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Development and implementation of VR-simulated experiences to train communication skills

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**THERAPEUTIC COMMUNICATION,
A NURSING EDUCATIONAL PROGRAM,
IMPLEMENTATION AND ANALYSIS,
A MIXED METHODS DESIGN**

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ABSTRACT

Background

Hospital admission can provoke significant anxiety and stress, impacting patients' well-being. Effective therapeutic communication is crucial to mitigate these effects. This study evaluated a blended learning program designed to enhance nurses' therapeutic communication skills, incorporating e-learning, virtual reality (VR), and in-person training.

Methods

Using Kirkpatrick's evaluation model, we applied a convergent mixed methods design. Quantitative data were gathered via pre- and post-training questionnaires, and qualitative data were collected through group interviews. The training included an e-learning module, a VR simulation of patient-embodied experiences, and a 1-day interactive workshop.

Results

Quantitative pre- and post tests results demonstrated significant improvements in knowledge scores, affirming training efficacy. Qualitative findings revealed high satisfaction rates and increased sensitivity in patient interactions. Key themes included enhanced empathy and strengthened team dynamics. Participants valued the practical relevance of the training.

Conclusion

Our findings highlight the feasibility and acceptance of therapeutic communication training. This program has the potential to improve quality of care and foster collaborative practices. Future studies should explore long-term implementation and patient outcomes.

INTRODUCTION

Hospital admission is often stressful for patients, driven by fear, treatment uncertainty, potential side effects, and loss of control, all of which can affect their physical and psychological well-being (1, 2).

This emotional stress can hinder patients' ability to adapt, especially in acute admission wards (3, 4). Invasive procedures and surgeries often cause preprocedural anxiety, affecting 11–80% of adult patients (1, 5). Anxiety amplifies the stress response, leading to more postoperative pain, chronic pain, and lower patient satisfaction (6–10).

Patient-centred care requires healthcare professionals to understand patients' experiences and values (11–14). High-quality communication within this framework depends on effective training, which helps providers manage anxious and distressed patients.

Therapeutic communication involves intentional use of verbal, paraverbal (e.g., tone, pace), and nonverbal cues (e.g., eye contact, body language) to positively influence interactions and context (15–17). These elements are key to building *rapport*—mutual understanding through meaningful connection (18, 19). Incorporating such skills can improve patient understanding, trust, self-care, adherence, emotional regulation, and overall well-being (20, 21).

Despite its importance, therapeutic communication is not systematically taught in medical or nursing education, and no standard approach exists for its instruction (22). Skills are often learned informally on the job, shaped by context rather than structured training. This raises the question of how best to teach and emphasize its value.

We hypothesize that experiencing care from a patient's perspective fosters empathy and supports learning therapeutic communication (23, 24). While many training programs exist, few evaluate scalable blended-learning approaches incorporating VR. This study addresses that gap by assessing a one-day program combining e-learning, patient-embodied VR, and small-group didactic training.

The main objective of this study is to evaluate the impact of our therapeutic communication training for nurses in the acute admissions ward of a tertiary hospital utilizing Kirkpatrick's four-level training evaluation model (25, 26), as shown in **Figure 1**. Our research questions are derived from the first two levels:

Level 1: How do participants feel about therapeutic communication training?

Level 2: Did participants learn about therapeutic communication?

The second objective of this study was to analyse current communication methods, in particular those evolving around pain, stress, and comfort of patients.

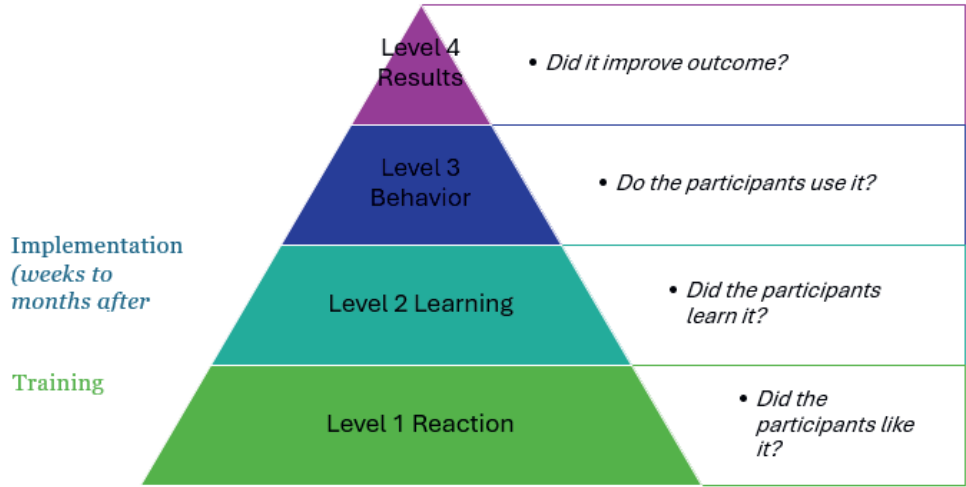


Figure 1. Kirkpatrick four-level training evaluation model

DESIGN

Setting and participants.

This prospective study was conducted at two wards in the Leiden Universiteit Medisch Centrum (LUMC) hospital, a tertiary teaching hospital in the Netherlands. One acute admission ward, one general ward. The protocol was approved by the Departmental Science Committee and received a waiver to be performed by the Institutional Review Ethics Committee (METC Leiden the Hague Delft, Leiden, the Netherlands) following GCP regulations. Personal data protection and consent from the research participants were obtained prior to data collection. The data were collected and recorded between March 2024 and September 2024.

Eligible participants were nurses who regularly communicated with patients or relatives, spoke Dutch fluently, and were available for interviews. Nurses leaving the ward within a year were excluded. To increase statistical power, nurses from a general ward were also invited. All eligible nurses received email invitations and could attend the training during working hours. No compensation was provided, and all participants gave informed consent. Interviews were conducted during day and evening shifts with nurses on duty.

Patients were not involved in developing the TC training, which was based on literature and prior VR training research (23, 24). The study focused on nurse outcomes; involving

patients would require a substantial shift in study design and ethical considerations, particularly concerning data collection from patients.

Study design

A convergent unblinded mixed method study design in which qualitative and quantitative data were used in multiple phases and merged and analysed equally for an interactive approach (27). Qualitative and quantitative investigations took place before and right after the TC training at the acute admission ward. At the general ward, only quantitative data collection was retrieved.

For quantitative outcomes, our pragmatic feasible objective is to include at least 50% of all nurses, which amounts to twenty nurses of the total forty nurses working in the acute admission ward, and twenty of the forty nurses in the general ward.

Intervention

Therapeutic Communication Training

The TC training was developed based on landmark patient-centered studies and included important aspects of lived patient experiences (6-9, 16, 28-31). The trainer was an anaesthesiologist and researcher (KH) with extensive teaching experience currently working at the LUMC hospital.

The blended TC training program included several components, with online and offline elements, and an overview can be found in **Appendix 4**.

- 1) Online E-Learning: an online training module covering the basics of therapeutic communication, activating eventual prior knowledge
- 2) VR patient-embodied experience: This immersive module allows nurses to experience the patient journey from the inside. It follows a woman undergoing knee surgery, from the preoperative area to anaesthesia induction. Healthcare providers in the video display minimal empathy and use negative suggestions, illustrating poor communication. Further details are available in our earlier work (23, 24).
- 3) 1-Day didactic training: This in-person session of a maximum of ten participants featured experiential small group activities, reinforcing the concepts learned online and in VR. The theoretical foundation of the training focuses on therapeutic communication techniques such as rapid rapport building and strategic word choice using hypnotic language. Techniques such as reframing, mirroring, and positive suggestions are emphasized while avoiding the nocebo effects of negative language and expectations. Practical exercises ensured an active learning process, enabling nurses to apply these techniques effectively in their interactions with patients.

Prior to its use in the current study, the TC training was piloted, tested, and refined with input from over 30 nurses in a separate department at LUMC strengthening content and delivery of the final TC training format.

Outcomes and measures

2.4.1 Qualitative outcomes and measures

Qualitative outcomes include, among others, individual and focus group interviews with the participating nurses of the acute admission ward before and after the training has taken place as shown in **Figure 3**. The interview guides can be found in **Appendix 3**.

Focus group interviews were used to interview a small number of demographically similar people in social, psychological and public health science (32). During their shift, nurses were invited to participate in an interview during working hours by our researchers. During these interviews, nurses were asked about their perceptions, attitudes, opinions and views regarding therapeutic communication. Group members were free to talk and interact with each other. All interviewers introduced themselves and their role initially and did not know the participants personally before the commencement of the study. During these interviews, the interviewer took notes and recorded the discussion for subsequent note-taking to learn from the group. Constructing the a priori template and analysis was performed by the principal investigator (KH). For practical reasons, when it was not possible to conduct a focus group interview, individual interviews were held to gather further data. The interviews were conducted by research interns (NK and CK), and the researchers (MvV and KH). Interviews after the intervention were not performed by KH, as she was the trainer of the TC training and this could have induced response biases.

Quantitative outcomes and measures

Quantitative outcomes included questionnaires on current knowledge of therapeutic communication, as well as validated training analysis questionnaires following Kirkpatrick analytical model (26), all conducted as shown in **Figure 2**.

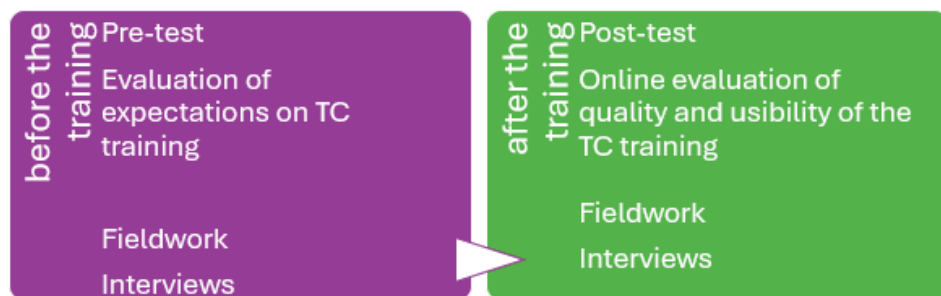


Figure 2. Data collection before and after the TC training

Kirkpatrick level 1 Reaction: What are participants' reactions to TC training?

This questionnaire was sent out after the training, including themes such as educational goals, trainees' preparation, the use of new teaching and learning methods, the use of learning tools, teaching environment, teacher assessment, and teacher characteristics on a 5-point Likert scale from very weak to excellent and can be found in **Appendix 2** (25).

Kirkpatrick level 2 Learning: Knowledge on therapeutic communication:

For this study, a standardized Nursing Education Program Implementation and Analysis (NEPIA) questionnaire was developed to evaluate knowledge of therapeutic communication. This questionnaire included questions leading up to a total point of 8, and can be found at **Appendix 1**. This questionnaire was conducted and validated by a pilot set of 10 nurses to evaluate the clarity of the questions without prior knowledge of TC. Their responses were not considered in further analysis. This questionnaire aimed to respond to Kirkpatrick's second level: "Learning". What is the impact of TC training on participants' self-efficacy regarding therapeutic communication?

Data analysis

All data were kept in password-protected files with limited user access on protected hospital network drives and collected in the electronic data capture system Castor EDC.

For quantitative data analysis, SPSS 25 (IBM Corp) for Windows was used. Chi-square tests, independent t tests and Mann–Whitney U tests were used to test differences before and after training, as appropriate.

We have adhered to Consolidated Criteria for Reporting Qualitative Research (COREQ) criteria for our qualitative analysis. Data analysis was performed using template analysis using Atlas.Ti (Lumivero) (33). Initial themes for the interviews can be found in **Appendix 3**. The *a priori* template was built by the principal investigator (KH). During the initial coding (KH, MvV), a critical reflection was performed. If needed, themes were modified, or additional themes were added to ensure that the themes fit the data and that the data were not selectively analysed to fit the themes. The initial analysis provided information for further participant selection and coding. The template was further developed by applying it to the full data set. Qualitative data were retrieved pursuing data saturation; that is, until we were empirically confident that additional data would not lead to new emergent input (34, 35).

In this mixed method study, quantitative and qualitative data used in distinct phases were merged and analyzed convergently (36). The decision to employ multiple methods was pragmatic, as relying on a single method could have led to an incomplete understanding. This triangulation strategy tested the validity of the data through convergence among different sources (37).

RESULTS

Sample recruitment

All 40 nurses working in the acute admission ward were invited to participate in the TC training, all 41 working in the general ward were invited. Of the 82 nurses invited, 74 accepted participation in this study. Of these nurses, 42 completed all questionnaires (22 and 20 respectively), and 22 only partially. 42 participants completed the e-learning. Details are also shown in **Figure 3**.

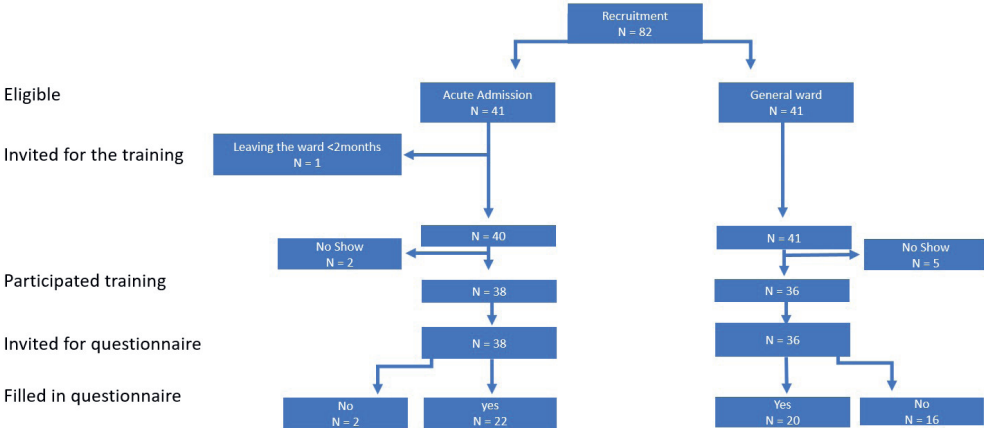


Figure 3. Flow chart

Demographic characteristics can be found in **Table 1**. The qualitative analysis of participants on the acute admission ward included 2 individual interviews, 7 focus group participants, and 43 open question questionnaires before training. After training, there were again 2 individual interviews and an increased focus group of 10 participants. Two participants participated in an interview before, and after the training.

Table 1. Demographic characteristics participants quantitative analysis

Characteristics*	
Age (years)	
Mean ± SD	39±12.9
Gender	
Male	2
Female	42
Relevant working experience (years)	15±13
Work section	
Acute admission ward	40
General ward	35

Table 1. Demographic characteristics participants quantitative analysis (*continued*)

Characteristics*	
Previous professional experience with any VR device	
Yes	10
No	30

*Participants were allowed to leave questions blank, resulting in an incomplete overview of demographic characteristics

Findings from qualitative analysis

Concurrent focus group and individual interviews were conducted, with distinct participant compositions, ensuring independence of the collected data. Field notes and observations were recorded and archived by the researchers (KH, LS, MvV). The quotes extracted from these discussions were translated from Dutch to English, preserving the original grammar structure to maintain authenticity. Verbatim transcript quotes were used to support the development of the thematic framework emerging from the data.

Analysis of before the training

The qualitative analysis of pre-training data resulted in 4 main themes and 9 subthemes as shown in Table 2. These qualitative data served the purpose of answering the second objective of this study being to analyse current communication methods, in particular those evolving around pain, stress, and comfort of patients.

Table 2. Overview of Main Themes, Subthemes before the training

Main Themes	Subthemes
Communication Practices and Challenges	Automated and Routine Communication
	Lack of Reflection and Awareness
	Efficiency vs. Sensitivity
	Established Communicative Norms of Nursing
Impact of Communication Style on Patient Care	Unintentional Insensitivity
	Task-Oriented Communication
Pain Assessment and Measurement	Challenges with Pain Measurement Tools
	Limitations of Standardized Pain Assessment Tools
	Lack of Structured Training
Need for Structured Communication Training	Obligatory nature
Expectation of training	Attitude towards training

Communication Practices and Challenges

Participants frequently described their communication as habitual and automatic, often influenced by routine and the pressures and requirements associated with a busy clinical environment.

Automatic and Routine Communication

Participants discussed how certain phrases became habitual, particularly in fast-paced environments. These automated responses often occurred without much reflectional thoughts. One participant mentioned,

"It's like my words are on autopilot. When I'm busy, I don't even realize I'm using the same phrases over and over again" (002, individual interview).

Another said:

"I always say the same thing when starting a procedure. It's just automatic" (009, individual interview).

Lack of Reflection and Awareness

Some participants noted that they did not consciously reflect on how their communication might impact patients. A participant reflected,

"We don't really stop to think about how we're communicating with patients. It's all just very quick and instinctive" (005, focus group).

Another participant added,

"I think we should be more mindful, but we're often just focused on getting through the day" (007, focus group).

Efficiency vs. Sensitivity

Participants acknowledged that their communication often prioritized efficiency over sensitivity, particularly during time-sensitive tasks.

"When we're busy, we focus on getting things done fast. It's not that we don't care, but we don't always have time to be as sensitive as we should" (008, focus group).

Another participant said,

"I try to be efficient, but sometimes that means I'm not as compassionate as I'd like to be" (003, individual interview).

Established Communication Norms

Participants highlighted the longstanding norms and routines that shaped their communication styles, many of which had been ingrained over years of practice. One participant explained:

"We've been communicating this way for years, and it's hard to break those habits" (001, individual interview).

Another noted:

"It's the way we've always done it, and changing that isn't easy" (004, focus group).

Impact of Communication Style on Patient Care

Participants discussed how their task-oriented and habitual communication styles impacted their interactions with patients, often resulting in unintended consequences for patient care.

Unintentional Insensitivity

Several participants acknowledged that their communication could sometimes come across as harsh or insensitive, even though it was not intended that way.

"I've realized that I might come off as insensitive without meaning to, especially when I'm focused on getting things done" (006, individual interview).

Another participant remarked,

"It's easy to sound short with patients when you're thinking about the task and not the person" (009, focus group).

Task-Oriented Communication

Task-oriented communication was frequently mentioned as a strategy to get through busy shifts efficiently. One participant explained,

"When you have so many tasks to complete, the focus is on getting through them quickly. You can't always stop to explain things thoroughly" (010, individual interview).

Another added:

"It's all about efficiency. Sometimes we focus on the task more than the patient's feelings" (005, focus group)

Pain Assessment and Measurement

Participants noted challenges with the current tools used for pain assessment, particularly the Numerical Rating Scale (NRS), and the limitations of standardized pain assessment practices.

Challenges with Pain Measurement Tools

Participants expressed dissatisfaction with the NRS, noting that it did not always capture the full extent of patients' pain experiences. One participant explained,

"The NRS only gives me a number, but I don't always feel that the number reflects what the patient is really going through" (010, focus group).

Another participant noted,

"I feel like the NRS is too simplistic for some patients. They might rate their pain, but I still don't understand the full picture" (007, individual interview).

Limitations of Standardized Pain Assessment Tools

Beyond the NRS, participants voiced concerns about standardized pain assessment tools in general, noting that they often failed to capture the complexity of pain experiences.

"The scales are helpful, but they don't give us everything we need to know about a patient's pain. There's more going on than just what can be measured by numbers" (011, individual interview).

Another participant remarked,

"These tools don't capture the emotional aspects of pain, and that's a big part of what patients experience" (006, focus group).

Need for Structured Communication Training

Participants recognized the need for more structured training in communication skills.

Lack of Structured Training

Participants noted that formal communication training was lacking, which left them relying on instinct and professional experience. One participant stated,

"We have never really had training on how to communicate better. It has always just sort of happened naturally" (008, focus group).

Another participant added:

"I think structured training would help us a lot. We're just doing our best with what we know" (005, individual interview).

Expectation of training

Obligatory nature

In the open questions of the questionnaire on expectations, sixteen participants out of the eighteen, mentioned the obligatory nature of the training.

Attitude towards training

In the open questions of the questionnaire, generally all participants expressed an open attitude:

"Approach it with an open mind; on our ward, pain is often difficult to manage, for example, in cases of mucositis." (participant 046).

Analysis after the training

The analysis after the training resulted in 5 main themes and 9 subthemes as shown in **Table 3**.

Table 3. Overview of Main Themes, Subthemes after the training

Main Themes	Subthemes
Satisfaction with Training	Engagement and Interaction Relevance and Sufficiency
Applicability and Challenges in Practice	Implementation and Practical Challenges Coping Mechanisms
Communication Practices and Challenges	Automatic and Habitual Communication Reflective and Sensitive Communication
Pain Assessment and Measurement	Current Limitations in Pain Measurement Openness to Innovative Assessment Methods
Impact on Team Dynamics	Enhanced Collaboration and Support

Satisfaction with Training

Participants expressed overall satisfaction with the training, particularly appreciating the interactive elements, the use of VR, and the relevance of the training to their daily practice.

Engagement and Interaction

Participants highlighted how the interactive nature of the training, especially the use of VR, made it more engaging. One participant shared,

“The VR part of the training really pulled me in. It made the whole experience more engaging, and I found myself paying closer attention” (22, individual interview after training).

Another said,

“Using the VR glasses made the learning feel more real. I was fully immersed, which helped me focus more” (29, focus group after training).

Relevance and Sufficiency

Participants noted that the training content was relevant to their daily work and found it sufficient to address their needs. One participant commented:

“I could use what I learned the very next day. It was really relevant to my daily interactions with patients” (54, focus group after training).

Another added,

“The training was practical, and I think it’s enough for what we face regularly in our work. It fits well with our needs” (30, focus group after training).

Applicability and Challenges in Practice

Participants recognized the practical applicability of the training, although they faced certain challenges in consistently implementing the new techniques in their routine practices.

Implementation and Practical Challenges

While participants saw the value of the training, they encountered difficulties applying the new communication methods during busy shifts. One participant noted:

“It’s hard to always apply what we learned when things are moving fast. I sometimes forget to use the techniques during peak hours” (9, focus group after training).

Another mentioned:

“The skills are helpful, but when the ward is hectic, it’s easy to fall back into old ways” (69, focus group after training).

Another added,

"It's tough to always stay mindful of the training when under pressure. Sometimes I just do what feels easiest in the moment" (30, focus group after training).

Coping Mechanisms

Participants reported using coping mechanisms, such as humor, to manage the stress of incorporating new techniques into their work flow. One participant explained:

"When things are stressful, I sometimes joke with patients to ease the tension, even though I know I should be applying the training techniques more carefully" (54, focus group after training).

Communication Practices and Challenges

Participants discussed both the improvements in their communication practices following the training and the ongoing challenges, especially when faced with habitual communication styles.

Automatic and Habitual Communication

Despite the training, participants admitted that automatic communication patterns still persisted during busy times.

"Even after the training, when things get really busy, I notice I still use the same phrases I've always used. It's like muscle memory" (29, focus group after training).

Another shared:

"It's hard to break those automatic habits, especially when time is tight" (009, focus group after training).

Reflective and Sensitive Communication

However, participants also noted an increase in reflection and sensitivity in their communication after the training.

"I'm much more conscious of how I speak to patients now. I think about how my words might affect them, whereas before, I didn't give it much thought" (69, focus group after training).

Another added,

"The training really made me stop and think about the way I approach difficult conversations with patients. I'm more careful with my words" (22, individual interview after training).

Established Communication Norms

Participants expressed challenges in changing the established communication norms within their teams, even after completing the training. One participant remarked,

"It's tough to implement the new methods when the rest of the team is still doing things the old way. It feels like I'm the only one trying to change" (54, focus group after training).

Another said,

"The communication style in our department has been the same for years. Getting everyone to adopt new approaches is harder than I expected" (30, focus group after training).

Pain Assessment and Measurement

Participants were open to using new methods of pain assessment and recognized the limitations of the current tools they were using.

Current Limitations in Pain Measurement

Participants acknowledged that the training exposed the limitations of the NRS and other pain assessment tools, which do not always capture the full extent of a patient's experienced pain.

"The NRS is good for a quick check, but I've realized it doesn't tell me everything. Sometimes the patient's pain is more complex than a number can show" (54, focus group after training).

Another participant shared,

"There are times when the NRS just isn't enough to understand what the patient is really feeling" (69, focus group after training).

Openness to Innovative Assessment Methods

Participants expressed enthusiasm for integrating new methods of pain assessment that aligned with therapeutic communication principles. One participant noted,

"I'm excited to try out the new pain measurement techniques we learned in training. I think they'll help us get a more accurate understanding of our patients' pain" (9, focus group after training).

Another commented,

"The new methods we learned make a lot of sense. I think they'll improve how we assess pain and communicate with patients about it" (29, focus group after training).

Impact on Team Dynamics

Participants observed positive changes in teamwork and communication within their teams after following the training, which improved collaboration.

Enhanced Collaboration and Support

Participants noted that the training fostered better communication and support within their teams.

"Since the training, I feel like we communicate more openly as a team. We talk more about patient care and share ideas" (69, focus group after training).

Another participant shared,

"The training helped us come together more. I feel like there's more support from my colleagues when it comes to applying what we learned" (9, focus group after training).

Findings from quantitative analysis

Kirkpatrick level 1 (reaction)

This questionnaire included themes such as course content, course support, and overall satisfaction. Forty-four participants completed this questionnaire with scores ranking from 0 to 5 points. Average scores of all themes were high, with a mean score of 4.3. The highest scores were obtained for satisfaction with the way the workshop was conducted (mean 4.6), and ability of the instructor in class management (mean 4.7). All participants graded a 4 or higher on general satisfaction with the quality of the training, and the way it was conducted. More than eighty percent of all participants rated 4 or higher the relevance of the training to their work, the likelihood of applying the gained knowledge from the training in their daily work, and to what extent they would recommend the training to colleagues.

More than 90 percent of the participants responded with satisfied or highly satisfied to the question to what extent the course met their expectations. Also, more than eighty percent responded 4 or higher on general satisfaction with the quality of the training, as well as the way it was conducted.

Course content and course support also received high rankings with global scores of 4 and 5. A complete overview of all results can be found in **Appendix 4**.

Kirkpatrick 2 (learning)

For this purpose, a pre-posttest was performed ranking from 0 to 8 points. A total of forty-two participants completed only the pretest with a median score of 5.0, (IQR 2.0). Forty-three completed only the posttest with a median score of 7.0 (IQR 1.0). There is a significant improvement in scores between these groups ($U = 361$, $p < 0.00001$). Of all participants, twenty-eight completed both pre and post tests, and their test results also improved significantly ($W = 24$, $p = 0.00016$).

Integration of Quantitative and Qualitative Findings

The results indicate feasibility of the implementation of a therapeutic communication training. The integration of the quantitative and qualitative findings evoke a convergence between the two data sets as they both underscore positive impacts of the therapeutic communication training program.

Quantitatively, the significant improvement in knowledge scores from pre- to post-training evaluations highlights a measurable enhancement in nurses' understanding and application of therapeutic communication techniques affirming Kirkpatrick's level 2. Qualitative data, with themes as improved communication practices and increased sensitivity in patient interactions show an agreement of data sets.

The qualitative findings highlight how the training fostered improved team dynamics and a supportive environment. These insights align with the high satisfaction rates and the perceived applicability of the training, as reflected in the quantitative data, affirming Kirkpatrick's Level 1 evaluation.

DISCUSSION AND CONCLUSION

Discussion

This study systematically evaluated the acceptance and feasibility of therapeutic communication according Kirkpatrick's evaluation model confirmed through both qualitative and quantitative assessments (research question 1).

The qualitative analysis, which revealed themes such as enhanced satisfaction with training, improved team dynamics, and more reflexive communication practices, underscores the program's impact on nursing staff.

Quantitatively, the significant improvements in knowledge scores from pre- to post-training as per Kirkpatrick's second level of training evaluation, validate the effectiveness of the training. The integration of VR and didactic elements likely contributed as reported by participants.

Existing research underscores the importance of therapeutic communication in reducing patient anxiety and pain perception; however, most training programs are time and resource intensive, and often lack immersive experiential components. Our one-day format, enriched with VR-based patient embodiment, addresses these gaps by providing a scalable, high-impact intervention. Previous studies on therapeutic communication training have not consistently incorporated technology-driven experiential learning, making this approach unique in its accessibility and potential for broader hospital-wide adoption.

In our study, combining quantitative and qualitative methods provided a deeper understanding by revealing complementary insights. By using triangulation, we explored the phenomenon from multiple perspectives, leading to a more comprehensive and nuanced analysis. The additional retrieval of quantitative data in another ward improved power, external validity, and reliability of quantitative results.

Another strength of this training is the opportunity to attend the TC training during working hours, enabling all nurses to participate which is seen in the high participation rate. The team leaders of both wards have made considerable efforts to accommodate this in the scheduling. Hence, we were able to limit selection and response biases.

A recognized limitation of this study is its confinement to a single hospital. The results, despite being informative, may not reflect the experiences of healthcare professionals in other hospitals, given clinical and contextual differences between institutions and countries.

Quite unexpectedly, the qualitative data reported participants already using elements learned during the TC training, indicating effectiveness on Kirkpatrick's level 3. With the interviews conducted in the days following the training, this was not something we had anticipated. Further research will be conducted to elaborate more extensively on this matter.

As mentioned, we hypothesized that the implementation of the TC training program would require more than an initial TC training to reach higher levels of learning. For this quality assurance, the Directorate of Quality and Patient Safety and the Communication Department of the Hospital were involved throughout this research project. They met regularly with the nurse experts and team leaders of the ward to evaluate the implementation process. Furthermore, we hypothesized that it would be necessary to have 'TC-ambassadors' on the ward to be able to answer questions, plan clinical bedside lessons and perform practical exercises. The effects of these measures to assure long-term implementation and learning outcomes remain to be evaluated.

Innovation

This study introduces several innovative elements in the design and implementation of a therapeutic communication training program for nurses, which distinguishes it from traditional communication training approaches in healthcare settings.

The use of patient-embodied VR simulations is a cornerstone innovative feature of this training program. By immersing nurses in the patient's perspective (Protheus effect), the VR component enhanced empathetic understanding by providing a visceral, impactful learning experience that traditional didactic methods often fail to achieve (38). This approach helped nurses appreciate the psychological and emotional dimensions of patient care crucial for effective therapeutic communication.

Blended Learning Approach: The program's blended learning format—integrating on-line e-learning, VR experiences, and in-person training—offered an innovative approach to healthcare training. By incorporating diverse learning styles and multiple channels of engagement, this method enhanced learning flexibility, allowing participants to interact with certain elements at their own pace and convenience (39).

CONCLUSION

This study has systematically evaluated the effectiveness of a therapeutic communication training program for nurses, adopting the framework of Kirkpatrick's evaluation model. Through both quantitative and qualitative analyses, we confirmed that the training significantly enhanced nurses' communication skills—critical in managing patient care effectively.

The study demonstrated notable improvements in knowledge regarding therapeutic communication, verified through pre- and post-training assessments as defined by Kirkpatrick's second level. In addition, qualitative data highlighted increased satisfaction with the training, improvements in team dynamics, and the adoption of more reflective communication practices among participants. Such outcomes illustrate the practical benefits of applying innovative educational tools like VR as cited by participants.

Our results may be useful for other healthcare institutions and implementation researchers when planning or implementing therapeutic communication skills training or using patient-embodied VR experiences. In addition, qualitative data from this study suggested a potential effect at Kirkpatrick's third level (behaviour change). Future research should further investigate Kirkpatrick's Level 3 and Level 4 outcomes, assessing whether participants apply therapeutic communication techniques in practice and whether patient outcomes improve.

Declarations

Competing interests

KH declares herself to be the trainer and developer of the TC training.

Funding

This study was funded by Verpleegkundige Vernieuwing (Nursing Innovation), an initiative that supports nurses in building a future-oriented work and learning environment. A project group was established to submit the funding application, and the program selected this project following an internal review.

Authors' contributions

K. Hoek, MD, PhD candidate at the Anaesthesiology Department of the Leiden University Medical Center and anaesthesiologist. Her research focuses on the educational challenges of acquiring communication skills among healthcare providers. KH had the original idea for the study and contributed to the data collection, transcription and analysis. She did not conduct interviews after the training to limit any bias. She wrote the original draft, methodology and final article.

L. Suur is a nursing expert at The Center For Unplanned Admission (CVOO) of the Leiden University Medical Center. She contributed to conceptualization and recruitment project management.

M. van Velzen, MD, PhD, is an educationalist, clinical research coordinator, and associate professor at the Department of Anaesthesiology of the Leiden University Medical Center. She contributed to data collection, conceptualization, data validation and analysis, and review.

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All authors revised and approved this article and met the ICMJE criteria for authorship.

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APPENDIX 1

The NEPIA questionnaire, Kirkpatrick's level 2:

Question 1: Which statement is correct? (0.5pt per right answer, 2pt in total)

- a. Pain leads to an increase in inflammatory markers in the blood.
- b. The brain can open or close pain gates and thus modulate pain.
- c. A high degree of stress leads to the suppression of the entorhinal cortex, thereby reducing pain perception.
- d. Shifting attention can increase pain perception.

Correct: A, B

The brain can open or close pain gates and thus modulate pain. An increase in inflammatory markers is a consequence of stress, not pain. These are very closely related. However, not every (minor) pain prick will cause increased inflammatory markers. How the brain recognizes and interprets pain depends on various factors and complex mechanisms. Pleasant stimuli (e.g., a gentle touch) can close pain gates (gate control), and the brain can also open pain gates, as seen in the feeling of a 'broken heart.' A high degree of fear and stress leads to the activation of certain areas in the brain (entorhinal cortex, insula, and anterior cingulate gyrus), enhancing pain perception. Studies using functional MRI have shown that visual and somatosensory stimuli have pain-modulating functions. Simply put: shifting attention results in less pain.

Question 2: You are administering a painkiller. Which action will ensure the medication works best? Choose the best answer. (1pt)

- a) Administer the medication without providing any additional information.
- b) Say that this is a very effective medication, and the patient will likely feel better.
- c) Say that you see the patient is in pain and this will help.
- d) Say that you don't think this medication will work well against the pain.

Correct: B

Say that this is a very effective medication, and the patient will likely feel better. Here, you are giving two positive suggestions: you trust the medication, and you indicate that the patient will feel better. The third answer is less effective because it focuses on the patient's pain, emphasizing a negative feeling, which is unnecessary.

Question 3: What promotes coping-stimulating behavior? Choose the best answer. (1pt)

Coping: the way someone deals with problems and stress

- a. Distraction techniques

- b. Lots of empathy
- c. Commentary
- d. Apology

Correct: A

Distraction techniques. Distraction techniques promote coping-stimulating behavior. Conversely, too much empathy, commentary, or an apology reduces coping-stimulating behavior because these focus on negative feelings.

Question 4: Which statement is correct? Choose the best answer. (1pt)

- a. Empathy always has a positive effect on a patient's comfort.
- b. Implicit factors, such as the color or temperature of the environment, affect a patient's experience.
- c. Anxiety is a detrimental mechanism that activates limbic structures.
- d. I should always give a warning before inserting an IV.

Correct: B

Implicit factors, such as the color or temperature of the environment, affect a patient's experience. Atmosphere can be influenced unnoticed by background noises, smells, and colors. The third answer is incorrect because anxiety is not always detrimental. Although anxiety activates limbic structures and triggers the sympathetic autonomic nervous system, causing physiological effects like tachycardia and tachypnea, these are stress responses. The last answer is incorrect because a warning can cause anticipatory stress and increased pain. For example, when inserting an IV, it's better to ask the patient to keep their arm still or consider distracting them by asking a question at the moment of insertion (e.g., what did you have for dinner last night?).

Question 5: Which statement about the placebo effect is correct? (1pt)

- a. The placebo effect only works mentally.
- b. Placebo effects can be harmful.
- c. In a randomized study, there are no placebo effects.
- d. Placebo effects can be unconscious.

Correct: D

Placebo effects can be unconscious. There are implicit or explicit placebo effects, with implicit effects being unconscious. Placebo effects can have biochemical and physiological impacts. Even in randomized studies, there can be (implicit) placebo effects.

Total: 0 to 6 points

APPENDIX 2

Course evaluation Kirkpatrick level 1:

Improving the quality of continuing education requires your constructive and insightful comments and recommendations. Please help us provide effective training conditions by answering the following questions accurately.

Name of the training course: Basic Therapeutic Communication Training (TC training)

Date of the course: [Enter the date here]

Please fill in your answer by choosing between:

- 1: very poor/little
- 2: somewhat poor/little
- 3: sufficient
- 4: somewhat good/much
- 5: very good/much

Questions added to validated questionnaire:

Workshop Satisfaction	excellent	Very good	Intermediate	weak	Extremely weak
Satisfaction with the quality of the work-shop/training					
Satisfaction with the way the workshop was conducted					
Relevance and Application	excellent	Very good	Intermediate	weak	Extremely weak
How relevant and useful do you think this was for your work?					
How likely are you to apply this training in your daily work?					
Recommendation and Expectations	excellent	Very good	Intermediate	weak	Extremely weak
To what extent would you recommend this course to a colleague?					
To what extent did this course meet your expectations?					

Validated questionnaire

Instructor Assessment	excellent	Very good	Intermediate	weak	Extremely weak
Academic proficiency of the instructor					
Lecturing method and the ability to transfer the concepts to learners					
Ability of the instructor in class management					
Use of active teaching methods and engaging the learners					
Ability to respond to the ambiguities and questions of learners					
Frequency of using practical examples during teaching					
Course content assessment	excellent	Very good	Intermediate	weak	Extremely weak
Effectiveness of the contents of the course in increasing your knowledge					
Relationship between training course and your organizational needs					
Up-to-datedness of the contents of the course					
Quality of teaching in the training course					
Course support assessment	excellent	Very good	Intermediate	weak	Extremely weak
Your satisfaction with the duration of the course					
Desirability of educational location and environment					
Brightness and light in the classes					
Ventilation and adequacy of cooling/heating system					
Catering and reception					
Treatment of authorities toward you					
Overall satisfaction	excellent	Very good	Intermediate	weak	Extremely weak
Satisfaction of the quality of workshops					
Satisfaction of the way of conducting workshops					

APPENDIX 3

Interview guide

Topic List for Before the Training

Topic	Question
Demographics (Round of questions - all at once)	- What is your name? - How old are you? - How long have you been a nurse/medical professional?
Pain	- What do you typically use to evaluate a patient's pain? How do you 'see' that a patient is in pain? - Is this a standard at LUMC? - Follow-up: What do you think about this? - What do you think are the most effective methods to assess pain? - What is the role of doctors in assessing/treating pain? Do they do things differently? - What are your experiences with the Central Pain Team?
Registration	It happens that the registration of NRS scores is not filled in, especially for the second measurement after a high NRS score. Why is this? Does it ever happen that a pain score does not match how a patient seems to experience the pain? How do you handle this?
Anxiety	- What do you typically use to assess a patient's anxiety? How do you 'see' that a patient is anxious? - Is there a standard at LUMC (similar to pain scores, but for anxiety)? What do you think about this? - How do you deal with an anxious patient? - What do you think are the most effective methods to assess (to 'see') anxiety? - What is your role in assessing/treating anxiety? What is the role of the doctor? Is there a difference?
TC (Not yet completed)	- What do you already know about the TC course? - Do you know why the TC course is being introduced? - What are your expectations of this course? - What would you like to learn during the course?

Topic List after the Training

Topic	Question
Demographics (Round of questions - all at once)	- What is your name? - How old are you? - How long have you been a nurse/medical professional? - Have you completed the TC training?
TC Training	- What did you think of the TC training? - To what extent do you think you can apply TC communication? Do you have an example? - Did the training meet your expectations? (Explain why/why not) - Do you need additional training at this time?
Pain	- During the TC training, it was discussed to evaluate pain and anxiety with a comfort score (NRS comfort), with a checkbox: does the patient need more pain relief. Do you agree with this? - Do you have any other suggestions to improve pain registration?
Free	- Do you have any other points regarding pain, anxiety, and therapeutic communication that you would like to discuss?

APPENDIX 4

Full overview quantitative results

	Evaluation training					
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Satisfaction with the way the workshop was conducted	43	4	5	4,63	,489	,252
How relevant and useful do you think this was for your work?	43	3	5	4,33	,715	,239
How likely are you to apply this training in your daily work?	43	3	5	4,21	,773	,511
To what extent would you recommend this course to a colleague?	43	3	5	4,67	,566	,598
To what extent did this course meet your expectations?	43	3	5	4,40	,623	,320
Academic proficiency of the instructor	43	3	5	4,56	,548	,388
Lecturing method and the ability to transfer the concepts to learners	43	3	5	4,65	,529	,300
Ability of the instructor in class management	43	3	5	4,72	,549	,280
Use of active teaching methods and engaging the learners	39	3	5	4,46	,555	,301
Ability to respond to the ambiguities and questions of learners	35	3	5	4,40	,651	,308
Effectiveness of the contents of the course in increasing your knowledge	43	3	5	4,30	,638	,424
Relationship between training course and your organizational needs	43	3	5	4,19	,588	,406
Up-to-datedness of the contents of the course	43	3	5	4,35	,650	,346
Quality of teaching in the training course	43	3	5	4,47	,592	,423
Your satisfaction with the duration of the course	43	3	5	4,12	,662	,350
Desirability of educational location and environment	42	2	5	3,95	,623	,439
Brightness and light in the classes	43	2	5	3,81	,699	,388
Ventilation and adequacy of cooling/heating system	43	1	5	3,42	,957	,488
Catering and reception	33	2	5	4,18	,808	,916
Treatment of authorities toward you	32	3	5	4,28	,683	,653