Abstract

Background

Quantitative analysis and objective evaluation of communication play an important role in medical communication education. In the process of developing an online methodology for medication counseling practice, we felt the necessity of conducting a quantitative evaluation to enhance its effectiveness.

Objectives

This study aimed to quantitatively evaluate the communication in each scenario to comprehensively identify the differences between face-to-face and online communication in medication counseling practicum. In addition, we examined how patient satisfaction changes between face-to-face and online interactions.

Methods

Face-to-face and online role-playing were conducted between simulated patients (SPs) and students acting as pharmacists, and their dialogues were videotaped. The utterances in each recorded dialogue were categorized and analyzed by the Roter interaction analysis system (RIAS). The Japanese version of the Medical Interview Satisfaction Scale (MISS-21J) responses of the SPs were analyzed for the patient satisfaction survey.

Result

The results of the RIAS analysis revealed that the socio-emotional category appeared significantly more frequently in face-to-face communication, with more utterances that were more attuned to the

feelings of the other person and more considerate of his or her feelings. The ratio of the number of utterances between students and SPs suggested that the communication was more interactive.

Conclusion

Based on the respective communication tendencies may have led to higher satisfaction in face-to-face than in online patient satisfaction surveys, less anxiety about illness and medications, and easier trusting relationships. Since it is difficult to grasp the mood of the other party and to open up to them due to the lack of nonverbal information in online dialogue, it is necessary to be more conscious of conversations that capture the feelings of patients in online medication counseling.

35 Keywords

36

37 Roter Interaction Analysis System (RIAS); Modified Individual Satisfaction Scale-21 (MISS21);

38 Online communication; Medication counseling; Pharmacy education; Simulated patients

Quantitative analysis of communication changes in online medication counseling

—Using the Roter Interaction Analysis System

1. Introduction

Owing to the COVID-19 pandemic, many industries, from education to manufacturing, have rapidly moved their operations online.[1] Medical care is no exception; efforts are being made to develop and spread online medical consultation systems.[2] Currently, 81.0% of pharmacies in Japan have an online system for medication administration guidance, but only 13.1% of pharmacies have implemented the system.[3] Since equipment and knowledge of its operation are essential for both parties involved in online calls, it is challenging to implement the system when there are many older patients. It has been pointed out that pharmacists must be able to support the use of the equipment.[4,5] It has also been suggested that the time it takes for the medication to reach the patient after the medication instruction and the hassle of delivery are barriers to the diffusion of the online system.[6] However, as the environment improves and more pharmacists are equipped with IT skills, it is presumed that these online systems will become more prevalent in the future. The Japan Pharmaceutical Association provides e-learning materials for training active pharmacists in online medication instructions[7] and training is conducted at local organizations and medical institutions based on these materials. Although practitioners must ensure smooth communication, even in online medical care, to safeguard the safety and security of patients and the effectiveness of medication counseling, it has remained at the stage of exploring the differences between face-to-face and online communication in medication counseling situations and the points to be noted online. As the utilization of online methods expands even in education, scholars should

elucidate the characteristics of online communication to create a more effective communication education method. The Roter interaction analysis system (RIAS) is a method that encodes conversations between medical professionals and patients into units called “utterances” according to their function and content, which are classified into approximately 40 categories used to analyze and evaluate conversations quantitatively. RIAS was developed by Dr. Debra Roter of Johns Hopkins University in the United States and has been used in more than 200 studies thus far.[8, 9, 10] Its validity and reliability have been confirmed, and its introduction and communication analysis have been attempted in the fields of nursing,[11] medicine,[12] dentistry,[13] veterinary medicine,[14] and, as in this study, pharmacy,[15, 16, 17] to evaluate the effectiveness of communication education. However, no reports have yet validated online medication counseling using RIAS. A previous study analyzed students in a pharmacist training course using RIAS and showed that the contribution of practical training experience to communication skills could be quantified and objectively evaluated.[18] In addition, a medical interview training method using a videoconferencing system was developed and practiced with students.[19] In this study, based on these results and to improve the effectiveness of the online medication counseling training method we established, we added an evaluation from the patient's perspective using a patient satisfaction questionnaire. We examined the communication in online medication counseling to quantitatively clarify the differences between face-to-face and online communication in medication counseling.

2. Methods

2.1. Participants

The participants were 10 students (5 male and 5 female) from Hokkaido University’s Faculty of Pharmaceutical

Sciences (six-year course) and Graduate School of Life Sciences. Among them, eight were undergraduate students, and two held graduate degrees. All participants underwent medication counseling training as part of their pharmacists' clinical practice in medical institutions. Additionally, preceding their pharmacists' clinical practice, they completed a medication counseling program at the university, complemented by online medication counseling training. Two simulated patients (SPs, both female) from general volunteers were also included as participants. After receiving a sufficient explanation regarding their participation in this research and with sufficient understanding, the participants provided the consent of their own free will.

2.2. Recording of dialogue and analysis by RIAS

The SPs and students playing the role of pharmacists were asked to role-play a scenario of medication counseling by online call using a personal computer terminal, and the dialogues were videotaped. Zoom was used as the online platform. Similarly, a role-play session in which the participants interacted directly using the same scenario was filmed, and the utterances in each recorded dialogue were categorized and analyzed using RIAS. The SPs underwent training to understand the content of the scenario. The target students were provided with materials, including medicine instructions and prescriptions, and completed patient forms in advance of the current roleplay scenario. A tendency observed in our university's medication counseling training is that when the same scenario is used for repeated roleplay, students' responses vary significantly between the initial and subsequent instances due to growing familiarity. Consequently, to eliminate the potential influence of factors beyond the "online or face-to-face" distinction on the frequency of utterances, we conducted training to acquaint the students with the progression of the

scenario beforehand. They were evaluated by dividing them into two groups: students who first conducted online medication counseling and those who first conducted face-to-face medication counseling. The detailed information of the two groups has been documented in Supplementary Table 1, and the contents of the scenario are given in Supplementary Table 2.

Concerning a previous report,[16] we transcribed all the content of the videotaped conversations and created a script. Next, we divided the phrases used in the dialogues into the smallest units of utterances and coded the videos while checking the images and sounds. The coding followed the Japanese version of the RIAS manual.[9] To increase reliability, we asked two people who had completed the RIAS coding training sponsored by the RIAS Research Society Japan Section to conduct the coding. The two coders independently coded the utterances of the students and SP participants. As there are many ambiguous expressions without a subject in Japanese, the same utterance may have completely different meanings depending on the context of the conversation. Therefore, for the contextual coding, the coders ensured rules coordination in advance. To examine the reliability between coders, we calculated Pearson's correlation coefficient for all the scripts; it was 0.99, indicating high reliability between coders. Unmatched utterances were verified and coded again. Moreover, we grouped categories with similar intentions based on a previous study,[18] organized broadly into the five clusters of "Partnership behaviors," "Question asking," "Information giving," "Counsel behaviors," and "Others" as the basis for the main analysis. Subsequently, we compared these results between face-to-face and online role-play. It should be noted that, in patient-centered care, it is important to pay attention to the patient's psychosocial factors and to show empathy,[20] as empathy is related to patient satisfaction.[21] Therefore, the present study focused on "partnership behavior," a cluster of 42 categories in the RIAS

77 that collects utterances related to emotional and affective matters, including empathy, and compared the ratios of the
78 number of utterances. For online dialogues, we found utterances that did not fit into existing categories and thus
79 added three new categories only to the analysis of online dialogues. The list of codes is shown in Table 1.
80
81 2.3. Evaluation of communication using the Japanese version of the Medical Interview Satisfaction Scale (MISS-
82 21J)
83 After the role-plays were completed, we asked the SPs to complete the MISS-21J. Developed by Meakin et al.,
84 Medical Interview Satisfaction Scale (MISS-21) is widely accepted as a reliable tool for judging patient satisfaction
85 in consultations and is used in various medical settings worldwide.[22] This 21-item questionnaire uses different
86 subscales to highlight different aspects of patient satisfaction (Supplementary Table 3). The subscales measure the
87 following: the ability to reassure patients by reducing anxiety about illness and medications and make them aware of
88 underlying fears and beliefs (Distress Relief, DR); the ability to convey accurate information with good
89 communication (Communication Comfort, CC); the ability to form trusting relationships during treatment (Rapport,
90 R); the ability to arouse patient confidence in the management plan, such as compliance with medication (Compliance
91 Intent, CI). Respondents were asked to indicate their level of agreement with each item using a seven-point Likert
92 scale (1 = *Very strongly disagree*, 2 = *Strongly disagree*, 3 = *Disagree*, 4 = *Neutral*, 5 = *Agree*, 6 = *Strongly agree*, 7
93 = *Very strongly agree*). Higher total scores indicate higher satisfaction.[22, 23, 24]
94 We used the Japanese version of MISS-21 created by Hanya et al.[25] Supplementary Table 3 shows the list of the
95 original questions, the reverse translation of the Japanese version used this time, and the subscales to which each

belongs. The responses were evaluated on a seven-point scale ranging from 1 = *Very strongly disagree* to 7 = *Very strongly agree*. The seven-point scale for each item was used directly as the score, and subtotals were calculated for each subscale. The total score was determined by summing individual scores. Six items (4, 9, 13, 14, 20, and 21) are negative-question inverse items and were reverse-scored and analyzed according to a previous report.[23] Additionally, the scale's internal consistency was measured by Cronbach's α value. The cut-off values for internal consistency were ≥0.70, ≥0.80, and ≥0.90 for "acceptable," "good," and "excellent," respectively.

2.4. Ethics

This study was conducted with the approval of the ethics review committee of Hokkaido University Graduate School Faculty of Pharmaceutical Sciences (Approval number: 2020-007).

2.5. Statistical Analyses

The normality of the number of utterances and patient satisfaction changes for in-person and online scenarios were confirmed using the Shapiro-Wilk test. Subsequently, paired t-tests were used to compare these two groups. The Wilcoxon signed-rank test was used to compare the utterance count ratio between the group that conducted the face-to-face role-play first and the group that performed the online role-play first. A significance level of $p < 0.05$ was applied to determine statistical significance. We used JMP Pro ver.16.2.0 (SAS Institute, North Carolina, U.S.) for the statistical analysis.

115 3. Results

116 3.1. Comparison of time taken for medication counseling role-play

117 The average interaction time was 7 minutes and 37 seconds for face-to-face and 7 minutes and 57 seconds for online,
118 with no statistically significant difference. Moreover, the average interaction time was 7 minutes and 46 seconds for
119 the first role-play and 7 minutes and 41 seconds for the second role-play; there was no significant difference here as
120 well (Supplementary Table 1).

121

122 3.2. Comparison of the number of utterances by RIAS

123 Table 1 shows the list of face-to-face and online comparisons of all categories of utterances by students and SPs used
124 in our study. Comparing the total number of utterances of pharmacy students to SPs in this scenario between the face-
125 to-face and online modes showed a decreasing trend in the online session, although there was no significant difference.
126 Similarly, the number of SP utterances decreased significantly from 79.4 ± 30.0 to 61.8 ± 21.0. Table 2 also shows
127 the ratio of pharmacy students' utterances to SPs in each of the face-to-face and online modes. The mean value of the
128 face-to-face utterance ratio of pharmacy students to SPs was 1.47 (SPs, 40.5%; students, 59.5%), and this was similar
129 to the patient participation rate of 40% in the history-taking dialogue reported by Roter et al.[26] Conversely, the mean
130 value of the utterance ratio for online medication counseling was 1.72 (SPs, 36.8%; students, 63.2%), and the
131 utterance ratio of students acting as pharmacists were significantly higher for online medication counseling.
132 Pharmacy students tended to speak more unilaterally online, or SPs tended to speak less.

133 Among the five clusters of “Partnership behaviors,” “Question asking,” “Information giving,” “Counsel behaviors,”

and “Others,” the number of utterances online was lower for both students and SPs for “Partnership behaviors” ($p < 0.05$) (Table 1). Examining the individual categories, we found few SP utterances online in Back-channel (BC) responses that indicated agreement responses ($p < 0.05$). Further, the category of Laughs (laughs, tells jokes), which included laughter, friendly banter, and utterances intended to make the other party laugh or entertained, was less frequent online for both students ($p < 0.05$) and SPs ($p < 0.01$). We found no statistically significant difference ($p = 0.086$) for R/O (Reassures, encourages, or shows optimism) or utterances intended to relieve patients from worries or reassure them by showing an optimistic attitude or encouraging them, but it showed a decreasing trend online. Furthermore, in the “Others” cluster, utterances categorized as Trans (Transition words), a category that indicated a signal to move on to another topic or action, meaningless fillers, or pauses, appeared significantly more online for SPs. Although not statistically significant, there was a trend toward more student speech online in a cluster of “Counsel behaviors” and more open-ended questions online in “Question asking.” The ratio of each category in the cluster of "Partnership behaviors" was checked and found that the ratio of BC decreased for SP utterances online, but the ratio was significantly higher for Agree (Shows agreement or understanding) and Concern (Shows concern or worry) (Table 3). In any category, we found no significant difference between the students who conducted the face-to-face dialogue first and those who conducted the online dialogue first.

3.3. Patient satisfaction survey in medication counseling interview

Table 4 shows the patient satisfaction levels for face-to-face and online dialogue modes. Questions 4, 9, 13, 14, 20, and 21 were inverse items that inquired about something negative (Supplementary Table 3). When the scores were

reversed and analyzed, Cronbach's α coefficient, which indicates the scale's internal consistency, was calculated as a negative value (-0.04) for "Compliance Intent." This showed that one of the items in that subscale was negatively correlated with another item in the same subscale, suggesting that the question's meaning may have been perceived by respondents as the opposite. Based on the analysis results, the overall α coefficient was calculated to be 0.94 when excluding question 21, which was the cause of the negative value. This calculation followed the method outlined by Ursachi et al.[27] Regarding subscales, the overall alpha coefficients were 0.94 for Distress Relief, 0.90 for Communication Comfort, 0.84 for Rapport, and 0.77 for Compliance Intent. In terms of the total satisfaction score, face-to-face scored higher than online, and the two showed a difference. Additionally, the group that conducted the online dialogue first have higher satisfaction levels in face-to-face interactions ($p < 0.05$, data not shown). In the subscales, face-to-face scores were significantly higher for Distress Relief and Compliance Intent scores, and although the difference was not statistically significant, face-to-face tended to score higher for Rapport ($p = 0.061$).

4. Discussion

This study could be considered a pioneering attempt to objectively compare online and face-to-face communication using RIAS for quantitative analysis, along with the inclusion of patient satisfaction measures. The total number of SPs utterances decreased significantly online compared with the face-to-face mode; although there was no statistically significant difference for students, they also showed a decreasing trend online (Table 1). Among the five clusters, the number of utterances online was significantly lower for both students and SPs in terms of "Partnership behaviors" (Table 1). Looking at the individual categories belonging to this cluster, we found fewer utterances online

for SPs for BC and both students and SPs for the Laughs category (Table 1). The decrease in the total number of utterances online compared with the face-to-face mode showed that “Partnership behaviors,” relating to socio-emotional utterances, decreased overall and was particularly due to the decrease in Laughs for students and BC and Laughs for SPs. Furthermore, focusing on the ratio of the total number of utterances between students and SPs, students spoke approximately 1.47 times more than SPs did in the face-to-face mode but did so 1.72 times online (Table 2), suggesting that one-way talking increased or that SPs utterances decreased. Considering that SP utterances in the BC category decreased based on these observations, in online medication counseling, there is a strong tendency to convey information unilaterally, or the SP tends to concentrate on listening without speaking.

In online communication, it is difficult to convey nonverbal information, such as gestures and eye contact, and to know exactly whether the other person is listening and understanding,[28] and it has been suggested that individuals may increase their verbal utterances per unit of time to compensate for the lack of nonverbal cues that they cannot effectively convey.[29] Moreover, due to the limited effectiveness of gaze coordination, the speech order in online conversations tends to overlap,[30] similar to voice-only conversations.[31] These characteristics suggest that the number of Trans category utterances that exhibit meaningless utterances and conversation pauses to transition to the next conversation increased, creating a situation where SPs need more time to understand and respond to student statements and to prepare for the next statement (Table 1). Additionally, considering the decrease in overall speech volume in online interactions, the increased proportion of "Counsel behaviors" and "Question asking" speech categories (Table 1) suggests that the student playing the role of a pharmacist may have attempted to facilitate patient understanding by conveying information and consistently posing questions, given the challenges in accurately

assessing whether their explanations are effectively communicated and comprehended by the patient. Despite the increase in the Trans category and the total number of utterances, as well as the increase in the ratio of the Agree and Concern categories of "Partnership behaviors" (Table 3), the overall dialogue time remained unchanged from the face-to-face interaction, suggesting that SPs tend to listen to what pharmacy students say, concentrate on expressing their opinions, especially their intentions in treatment such as agreement and anxiety, and verbalize them clearly.

The decrease in the Laughs category for both SPs and students online (Table 1) was considered to be due to the difficulty in creating a friendly atmosphere online compared with the face-to-face mode. Previous research[19] also showed that students tend to become more nervous during online medication counseling practice, that an intended atmosphere is difficult to share online, and that these factors prevent them from “opening up” to the other party, leading to a sense of tension because the awareness of being strangers could not be dispelled. Using humor in communication enhances connection,[32] but it requires the ability to gauge whether the topic may offend the other person, necessitating a certain level of mutual intimacy.[33] Even in our study, conversations online may have remained tense and reserved, resulting in fewer conversations that elicited laughter.

Multiple reports have examined patient satisfaction in communication with pharmacists and pharmacy students. These studies utilized various evaluation tools, such as the Satisfaction with Pharmacist (SWiP) scale,[34] the modified Patient Assessment of Chronic Illness Care tool (PACIC-RxFM) for chronic disease care,[35] and Teramachi's Pharmacist Communication Skill Scale (TePSS-31).[36] There is also a report on the use of the modified MISS-21 to help improve the quality of medication instruction in OTC drug sales.[37] In this study, Cronbach’s α coefficient was initially calculated as a negative value for the Compliance Intent subscale. Along with the ambiguity of Japanese

expressions, the negative questions could have been answered without understanding that they were negative.

In terms of total patient satisfaction scores, face-to-face communication scored higher than online communication, indicating that the face-to-face mode provided higher satisfaction (Table 4). In general, medical settings, patients have been reported to prefer face-to-face care in non-emergency situations.[38] Numerous studies highlight differences between online and face-to-face communication. Face-to-face interactions facilitate stronger impressions, with non-verbal cues shaping the conversation and enabling emotion sharing. In contrast, online communication relies on compensatory measures like explicit voice and body movements due to limited non-verbal information.[39, 40, 41] Judgments are primarily based on spoken language, necessitating a high cognitive ability to infer emotions accurately.[42] In other words, the need to pay attention to speech, gestures, facial expressions, memory, thoughts, calculations, and language itself causes mental and physical fatigue. These cognitive load phenomena are called "Zoom fatigue".[43] In a situation where specialized information is explained, such as in medication counseling, the aforementioned tendencies are inferred to be particularly stronger. Conversely, while online relationships are reported to be time-consuming and delicate to build,[44] when first meeting in person with an acquaintance with whom one has already established a certain level of trust online, trust increases in more than half of the cases and decreases in less than 3% of the cases.[45] In our study, this psychological function may have been involved in the tendency to have a higher level of satisfaction with face-to-face conversations in the group that conducted online medication first. In the subscales, face-to-face communication had significantly higher scores for Distress Relief and Compliance Intent. Although there was no statistically significant difference, face-to-face communication also tended to score higher in the Rapport subscale (Table 4). Distress Relief is a subscale that indicates the level of satisfaction in reducing anxiety

about illness and medicine, and this level of satisfaction is related to the fact that face-to-face communication tends to have more utterances in the R/O category in RIAS (Table 1). Compliance Intent indicates satisfaction with a healthcare professional's ability to inspire patient confidence in the management plan, such as medication compliance. Face-to-face communication has been suggested to increase patients' trust in healthcare providers.

4.1. Limitations of research and suggestions for future research

This study also had a few limitations. The possibility that the results were influenced by the following factors cannot be excluded: the small sample size, factors other than being online or face-to-face (e.g., the temperament of each student and their compatibility with their respective SPs), and the abundance of the students' experience in practical online medication counseling. Future studies should increase the number of cases and reduce the influence of factors other than being online or face-to-face as much as possible and conduct comparative analysis.

Now that the pandemic is subsiding, we believe it is necessary to continue our research, considering the social climate where online medical care and online medication instruction are expected to increase due to future shortages of medical personnel and advancements in technology while recognizing that face-to-face medical care remains the fundamental method of care.

4.2. Conclusions

Using RIAS and MISS-21J, we quantified and objectively evaluated each communication method of face-to-face and online medication counseling. Our results suggested that face-to-face communication, compared with online

248 communication, engendered higher patient satisfaction, was more interactive, and had many utterances that were
249 more empathetic and considerate of the other party's feelings. Therefore, in online medication counseling
250 communication, practitioners must be more conscious of conversations that empathize with the patient's feelings.
251

Conflict of interest statement

The authors declare no competing financial interest.

Acknowledgment

We would like to thank Editage (www.editage.jp) for English language editing.

References

1. United Nations Conference on Trade and Development. COVID-19 and e-commerce: a global review. https://unctad.org/publication/covid-19-and-e-commerce-global-review/;2021 Accessed 26 April 2023.

2. Nomura K, Ebihara S, Ikebata Y, Umegaki H, Ooi K, Ogawa S, Katsuya T, Kobayashi Y, Sakurai T, Miyao M, Yamaguchi K, Akishita M. Japan Geriatrics Society "Statement for the use of telemedicine in geriatric care: Telemedicine as a complement to in-person medical practice": Geriatric Medical Practice Committee consensus statement. Geriatrics & Gerontology International. 2022; 22: 913-916. https://doi.org/10.1111/ggi.14490.

3. Nippon Pharmacy Association. Management pharmacist questionnaire report. https://secure.nippon-pa.org/pdf/enq_2023_03.pdf; 2023 Accessed 22. 08. 23.

4. Ishimura A, Gotani M. Survey of Patient Awareness on the Online Medication Instruction. J Community Pharm Pharm Sci. 2022; 14: 55–60. https://doi.org/10.32160/yakkyoku.nt.2022-0002.

5. Matsumoto Y, Kizaki H, Ikeda Y, Nakamura S, Kina S, Nagai T, Nasu T, Miyamoto K, Hori S. Telepharmacy in mountainous depopulated areas of Japan: an exploratory interview study of patients' perspectives. Drug Discov Ther. 2021; 15: 337-340. https://doi.org/10.5582/ddt.2021.01102.

6. Sano T, Fukuoka K, Ito Y, Yuge S, Morikoshi Y, Takimoto K. Examination of Necessary Requirements for the Spread of Online Medication Guidance Based on Patient Questionnaires. Medical Consultation & New Remedies. 2023; 60: 237-240.

7. Japan Pharmaceutical Association. Online Medication Guidance. https://www.nichiyaku.or.jp/pharmacy-info/onlinemedicationguidance/index.html; 2022 Accessed 22. 08. 23.

8. Roter DL, Larson S. The relationship between residents' and attending physicians' communication during primary care visits: an illustrative use of the Roter Interaction Analysis System. Health Commun. 2001; 13: 33-48. https://doi.org/10.1207/S15327027HC1301_04.

9. Noro I, Abe K, Ishiakawa H. The Roter Method of Interaction Process Analysis System (RIAS), 2nd ed. Nagoya, Sankeisha Co.; 2011.

10. Pires CM, Cavaco AM. Communication between health professionals and patients: review of studies using the RIAS (Roter Interaction Analysis System) method. Rev Assoc Med Bras (1992). 2014; 60: 156-172. https://doi.org/10.1590/1806-9282.60.02.014.

11. Chao LF, Guo SE, Xiao X, Luo YY, Wang J. A profile of novice and senior nurses' communication patterns during the transition to practice period: an application of the Roter Interaction Analysis System. Int J Environ Res Public Health. 2021; 18: e10688. https://doi.org/10.3390/ijerph182010688.

12. Richard C, Glaser E, Lussier MT. Communication and patient participation influencing patient recall of treatment discussions. Health Expectations. 2017; 20: 760-770. https://doi.org/10.1111/hex.12515.

13. Watanabe S, Yoshida T, Kono T, Taketa H, Shiotsu N, Shirai H, Torii Y. Relationship of trainee dentists' self-reported empathy and communication behaviors with simulated patients' assessment in medical interviews. PLOS ONE. 2018; 13: e0203970. https://doi.org/10.1371/journal.pone.0203970.

14. Pereira MM, Artemiou E, Pedro PD, Adams C, Ritter. The use of the roter interaction analysis system in assessing veterinary student clinical communication skills during equine wellness examinations in rural Kentucky, USA: A pilot study. Vet Rec Open. 2021; 8: e23. https://doi.org/10.1002/vro2.23.

295 15. Arita E. Research Using the Roter Method of Interaction Process Analysis (RIAS) for Communication Education
296 in the Pharmaceutical Sciences. Yakugaku Zasshi. 2017; 137: 665-669. https://doi.org/10.1248/yakushi.16-00224-3.
297 16. Nakayama C, Kimata S, Oshima T, Kato A, Nitta A. Analysis of pharmacist-patient communication using the
298 Roter Method of Interaction Process Analysis System. Res Social Adm Pharm. 2016; 12: 319-326.
299 https://doi.org/10.1016/j.sapharm.2015.05.007.
300 17. Pelicano-Romano J, Neves MR, Amado A, Cavaco AM. Do community pharmacists actively engage elderly
301 patients in the dialogue? Results from pharmaceutical care consultations. Health Expect. 2015; 18: 1721-1734.
302 https://doi.org/10.1111/hex.12165.
303 18. Takekuma Y, Mori A, Kobayashi M, Yamada Y, Sato Y, Narumi K, Furugen A, Sugawara M. Analysis by using
304 Roter Method of Interaction Process Analysis (RIAS) of the ability of pharmacy students to communicate after
305 clinical training for pharmacy. Yakugaku Zasshi. 2018; 138: 1579-1586. https://doi.org/10.1248/yakushi.18-00032.
306 19. Mori A, Kato I, Kashiwagi H, Imai S, Narumi K, Sato Y, Furugen A, Yamada Y, Kobayashi M. Development of
307 an online role-play-based medical interview training method for fourth-year pharmacy students. Yakugaku Zasshi.
308 2022; 142: 661-674. https://doi.org/10.1248/yakushi.21-00233
309 20. Drossman DA, Chang L, Deutsch JK, Ford AC, Halpert A, Kroenke K, Nurko S, Ruddy J, Snyder J, Sperber A.
310 A Review of the Evidence and Recommendations on Communication Skills and the Patient-Provider Relationship:
311 A Rome Foundation Working Team Report. Gastroenterology. 2021; 161:1670-1688.e7.
312 https://doi.org/10.1053/j.gastro.2021.07.037.
313 21. Boissy A, Windover AK, Bokar D, Karafa M, Neuendorf K, Frankel RM, Merlino J, Rothberg MB.

314 Communication Skills Training for Physicians Improves Patient Satisfaction. J Gen Intern Med. 2016; 31: 755-61.
315 https://doi.org/10.1007/s11606-016-3597-2.
316 22. Meakin R, Weinman J. The 'Medical Interview Satisfaction Scale'(MISS-21) was adapted for British general
317 practice. Family Practice. 2002; 19: 257-263. https://doi.org/10.1093/fampra/19.3.257.
318 23. Balestrieri M, de Girolamo G, Rucci P. Construct validity and psychosocial correlates of the Italian version of the
319 21-item Medical Interview Satisfaction Scale in primary care. BJPsych Open. 2021; 7: e57.
320 https://doi.org/10.1192/bjo.2020.164.
321 24. Ponnusankar S, Vishwas HN, Anjali K, Kumar SM, Balasubramaniam V. Medication adherence and patient
322 satisfaction among low socioeconomic hypertensive older people visiting a secondary care public hospital in south
323 India. J Appl Pharm Sci. 2022; 12: 186-193. https://doi.org/10.7324/JAPS.2022.120618.
324 25. Hanya M, Sakurai M, Yoshioka Y, Murata A, Kamei H. Development and validity testing of a Japanese version
325 of MISS-21 for evaluating patient satisfaction with patient education regarding taking OTC medication. Journal of
326 Pharmaceutical Communication. 2013; 11: 24-32.
327 26. Roter DL, Hall JA, Katz NR. Patient-physician communication: A descriptive summary of the literature. Patient
328 Educ Couns. 1988; 12: 99-119. https://doi.org/10.1016/0738-3991(88)90057-2.
329 27. Ursachi G, Horodnic IA, Zait A. How Reliable are Measurement Scales? External Factors with Indirect Influence
330 on Reliability Estimators. Procedia Econ Finance. 2015; 20: 679-686. https://doi.org/10.1016/S2212-5671(15)00123-
331 9.
332 28. Wiederhold BK. Connecting through technology during the coronavirus disease 2019 pandemic: Avoiding "Zoom

Fatigue". Cyberpsychol Behav Soc Netw. 2020; 23: 437-438. https://doi.org/10.1089/cyber.2020.29188.bkw.

29. Hamada Y, Takahashi N, Shoji H. A Comparison of Online and Face-to-Face Consensus-building Processes. Transactions of Japan Society of Kansei Engineering. 2022; 21: 41-48. https://doi.org/10.5057/jjske.TJSKE-D-21-00027.

30. Sato R, Sakamoto T, Hyodo S, Ishikawa T, Ichikawa J, Goto T, Takeuchi Y. Eye Contactable Multi-party Video Conferencing System. Proceedings of the 28th annual meeting of the Japanese Cognitive Science Society. 2011; 205-212.

31. Sellen, AJ. Remote conversations: The effects of mediating talk with technology. Human-Computer Interaction. 1995; 10: 401–444. https://doi.org/10.1207/s15327051hci1004_2.

32. Miyamoto T, Katagami D, Shigemitsu Y, Usami M, Tanaka T, Knamori H. The effect of differences in linguistic behavior by conversational agents based on politeness strategies for development relationship with humans – Psychological effects of joke at the first meeting –. Journal of Japan Society for Fuzzy Theory and Intelligent Informatics. 2018; 30: 753-765. https://doi.org/10.3156/jsoft.30.5_753.

33. Miyato M. Relationships between the humor expression and close friendship with the partner. Journal of the Faculty of Education and Human Sciences, Yokohama National University. The educational sciences. 2016; 18: 115-127.

34. Hernández L, Chang CH, Cella D, Corona M, Shiomoto G, McGuire DB. Development and validation of the satisfaction with pharmacist scale. Pharmacotherapy. 2000; 20: 837-843. https://doi.org/10.1592/phco.20.9.837.35188.

352 35. Buatois EM, Covington LP, Lopez ND, Young RB, MacLaughlin EJ. Impact of a pharmacist-led chronic disease
353 state management clinic on patient assessment of chronic illness care. Journal of Patient Experience. 2022; 9: 1-6.
354 https://doi.org/10.1177/23743735221105682.
355 36. Teramachi H, Ino Y, Sugita I, Nishio Y, Yoshida A, Hayashi Y, Esaki H, Saito K, Noguchi Y, Iguchi K, Tachi T.
356 Evaluating communication skills after long-term practical training among Japanese pharmacy students. Curr Pharm
357 Teach Learn. 2018; 10: 446-452. https://doi.org/10.1016/j.cptl.2017.12.006.
358 37. Watson MC, Cleland JA, Bond C. Sifmulated patient visits with immediate feedback to improve the supply of
359 over-the-counter medicines: a feasibility study. Fam Pract. 2009; 26: 532-542.
360 https://doi.org/10.1093/fampra/cmp061.
361 38. Predmore ZS, Roth E, Breslau J, Fischer SH, Uscher-Pines L.Assessment of Patient Preferences for Telehealth
362 in Post–COVID-19 Pandemic Health Care. JAMA Netw Open. 2021; 4: e2136405.
363 https://doi.org/10.1001/jamanetworkopen.2021.36405.
364 39. Croes EAJ, Antheunis ML, Schouten AP, Krahmer EJ. Social attraction in video-mediated communication: The
365 role of nonverbal affiliative behavior. J Soc Pers Relat. 2019; 36: 1210-1232.
366 https://doi.org/10.1177/0265407518757382.
367 40. Tanaka S, Mori N. Qualitative differences between online and face-to-face conversation from the viewpoint of
368 intercorporeality. Journal of Epistemology and Mind Sciences. 2022; 4: 2-17.
369 https://doi.org/10.50882/epstemindsci.4.1_2.
370 41. Yokoi T, Sato S. Difference between face-to-face and non-face-to-face communication process. Osaka Sangyo

University Journal of Human Environmental Studies. 2019; 18: 65-78.

42. Reinhard MA, Sporer SL. Verbal and nonverbal behaviour as a basis for credibility attribution: The impact of task involvement and cognitive capacity. J Exp Soc Psychol. 2008; 44: 477–488. https://doi.org/10.1016/j.jesp.2007.07.012.

43. Bailenson JN. Nonverbal overload: A theoretical argument for the causes of Zoom fatigue. Technology, Mind, and Behavior. 2021; 2. https://doi.org/10.1037/tmb0000030.

44. Bos N, Olson J, Gergle D, Olson G, Wright Z. Effects of four computer-mediated communications channels on trust development. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI'02). 2002; 135–140. https://doi.org/10.1145/503376.503401.

45. Ministry of Internal Affairs and Communications. 2018 White Paper on Information and Communications in Japan. https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2018/2018-index.html/; Accessed 26 April 2023.

Table 1. Comparison of face-to-face and online RIAS category means for student and SPs speech

Category in this study	RIAS category		Student			SP		
			Face-to-face	online		Face-to-face	online	
		Abbreviation	Average±S.D.	Average±S.D.		Average±S.D.	Average±S.D.	
Partnership behaviors	Personal remarks, social conversation	Personal	6.9±2.4	7.8±3.6		4.4±1.6	3.9±1.6	
	Laughs, tells jokes	Laughs	2.2±1.9	0.2±0.4	*	1.9±1.8	0.4±1.0	**
	Shows approval-direct	Approve	3.9±2.3	3.7±2.5		2.6±1.3	1.9±1.0	
	Gives compliment-general	Comp	0	0		0	0	
	Shows disapproval-direct	Disapprove	0	0		0.2±0.4	0	
	Shows criticism-general	Crit	0	0.1±0.3		0.4±0.7	0	
	Shows agreement or understanding	Agree	8.2±4.0	6.8±2.8		19.3±10.4	17.9±5.9	
	Back-channel responses	BC	4.2±3.6	1.9±1.4		31.8±18.1	19.0±12.7	*
	Remediation	Remediation	1.2±1.1	0.3±0.7		0.1±0.3	0.2±0.4	
	Empathy statements	Empathy	1.7±1.1	1.2±1.2		0.5±1.6	0	
	Legitimizing statements	Legit	1.2±1.3	1.0±0.7		0	0	
	Shows concern or worry	Concern	0.3±0.5	0.1±0.3		3.1±1.8	4.1±2.2	
	Reassures, encourages or shows optimism	R/O	4.9±3.2	2.6±2.0		1.1±1.1	0.6±0.8	
	Asks for reassurance	?Reassure	0	0.1±0.3		1.6±1.0	0.9±0.7	
	Partnership statements	Partner	0.3±0.7	0.5±1.0		0	0.2±0.6	
	Self-disclosure statements	Sdis	0	0		0	0	
Subtotal			35.0±12.9*	26.3±0.5	*	67.0±26.0	49.1±16.1	*
Question asking	Asks open-ended questions about medical condition	?Med	1.1±0.7	1.4±0.7		0	0	
	Asks closed-ended questions about medical condition	[?]Med	0.9±1.0	0.5±0.7		0.1±0.3	0	
	Asks open-ended questions about therapeutic regimen	?Thera	0.2±0.4	0.2±0.4		0.2±0.4	0.2±0.4	
	Asks closed-ended questions about therapeutic regimen	[?]Thera	0.3±0.5	0.2±0.4		0.5±0.7	0.1±0.3	
	Asks open-ended questions about lifestyle information	?L/S	0	0		0	0	
	Asks closed-ended questions about lifestyle information	[?]L/S	0	0.1±0.3		0	0.1±0.3	
	Asks open-ended questions about psychosocial information	?P/S	1.1±1.2	1.2±1.1		0	0	
	Asks closed-ended questions about psychosocial information	[?]P/S	0	0		0	0	
	Asks open-ended questions about other	?Other	0	0		0.1±0.3	0	
	Asks closed-ended questions about other	[?]Other	0	0		0.2±0.4	0	
	Asks for opinion	?Opinion	2.2±1.0	2.2±1.2		0	0	
Subtotal			5.8±1.2	5.8±1.8		1.1±1/0	0.4±0.7	
Information giving	Gives information about medical condition	Gives-Med	0.9±1.3	0.5±1.0		3.0±1.1	3.8±0.9	
	Gives information about therapeutic regimen	Gives-Thera	23,4±8,2	20.2±6.3		0.9±0,6	0.6±0.8	
	Gives information about lifestyle information	Gives-L/S	0	0		0.1±0.3	0.1±0.3	
	Gives information about psychosocial information	Gives-P/S	0	0.2±0.6		2.2±0.9	1.4±1.0	
	Gives information about other	Gives-Other	0.1±0.3	0		0	0.4±0.8	
Subtotal			24.4±9.2	20.9±6.2		6.1±1.6	6.3±2.3	
Counsel behaviors	Counsels or directs behavior about medical condition	C-Med	0	0		0	0	
	Counsels or directs behavior about therapeutic regimen	C-Thera	17.9±6.6	18.1±4.1		0	0	
	Counsels or directs behavior about lifestyle information	C-L/S	0	0		0	0	
	Counsels or directs behavior about psychosocial information	C-P/S	0	0		0	0	
Subtotal			17.9±6.6	18.1±4.1		0	0	
Others	Gives orientation, instructions	Orient	6.9±1.7	5.6±2.3		0.7±0.7	1.1±1.0	
	Paraphrase/checks for understanding	Check	8.6±3.9	9±3.8		3.5±3.5	1.9±2.1	
	Asks for permission	?Permission	1.6±0.5	1.5±0.5		0.1±0.3	0	
	Asks for understanding	?Understand	0.2±0.6	0		0	0	
	Bid for repetition	?Bid	0	0		0.3±0.7	0.5±1.3	
	Requests for services or medication	?Service	0	0		0	0	
	Transition words	Trans	9.5±6.2	11.2±6.3		0.6±0.5	2.4±1.4	**
	Unintelligible utterances	Unintell	0	0		0	0	
	Asks open-ended questions about online	?Online	-	0		-	0	
	Asks closed-ended questions about online	[?]Online	-	0.5±0,7		-	0	
Subtotal			26.8±11.2	27.8±7.8		5.2±3.8	6.0±4.2	
Total			109.9±32.3	98.9±16.7		79.4±30.0	61.8±21.0	*

*$p<0.05$, **$p<0.01$

The Roter interaction analysis system (RIAS) is a method that encodes conversations between medical professionals and patients into units called “utterances” according to their function and content. This table lists all RIAS categories used in this study and compares the mean ± SD of the number of utterances in each category, both face-to-face and online, for students and simulated patients (SPs), respectively. Abbreviations prefixed with a question mark (or question mark with parentheses) are categories of utterances that contain something to ask the other person. The symbols "*" and "**" represent the comparison between the results of face-to-face and online interactions for students and SPs, respectively. (paired t-test) The category marked with the symbol "†" represents a newly created category in this study.

Table 2. Ratio of students' utterances to SPs

Student ID	face-to-face	online	
A	1.08	1.49	
B	1.19	1.44	
C	1.09	1.16	
D	1.38	1.32	
E	1.36	1.22	
F	1.77	2.19	
G	1.19	1.88	
H	2.00	2.21	
I	1.92	2.37	
J	1.74	1.88	
Average±SD	1.47±0.35	1.72±0.45	*

*$p < 0.05$

This table shows the ratio of pharmacy students' utterances to SPs in each of the face-to-face and online modes. The symbol "*" represents the p-value indicating the comparison of data between face-to-face and online results. (Wilcoxon signed-rank test)

Table 3. Comparison of ratios for each category in “Partnership behavior."

	Student		SP		
	Face-to-face	online	Face-to-face	online	
Abbreviation	Average (S.D.)	Average (S.D.)	Average (S.D.)	Average (S.D.)	
Personal	0.202 (0.038)	0.300 (0.131)	0.078 (0.049)	0.080 (0.024)	
Laughs	0.062 (0.063)	0.008 (0.016)	0.029 (0.033)	0.007 (0.016)	
Approve	0.118 (0.067)	0.140 (0.085)	0.040 (0.017)	0.039 (0.017)	
Comp	0	0	0	0	
Disapprove	0	0	0.004 (0.009)	0	
Crit	0	0.003 (0.011)	0.014 (0.024)	0	
Agree	0.229 (0.049)	0.258 (0.083)	0.303 (0.135)	0.404 (0.185)	**
BC	0.116 (0.076)	0.075 (0.058)	0.040 (0.134)	0.353 (0.141)	*
Remediation	0.031 (0.031)	0.016 (0.036)	0.001 (0.004)	0.003 (0.007)	
Empathy	0.057 (0.048)	0.042 (0.041)	0.005 (0.017)	0	
Legit	0.030 (0.033)	0.038 (0.024)	0	0	
Concern	0.007 (0.013)	0.003 (0.010)	0.047 (0.020)	0.082 (0.031)	**
R/O	0.139 (0.077)	0.098 (0.073)	0.015 (0.019)	0.009 (0.013)	
?Reassure	0	0.030 (0.024)	0.003 (0.010)	0.019 (0.014)	
Partner	0.009 (0.022)	0.016 (0.031)	0	0.003 (0.011)	
Sdis	0	0	0	0	

*$p < 0.05$, **$p < 0.01$

The symbols "*" and "**" represent the comparison between the results of face-to-face and online interactions for students and SPs, respectively. (paired t-test)

Table 4. Descriptive statistics of the 21 items of the Japanese version of the Medical Interview Satisfaction Scale (MISS21-J)

	Face-to-face	online			
Question	Average±S.D.	Average±S.D.		Subscale	Cronbach's α
1	6.2±0.9	6.2±0.9		Distress Relief (DR)	0.94
2	5.8±1.4	5.7±1.3			
3	5.7±1.4	5.3±1.4			
5	6.0±1.1	5.2±1.5			
17	6.1±0.7	5.9±1.1			
18	6.3±0.8	5.7±1.1			
Subtotal	36.1±5.9	34.0±6.3	**		
6	4.0±0.5	4.3±0.7		Rapport (R)	0.90
7	6.1±1.1	5.8±1.4			
8	6.1±1.1	6.3±0.8			
10	4.4±0.5	4.4±0.5			
11	6.0±1.1	5.2±0.9			
12	5.6±1.6	5.4±1.3			
15	6.5±0.7	6.0±1.2			
16	6.4±0.7	6.1±1.0			
Subtotal	45.1±5.7	43.5±6.4			
4	6.4±0.7	6.3±0.8		Communication Comfort (CC)	0.84
9	6.3±0.9	5.9±1.1			
13	6.4±0.7	6.4±0.7			
14	6.7±0.7	6.8±0.4			
Subtotal	25.8±2.9	25.4±2.6			
19	5.3±0.5	4.7±0.7		Compliance Intent (CI)	0.77
20	6.1±0.9	5.6±1.2			
Subtotal	11.4±1.3	10.3±1.7	*		
Total	118.4±13.6	113.2±13.4	*		

*$p<0.05$, **$p<0.01$

The subscales measure the following: the ability to reassure patients by reducing anxiety about illness and medications and make them aware of underlying fears and beliefs (Distress Relief); the ability to convey accurate information with good communication (Communication Comfort); the ability to form trusting relationships during treatment (Rapport); the ability to arouse patient confidence in the management plan, such as compliance with medication (Compliance Intent). Items 4, 9, 13, 14, 20, and 21 are inverse items. In the calculation of Cronbach's α for the CI subscale, the initially negative value may have caused respondents to respond without understanding that item 21 was a reversal item. We thus performed the calculation by removing question 21, which was the cause of the negative value. Symbols "*" and "**" represent comparisons between face-to-face and online interactions for patient satisfaction scores. (paired t-test)

Author Contributions

Ayako Mori: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing - Original Draft, Visualization, Funding acquisition. Izumi Kato: Formal analysis, Investigation, Data Curation, Writing - Review & Editing. Katsuya Narumi: Investigation, Writing - Review & Editing. Yoh Takekuma: Data Curation, Writing - Review & Editing, Visualization. Hitoshi Kashiwagi: Resources, Writing - Review & Editing. Yuki Sato: Writing - Review & Editing. Mitsuru Sugawara: Resources, Writing - Review & Editing. Masaki Kobayashi: Conceptualization, Methodology, Resources, Writing - Review & Editing, Supervision, Project administration, Funding acquisition.