

# Implementation of a Cross-specialty Training Program in Basic Laparoscopy

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## ABSTRACT

**Background and Objectives:** Several surgical specialties use laparoscopy and share many of the same techniques and challenges, such as entry approaches, equipment, and complications. However, most basic training programs focus on a single specialty. The objective of this study was to describe the implementation of a regional cross-specialty training program for basic laparoscopy, to increase the flexibility of educational courses, and to provide a more efficient use of simulation equipment.

**Methods:** Using a regional training program in basic laparoscopy for gynecology as a model, we developed a cross-specialty training program for residents in surgery, gynecology, urology, and thoracic surgery. We reviewed data on training for the first year of the program and evaluated the program by using a scoring system for quality criteria for laparoscopic curricula and skills.

**Results:** We held 6 full-day theoretical courses involving 67 residents between September 1, 2013, and August 31, 2014. In the weeks following each course, residents practiced in a self-directed, distributed, and proficiency-based manner at a simulation center and in local hospital departments. A total of 57 residents completed the self-practice and a subsequent practical animal laboratory-based course. The structure of the training program was evaluated according to identified quality criteria for a skills laboratory, and the program scored 38 of a maximum 62 points.

**Discussion:** Implementation of a regional cross-specialty training program in basic laparoscopy is feasible. There

are several logistic benefits of using a cross-specialty approach; however, it is important that local departments include specialty-specific components, together with clinical departmental follow-up.

**Key Words:** Curriculum, Education, Laparoscopy, Training

## INTRODUCTION

To increase patient safety and support surgical education, surgeons should complete simulator training based on the principles of best practice before operating on patients.

Despite the increasing evidence supporting the use of laparoscopic simulation, successful implementation of training remains a problem.<sup>1</sup> Minimally invasive surgery, such as laparoscopy and thoracoscopy, is used in several surgical specialties: general surgery, gynecologic and urologic surgery, and thoracic surgery and joint training in basic principles could be beneficial, yet most training programs and curricula focus on only 1 specialty. Current evidence on surgical simulation suggests that optimal acquisition of technical skills should include deliberate, distributed, and proficiency-based practice.<sup>2</sup> However, the use of deliberate practice requires training and assessment tools with evidence of validity, and dispersed practice sessions can be demanding to organize. Proficiency-based training allows the training to be adapted to satisfy each participant's needs, taking into account their previous experience or innate ability.

An effective training program that keeps residents motivated requires relevant curriculum content, personnel, and resources and the use of optimal flexible training strategies. However, creating a training program that incorporates all of these aspects is a challenging task, and the limited number of residents from 1 specialty in a given region can pose a limitation on the cost-effectiveness and flexibility of such a training program.<sup>3,4</sup>

The objective of this article is to describe the implementation of a regional cross-specialty training program in basic laparoscopy for residents in general surgery, gynecologic urologic procedures, and thoracic surgery; to in-

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**Figure 1.** Surgical, urological, and gynecological residents at a joint practice session in the simulation center.

crease the flexibility of training; and to evaluate the first year of the training program.

## MATERIALS AND METHODS

### Study Setting

Before implementation of the cross-specialty training program, training in basic laparoscopy in Eastern Denmark was provided separately by each specialty. Gynecology had a regional mandatory training program consisting of a 1-day course followed by simulation-based training that had been implemented in a national curriculum,<sup>4</sup> and general, urologic, and thoracic surgery, had voluntary half-yearly 1-day courses with box training or animal laboratory training. Departments were located in 12 different hospitals in the region.

### Structure of the Cross-specialty Training Program

The cross-specialty training program was modeled on the existing regional training program for gynecology. It consisted of a 1-day course that covered the theoretical aspects of laparoscopy, followed by self-directed training sessions with simulator training and, after the resident reached proficiency on the simulators, a 1-day practical operative animal course.<sup>4,5</sup>

The theoretical topics covered on the 1-day course were: laparoscopic equipment function and malfunction, entry techniques and insufflations, ergonomics and instrument handling, electrosurgery, and management of complications. The course also included hands-on training with

box trainers and virtual reality simulators, to familiarize the participants with the equipment.

The theoretical course was followed by sessions of self-directed proficiency-based simulator training on the same equipment, performed at either a regional simulation center or at local hospital departments or simulation units (see **Figure 1**).<sup>6</sup> Using an online booking system, residents could book 2-hour training sessions at the simulation center during the daytime, or the evening, throughout the week, including weekends.<sup>7</sup> There was sufficient equipment for 4 residents to practice simultaneously (4 virtual reality simulators and 4 box trainers). Medical students attended all training sessions, to assist with technical problems and provide feedback and instructions. The medical students affiliated with the center had completed the simulation-based training themselves and had received instructions on how to provide feedback.<sup>8,9</sup> Residents were encouraged to practice using all training opportunities available to them. Upon completion of the simulator training and after demonstrating that they had reached the predefined proficiency level, residents could participate in a 1-day practical operative animal course., focused on practicing skills not available on simulators, such as entry techniques and the management of complications. On all courses, the faculty consisted of experienced surgeons from all specialties involved, from departments across the region.

### Program Evaluation

The authors used a novel scoring system for curricula and skills laboratories for laparoscopic training programs, to evaluate the program described.<sup>10</sup> This system was based on a Delphi survey on the most essential components of a laparoscopic curriculum or skills laboratory. Depending on whether a specific component was present or not and on how important this component was, an item-specific score between 0 and 3 was awarded, with “not present” allocated a score of 0.

Data on practice sessions were retrieved from simulation center logbooks kept by the medical students who were present during the training sessions, and from the virtual reality simulators, which automatically stored training data in a unique account for each resident.

Overall completion time was calculated as the number of days from starting the theoretical course to completing the practical course. Data on training outside of the center were not available. All participant data were kept anonymous for publication purposes.

**Table 1.**  
Data on Completion Rates and Self-practice

	General Surgery	Gynecology	Urology	Thoracic Surgery	All Specialties
Approximate number of trainees in 1-year educational positions in the region annually <sup>11</sup> (minimum– maximum)	24–42	21–28	12–21	1.5–3	–
Participants in the theoretical courses, <i>n</i>	28	28	9	2	67
Participants who completed simulator training, <i>n</i>	26	26	5	0	57
Participants in the animal lab courses, <i>n</i>	26	26	5	0	57
training sessions at the skills center median <i>n</i> (range) <sup>a</sup>	2 (1–6)	3 (1–6)	3 (1–4)	–	3 (1–6)
Effective minutes spent on virtual reality simulator training, median (range) <sup>a,b</sup>	142 (28–257)	184 (20–364)	106 (23–168)	–	152 (20–364)
Minutes spent on box trainers, median (range) <sup>a,b</sup>	45 (10–255)	–	68 (10–90)	–	45 (10–255)
Days from theoretical course to animal lab course, median <i>n</i> (range)	55 (18–214)	113 (28–208)	128 (74–208)	–	60 (18–214)

<sup>a</sup>Does not include training at local facilities.

<sup>b</sup>Numbers for different specialties are not directly comparable, because the content of simulator training varies according to specialty.

According to the regional scientific ethics committee, no approval was necessary for using the data from the training program (H-3-2014-FSP57).

## RESULTS

Two pilot courses, 1 theoretical and 1 animal laboratory, were held in the spring of 2013. Over a 1-year period, from September 1, 2013, to August 31, 2014, the 1-day theoretical courses in basic laparoscopy were held on 6 occasions. The data for residents who participated in these theoretical courses and the number who completed the subsequent steps, along with data on their training, are presented in **Table 1**. The overall completion rate was 85% (57/67 participants).

According to the scoring system criteria for curricula and skills laboratories, the entire program received 38 points of a possible 62.<sup>10</sup> **Table 2** shows how the training program scored in each of the 3 main categories: personnel and resources, trainee motivation, and curriculum. In the first domain, Personnel and Resources, all the requirements were fulfilled, resulting in the maximum score of 20. For the domain Trainee Motivation, 4 criteria were not met for all specialties. Two of these (“time is dedicated for skills training in the curriculum” and “residents are not allowed to operate before practice is completed”) were the responsibility of clinical departments. The score was

10 of a possible 21. In the final domain, Curriculum, a score of 8 of 21 was awarded. Local departments managed the integration of skills training in resident evaluations, and the allocation of protected training time. However, the following were not incorporated into the training program: maintenance of training, goal progression with progression in residency, and evaluation of retention.

## DISCUSSION

Cross-specialty evidence-based training in basic laparoscopy is feasible and can increase the flexibility of training programs. Only a few publications describe cross-specialty curricula within surgical education, despite the obvious advantages.<sup>12,13</sup> With this structure for a training program, courses can be offered more frequently, and training resources can be used more effectively. The costs associated with simulation training make it imperative to develop the most efficient training strategies and to use the available equipment optimally while still adhering to the best form of practice.<sup>14,15</sup>

The completion rate of the program (85%) was comparable with that of a training program previously established in the region for gynecology alone (73%).<sup>4</sup> A report from the Danish Health and Medicines Authority on future perspectives in specialty training from 2012 recommended a higher degree of coordination of simulation

**Table 2.**  
Evaluation of the Training Program (based on Hiemstra et al<sup>10</sup>)

Criteria	Criterion Met	Score
Personnel and resources		
1. Availability 24 hours a day	<input checked="" type="checkbox"/>	2
2. Space for at least four trainees to train simultaneously	<input checked="" type="checkbox"/>	2
3. Presence of a laboratory technician	<input checked="" type="checkbox"/>	1
4. Presence of a curriculum director (a laparoscopy expert)	<input checked="" type="checkbox"/>	3
5. Presence of a box (video) trainer	<input checked="" type="checkbox"/>	3
6. Presence of a virtual-reality trainer	<input checked="" type="checkbox"/>	2
7. Effective instruction material for the use of trainers (e.g. video)	<input checked="" type="checkbox"/>	2
8. Presence of an animal laboratory	<input checked="" type="checkbox"/>	2
9. Availability of financial resources for the skills laboratory	<input checked="" type="checkbox"/>	3
Total score for personnel and resources (max. 20)		20
Trainee motivation		
1. Training sessions are supervised by a laparoscopy expert	<input type="checkbox"/>	–
2. Training sessions are supervised by a laboratory technician	<input checked="" type="checkbox"/>	2
3. A proficiency-based (i.e., expert) training goal was set	<input checked="" type="checkbox"/>	2
4. The training goal is based on time and precision	<input checked="" type="checkbox"/>	2
5. Training is mandatory	<input type="checkbox"/> <sup>a,b</sup>	–
6. Residents are not allowed to perform surgery if a predefined skill level is not reached	<input type="checkbox"/> <sup>a,b</sup>	–
7. Awards are given for good attendance	<input type="checkbox"/>	–
8. Presence of tasks of increasing level of difficulty	<input checked="" type="checkbox"/>	2
9. Variability is present in the laparoscopic tasks	<input checked="" type="checkbox"/>	2
Total score for trainee motivation (max 21)		10
Curriculum		
1. Presence of a structured skills curriculum	<input checked="" type="checkbox"/>	3
2. Time is dedicated to skills training in the residency curriculum	<input type="checkbox"/> <sup>a,b</sup>	–
3. Monthly training sessions are organized	<input checked="" type="checkbox"/>	2
4. Presence of overtraining (i.e., better than training goal) facilities	<input checked="" type="checkbox"/>	1
5. Repetitive training over various training sessions	<input checked="" type="checkbox"/>	2
6. Maintenance of training	<input type="checkbox"/>	–
7. Retention of skills is established every 12 months	<input type="checkbox"/>	–
8. Training goal increases with progression in residency	<input type="checkbox"/>	–
9. Progress in laparoscopic skills is incorporated in yearly evaluation of resident	<input type="checkbox"/> <sup>a</sup>	–
Total score for curriculum (max 21)		8
Overall score (max 62)		38

: criterion was met; : criterion was not met.

<sup>a</sup>Responsibility of the clinical departments.

<sup>b</sup>Already implemented in gynecology.

training among the different specialties.<sup>16</sup> Before implementation of this program, only gynecology had a comprehensive simulation-based training program for basic laparoscopy. The cross-specialty approach can expedite implementation of training in specialties where programs are not readily available.

As demonstrated by the scoring system for quality criteria for the surgical curricula used, the current training program has the necessary personnel and resources. Also, the centralized approach reduces the costs and logistical burden for individual departments to provide simulation-based training in technical skills.<sup>10</sup> Cross-specialty training programs can increase the use of training facilities and equipment, thereby making training programs more cost effective.

The strength of our program is the evidence-based approach regarding theoretical principles for optimal training and its flexibility and accessibility.

Flexibility of practice is essential, because experience and pace of learning vary among residents. A proficiency-based approach to training is the most favorable because it ensures that all residents acquire the necessary skills, and at the same time prevents residents from unnecessarily practicing skills they have already acquired.<sup>2,17-19</sup> This is demonstrated by the large variation in time and number of sessions required for completing the training program, as illustrated in Table 1.

Many studies have compared box trainers with virtual reality simulators, to determine whether one training tool is superior to the others. Current evidence suggests that the 2 types of simulators are complementary and provide a similar training outcome. The most important factors are the method and structure of the training.<sup>20,21</sup> Training tools may be perceived differently, depending on trainees' experience and where they are on the learning curve.<sup>22</sup> It is therefore appropriate to incorporate both forms of training in a surgical curriculum.<sup>23</sup> Most laparoscopic training programs focus on technical skills and instrumentation, but many of the complications associated with laparoscopy, such as entry into the abdomen and port placement, are not related to instrumentation. Therefore, it is important to practice the techniques and handling of potential complications, and an animal laboratory is the best setting for this practice.<sup>24,25</sup> Cross-specialty training is advantageous when practicing basic technical skills and teaching the common basic theory for laparoscopy; however, it can be difficult to teach specialty-specific components by using this approach. There may also be different traditions in certain areas, such as laparoscopic entry techniques.<sup>26</sup>

Thoracic surgery had a limited number of residents in the region and an isolated training program for these residents would not be cost-effective; at the same time, some of the course content is less relevant for them, which might explain the low completion rate for this program. Therefore, it is essential that the specialty-specific elements, such as specific procedures and diagnostics, be taught in clinical departments or in other courses.

A limitation of the training program, as demonstrated by the scoring system, is that it does not involve a progressive approach to training throughout residency, either through increasing task difficulty or assessing retention of skills, and it is limited to basic laparoscopy for first-year residents.<sup>10</sup> A laparoscopic surgeon was not present during training sessions; however, a previous study demonstrated that the presence of a surgeon is not necessary for standardized virtual-reality simulator training.<sup>8</sup> In addition, completion of the training program is currently mandatory only in the national postgraduate curriculum in gynecology and obstetrics, but this requirement is likely to change when the benefits of simulation training in laparoscopy become more evident in clinical practice.<sup>27</sup>

The criteria for curricula and skills laboratories in the scoring system may be directed more toward evaluation of local training facilities in each hospital or department, not in a centralized simulation center covering an entire region. This limitation explains why some of the most important quality criteria in a training program were not met in our program. Simulation centers are responsible for making training facilities accessible and practice as flexible as possible, but it is the responsibility of the departments to allocate the necessary time for course participation and practice sessions and to include the training as part of the evaluation of residence performance.<sup>4</sup>

The main objective of a simulation-based laparoscopic training program is to prepare residents to perform supervised procedures on patients. Residents therefore should participate as early as possible and when clinically relevant. To fulfill this goal, it is essential that departments prioritize, plan, and encourage simulation-based training before performing supervised surgery on patients and that simulation centers and clinical departments collaborate closely to enable the successful integration of simulation-based training and certification in the curriculum.

## Future Perspectives

The current program includes a validated test of theoretical knowledge for gynecology residents, and it is desirable that a similar test be available for all specialties in the future.<sup>28</sup> The need also applies to procedure-specific virtual-reality training, which is currently available only for gynecology.<sup>29</sup> Further development of the curriculum should focus on even stronger collaboration between clinical departments and should include progressive training of more advanced skills throughout the period of residency.

## CONCLUSIONS

Implementation of a regional cross-specialty training program for basic laparoscopy is feasible. This approach can increase the flexibility of a training program, because courses can be offered more frequently, and training resources can be used more effectively. It is important, however, that simulation centers work in concert with clinical departments, to ensure the successful integration of simulation-based training in a surgical curriculum.

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