報　文

Differences in Color Impressions between Nurses and Patients

— A Survey of Psychiatric Wards —

Yayoi HARA*, **#, Eunjung LEE*, Fuyuko NAKASHIMA**, Shigeko SHOYAMA*

*Fukuoka Women's University, Fukuoka, Japan
**Fukuoka Nursing college, Fukuoka, Japan

Abstract

This study examined the suitability and impressions of various bedding colors among 66 nurses and 64 patients on psychiatric wards.

(1) The colors chosen as suitable for hospital rooms were white in the male nurse and male patient groups, pale green in the female nurse group, and pale red in the female patient group. As unsuitable bedding colors, pale yellow was chosen by the male and female nurse groups and the female patient group, and pale red by the male patient group.

(2) There were marked differences in the impressions of white and pale blue between the nurse and patient groups.

(3) Factor analysis identified 2 factors: [psychological comfort] and [brightness/warmth]. The mean factor scores were relatively high for white, pale green, and pale blue for [psychological comfort], and were pale red and pale yellow for [brightness/warmth].

Thus, selecting bedding in consideration of patient perspectives is necessary.

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Key words: *bedding, color, nurse, psychological department, inpatient, impression, factor analysis*

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1. Introduction

With an increase in the national cost for medical care, the Japanese government launched the Medical Care Expenditure Regulation Plan in 2008. To shorten the mean length of stay (LOS) is an aim of this plan. In 2019, the mean LOS was 16.0 days on general wards and 265.8 days on psychiatric wards, revealing differences among different types of wards[1]. Many patients staying in hospitals experience stress due to anxiety over their diseases and changes in their living environment. Especially, patients with a prolonged hospitalization in psychiatric departments have been shown to face various types of anxiety and distress[2]. Sleep that provides rest for the body and mind is essential for patients in such a situation, but it is easily affected by stress. With regard to inpatients'sleep status, Takeo et al.[3] reported that approximately 40％of these patients had difficulty in falling asleep, lacked a feeling of sound sleep, or experienced nocturnal or early morning awakenings.

To improve the comfort of hospital stays for patients, various studies on hospital lighting[4], hospital interiors[5], and colors of medical uniforms[6] have recently been conducted. On the other hand, in a survey conducted by Ito et al. to examine patient

#Corresponding Author: E-mail: hara@fdcnet.ac.jp

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room colors nationwide, beige was the color most frequently used for curtains in patient rooms, and the reasons for its use were that“It is natural”and“It is low cost”[7]. Another nationwide survey on bedding colors used in hospitals revealed that white is the most frequently used color, and the most common reason for its use was that“It gives a clean impression”[8]. These findings suggest that cost and cleanliness are key considerations in patient rooms.

In patient rooms, inpatients spend most of their day in bed, and bedclothes that cover beds are the item most frequently seen by them. We previously examined psychiatric inpatients'preferences for bedding colors in the summer and winter, and found that white and pale blue are recommendable as bedding for psychiatric wards in both seasons[9]. However, as bedding is selected based mainly on nurses'opinions from the perspective of hospitals in actual settings, the necessity of clarifying whether there are differences in the impression of hospital bedding between nurses and patients was also suggested.

Therefore, the purpose of the present study was to clarify differences in color impressions between nurses and patients, including the impressions of various hospital bedding colors among nurses to those among psychiatric inpatients we reported in our previous studies[9, 10].

2. Study outline

(1) Location

A psychiatric hospital in Saga Prefecture.

(2) Subjects

- 66 nurses (male: 33; female: 33).
- 64 inpatients (male: 31; female: 33).

Among inpatients, only those with stable mental symptoms were included, and those on locked and isolated wards were excluded. To examine these patients, data from our previous studies[9, 10] were used.

(3) Study period

- August to September 2019.

The average maximum and minimum outside air temperatures during the study period were 36.6°C and 18.7°C, respectively[11]. The temperature in the patient rooms was kept at about 24.0-26.0°C by air conditioning equipment.

(4) Samples

We adopted a bedding color (white) from a photograph of the inside of a patient room (PIXTA 2019)[11] (Figure 1) and converted it into 5 pale tones using image-editing software (Adobe Photoshop Creative Suite 2). Thus, there were the original image and 5 with changed colors, a total of 6 samples. A total of seven sheets were used in the study: one sheet of A4-size Kent paper with six samples printed on it and six sheets of A4-size Kent paper with one sample printed on it. Table 1 shows the Munsell values of the 6 colors. When editing these images, we selected pale tones, considering that high brightness is desirable for patient rooms, as high-brightness colors were preferred in a previous study on medical uniforms[6]. We edited all images, following the PIXTA usage guidelines (2019).

(5) Procedure

We distributed a questionnaire to the nurses, and collected their responses (response rate: 100%). For the inpatients, the hospital nurses in charge individually asked them these questions in their rooms while paying attention to their levels of fatigue, and entered their responses in the questionnaire (97%).

Fig.1 Sample（white）.

Table 1 The Munsell values of the 6 colors.

Sample	Munsell values	Practical Color Co-ordinate System	code
1	N9.5	White	Wt
2	3.4R8.0/5.0	pale Red	p-R
3	5.7Y8.9/3.4	pale Yellow	p-Y
4	4.7G8.4/3.3	pale Green	p-G
5	3.4PB7.9/4.4	pale Blue	p-B
6	5.2P7.7/4.5	pale Purple	p-P

(6) Study environment

The patient rooms of the inpatients had windows, and the lighting used was fluorescent lamps (HotaluX FHF-32EX-N-HX; color temperature: 5000K; color rendering [Ra]: 84).

(7) Study items

(i) Age, (ii) sex, (iii) the most suitable and unsuitable bedding colors for patient rooms (selected from the 6 samples), and (iv) the impressions of the 6 samples. Based on the findings of a study on the sensitive images of bedding/colors and medical uniforms by Syouyama et al.[6, 13], we presented 14 statements, including those regarding the images required of hospitals, which were rated on a 5-point scale: <Strongly disagree>, <Disagree>, <Neutral>, <Agree>, and<Strongly agree>.

(8) Analysis methods

Simple tabulation, t-test, Mann-Whitney U test, factor analysis, one-way analysis of variance (ANOVA), and multiple comparison test (Bonferroni). For statistical processing, we used the statistical analysis software SPSS Ver. 26.0 for Windows.

3. Results

3-1 Subjects

Table 2 shows the mean ages and standard deviations of the overall, male, and female nurse and patient groups. On analyzing differences in the mean age between the overall nurse and patient groups using the t-test, the former's mean age was significantly lower, revealing a difference ($t(128)=4.817$, $p<0.001$).

Table 2 Age of subjects.

ages	nurse n=66	patient n=64
	mean±standard deviations	mean±standard deviations
male	39.27±11.69	59.35±12.32
female	48.94±10.43	61.48±18.48
overall	44.11±12.02	60.45±15.72

3-2 Suitable of the samples

Each group selected the most suitable bedding color for patient rooms from the 6 samples (Figure 2). White was the most frequently selected color in the male nurse group, at 48.5%, whereas it was pale green in the female nurse group, at 33.3%. Similarly, white was most frequently selected by the male patient group, at 50.0%, and pale red by the female patient group, at 37.5%. Thus, suitable bedding colors for patient rooms varied between the sexes, as males tended to select white, while females tended to select colored bedding, such as pale red and pale green. The chi-square test on the suitable of bedding for patient rooms based on the results of cross tabulation for the 2 (nurse and patient) groups and 6 samples revealed no significant differences between the groups ($\chi^2(5)=6.650$, $p<0.05$).

On the other hand, the most unsuitable sample for patient rooms was pale yellow in both the male and female nurse groups, at 42.2 and 57.6%, respectively. It was pale red in the male patient group, at 34.4%, and pale yellow in the female patient group, at 34.5% (Figure 3). The chi-square test on the unsuitable of bedding for patient rooms revealed significant differences ($\chi^2(5)=13.045$, $p<0.05$) as the rate of deeming pale yellow inappropriate was higher in the nurse (50%) than patient group (28.8%). Furthermore, the rate of deeming white unsuitable was higher in the patient (16.9%) than nurse group (6.1%).

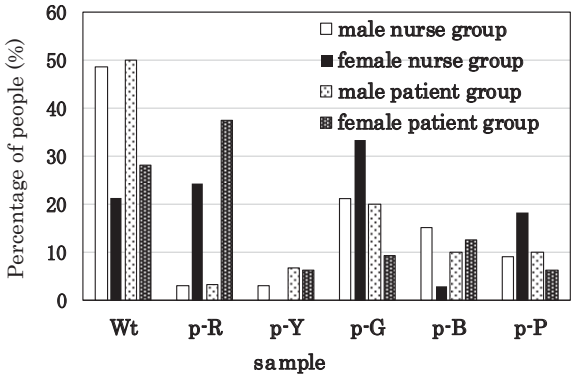

Fig.2 Appropriate sample for patient rooms.

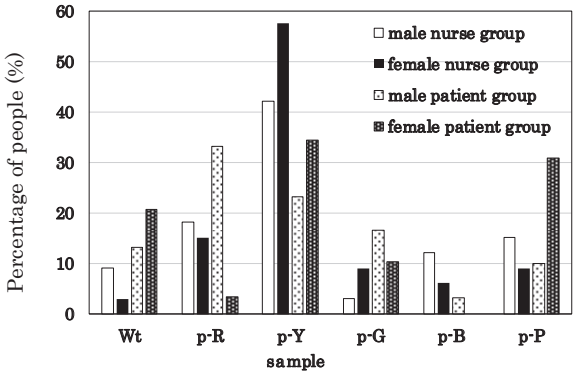

Fig.3 Inappropriate sample for patient rooms.

3-3 Impression of each sample

On examining differences in the impression of each sample between the nurse and patient groups using the Mann-Whitney U test (Table 3) the bedding color with the largest number of items showing differences between the groups was pale blue (7 items), and then white (6).

The patient group rated pale blue more highly than the nurse group for the following items: “soothing bedding”, “bedding that brightens one’s mood”, “bedding that gives an elegant impression”, “bedding that gives a clean impression”, “bedding that is appropriate for patient rooms”, “bedding that makes the room feel bright”, and “bedding that makes the room feel warm”(Figure 4).

Similarly, the patient group rated white more highly than the nurse group for the following items: “bedding that gives a feeling of security”, “bedding for sound sleep”, “soothing bedding”, “bedding that brightens one’s mood”, “bedding that gives a fancy impression”, and “bedding that makes the room feel warm”(Figure 5).

Table 3 Differences of the number of items between nursing and patient group according to sample.

Sample	1	2	3	4	5	6
Difference between nurses and patients number of items	6	4	2	1	7	2

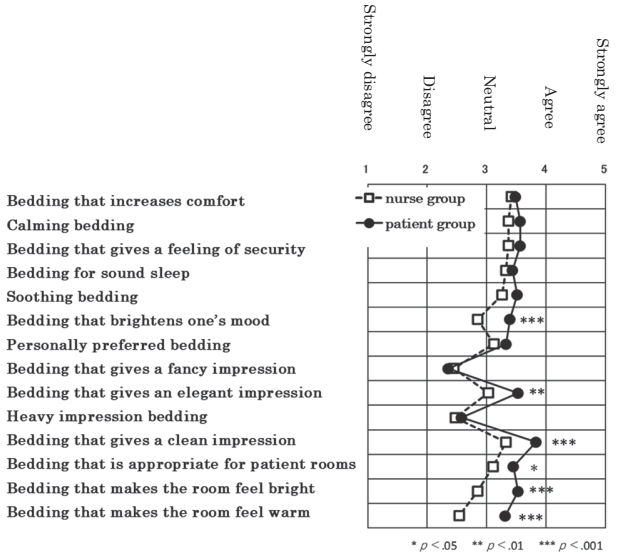

Fig.4 Impression of pale blue (nurse-patient comparison).

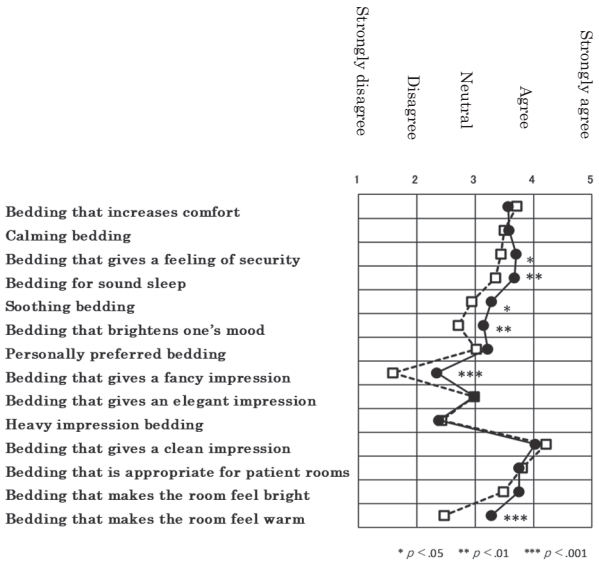

Fig.5 Impression of white (nurse-patient comparison).

3-4 Impressions of all samples

Each group answered the impressions of the 6 samples on a 5-point scale: <Strongly disagree>, <Disagree>, <Neutral>, <Agree>, <Strongly agree>. To compare the impressions among the 6 samples, we used one-way ANOVA. As Figure 6 shows, all of the 14 items revealed significant differences in the nurse group. In the subsequent multiple comparison test, white achieved significantly higher mean scores for “bedding that is appropriate for patient rooms” and “bedding that gives a clean impression” than the 5 other samples. On the other hand, pale yellow achieved a significantly higher mean score for “bedding that gives a fancy impression”than white, pale green, and pale blue.

In the patient group, as Figure 7 shows, 10 of the 14 items revealed significant differences. In the subsequent multiple comparison test, white achieved a significantly higher mean score for “bedding that is appropriate for patient rooms” than pale yellow and pale purple. White also achieved a significantly higher mean score for “bedding that gives a clean impression” than pale red, pale yellow, pale green, and pale purple, whereas pale yellow achieved a significantly higher mean score for “bedding that gives a fancy impression” than white and pale blue.

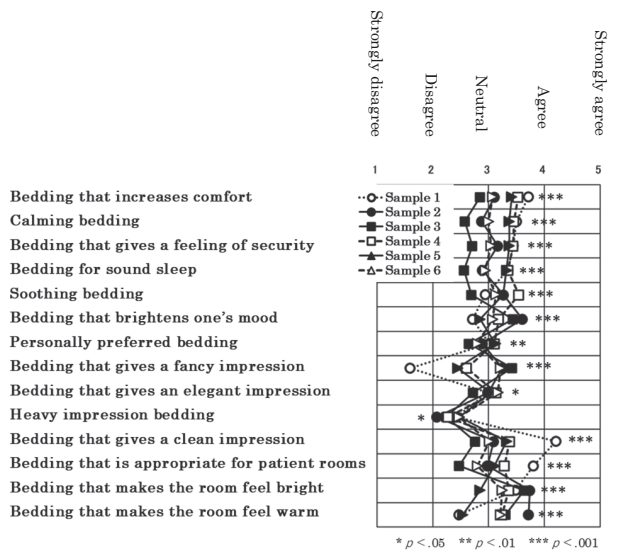

Fig.6 Impressions of the 6 samples (nurse group).

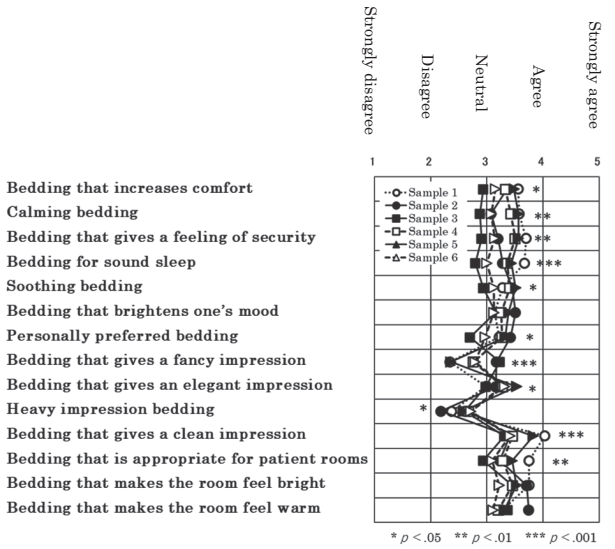

Fig.7 Impressions of the 6 samples (patient group).

Subsequently, through factor analysis (varimax rotation by the principal factor method with an eigenvalue of 1 or higher) to clarify the structure of the impressions of the 6 samples in the male and female nurse and patient groups, 2 factors were identified (Table 4). Factor 1, consisting of "calming bedding", "bedding that gives a feeling of security", "bedding for sound sleep", "bedding that increases comfort", "bedding that is appropriate for patient rooms", "soothing bedding", "personally preferred bedding", "bedding that gives a clean impression", and "bedding that gives an elegant impression", was named [psychological comfort]. Factor 2, consisting of "bedding that makes the room feel warm", "bedding that makes the room feel bright", and "bedding that brightens one's mood", was named [brightness/warmth]. The cumulative contribution rate was 69.63% Cronbach's alpha was 0.93 for Factor 1 and 0.85 for Factor 2.

On calculating the mean factor score for each sample, and examining differences in the score in terms of Factors 1 and 2 by one-way ANOVA (Table 5%, both factors revealed significant differences among a total of 24 samples (6 samples for the male and female nurse and patient groups). Figure 8 shows a distribution of the mean factor scores for the samples, with Factor 1 [psychological comfort] and Factor 2 [brightness/warmth] as the 2 axes.

In terms of Factor 1 [psychological comfort], the 4 groups relatively highly rated white, pale green, and pale blue. In the consequent multiple comparison test, the mean factor scores for white and pale blue in the male nurse group were significantly higher than those for pale yellow in the female nurse, male patient and female patient groups. The mean factor scores for white, pale green, and pale blue in the female nurse group were significantly higher than those for pale yellow in the male nurse, male patient, and female patient groups. The mean factor scores for white, pale green, and pale blue in the male patient group were significantly higher than those for pale yellow in the male nurse, female nurse, and female patient groups. Moreover, the mean factor scores for white, pale green, and pale blue in the female patient group were significantly higher than those for pale yellow in the male nurse, female nurse, and male patient groups.

Table 4 Results of factor analysis.

	Factor 1 Psychological comfort	Factor 2 Brightness/ warmth
Calming bedding	0.868	0.241
Bedding that gives a feeling of security	0.814	0.319
Bedding for sound sleep	0.808	0.273
Bedding that increases comfort	0.788	0.300
Bedding that is appropriate for patient rooms	0.657	0.419
Soothing bedding	0.651	0.473
Personally preferred bedding	0.607	0.444
Bedding that gives a clean impression	0.577	0.340
Bedding that gives an elegant impression	0.478	0.462
Bedding that makes the room feel warm	0.228	0.789
Bedding that makes the room feel bright	0.279	0.781
Bedding that brightens one's mood	0.396	0.676
Eigenvalue	7.199	1.156
Cumulative Contribution Ratio	59.993	69.629

Table 5　Mean scores of factor for each sample.

Sample code (target group)	Factor 1 psychological comfort	Factor 2 brightness/ warmth
Wt (male nurse)	0.401	-0.402
p-R (male nurse)	-0.439	0.380
p-Y (male nurse)	-0.670	0.317
p-G (male nurse)	0.089	0.042
p-B (male nurse)	0.336	-0.514
p-P (male nurse)	-0.246	-0.142
Wt (female nurse)	0.533	-0.591
p-R (female nurse)	-0.401	0.615
p-Y (female nurse)	-0.842	0.251
p-G (female nurse)	0.424	-0.214
p-B (female nurse)	0.391	-0.791
p-P (female nurse)	-0.228	0.031
Wt (male patient)	0.427	0.098
p-R (male patient)	-0.214	0.159
p-Y (male patient)	-0.677	0.091
p-G (male patient)	0.277	-0.031
p-B (male patient)	0.337	0.179
p-P (male patient)	-0.092	-0.169
Wt (female patient)	0.375	-0.122
p-R (female patient)	-0.039	0.758
p-Y (female patient)	-0.245	0.148
p-G (female patient)	0.161	-0.003
p-B (female patient)	0.358	-0.027
p-P (female patient)	-0.061	-0.027
P	***	***
degree of freedom	23 744	23 744
F	6.936	5.792

*** $p < .001$

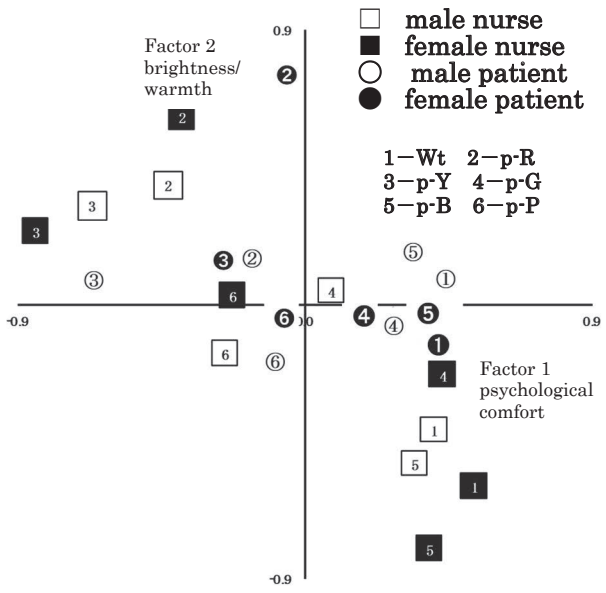

Fig.8 Distribution of means of Factors 1 and 2 (Nurses and Patients by Gender).

There were no significant differences in the mean factor score for each color among the 4 groups.

In terms of Factor 2 [brightness/warmth], the male nurse, female nurse, and female patient groups relatively highly rated pale red and pale yellow. The male patient group relatively highly rated pale blue, pale red, and pale yellow. In the subsequent multiple comparison test, only the mean factor score for pale blue varied among the 4 groups, as it was significantly higher in the male patient than female nurse group ($p<0.01$). In respect of [brightness/ warmth], the nurse group rated pale blue low, but the patient group did not show such a tendency.

4. Discussion

This study examined the impressions of different bedding colors, involving male and female nurses and patients on psychiatric wards. Among the 6 samples, the most suitable bedding color for patient rooms was white in both the nurse and patient groups. There were no significant differences between them, indicating that they similarly deemed white bedding appropriate for patient rooms. White is associated with "cleanliness" and "hospital"[13], and this may explain the high appreciation of white bedding for patient rooms among both nurses and patients. Furthermore, on comparing the impressions among the 6 samples, white achieved the highest mean scores for "bedding that gives a clean impression" and "bedding that is appropriate for patient rooms". Thus, white gives a clean impression, and white bedding may be appropriate for patient rooms. However, Hiraizumi et al. examined the white coat phenomenon in untreated patients with essential hypertension, and reported that the patients'blood pressure levels were higher in medical compared with non-medical settings[15]. In hospitals where importance is placed on the early identification of abnormalities and sense of cleanliness, white is commonly used for bedding and uniforms. On the other hand, the finding of the present study suggests the possibility that white bedding is often associated with "hospital" causing a tense feeling in patients. The nurse group rated white significantly more highly than the other samples, focusing on the sense of cleanliness, whereas there were no significant differences between white and pale green or pale blue in the patient group. This suggests that bedding colors that give a clean

impression vary between nurses and patients. Another point is that in both the nurse and patient groups, males deemed white bedding appropriate, whereas females selected colored samples, rather than white. In our previous study to clarify the current status of bedding used in hospitals nationwide, we examined the bedding colors used and the reasons for selecting each color, and found that the most common reason for using white bedding was that it gives a clean impression, and that for using colored bedding was that it relaxes patients[8]. Based on these findings, what males and females require of hospital bedding may be a sense of cleanliness and relaxing effect, respectively.

In contrast, the most unsuitable bedding color for patient rooms was pale yellow in both the nurse and patient groups. According to a survey conducted by the Japan Color Research Institute to examine words and events associated with different colors in university students, yellow was most frequently associated with "bright", but "unclean" was also included in the associative words for this color[14]. Pale yellow may have been associated with excreta, and this shows how the impressions of colors influence us, similar to the case of white. In the present study, both the nurse and patient groups rated pale yellow as "bedding that gives a fancy impression", when asked about its impression; it can be inferred that they deemed colors that give a fancy impression inappropriate for patient rooms in hospitals. Furthermore, when focusing on the rate of deeming "inappropriate", the rate for white bedding was higher in the patient group. Therefore, the impression of white bedding may vary between nurses and patients.

On comparing the impressions of the 6 samples between the nurse and patient groups, differences were observed in 6 items for white, and 7 items for pale blue, indicating the necessity of considering possible differences in the impressions of these 2 colors between nurses and patients.

In terms of [psychological comfort] as one of the factors identified through factor analysis, the mean factor scores for white, pale green, and pale blue were relatively high in all of the male and female nurse and patient groups. As the subsequent multiple comparison test did not reveal significant differences in the score for each color among the 4 groups, both the nurse and patient groups may have had similar impressions of the 6 samples in terms of psychological comfort. Moreover, in all of the 4 groups, the mean factor scores for white and pale blue were significantly higher than pale yellow. Based on this, white and pale blue have a significantly greater effect to increase psychological comfort than pale yellow, and they are recommendable as bedding colors for psychiatric departments.

In terms of the other factor, [brightness/warmth], only pale blue revealed differences among the 4 groups, and the mean factor score was significantly higher in the male patient than female nurse group. In the survey by the Japan Color Research Institute, associative words for blue included "cold" and "lonely"[14]. As a background factor that explains why brightness and warmth opposite to coldness and loneliness were more strongly associated with blue among patients in the present study, their mental status should be noted. Matsuda et al. examined university students'color preferences and personalities, and reported that emotionally unstable and introversive students tended to prefer low-saturation and high-brightness blue[16]. Therefore, the above result may have represented the characteristics of the psychiatric inpatients involved in the present study.

Concerning blue, the possible influence of gender bias on colors should also be considered. In a survey on color preferences and gender attitudes among young children and their parents conducted by Shimizu, girls tended to prefer warm colors such as pink, whereas boys tended to prefer cool colors such as blue. When asked about girlish and boyish colors, most parents selected pink and blue, respectively[17]. As pale blue is more masculine than pale red, and it matches their gender, male patients in the present study may have had the impression that it brightens one's mood and room.

In patient rooms, brightness and warmth are required, as well as psychological comfort. Suzuki et al. examined the relaxing effect of hand massage on patients with schizophrenia, and reported various changes in these patients, such as beginning to talk about their own problems and having more realistic conversations, rather than those based on

their delusions[18]. The relaxing effect that may bring about healthy changes in patients is also required for patient rooms. In a study conducted by Toyota et al. to clarify the reasons for using a private room to psychiatric inpatients, positive factors included appropriate distances from others and privacy preservation, while negative factors included anxiety and loneliness[19]. In psychiatric hospitals, a private room with only a bed is provided as part of treatment in some cases. The use of bedding with high psychological comfort is expected to reduce anxiety and loneliness in patients who use such private rooms, and consequently facilitate their treatment. In addition, nurses working in psychiatric hospitals treat patients in a way that reduces their tension, with a view to promoting communication and trust-based relationships with them[20]. The present study showed that patients'impressions of bedding varied among the colors, suggesting that the use of suitable bedding colors in patient rooms also reduces patients'tension and improves nursing care. The bed colors that were relatively highly rated by the patient group in terms of both Factors 1 and 2 were white, pale green, and pale blue, showing that these colors are desirable for psychiatric patients.

In short, as the impressions of some bedding colors were common between nurses and patients, while the impressions of others varied between them, it may be necessary to select bedding in consideration of patient perspectives.

Lastly, aging among inpatients of psychiatric hospitals should also be noted as a background factor associated with the significant difference in the mean age between the nurse and patient groups. The Ministry of Health, Labour, and Welfare reported that 45.4% of patients admitted to psychiatric hospitals are elderly aged 65 or older[21]. In this respect, the age of the subjects was a limitation of the present study.

5. Conclusions

We examined the suitability and impressions of 6 bedding colors for patient rooms, involving nurses and patients on psychiatric wards to compare the impressions between them. The sample bedding colors were white and 5 pale tones with high brightness, which were highly rated in a previous study. The results are summarized as follows:

(1) Both the nurse and patient groups deemed white the most appropriate and pale yellow the most unsuitable bedding color for patient rooms.

(2) Among the 6 samples, there were marked differences in the impressions of white and pale blue between the nurse and patient groups. This should be taken into account when selecting bedding.

(3) Factor analysis identified 2 factors: [psychological comfort] and [brightness/warmth]. The colors with a relatively high mean [psychological comfort] score were white, pale green, and pale blue, whereas those with a relatively high mean [brightness/warmth] score were pale red and pale yellow. When focusing on [brightness/warmth], there were significant differences in the score for pale blue between the female nurse and male patient groups, revealing that the impression of this bedding color varied between them.

(4) The bedding colors that are recommendable for psychiatric wards from the perspective of patients may be white, pale green, and pale blue. As for pale red, it may be necessary to create an environment for patients to make their own choices, as the preference for this color varied between the sexes.

Ethical Considerations

This study was conducted with the approval of the Ethical Review Committee of the Fukuoka Gakuen School Corporation (Approval No. 475). We explained the study outline and methods to the director of the cooperating hospital and the head of its nursing department to obtain their approval. We also provided such an explanation to the subjects to obtain their written consent.

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