The Structure of Clinical Judgment Making Based on Nurse's Visual Observation

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Abstract. To elucidate the structure of nurses' clinical decisions based on visual observation; we established objectives targeting nurses with varying levels of experience. Subjects: Thirty-three nurses. As simulated patient information, written information on an 85-year old inpatient with pneumonia was provided to subjects. Four images of a simulated patient room with the simulated patient in the bed, each image was displayed on the monitor for five seconds. After observation, while confirming the path of line of sight during observing simulated patient room images, which was measured with Talk Eye II, subjects reviewed their thought processes and made an oral report. No significant differences were observed in indices of eye movement based on years of clinical experiences. But, this indicated that potential awareness and peripheral vision might be used to prioritize the order of areas to observe. There were 58 types of observation items, and then divided into the seven categories. From the relationship of included in the thought process, four types of thoughts were extracted. Overall, the proportion of visual observation being reflected in verbal data was 50.4–68.9%. Among nurses with 10 or more years of clinical experience, their visual observation was reflected in verbal data slightly less than among nurses with less clinical experiences. The results of analyses showed the eye movement of nurses, potential awareness and peripheral vision were used to determine the priority of areas for observation. In addition, during the observation of a simulated patient room, and years of clinical experience affected thought type.

Keywords: Eye movement · Clinical experiences · Protocol analysis · Gaze · Verbal report

1 Introduction

Observation is an extremely important nursing activity. Nurses must have the practical ability to quickly understand patients' conditions based on observation and provide necessary support at all times.

Humans use five senses to make observations. Of these five senses, visual information accounts for 83%, therefore playing a very important role in observation. However, vision can also lead to mistakes such as oversights, overlooking, and mistakes. This can therefore harm patients by leading to medical accidents, or cause patients to suffer due to their needs not being noticed. In clinical sites, when nursing students and new nurses observe the same situation as experienced nurses, they may

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actually be looking at different things. Even while looking at the same thing, they might come to different conclusions. Observation skills do not only involve looking at a certain thing. Rather, they involve making appropriate judgements based on observation and implementing nursing support.

Previous studies have objectively showed what nurses are looking at using a device that measures eye movements [1–3]. The details of interviews were analyzed to the thought processes of nurses in reaching clinical decisions based on observations [4]. However, no studies have objectively shown nurses' line of sight, and their thoughts and decision-making based on movement of their line of sight.

Therefore, we used a device that tracks eye movements (Talk Eye II) to objectively show the movements of nurses' line of sight and their thoughts based on this visual observation.

2 Study Objectives

To elucidate the structure of nurses' clinical decisions based on visual observation; we established three objectives targeting nurses with varying levels of experience.

(1) To clarify trends in the eye movements of nurses during observing simulated patient room,
(2) To clarify thought process based on nurses' visual observation, and
(3) To clarify the proportion of visually observation of simulated patient room reflected in observed items included in the thought process.

3 Research Methods

Subjects: Thirty-three nurses working at a hospital

Study procedure:

(1) As simulated patient information, written information on an 85-year old female inpatient with pneumonia was provided to subjects.
(2) Four images of a simulated patient room with the simulated patient in the bed were sequentially shown so that subjects could imagine visiting the hospital room of the simulated patient for observations. Each image was displayed on the monitor for five seconds (Fig. 1).
(3) The eye movements during observation of the simulated patient room images were measured using Talk Eye II.
(4) After observation, while confirming the path of line of sight during observing simulated patient room images, which was measured with Talk Eye II, subjects reviewed their thought processes and made an oral report.

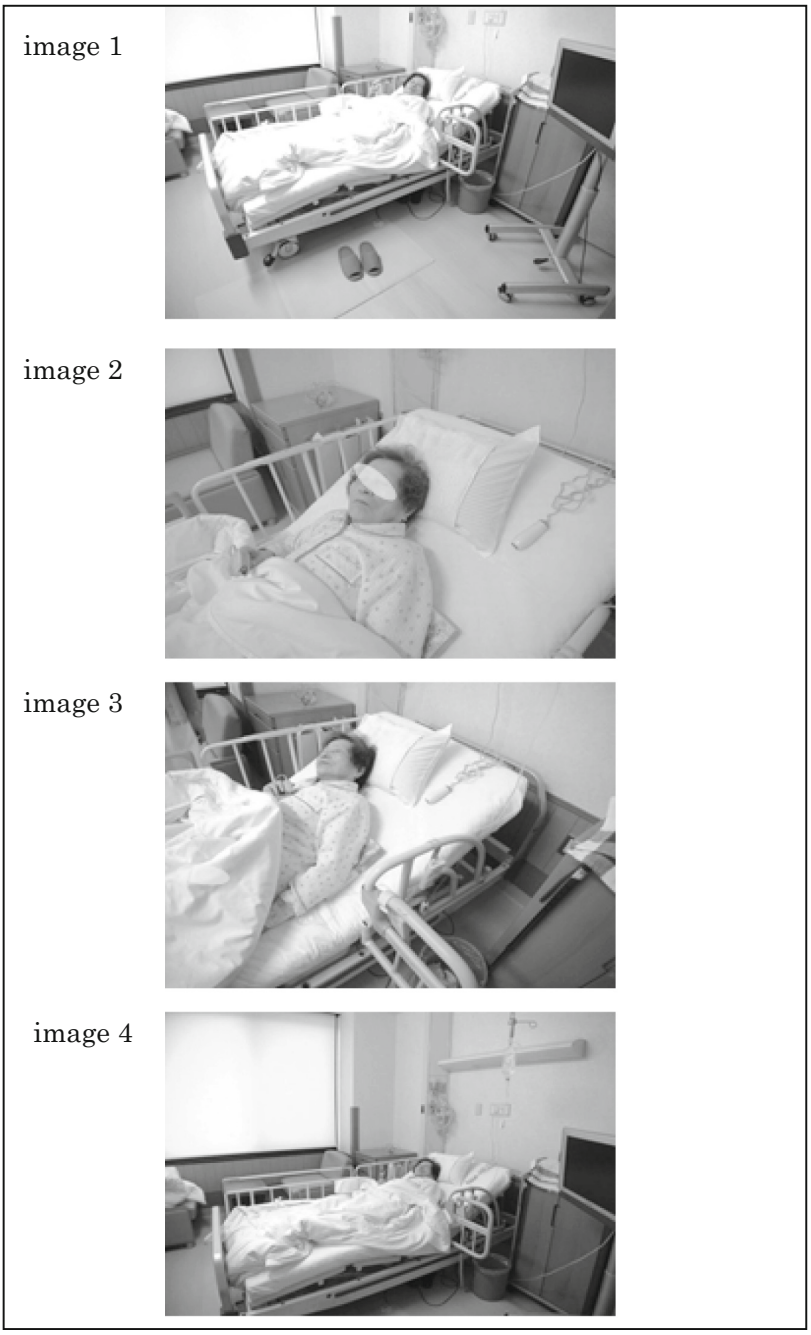

Fig. 1. Four images of a simulated patient room with the simulated patient in the bed

4 Data Collection Method

4.1 Eye Movement Measurements

Movements in the line of sight were measured with Talk Eye II. Gaze was defined as having ocular movement at a velocity of 5 deg/s with eye fixation duration of 100 ms or longer. Data measurement was made with sampling frequency of 30 Hz.

4.2 Thought Processes

After viewing simulated hospital room images, subjects were asked to orally describe their thoughts during observation while reviewing the movement of their line of sight as measured with Talk Eye II in the "think aloud method". We used the retrospective think aloud method whereby subjects speak while reviewing the task [5].

5 Analytical Method

- An arbitrary region analysis processing program (Takei Scientific Instruments Co., Ltd.) was used to set regions for analysis per image in the eye movement data measured using Talk Eye II. For each of four images, we extracted "total gazing time", "gazing time for each area", and "number of people gazing" as measurement indices. In accordance with the situation that each image showed, there were 10 areas in Image I, and nine regions for Images II through IV. Analysis was performed for each of these areas. Measurement indexes were compared in three groups: 1–4 years of clinical experience, 5–9 years of clinical experience, and 10 years or more of clinical experience. "Total gazing time" was analyzed through one-way analysis of variance. "Gazing time for each area" was analyzed through Kruskal-Wallis test. We used SPSS Statistics 20 for statistical analysis and the level of statistical significance was set at 5%.
- We recorded a retrospective oral report on thought processes during image observation while reviewing the movement of line of sight as measured with Talk Eye II using an IC recorder. We then used verbatim records as verbal data. The verbal data were analyzed for thought processes using protocol analysis. Verbal data were classified into four groups based on years of clinical experience: first year, 2–4 years, 5–9 years, and 10 years or more.
- We analyzed the proportion of thought processes in which the visual observation of the simulated hospital room was reflected (Fig. 2).

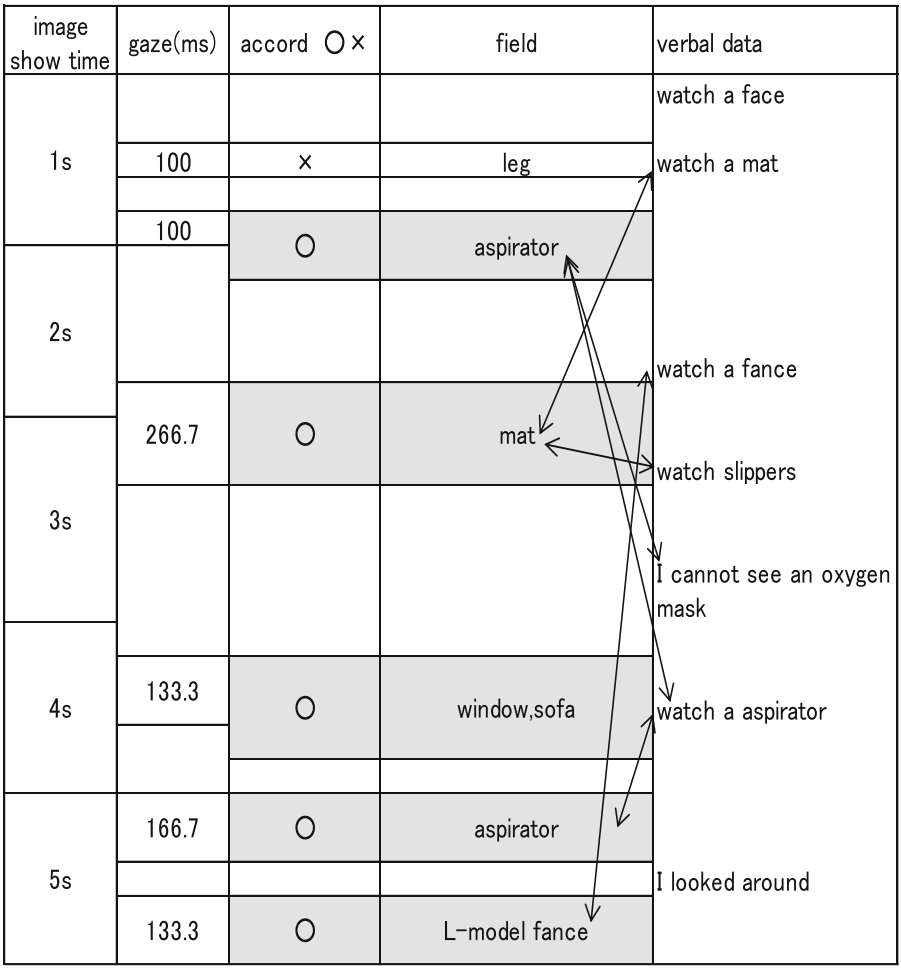

Fig. 2. Accord of gaze and verbal (example)

6 Results

- No significant differences were observed in indices of eye movement ("total gazing time", "gazing time for each area", and "number of people gazing") based on years of clinical experiences. However, longer "gazing time for each area" tended to be spent looking at areas of Image I <<suction bottle>>, Image II <<face>>, Image III <<intravenous drip injection site/route>>, and Image IV <<feet/sensor mat>> than at other areas. In addition, in "presence/absence of gaze", the number of people gazing at Image I <<patient's feet/couch>>, Image II <<face>>, Image III <<intravenous drip injection site/route>>, and Image IV <<oxygen mask/central

piping>> tended to be high. This indicated that potential awareness and peripheral vision might be used to prioritize the order of areas to observe.

- There were 58 types of observation items. These were then divided into the following seven categories: <<fall/fall prevention>>, <<oxygen inhalation therapy/suction>>, <<improved living environment under medical treatment>>, <<patient>>, <<maintenance of comfortable posture>>, <<intravenous injection/infusion>>, and <<nurse call>>. Thought processes were classified into "check and initial understanding", "clinical deduction", and "determination of the care". Categories with high proportion of verbal data were as follows: overall <<oxygen inhalation therapy/suction>> (18.7%), first year <<fall/fall prevention>> (23.5%), 2–4 year <<patient>> (18.8%), 5–9 year <<oxygen inhalation therapy/suction>>, and 10 or more years <<improved recuperative environment facilities>> (18.3%) (Tables 1 and 2).

Table 1. Verbal report according to the area

Years of experience		Total	Fall/fall prevention		Oxygen inhalation therapy/suction		Improved living environment under medical treatment	
		Verbal	Verbal	%	Verbal	%	Verbal	%
Total	n = 33	926	160	17.3	**173**	**18.7**	162	17.5
1 years	n = 7	200	**47**	**23.5**	38	19.0	29	14.5
2–4 years	n = 4	101	17	16.8	18	17.8	18	17.8
5–9 years	n = 12	336	53	15.8	**66**	**19.6**	62	18.5
10 years	n = 10	289	43	14.9	51	17.6	**53**	**18.3**

Table 2.

Years of experience		Patient		Maintenance of comfortable posture		Intravenous injection/infusion		Nurse call	
		Verbal	%	Verbal	%	Verbal	%	Verbal	%
Total	n = 33	75	8.1	114	12.3	139	15.0	103	11.1
1 years	n = 7	15	7.5	20	10.0	27	13.5	24	12.0
2–4 years	n = 4	8	7.9	13	12.9	19	18.8	8	7.9
5–9 years	n = 12	28	8.3	39	11.6	48	14.3	40	11.9
10 years	n = 10	24	8.3	42	14.5	45	15.6	31	10.7

In reference to Tanner [6] "A Research-Based Model of Clinical Judgment in Nursing", from the relationship of "check and initial understanding", "reasoning", and "choice of nursing intervention" included in the thought process, four types of thoughts were extracted: {check and initial understanding type}, {reasoning type}, {choice of nursing intervention type}, and {intuitive choice of nursing intervention type}.

Thought types of the first-year nurses were often {check and initial understanding type}, but nurses with more clinical experience tended to use thought types such as {reasoning type} and {choice of nursing intervention type}.
Among observation categories, <<fall/fall prevention>> was "reasoning" about risk and <<maintenance of comfortable posture>> was "reasoning" about patient's pain; therefore, depending on the type of observation category, content of "reasoning" had different characteristics.

- Overall, the proportion of visual observation being reflected in verbal data was 50.4–68.9%. Based on the years of clinical experience, <<fall/fall prevention>> (67.6%) was most reflected for the first year of experience, while <<fall/fall prevention>> (50.0%) was most reflected for 2–4 years, and (67.6%) for 5–9 years. Rhenius et al. [7], I collated it with the data of thought contents provided by a gaze point and a protocol analysis and confirmed agreement of, 73–98%. Among nurses with 10 or more years of clinical experience, their visual observation was reflected in verbal data slightly less than among nurses with less clinical experiences.

7 Discussion

7.1 Trends in Eye Movement Based on Years of Clinical Experience

No significant differences were noted in the indices of eye movement based on years of clinical experience. Previously, many reports have shown different observation time due to difference in years of clinical experience. In this study, however, as the subjects were shown fairly routine patient situations, observations were able to be made quickly even if they had limited experience. In addition, since patient information was provided prior to displaying the images, subjects likely already had images of important points for observation. Areas gazed up by a high number of subjects are likely to be areas that require particularly careful observation of the displayed images.

However, areas that were gazed up for a short period of time and by a small number of people might be subject to oversights. A particularly small number of nurses gazed at <saturation monitor> in Image I, whereas the number of people gazing at it increased in Image II. As such, there may be appropriate timing for making observations. The existence of such appropriate timing suggests that patterns for patient room observation might already be determined.

In addition, this study set 100 ms or more as the duration of gaze, and there may be a chance that subjects were making observation faster than the set time or making observation through peripheral vision without gazing.

7.2 Thought Processes During Observation

Observation categories obtained from the think aloud method had many speeches on <<oxygen inhalation therapy/suction>>, <<fall/fall prevention>>, <<improved recuperative environment facilities>>, and <<patient>>. In the patient settings in this study, we used an 85-year old elderly patient who was hospitalized for pneumonia. Therefore,

in addition to the observation items on respiratory symptoms specialized for pneumonia, observation items for predicting daily activities such as fall risk and fall prevention were noted because of the patient's advanced age.

In this study, subjects made oral reports reviewing their thought processes during image observation while reviewing the movement of line of sight. Visual cognition such as "seeing" by moving line of sight was processed by visual center. Therefore, observation categories with a large amount of verbal data are likely to be observation items of higher priority when observing seniors hospitalized for pneumonia as shown in this study.

7.3 Thought Types During Observation

As types of thought process during observing the patient hospital room, {check and initial understanding type}, {reasoning type}, {choice of nursing intervention type}, and {intuitive choice of nursing intervention type} were extracted.

With {check and initial understanding type}, the thought process was limited to determining position and status of observed contents included in observation categories. In this study, since we did not confirm the meaning of thoughts, we cannot determine whether subjects determined there to be "no abnormality" without thinking further or simply remembered what they saw.

{Reasoning type} is a thought process in which [reasoning] is used to interpret and predict [check and initial understanding]. This process was shown only in 50% or less, and those who showed this type had many years of clinical experience. Furthermore, those who showed thought process of {care determination type} for [care determination] was 10% or less.

Therefore, first-year nurses are limited to the thought process of {check and initial understanding type}, and as the years of clinical experience increased, knowledge and experience become enriched, and nurses started moving onto thought processes of {reasoning type} and {choice of nursing intervention type}. Furthermore, for [reasoning], there were characteristics in content of thought such as risk for patients, stage and degree of symptoms, patient's pain, and prediction of patient's movements. [Reasoning] needs [check and initial understanding] of actual information. Therefore, it is important to first perform [check and initial understanding].

7.4 Relationship Between Eye Movement and Content of Thought

Four categories for those with 10 years or more experience and six categories for those with less experience had gaze consistent with verbal data for observation categories. When gaze and verbal data are consistent, it means that cognitive function worked from visual information. Observation category with the highest consistency was <<intravenous injection/infusion>>, and this should be precisely observed and confirmed regardless of the years of clinical experience. Observation category with low consistency was <<improved recuperative environment facilities>>, where there were many verbal data despite not gazing. For the area of <<improved recuperative environment facilities>>, overall image was understood through peripheral vision other than careful observation.

In terms of years of clinical experience, those with 10 years of experience or more were less consistent, but they might have been using observation with gaze duration of 100 ms or less (the setup value) or peripheral vision. However, with more experience, there could be "complacency" that could lead to mistakes such as "miss" and "oversight".

8 Conclusions

The results of three analyses showed that during the observation of a simulated patient room, as a trend in the eye movement of nurses, potential awareness and peripheral vision were used to determine the priority of areas for observation. In addition, during the observation of a simulated patient room, nurses' [reasoning] for gazing has characteristic, and years of clinical experience affected thought type. Benner and Tannar [8], The expert nurse observes it instantly and shows that I have pattern recognition, similar recognition, common-sense understanding, the practical knowledge that I was an expert of, ability to sense an important point and ability of the rationality that was an expert of with me.

Based on the proportion of areas visually observed by nurses being reflected in verbal data, nurses in their first year thoroughly employed visual observation and performed [check and initial understanding]. However, nurses with 10 years or more experience used peripheral vision for observation and linked this to the thinking process.

Visual observation can lead to oversights, overlooking and mistakes. In order to make appropriate clinical decisions, it is important to make visual observations and to employ one's thinking ability to consider what has been observed. The results of the present study could be useful for examining education methods that encourage the objective presentation of visual observation and subsequent employment of thinking ability.

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