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The palpation skills in maternity nursing using quantitative analysis process

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Abstract - Recent nursing education is claimed to have a large gap between rookie nurses' abilities and those necessary in clinical settings, and this gap has to be bridged in order to improve the educational experience of nursing students. However, expanding the clinical site's amenities and chances for practical nursing skill development are tough to come by. Due to decreased birth rates, it is also challenging for nursing students to strengthen their practical abilities, particularly in maternity nursing education. When a nurse uses Leopold Maneuvers to palpate the position of the foetus, it's important to know whether or not the palpation is done according to the textbook or not. According to the textbook, palpation prefers to investigate with less pressure and gently touch rather than apply excessive pressure to the skin. In the future, quantitative measurement of palpation in nursing education might help raise the bar for students.

Index Terms—Maternity nursing education, Palpation training, Qualitative evaluate support, Pressure data analysis.

I. Introduction

In recent years, the health care and medical environments have changed dramatically, and nursing staff have seen a variety of shifts in their duties [1]. The capacity of nursing personnel to adapt to changes in medical technology and ensure medical safety, for example, necessitates an increase in clinical practise competence.

In particular, newbie nursing staffs require any structured and systematic efforts to develop their clinical practise skills [1]. The Japan Nursing Association likewise aims to enhance people's lives both qualitatively and quantitatively via the extension of medical care [2]. However, it should be noted that each school has a different degree of proficiency in nursing abilities. The rationale for this is because each student has their own set of unique objectives, such as gaining practical nursing skills before graduating from a foundational nursing programme. There are also less possibilities for practical training and the development of practical nursing skills in real clinical settings [1].

In addition, there have been a number of issues in recent years, such as the need to ensure nursing training facilities, tailor education to the abilities of nursing students, and train supervisors [3]. Maternity nursing clinical site training may suffer as a result of Japan's recent decline in birthrate [4]. As a result, future generations of nursing students will have less opportunities to see actual pregnant women in the classroom [5]. Basic nursing skills are taught to nursing students as part of their undergraduate training, and these abilities must be retained throughout their careers as nurses [6]. Using virtual patients in nursing education also has major educational consequences, such as helping students comprehend the whole picture of nursing [7]. [8]. When it comes to teaching several nursing students at once at Kochi University's Department of Nursing, there is an issue.

As a result, there are less possibilities for nursing students to undergo training since they must complete a large number of different nursing classes and training courses. Many nursing students are afraid to palpate genuine pregnant ladies during practical training due to their lack of self-confidence. Aside from their

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theoretical knowledge, newbie nurses need to learn how to practise their abilities in a clinical setting throughout their maternity nursing training [6]. Additionally, in nursing education, the evaluation is often qualitative. As a result, the evaluation shows that there are issues with nursing education. Supervisors, for example, may find it difficult to explain their own experiences and perceptions to nursing students. Students may be left with an ineffective education as a consequence of this. Developing high-quality nursing personnel is critical to the success of the training process for basic nursing education. However, the concerns outlined above suggest that present nursing training is ineffective in terms of instruction for nursing students.

This research focuses on the use of quantitative assessment in maternity nurse education.

During a data collecting experiment that mimicked real-world maternity nursing training, we measured the pressure on the hands of nursing students and supervisors. We next evaluated the data in terms of the most often used finger palm, the intensity of pressure, and the rate at which pressure changed. ' Furthermore, we conducted a statistical analysis of the obtained data to see whether or not the palpation was consistent with the textbook. Lastly, we spoke about the use of the quantitative evaluation approach for maternity nursing training, including the experiment equipment for pressure data collecting, the analysed results, and the statistical test results.

II. Review Of Related Literature

A Changes in hands pressure during palpation

Hand pressure and the nurse's posture were studied by Kaetsu et al. when the nurse moved from a face-up to a lateral position [9]. Hand pressure was measured using pressure measuring films in this study's experiment. When pressure measuring film is used to measure pressure, we can see the precise maximum pressure of the whole hand, but we are unable to detect the pressure change over time. The goal of this study is to better understand how to utilise the palm of one's hand when doing palpation. As a result, we make use of a pressure sensor capable of continuously collecting pressure data. To capture data on finger palm pressure during palpation, researchers have devised experimental devices that install several pressure sensors in precise locations on the finger palm.

B Skills acquisition

An assessment approach that allows quantitative evaluation of qualitative evaluation in junior high school technical courses has been suggested by Fukutani et al. Students' work has previously been assessed visually and subjectively by previous technical instructors, and in their study, they offered a quantitative assessment approach based on smartphone technology. They were able to demonstrate the benefit of lessening teachers' assessment work, but they failed to take into consideration what instructors were being taught about skills and the educational effectiveness of their methods.

Aside from the quantitative measurement of nursing abilities, this study also attempts to enhance educational outcomes. We gather data on nursing students' and supervisors' palpation abilities and look at how they might be improved by using the palms of the hands.

C Understanding of own palpation

[11] Hosozawa et al. devised a technique to assist clinical nurses in developing effective physical assessment skills. For nursing, the abdomen simulator had a pressure sensor connected to it in the method they presented. In addition, when the image is being felt, the display shows the pressure distribution and the location of the centre of gravity. It helps nursing students comprehend how experienced nurses palpate the abdomen position and pressure changes. The clinical site, on the other hand, need the ability to practise nursing skills that are specific to each patient's needs and circumstances. Because of this, it is critical that students learn how to utilise their finger palms during palpation training, which is a fundamental part of nursing education.

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In this study, we opted to use a pressure sensor on the finger palm to capture pressure data during palpation. Our goal is to help nursing student's better grasp their palpation skills by examining how their fingers and palms were utilized throughout the examination process.

III. Data Collection Experiment

A Experiment conditions

Experiment conditions are shown in Figure 1. For this project, we worked along with the School of Medicine's Department of Nursing at Kochi University. Figure 1 depicts the setting for the experiment.

Figure. 1. The experiment environment

A total of 20 people participated in this study, including 10 third-year undergraduates, 6 second-year graduate students, and 4 nursing faculty members. All of the individuals are right-handed ladies who are both physically and cognitively fit.. It is expected in this experiment that the participants wear experimental instruments to perform the first and second phases of Leopold Maneuvers' maternity training. Pregnant woman posed for a doll that was used to do the palpation. Subjects use both hands to palpate the upper abdomen of the doll and interpret the presentation in the first phase. The position of the womb and the foetus termed the presentation. In the second step, each participant feels the doll's abdomen with both of her hands and determines where the doll is in relation to her body. The orientation of the fetus's back or face determines the presenting position. If the bed's height and the doll's belly's air pressure were both the same, this would be ideal.

Undergraduates are expected to be able to palpate in accordance with a textbook, according to the university's expectations. This person is well-known to them. Leopold Maneuvers' instruction, on the other hand, isn't available to them. As a result, the supervisor of the maternity nursing programme explained to them how the training would be similar to what they would get at the university level in the real world. Leopold Maneuvers were explained in detail, including a verbal and whiteboard presentation of the first and second phases of the manoeuvres, and an observation of the supervisor's performance. We also explained to them that the experiment's findings would have no influence on their future evaluations. Postgraduate students, on the other hand, have a great deal of training and experience.

As soon as each step of palpation was completed, we requested the subject to signal to us that she was done and to remove her hands from the doll at the same time. At the same moment as we make our indication, the patient begins palpation on her left side. We videotape her palpation and note the start time, end time, and duration of each phase.

B Experiment Devices

Fig. 2 shows the experimental gadgets, which include microcomputers and sensors that are attached to the fingers and palms. The microcomputers utilised were the Arduino UNO and 0.5-inch round sensitive

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pressure sensors from Spark Fan Electronics. Every 30 milliseconds, the microcomputers communicate all of the pressure sensors' readings to a central computer.

Figure. 2.. The example of the palpation simulated the experience

The data collection computer was an Apple MacBook. Data supplied from the microcomputers is saved in CSV format by the collecting computer. Fig. 3 depicts the pressure-sensitive sensors. As illustrated in Fig. 3, each location for the sensitive-pressure sensors is referred to by its own name throughout this article. Little, Ring, Middle, Index, and Thumb Finger Sensors are numbered from the little finger in that sequence. As an additional note, "l-" is appended to the name of a left-handed fingertip, while a right-handed fingertip's name is given a "r-" suffix.

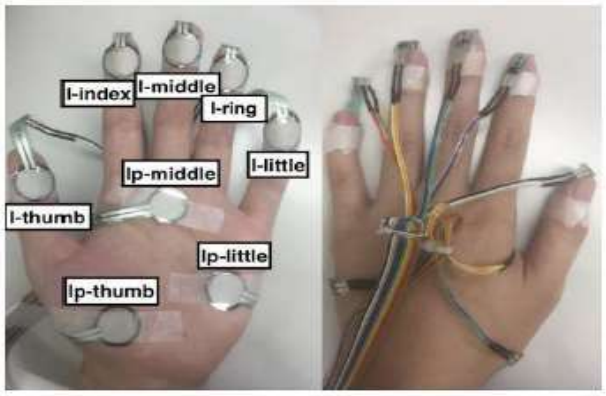

Figure. 3.. The positions of each sensor

As a side note, the lower portion of the little finger, lower part of the middle finger, and lower part of the thumb are all added to the name if the position is on the left hand, whereas if the position is on the right, "rp-" is added. Paper white tape was used as the tape to fix each of the 16 sensors, for a total of 8 on each hand. Each sensor was placed at the same location on the body of the individual. Fingertip sensors were positioned at a set 5-millimeter distance from the distal interphalangeal joint of each finger. The metacarpophalangeal joint of each little finger was fastened to the side of both palms' sensors beneath the little finger by 30 millimetres. The metacarpophalangeal joint of each middle finger was positioned at a distance of 7 millimetres from the sensors on both palms. The sensors beneath the thumb of both palms were mounted in the top 20 millimetres of each wrist. Ten thousand twenty-three is the sensor's maximum value. However, the sensor's maximum limit was pushed to 900 when the author put significant pressure on it.

IV. Result Of The Analysis And Statistical Hypothesis Test

A Analysis of the values collected

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We meticulously pre-processed the data before doing the analysis. Initial adjustments were made to 30 ms multiples since certain values' times were not accurately recorded. Finally, if there was no record of time or values before and after, the time and values were supplemented by the mean value of their pre- and post-recorded counterparts. A few outliers caused by experimental equipment malfunctions were also verified. As a result, we adjusted the value to zero after verifying the video. Noises created by the experiment devices were eliminated by changing the value beneath 50 to zero.

The denominator for each topic is the total value of all fingers and palms, while the numerator is the value of each fingertip or palm. The "main finger palm" of the fingers and palms most often utilised by the individuals during palpation was defined as the one with the highest ratio. We also thought it was critical to consider the combination of each abdomen's location and the number of hands when defining the principal finger palm. To begin, the patients palpate their upper abdomen with both hands; however, to go on to the second phase, they only use their left hand and only use their right hand to palpate their upper abdomen. Because of this, each abdominal position has a main finger palm that serves as the starting point. In Tab. I, each subject's major finger palm is shown. There are three types of students: undergraduates, postgraduates, and supervisors. The first kind of student is referred to as "b."

Table I: The Primary Finger Palm Of Each Subject

Abdomen	*Upper*	*Right*	*Left*
b-0	l-middle	lp-little	rp-thumb
b-1	l-middle	lp-thumb	r-middle
b-2	l-ring	lp-little	r-ring
b-3	l-ring	lp-middle	r-index
b-4	l-ring	lp-thumb	rp-ring
b-5	l-index	lp-middle	r-middle
b-6	rp-little	lp-little	rp-thumb
b-7	rp-little	lp-middle	rp-thumb
b-8	rp-little	lp-middle	rp-middle
b-9	l-middle	lp-middle	rp-thumb
m-0	rp-little	lp-little	rp-middle
m-1	rp-little	lp-middle	rp-middle
m-2	l-ring	lp-little	r-ring
m-3	rp-little	lp-little	r-middle
m-4	lp-middle	lp-little	rp-thumb
m-5	rp-little	lp-thumb	r-index
n-0	l-middle	lp-middle	rp-middle
n-1	l-middle	lp-middle	rp-middle
n-2	rp-little	lp-middle	rp-middle
n-3	rp-little	lp-middle	rp-middle

Using the results of the analysis, each subject's main finger palm was given a maximum, average, maximum rate of change, positive and negative mean rate of change, and minimum rate of change. Difference between historical and current values was divided by 30 in order to calculate change. And the university's mission is to ensure that "every undergraduate student can palpate according to the textbook." This is why the results of each abdomen's study were divided into two groups.

As a result of this on this paper, N0 refers to the textbook's palpation group, and N1 refers to the other. It was also determined whether or not each subject's main finger palm was identical to that of the subject's maternity nursing supervisor. Consequently, each abdominal palpation yields an entirely distinct N0 and N1 value. Each analytical result is represented by a mean value in Tab. I.

Table II: The Mean Values For Each Analysis Result

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Abdomen	*Upper*	
Group	N_0	N_1
Max	347.889	642
Mean	183.483	363.654
Max rate of change	4.211	4.898
Positive mean rate of change	0.563	1.206
Negative mean rate of change	-0.556	-1.745
Min rate of change	-3.826	-7.321
Abdomen	*Right*	
Group	N_0	N_1
Max	341.7	650
Mean	172.962	319.624
Max rate of change	2.947	4.693
Positive mean rate of change	0.387	0.825
Negative mean rate of change	-0.482	-1.043
Min rate of change	-3.313	-5.623
Abdomen	*Left*	
Group	N_0	N_1
Max	260	545.462
Mean	133.459	261.766
Max rate of change	3.781	4.6
Positive mean rate of change	0.546	0.868
Negative mean rate of change	-0.554	-1.148
Min rate of change	-3.557	-4.769

B Statistical difference between the two groups

For each abdomen, we conducted a statistical comparison of the analytical findings between two groups. We conducted a Shapiro-Wilk test to see whether the population of the data set was normally distributed before comparing the two groups. A one-sided Mann-Whitney U test was used in this study since the population of certain data sets did not follow a normal distribution. There is further confirmation that, across both groups, the absolute value of N0 is less than that of N1, with respect to the median value of N1. No difference in the median value of the two groups (H0) and a difference in the median value (H1) are the two hypotheses being tested. Null hypothesis is adopted based on statistics and rejection limit value in case the same rank is not present in data set, and p-value is adopted based on statistics and rejection limit value in case it is present in data set. Tab. III displays the test results.

Table III: Mann-Whitney U Test

Abdomen	*Upper*	*Right*	*Left*
Max	Reject*	Reject*	Reject*
Mean	Reject*	Reject*	Reject*
Max rate of change	Accept	Reject*	Accept
Positive mean rate of change	Reject*	Reject*	Accept
Negative mean rate of change	Accept	Accept	Accept
Min rate of change	Accept	Reject*	Accept

*: $p<0.01$

V. Discussion

A Validity of data collection and data analysis

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The purpose of this study is to better understand the pedagogical application of quantitative assessment in maternity nursing education. The validity of data collecting and data analysis will be discussed in this study.

Paper tape was used to fix pressure data on the hands of individuals in the data gathering experiment. We were concerned about the effect that any fixing method may have on the experiment. In general, however, majority of the participants reported little pain with the devices. During the trial, the gadgets did not move while being palpated. In addition, the obtained data reveals the features of palpation, such as "palpation used fingers only" and "palpation utilised complete hands." As a result, it is believed that the experiment equipment' data collecting for palpation analysis was accurate. As a result, it may be difficult to attach sensors to the hands of hyperhidrosis patients due of the shifting of the tape. In the experiment, one participant's hands were moist from her own perspiration. We had the individuals wear rubber gloves and attach sensors to them. As a consequence, we decided to conduct the experiment under the same parameters. As a result, if the gadgets are to be used as assessment systems in the future, they will need to be improved in terms of wearability and flexibility.

After analysing the most often used finger palm, we also looked at the strength of the data and how it changed over time. Flexible palpation techniques are required by the nurse in Leopold Maneuvers.

Therefore, it is felt that it is important to determine which fingers are more often utilised, as well as to compare the pressure values of each finger.

Analysis of the rate of time for each finger palm is another method for determining main finger palm. Finger palm for supporting the object of palpation may be identified as the principal one based on time analysis. Therefore, it is assumed that the rate of pressure value may be used to evaluate the gathered data if we utilise the strength of pressure and also the change in pressure. According to researchers, the pressure value may be used statistically to determine whether palpation causes pregnant women to become worried.

B Importance of primary finger palm

Nurse students need to know how to utilise their own finger palm and the difference between their own and their supervisor's while palpating each abdomen. The maternity ward supervisor at the university instructs undergraduate nursing students how to palpate in accordance with the textbook. To begin, the distal interphalangeal joint of each finger is gently palpated with both hands curled in a clockwise direction. Second-phase palpation has relied heavily on the middle of their hand, with all of their fingers extended. In the first phase, the primary finger palms of the supervisors in Tab. I vary from one another; nevertheless, in the second phase, the main finger palms of all the supervisors are identical. They palpate each topic with their hands curved in the first phase, making it simple to distinguish the primary of each subject. A person's wrist and hand curvature affect the angle of each fingertip that touches their upper belly when lying on their backs. Two N1 supervisors acknowledged that they employed "lp-little" on the upper abdomen, therefore it can't be stated that they used a different palpation approach than textbooks. Second, the participants use their extended hands to palpate the skin. As a result, it seems that all supervisors had the same main finger palms.

When the right abdomen is palpated, the main finger palms of all subjects are present. Palpation to the left, on the other hand, has no characteristic. The location of the people and their postures seem to be the source of the trait. For the subjects, the right abdomen is in the front, and the left abdomen is in the rear for this palpation. They seem to have difficulty palpating with their centre right hand without planned postures under these settings. From the foregoing, we cannot neglect the link between each abdomen and the main finger palm on whether them palpation is appropriate to the textbook or not. Therefore, the knowledge about the main finger palm on each abdomen and the trend is incredibly crucial for the realization of appropriate instruction on the palpation training.

C High-quality palpation

It is crucial to distinguish between a training environment and an actual clinical setting when it comes to palpation. The best nursing care for actual patients includes not only specialist knowledge but also the ability to alleviate the patient's stress. Because of this, palpation with less pressure is a key component of high-quality nursing abilities. There are considerable discrepancies between N0 and N1 on the palpation for each

abdomen, as shown in Tab. III by "Max" and "Mean." According to Tab. II, the N0's maximum and average pressure values are half of those of the N1. According to the intensity of the abdominal pressure, N0 is statistically lower than N1. When it comes to the difference in pressure to each abdomen, it was explained that participants of N0 may palpate with half the pressure of N1.

Tab. III also indicates substantial differences between N0 and N1 in terms of "Max rate of change," "Positive mean rate of change," and "Min rate of change" on the right abdomen. When the right abdomen is palpated, the subjects of N0 take longer than the subjects of N1 to change the pressure. There are no statistical differences in palpation of the left abdomen, however. These seem to be influenced by the persons' postures as well. Compared to the left abdomen, it seems that the individuals found it easier to alter the intensity of pressure on the right abdomen in the front. When we checked the frequency of left-hand fingertip and palm usage, we found that 18 of the patients had done so. It seems that individuals of N0 were better able to regulate their hand pressure than those of N1, as shown in Tab. II by the test-accepted change rate. As seen above, there are significant variations in both the palpable pressure and the rate of change between N0 and N1 for each abdomen. Primary finger palm pressure and change rate seem to have a significant impact on successful instruction..

D Usefulness to effective education

On the basis of this study, we examine from two angles how best to teach palpation training. First and foremost, this position serves as a resource for the supervisor. Prior to this, the university's supervisor validated by looking into the faces of various nursing students that they were able to palpate correctly and provided instruction where required. However, if palpation, confirmation by the eyes, and quality instruction are increased at the same time, more effective education may be achieved. For example, even if many palpation trainings are taking place at the same time, the supervisor's task of teaching will be significantly reduced. It is also likely that it will help nursing students with guidance and assessments, even if the substance of the training is difficult to grasp. Efforts to avoid overlooks and make learning easier for students seem to be critical to the success of nursing education.

There is also the potential of varying the degree of each student's nursing education. It is possible to tell by looking at the palpation data which fingers and palms are used, how painful the palpation feels, how much pressure is used, etc. The ability to assess one's own palpation abilities following training has been difficult for nursing students up until now.

Nursing students' understanding of their palpation abilities may improve if data on their training is included in their evaluation. It's also doable when comparing the palpation differences between the students and the supervisor. So the supervisor may educate and assess each student according to their ability, making it easier for students to master palpation skills than previously. It seems that nursing students' comprehension of things like their finger palm characteristics, pressure values, and other things related to palpation is critical for good training in education.

VI. Conclusion

According to modern nursing education, rookie nurses lack the competence to perform at the level needed in clinical settings; thus, it is necessary to increase the practical experience of nursing students and improve their educational outcomes. However, expanding the nursing school's facilities and chances for students to practise their practical skills is a challenging task. Due to Japan's dropping birthrate, it is also challenging for nursing students to strengthen their practical abilities, particularly in maternity nursing education. Nursing students and supervisors' finger palm pressure was measured during a simulated Leopold Maneuvers experiment. We initially assessed the obtained data from the perspective of the most frequently utilised finger palms. In addition, it was determined whether or not the palpation was done in accordance with the textbook while analysing the data. Analysis of obtained information was also conducted with regard to pressure measurements as well as their changes. Using a statistical hypothesis test, we show that the participants who palpate according to the textbook were palpating with no excessive pressure and gradual pressurisation. When discussing palpation data, we proposed that it would be beneficial to evaluate it and utilise the findings in maternity nursing training. For high-level novice nurses, we found that a quantitative assessment is more helpful than a qualitative evaluation.

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