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Laparoscopic psychomotor skill proficiency of Filipino medical doctors in-training in a tertiary hospital in the Philippines

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Abstract:

INTRODUCTION: The conventional teaching of laparoscopic surgery in academic centers in the apprentice/mentor model is highly subjective. The Gynecological Endoscopic Surgical Education and Assessment is a well-structured education program proposed by the European Society for Gynaecological Endoscopy (ESGE). This program uses the Laparoscopic Skills Training and Testing (LASTT) kit, an objective, validated, and measurable test to evaluate an individual's competence level in basic laparoscopic psychomotor skills. The LASTT kit may be used to assess the basic laparoscopic psychomotor skills of Filipino doctors, guide surgical training recruitment, and improve the local minimally invasive surgery curriculum.

GENERAL OBJECTIVE: The study will describe the implementation of the LASTT kit in evaluating the psychomotor skills of Filipino physicians in training and assess the feasibility and user acceptance of the kit.

METHODOLOGY: A descriptive cross-sectional research design was used. A total of 34 trainees (19 medical interns and 15 surgical residents) were included. All trainees underwent the LASTT test to have the baseline data for comparison of each cohort. A posttest questionnaire for the feasibility and user acceptance of the kit was accomplished.

RESULTS: A majority of participants were right-handed, and female, with 0–30 laparoscopic assists. The mean age of surgical residents was higher than medical interns. Surgical residents showed a significantly shorter time to accomplish the exercises than medical interns. Finally, it showed that the kit was clear and understandable, easy to use, and represented a realistic model of the actual laparoscopic surgery.

CONCLUSIONS: The surgical residents were superior to medical interns in laparoscopic psychomotor skills, which supports that hands-on training and exposure to procedures improve skill proficiency. Furthermore, the LASTT kit was well accepted and would greatly aid in recruitment and skills training in the Philippines.

Keywords:

Laparoscopic skills training and testing, laparoscopy, surgical residents

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Introduction

The current trend in gynecologic surgery is minimally invasive surgery (MIS) due to its faster patient recovery, shorter hospital stays, decreased blood loss, lower infection rate, cost-effectiveness, and increased patient satisfaction.[1] Hysterectomies, for example, may have multiple approaches such as abdominal, vaginal, or laparoscopic. These numerous techniques give both the surgeon and the

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patient the chance to structure the most beneficial and optimal approach to surgery. However, this creates the challenge to produce competent and well-trained physicians with modern surgical skills.[2] The conventional teaching of laparoscopic surgery in many academic centers is the apprentice/mentor model, but this is highly subjective. The characteristics of laparoscopic surgery itself affect this kind of approach. First, there is a slow learning curve to developing hand–eye coordination because of its two-dimensional vision. Second, long instruments are only partially visible. Third, there is impaired tactile feedback. And lastly, there is the fulcrum effect – the tool endpoint moving in the opposite direction of the surgeon's hand because of the pivot point.[2]

Other challenges in laparoscopic training are the pressure to reduce operation time to be more cost-effective and to limit patient morbidity and complications.[3] In a multicenter study done by Ranjit *et al*., young doctors would often have minimal teaching or hands-on experience in laparoscopic skills as undergraduates. They would only assist in surgery one to two times during the week. Thus, there is very little time left to practice basic laparoscopic skills.[4] Moreover, there is constant innovation in treatment modalities that needs to be learned by the mentors, and this causes fewer teaching and learning opportunities for the trainees.[5]

To address this concern in the Netherlands, it has become mandatory to establish an objective, validated, and measurable examination to prove skill competency in MIS. One of the validated models for testing and training laparoscopic psychomotor skills is the Laparoscopic Skills Testing and Training (LASTT) model by the European Society of Gynecological Endoscopy (ESGE). It is a cost-effective tool that is tutor independent and appropriate for any trainer box. The participants are tasked to perform three exercises; camera navigation, hand–eye coordination, and bimanual coordination, which are measurable objectives that are within a limited time frame.[6] Camera navigation evaluates the skill of handling a 30° optic camera, hand–eye coordination evaluates the skill of simultaneous camera and instrument handling, whereas bimanual coordination evaluates the skill of bimanual instrument handling.

The simulation model has become an essential component in learning basic psychomotor skills. This may now be used by medical trainees to improve their psychomotor skills in a safe environment with constant repetition and practice. Simulation can either be done by virtual reality (VR), animal models, simulated patients, or static or interactive manikins. Although this educational approach has been the current trend for the past few years, it has not reached widespread adoption in health-care education and training.[4] In the local setting, the Philippine Society for Gynecologic Endoscopy hosted their first European Society for Gynecologic Endoscopy (ESGE) and Asia-Pacific Association for Gynecologic Endoscopy meeting in East Asia last August 2019. They offered a Gynecological Endoscopic Surgical Education and Assessment (GESEA) Level 1 program in hysteroscopy and laparoscopy for credentialing.[7]

The GESEA Level 1 is composed of a theoretical examination (TESTT1), and three practical examinations, the Laparoscopic Skills Test and Training (LASTT), Suturing and knot tying Training and Testing (SUTT), and Hysteroscopic Skills Test and Training.[8] With the accessibility of these new models (e.g., VR, animal models, and pelvic training boxes), we can use these standardized and objective examinations to assess the basic laparoscopic psychomotor skills of Filipino doctors that could be used to guide surgical training recruitment and improve the MIS curriculum. The obstetrics and gynecology department is in the process of incorporating MIS in the training program of the hospital. Therefore, a validated basic skills proficiency test would be very useful. This will be the first study to identify the current baseline proficiency in basic laparoscopic psychomotor skills of Filipino medical doctors in a tertiary hospital through a validated simulation system. This study could provide a guideline for setting up safe and standardized skills training in the Philippines using a validated pelvic trainer box.

Objectives of the study

Primary objective

The main objective of the present study was to describe the pilot implementation of the LASTT kit in evaluating psychomotor skills, such as camera navigation, hand–eye coordination, and bimanual coordination of physicians in training. Furthermore, the study specifically aimed to:

Secondary objectives

1. To determine the known-groups validity of the LASTT kit to measure camera navigation, hand–eye coordination, and bimanual coordination.
2. To identify and compare specific characteristics of interns and surgical residents according to the:
   - Age
   - Gender
   - Hospital Department
   - Year level of training
   - Hand dominance
   - Number of laparoscopic assists
   - Previous hands-on activities (e.g., animal model, pelvic training box, or VR).
3. To describe the feasibility and user acceptance of the LASTT kit psychomotor evaluation.

Methodology

Study design and research locale

This was a cross-sectional study to assess the laparoscopic psychomotor skills of in-service interns and surgical specialty residents of Makati Medical Center. Assessments were conducted in the library of the delivery room of Makati Medical Center.

Operational definitions

1. Intern concluded 4 years of medical school proper and is now in the last year of training before taking the medical doctor licensure examination. Participants should have been in an internship for no more than 12 months
2. Surgical specialty resident-licensed medical doctor currently training to specialize in obstetrics and gynecology, general surgery, urology, or orthopedic surgery. Participants should have been in residency for no more than 5 years
3. Laparoscopic psychomotor skills – laparoscopic camera navigation, depth appreciation from a two-dimensional screen using subtle visual clues, hand–eye coordination, remote handling of instruments without tactile feedback, fine motor skills to deal with the fulcrum effect, and the lever forces of the long instruments.

Study population

The main population of the present study will be interns and surgical residents in Makati Medical Center. This list was generated from the database of all active interns and surgical residents in Makati Medical Center. The chairman of each department was sent a formal letter inviting their residents and interns to be part of the study.

1. From the population, the subjects were grouped based on their training status (intern or surgical resident)
2. For each group, they were assigned a number to each subject from 1 to *N*, where *N* was the total number of subjects in the list
3. From the list, participants were selected and recruited using stratified random sampling
4. Random numbers were generated to identify the selected subjects
5. The record of the subject assigned with the number randomly selected was reviewed for inclusion in the study
6. Continue with the rest of the random numbers until each group achieved the minimum sample size
7. The chosen residents were sent an invitation letter and a consent form
8. The participants who consented to be part of the study were identified and selected to be a representative sample of each subgroup (interns and residents)
9. Once they agreed, they were given timeslots that they could choose from.

The inclusion and exclusion criteria were as follows:

Inclusion criteria

1. The intern must be newly graduated from their medical school
2. Any resident currently training in obstetrics and gynecology, general surgery, urology, and orthopedic Surgery.

Exclusion criteria

1. Residents in training for more than 5 years
2. Non-Filipino resident
3. Doctors with formal laparoscopic training or certification before the study
4. Surgical specialty resident that had a history of transfer of residency from a different institution.

The interns were included to assess the baseline laparoscopic skills that doctors had in comparison to those who were already in residency training. Although laparoscopic skills were not required in medical school, the trend of minimally invasive training is starting to be the cornerstone of treatment which should be trained early on. The exclusion of residents who trained for more than 5 years was incorporated to avoid the risk of prior training in a different institution.

Sample size estimation

The sample size was computed using G*Power Version 3.1.9.2 (Bruin, J. 2006. UCLA: Statistical Consulting Group. University of California, Los Angeles, USA. A minimum of 34 subjects (17 in each group) were required for this study based on a level of significance of 5%, a power of 80%, and a 10% dropout, assuming a large effect size of 0.8 (i.e. a large difference between known groups).

To account for the attrition rate that might be due to missing data, there should be an additional 10%. The computation was as follows:

$$N_{final} = 34 + .10N_{final}$$

$$0.90N_{final} = 34$$

$$N_{final} = 37.78$$

The final sample size was 38.

Plan of analysis

Descriptive statistics were used to summarize the general and clinical characteristics of the participants. Frequency and proportion were used for categorical variables (nominal/ordinal), mean and standard deviation for normally distributed interval/ratio

variables, and median and range for nonnormally distributed interval/ratio variables.

Independent *t*-test/Mann–Whitney *U*-test was used to compare the mean/median LASTT camera navigation, hand–eye coordination, and bimanual coordination scores between interns and surgical residents. For categorical variables, Fisher's exact test was used to compare the outcomes.

All valid data were included in the analysis. Missing variables were neither replaced nor estimated. The null hypothesis was rejected at 0.05 α-level of significance. STATA 15.0 (StataCorp SE, College Station, TX, USA) was used for data analysis.

Study process and data collection

The principal investigator sent out letters to the department heads, and the head of internship to invite their residents or interns to be part of the study. From the population, the subjects were grouped based on their training status (intern or surgical resident). For each group, they were assigned a number to each subject from 1 to *N*, where *N* was the total number of subjects in the list from the list, participants were selected and recruited using stratified random sampling. Random numbers were generated to identify the selected subjects. The record of the subject assigned with the number randomly selected was reviewed for inclusion in the study. Continue with the rest of the random numbers until each group achieves the minimum sample size. The chosen residents were sent a letter of invitation and a consent form. The participants who consented to be part of the study were identified and selected to be a representative sample of each subgroup (interns and residents). Once they agreed, they were given timeslots that they could choose from.

We then gathered the basic information of all the participants that were involved, which includes name, age, gender, date of graduation from medical school, hospital department, year level of training, previous laparoscopic or hysteroscopic assists, exposure to hands-on activities (e.g., animal model, pelvic training box or VR), and hand dominance. The principal investigator had no necessary training needed before conducting the study. The scoring was either a pass or a fail, which could be done by a nonmedical professional.

1. The principal investigator prepared the LASTT kit which contained the following:[12]
   a. Wooden LASTT model
   b. Exercise inserts [Figure 1]
   c. Exercise elements – six colored rings and six pins [Figure 2]
   d. Pelvic trainer box
   e. Laparoscope
   f. Graspers
   g. Watchtower
   h. Stopwatch
   i. Scoring sheets [Figure 3].
2. The setup of the LASTT kit was as follows

a. Camera navigation
   i. Place the exercise inserts at the LASTT model
   ii. The wooden LASTT model is placed at the back wall of the pelvic trainer box
   iii. The screen is equipped with a transparent target sheet which has a circle in the middle
   iv. The 30° optic camera is placed in between the oblique panels visualizing the European Academy of Gynecological Surgery logo.

b. Hand–eye coordination
   i. Flip the exercise inserts to show the colors on the oblique wooden panels
   ii. Mount the 0° optic
   iii. Place the six colored rings by placing 2 of each color in a circle around the logo
   iv. Introduce the dissecting forceps using the dominant hand.

c. Bimanual coordination
   i. Position the six colored pins around the logo, 2 of each color plastic part facing inwards
   ii. Camera handling will be held by the assistant with a 0° optic
   iii. Introduce the dissecting forceps using the dominant hand and the grasping forceps in the nondominant hand.

3. The Laparoscopic Skills Testing and Training (LASTT) model PowerPoint and video provided by GESEA were shown to each participant. It explained the three exercises below [Figure 4]
   a. Camera navigation evaluates the skills to handle the camera and work with a 30° optic
   b. Hand–eye coordination evaluates the skills of simultaneous camera and instrument handling
   c. Bimanual coordination evaluates the skills of bimanual instrument handling.

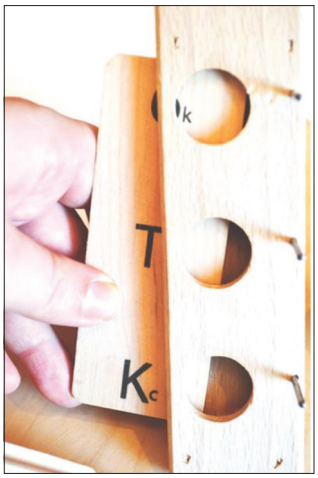

Figure 1: LASTT Training Exercise Inserts

4. The participant performed the following tasks which were observed by the experimenter

a. Camera handling
   i. The participant will handle the laparoscope with both hands
   ii. The screen will have a circle in the middle where he will insert the corresponding letter or number while manipulating the laparoscope

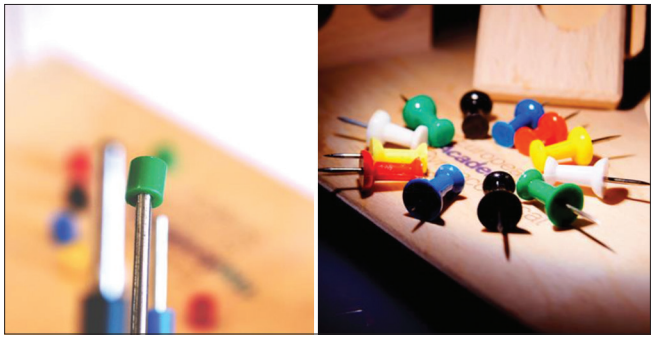

Figure 2: LASTT Training Exercise Elements

   iii. Once the letter or number is fully visualized in the circle, he may proceed to the next letter or number until he reaches the "END" sign
   iv. The participant will be given 2 min to complete the task.

b. Hand–eye coordination
   i. The participant will be holding the laparoscope and a grasper
   ii. The colored rings will be prepared in front of the LASTT Kit logo
   iii. The participant must navigate around the field using the laparoscope and be able to grasp a colored ring
   iv. The colored ring must be placed on its corresponding hooks. If the ring is red, the color beside the hook must be red as well, and so on
   v. The participant will be given 3 min to complete the task.

c. Bimanual coordination.
   i. The participant will be holding two graspers, whereas the laparoscope will be held separately by a stand

European theAcademy of Gynaecological Surgery

LAST+T1

Psychomotor Skills Test

SCORING FORM

Mentee:	Date:
Mentor:	

Please indicate the time as you read it on the stopwatch in MM:SS:HH

EXERCISE 1: CAMERA NAVIGATION

Runs	Time required for identifying the 14 targets OR 2 minutes	Last identified character after 2 minutes
# 1	: :	
# 2	: :	
# 3	: :	

EXERCISE 2: HAND-EYE COORDINATION

Runs	Time required for positioning 6 rings OR 3 minutes	Number of rings transported in max 3 minutes
# 1	: :	
# 2	: :	
# 3	: :	

EXERCISE 3: BI-MANUAL COORDINATION

Runs	Time required for positioning 6 pins OR 3 minutes	Number of pins transported in max 3 minutes
# 1	: :	
# 2	: :	
# 3	: :	

Figure 3: LASTT Scoring Form

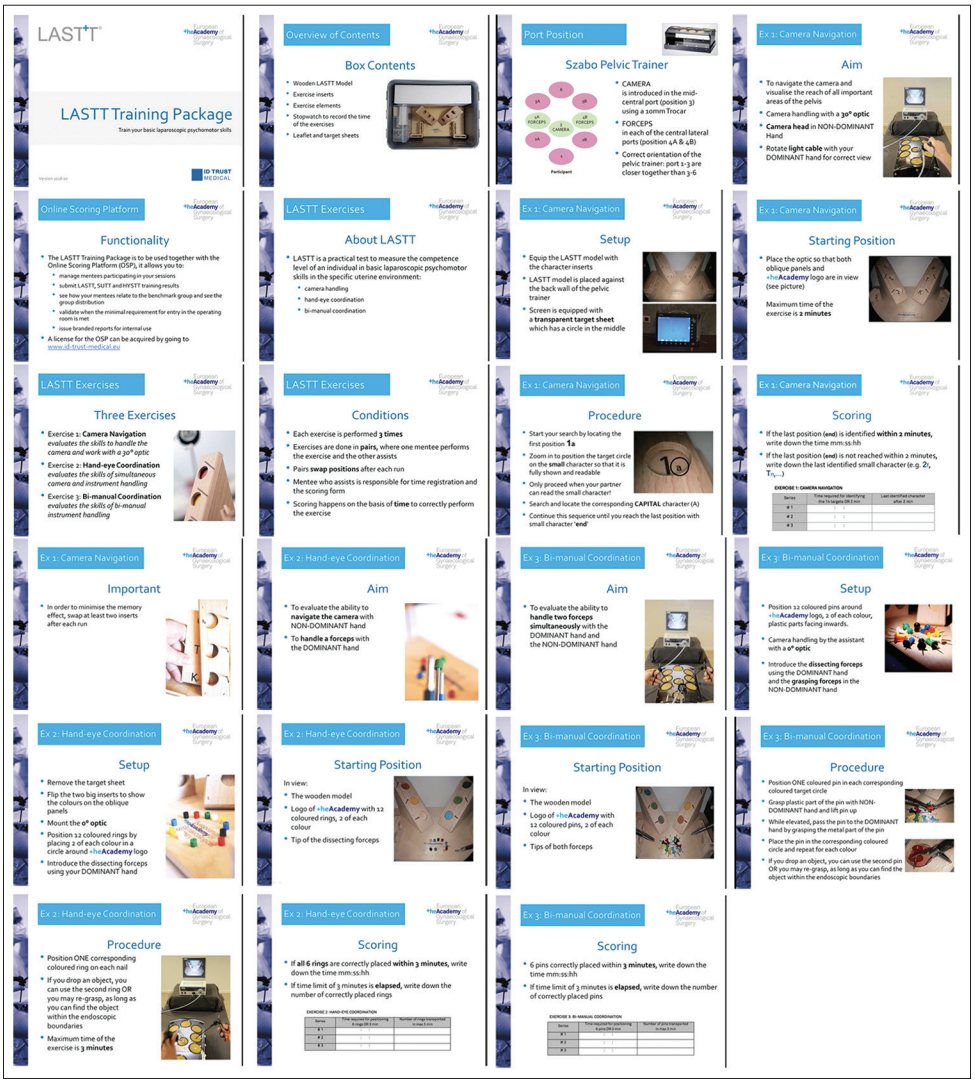

Figure 4: LASTT PowerPoint and video by GESEA

ii. The colored pins will be prepared in front of the LASTT Kit logo
iii. The participant must transfer the pin from one grasper to the other grasper
iv. Once transferred, he may place the colored pin on the corresponding hole. If the pin is red, the color of the hole must be red as well, and so on
v. The participant will be given 3 min to complete the task.

5. The performer had 3 runs of each task. Each participant was timed, and the last identified character or transported pin or ring was recorded in the scoring sheet of ID Medical Trust
6. The time lapsed for each exercise was placed if the participant accomplished the task, and this was scored as a pass. If the task was done beyond the allotted time, this was then scored as a fail
7. The last viewed character or ring/pin transported was indicated if the participant was unable to accomplish the task. This was then scored as a fail
8. The principal investigator then handed out a questionnaire to the participants regarding the feasibility and acceptance of the LASTT model [Figure 5].

Data encoding was done using MS Excel for ease of encoding. While doing this, completeness, consistency, and errors among the answers were checked. After completing the datasets, this was edited and analyzed using STATA15. Descriptive statistics such as mean and standard deviation were used to present data on the demographic and clinical profile of the recruited subjects. Frequency and percentages were used to present categorical data. The graphical presentation was also utilized in presenting the data. Differences in the characteristics were compared using Student's *t*-test if continuous variables and the Chi-square test or Fisher's exact test if categorical variables. $P < 0.05$ was considered statistically significant.

POST TEST QUESTIONNAIRE	
Assigned participant number: _____	
Answer the following from 1 to 10. **Score 1 as least applicable to you, and 10 as most applicable to you.**	
	1. The instructions given to me were clear and understandable.
	2. I was able to follow the instructions and apply it to the activity.
	3. The camera navigation was easy to do.
	4. The hand eye coordination test was easy to do.
	5. The bimanual coordination test was easy to do.
	6. Overall, the testing tool was easy to use.
	7. The tool feels like a realistic model to simulate the movements required in an actual laparoscopic surgery.
	8. The exercises caused me stress and anxiety.
	9. For surgical residents: I feel like this training tool can help me in my surgical training.
	10. For interns: I feel like this tool helped me consider training in the field of surgery.

Figure 5: Post Test Questionnaire

Definition of terms

1. Psychomotor skill – the ability to combine and coordinate a set of cognitive and motor processes[12]
2. Camera navigation – it is manually handling a video scope to intentionally visualize an area[12]
3. Hand–eye coordination – it is the skill of one's hands and sight to work together to be able to achieve a specific task with speed and accuracy[12]
4. Bimanual coordination – it is the integration of the left- and right-hand movements to attain a specific task with speed and accuracy[12]
5. Pivot point – It is a position in the Trochar where movements are restricted by the abdominal incision, resulting in a fulcrum effect.[11]

Results and Discussion

Table 1 shows the demographic profile of the study participants included in the investigation. There were 19 medical interns and 15 surgery residents who were covered in the study. The mean age of medical surgical specialty residents was significantly higher than medical interns included in the research (29.50 ± 2.07 vs. 25.90 ± 1.20, respectively; $P = 0.001$ and $P < 0.05$). The largest number of patients was female (25; 73.3%), and there were only 9 (26.47%) males included in the investigation. Most of the surgical specialty residents and medical interns were females (11; 73.3% and 14; 73.68, respectively, $P = 0.999$ $P > 0.05$). There was an equal distribution of obstetrics and gynecology residents, orthopedics, and surgery residents (5; 33.3%). There was no statistical analysis done due to the internal consistency of the data. The majority of study participants were right-handed (30; 88.24%). There were only 4 (11.76%) study participants who were left-handed. Most of the medical interns and surgical specialty residents were right-handed (18; 94.74 and 12; 80%, respectively, $P = 0.299$ $P > 0.05$).

The largest number of respondents had 0 to <30 laparoscopic assists (29; 85.29%) with only 5 (14.71%) study participants noted to have 30 to more than 50 laparoscopic assists. All 19 (100%) medical interns had 0 to <30 laparoscopic assists, whereas 10 (66.67%) surgical specialty residents had 0 to <30 laparoscopic assists. Only 5 (33.3%) surgical specialty residents had 30 to more than 50 laparoscopic assists ($P = 0.011$ $P < 0.05$). There was no animal model used as per the report of medical interns (19; 100%) and surgical specialty residents (15; 100%). Trainer box use was mostly 0 (22; 64.71%). On the other hand, around 4 (11.7%) had utilized regular trainer boxes. All medical interns had no trainer box used (19; 100%), whereas 8 (53.3%) surgical specialty residents had used 1–2 trainer boxes ($P = 0.001$ $P < 0.05$).

Almost all study participants had not used VR (33; 97.06%) and only 1 (2.94%) had around 1–2 sessions of VR. Of these, all 19 (100%) medical interns had not used VR and 14 (93.3%) surgical specialty residents had not used VR ($P = 0.441$ $P > 0.05$). There were no video game hours ($P = 0.293$ $P > 0.05$) and musical instrument hours ($P = 0.883$ $P > 0.05$) noted (0; 0%) in both medical interns and surgical specialty residents.

Table 2 shows the assessment of laparoscopic psychomotor skills of study participants using the LASST kit at Makati Medical Center. It could be seen based on the data obtained from the study that surgical specialty residents had a significantly shorter time to accomplish camera navigation over medical interns (84.05 ± 19.34 vs. 105.92 ± 11.81, respectively, 95% confidence interval [CI] 21.87 [3.48–40.24] $P = 0.023$ $P < 0.05$). Similarly, surgical specialty residents had significantly shorter hand–eye coordination over their medical interns' counterparts (106.78 ± 11.85 vs. 135.62 ± 32.47, respectively, 95% CI 27.84 [9.56–46.13] $P = 0.004$ $P < 0.05$). Finally, bimanual coordination was statistically shorter among surgical specialty residents than medical interns (116.80 ± 25.67 vs. 144.83 ± 27.68, respectively, 95% CI: 28.03 [7.30–48.77] $P = 0.010$ $P < 0.05$).

Table 3 shows the results of the posttest questionnaire on the feasibility and acceptance of the LASTT questionnaire. The investigation found that the instructions given were clear and understandable (median of 10, interquartile range [IQR] 10–10). Both medical interns and surgical specialty residents rated this statement high (median of 10, IQR 10–10). Further, respondents were able to follow instructions and apply it to the activity (median of 10, IQR 9–10). This was observed in both medical interns and surgical specialty residents (median of 10, IQR 9–10). This was followed by a statement about the testing tool being very easy to use (median of 9, IQR 8–10). This was observed in both medical residents and surgical specialty residents (median of 9, IQR: 8–10 and IQR: 9–10, respectively). Similarly, respondents considered that the tool feels such as realistic model to simulate the movements required in an actual

Table 1: Demographic characteristics of study participants, Makati Medical Center

	Mean±SD; median (IQR); frequency (%)			*P*
	All (*n*=34)	Interns (*n*=19)	Surgical specialty residents (*n*=15)	
Age (years)	27.5±2.44	25.90±1.20	29.50±2.07	<0.001*
Sex				
Male	9 (26.47)	5 (26.32)	4 (26.67)	>0.999†
Female	25 (73.53)	14 (73.68)	11 (73.33)	
Specialty				
Obstetrics and gynecology	5 (33.33)	-	5 (33.33)	-
Orthopedic surgery	5 (33.33)	-	5 (33.33)	
Surgery	5 (33.33)	-	5 (33.33)	
Hand dominance				
Left	4 (11.76)	1 (5.26)	3 (20)	0.299†
Right	30 (88.24)	18 (94.74)	12 (80)	
Number of laparoscopic assists				
0–<30	29 (85.29)	19 (100)	10 (66.67)	0.011†
30–<50	5 (14.71)	0	5 (33.33)	
Animal model				
0	34 (100)	19 (100)	15 (100)	-
1–2	0	0	0	
Regular	0	0	0	
Trainer box				
0	22 (64.71)	19 (100)	3 (20)	<0.001†
1–2	8 (23.53)	0	8 (53.33)	
Regular	4 (11.76)	0	4 (26.67)	
Virtual reality				
0	33 (97.06)	19 (100)	14 (93.33)	0.441†
1–2	1 (2.94)	0	1 (6.67)	
Video game hours	0 (0–2)	0 (0–3)	0 (0–1)	0.293‡
Musical instrument hours	0 (0–0)	0 (0–0)	0 (0–0)	0.883‡

Statistical tests used: *Independent *t*-test, †Fisher's exact test, ‡Mann–Whitney *U*-test. SD: Standard deviation, IQR: Interquartile range

Table 2: Assessment of laparoscopic psychomotor skills of study participants using laparoscopic skills training and testing kit, Makati Medical Center

	Mean±SD			Mean difference (95% CI)	*P*
	All (*n*=34)	Interns (*n*=19)	Surgical specialty residents (*n*=15)		
Camera navigation (s)	*n*=18	*n*=6	*n*=12	21.87 (3.48–40.24)	0.023
	91.34±19.89	105.92±11.81	84.05±19.34		
Hand-eye coordination (s)	*n*=30	*n*=15	*n*=15	27.84 (9.56–46.13)	0.004
	120.70±27.88	135.62±32.47	106.78±11.86		
Bimanual coordination (s)	*n*=28	*n*=13	*n*=15	28.03 (7.30–48.77)	0.010
	129.82±29.75	144.83±27.68	116.80±25.67		

Statistical test used: Independent *t*-test. SD: Standard deviation, CI: Confidence interval

laparoscopic surgery (median of 9, IQR: 8–10). Medical interns and surgical specialty residents obtained similar evaluation (median of 9, IQR: 8–10).

Medical surgical residents believed that the training tool could help them in surgery training (median of 10, IQR: 10–10). Medical interns also considered the tool to help them in training in the field of surgery (median of 9, IQR: 8–10). On the other hand, the lowest median of 5 (IQR: 2–7) was all about the stress and anxiety that the exercises caused surgical specialty residents and medical interns (median of 6, IQR: 3–6 and median of 3, IQR: 1–8).

Discussion

In the field of gynecologic surgery, laparoscopic techniques are considered to be an essential skill that every resident trainee must possess. To this day, the ideal training method for this procedure remains a debate among medical professionals. Due to this, several methods and systems have been proposed and created based on the varying models of laparoscopy, target participants, characteristics of medical institutions, and specialization.[8,9] Despite these challenges, a number of medical specialists, consultants, and professors agree that the traditional approach involving the apprentice-tutor

Table 3: Posttest Questionnaire on the feasibility and acceptance of the laparoscopic skills training and testing model, Makati Medical Center

	Median (IQR)		
	All (*n*=34)	Interns (*n*=19)	Surgical specialty residents (*n*=15)
The instructions given to me were clear and understandable	10 (10–10)	10 (10–10)	10 (10–10)
I was able to follow the instructions and apply it to the activity	10 (9–10)	10 (9–10)	10 (9–10)
The camera navigation was easy to do	7 (6–9)	7 (6–8)	8 (6–10)
The hand–eye coordination test was easy to do	8 (7–9)	8 (6–9)	8 (7–8)
The bimanual coordination test was easy to do	8 (7–9)	8 (6–9)	8 (7–9)
Overall, the testing tool was easy to use	9 (8–10)	8 (7–10)	9 (8–10)
The tool feels like a realistic model to simulate the movements required in an actual laparoscopic surgery	9 (8–10)	9 (8–10)	9 (8–10)
The exercises caused me stress and anxiety	5 (2–7)	6 (3–6)	3 (1–8)
For surgical residents: I feel like this training tool can help me in my surgical training.	10 (10–10)	-	10 (10–10)
For interns: I feel like this tool helped me consider training in the field of surgery	9 (8–10)	9 (8–10)	-

IQR: Interquartile range

model is already obsolete, and no longer useful for teaching all the skills necessary for laparoscopic surgery. Such an approach is obsolete because of the following; the longer operating time, the limited number of tutors and surgery cases, and the long learning curve among students.[10,11]

There are specific psychomotor skills needed to perform laparoscopic surgery. These include hand–eye coordination, an adaptation from 3-dimension to a 2-dimensional screen, dealing with the fulcrum effect, and handling long instruments without tactile feedback.[4] The main challenge in laparoscopic training is its ethical purpose. There cannot be any patient morbidity and error rate during actual surgery. Against these aforementioned challenges, practical skills must be adapted to produce competent surgeons who will be lead surgeons in future.[12] Therefore, the need for an objective and measurable level to practice the skills should then be established and validated before the actual gynecologic surgery.[8]

The objective test should be able to predict the participants' level of skill performance and surgical performance. A study showed that the medical interns had a wide range of innate psychomotor skills in those interested in surgery and even those who were not considering surgery. Although the study discussed that this technical skill is not a requirement before a surgical career, the innate ability of a doctor was shown to be a predictor of skill acquisition, and therefore, the training becomes more competency based.[4] They could even use the psychomotor ability assessments with cognitive and communication testing to recruit candidates who want to pursue surgery, and those trainees with lower scores can be closely monitored and trained to achieve better competency.[9]

There are different models already created for laparoscopists, which include *in vitro* models (e.g., trainer box, VR, and animal cadavers). These allow the trainer to have a controlled and monitored environment. In a study by Cope and Fenton-Lee they assessed the baseline laparoscopic psychomotor skills of interns using the Minimally Invasive Surgical Trainer VR simulator.[9]

Another *in vitro* model is the pelvic training boxes. These are relatively easy and cheap simulation models for practice and are found to be as equally effective as VR trainer.[5] In a study by Campos *et al*., they found that there is no significant difference between VR versus pelvic training boxes, thereby suggesting that pelvic training boxes are as effective and an economic alternative for residency programs.[5] Although both *in vitro* models provide realistic haptic feedback, objective assessment could still be a challenge. Therefore, an expert observer must be present to assess performance. In addition to an expert, observer is the inclusion of a validated exercise with a proper training goal that should be practiced. However, there are only a limited number of trainer boxes that are scientifically validated.

One of the validated models for testing and training laparoscopic psychomotor skills is the Laparoscopic Skills Testing and Training (LASTT) model by the European Society of Gynecological Endoscopy (ESGE). It is a cost-effective tool that is tutor independent and suitable for any trainer box. The participants are tasked to perform three exercises; camera navigation, hand–eye coordination, and bimanual coordination, which are measurable objectives that are within a limited time frame.[6] A prospective cohort study was done to evaluate obstetrics and gynecology residents versus participants of the Annual GESEA Diploma Course. The course program includes LASTT, Suturing and knot tying Training and Testing (SUTT), and animal surgeries.

Results showed that residents with previous training in MIS and laparoscopy compared to older OB-GYN specialists, achieved better results in all exercises, and there was a significant improvement in test results after taking the GESEA diploma course. Although they cannot confirm in this study that their training courses can be transferred in actual surgery,[10] there are multiple studies that show that basic laparoscopic skills are often transferable to the operating field. Therefore, skills must be honed with simulation sessions before assisting in the surgery to gain better proficiency and confidence in the operating field. In addition, there would be ease in discussion intraoperatively which would be an asset for the surgical team, and it would also save time.[3]

In a study by Campo *et al*., those who underwent training in the European Academy of Gynecological Surgery (+he Academy) which includes the LASTT model retained the skills after an 18-month follow-up, even with better baseline skills. Furthermore, those who had more intensive training in between the follow-up had superior skills over those who did not follow more complete training.[11] On the other hand, a systematic review by Torres-de la Roche *et al*. stated that proficiency may decline over time if it is solely learned and practiced by simulation trainers. They also reported that a curriculum that includes theory, mentoring, and preoperative basic and advanced skills tasks improve operative performance. However, there is still lacking evidence on which specific training program is superior in terms of duration, tasks, facilities, mentoring, and availability. In the same systematic review, the problems gathered by several surveys consist of poorly designed workshops, infrequent exposure (once a year), poorly facilitated programs that did not help in the retention of skills, and no objective evaluation of psychomotor skills used.[12]

In response to these drawbacks, GESEA program offered a structured approach and learning program that certified surgeons to maximize patient safety and operation time and avoid malpractice suits.[12] In a meta-analysis by Nagendran *et al*., results showed that the pelvic box-trained group had a significantly shorter time to complete the task, had a lower error rate, and had better accuracy scores than the control group with no training. There were mixed results in terms of distance movement. There was one trial that showed significantly lower movement distance in box model training compared to no training, but two trials showed that there were no significant differences. In summary, the study suggests that novice surgical trainees with no prior experience in laparoscopic surgery have improved technical skills through box model training.[13]

It was at this juncture that the investigation was made to describe the pilot implementation of the LASTT kit in evaluating the psychomotor skills, such as camera navigation, hand–eye coordination, and bimanual coordination of physicians in training. The investigation revealed that surgical specialty residents were more familiar with laparoscopic skills than medical interns. This is already an expected finding since surgical residents specializing in surgery, orthopedics, and obstetrics and gynecology have acquired a considerable amount of time assisting in laparoscopic surgeries. With this, their performance in Laparoscopic Skills Training and Testing (LASTT) is better in terms of time duration than medical interns. Laparoscopic techniques are known to be correlated with morbidity and mortality, so poorly performed surgeries therefore have resulted in such events. Hence, medical residents specifically those who are in the field of surgery undergo rigorous training and evaluation on laparoscopic techniques to avoid these incidents. In all probability, this could be the reason why a much shorter time on camera navigation, hand–eye, and bimanual coordination was observed since this group was presumed to have already achieved more skills than medical interns.

Training, based on several studies, is essential in improving laparoscopic skills. Residents who undergo consistent training on laparoscopy carry the procedure with ease. Therefore, it is vital that this must be done in order for medical residents to become adept at the procedure.[13,14] In relation to the study, it could be the reason why the surgical specialty residents performed at a much shorter time pace over medical interns.

Furthermore, studies showed that this kind of training is effective in giving medical interns and residents a hands-on approach toward learning laparoscopy before performing the actual surgery. A number of investigations have also mentioned that the residents who have undergone training on LASTT had registered a significantly better starting level, over those who did not undergo training.[15-17] In this study, both medical interns and surgical specialty residents considered the test feasible, and a good way to provide them training in laparoscopic surgery.

In summary, the traditional apprentice/mentor model is an outdated style of learning, hence numerous models such as pelvic trainer boxes, VR, and animal cadavers, were created in other countries. With the availability of these new models, we can use these standardized and objective examinations to assess the basic laparoscopic psychomotor skills of Filipino doctors. This could also be used to guide surgical training recruitment and the MIS curriculum of the department. This is the first study on the baseline proficiency and comparison of laparoscopic psychomotor skills of surgical residents and interns in the Philippines. This LASTT training approach

had demonstrated feasibility, especially in providing training specifically on camera navigation, hand–eye, and bimanual coordination. It was also proven to be effective in giving medical interns and residents hands-on approach toward learning laparoscopy before performing the actual surgery. The aforementioned could be the reason why both medical interns and residents regarded this approach as an important aspect in honing their skills in laparoscopy. The training essentially was then known to be helpful in the mastery of laparoscopy before conducting the actual procedure itself.

Conclusions and Recommendations

Conclusions

Based on the findings noted in this investigation, the following recommendations are forwarded:

1. The mean age of participants included in the study was 28 years old, with medical interns having a mean average of 26 years old and surgical specialty residents had mean average of 30 years old. The largest number of participants was female where an equal distribution of OB GYN, OR, and Surgery was obtained. The majority of study participants were right-handed with 0 to <30 laparoscopic assists. The largest number of participants had not used animal model, trainer box, and virtual assist
2. Surgical specialty residents were found to be statistically adept as regards laparoscopic skills compared to medical interns. The results were based on the fact that this group of participants finished their tasks on Laparoscopic Skills Training and Testing (LASTT) specifically camera navigation, hand–eye coordination, and bimanual coordination with a significantly short amount of time compared to their medical intern counterparts. This indicates that exposure to laparoscopic procedures and hands-on training would definitely benefit medical professionals
3. Both medical interns and surgical specialty residents considered the Laparoscopic Skills Training and Testing (LASTT), a good tool in measuring their competence as regards laparoscopic procedure. This particular tool was regarded to be feasible and study participants had a good level of acceptance toward it, especially in terms of providing good training in laparoscopic surgery.

Recommendations

Based on the conclusions drawn from the results of the study, the following recommendations are forwarded:

1. Laparoscopy training is essential in producing competent laparoscopists in the fields of obstetrician gynecology and surgery among many others. Exposure to training must start as early as a medical internship as this would enable student doctors to acquire the necessary skills in performing laparoscopy
2. Hospitals and other medical institutions should consider acquiring Laparoscopic Skills Training and Testing (LASTT) tool. This was based on the fact that it provides good *in vitro* training for medical interns and residents, especially in enhancing basic laparoscopic techniques
3. Medical universities and colleges that offer medicine must consider Laparoscopic Skills Training and Testing (LASTT) as part of their laboratory training for medical students. This would give students exposure to laparoscopic techniques that they may find useful once they undergo training in actual laparoscopic surgery
4. The feasibility and level of acceptance toward Laparoscopic Skills Training and Testing (LASTT) were not measured using a multicenter study approach. In this regard, the main proponent of the study very highly recommends an investigation that centers on this area be conducted on hospitals both public and private institutions. This would provide a detailed assessment of the applicability and feasibility of this tool.

Authorship contributions

Maria Mikaela V. Comendador - Involved in conceptualization, methodology, validation, format analysis, resources, data curation, written original draft, review and editing, visualization, supervision, funding.

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Ursula Catena - Involved in conceptualization, methodology, review and editing, supervision.

Vasilios Tanos - Involved in review and editing.

Rudy Leon De Wilde - Involved in review and editing.

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Conflicts of interest

There are no conflicts of interest.

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