Received: 28 November 2024 | Revised: 6 February 2025 | Accepted: 23 February 2025

DOI: 10.1002/pcn5.70078

PCN Reports
Psychiatry and Clinical Neurosciences
Open Access

ORIGINAL ARTICLE

Medical staff's knowledge of delirium by occupation and the effectiveness of an on-demand e-learning

Hirotaka Yamagata MD, PhD[1,2,3] | Rieko Kobayashi Diploma[4] | Kenichi Hirose MD[3] | Tomoe Seki MD, PhD[5] | Takahisa Takihara MD[6]

[1]Kokoro Hospital Machida, Machida, Japan

[2]Department of Psychiatry, Ebina General Hospital, Ebina, Japan

[3]Department of Internal Medicine, Hirose Hospital, Sagamihara, Japan

[4]Department of Nursing, Ebina General Hospital, Ebina, Japan

[5]AOBA Urban Clinic, Yokohama, Japan

[6]Department of Respiratory Medicine, Ebina General Hospital, Ebina, Japan

Correspondence
Hirotaka Yamagata, MD, PhD, Kokoro Hospital Machida, 2140 Kamioyamadamachi, Machida, Tokyo 194-0201, Japan.
Email: hyamagat@kokoro-hospital.jp

Funding information
None

Abstract

Aim: We aimed to evaluate the understanding of delirium among multidisciplinary medical staff and assess whether a brief e-learning course improved their knowledge on the topic.

Methods: A total of 611 medical staff members participated in the study, including 32 physicians, 393 nurses, 33 nursing assistants, 21 pharmacists, and 132 other multidisciplinary staff, which included non-clinical personnel. A 20-question delirium knowledge test was administered both before and after a 40-min, on-demand e-learning course.

Results: At baseline, there was limited understanding that delirium involves a disturbance of consciousness, can be triggered by physical illness or medications, and that few medications are recommended for its treatment. Furthermore, visual hallucinations were not widely recognized as a common type of hallucination in delirium. However, care strategies and non-pharmacological interventions for delirium were well understood even before the course. After the brief e-learning course, knowledge scores significantly increased, demonstrating a large effect size of 0.53. Physicians and pharmacists achieved higher overall knowledge scores after the course compared to other occupational groups.

Conclusion: Education and targeted dissemination efforts regarding the causes, diagnosis, and pharmacological treatment of delirium are essential for enhancing delirium knowledge among multidisciplinary staff. The leadership role of a "liaison" psychiatrist is pivotal for ensuring effective delirium care and fostering a team-based approach in clinical practice.

KEYWORDS
delirium, e-learning, liaison psychiatry, staff education, team-based medicine

INTRODUCTION

Delirium is a major barrier to the effective treatment of physical illnesses in geriatric populations, particularly in inpatient settings. Delirium has been reported in approximately 20% of hospitalized patients.[1] Comorbid delirium is known to impair decision-making and increase mortality.[2,3] Delirium also imposes a substantial social burden by elevating healthcare costs[4,5] and increasing the strain on caregivers and medical staff.[6,7]

In everyday clinical practice, statements from physicians and nurses, such as "The patient's consciousness is clear but has delirium," or "Dementia has worsened because of delirium," reflect a misunderstanding of the pathophysiology of delirium. Delirium is not synonymous with dementia but rather represents an acute disturbance of consciousness. The symptoms of delirium are varied and can include hallucinations, delusions, and mood disturbances, often leading to misdiagnoses as schizophrenia, depression, or dementia. It

is essential to identify the underlying causes of consciousness disturbances in delirium, such as cerebrovascular disease, metabolic imbalances, infections, or medications, including sedatives. Insufficient knowledge in this area may hinder accurate diagnosis, delaying appropriate treatment of the underlying condition.

We recently reported that medical staff who are more confident in their knowledge of delirium are more likely to engage in effective delirium management behaviors.[6] This highlights the critical need for comprehensive delirium education. However, current efforts in delirium education remain insufficient, with recent studies indicating that more than half of ICU nurses have not received adequate training and possess an inadequate understanding of delirium.[8,9] Moreover, studies examining delirium knowledge and the impact of educational interventions are limited, particularly among non-nursing medical staff. Medical professionals in hospital settings often face time constraints, limiting opportunities for formal education. On-demand e-learning offers a solution, allowing participants to access training at their convenience and enabling educators to deliver content without adjusting to individual schedules. This method also facilitates education for remote participants. However, it remains uncertain whether e-learning can effectively improve delirium knowledge. In this study, we aimed to evaluate whether hospital staff, including physicians, pharmacists, and other medical personnel, including non-clinicals, possess accurate knowledge of delirium and whether e-learning courses can enhance their understanding.

METHODS

Study design and population

This study was approved by the Ethics Committees of Hirose Hospital and Ebina General Hospital (neither of which employs a regular psychiatrist) in accordance with the provisions of the Helsinki Declaration. The participants were medical staff who worked at these hospitals during the survey period and provided informed consent, either in writing or electronically. Medical staff of any occupation, age, or gender were eligible for inclusion. The delirium education course was delivered either in person or through on-demand e-learning. Data were collected from the participants regarding their knowledge of delirium and their satisfaction with the course through a questionnaire administered before and after the course. Additional data on occupation, age, gender, and years of professional experience were also collected.

Developing the comprehension test

A comprehension test, originally developed in Japanese by the author (H.Y., a psychiatrist specializing in liaison psychiatry), was reviewed and refined by a co-author (T.S., also a liaison psychiatry specialist) to assess participants' knowledge of delirium. The test comprised 20 questions designed to assess a broad range of delirium knowledge, including pathophysiology, symptomatology, societal impacts, physical disease treatment, direct causes, pharmacotherapy, and non-pharmacotherapy (Supporting Information S1). Emphasis was placed on assessing delirium as a disorder of consciousness and its causes, areas identified by the authors as insufficiently understood by medical staff in their liaison work. All questions were multiple-choice, with designated correct and incorrect responses. The content of the test was reviewed by a nurse specialist in palliative care (R.K.) and two physicians (K.H. and T.T.) to ensure its clinical relevance and accuracy. Each question was worth one point, with a possible total score of 20. Paper-based questionnaires were manually scored by H.Y., while scores from electronic tests were calculated automatically. Participants were also asked to rate their subjective understanding of delirium before and after the course, their satisfaction with the course, and whether they felt the course improved their subjective knowledge of delirium on a 6-point scale (Supporting Information S1).

Developing the learning course

The course was approximately 40 min long, delivered in a lecture format with explanations in Japanese while accompanying slides were presented. The course content was developed by the author (H.Y.) and subsequently reviewed and refined by the co-author (T.S.). The slides covered key aspects of delirium, including its pathophysiology (explaining that delirium is a disturbance of consciousness distinct from dementia), the impact of delirium on the patient's underlying condition, diagnostic criteria, symptoms, and the factors that contribute to delirium (preparatory, direct, and facilitating). The course also addressed non-pharmacologic treatment (including methods of care, the importance of rehabilitation, and minimizing the use of physical restraints) and pharmacotherapy for delirium (highlighting the lack of evidence for antipsychotic medications), along with hypothetical case presentations.

A pilot test and face-to-face lecture were conducted in October 2023 for staff members at Hirose Hospital, including both clinical and non-clinical staff. To encourage maximum participation, staff who did not consent to participate in the study were still allowed to attend the course. Recruitment posters were displayed throughout the hospital; 29 individuals agreed to participate by providing written consent or registering via a Google form. The test was administered either through a paper-based questionnaire or a Google form. Of the 29 participants, four were excluded because of missing data, leaving 25 participants for preliminary analysis. Demographic data and test results are shown in Supporting Information S2–S4. The course was deemed effective if it resulted in the same or an increased number of correct answers for all questions (except Question [Q] 1) and a significant overall increase in total scores post-course. However, the percentage of correct answers for Q1 decreased after the course, and questions Q3, Q11, Q12, and Q13 had less than 80% correct responses. These questions were identified as areas that required more thorough coverage in the course.

TABLE 1 Demographic data of participants.

		Age (years)			Professional experience (years)		
Occupation	Number of participants (male/female)	Median	IQR	Range	Median	IQR	Range
Total	611 (121/490)	31	25–42	21–75	7	3–13	0–51
Physician	**32 (21/11)**†	**43**§	34–51	24–75	**15**††	9–25	1–51
Nurse	**393 (51/342)**‡	**30**‡	25–37	21–62	**7**‡	3–13	1–37
Nursing assistant	33 (8/25)	**47**¶	37–58	23–69	5	2–10	1–25
Pharmacist	21 (6/15)	28	27–30	24–68	4	3–6	1–35
Multidisciplinary	132 (35/97)	32	27–46	21–74	4	1–10	0–50

Note: Significant differences are indicated in **bold**. Each symbol indicates a significant change compared to the following groups: †for nurse, nursing assistant, and multidisciplinary; ‡for multidisciplinary; §for nurse and pharmacist; ¶for nurse, pharmacist, and multidisciplinary; ††for all other groups. Abbreviation: IQR, interquartile range.

On-demand e-learning course

Following the face-to-face pilot, the same course content was recorded and offered as an on-demand e-learning course at Ebina General Hospital. This on-demand course was conducted from May 2024 to June 2024 using the Manabibako system (https://manabibako.com/faq). To encourage widespread participation, staff who did not consent to the study were still permitted to attend the course. A total of 978 participants viewed the study description, with 812 responding. Of these, 718 electronically consented to participate in the study and completed the pre-test questionnaire. Participants were instructed not to use any reference materials, such as documents or textbooks, while completing the tests. Of the 718 participants, 632 completed the course and submitted the post-test questionnaire. Twenty-one participants with obvious data discrepancies (e.g., listing two different occupations or missing data) were excluded, leaving 611 participants for analysis (Table 1). Participants were categorized by occupation: physicians, nurses, nursing assistants, pharmacists, and a multidisciplinary group (which included radiologists, physiotherapists, social workers, dietitians, clerks, and other non-clinical staff).

Statistical analysis

Statistical analyses were conducted using Excel (Microsoft) and EZR.[10] The median and interquartile ranges (IQRs) were rounded to the nearest whole number. Proportion comparisons by gender were performed using Fisher's exact test. The Kolmogorov–Smirnov test was used to assess normality. Since age, years of experience, and total test scores were not normally distributed, nonparametric tests were employed for subsequent analyses. The Mann–Whitney *U*-test was used for comparisons of age, years of experience, and total test scores across multiple groups. Spearman's rank test was used for correlation analysis. Wilcoxon's signed-rank test was used to compare baseline and post-course total scores, and McNemar's chi-square test was applied to compare the percentage of correct answers for each test question. The effect size was calculated by dividing the *Z*-value by the square root of the sample size. Effect sizes (r) were categorized as large ($r > 0.5$), moderate ($0.3 \le r \le 0.5$), and small ($r < 0.3$). To correct for multiple testing, the Bonferroni correction was applied: Fisher's exact test was performed 10 times, Spearman's rank correlation eight times, the Mann–Whitney *U*-test 52 times, Wilcoxon's signed-rank test seven times, and McNemar's chi-square test 20 times. Detailed *p*-values are provided in Tables 2, 3 and Supporting Information S5–S7.

RESULTS

The demographic data of the participants are presented in Table 1. Physicians had a significantly higher proportion of men compared to nurses (adjusted-$p < 0.001$), nursing assistants (adjusted-$p = 0.011$), and the multidisciplinary staff, including non-clinicals (adjusted-$p < 0.001$). Nurses had a significantly higher proportion of women compared to the multidisciplinary staff (adjusted-$p = 0.006$). Physicians were significantly older than nurses (adjusted-$p < 0.001$) and pharmacists (adjusted-$p = 0.010$). Nurses were younger than the multidisciplinary staff (adjusted-$p = 0.017$), while nursing assistants were significantly older than nurses (adjusted-$p < 0.001$), pharmacists (adjusted-$p = 0.007$), and the multidisciplinary staff (adjusted-$p = 0.036$). Physicians also had significantly more years of professional experience than all other occupations (nurses: adjusted-$p = 0.015$; nursing assistants: adjusted-$p < 0.001$; pharmacists: adjusted-$p = 0.016$; and multidisciplinary staff: adjusted-$p < 0.001$). Additionally, nurses had significantly more years of experience than the multidisciplinary staff (adjusted-$p < 0.001$).

The median total score for all participants at baseline was 15 out of 20 (Table 2). Eleven questions (Q2, Q3, Q5–8, Q10–14) had less than 80% correct answers at baseline, with Q11–14 showing less than 50% of correct responses (Table 3). Baseline total scores did not differ significantly by gender (adjusted-$p = 1$) and showed no significant correlation with age (adjusted-$p = 1$) or years of experience (adjusted-$p = 0.39$). However, subjective confidence in delirium care

TABLE 2 Comparison of knowledge scores at baseline and post-course by occupations.

	Baseline			Post-course			Statistic (baseline versus post-course)			
Occupation	Median	IQR	Range	Median	IQR	Range	*Z*-value	*p* value	Adjusted-*p*	*r*
Total	15	14–16	7–20	16	15–18	9–20	13.1	2.2E-39	**1.5E-38**	0.53
Physician	**16**‡‡	15–17	11–20	**18**†	17–20	15–20	3.7	2.2E-04	**1.6E-03**	0.65
Nurse	**15**‡‡	14–16	7–20	**16**‡	15–18	9–20	10.1	3.8E-24	**2.7E-23**	0.51
Nursing assistant	13	12–16	7–19	15	13–17	10–20	2.6	9.5E-03	0.066	0.45
Pharmacist	**16**‡	14–17	11–20	**19**†	17–20	14–20	3.5	4.7E-04	**3.3E-03**	0.76
Multidisciplinary	14	12–15	8–19	16	14–17	9–20	6.2	4.4E-10	**3.0E-09**	0.54

Note: *p* values were calculated using Wilcoxon's signed-rank test to compare baseline and post-course total scores and adjusted using Bonferroni correction. The effect size (r) was calculated by dividing the *Z*-value by the square root of the number of samples. Adjusted *p*-values (<0.05) were considered significant and are **boldfaced**. Each symbol indicates a significant change compared to the following groups: †for nurse, nursing assistant, and multidisciplinary; ‡for multidisciplinary; ‡‡for nursing assistant and multidisciplinary.
Abbreviation: IQR, interquartile range.

TABLE 3 Comparison of correct answers for each question in the knowledge test for all participants.

		Baseline		Post-course		Statistic (baseline versus post-course)		
Item	Contents	*n*	%	*n*	%	McNemar's chi-squared	*p* value	Adjusted-*p*
Q1	Agitated state of dementia	498	81.5	519	84.9	3.4	0.067	1
Q2	Disturbance of consciousness	488	79.9	591	96.7	86.0	1.8E-20	**3.6E-19**
Q3	Diagnostic criteria for delirium	355	58.1	433	70.9	32.6	1.2E-08	**2.3E-07**
Q4	Diurnal variation	592	96.9	605	99.0	6.9	8.8E-03	0.18
Q5	Increase in medical costs	481	78.7	545	89.2	40.0	3.0E-10	**6.0E-09**
Q6	Decision-making	484	79.2	528	86.4	19.3	1.1E-05	**2.3E-04**
Q7	Hyponatremia	456	74.6	527	86.3	33.8	6.1E-09	**1.2E-07**
Q8	Acute cerebral infarction	461	75.5	537	87.9	41.4	1.3E-10	**2.5E-09**
Q9	Benzodiazepines	534	87.4	574	93.9	17.3	3.2E-05	**6.4E-04**
Q10	Anticholinergics	418	68.4	557	91.2	102.9	3.5E-24	**6.9E-23**
Q11	Indication of quetiapine	203	33.2	225	36.8	2.1	0.15	1
Q12	Indication of risperidone	161	26.4	217	35.5	15.0	1.1E-04	**2.2E-03**
Q13	Indication of haloperidol	252	41.2	267	43.7	1.0	0.32	1
Q14	Hallucinations of delirium	268	43.9	352	57.6	31.3	2.2E-08	**4.4E-07**
Q15	Acute onset	577	94.4	594	97.2	6.2	0.013	0.25
Q16	Physical restraints in advance	534	87.4	566	92.6	17.8	2.5E-05	**4.9E-04**
Q17	Handing over the scissors	602	98.5	602	98.5	0	1	1
Q18	Keeping the nurse call away	579	94.8	574	93.9	0.4	0.53	1
Q19	Dark room in the daytime	572	93.6	590	96.6	9.6	1.9E-03	**0.038**
Q20	Spending all day in bed	569	93.1	582	95.3	3.7	0.055	1

Note: The numbers (*n*) and percentages (%) of correct answers at the baseline and after the course are presented. McNemar's chi-squared test was used to compare the percent correct for each question, and *p*-values were adjusted using the Bonferroni correction. Adjusted *p*-values (<0.05) were considered significant and are **boldfaced**.

at baseline was significantly correlated with the total score (adjusted-$p < 0.001$), although the correlation coefficient was small ($r = 0.20$; Supporting Information S7). Physicians scored significantly higher than nursing assistants (adjusted-$p = 0.027$) and the multidisciplinary staff (adjusted-$p < 0.001$) (Table 2). Nurses had significantly higher scores than nursing assistants (adjusted-$p = 0.019$) and the multidisciplinary staff (adjusted-$p < 0.001$), while pharmacists scored significantly higher than the multidisciplinary staff (adjusted-$p = 0.031$).

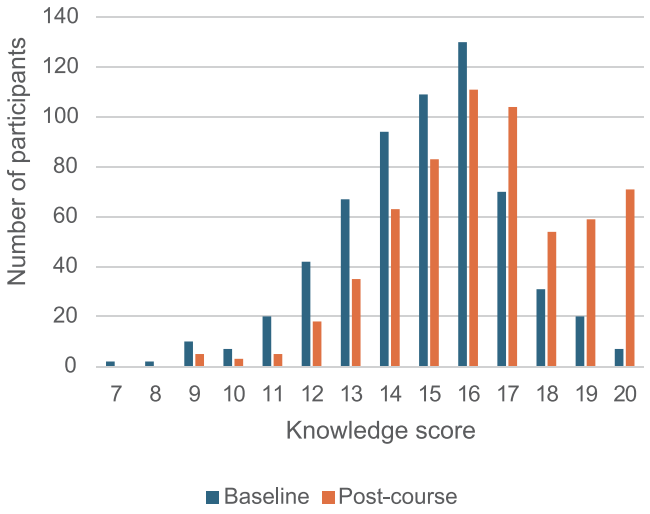

FIGURE 1 Distribution of knowledge scores at baseline and post-course.

After the course, the median total knowledge score for all participants increased to 16 out of 20, which was significantly higher than the baseline score (adjusted-$p < 0.001$). The distribution of knowledge scores before and after the course are shown in Figure 1 and Supporting Information S8. The effect size was large, at $r = 0.53$ (Table 2). Post-course scores did not differ significantly by gender (adjusted-$p = 1$) and showed no significant correlation with age (adjusted-$p = 1$). However, the following variables were significantly, though weakly, correlated with the total score: years of experience ($r = 0.12$, adjusted-$p = 0.018$), subjective confidence in delirium care after the course ($r = 0.16$, adjusted-$p < 0.001$), satisfaction with the course ($r = 0.26$, adjusted-$p < 0.001$), and subjective understanding of the course ($r = 0.27$, adjusted-$p < 0.001$). Test items with less than 80% correct responses after the course were Q3, Q11, Q12, Q13, and Q14 (Table 3), with Q11, Q12, and Q13 showing less than 50% correct responses. The percentage of correct answers significantly increased after the course for 13 questions (Q2–10, Q12, Q14, Q16, and Q19) compared to the baseline (Table 3). Physicians had significantly higher total scores after the course compared to nurses (adjusted-$p = 0.002$), nursing assistants (adjusted-$p < 0.001$), and the multidisciplinary staff (adjusted-$p < 0.001$). Pharmacists also had significantly higher post-course scores than nurses (adjusted-$p = 0.012$), nursing assistants (adjusted-$p = 0.004$), and multidisciplinary staff (adjusted-$p < 0.001$). Nurses achieved significantly higher total scores than the multidisciplinary staff (adjusted-$p = 0.001$). While all occupations demonstrated higher knowledge scores after the course compared to baseline, the increase for nursing assistants was not statistically significant (Table 2). There was no significant difference in the amount of change in scores before and after the course by occupation (Supporting Information S6). Effect sizes were large for physicians ($r = 0.65$), nurses ($r = 0.51$), pharmacists ($r = 0.76$), and multidisciplinary staff ($r = 0.54$), but moderate for nursing assistants ($r = 0.45$). The percentage of correct answers for each question by occupation is provided in Supporting Information S9.

DISCUSSION

In this study, we surveyed delirium knowledge in a multi-occupational setting before and after providing delirium education via an on-demand e-learning course. One of the primary objectives was to evaluate whether baseline knowledge of delirium among medical staff was insufficient. Specifically, questions related to delirium as a disturbance of consciousness caused by physical illness or medications (Q2, Q7, Q8, and Q10) were answered correctly by less than 80% of participants. Other questions with similarly low correct response rates included those addressing the limited role of medications in delirium management (Q11, Q12, Q13), the diagnostic criteria for delirium (Q3), the impact of delirium on decision-making and healthcare costs (Q5, Q6), and the common occurrence of visual hallucinations in delirium (Q14). In contrast, questions regarding the care and non-pharmacological treatment of delirium (Q16–Q20) had a high percentage of correct responses prior to the course. This suggests that assessment of direct physical factors contributing to delirium is insufficient. However, once delirium is diagnosed, appropriate non-pharmacological interventions appear to be effectively implemented. Education on delirium should focus not only on non-pharmacological interventions of delirium, but also on understanding the causes, diagnosis, and pharmacotherapy of delirium.

In Japan, over the past decade, the prevention and early detection of delirium and related environmental adjustments (non-pharmacological treatment) have been emphasized. For example, the DELTA program aims to promote early detection and intervention for delirium. It provides education on delirium and assessment tools that include risk assessment for delirium, symptom-based screening, and specific intervention methods.[11] The introduction of the DELTA program has reduced the incidence of delirium and adverse events, such as falls and self-extubation. In addition, the 2022 revision of medical fees introduced "the Add-On of Care for Patient at High Risk of Delirium," and many hospitals have been conducting risk assessment for delirium and non-pharmacological interventions. These measures may explain why the healthcare professionals already had knowledge of environmental adjustment (non-pharmacological intervention).

Several studies have explored delirium knowledge (though most have primarily focused on symptoms and risk factors), aiming to improve nurses' prediction and early detection of delirium.[9,12–17] We believe that recognizing delirium as a disturbance of consciousness is crucial for its effective management. Impaired consciousness often signals serious underlying physical conditions. Using sedation or physical restraints can delay the identification of these conditions, worsen delirium, and potentially lead to life-threatening outcomes. Previous research has also shown that nursing staff often do not sufficiently comprehend the definition of "delirium."[15] In our study, the percentage of correct answers to Q2, "Delirium is a disturbance of consciousness," was 96.7% after the course, a significant improvement from the baseline score, indicating the course's effectiveness (Table 3).

To the best of our knowledge, questions regarding the indications for pharmacotherapy (Q11–Q13) have not been investigated in previous studies. In Japan, antipsychotics are not indicated for the

treatment of delirium. Notably, the percentage of correct answers to these questions was approximately one-third, both at baseline and after the course. These findings suggest that antipsychotics are routinely used to treat delirium, despite the lack of formal indications. In Japan, the Ministry of Health, Labour, and Welfare has approved the off-label use of quetiapine, risperidone, perospirone, and haloperidol for delirium patients. These antipsychotics are often used in clinical practice; this may have led to the incorrect answers provided for Q11–Q13. The concept of "indications" may have been challenging for professionals not directly involved in prescribing or pharmacy, as more than 60% of physicians and 80% of pharmacists answered these questions correctly post-course. There was no significant difference in the amount of change in scores after the course by occupation. However, the increase in scores for nurses was relatively smaller than that for pharmacists. This may be because the correct answer rate for questions related to pharmaceuticals did not improve after the course. While previous studies have included questions on the use of haloperidol for delirium,[9,16] the use of pharmacotherapy, particularly antipsychotics, in delirium management has been controversial.[18–22] A recent meta-analysis reported poor efficacy of antipsychotic medications for delirium. Therefore, formulating questions on the advantages or disadvantages of using antipsychotics was challenging, and the questions on pharmacotherapy for delirium were biased towards the indications. Future high-quality research on the use of antipsychotics for treating delirium is needed.

In the analysis by occupation, physicians, nurses, and pharmacists scored significantly higher than the multidisciplinary staff, including non-clinicals, supporting the validity of the question's content. The percentage of correct responses to Q1, which addressed the difference between delirium and dementia, was low among nursing assistants (57.6%) (Supporting Information 8). Similarly, the percentage of correct responses to Q3, concerning the diagnosis of delirium, was low across all participants (58.1%) at baseline (Table 2). These findings suggest that many medical staff struggle to differentiate between delirium and dementia and face challenges in diagnosing delirium. Scores for Q3 improved significantly after the course, but scores for Q1 did not show significant improvement. This indicates that continued education on the distinction between delirium and dementia is necessary.

Another objective of this study was to determine whether a short, on-demand e-learning course could enhance delirium knowledge. The total post-course score was significantly higher than the pre-course score, with a large effect size, suggesting that the short e-learning course improved delirium knowledge. Although several studies have investigated delirium education for medical staff, most of these programs have been aimed at nurses.[8,9,12–15] Educational approaches that incorporate group discussions, role-play, and reflective practice are generally considered more effective than simple lectures.[11,23–26] However, such programs require substantial manpower and time. One study reported no significant difference in knowledge improvement between groups that received only lectures and those that received lectures combined with objective structured clinical examination.[27] Although one study involving a small group of nurses found that e-learning did not improve knowledge,[14] other studies have demonstrated that several hours of e-learning can increase delirium knowledge.[15,16] E-learning courses may thus be a practical option for educating large numbers of medical staff.

The strength of this study lies in the large number of participants and the inclusion of multidisciplinary professionals, providing a comprehensive assessment of delirium knowledge and the impact of e-learning on this knowledge. However, this study has several limitations. First, while the questions were designed to cover a broad range of delirium-related topics, several important elements were not included in the assessment, such as the impact of delirium on physical prognosis, hypoactive delirium, alcohol withdrawal delirium, and dealing with physical symptoms, including constipation and pain, though these topics were covered in the course. Adding more questions could broaden the scope of knowledge assessed but might also increase participant burden, leading to higher dropout rates. When conducting similar research in the future, the validity of the questions should be re-examined, and the questions may need to be revised. Second, the use of a correct/incorrect question format may have led to an overestimation of the correct response rate. For example, including an "unknown" option might improve accuracy by allowing participants to indicate uncertainty. However, such an option could also reduce the educational impact by discouraging participants from engaging more deeply with the material and thinking through their answers more thoroughly. Third, the course content did not vary by occupation in this study. Since important knowledge may differ depending on the role, the content of courses and assessments may need to be tailored to specific occupations to further enhance knowledge. Fourth, although improvements in delirium knowledge were observed after the short on-demand e-learning course, we did not examine whether this knowledge was retained over time or if it translated into improved delirium care practices. Further investigation is required to determine whether knowledge retention and practical application occur following this course. Finally, as this study was conducted primarily at a single site, the generalizability of the results is uncertain. Additional validation in multiple facilities is needed.

To conclude, the knowledge of delirium among general hospital medical staff was insufficient, but significant improvement was observed following the on-demand e-learning course. As the number of patients with delirium is expected to rise in aging societies, addressing this knowledge gap is increasingly important. Delirium is often identified through psychiatric symptoms; however, it is not a condition that can be managed solely by psychiatrists. Ensuring that multidisciplinary staff possess adequate knowledge of delirium will promote more effective team-based practices. This also highlights the critical leadership role of liaison psychiatrists in coordinating delirium care.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the authors used DeepL Pro for English proofreading. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

AUTHOR CONTRIBUTIONS

Hirotaka Yamagata: Conceptualization; methodology; formal analysis; investigation; resources; data curation; writing—original draft; visualization; project administration. **Rieko Kobayashi**: Investigation; resources; writing—review and editing; **Kenichi Hirose**: Investigation; resources; writing—review and editing; **Tomoe Seki**: Conceptualization; methodology; project administration; writing—review and editing. **Takahisa Takihara**: Investigation; resources; writing—review and editing.

ACKNOWLEDGMENTS

We thank Editage [http://www.editage.com] for editing and reviewing this manuscript for English language. We also thank Mr. Daisuke Komatsu (Mediva Incorporated) for his cooperation in promoting liaison psychiatry practices and Mrs. Saori Takizawa (Hirose Hospital) for advertising the lecture within the hospital.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The datasets in this study are not publicly available due to ethical restrictions.

ETHICS APPROVAL STATEMENT

This study was approved by the Ethics Committees of Hirose Hospital and Ebina General Hospital in accordance with the provisions of the Helsinki Declaration.

PATIENT CONSENT STATEMENT

All participants provided informed consent, either in writing or electronically.

CLINICAL TRIAL REGISTRATION

N/A.

ORCID

Hirotaka Yamagata http://orcid.org/0000-0002-5783-7237

REFERENCES

1. Bellelli G, Brathwaite JS, Mazzola P. Delirium: a marker of vulnerability in older people. Front Aging Neurosci. 2021;13:626127. https://doi.org/10.3389/fnagi.2021.626127
2. Witlox J, Eurelings LSM, de Jonghe JFM, Kalisvaart KJ, Eikelenboom P, van Gool WA. Delirium in elderly patients and the risk of postdischarge mortality, institutionalization, and dementia: a meta-analysis. JAMA. 2010;304(4):443–51. https://doi.org/10.1001/jama.2010.1013
3. Hamilton GM, Wheeler K, Di Michele J, Lalu MM, McIsaac DI. A systematic review and meta-analysis examining the impact of incident postoperative delirium on mortality. Anesthesiology. 2017;127(1):78–88. https://doi.org/10.1097/ALN.0000000000001660
4. Leslie DL. One-year health care costs associated with delirium in the elderly population. Arch Intern Med. 2008;168(1):27–32. https://doi.org/10.1001/archinternmed.2007.4
5. Igarashi M, Okuyama K, Ueda N, Sano H, Takahashi K, P Qureshi Z, et al. Incremental medical cost of delirium in elderly patients with cognitive impairment: analysis of a nationwide administrative database in Japan. BMJ Open. 2022;12(12):e062141. https://doi.org/10.1136/bmjopen-2022-062141
6. Yamagata H, Takihara T, Kobayashi R, Hirose K, Higuchi K, Miyahara M, et al. Burnout and perceived burden levels related to delirium in physicians and nurses. Gen Hosp Psychistry. 2024;87:162–3. https://doi.org/10.1016/j.genhosppsych.2023.12.010
7. Morandi A, Lucchi E, Turco R, Morghen S, Guerini F, Santi R, et al. Delirium superimposed on dementia: a quantitative and qualitative evaluation of informal caregivers and health care staff experience. J Psychosom Res. 2015;79(4):272–80. https://doi.org/10.1016/j.jpsychores.2015.06.012
8. Xing H, Zhu S, Liu S, Xia M, Jing M, Dong G, et al. Knowledge, attitudes and practices of ICU nurses regarding subsyndromal delirium among 20 hospitals in China: a descriptive cross-sectional survey. BMJ Open. 2022;12(9):e063821. https://doi.org/10.1136/bmjopen-2022-063821
9. Lange S, Mędrzycka-Dąbrowska W, Tomaszek L, Wujtewicz M, Krupa S. Nurses' knowledge, barriers and practice in the care of patients with delirium in the intensive care unit in Poland—a cross-sectional study. Front Public Health. 2023;11:1119526. https://doi.org/10.3389/fpubh.2023.1119526
10. Kanda Y. Investigation of the freely available easy-to-use software 'EZR' for medical statistics. Bone Marrow Transplant. 2013;48(3):452–8. https://doi.org/10.1038/bmt.2012.244
11. Ogawa A, Okumura Y, Fujisawa D, Takei H, Sasaki C, Hirai K, et al. Quality of care in hospitalized cancer patients before and after implementation of a systematic prevention program for delirium: the DELTA exploratory trial. Supp Care Cancer. 2019;27(2):557–65. https://doi.org/10.1007/s00520-018-4341-8
12. Papaioannou M, Papastavrou E, Kouta C, Tsangari H, Merkouris A. Investigating nurses' knowledge and attitudes about delirium in older persons: a cross-sectional study. BMC Nurs. 2023;22(1):10. https://doi.org/10.1186/s12912-022-01158-9
13. Alhalaiqa F, Masa'deh R, Al Omari O, Shawashreh A, Khalifeh AH, Gray R. The impact of an educational programme on jordanian intensive care nurses' knowledge, attitudes, and practice regarding delirium and their levels of self-efficacy: a Quasi-experimental design. Iran J Nurs Midwifery Res. 2023;28(3):312–9. https://doi.org/10.4103/ijnmr.IJNMR_437_20
14. Detroyer E, Dobbels F, Teodorczuk A, Deschodt M, Depaifve Y, Joosten E, et al. Effect of an interactive E-learning tool for delirium on patient and nursing outcomes in a geriatric hospital setting: findings of a before-after study. BMC Geriatr. 2018;18(1):19. https://doi.org/10.1186/s12877-018-0715-5
15. van de Steeg L, IJkema R, Wagner C, Langelaan M. The effect of an e-learning course on nursing staff's knowledge of delirium: a before-and-after study. BMC Med Educ. 2015;15:12. https://doi.org/10.1186/s12909-015-0289-2
16. Detroyer E, Dobbels F, Debonnaire D, Irving K, Teodorczuk A, Fick DM, et al. The effect of an interactive delirium e-learning tool on healthcare workers' delirium recognition, knowledge and strain in caring for delirious patients: a pilot pre-test/post-test study. BMC Med Educ. 2016;16:17. https://doi.org/10.1186/s12909-016-0537-0
17. Alshurtan K, Ali Alshammari F, Alshammari AB, Alreheili SH, Aljassar S, Alessa JA, et al. Delirium knowledge, risk factors, and attitude among the general public in Saudi Arabia: a cross-sectional study. Cureus. 2024;16(4):e59263. https://doi.org/10.7759/cureus.59263
18. Burry L, Mehta S, Perreault MM, Luxenberg JS, Siddiqi N, Hutton B, et al. Antipsychotics for treatment of delirium in hospitalised non-ICU patients. Cochrane Database Syst Rev. 2018;6(6):CD005594. https://doi.org/10.1002/14651858.CD005594.pub3
19. Andersen-Ranberg NC, Barbateskovic M, Perner A, Oxenbøll Collet M, Musaeus Poulsen L, van der Jagt M, et al. Haloperidol for the treatment of delirium in critically ill patients: an updated systematic review with

meta-analysis and trial sequential analysis. Crit Care. 2023;27(1):329. https://doi.org/10.1186/s13054-023-04621-4
20. Y Wu YC, Tseng PT, Tu YK, Hsu CY, Liang CS, Yeh TC, et al. Association of delirium response and safety of pharmacological interventions for the management and prevention of delirium: a network meta-analysis. JAMA Psychiatry. 2019;76(5):526–35. https://doi.org/10.1001/jamapsychiatry.2018.4365
21. Oh ES, Needham DM, Nikooie R, Wilson LM, Zhang A, Robinson KA, et al. Antipsychotics for preventing delirium in hospitalized adults: a systematic review. Ann Intern Med. 2019;171(7):474–84. https://doi.org/10.7326/M19-1859
22. Nikooie R, Neufeld KJ, Oh ES, Wilson LM, Zhang A, Robinson KA, et al. Antipsychotics for treating delirium in hospitalized adults: a systematic review. Ann Intern Med. 2019;171(7):485–95. https://doi.org/10.7326/M19-1860
23. Molitor V, Busse TS, Giehl C, Lauer R, Otte IC, Vollmar HC, et al. Educational interventions aimed at improving knowledge of delirium among nursing home staff-a realist review. BMC Geriatr. 2024;24(1):633. https://doi.org/10.1186/s12877-024-05213-9
24. Bush SH, Skinner E, Lawlor PG, Dhuper M, Grassau PA, Pereira JL, et al. Adaptation, implementation, and mixed methods evaluation of an interprofessional modular clinical practice guideline for delirium management on an inpatient palliative care unit. BMC Palliat Care. 2022;21(1):128. https://doi.org/10.1186/s12904-022-01010-6
25. Shikino K, Ide N, Kubota Y, Ishii I, Ito S, Ikusaka M, et al. Effective situation-based delirium simulation training using flipped classroom approach to improve interprofessional collaborative practice competency: a mixed-methods study. BMC Med Educ. 2022;22(1):408. https://doi.org/10.1186/s12909-022-03484-7
26. Takaesu Y, Watanabe K, Numata S, Iwata M, Kudo N, Oishi S, et al. Improvement of psychiatrists' clinical knowledge of the treatment guidelines for schizophrenia and major depressive disorders using the 'Effectiveness of Guidelines for Dissemination and Education in Psychiatric Treatment (EGUIDE)' project: a nationwide dissemination, education, and evaluation study. Psychiatry Clin Neurosci. 2019;73(10):642–8. https://doi.org/10.1111/pcn.12911
27. Montgomery A, Smerdely P, Hickman L, Traynor V. Comparing the delirium objective structured clinical examination (OSCE) education package to standard education for post-registration nurses: a randomised controlled trial. Nurse Educ Today. 2024;139:106211. https://doi.org/10.1016/j.nedt.2024.106211

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Yamagata H, Kobayashi R, Hirose K, Seki T, Takihara T. Medical staff's knowledge of delirium by occupation and the effectiveness of an on-demand e-learning. Psychiatry Clin Neurosci Rep. 2025;4:e70078. https://doi.org/10.1002/pcn5.70078