

Original Article

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# Insufficient training in colposcopy and loop electrosurgical excision procedure among residents

Louise Krog<sup>1, 2, 3</sup>, Kathrine Dyhr Lycke<sup>1, 2, 3</sup>, Anne Gamst Christiansen<sup>1</sup> & Anne Hammer<sup>1, 2, 3</sup>

1) Department of Obstetrics and Gynaecology, Gødstrup Hospital, Herning, 2) NIDO, Centre for Research and Education, Gødstrup Hospital, Herning, 3) Department of Clinical Medicine, Aarhus University, Denmark

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**ABSTRACT**

**INTRODUCTION.** Colposcopy is an important tool in the diagnostic work-up of women with an abnormal cervical smear. Unlike in other countries where colposcopy is mostly performed by certified colposcopists, in Denmark, colposcopy may be performed by residents in obstetrics and gynaecology (OB/Gyn). We aimed to evaluate training in colposcopy and loop electrosurgical excision procedure (LEEP) among Danish OB/Gyn residents.

**METHODS.** Two questionnaires were developed: one for OB/Gyn residents who are required to learn colposcopy and LEEP during their residency, and one for chief physicians who are responsible for providing their training. Questionnaires were distributed by e-mails and via social media from November to December 2021.

**RESULTS.** Among 120 eligible residents, 93 completed the questionnaire. The median age was 36 (interquartile range: 34-39) years. Most received training in colposcopy (84.9%), but the majority considered training to be insufficient (76.3%) and had low self-efficacy in performing colposcopy (72.0%). With respect to LEEP, most received training (84.9%), but nearly half considered that their training had been insufficient (43.0%) and had low self-efficacy in performing LEEP (49.5%).

**CONCLUSIONS.** Most Danish OB/Gyn residents receive insufficient training in colposcopy and LEEP, which demonstrates a need for a formal training programme for residents and their supervisors to ensure an appropriate level of training and adequate patient care.

**FUNDING.** Danish Association of Younger Gynaecologists and Obstetricians (FYGO).

**TRIAL REGISTRATION.** Not relevant.

Since the introduction of cervical cancer screening, the incidence of and mortality from cervical cancer have declined substantially in developed countries, including Denmark [1]. Women with abnormal screening results may be referred for colposcopy where colposcopy-directed biopsies are collected. Hence, colposcopy is an important tool in diagnosing cervical precancer. However, colposcopy is a subjective procedure with high inter- and intraobserver variation [2, 3]. The ability to visualise precancerous lesions at colposcopy depends heavily on the colposcopist's level of training and experience [4]. As clinical management depends on the colposcopic evaluation and the biopsy result, it is critical that colposcopists are adequately trained.

Treatment of cervical precancer is typically performed by a loop electrosurgical excision procedure (LEEP) to avoid progression to cancer. Previous studies have demonstrated that, compared to experienced gynaecologists, residents often remove a larger volume of the cervix, thereby increasing the risk of reproductive harm [5]. Hence, adequate LEEP training is also important.

According to current recommendations from the European Federation for Colposcopy, each colposcopy trainee should see a minimum of 100 colposcopy cases [6]. In Denmark, training in colposcopy and LEEP is part of the residency training in obstetrics and gynaecology (OB/Gyn), but no formal training programme exists [7].

In this study, we aimed to evaluate the self-reported level of training in colposcopy and LEEP among Danish OB/Gyn residents.

## **METHODS**

In Denmark, colposcopies are performed at public hospitals or in private gynaecology clinics. The procedure may be performed by gynaecologists, OB/Gyn residents or nurses trained in colposcopy. Training in colposcopy and LEEP is a part of the four-year OB/Gyn residency training programme. The Danish Society of Obstetrics and Gynaecology and the Danish Health Authority have agreed on which competences should be acquired during residency training [7]. Residents should be able to inform, examine (colposcopy and biopsy), treat (LEEP) and manage women with cervical precancer. Moreover, they should perform approximately 15 LEEP during their residency and be able to interpret biopsy and LEEP results [7]. Each OB/Gyn department employs a chief physician who oversees residency training, but no formal training programme exists in either colposcopy or LEEP. Hence, how the required competences are achieved is left to individual programmes at each department.

We conducted a questionnaire study in Denmark from November to December 2021. We created two digital questionnaires in Danish: one targeting residents in OB/Gyn and one for chief physicians in charge of residency training. The resident questionnaire was distributed to all residents in Denmark by direct e-mails and via social media. Information about the study and a link to access the questionnaire was posted on Instagram and in various Facebook groups targeting OB/Gyn residents. The chief physician questionnaire was distributed by direct e-mails from the Chairman of the Education Committee in the Danish Society of Obstetrics and Gynaecology.

The questionnaire targeting residents consisted of 35 questions and was divided into three parts: basic characteristics of the respondent, colposcopy training and LEEP training. The residents were asked if they had received training in colposcopy and LEEP (yes, partly, no) and whether they considered the training sufficient (yes, partly, no). Moreover, they described the type of training they had received. We also investigated the residents' self-efficacy in performing colposcopy and LEEP on a scale from 1 (very low) to 5 (very high). For the analyses, we grouped self-efficacy into binary outcomes, i.e., low (1-3) and high self-efficacy (4-5). The chief physician questionnaire consisted of 31 questions and was divided into the same three parts as the other questionnaire.

### **Statistical analyses**

Data were entered into and stored in Research Electronic Data Capture (REDCap). Data were mainly reported descriptively, and Stata version 15.0 (StataCorp LLC, 2017, College Station, TX) was used for statistical analyses.

*Trial registration:* not relevant.

## RESULTS

### Resident questionnaire

Among 120 eligible residents, 93 (77.5%) responded. Of these, 55.9% were first- or second-year residents. Most were female (90.3%) and their median age was 36 (interquartile range: 34-39) years. More than half had  $\geq 3$  years of clinical experience in OB/Gyn (data not shown).

Regarding training in colposcopy (**Table 1**), most residents received training in full or in part (84.9%). However, the majority considered the training insufficient (76.3%). Most residents performed colposcopies independently (77.4%), but nearly half had  $< 5$  supervised colposcopies before performing them independently. During the past year, more than half of all first- and second-year residents performed  $< 10$  colposcopies (57.7%), whereas this applied to a smaller proportion of third- and fourth-year residents (24.4%). Most residents had low self-efficacy in performing colposcopy (72.0%), including assessing the transformation zone (63.4%) and describing the colposcopic findings (72.0%). Overall, compared to first- and second-year residents, third- and fourth-year residents had a higher self-efficacy, although the proportion of residents with high self-efficacy remained below 60%.

**TABLE 1** Evaluation of colposcopy training among Danish residents in obstetrics and gynaecology, overall and stratified by years of training.

Questionnaire item	1st and 2nd year (N <sub>1-2</sub> = 52)		3rd and 4th year (N <sub>3-4</sub> = 41)		Total (N <sub>tot</sub> = 93)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
<i>Received training in colposcopy?</i>						
Yes/partly	41	78.8 (65.3-88.9)	38	92.7 (80.1-98.5)	79	84.9 (76.0-91.5)
No	11	21.2 (11.1-34.7)	3	7.3 (1.5-19.9)	14	15.1 (8.5-24.0)
Missing	0		0		0	
<i>Considered training in colposcopy sufficient?</i>						
Yes/partly	10	19.2 (9.6-32.5)	11	26.8 (14.2-42.9)	21	22.6 (14.6-32.4)
No	41	78.8 (65.3-88.9)	30	73.2 (57.1-85.8)	71	76.3 (66.4-84.5)
Missing	1	1.9 (0.0-10.3)	0		1	1.1 (0.0-5.8)
<i>Performed colposcopy independently?<sup>a</sup></i>						
Yes	33	63.5 (49.0-76.4)	39	95.1 (83.5-99.4)	72	77.4 (67.8-85.4)
No	18	34.6 (22.0-49.1)	2	4.9 (0.6-16.5)	20	21.5 (13.7-31.2)
Missing	1	1.9 (0.0-10.3)	0		1	1.1 (0.0-5.8)
<i>Supervised colposcopies before performing them independently, n<sup>b</sup></i>						
< 5	22	42.3 (28.7-56.8)	20	48.8 (32.9-64.9)	42	45.2 (34.8-55.8)
5-10	9	17.3 (8.2-30.3)	14	34.1 (20.1-50.6)	23	24.7 (16.4-34.8)
> 10	2	3.8 (0.5-13.2)	4	9.8 (2.7-23.1)	6	6.5 (2.4-13.5)
Missing	19	36.5 (23.6-51.0)	3	7.3 (1.5-19.9)	22	23.7 (15.5-33.6)
<i>Colposcopies performed during the past year, n<sup>b</sup></i>						
< 10	30	57.7 (43.2-71.3)	10	24.4 (12.4-40.3)	40	43.0 (32.8-53.7)
10-24	9	17.3 (8.2-30.3)	13	31.7 (18.1-48.1)	22	23.7 (15.5-33.6)
25-49	5	9.6 (3.2-21.0)	12	29.3 (16.1-45.5)	17	18.3 (11.0-27.6)
≥ 50	4	7.7 (2.1-18.5)	6	14.6 (5.6-29.2)	10	10.8 (5.3-18.9)
Missing	4	7.7 (2.1-18.5)	0		4	4.3 (1.2-10.6)
<i>Self-efficacy in performing colposcopy</i>						
High	10	19.2 (9.6-32.5)	13	31.7 (18.1-48.1)	23	24.7 (16.4-34.8)
Low	39	75.0 (61.1-86.0)	28	68.3 (51.9-81.9)	67	72.0 (61.8-80.9)
Missing	3	5.8 (1.2-15.9)	0		3	3.2 (0.7-9.1)
<i>Self-efficacy in assessing the transformation zone</i>						
High	12	23.1 (12.5-36.8)	19	46.3 (30.7-62.6)	31	33.3 (23.9-43.9)
Low	37	71.2 (56.9-82.9)	22	53.7 (37.4-69.3)	59	63.4 (52.8-73.2)
Missing	3	5.8 (1.2-15.9)	0		3	3.2 (0.7-9.1)
<i>Self-efficacy in describing the colposcopic findings</i>						
High	5	9.6 (3.2-21.0)	18	43.9 (28.5-60.3)	23	24.7 (16.4-34.8)
Low	44	84.6 (71.9-93.1)	23	56.1 (39.7-71.5)	67	72.0 (61.8-80.9)
Missing	3	5.8 (1.2-15.9)	0		3	3.2 (0.7-9.1)
<i>Self-efficacy in deciding the appropriate clinical management after receiving the biopsy result</i>						
High	9	17.3 (8.2-30.3)	23	56.1 (39.7-71.5)	32	34.4 (24.9-45.0)
Low	40	76.9 (63.2-87.5)	18	43.9 (28.5-60.3)	58	62.4 (51.7-72.2)
Missing	3	5.8 (1.2-15.9)	0		3	3.2 (0.7-9.1)

CI = confidence interval.

a) Without supervision from a senior doctor from the beginning of the examination.

b) Includes supervised and unsupervised colposcopies.

With respect to LEEP training (Table 2), most residents received training in full or in part (84.9%). However, almost half of the residents considered the training insufficient (43.0%). Two out of three residents performed LEEP independently, most of whom were in their third or fourth year of residency training. During the past year, half of all residents performed < 5 LEEP. Overall, nearly half of all residents had a low self-efficacy in performing LEEP, but the fraction declined with years of residency training.

**TABLE 2** Evaluation of training in loop electrosurgical excision procedure among Danish residents in obstetrics and gynaecology, overall and stratified by years of training.

Questionnaire item	1st and 2nd year (N <sub>1-2</sub> = 52)		3rd and 4th year (N <sub>3-4</sub> = 41)		Total (N <sub>tot</sub> = 93)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
<i>Received training in LEEP?</i>						
Yes/partly	40	76.9 (63.2-87.5)	39	95.1 (83.5-99.4)	79	84.9 (76.0-91.5)
No	10	19.2 (9.6-32.5)	0		10	10.8 (5.3-18.9)
Missing	2	3.8 (0.5-13.2)	2	4.9 (0.6-16.5)	4	4.3 (1.2-10.6)
<i>Considered training in LEEP sufficient?</i>						
Yes/partly	20	38.5 (25.3-53.0)	26	63.4 (46.9-77.9)	46	49.5 (38.9-60.0)
No	27	51.9 (37.6-66.0)	13	31.7 (18.1-48.1)	40	43.0 (32.8-53.7)
Missing	5	9.6 (3.2-21.0)	2	4.9 (0.6-16.5)	7	7.5 (3.1-14.9)
<i>Performed LEEP independently?<sup>a</sup></i>						
Yes	25	48.1 (34.0-62.4)	33	80.5 (65.1-91.2)	58	62.4 (51.7-72.2)
No	25	48.1 (34.0-62.4)	5	12.2 (4.1-26.2)	30	32.3 (22.9-42.7)
Missing	2	3.8 (0.5-13.2)	3	7.3 (1.5-19.9)	5	5.4 (1.8-12.1)
<i>Supervised LEEP before performing them independently, n<sup>b</sup></i>						
< 5	18	34.6 (22.0-49.1)	15	36.6 (22.1-53.1)	33	35.5 (25.8-46.1)
5-10	6	11.5 (4.4-23.4)	12	29.3 (16.1-45.5)	18	19.4 (11.9-28.9)
> 10	1	1.9 (0.0-10.3)	6	14.6 (5.6-29.2)	7	7.5 (3.1-14.9)
Missing	27	51.9 (37.6-66.0)	8	19.5 (8.8-34.9)	35	37.6 (27.8-48.3)
<i>LEEP performed during the past year, n<sup>b</sup></i>						
< 5	31	59.6 (45.1-73.0)	14	34.1 (20.1-50.6)	45	48.4 (37.9-59.0)
5-10	11	21.2 (11.1-34.7)	15	36.6 (22.1-53.1)	26	28.0 (19.1-38.2)
> 10	5	9.6 (3.2-21.0)	9	22.0 (10.6-37.6)	14	15.1 (8.5-24.0)
Missing	5	9.6 (3.2-21.0)	3	7.3 (1.5-19.9)	8	8.6 (3.8-16.2)
<i>LEEP performed overall, n<sup>b</sup></i>						
< 5	16	30.8 (18.7-45.1)	2	4.9 (0.6-16.5)	18	19.4 (11.9-28.9)
5-10	8	15.4 (6.9-28.1)	7	17.1 (7.2-32.1)	15	16.1 (9.3-25.2)
11-20	11	21.2 (11.1-34.7)	8	19.5 (8.8-34.9)	19	20.4 (12.8-30.1)
> 20	12	23.1 (12.5-36.8)	21	51.2 (35.1-67.1)	33	35.5 (25.8-46.1)
Missing	5	9.6 (3.2-21.0)	3	7.3 (1.5-19.9)	8	8.6 (3.8-16.2)
<i>Self-efficacy in performing LEEP</i>						
High	15	28.8 (17.1-43.1)	24	58.5 (42.1-73.7)	39	41.9 (31.8-52.6)
Low	32	61.5 (47.0-74.7)	14	34.1 (20.1-50.6)	46	49.5 (38.9-60.0)
Missing	5	9.6 (3.2-21.0)	3	7.3 (1.5-19.9)	8	8.6 (3.8-16.2)
<i>Self-efficacy in deciding appropriate follow-up after LEEP after receiving the cone result</i>						
High	18	34.6 (22.0-49.1)	29	70.7 (54.5-83.9)	47	50.5 (40.0-61.1)
Low	29	55.8 (41.3-69.5)	9	22.0 (10.6-37.6)	38	40.9 (30.8-51.5)
Missing	5	9.6 (3.2-21.0)	3	7.3 (1.5-19.9)	8	8.6 (3.8-16.2)

CI = confidence interval; LEEP = loop electrosurgical excision procedure.

a) Without supervision from a senior doctor from the beginning of the examination.

b) Includes supervised and unsupervised LEEP.

Compared with residents with insufficient training in colposcopy, those who considered their training fully or partly sufficient were more likely to have received oral introduction, theoretical introduction, review of colposcopy pictures and supervised colposcopy (Table 3). Likewise, those who considered training in LEEP fully or partly sufficient were more likely to receive oral introduction and supervised LEEP than residents reporting insufficient LEEP training.

**TABLE 3** Type of training in colposcopy and loop electrosurgical excision procedure stratified by whether training was deemed sufficient.

	Fully or partly sufficient training		Insufficient training	
	n <sup>a</sup>	n/N, % (95% CI)	n <sup>a</sup>	n/N, % (95% CI)
<i>Colposcopy</i> <sup>b</sup>				
Oral introduction	16	76.2 (52.8-91.8)	35	49.3 (37.2-61.4)
Theoretical introduction	10	47.6 (25.7-70.2)	9	12.7 (6.0-22.7)
Review of colposcopy pictures	5	23.8 (8.2-47.2)	3	4.2 (0.9-11.9)
Courses	10	47.6 (25.7-70.2)	24	33.8 (23.0-46.0)
Hands-on training	3	14.3 (3.0-36.3)	1	1.4 (0.0-7.6)
Observing a doctor performing colposcopy	14	66.7 (43.0-85.4)	33	46.5 (34.5-58.7)
Supervised colposcopy	15	71.4 (47.8-88.7)	34	47.9 (35.9-60.1)
Fast-track procedure <sup>c</sup>	3	14.3 (3.0-36.3)	0	
Subtotal (N <sub>c</sub> )	21		71	
<i>LEEP</i> <sup>d</sup>				
Oral introduction	30	65.2 (49.8-78.6)	8	20.0 (9.1-35.6)
Hands-on training	4	8.7 (2.4-20.8)	1	2.5 (0.1-13.2)
Observing a doctor performing LEEP	33	71.7 (56.5-84.0)	30	75.0 (58.8-87.3)
Supervised LEEP	45	97.8 (88.5-99.9)	25	62.5 (45.8-77.3)
Fast-track procedure <sup>c</sup>	4	8.7 (2.4-20.8)	0	
Subtotal (N <sub>i</sub> )	46		40	

CI = confidence interval; LEEP = loop electrosurgical excision procedure.

a) Each responder could be trained in several ways, and so the sum of n values > N.

b) Missing: n = 1.

c) A specific period of time with supervised colposcopies/LEEP every week.

d) Missing: n = 7.

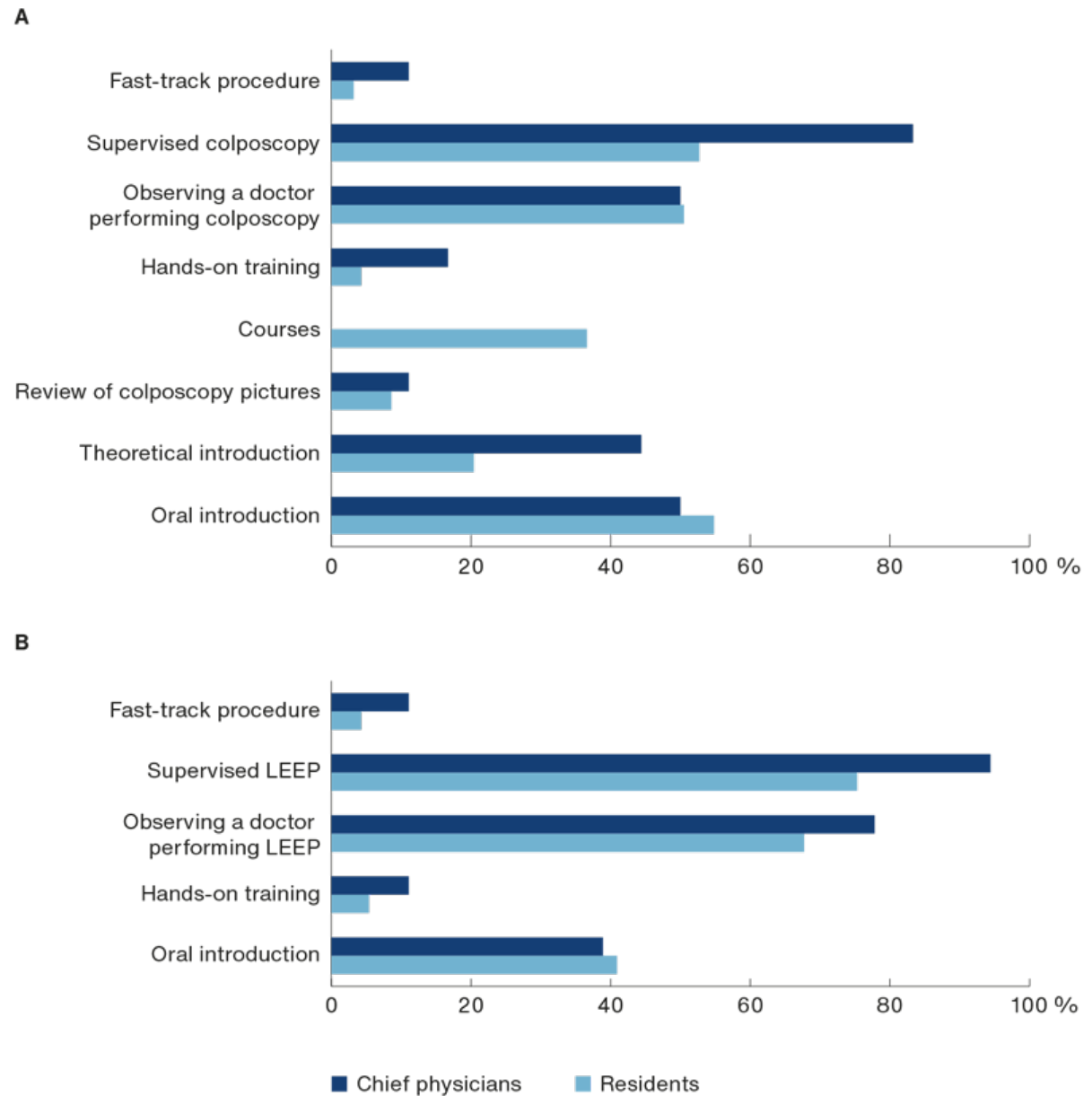
### Questionnaire for chief physicians responsible for residency training

Among 20 eligible departments, chief physicians from 18 departments (90.0%) completed the questionnaire. Most reported that their department was either fully (55.6%) or partly (33.3%) responsible for training in colposcopy and LEEP. However, more than half did not have a systematic training programme in either colposcopy (61.1%) or LEEP (55.6%). Furthermore, only half of the chief physicians assessed the residents as sufficiently trained in colposcopy (44.4%) and LEEP (61.1%) (data not shown).

Training offered by the chief physicians and training received by the residents are compared in **Figure 1**.

**FIGURE 1** Type of colposcopy and loop electrosurgical excision procedure (LEEP) training received by residents compared with type of training offered by the chief physicians.

**A.** Colposcopy training. **B.** LEEP training.



## DISCUSSION

Most residents in OB/Gyn received training in colposcopy and LEEP. However, many considered the training insufficient and had low self-efficacy in performing the procedures. Although third- and fourth-year residents were more likely to report receiving training and had a higher self-efficacy than first- and second-year residents, the fraction of residents with insufficient training and low self-efficacy remained high. Hence, our findings indicate a need to establish a formal training programme to ensure adequate patient care and reduce the risk of unnecessary reproductive harm.

Colposcopy is an important tool in the diagnostic work-up of women with abnormal screening results. Consequently, the high proportion of OB/Gyn residents reporting that they had received insufficient training is concerning and underlines the need to set-up formal training programmes. Importantly, this should also include training of the trainers to ensure that residents receive adequate supervision. In the United Kingdom, colposcopy is mostly performed by experienced and certified colposcopists who have undergone a specific training and certification programme [8]. In the United States, several milestones have been set up for training in colposcopy but, similar to Denmark, the optimal way to reach these milestones is left to individual programmes [9]. Also, training programmes in the United States have insufficient clinical volume to achieve sufficient training in colposcopy [10].

In Denmark, more than half of all colposcopies and LEEP are performed in private gynaecology clinics [11]. This results in a reduced volume of patients at public gynaecology clinics in Denmark, thereby negatively impacting training as training in colposcopy and LEEP takes place only at public departments. Additionally, several changes in relation to the screening programme may be expected. As a growing proportion of women attending screening will have received the HPV vaccine, the colposcopy referral rate will likely decline in cohorts vaccinated as part of the childhood vaccination programme [12]. On the other hand, the colposcopy referral rate will likely increase in HPV-screened cohorts, particularly in the first screening round as HPV-based screening is more sensitive than cytology. Nevertheless, several studies have demonstrated that the likelihood of cervical precancer at colposcopy is lower in HPV-vaccinated cohorts but also in HPV-screened cohorts [12, 13]. These findings suggest a need to rethink current colposcopy practice and training to reduce the risk of overdiagnosis and overtreatment.

According to Danish guidelines, all women referred for colposcopy should have a minimum of four biopsies collected irrespective of their colposcopic findings [14]. This recommendation is based on studies from Denmark and the United States that show an increasing CIN2+ detection rate with increasing number of biopsies collected [15, 16]. Other studies have reported that the number of biopsies is positively correlated to risk of bleeding and discomfort for the woman [17]. Thus, it would be worth exploring if receiving better colposcopy training may reduce the number of biopsies collected without compromising diagnostic accuracy. One study reported that senior colposcopists were more likely to pick up high-grade lesions than junior colposcopists (73.7% versus 48.4%) [4]. In contrast, another study reported a lower sensitivity but a higher positive predictive value for detection of high-grade lesions among experienced than among unexperienced colposcopists [18]. The authors concluded that the higher sensitivity was owed to the fact that unexperienced colposcopists collected more biopsies. Formally comparing study results is, however, difficult as the definition of training and experience varies between studies.

With respect to LEEP training, we did not collect information on patient outcomes in this study. Hence, we are unable to infer whether insufficient training of residents resulted in a higher risk of treatment failure, such as a high proportion of positive resection margins or larger cone volume. Only a few studies have investigated differences in performance of LEEP between residents and experienced gynaecologists. One study found that the rate of incomplete resections was comparable between the two groups. However, the residents had a significantly larger cone volume [5]. LEEP is considered sufficient when the precancer is completely resected, but treatment should be done by removing the smallest possible amount of tissue to minimise the risk of reproductive harm [19]. Yet, lack of experience may cause the surgeon to remove more cervical tissue than needed [5]. Another study reported that junior colposcopists performing LEEP had a significantly higher rate of artifacts leading to inconclusive margins than experienced colposcopists had [20]. These findings demonstrate a need to improve current LEEP training to improve self-efficacy, secure sufficient treatment and reduce the risk of reproductive harm.



This study has several limitations that need to be addressed. First, we cannot rule out selection bias as it is possible that residents who are either satisfied or dissatisfied with their training may have a greater tendency to participate, thereby affecting our results in either direction. Second, the study is vulnerable to information bias, especially recall bias, and it is possible that residents who are dissatisfied with their training may claim to have received less training than they actually did. Thus, our results may possibly overestimate lack of training in colposcopy and LEEP. Third, the questionnaires were not formally validated, which may have affected our results. Fourth, although we chose to evaluate the residents' self-reported level of training and self-efficacy, it would have been interesting to link these results to objective measures of performance, such as margin status and cone volume. Unfortunately, we were unable to retrieve this information. Fifth, although our results may not be generalisable to settings where colposcopy is performed only by certified colposcopists, we believe that our findings warrant an investigation of colposcopy and LEEP training in countries where these procedures are performed by residents. The strengths include a high response rate of nearly 80% for residents and 90% for chief physicians. Furthermore, we received completed questionnaires from all geographical areas in Denmark.

## CONCLUSIONS

Most Danish OB/Gyn residents received insufficient training in colposcopy and LEEP. Although residents in the final years of residency training were more likely to report sufficient training and higher self-efficacy than residents in their first years, our findings suggest that a formal training programme for residents and their supervisors is warranted to ensure an appropriate level of training and adequate patient care.

**Correspondence** Anne Hammer. E-mail: anne.hammer.lauridsen@vest.rm.dk

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