy were not a significant part of the medical curriculum [19].

Strengths and limitations

The main strength of our study is the design, which first involved the development of a list of essential structures from textbooks related to gynaecology examination and surgery. This list was checked by an anatomist and gynaecologists from all

subspecialties. Secondly, gynaecology trainees from years 4 – 6, as well as surgeons, urologists and radiologists, discussed this list in two focus groups. Thirdly, consensus on the structures agreed as relevant during the focus groups was reached using the Delphi method, involving gynaecologists and trainees from years 2 – 6. This has resulted in a widely supported and clinically relevant list of anatomical structures that can be used to guide the teaching of anatomy during gynaecology postgraduate education. Through this list, we not only make anatomy teaching clinically relevant, but also effective in a time of increasing demands by providing a structure that programme directors can follow.

Related to the design is the diversity within the focus groups, which included different subspecialists from gynaecology as well as other specialties, i.e., surgery, urology and radiology. Diversity also comes from the involvement of trainees and medical doctors with differing levels of experience and education. The large number of trainees participating in this study could be seen as a limitation of this study. However, in our opinion, it is a fare reflection of the medical doctors employed in gynaecology nowadays in the Netherlands. Overall, we have almost 1000 gynaecologist and approximately 400 trainees. This means that trainees compromise 40 % of the doctors working in the modern field of gynaecology as in our Delphi survey. In our opinion we believe this diversity is a key strength since it demonstrates the engagement of all parties involved in the development process, which makes uptake more likely [20]. Several reports have evaluated the role of gross human anatomy in the medical curriculum, illustrating differing perspectives held by students [21–24], anatomists [25], postgraduate doctors [26] and clinicians [27,28]. Therefore, to establish a realistic and widely supported list it is important to reflect the perspectives of them all.

We believe that the response rate seen in this study represents another strength, being higher than the previously-reported range for questionnaire-based surveys. Baruch and Holtom (2008) analysed 490 studies that involved the use of surveys and demonstrated the average response rate to be approximately 50 %, with a standard deviation of approximately 20 % [29]. In addition, the fact that panellists from academic, non-academic teaching and non-academic non-teaching hospitals responded ensures that our results are comprehensive and representative, and that panellists from all subspecialties within gynaecology were represented.

A limitation of this study is that although the Delphi approach is highly effective to generate consensus between individuals, it does not provide guidance on the pedagogic approach required to deliver these components. It is known that the relationship between knowledge and its application in clinical practice is not a straightforward one. Individual experience can vary and personal perceptions of anatomy, the context of learning and emotions all play a role in this process [5,30]. Future studies may be required to provide additional guidance for teaching programmes.

Another limitation is that the final process of the Delphi approach included only clinicians and no anatomists. This carries the risk that what is not known is not found important, although Koens et al. (2006) have shown that basic scientists and physicians do not diverge at the clinical level of biomedical science [31].

Conclusions

This study identified a core list of anatomical structures that are relevant to the safe and competent practice of general gynaecologists and that can be used to guide gynaecology postgraduate education. This is the first step in a much wider and complex process of becoming a competent gynaecologist. The next step could be to investigate suitable teaching methods for work-related learning.

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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