University of Twente

Master Thesis Health Sciences Faculty of Science and Technology

_____

The Potential of Interactive Virtual Reality Technology to Improve the Guidance of Forensic Inpatients: A Qualitative Study

_____

Eline Duikersloot

2873885

First supervisor: Hanneke Kip, PhD

Second supervisor: Marileen Kouijzer, MSc

Enschede, February 2024

Samenvatting/Abstract

Achtergrond: Zorgprofessionals ondersteunen forensische psychiatrische patiënten bij hun uitdagende overgang van kliniek naar maatschappij. Binnen klinische instellingen zijn er beperkte mogelijkheden voor deze patiënten om te oefenen met reacties op externe triggers. Interactieve VR-toepassingen kunnen een oplossing bieden door een veilige en gecontroleerde omgeving te bieden waarin patiënten deze overgang kunnen oefenen. Het heeft het potentieel om een waardevol hulpmiddel te zijn om de revalidatie van patiënten in de kliniek te verbeteren. Ondanks dit potentieel is er beperkt of geen bestaand onderzoek naar het gebruik van VR bij het begeleiden van forensische patiënten.

Doelen: Het doel van deze scriptie is inzicht te bieden in de mogelijke toepassing van VR om zorgprofessionals te helpen bij het begeleiden van forensische patiënten. Dit omvat het identificeren van bestaande tekortkomingen in het huidige begeleidingsproces van patiënten en het beoordelen of de VR-software van CleVR het potentieel heeft om deze tekortkomingen aan te pakken. Daarnaast beoogt de studie barrières voor de implementatie van deze technologie te identificeren en potentiële strategieën voor het overwinnen van deze obstakels voor te stellen.

Methoden: Deze kwalitatieve studie omvatte deskresearch gevolgd door een semigestructureerde interviewstudie met 15 deelnemers. Deze deelnemers omvatten negen verpleegkundigen en sociotherapeuten werkzaam in forensische klinische zorg, evenals zes VR-experts met ervaring in het gebruik of onderzoek naar VR in het forensische veld. Het doel van de interviewstudie en deskresearch was om inzicht te krijgen in gebieden voor verbetering van de begeleiding van forensische patiënten, de voordelen van CleVR in klinische instellingen te verkennen en barrières en implementatiestrategieën voor CleVR te identificeren. Daarnaast zocht de deskresearch naar zorgprofessionals die patiënten begeleiden voor betrokkenheid bij het interview, terwijl daaropvolgende interviews de optimale rol van CleVR in het zorgproces bepaalden.

Resultaten: Deskresearch onthulde de betrokkenheid van verpleegkundigen, sociotherapeuten en psychologen bij het begeleiden van patiënten op de klinische afdelingen. Daarnaast identificeerde het bestaande materialen, waaronder onderzoek gericht op het verbeteren en implementeren van VR, inclusief CleVR's software, in de forensische psychiatrie. Echter, het gevonden onderzoek richtte zich voornamelijk op het behandelen van forensische patiënten in plaats van het begeleiden van patiënten op de afdeling. Ondanks dit blijven de bevindingen van 20 materialen veelbelovend. De interviews resulteerden in vier verschillende coderingsschema's, elk bestaande uit acht tot twaalf sub codes. CleVR toont potentie bij het aanpakken van bepaalde geïdentificeerde verbeterpunten, met name binnen de behandelfase, maar ook in andere fasen van het begeleiden van patiënten op de afdeling. Negen implementatiebarrières werden geïdentificeerd tijdens de interviews, wat de deelnemers aanzette tot het voorstellen van acht verschillende implementatiestrategieën. Door de bevindingen van deskresearch en het interviewonderzoek te vergelijken, werden nieuwe inzichten verkregen in het gebruik en de implementatie van VR, specifiek CleVR-software, bij het begeleiden van patiënten op de afdeling.

Discussie: Zorgprofessionals uiten enthousiasme voor het gebruik van VR-interventies zoals CleVR om forensische patiënten te begeleiden, vooral bij het voorbereiden en beoordelen van patiënten voorafgaand aan (begeleid) verlof. Patiënten ervaren vaak stress voor vertrek, wat VR kan helpen verlichten door patiënten mogelijkheid te bieden om te oefenen en vertrouwd te raken met mogelijke stressvolle en uitdagende situaties voorafgaand aan verlof. Bovendien kunnen zorgprofessionals VR-sessies gebruiken om de gereedheid van een patiënt voor verlof te beoordelen en eventuele aanvullende hulpvragen te identificeren. Ondanks variaties in VR-interventies of doelstellingen voor de behandeling of begeleiding van forensische patiënten, kunnen inzichten uit eerdere implementatieonderzoeken nog steeds helpen bij het opstellen van een implementatieplan, vanwege

mogelijke overlappingen in belemmeringen en strategieën, zoals benadrukt in de huidige studie. Deelnemers aan de huidige studie identificeerden echter de uitdaging van 'onregelmatig gebruik', waarbij hulpverleners aanmoediging nodig hebben om technologie te omarmen. Om deze uitdaging aan te pakken, zijn implementatiestrategieën, waaronder protocollen, VR-experts, training en geplande VR-sessies, erop gericht om hulpverleners aan te moedigen CleVR effectief te gebruiken.

Trefwoorden: Forensische Psychiatrie, Virtuele Realiteit, Implementatie, Verlof, Begeleiding van forensische patiënten

Abstract/Samenvatting

Background: Healthcare professionals (HCPs) assist forensic psychiatric inpatients in their challenging transition from clinic to society. Within inpatient settings, opportunities for these patients to practice reactions to external triggers are limited. Interactive VR applications could provide a solution by offering a safe and controlled environment for patients to practice this transition. It has the potential to be a valuable tool to improve inpatient rehabilitation. Despite this potential, there is limited or no existing research on the utilization of VR in guiding forensic inpatients.

Objectives: The objective of this thesis is to offer understanding of potential application of VR to assist HCPs in guiding forensic inpatients. This involves identifying existing shortcomings in the current process of guiding inpatients and assessing whether the VR software from CleVR has the potential to address these shortcomings. Additionally, the study aims to identify barriers to implementing this technology and propose potential strategies for overcoming these obstacles.

Methods: This qualitative study comprised desk research followed by a semi-structured interview study involving 15 participants. These participants included nine nurses and socio-therapists working in inpatient forensic care, as well as six VR experts with experience in using or researching VR in the forensic field. The interview study and desk research aimed to understand areas for improving the guidance of forensic inpatients, explore CleVR's benefits in inpatient settings, and identify barriers and implementation strategies for CleVR. Additionally, desk research sought to identify HCPs guiding inpatients for interview involvement, while subsequent interviews determined CleVR's optimal role in the healthcare process.

Results: Desk research revealed the involvement of nurses/caregivers, socio-therapists, and psychologists in guiding inpatients. Additionally, it identified existing materials including research focused on improving and implementing VR, including CleVR's software, in forensic psychiatry. However, found research with a predominant focus on treating forensic patients rather than guiding inpatients. Despite this, the findings of 20 materials remain promising. The interviews resulted in four distinct coding schemes, each comprising eight to twelve sub-codes. CleVR demonstrates potential in addressing certain identified improvement areas, particularly within the treatment phase, but also across other phases of guiding forensic inpatients' healthcare processes. Nine implementation barriers were identified during the interviews, prompting participants to propose eight different implementation strategies. By comparing the findings of desk research and the interview study, new insights into the utilization and implementation of VR, specifically CleVR software, in guiding forensic inpatients were uncovered.

Discussion: HCPs express significant enthusiasm for utilizing VR interventions like CleVR to guide forensic inpatients, especially in preparing and assessing patients before guided leave. Patients often experience stress before leave, which VR can help alleviate by allowing them to practice and become familiar with potential stressful and challenging situations beforehand. Furthermore, HCPs can use VR these sessions to assess a patient's readiness for leave and identify any additional support needed. Despite variations in VR interventions or aim of treating of guiding forensic (in)patient insights of previous implementation research, the studies still can aid in making an implementation plan, due to potential overlap in barriers and strategies, as highlighted in the current study. However, participants in the current study identified the challenge of 'disorganized use,' where HCPs require encouragement to adopt technology. To address this challenge, implementation strategies, including protocols, VR experts, training, and planned VR sessions, aim to encourage HCPs to utilize CleVR effectively.

Keywords: Forensic Psychiatry, Virtual Reality, Implementation, Going on leave, Guiding forensic Inpatients

Table of Contents

1. Introduction

1.1 Forensic mental healthcare

In forensic psychiatry, patients exhibit aggressive or sexual disobedient behavior, often leading to offenses. Treatment, either voluntary or mandated, aims to prevent offending and reoffending through targeted interventions for diagnosis and symptom/behavior modification (1-5). The guidance process distinguishes itself by focusing on monitoring patient behavior and enhancing daily life functioning. Guiding and treating these patients is challenging due to psychiatric disorders, low engagement, and the heterogeneous nature of the group, characterized by variations in comorbidity, risk, types of offending, and sociodemographic backgrounds (4-6). In forensic psychiatry a difference in security levels can be observed for these patients: forensic outpatients live in their own homes and undergo treatment at outpatient clinics, while inpatients reside within the forensic clinic as they prepare to reintegrate into society (1). Freedom restrictions may tighten for those displaying aggression or undesirable behavior and loosing for those who do not violate terms or agreements (4, 7). Patients with fewer restrictions are allowed to go on guided or unguided leave, allowing them to familiarize themselves with environments rich in stimuli and the activities of daily life (8, 9). Here, they gain valuable insights into their behavior, identify triggers, and apply coping strategies in real-world scenarios (4, 10). Nonetheless, the transition from clinic to out-clinic settings presents challenges for patients due to potential triggers outside the clinic and limited preparation available to assist patients through this transition (11).

Limitations in guiding and treating patients contribute to a high chance of reoffending, ranging from 26% to 37%, both during and after treatment. Consequently, many patients may need to return to the clinic setting from which they originated (11, 12). Currently, potential triggering situations are practiced in a therapeutic environment, relying on the patient's imaginative abilities (4, 10). This might be difficult for patients due to common characteristics such as low intelligence, a lack of empathy, limited reflective abilities and cognitive deficits (4, 13, 14). Also, the heterogeneity of the patient group makes it difficult to prepare patients for reintegration into society, particularly when societal changes occur during their time in a clinical setting (1). For these patients, simple activities like traveling by public transport can be overwhelming if they lack knowledge of how it works and struggle with communication. Furthermore, when a patient is granted leave, any risky behavior is regularly punished to enhance public safety. Consequently, patients tend to be dishonest about their actions outside the clinic to avoid repercussions (4). This creates challenges for healthcare professionals (HCPs) in monitoring a patient's treatment progress and limits opportunities for them to learn from their mistakes (4, 14, 15). An improved method is needed to guide patients through their rehabilitation process, ultimately enhancing care outcomes and preparing patients for increased independence (1, 4, 6).

1.2 Virtual Reality

VR can be helpful in the transition from being in a forensic clinic to being in the 'outside' world. Due to its unique characteristics it creates opportunities to practice this transition in a safe and controlled environment (6). This environment can be entered through VR-glasses which provide a realistic feeling, created by 360 °videos or interactive animated worlds (1, 6, 16). In a 360°-video a user can actively look around in a filmed environment for which it is often impossible to interact with. In interactive animated worlds the user can interact with the environment, subsequently the environment is able to respond to the patient or actions of the patient (6, 17, 18). Within the immersive VR environment, patients are no longer conscious of their presence within the safe clinic environment (13, 16). However, despite their awareness that the environment is not real, patients still experience emotional, psychological, and physical reactions to situations in the virtual environment.

This makes it more feasible and less stressful for patients to willingly immerse themselves in virtual environments and confront challenging situations in VR compared to real life (16, 19). Furthermore, VR environments can be personalized to the user's needs for practicing behavior, due to the possibility to change certain elements in the animated worlds (17). The practiced skills in these situations could refer to daily-life situations like traveling with public transport or skills that are needed for having proper interactions with people, like have small talk in a supermarket. Additionally, it might involve practicing skills and behaviors needed in particular triggering situations within unexpected real-life scenarios (13, 20). These skills could be related to the offense, such as refusing drugs or managing aggression (4, 13, 21). In addition, it is valuable to observe present-time behaviors of patients in various situations, aiding in the prevention risky behavior where patient harm to others or themselves (6, 17, 22). This observation can potentially help identify protective and risk factors that contribute to risky behavior, allowing for adjustments in further treatment and guidance. Given these factors, using VR interactive animated worlds appears to be a potentially suitable tool for guiding forensic inpatients in their rehabilitation process (1, 5).

However, there appears to be limited or no research on the usage of VR in guiding forensic patients (10, 23). Nevertheless, recent studies emphasize the potential of VR to enhance treatment in forensic psychiatry. In 2020, a study by Klein Tuente et al. investigated the effect of novel virtual reality aggression prevention therapy (VRAPT) on forensic psychiatric inpatients (24). The VR therapy VRAPT is created with the VR software called CleVR. CleVR consists of different modules, where one of the modules allowed the patient to walk through virtual environments. These environments can be personalized and tailored by adding specific items or characters to it (25, 26). While no significant treatment effect was observed, VRAPT introduces new possibilities to current aggression treatment. These include improved patient engagement and motivation, interactive simulated role-playing experiences, and the personalization of lifelike social scenarios for the patient to practice, advantages also underscored in other literature (5, 6, 10, 13). While it's conceivable that certain advantages and disadvantages of VR usage in patient treatment may extend to guiding inpatients, further investigation is required to verify this and identify additional promising applications of VR in guiding inpatients.

1.3 Implementation of VR

The integration of eHealth technologies, such as VR, into healthcare practices is a complex process marked by various challenges (18, 27). These challenges occur due to the recent introduction of VR into healthcare practices, contributing limited knowledge about the added value of VR in practice (27). The technology's flexible nature currently introduces uncertainties, leaving HCPs uncertain about when and how to use VR (19, 28). Besides that, maximizing the effectiveness of VR in forensic inpatient care demands an approach that directly addresses relevant issues of this setting (4, 22). As previously mentioned, there appears to be a need for enhanced guidance for forensic inpatients. To understand the areas for improvement, it is essential to gather perspectives from HCPs who work closely with forensic inpatients. Next, it can be explored whether VR can be utilized to address these identified areas for improvement. It's crucial to pinpoint where VR might be beneficial in the current process of guiding forensic psychiatric patients to integrate it correctly into the care process and not overlook potential points of added value. While research underscores VR's potential in the treatment phase of forensic care, little to no research has explored its potential value in other phases of the health care process (4, 6, 13). An overview of when and potentially how the technology can be applied would be valuable in reducing uncertainty about potential applications. Once the specific benefits of VR for enhancing the guidance of forensic patients are identified, the next step is to determine the optimal implementation approach for this technology.

Correctly implementing an eHealth technology is crucial to realizing its added value and ensuring frequent and accurate use of the technology (27). Conversely, poor implementation can result in various factors, including lack of usage, insufficient financial resources, and negative attitude

towards the technology. Therefore, integrating VR into the current care rather than treating it as a separate addition is crucial to make it as effective and efficient as possible (3). VR is already being used in forensic healthcare settings, and it is important to learn from these settings (10, 13, 27, 29). There is a chance that similar problems may arise, and HCPs may have ideas about possible barriers to implementing VR based on their own experiences or knowledge of the department. For example a scoping review on the implementation process of virtual reality in various healthcare settings showed that despite the expected advantages of VR, challenges arises, including low uptake and resistance among HCPs due to factors like insufficient knowledge, limited experience, and time constrains (27). To address implementation barriers, suitable strategies should be employed, which can collectively or individually create an implementation intervention (22, 27). A valuable tool for guiding the potential adoptions of a technology is the use of a framework that develops, implements, and evaluates eHealth technologies. The CeHRes Roadmap is a frequently utilized framework, proven to be helpful in forensic psychiatric care (30, 31). This roadmap aids in examining the context for a new or existing eHealth technology, such as VR, forming the foundation for the development and implementation process (18). The usage of a framework helps with shaping, coordination and implementing eHealth interventions like VR, so it becomes clear what works there needs to be done before forensic inpatients settings are ready to use VR to guide their patients (4, 18).

1.4 Current study
The aim of this thesis is to explore the conditions for utilizing VR, specifically CleVR's software, Social Words, in guiding inpatients within a forensic setting. The next research question and sub-questions are formulated to create a structured path in defining these conditions. Guided by the CeHRes Roadmap, the initial four research questions (RQ) of this study focused on investigating the potential context and added value of the technology, while the subsequent two questions aimed into gaining early insight into potential barriers and strategies for technology implementation(18).

Research question:
In what way can CleVR be used to help HCPs in guiding forensic inpatients during their rehabilitation?

Sub-questions
1. Which HCPs are involved and in which role during the guidance of forensic inpatients?
2. What are points of improvement in the current situation regarding guiding forensic inpatients in their rehabilitation?
3. What advantages could CleVR offer in guiding the rehabilitation of forensic inpatients, as perceived by forensic HCPs and VR experts?
4. During which phase of the healthcare process is the most suitable time to incorporate CleVR, according to forensic HCPs and VR experts?
5. What are main barriers of using CleVR in an inpatient forensic setting, as perceived by HCPs and VR experts?
6. Which implementation strategies could be used to tackle the main barriers of implementing CleVR in an inpatient forensic setting, as perceived by HCPs and VR experts?

2. Methods

2.1 Design

In this qualitative study, multiple methods were employed to address the research questions. An interview, conducted through semi-structured interviews alongside desk research, provided additional insights, enabling the recognition of new findings from the interviews (18). Figure 1 provides an overview of the different methods linked with the RQs and objectives. The primary goals of both the interview study and desk research were to obtain a clear understanding of the areas requiring improvement in the current guidance of forensic inpatients, explore the potential benefits of incorporating CleVR in an inpatient setting, and identify the barriers and implementation strategies for CleVR in a forensic inpatient environment. In addition, the desk research had the objective of identifying the HCPs engaged in guiding inpatients, with the aim of involving them in the interview study. The subsequent interviews further explored determining the optimal place of CleVR within the healthcare process. To increase efficiency, different objectives were addressed within the same interview. Literature recommends employing a variety of methods to gather information, minimizing the risk of overlooking essential details and not obtaining a thorough understanding of the context (18). This research was approved (No. 230164) by the Ethics Committee of the faculty of Behavioral Management of Social Sciences of the University of Twente and Ethics Committee of Scientific Research of the Dimence Group.
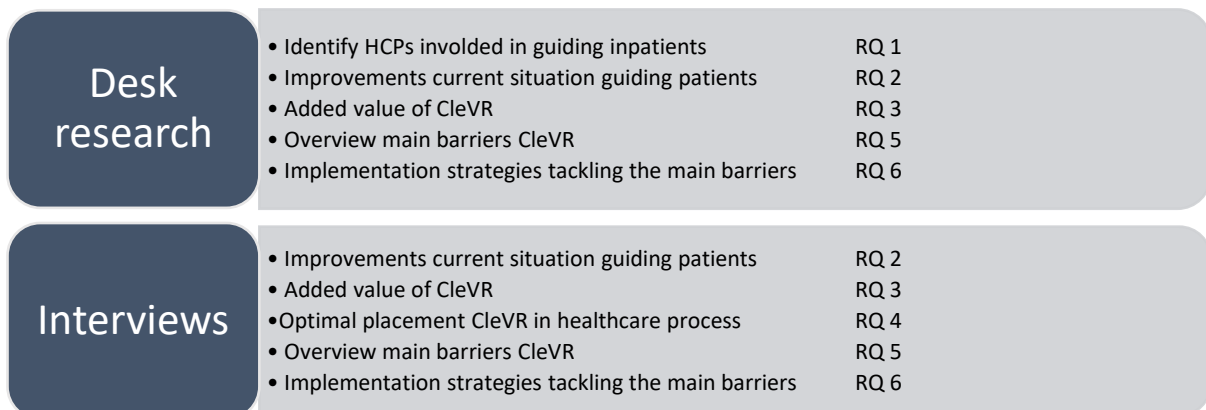
Desk research	• Identify HCPs involded in guiding inpatients	RQ 1
	• Improvements current situation guiding patients	RQ 2
	• Added value of CleVR	RQ 3
	• Overview main barriers CleVR	RQ 5
	• Implementation strategies tackling the main barriers	RQ 6
Interviews	• Improvements current situation guiding patients	RQ 2
	• Added value of CleVR	RQ 3
	•Optimal placement CleVR in healthcare process	RQ 4
	• Overview main barriers CleVR	RQ 5
	• Implementation strategies tackling the main barriers	RQ 6

Figure 1: Overview of methods used in this study with types of outcomes seen in each method.

2.2 Setting

2.2.1 Transfore

The current study took place within a single forensic mental health care organization, Transfore. Transfore is the largest institution for forensic mental healthcare in East Netherlands, annually treating over 1500 individuals with boundary-crossing behavior (32). Patients can receive care in three clinics, two supported living locations, the FACT (Forensic/Flexible Assertive Community Treatment) team, or at the outpatient and day clinic. Transfore has two different types of clinics: Forensic Psychiatric Clinic (FPC) and Forensic Psychiatric Unit (FPU). An FPC, at safety level 3, houses patients with extended stays under significant restrictions for severe psychiatric disorders. In an FPU, safety level 2, patients may experience reduced freedom restrictions within 6-12 weeks (1). Transfore, a part of the Dimence Group is committed to sustainability, human development, and digital transformation. They are committed to scientific research, aiming to improve treatment methods and effectiveness by integrating technology, including VR, self-control apps, and biofeedback (33, 34). Currently, Dimence exclusively offers VR in outpatient treatments at three locations, utilizing the VR application 'Triggers

& Helpers' with CleVR's software. VR is utilized to assist therapists and patients in identifying triggers and providing patients with tools to cope with these triggers (35).

2.2.2 CleVR

This study was focused on the potential usage of 'Social Worlds' from CleVR in a forensic inpatient setting. CleVR is a company that provides certified VR hard- and software within mental health care and training sectors. Figure 2 shows an example of a set-up that can be used during VR treatment. CleVR's products can be personalized, and a software package includes six different modules: walking around, roleplay, perspective change, emotion recognition, emotion distinguishing and catwalk. During the VR-session, the HCP lets the patient immersed in the simulated would through VR-glasses and headphone. HCPs can observe and listen to the patient's experience through a laptop screen and a headset (35). The HCP has the option to personalize the VR environment in terms of setting (e.g., at home, in a crowded street, in a bus, at a supermarket (see Image 1)), position of the user (sitting, standing, and walking), background sounds (e.g., traffic, birds, music) and the use of personalized characters. These characters can be customized in terms of age, gender, voice, clothes, and height. HCPs can individually control these characters on a device by adding movement, expressions, and speech. Speech can be included by altering the HCP voice through a voice morphing microphone.

Figure 2: A overview of the VR-system of CleVR

Image 1: Example options environments CleVR

2.3 Desk research

Desk research aimed to gather information on various objectives through a diverse approach. Initially, the Transfore archive was explored for relevant materials available on their personnel platform, housing documents and learning modules on practices, educational materials, and current treatment programs. Additional materials, such as scientific articles, flyers, videos, and work routines, were obtained from researchers engaged in a VR project at Transfore. The CleVR.net article database was also searched for relevant materials, primarily previewing links to scientific literature. Overall, desk research encompassed scientific and non-scientific literature, policy documents, e-learnings, and other relevant resources. All materials were scanned for relevant information, and any relevant findings were used to address one of the research questions (RQ 1, 2, 3, 5, or 6) in the study.

2.4 Interview study

2.4.1 Participants

In the interview study, both HCPs and experts were interviewed. Experts, in this context, are individuals familiar with CleVR's technology through daily practice or research, specifically within a forensic setting, irrespective of the security level. HCPs are defined as individuals working in a forensic inpatient setting (security level 2 or 3), specifically as nurses, social therapists, or psychologists. In contrast to experts, HCPs are not required to have prior CleVR experience. Convenience sampling was utilized to recruit participants, making it easier and quicker to attain the desired number of participants. To achieve the target number of HCP interviews, Transfore-employed HCPs were approached during two guided tours in different inpatient departments. These tours served to familiarize the researcher with the forensic setting and the operational routines of forensic HCPs. Email reminders were sent to HCPs who engaged in these tours, and recommendations from initial interviews were followed up through email. Despite the initial goal of ten interviews, ultimately, nine HCPs were willing and available to participate. An employee of CleVR supplied a list of fifteen individuals from eleven distinct forensic healthcare settings, all with expertise in the use of VR in forensic contexts. Eight experts were contacted via email, and three responded. Additionally, three experts associated with Transfore were approached for interviews, and all three responded positively. To compensate the number of interviews with HCPs, more interviews were conducted with experts than originally intended. Instead of five, six experts were interviewed. A total of 15 participants were part of this interview study,.

2.4.1 Materials & Procedure

The 15 interviews were conducted between July 2023 and October 2023. All participants signed an informed consent (Appendix A), and the interviews were recorded. Interviews with the HCPs were conducted online or at locations according to the participants preference. In the case of an online meeting the interview was held by using the platform Microsoft Teams. The interviews with HCPs lasted between 17:50 and 53:06 minutes, with an average duration of 32:53 minutes. Next to that, the interviews with experts lasted between 30:40 and 1:00:55 minutes, with an average duration of 40:23 minutes. A semi-structured interview scheme was used for both interviews. Two researchers involved in current research concerning CleVR provided feedback on the content and structure of the interview scheme for HCPs. Subsequently, a pilot test was conducted with a socio-therapist with experience in using CleVR, resulting in minor adjustments to the scheme. A pilot test was also conducted for the expert interview with a researcher engaged in a VR project at Transfore, resulting in minor adjustments after the test. In case of HCPs, they received an information letter before the interview, instructing them to watch an introductory video about CleVR (Appendix B) to familiarize themselves with its simulated environments. To briefly assess the technology's functionalities, HCPs

engaged in a simulated environment before the interview. A randomly chosen template from Social Worlds 'park with a drug dealer' was used to showcase the immersive and exposing nature of the software.

All interviews began with an introduction outlining the purpose of the interview. The interview scheme, as detailed in Appendix C, D, covers various topics, as shown in Table 1. The current situation topic reveals a noteworthy difference in approach. Multiple questions delve into this area for HCPs, while experts do not extensively explore this aspect. Instead, the focus with experts is broader, encompassing barriers and strategies for implementing CleVR. This contrast emerges because experts may not have expertise in the current methods of guiding forensic inpatients, whereas HCPs specialize in this domain. In the HCP interview, post-it notes were used as memory aids to better connect improvement points to the potential added value of CleVR. The interviewer recorded all improvement points mentioned by the participants in keywords. These keywords were then linked to predetermined categories: admission, treatment process, leave, or discharge. The participant later reviewed the post-it notes to identify specific issues where CleVR could contribute to improvement, particularly in terms of its potential added value. As an example, a participant mentioned the desire to have a better understanding of patients' risks. The interviewer noted down 'better understand risks'. Later in the interview, they revisited this point, and the interviewer asked, 'Can CleVR help improve a better understanding of the risks of patients?'. In the expert interview, the same categories were employed, but the focus was more on exploring how CleVR's software could be utilized in different phases of the healthcare process, along with the associated barriers and strategies in each phase. With HCPs barriers and strategies were discussed in a more general manner, as discussions on improvements fell more within their expertise rather than focusing solely on implementation topics.

Table 1: Sample Questions for Interview Guide

Topic	Sample question	
	HCPs	*Expert*
Improvements current situation	What can be improved regarding the process of going on leave?	-
Added value CleVR	When would you use CleVR in a clinical setting?	What added value these could CleVR provide as guidance in the clinic?
Barriers implementation	What are the barriers that could prevent you and your team from working with CleVR?	What are experienced or potential barriers to the implementation of CleVR during the treatment process?
Implementation strategies	What do you think needs to happen before CleVR can be used to guide patients?	What advice would you give to organizations initiating on the implementation of CleVR in the clinic?

2.5 Analysis

All interviews were transcribed verbatim using Amberscript, followed by the application of inductive coding to address the research questions. HCP and expert interviews were coded in the same coding scheme. The coding process started with a comprehensive review of four HCP and three expert interviews, extracting relevant quotes categorized improvement current situation (RQ 2), added value and place in healthcare process of CleVR (RQ 3 & 4), overview main barriers implementing CleVR (RQ 5) and possible implementation strategies CleVR (RQ6). Microsoft Word was employed to create four distinct coding schemes, with raw subcodes for easy fragment categorization. Subcodes were merged

when applicable to deduce overlap and for structure and clarity. Continuous refinement and revision of subcodes occurred with each new interview analysis. Subcodes were later transcribed onto post-it notes to explore potential categorizations into main codes. These main codes were derived based on the nature of subcodes without predetermined categories. In total, 1181 fragments were coded.

3. Results

3.1 Desk research

For this study, 20 documents were used to address RQ 1, 2, 3, 5 and 6. For a comprehensive overview of the materials used in desk research, their acquisition process, and brief descriptions specifying material types and aims, refer to Appendix E.

3.1.1 HCPs involved in Guiding Inpatients (RQ1)

Table 2 presents an overview of the functions and roles of various HCPs engaged in the treatment and guidance of patients. It distinctly categorizes HCPs based on their involvement in patient guidance. Within Transfore, each patient has two personal guides (PG) that work within the clinical department as socio-therapists. A PG supports the patient through the treatment process with input from the treatment plan and leave plan. As a PG, you need to keep several work documents up to date: signaling plan, de-escalation plan, risk management plan, and leave plan (36, 37). All these documents are related to recognizing risks and preventing unwanted behavior. Notably, nurses, socio-therapists, and psychologists, identified as actively involved in patient guidance, were interviewed during the study to contribute to answering sub-questions 2-6.

Table 2: Overview of Different HCP Functions Involved in Guiding Patients and Their Roles

Function	Role
Nurses and other caregivers	Guides patients in 24-hour care, supports rehabilitation, collaborates on treatment goals with other healthcare professionals, assesses treatment effectiveness, and administers medications.
Socio-therapists	Guides in 24-hour care patients with practical and psychosocial challenges, aiming to improve living situations and promote recovery-oriented care for increased independence.
Psychologist	Assists in treating, diagnosing, and guiding patients through therapies, tailored to the psychologist's qualifications.

(38-40)

3.1.2 CleVR's Potential Value in Addressing Inpatient Care Improvements (RQ2 & RQ3)

Desk research has identified areas for improvement in guiding forensic inpatients through their rehabilitation. Table 3 outlines these improvements, along with the potential added value CleVR could provide. The materials in Appendix E were examined to identify relevant aspects for improvement in the current way of guiding forensic inpatients. Subsequently, they were re-evaluated to determine their connection to VR, encompassing both general VR content and CleVR's software. In Appendix E, you can find a summary indicating whether each material primarily focused on VR in general or CleVR's software. However, it's important to note that the materials used to create this table have not been extensively tested or have been tested within small sample sizes, with only one material referencing a RCT testing the added value of VR in forensic care (reference 13). Consequently, the demonstrated added value in Table 3 has not been validated in forensic settings and holds potential value for the forensic context.

Table 3: Overview of Points for Improvement and Associated Potential of Added Value

Point of improvement	Related added value	References
Decreasing aggressive behavior	CleVR demonstrated enhanced anger control and reduced impulsivity compared to the waiting list	(13, 28)

Decreasing workload to prevent burnouts	n/a*	(13)
More open environment where patients can make mistakes and discus them	VR-assisted roleplay can improve the collaboration and feedback between therapists and patients	(4, 14, 15, 23)
Improving testing readiness to leave patients	VR settings could play a role in risk assessment, potentially transforming into a mandatory element for obtaining approval for temporary leave	(9, 10)
Treatment goals better connected to going on leave	CleVR offers methods for doing exercises tailored to the personal goals and/or treatment goals of a patient	(4, 12, 13, 21)
Better insight into behavior of a patient	HCPs can observe the patient response to possible triggers to find out if patients are gaining control of behavior	(4)
Practice skills in real-life safe context	HCPs can engage in realistic roleplays in CleVR's virtual environment using voice morphing and character control, providing patients a safe setting without bystanders	(4, 13, 28)
Big change clinic to out clinic setting	Due to the different worlds and scenarios in CleVR a patient can practice specific behavioral skills and coping strategies in a safe and realistic environment, so patients can be better prepared for their reintegration	(4, 11)
Better emotional and cognitive preparation for out-clinic environment		(4, 13, 20)
Low cognitive skills to comprehend their treatment	Patients gain insight into triggering behaviors, helping them understand risky behavior triggers and contributing to prevention.	(4, 14, 28)
Limited motivation for treatment	Patients appear to be more willing to participate in interventions because of CleVR.	(4, 14)

* Not addressed in the materials used for desk research

3.1.3 CleVR's Potential Main Barriers and Associated Strategies (RQ4 & RQ5)

The primary obstacles for potentially implementing CleVR in healthcare, identified in recent scientific studies, are briefly outlined below, providing a concise summary of points highlighted in the articles. See Table 4 for a list of the found main barriers together with their strategies. The table was compiled using a mix of materials (Appendix E), primarily centered on barriers and strategies for implementing CleVR's software. However, references 24 and 39, which significantly influenced a portion of the table, addressed barriers and strategies for implementing VR in general.

Table 4: Overview Main Barriers and Possible Implementation Strategies

Main barrier	Strategy	References
Substantial costs	n/a*	(41)
Usage of standard templates	Room for personalization within the VR-protocol	(10, 13)
It can be challenging to personalize the intervention for HCPs	Clear instructions on how to use CleVR's software	(28, 29)
Not all HCPs have the necessary roll-playing skills	Clear instructions on how to use CleVR's software	(23, 29)
Added value CleVR is unclear	Further studies need to assess the possible benefits of CleVR	(10, 13, 23, 27, 28)

Further research requires the participation of vulnerable patients	Patients can exit the VR environment and study at any moment	(20, 23)
Contraindications are unclear	Available protocols or guides that describe the contraindications and indication criteria of when using CleVR	(20, 23, 29)
Users can experience cyber sickness	n/a	(27, 28)
Users can experience CleVR as too confronting	Intensity and triggering elements gradually increase over subsequent sessions	(13, 20)
Potential safety risk for HCPs and patients	Implement incident management	(10)
HCPs are unfamiliar with CleVR	Knowledge enhancement through the implementation of training programs, trial periods, and receiving guidance from HCPs who are already using CleVR in practice	(10, 27, 29)
Technical hurdles	Personal attention for developing skills necessary for CleVR-usage and technical support	(10, 27)
Users experience discomfort and isolation while have a headset	n/a	(10, 27)
HCPs lack time for VR training	Scheduling time for VR usage	(27, 29)
Limited resources (such as available treatment rooms and VR equipment)	Allocate physical space for HCPs	(10, 20, 27, 41)
Behavioral change to incorporated VR into a HCPs practice	Usage of behavior change interventions like Intervention Mapping	(27, 29)
Set-up and dismantling VR equipment requires time	n/a	(20)
Reflection on the VR session beyond its duration	n/a	(13)

* Not addressed in the materials used for desk research

3.2 Interviews

3.2.1 Points of Improvement in Guidance Forensic Inpatients (RQ2)

The interviews with both HCPs and experts highlighted areas in forensic inpatient care that could benefit from improvement, although specific solutions were not provided for these issues. Table 5 presents main and sub codes alongside their definitions, with sub codes also featuring illustrative quote. A total of 297 quotes with three main codes and eleven sub codes have been compiled to contribute to answering the sub-question.

Table 5: Subcodes for Points of Improvement Alongside Their Detailed Definitions

Main and sub codes	Definition of code	Illustrative quote	Total[1]	HCPs[2]	Experts[3]
Code 1: Practical issues	*HCPs encounter challenges in healthcare organization, including staffing, communication, and coordination issues, affecting care efficiency*		128	9 (125)	2 (3)
Patient data	HCPs lack information and cooperation for the effective alignment of care with prior and current treatments within and outside the institution	*''They have sessions with a psychologist, [...] whether I can contribute to those sessions [...], that's unclear'' (pp. 4)*	39	8 (39)	
Unproductive time patients	Patient can have too much unstructured free time due to a lack of defined rehabilitation goals	*''It's okay to have free time, but even in that, you can look at the existing support needs.'' (pp. 4)*	36	7 (36)	
Care location transitions	Patients and HCPs face transition challenges such as differences in communication, restrictions, and room preparation across care locations	*''But it also sometimes happens very abruptly, and ideally, you would want or wish that they have some sort of transition period.'' (pp. 6)*	35	8 (32)	2 (3)
Basic needs	Patients can lack the security in housing, (voluntary) work, and finances needed to prevent re-offending	*''For their discharge, things need to be clear. They should have a home, they should have a job, [...] Otherwise, they have nothing but free time, [...] they might relapse.'' (pp. 3)*	13	6 (13)	
Engagement non-HCPs	Patients lack contact with non-HCPs, such as patients' social circles, which can add value to their rehabilitation	*''You can clean together, cook together, [...], and then you can also extract very valuable information. Because they learn a lot from each other.'' (pp. 5)*	5	3 (5)	
Code 2: Going on leave	*Patients and HCPs encounter challenges related to going on leave that can contribute to them exhibiting undesirable behavior or becoming overstimulated.*		112	9 (106)	4 (6)
Assessing patient behavior	HCPs lack the time and tools to estimate or assess potential undesired behavior in specific situations	*''This assessment is made based on what you observe on the ward, and you're not on the ward very often.'' (pp. 2)*	54	8 (53)	1 (1)

Out-clinic overstimulation	Patients can be easily overwhelmed by the stimuli and triggers they encounter outside the clinic	*''Some people, when they see the police, experience a lot of tension, […] They can then be feeling bad for a day or a few days.'' (pp. 7)*	29	5 (27)	1 (2)
Error-tolerant learning environment	HCPs can lack the resources to provide a learning environment that facilitates error-tolerant real-life exposure	*''You don't want to constantly watch someone, as they won't learn from that. You also need to give someone the freedom to make mistakes.'' (pp. 6)*	17	3 (15)	2 (2)
Out-clinic safety risks	Patients may exhibit undesired reactions to external stimuli, endangering bystanders and violating conditions	*''So, despite people having the right to leave or the need to practice, it sometimes goes wrong. They may fall back into use, indeed, or they may violate their conditions.'' (pp. 6)*	12	5 (11)	1 (1)
Treatment-related factors					
Code 3: *Treatment-related factors*	*HCPs encounter challenges within a clinical setting that hinder the complete effectiveness and efficiency in treating patients' risk factors and conditions*		57	9 (54)	1 (3)
Daily living skills	Patients can lack abilities necessary for proper interpersonal interaction and everyday routines	*''But just regular social interactions in the store, […] Some people who haven't been outside for twelve years, they don't look left or right because they aren't used to it'' (pp. 7)*	25	8 (25)	
Understanding own behavior	Patients can have little understanding of their treatment progress and the factors that can trigger undesired actions	*''They say: yes, it will be fine […] but they can't make the translation to act on it at that moment. They are surprised by the stimuli and potentially triggered.'' (pp. 7)*	17	7 (16)	1 (1)
Treatment motivation	Patients can lack motivation to follow treatment and HCPs observe a shortage of tools to address this obstacle	*''When you talk about patients who are not motivated, […] there are too few tools to help someone understand the purpose of admission.'' (pp. 6)*	15	6 (13)	1 (2)

[1] *The total count of the code mentioned in all interviews*

[2] *The count of the different HCPs that bring up a code and (X) the total count of times the code appeared in all HCPs interviews*

[3] *The count of the different Experts that bring up a code and (X) the total count of times the code appeared in all expert interviews*

3.2.2 Potential Added value CleVR (RQ3 & RQ4)

In addition to pinpointing areas for improvement, both HCPs and experts acknowledged potential benefits of using CleVR to address those areas (RQ3). Table 6 provides three main codes and nine sub codes related to the added value of CleVR, totaling 321 quotes to answer the sub-question

Table 6. Subcodes added value CleVR and their definitions

Main codes and sub codes	Definition of code		Total[1]	HCPs[2]	Experts[3]
***Code 1:** Preparation specific situations*	*CleVR assists patients in preparing for various situations relevant to their overall reintegration and specific reintegration goals*		98	9 (51)	6 (47)
Out-clinic presence	CleVR enables patients to practice out-clinic scenarios, aiding in temporary leave and rehabilitation into society	*''You […] practice scenarios with someone that one may encounter […] a kind of preparation for going on leave'' (pp. 14)*	66	8 (31)	6 (35)
Confidence	CleVR contributes to the development and enhancement of a patient's self-efficacy/confidence in specific situations	*''I've faced similar situations before and dealt with them effectively, so it might lead to greater self-dependence.'' (pp. 2)*	16	6 (12)	2 (4)
Social skills	CleVR contributes to the development and enhancement of abilities necessary for proper interpersonal interaction	*''How about interacting at the town hall, so using it for more social activities?'' (pp. 8)*	16	5 (8)	4 (8)
Code 2: Insight patient behavior	*CleVR assists in gaining a better understanding of a patient's behavior through strengthening care-oriented interactions.*		146	9 (80)	6 (66)
Patient status evaluation	CleVR helps HCPs monitor patient progress, assess readiness for more independence, and identify ongoing trigger challenges	*''What are your triggers? […] you could use it as a kind of check […] to evaluate if someone is truly ready to do it on their own.'' (pp. 10)*	78	9 (44)	6 (34)
Patient engagement	CleVR can enhance opportunities for HCPs to establish rehabilitation-focused contact with patients, supporting their treatment progress	*''I can imagine that in some cases, if other methods don't work for a patient during their admission, VR might be a potential solution or idea.'' (pp. 11)*	40	7 (20)	6 (20)
Discussing and reflecting	CleVR can facilitate a dialogue between patients and HCPs, with an emphasis on exploring behavior and emotions	*''You're in the situation, I see this and this happening with you. Can you say something about it?'' (pp. 3)*	28	6 (16)	4 (12)
Code: 3: Practice environment	*CleVR provides a realistic secure environment for patients that is optimal to practice coping strategies and desired behavior*		77	6 (28)	5 (49)

Personalization	CleVR enables HCPs to personalize the software to align with their and their patient's specific preferences, skills, and requirements	*''It remains a beautiful, accessible method […] To increase both reach and practice various topics.'' (pp. 8)*	53	8 (17)	6 (36)
Realistic feeling	CleVR offers patients a simulated scenario, sparing them the effort of imagining the situation themselves	*''You can still put someone in that situation without any prompting, like, 'Imagine this is the situation, what would you do?''' (pp. 1)*	13	4 (6)	5 (7)
Safety	CleVR provides a secure simulated environment where potential bystanders remain unharmed in the event of a patient expressing aggression	*''Even when they go on leave, it's not very ethical to try to apply everything they've learned about aggression or sexual offenses in practice.'' (pp. 12)*	11	3 (5)	4 (6)

¹ *The total count of the code mentioned in all interviews*

² *The count of the different HCPs that bring up a code and (X) the total count of times the code appeared in all HCPs interviews*

³ *The count of the different Experts that bring up a code and (X) the total count of times the code appeared in all expert interviews*

Table 7 provides an overview of where CleVR could potentially be utilized in the healthcare process (RQ4). The table was compiled based on quotes from both HCPs and experts, categorized according to the phases of the healthcare process outlined in Appendix F. Ideas for the software's possible implementation exist in every phase, owing to the flexibility of the software that allows it to be adjustable to each phase. However, participants suggest that during the admission and discharge phases of the healthcare process, the use of CleVR may not be suitable. Contradictory opinions are evident in this context. Contrary to that, all participants view the potential utilization of CleVR during the treatment phase positively.

Table 7: Overview Potential Added Value CleVR according to Experts

Admission ⟶	Treatment process ⟶	Discharge
Positive perspective	*General*	*Positive perspective*
Preparation new setting (pp. 12)	Practice new behavior (pp. 10,11,15)	Assessment tool (pp. 10)
Insight treatment progress (pp. 11,14)	Patients reflecting own behavior (pp. 10,11,15)	Recap your learning journey and highlight areas that require attention (pp. 14)
Tailored preparation new situations (pp. 10,15)	Exposure (social) situations to reduce anxiety (pp. 8,9,11)	Usage occasionally or based on patient's initiative (pp. 12)
Familiarize VR-environment (pp. 14)	Protocolized treatments (pp. 11,14)	Practice obstacles related to this phase (pp. 13,15)
Assessment tool (triggers and diagnostics) pp. 10,11))	Practice general life skills (pp. 11)	
VR-usage only for relaxation purpose (pp. 13)	Discuss or replay incidents that occurred in the clinic (with and without the patient) (pp. 12)	
	Tailored to patient related goal and support question (pp. 6,7,13)	
	Open usage without protocols (pp. 15)	
Negative perspective	*Going on leave*	*Negative perspective*
Patients might be too vulnerable, focus should be on stabilizing (pp. 11,13,14,15)	Preparation going on leave (pp. 1,3,4,5,10,11,12,14,15)	Patients do not need it (pp. 12)
Existing problem areas should be clear before using it (pp. 2)	Assessing going on leave (pp. 2)	
	Evaluation going on leave (pp. 10,11,12)	

3.2.3 Main barriers for Implementation of CleVR (RQ5)

A part of the interviews with HCPs and experts aimed to identify the main barriers to implementing CleVR in a forensic inpatient setting. Table 8 presents the three main codes and nine sub codes, along with their corresponding definitions, outlining the primary barriers to CleVR implementation. A total of 350 quotes have contributed to addressing the sub-question.

Table 8. Subcodes main barriers CleVR and their definitions

Codes and sub codes	Definition of code	Illustrative quote	Total[1]	HCPs[2]	Experts[3]
Code 1: Practical resources	*CleVR necessitates practical resources such as funding, available equipment, and trained staff and work instructions to enable its use*		111	9 (34)	6 (36)
Disorganized use	CleVR's optional and disorganized use without specific goals restricts its application	*"I can't envision a VR system being present on a ward. People spontaneously deciding to use it, like, 'Oh, let's quickly use VR or something.'" (pp. 11)*	41	5 (8)	6 (33)
Financial costs	CleVR usage entails significant expenses for the acquisition and maintenance of one or multiple sets	*"Financially, it's simply not attractive because it costs a lot of money to acquire and maintain such technology" (pp. 10)*	31	8 (17)	5 (14)
Time	CleVR usage is constrained by the challenging shifts and understaffing experienced by HCPs.	*"The biggest barrier is always time. Yes, especially those colleagues […] are always incredibly busy. Many shifts are understaffed." (pp. 12)*	20	6 (10)	5 (10)
Training HCPs	CleVR usage involves HCPs needing instruction, followed by real-life scenario practice and role-play to gain experience	*"One must have the time and energy to effectively participate in these training sessions and apply and exercise what they've learned in practice." (pp. 1) "You should […] be skilled in role-playing." (pp. 11)*	19	3 (7)	4 (12)
Code 2: Limited research and development	*CleVR software faces limitations in development and research, including usability issues, software restrictions, and uncertainties about its benefits*		131	9 (41)	6 (90)
Uncertain benefits	CleVR's benefits are uncertain for HCPs and patients due to limited research and potential patient aggression, anxiety, and sickness in and outside VR	*"As soon as they take off that headset, there can still be aggression present, and we actually don't know yet how to best deal with that." (pp. 10)*	61	5 (15)	6 (46)

Design VR world	CleVR's VR environments, characters, and objects have limited options which do not align with real-world standards	*''The only issue I can think of is that the virtual worlds are quite limited now, so maybe they'll say it's so specific that it can't be fully explored yet. But I'm not sure.'' (pp. 14)*	36	3 (12)	6 (24)
User-friendly	CleVR's software usage requires HCPs to multitask and have specific digital and practical skills, making it demanding	*''You have to control the VR set, operate the dashboard, control a VR character, […] you also need to keep an eye on your clients.'' (pp. 10)*	34	6 (14)	5 (20)
Code 3: Potential users	*CleVR usage faces hindrance when users have uncertainties about when, for whom, how, and why it should be utilized*		108	9 (70)	6 (79)
User motivation	CleVR faces patient and HCPs resistance due aspects as anxiety, unfamiliarity, and value uncertainty, favoring alternatives	*''You have VR lovers and VR haters. Some people just don't like it at all.'' (pp. 11)* *''Some might still prefer gaming and hanging out in their rooms.'' (pp. 2)*	95	9 (60)	6 (35)
Stability	CleVR requires a certain level of patient stability, including ward familiarity and no drastic behavior changes	*''Some may not even be capable of using a VR headset, as they might not be in a suitable state for it'' (pp. 12)*	13	2 (2)	5 (11)

¹ *The total count of the code mentioned in all interviews*

² *The count of the different HCPs that bring up a code and (X) the total count of times the code appeared in all HCPs interviews*

³ *The count of the different Experts that bring up a code and (X) the total count of times the code appeared in all expert interviews*

3.2.4 Implementation strategies to Tacke Barrier Implementing CleVR (RQ6)

A part of the interviews with HCPs and experts focused on identifying strategies for implementing CleVR in a forensic in-clinic setting. The formulation of these strategies was made with the intention to overcome the barriers discussed in the interviews. Table 9 outlines the three main codes and eight sub codes for the discussed implementation strategies along with their definitions. A total of 213 quotes have contributed to addressing the sub-question.

Table 9. Strategies for implementing CleVR according to HCPs and Experts

Codes and sub codes	Definition of code	Illustrative quote	Total[1]	HCPs[2]	Experts[3]
Code 1: Practical resources	*A healthcare organization must allocate essential resources, including time, equipment, and training, for VR interventions*		88	7 (30)	6 (23)
Protocol/ guides	HCPs will receive assistance through protocols and/or guides in the integration of CleVR into their daily work routines	''So, […] develop protocols that clearly outline exactly what someone needs to do. Having these protocols in place would help bring things to life and allow people to find their own ways from there'' (pp. 14)	36	4 (10)	6 (26)
Training HCPs	HCPs are prompted to use CleVR by mandatory training to learn and subsequently apply it their daily practice	''We currently do this by requiring mandatory training if you want to use VR. […] so, it's less optional'' (pp. 10)	27	5 (9)	6 (18)
Planned VR-sessions	HCPs and patients are prompted to use CleVR through dedicated time slots in nearby VR-rooms with working software	''No, I would schedule fixed times. […] You have a block of therapy, so to speak, and then you have a block of free time.'' (pp. 8)	25	6 (21)	2 (4)
Continue development					
Code 2: Continue development	*The software and its value need ongoing development, and practical implementation should be refined to ensure accurate and effective usage*		71	7 (12)	6 (22)
VR expert(s)	One or more qualified staff members are appointed or hired to encourage consistent CleVR usage and effectiveness	''Someone in the institution who takes the lead, someone who really stands for it, and everyone can turn to for questions and things that promote it.'' (pp. 14)	36	6 (18)	5 (18)
More research	CleVR's software requires additional research with HCPs and patients to identify effective and efficient utilization methods	''More research and truly understand what exactly the added value is.'' (pp. 11)	22	5 (9)	5 (13)

			[1]	[2]	[3]
		''Approach it systematically and involve stakeholders, […], to assess: what do you really need?'' (pp. 10)			
Updates technology	CleVR's software continuously upgrades and expands its capabilities enhancing personalization.	''Yes, they are increasingly trying to provide updates, […] They're currently working on those child avatars.'' (pp. 1)	13	2 (3)	4 (10)
Potential users					
Code 3: Potential users	*HCPs and patients are recruited by gradually introducing them to the technology while screening patients for compatibility*		54	9 (23)	5 (13)
Introduction technology	All HCPs and patients are engagingly informed about CleVR to prepare them for potential usage	''Research demonstrates the importance of slowly introducing the technology. Expectation management is extremely important.'' (pp. 10)	36	8 (23)	5 (13)
Screening patients	HCPs analyze patients to ensure correct CleVR usage aligned with their characteristics and specific rehabilitation goals	''Suppose someone qualifies for this, or the team sees potential in it. Well, it might be helpful for that person.'' (pp. 2)	18	5 (9)	2 (9)

[1] The total count of the code mentioned in all interviews

[2] The count of the different HCPs that bring up a code and (X) the total count of times the code appeared in all HCPs interviews

[3] The count of the different Experts that bring up a code and (X) the total count of times the code appeared in all expert interviews

4. Discussion

4.1 Principal Findings of the Study

The main goal of this study was to explore the conditions for utilizing VR, specifically CleVR's VR software, Social Words, in guiding inpatients within a forensic setting. According to desk research nurses/caregivers, socio-therapists and psychologist are involved in guiding inpatients, with nurses and socio-therapists playing an important role in guiding inpatients do providing 24-hour care. In addition, to desk research, an interview study was conducted, revealing new insights compared to the materials utilized in the desk research. Theses insights revealed challenges in patients guidance due to incomplete patient data, complicating HCPs adjustment of guidance to available patient information. This adds to the overwhelming nature of transitions between care locations, as patients encounter variations in restrictions and HCP support. Participants emphasized the importance of a stable environment with basic needs to prevent excessive dwelling on negative behavior, encouraging patients to continue working on rehabilitation goals in an inpatient setting. CleVR could enhance intervention relevance by addressing points of improvement in guiding forensic inpatients. Unfortunately, it appears that CleVR does not offer a solution to the issues mentioned above. Nonetheless, CleVR remains effective in addressing various challenges especially in the treatment phase of guiding inpatients, as indicated by findings from both the interview study and desk research. However, there was a discrepancy between the interview study and desk research findings, particularly regarding confidence enhancement. Strengthening patient confidence shows promise in addressing out-clinic overstimulation, as patients tend to prefer staying in the clinic due to fears of triggers in outpatient settings. Using VR to boost confidence in anxiety-inducing situations may enhance outdoor engagement, reduce tension, and facilitate progress toward treatment goals. To bring out the added value, studies recommended utilizing an implementation model for intervention development (27, 29).

For a comprehensive view, the main barriers and accompanying strategies identified in the interview study are organized within the NASSS framework: technology, adopters, organization(s), wider system or embedding, and adaptation over time, presented in Appendix G (27). This reveals that the main barriers in interviews cover nearly all categories of the framework, excluding the external context. For every barrier identified, there are specific strategies in place, with certain strategies capable of addressing barriers spanning different domains within the NASS framework. This underscores the necessity of adopting a multilayered implementation approach, aligning with existing literature in the field (27, 29). In contrast to desk research, participants identified the challenge of 'disorganized use,' where HCPs require encouragement to adopt technology. Implementation strategies, including protocols, VR experts, training, and planned VR sessions, aim to encourage HCPs in utilization of CleVR. Behavioral change, as shown in previous implementation research, is crucial and complex, emphasizing the need to address it when developing an implementation plan (27, 29).

4.2 CleVR's Fit in Healthcare Process

According to interviewed participants, the most valuable application of CleVR is within the treatment process in inpatient forensic psychiatry. CleVR emerges within this phase as a potential tool to reduce anxieties by increasing a patient's self-efficacy and confidence in specific situations, as they have already dealt with them effectively in VR. Desk research did not specifically mention CleVR's potential in this regard, likely due to the broad nature of the forensic patient group and the generalized descriptions of added value found in the literature (4, 13). The use of VR interventions to enhance confidence and self-efficacy may have been considered too specific for the literature reviewed in the desk research. However, the Vreedom study by Hendriks et al., a VR-assisted program was introduced to train forensic patients, with the goal of reducing stress and unwanted behavior through simulated

challenging situations resembling out-clinic situations (10). The study discusses stress reduction in forensic patients through the use of VR. While the study implies the success of the training in reducing stress, concerns arise due to the lack of a proper control group (10). Beyond forensic care, Geraets et al. conducted an uncontrolled pilot study assessing the potential effect of VR-based cognitive-behavioral therapy for patients with generalized social anxiety disorder (42). The use of VR to simulate feared situations allowed patients to experience the non-occurrence of anticipated consequences, leading to a reduction in anxiety and related symptoms (42). Future research could explore the extent to which VR affects anxiety, confidence, and self-efficacy in guiding or treating forensic patients. In the treatment process, CleVR is perceived to be of the highest value not only for anxiety reduction, but also for its potential role in facilitating authorized leave.

There exists a gap between risk assessments and real patient behavior, indicating the need for innovative solutions like CleVR to enhance the accuracy of risk assessment. Current risk estimations often include false positives or negatives (9). As indicated by the current study, CleVR holds the potential to enhance the reliability of risk assessment for nurses and socio-therapists, while simultaneously streamlining the process of guided leave. Furthermore, findings from the VReedom study suggest that VR interventions positively influence patient progress and the frequency of authorized leave in forensic psychiatry (10). The study also proposes VR environments as a prerequisite for obtaining leave authorization, although further research needed to substantiate this claim (10). Patients can practice desired behaviors in challenging, personalized situations before their leave without compromising societal safety, addressing a concern where VR offers innovative solutions. (5, 13, 24). HCPs gain familiarity with potential undesired patient reactions through VR simulations of leave scenarios, thereby enhancing their ability to assess patient readiness and identify specific triggers. VR's broader utilization for leave preparation remains despite the VReedom study limited (10). It is also important to be aware that also responses in CleVR may not perfectly align with real-life reactions during leave, necessitating ongoing awareness and flexibility in interpreting patient behaviors. In a cross-sectional survey study by Lindner et al., one of the most significant concerns of participating cognitive behavioral therapists was that improvements in VR do not necessarily translate to real-world improvements (43). Further research should be conducted to investigate the extent to which behavior in VR differs from behavior outside VR. CleVR offers further utilization opportunities beyond the treatment phase, despite some participants' perception of its lesser suitability for these stages.

During admission and discharge, there are multiple ways to use CleVR to guide forensic inpatients. Participants mentioned that the admission phase is focused on stabilizing and introducing the patient to the clinic. CleVR would contradict these goals because it currently lacks the option to reduce tension due to the exposure nature of the intervention. Conversely, there are other VR interventions demonstrating promising results in reducing tension among individuals with psychiatric disorders. Veling et al.'s RTC research indicated that the incorporation of VRelax, a virtual reality relaxation method, resulted in an immediate alleviation of negative affective states and enhancement of positive affective states among patients undergoing ambulatory psychiatric treatment (44). Some VR experts in the interview study suggested that CleVR could potentially be utilized during the admission phase to introduce and familiarize patients with the software. This approach allows patients to begin practicing situations immediately during the treatment phase, thereby increasing the efficiency of care. Participants also indicated that, on the one hand, during the discharge phase, patients may not necessarily require to use CleVR as their treatment at the clinic is concluding. On the other hand, in interviews, it is mentioned that for gaining more insight into the final treatment process of patients or addressing remaining support needs, deploying CleVR could still be interesting. The appropriateness of using CleVR during the admission and discharge phases of healthcare processes in

forensic inpatient care remains unclear. However, it is crucial to effectively implement CleVR in the chosen appropriate phase or phases of the care process to realize its added value.

4.3 Barriers and Strategies for CleVR in Inpatient Guidance

Aligning implementation strategies with barriers is crucial for the successful integration of VR into a forensic inpatient setting. The qualitative case study by Kip et al. identifies relevant implementation barriers, highlighting the unexpected importance of explicitly integrating VR into existing treatment routines to simulate VR-usage (29). Participants in the interview study also emphasized the significance of incorporating VR into current practices. According to interviewed HCPs, achieving this integration could involve making CleVR a standard tool for tasks of a PG, which includes the creation of risk-related documents like a crisisplan. A crisisplan incorporates elements from the offense scenario and outlines what the patient and individuals around them, such as caregivers, family, or friends, can do to recognize early warning signs of aggression and prevent relapse (45). By using CleVR in the creation of a crisisplan, both the patient and the HCPs gain a deeper understanding of the patient's warning signals. This approach can be implemented by observing behavior in VR and then discussing it, as highlighted in both desk research and the interview study. Furthermore, CleVR can aid in developing coping strategies or ideas for coping that can be integrated into the crisisplan. Another way to incorporate CleVR into current practices is by integrating it in the Comprehensive Approach to Rehabilitation (CARe) approach, which is according to an interviewed HCPs effectively used by him and his collages team.

Incorporating CleVR into the framework of the CARe approach aids in promoting its effective implementation and evaluating its applicability for enhancing patient guidance. Nonetheless, it's essential to recognize that certain interventions may not align with the objectives of the approach, which makes it a tool to see if the technology matches with the context. The CARe approach employs four core actions: connecting, understanding, ensuring, and strengthening (46-48). Initially, CleVR can be used to support the core action of connection, as both previous and current research indicate that CleVR can enhance patient motivation (4, 13, 14). Consequently, implementing this approach creates opportunities for patient interaction, essential for fostering collaborative relationships, particularly with forensic patients who may exhibit limited motivation for treatment (4, 14, 46, 47). According to the core action understanding, understanding the client's situation is crucial. CleVR offers insights into patient behavior, wishes, and needs, especially for those who may struggle to communicate this verbally or cognitively (46, 47). This information can be gathered through observing behavior in various scenarios facilitated by CleVR, enabling discussions about additional practice or further needs. In the third core action, ensuring, HCPs can use CleVR to better assess if a patient is ready for increased freedom, thereby enhancing patient and environmental safety. Where in the final core action of strengthening, a HCPs focusses on the strengths and possibilities of the patient and their environment (46, 47). CleVR provides a secure and adaptable environment for patients to pursue their personal goals. By demonstrating progress and achieving milestones within this environment, patients experience an enhancement in confidence and self-efficacy. Additionally, CleVR facilitates self-regulation by allowing patients to practice skills and achieve personal objectives. The CARe approach underscores respect for the diversity and uniqueness of each patient, fostering collaboration to attain achievable goals in the recovery journey (46, 47). CleVR's flexible application and explorative nature align seamlessly with this approach, offering promising prospects for integrating technology into this guidance methods.

The alignment of barriers and strategies identified in the interview study with desk research suggests that VR implementation recommendations can be applicable for guiding forensic inpatients using CleVR. Still there were differences between the interview study and desk research arise in identifying main barriers and implementation strategies. Interview participants highlight the need for

organized VR usage and the consideration of patient stability. While these points are present in previous research, they are not emphasized as main barriers in desk research, leading to their exclusion. Additionally, strategies like technology updates and patient screening, although not identified in desk research, are still acknowledged in the literature. In the scoping review by Kouijzer et al., relevant implementation factors are identified, with a focus was found on barriers primarily within the organization and adopter system categories of the NASS framework (27). Similarly, the qualitative case study by Kip et al. underscores the significance of barriers within the organization categories, particularly during the initial stages of implementation (29). This finding partially corresponds with the interview study's results, where the adopter system emerged as the category with the most barriers. However, a notable distinction arises in the organization category, which only presented one identified barrier 'disorganized use' resulting in its limited prominence in the interview study. Furthermore, besides the three barriers identified in the adopter system category, the barriers are evenly distributed across the categories, with none in the context category. Furthermore, each category of the NASS framework has one or multiple strategies to address its barriers. Certain strategies seem particularly promising as they can target multiple categories of the NASS framework, thereby addressing several barriers simultaneously. Training HCPs, VR expert(s) and more research are the codes of implementation strategies that tackle the most areas of the NASS framework. Kouijzer's scoping review and Kip's et al qualitative case study underscores the importance of training healthcare professionals (HCPs) and conducting further research, as well as recruiting VR experts, as significant strategies for effectively implementing VR. Despite variations in previous research focusing on different VR technologies, forensic settings, or types of HCPs, integrating insights from these studies into implementation plans is advisable due to potential overlap in barriers and strategies, as highlighted in the current study.

4.4 Strengths and limitations

This study employed a qualitative multi-method approach, incorporating desk research and an interview study to explore the potential application of CleVR in forensic inpatient care. The inclusion of diverse methods aimed to enhance the overall quality of the study and to highlight new insights from the interview study. One limitation of the study was that in the interview study, three HCPs lacked direct exposure to CleVR, which could potentially influence their perspectives. Technical issues, cybersickness, and location problems prevented three participants from having hands-on experience. As an alternative, they received a step-by-step guide focusing on how and why CleVR's software was utilized in a VR project in outpatient care. This approach aimed to provide participants with an understanding of CleVR's capabilities and usage, aligning with the same aim of exposing them to CleVR. Although participants either immersed themselves in the technology or were given alternative means to learn about CleVR functionalities, most HCPs had no prior experience with using VR. This limitation affects the generalizability of the findings. However, it is crucial to emphasize that the primary objective of this qualitative study was to explore the potential application of CleVR in inpatient clinics. Insights and perspectives from HCPs working in these settings are valuable for creating an implementation plan or deciding the next steps in determining whether CleVR is a suitable tool for guiding forensic inpatients.

Another limitation of the study is the small number of participants interviewed. While both HCPs and VR experts were interviewed, the study faced additional constraints due to the homogeneous backgrounds of the HCPs, all of whom worked in a department with security level 2 within the same organization. However, this homogeneity expedited data saturation, as HCPs often highlighted similar points in similar settings. This accelerated data saturation process ensured that no new information emerged during the coding of subsequent interviews, thereby strengthening the validity of the interview research. Furthermore, the study's generalizability was strengthened by

consulting experts from four different forensic organizations. Nonetheless, no patients were interviewed, despite their status as end-users of VR for inpatient guidance. This decision was driven by ethical considerations regarding patient vulnerability, which posed challenges to their inclusion in the study. Integrating patients into the study would involve familiarizing them with VR prior to the interview, a process not previously conducted within the inpatient care at Transfore. Given the constraints of the study timeline, obtaining approval for such exposure, and conducting interviews safely was unfeasible. Nevertheless, certain experts had interacted with or interviewed patients who had experienced VR exposure, enabling them to provide valuable patient insights during interviews and discuss practical barriers related to patient experiences.

Moreover, the extent to which the findings regarding identified barriers and strategies for implementing CleVR in an inpatient forensic setting are generalizable remains uncertain. Besides the three barriers identified in the adopter system category, the barriers are evenly distributed across the categories, with none in the context category. This uniform distribution can be attributed to the interview structure, where questions about barriers were divided into categories such as general barriers, healthcare provider barriers, patient barriers, organizational barriers, and technological barriers. These categories partly align with the NASS framework, only excluding the context category. This explains why this category was least mentioned. Additionally, the most frequently mentioned category is the adopter system, which can be explained by the predominant inclusion of HCPs in the interviews, who are potentially likely to identify barriers primarily from their own perspective. Nevertheless, it remains valuable to observe that the findings align with previous research. Prior studies have highlighted the necessity of considering all phases of a framework in implementation, a principle reflected in the thorough questioning that encompassed nearly all phases of the NASS framework during the interviews (27, 29).

4.5 Implications Future Research

For future research, there are several implications to consider based on the findings and recommendations of this study. Firstly, the diverse potential applications of CleVR in guiding forensic inpatients throughout the healthcare process warrant further investigation. The current study highlights CleVR's potential across all phases of healthcare, offering multiple ideas for its utilization. Further research could explore this potential added value of VR applications, potentially testing these ideas in practice through pilot studies. Additionally, involving patients in the research process, as underscored in the current study, is crucial for evaluating the suitability and effectiveness of interventions.

Furthermore, the alignment of proposed barriers and strategies with previous implementation research underscores the importance of more research to validate these findings and gain deeper insights into specific barriers and strategies for guiding forensic patients. Collaborations between forensic organizations and the sharing of best practices could facilitate the implementation of VR interventions and enhance the quality of these implementation plans. These collaborations should consider the perspectives of all stakeholders within an organization to avoid overlooking barriers and associated strategies in any area. Based on these findings, the development of a VR protocol incorporating all aspects of an implementation framework is warranted, with practical experiences refining the protocol over time.

5. Conclusion

In summary, this study explores the potential use of VR to aid HCPs in guiding forensic inpatients, with a particular focus on the application of CleVR software. Participating HCPs show significant interest in utilizing VR interventions like CleVR, especially for preparing and assessing patients before guided leave. Contributing to the ongoing enhancements in guiding inpatients regarding leave, highlighted by the subcode 'assessing patient behavior', 'out-clinic overstimulation', 'error-tolerant learning environment and 'out-clinic safety risks.' CleVR's software offers flexibility that presents diverse opportunities throughout the healthcare process. However, this diversity also adds complexity to determining the intervention's most effective applications. While identified barriers and implementation strategies generally align with existing literature, some barriers and strategies appear particularly crucial when implementing CleVR or other VR interventions for guiding forensic inpatients. Notably, participants highlighted the challenge of 'disorganized use,' emphasizing the need to encourage HCPs to embrace technology. Implementation strategies, including protocols, VR experts, training, and planned VR sessions, aim to address this challenge. This study underscores the importance of a multi-level implementation process that considers barriers and strategies across all categories of implementation frameworks.

Acknowledgement

References

1.	Kip H, Kelders SM, Weerink K, Kuiper A, Brüninghoff I, Bouman YHA, et al. Identifying the Added Value of Virtual Reality for Treatment in Forensic Mental Health: A Scenario-Based, Qualitative Approach. Frontiers in Psychology. 2019;10.

2.	WAT IS FORENSISCHE ZORG? www.transfore.nl: Transfore; [Available from: https://www.transfore.nl/wat-forensische-zorg-0.

3.	Kip H, Bouman YHA, Kelders SM, van Gemert-Pijnen L. eHealth in Treatment of Offenders in Forensic Mental Health: A Review of the Current State. Front Psychiatry. 2018;9:42.

4.	Kip H. The added value of eHealth in treatment of offenders2021 26-03-2021.

5.	Kip H, Oberschmidt K, Bierbooms J, Dijkslag D, Kelders S, Roelofsen B. Technologie in de forensische zorg - Crossing borders. Transfore, University of Twente, GGZ Noord-Holland Noord, GGzE, Tilburg University; 2019.

6.	Kip H, Bouman YHA. Van denken en praten naar doen en ervaren: Op zoek naar de toegevoegde waarde van technologie voor de forensische psychiatrie. Sancties. 2020:249--60.

7.	Transfore maakt de samenleving veiliger transfore.nl [Available from: https://www.transfore.nl/transfore-maakt-de-samenleving-veiliger.

8.	Veiligheid MvJe. Handboek Forensische Zorg. www.forensischezorg.nl: Ministerie van Justitie en Veiligheid; 2021 10-2021.

9.	Meurkens N, Bähler M, de Kievit E, van der Kroft S, Valentijn-Stoutenbeek M. Ontwikkeling van een Handreiking Verloftoetsing in Forensisch Psychiatrische Afdelingen (FPA's). Kwaliteit forensische zorg: Programma KFZ; 2022.

10.	Hendriks C, Jansen JM, Smit M, Smulders LM, Popma A, Van Der Pol T. VReedom: training for authorized leave of absence through virtual reality – a feasibility study. Frontiers in Psychology. 2023;14.

11.	de Vogel V, Schaftenaar P, Clercx M. Mind the gap. Kwaliteit forensische zorg: Programma KFZ; 2019 06-2019.

12.	Bults N, Schimmel M, Vos J. Kwaliteitskader Forensische zorg 2022 - 2028. Kwaliteit forensische zorg; 2022 31-06-2022.

13.	Klein Tuente S. Understanding aggression and treating forensic psychiatric inpatients with Virtual Reality 2020.

14.	Introductie op een gezond leef- en werkklimaat Forensische Leerlijn (GGZ Ecademy) [Available from: https://forensischeleerlijn-ggzecademy.anewspring.nl/do?action=viewActivities&courseId=41354.

15.	Boone M, Althoff M, Koenraadt F, Timp mmvI. Het leefklimaat in justitiële inrichtingen. Forensische Leerlijn (GGZ Ecademy): Willem Pompe Instituut voor strafrechtswetenschappen, Utrecht en de Vakgroep Strafrecht en Criminologie, Rijksuniversiteit Groningen, Boom criminologie; 2016.

16.	Freeman D, Reeve S, Robinson A, Ehlers A, Clark D, Spanlang B, et al. Virtual reality in the assessment, understanding, and treatment of mental health disorders. Psychol Med. 2017;47(14):2393-400.

17.	Cornet LJM, den Besten AL, van Gelder J-L. VIRTUAL REALITY EN AUGMENTED REALITY IN JUSTITIËLE CONTEXT VIRTUAL REALITY EN AUGMENTED REALITY IN JUSTITIËLE CONTEXT Universiteit Twente, Directoraat-Generaal Straffen en Beschermen, Ministerie van Justitie en Veiligheid; 2019.

18.	van Gemert-Pijnen L, Kelders SM, Kip. H, Sanderman. R. eHealth Research, Theory and Development: A Multi-Disciplinary Approach: Routledge; 2018.

19.	Geraets CNW, van der Stouwe ECD, Pot-Kolder R, Veling W. Advances in immersive virtual reality interventions for mental disorders: A new reality? Current Opinion in Psychology. 2021;41:40-5.

20.	Ivarsson D, Delfin C, Enebrink P, Wallinius M. Pinpointing change in virtual reality assisted treatment for violent offenders: a pilot study of Virtual Reality Aggression Prevention Training (VRAPT). Frontiers in Psychiatry. 2023;14.

21.   Weerink K. DEVELOPING VIRTUAL REALITY IN FORENSIC MENTAL

HEALTHCARE: a contextual inquiry. essay.utwente.nl: University of Twente; 2017.

22.   Kip H, Oberschmidt K, Bierbooms JJPA. eHealth Technology in Forensic Mental Healthcare: Recommendations for Achieving Benefits and Overcoming Barriers. International Journal of Forensic Mental Health. 2021;20(1):31-47.

23.   Sygel K, Wallinius M. Immersive Virtual Reality Simulation in Forensic Psychiatry and Adjacent Clinical Fields: A Review of Current Assessment and Treatment Methods for Practitioners. Frontiers in Psychiatry. 2021;12.

24.   Klein Tuente S, Bogaerts S, Bulten E, Keulen-de Vos M, Vos M, Bokern H, et al. Virtual Reality Aggression Prevention Therapy (VRAPT) versus Waiting List Control for Forensic Psychiatric Inpatients: A Multicenter Randomized Controlled Trial. Journal of Clinical Medicine. 2020;9(7):2258.

25.   Cornet LJM, Van Gelder J-L. Virtual reality: a use case for criminal justice practice. Psychology, Crime & Law. 2020;26(7):631-47.

26.   CleVR. CleVR: actief op het kruispunt van psychologie en techniek clevr.net [Available from: https://clevr.net/producten.html.

27.   Kouijzer M, Kip H, Bouman Y, Kelders S. Implementation of virtual reality in healthcare: a scoping review on the implementation process of virtual reality in various healthcare settings2022.

28.   González Moraga FR, Klein Tuente S, Perrin S, Enebrink P, Sygel K, Veling W, et al. New Developments in Virtual Reality-Assisted Treatment of Aggression in Forensic Settings: The Case of VRAPT. Frontiers in Virtual Reality. 2022;2.

29.   Kip H, Buitelaar-Huijsse GKG, Kouijzer MTE, Kelders SM. From Theory to Implementation in Practice: A Qualitative Case Study of the Implementation of Virtual Reality in Mental Healthcare. Global Implementation Research and Applications. 2023.

30.   Kip H, Keizer J, da Silva MC, Beerlage-de Jong N, Köhle N, Kelders SM. Methods for Human-Centered eHealth Development: Narrative Scoping Review. J Med Internet Res. 2022;24(1):e31858.

31.   Kip H, Kelders SM, Bouman YHA, van Gemert-Pijnen LJEWC. The Importance of Systematically Reporting and Reflecting on eHealth Development: Participatory Development Process of a Virtual Reality Application for Forensic Mental Health Care. J Med Internet Res. 2019;21(8):e12972.

32.   Collega's vertellen over hun werk bij Transfore transfore.nl [Available from: https://www.transfore.nl/collegas-vertellen-over-hun-werk-bij-transfore.

33.   De mogelijkheden van technologie voor de forensische zorg [Available from: https://www.transfore.nl/de-mogelijkheden-van-technologie-voor-de-forensische-zorg.

34.   Onderzoek transfore.nl [Available from: https://www.transfore.nl/onderzoek.

35.   Stappenplan Virtual Reality - Triggers & Helpers. Transfore, De waag, Universiteit Twente & CleVR.

36.   Persoonlijk Begeleider Transfore. Handboek Stichting Transfore: Transfore; 2019 14-11-2019.

37.   Persoonlijk begeliederschap FPK Transfore. Handboek Stichting Transfore: Transfore; 2019 14-11-2019.

38.   Handboek Forensisch (F)ACT. Handboek Stichting Transfore: Transfore; 2022 22-08-2022.

39.   Werkinstructie opname FPK. Handboek Stichting Transfore: Transfore; 2021.

40.   Dimence Groep Functiegebouw 2023. Intranet Dimence Groep2023.

41.   Arissen C, van der Helm L, Dijkstra B, Markus W. Virtual Reality to Support Inpatient Addiction Treatment: Patients Are Ready, What About Therapists? A Feasibility Study. International Journal of Mental Health and Addiction. 2022.

42.   Geraets CNW. Social environments and mental health: Exploring new worlds with virtual reality. Rijksuniversiteit Groningen: University of Groningen; 2020.

43.   Lindner P, Miloff A, Zetterlund E, Reuterskiöld L, Andersson G, Carlbring P. Attitudes Toward and Familiarity With Virtual Reality Therapy Among Practicing Cognitive Behavior Therapists: A Cross-Sectional Survey Study in the Era of Consumer VR Platforms. Front Psychol. 2019;10:176.

44.   Veling W, Lestestuiver B, Jongma M, Hoenders HJR, van Driel C. Virtual Reality Relaxation for Patients With a Psychiatric Disorder: Crossover Randomized Controlled Trial. J Med Internet Res. 2021;23(1):e17233.

45.   van Erp N, van Vugt M, van der Veeken F, van Boxtel M, van Rooijen S. Herstelondersteunend handelingsplan

psychotische aandoeningen in de

forensische zorg. Trimbos-instituut: Programma Kwaliteit Forensische Zorg (KFZ); 2018.

46.   van Gijzel S, Wilken J, Brink C. Systematisch Rehabilitatiegericht Handelen. Nederlands Jeugd Instituut, Nederlands Cetrum Jeugdgezondheid, Rijksinstituut voor Volksgezondheid en Mileu, Nederlands Instituut voor Sport & Bewegen, Trimbos instituut, movisie, Vilans.

47.   Wilken J, den Hollander D. Interventiebeschrijving Steunend Relationeel Handelen. Trimbos instituut: Kenniscetrum Sport & Bewegen, movisie, Nederlands Jeugdinstituut, Rijksinstituut voor Volksgezondheid en Mileu, Trimbos instituut, Vilans; 2015.

48.   Bitter N, Roeg D, van Assen M, van Nieuwenhuizen C, van Weeghel J. How effective is the comprehensive approach to rehabilitation (CARe) methodology? A cluster randomized controlled trial. BMC Psychiatry. 2017;17(1):396.

Appendix A: Informed consent

Informatieblad voor onderzoek 'The potential of CleVR to guide forensic inpatients in rehabilitating: a qualitative study'.

Doel van het onderzoek
Dit thesisonderzoek wordt geleid door Eline Duikersloot voor haar masteropleiding Health Sciences vanuit de Universiteit Twente.

Het belangrijkste doel van deze studie is om inzicht te krijgen in hoe CleVR potentieel geïmplementeerd kan worden in forensische psychiatrische klinieken. Om dit te achterhalen is er informatie nodig over (1) mogelijke verbeterpunten van de huidige zorg met betrekking tot het begeleiden van patiënten in hun re-integratie, (2) mogelijke toegevoegde waarde van CleVR om patiënten te begeleiden in hun re-integratie, (3) mogelijke barrières bij het implementeren en gebruiken van CleVR in een klinische omgeving en (4) de bijbehorende implementatiestrategieën.

Hoe gaan we te werk?
U neemt deel aan een onderzoek waarbij we informatie zullen vergaren door: U te interviewen en uw antwoorden op te nemen via een audio-opname. Er zal ook een transcript worden uitgewerkt van het interview.

Potentiële risico's en ongemakken
Er zijn geen fysieke, juridische of economische risico's verbonden aan uw deelname aan deze studie. U hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. Uw deelname is vrijwillig en u kunt uw deelname op elk gewenst moment stoppen.

Vergoeding
U ontvangt voor deelname aan dit onderzoek geen vergoeding.

Vertrouwelijkheid van gegevens
Wij doen er alles aan uw privacy zo goed mogelijk te beschermen. Er wordt op geen enkele wijze vertrouwelijke informatie of persoonsgegevens van of over u naar buiten gebracht, waardoor iemand u zal kunnen herkennen.
Voordat onze onderzoeksgegevens naar buiten gebracht worden, worden uw gegevens zoveel mogelijk geanonimiseerd, tenzij u in ons toestemmingsformulier expliciet toestemming heeft gegeven voor het vermelden van uw naam, bijvoorbeeld bij een quote.
In een publicatie zullen anonieme gegevens of pseudoniemen worden gebruikt. De audio-opnamen, formulieren en andere documenten die in het kader van deze studie worden gemaakt of verzameld, worden opgeslagen op een beveiligde locatie bij de Universiteit Twente en op de beveiligde (versleutelde) gegevensdragers van de onderzoekers.
De onderzoeksgegevens worden bewaard voor een periode van 10 jaar. Uiterlijk na het verstrijken van deze termijn zullen de gegevens worden verwijderd of worden geanonimiseerd zodat ze niet meer te herleiden zijn tot een persoon.
De onderzoeksgegevens worden indien nodig (bijvoorbeeld voor een controle op wetenschappelijke integriteit) en alleen in anonieme vorm ter beschikking gesteld aan personen buiten de onderzoeksgroep.

Tot slot is dit onderzoek beoordeeld en goedgekeurd door de ethische commissie van de faculteit BMS

Vrijwilligheid
Deelname aan dit onderzoek is geheel vrijwillig. U kunt als deelnemer uw medewerking aan het onderzoek te allen tijde stoppen, of weigeren dat uw gegevens voor het onderzoek mogen worden gebruikt, zonder opgaaf van redenen. Het stopzetten van deelname heeft geen nadelige gevolgen voor u of de eventueel reeds ontvangen vergoeding.

Als u tijdens het onderzoek besluit om uw medewerking te staken, zullen de gegevens die u reeds hebt

verstrekt tot het moment van intrekking van de toestemming in het onderzoek gebruikt worden.

Wilt u stoppen met het onderzoek, of heeft u vragen en/of klachten? Neem dan contact op met de onderzoeksleider:

Eline Duikersloot
e.m.duikersloot@student.utwente.nl

Voor bezwaren met betrekking tot de opzet en of uitvoering van het onderzoek kunt u zich ook wenden tot de Secretaris van de Ethische Commissie / domein Humanities & Social Sciences van de faculteit Behavioral, Management and Social Sciences op de Universiteit Twente via ethicscommittee-hss@utwente.nl. Dit onderzoek wordt uitgevoerd vanuit de Universiteit Twente, faculteit Behavioral, Management and Social Sciences. Indien u specifieke vragen hebt over de omgang met persoonsgegevens kun u deze ook richten aan de Functionaris Gegevensbescherming van de UT door een mail te sturen naar dpo@utwente.nl.

Tot slot heeft u het recht een verzoek tot inzage, wijziging, verwijdering of aanpassing van uw gegevens te doen bij de Onderzoeksleider.

Door dit toestemmingsformulier te ondertekenen erken ik het volgende:

1.   Ik ben voldoende geïnformeerd over het onderzoek door middel van een separaat informatieblad. Ik heb het informatieblad gelezen en heb daarna de mogelijkheid gehad vragen te kunnen stellen. Deze vragen zijn voldoende beantwoord.

2.   Ik neem vrijwillig deel aan dit onderzoek. Er is geen expliciete of impliciete dwang voor mij om aan dit onderzoek deel te nemen. Het is mij duidelijk dat ik deelname aan het onder- zoek op elk moment, zonder opgaaf van reden, kan beëindigen. Ik hoef een vraag niet te beantwoorden als ik dat niet wil.

Naast het bovenstaande is het hieronder mogelijk voor verschillende onderdelen van het onderzoek specifiek toestemming te geven. U kunt er per onderdeel voor kiezen wel of geen toestemming te geven. Als u voor alles toestemming wil geven, is dat mogelijk via de aanvinkbox onderaan de stellingen.

	JA	NEE
3. Ik geef toestemming om de gegevens die gedurende het onderzoek bij mij worden verzameld te verwerken zoals is opgenomen in het bijgevoegde informatieblad.	☐	☐
4. Ik geef toestemming om tijdens het interview geluidopnames te maken en mijn antwoorden uit te werken in een transcript.	☐	☐
5. Ik geef toestemming om mijn antwoorden te gebruiken voor quotes in de onderzoek publicaties.	☐	☐
6. Ik geef toestemming om de bij mij verzamelde onderzoeksdata te bewaren en te gebruiken voor toekomstig onderzoek en voor onderwijsdoeleinden.	☐	☐
Ik geef toestemming voor alles dat hierboven beschreven staat.	☐	

Naam Deelnemer: Naam Onderzoeker:

Handtekening: Handtekening:

Datum: Datum:

Appendix B: Brochure potential participants Interviews

De potentie van CleVR om forensische patiënten te begeleiden bij hun revalidatie: een kwalitatieve studie

Geachte heer/mevrouw,

Met deze informatiebief wil ik u vragen of u wilt meedoen aan mijn thesisonderzoek vanuit mijn masteropleiding Health Sciences (Universiteit Twente). Het meedoen aan dit onderzoek is vrijwillig. Het onderzoek is goedgekeurd de door Universiteit Twente en de Dimence Groep.

Algemene informatie
Dit onderzoek vindt plaats in de forensische psychiatrische klinieken van Transfore. Er wordt in dit onderzoek gekeken naar de eventuele bijdrage die de Virtual-Reality (VR) software van CleVR kan leveren in een klinische setting. VR wordt momenteel vooral ambulant gebruikt binnen Transfore, maar er wordt gekeken wat de mogelijkheden voor de klinieken zijn. In de virtuele interactieve werelden van CleVR kan gewenst gedrag met patiënten worden geoefend en huidig gedrag van een patiënt worden geobserveerd. CleVR biedt verschillende software modules aan, waarin ook verschillende vaardigheden met patiënten geoefend kunnen worden.

Wat is het doel van het onderzoek?
Er is behoefte aan een meer geleidelijke re-integratie, zodat patiënten beter voorbereid zijn op hun terugkeer in de echte wereld na hun ontslag. Patiënten en zorgprofessionals hebben al een sterke intentie getoond om de VR-software CleVR te gebruiken, maar eerdere ervaringen hebben aangetoond dat succesvolle implementatie niet gegarandeerd is. Het is daarom nodig om te onderzoeken of en hoe CleVR kan worden gebruikt in forensisch psychiatrische klinieken en op welke manier dit moet worden gefaciliteerd. Door forensische gezondheidswerkers en relevante experts te interviewen, wordt informatie verzameld over (1) mogelijke verbeterpunten van de huidige zorg met betrekking tot het begeleiden van patiënten in hun re-integratie, (2) mogelijke toegevoegde waarde van CleVR om patiënten te begeleiden in hun re-integratie, (3) mogelijke barrières bij het implementeren en gebruiken van CleVR in een klinische omgeving en (4) de bijbehorende implementatiestrategieën.

Wat betekent deelname?
Om informatie te winnen over de eerdergenoemde punten worden interviews afgenomen. Het interview zal maximaal 60 minuten duren en vindt plaats op uw eigen werklocatie van Transfore. Tijdens het interview krijgt u indien mogelijk de VR-bril van CleVR op om de werelden ook kort zelf te kunnen ervaren. Voorafgaand aan het interview kan u het volgende introductiefilmpje kijken; https://www.youtube.com/watch?v=4X5XeTD0kWM.
Verder wordt er van de deelnemers gevraagd om een toestemmingsformulier te ondertekenen, waarin o.a. wordt aangegeven dat er een geluidsopname wordt gemaakt van het interview. Zonder reden mag u zich op elk moment terugtrekken uit het onderzoek.

Resultaten

Als u interesse heeft is het mogelijk om de resultaten te ontvangen die worden verwerkt in mijn thesis.

Mocht u nog vragen hebben of meer informatie nodig hebben over het onderzoek, kunt u contact met mij opnemen via mijn e-mailadres: e.duikersloot@zorgnetonline.nl.

Met vriendelijke groet,

Eline Duikersloot
Onderzoeksstagiaire Transfore

Appendix C: Interview scheme Zorgverlener

Mijn naam is Eline Duikersloot en vandaag is het *datum en jaar.* Ik zit hier met *zorgverlener nummer x* en dit is interview nummer *x*.

Voor mijn afstudeer thesis doe ik onderzoek naar de eventuele bijdrage die de VR-software van CleVR kan leveren in een klinische setting. VR wordt momenteel vooral ambulant gebruikt binnen Transfore, maar we zijn aan het kijken wat de mogelijkheden voor de klinieken zijn. In dit interview gaan we daarom ook op zoek wat de eventuele meerwaarde van CleVR kan zijn in een klinische setting. Deze meerwaarde wordt achterhaald door te kijken wat er verbetert kan worden in de begeleiding van de patiënten in de kliniek. Vervolgens wordt er gekeken wat jullie nodig hebben om VR in te zetten, zodat de meerwaarde van VR tot uiting kan komen. Verder heb ik eerder mondeling aangegeven dat ik een geluidsopname ga maken van het interview van vandaag. Het interview zal verder maximaal 60 minuten duren. Je gegevens worden anoniem verwerkt en je kan je ten alle tijden terugtrekken uit het onderzoek wat ook terug te vinden is in het informed consent. Heb je nog verdere vragen? We gaan dan verder.

Onderwerpen	Subonderwerpen	Vragen
1. Achtergrond	Functie	Wat is je huidige functie binnen Transfore?
	Werkervaring	Hoe lang ben je al werkzaam binnen deze functie?

We gaan eerst kijken naar wat er verbeterd kan worden in de huidige situatie waarin patiënten worden begeleiden in hun re-integratieproces. Ik schrijf in steekwoorden mee welke verbeterpunten ter sprake komen als geheugensteuntje voor later in het interview.

2. Verbeteringen huidige situatie	1. Opname	Wat zijn punten van verbetering van de begeleiding bij de opname van een patiënt?
	2. Behandelproces	Hoe kan de begeleiding tijdens het behandelproces van een patiënt verbeterd worden?
	Voldoende oefening	*Wat kan verbeterd worden aan de bestaande begeleidingsmethoden in de kliniek? Denk aan het oefenen vaardigheden die patiënten nodig hebben in het dagelijks leven.*
	3. Verlof	Wat kan verbeterd worden rondom het plannen van verlof?
		Wat kan er verbeterd worden rondom het gaan met verlof?
	Voldoende vaardigheden	*Welke vaardigheden worden te weinig geoefend of missen patiënten als ze met verlof gaan?*
	4. Ontslag	Hoe kunnen patiënten beter worden voorbereid op hun ontslag?
	Situatie algemeen	Kan je nog verdere verbeterpunten opnoemen rondom het begeleiden van patiënten?

*Interviewer laat de deelnemer kort CleVR en de behoorde video over CleVR zien (als dit nog niet is gebeurd) * Voorafgaand aan dit interview heb je alvast een video bekeken over CleVR en hierover kort wat gelezen.*

3. Indruk over CleVR	Bekendheid CleVR	Heb je al eerder gewerkt of gehoord van CleVR? *(Waar en wanneer was dit?)*
	Eerst indruk CleVR	Wat was je eerste indruk van CleVR?
	Interesse CleVR	Welk onderdeel van CleVR spreekt je aan en waarom?
4. *Meerwaarde CleVR*	CleVR klinisch	Wanneer zou je CleVR gebruiken in een klinische setting?
	Koppelen verbeterpunten	Welke meerwaarde kan CleVR bieden in de huidige situatie waarin patiënten begeleid worden? ➔ Zie post-its!

We hebben net besproken wat de mogelijke meerwaarde van CleVR kan zijn in een klinische setting. Echter betekend dat niet dat deze meerwaarde per se tot uiting komt. Het is belangrijk dat nieuwe technologieën zorgvuldig en correct worden ingezet. Voordat dit kan worden gedaan moeten barrières voor een succesvolle implementatie worden achterhaald. Vervolgens kan er gekeken worden hoe deze aangepakt kunnen worden.

5. *Barrières implementatie*	Voorbereidingen VR	Wat denk je dat er moet gebeuren voordat CleVR gebruikt kan worden om patiënten te begeleiden?
	Barrières zorgverleners	Wat zijn barrières dat jouzelf en je team ervan kan weerhouden om te werken met CleVR? *(Hoe kan dit voorkomen worden?)*
	Barrières patiënten	Wat zijn barrières die patiënten ervan kunnen weerhouden om te werken met CleVR? *(Hoe kan dit aangepakt worden?)*
	Barrières Transfore	Wat zijn barrières dat Transfore ervan kan weerhouden om CleVR in te zetten op klinische afdelingen? (Wat kan hieraan gedaan worden)
	Barrières technologie	Wat zijn technologische barrières waardoor er niet met CleVR gewerkt kan worden? *(Wat kan hieraan gedaan worden?)*

Dit waren alle vragen, bedankt voor je tijd en heb je verder nog wat aanvullingen of wil je nog iets anders kwijt.

Appendix D: Interview scheme Expert CleVR

Mijn naam is Eline Duikersloot en vandaag is het *datum en jaar.* Ik zit hier met *expert nummer x* en dit is *interview nummer x.*

Momenteel ben ik bezig met mijn masterthesis Health Sciences aan de Universiteit Twente, waarbij ik verbonden ben aan Transfore. Voor mijn masterthesis doe ik onderzoek naar de eventuele bijdrage die de VR-software van CleVR kan leveren in het begeleiden van patiënten in een klinische setting. Om hierachter te komen wil ik graag ervaringen en ideeën bundelen van onderzoekers en zorgprofessionals die al met CleVR werken of gaan werken. Ik deel ook graag deze inzichten als ik de resultaten in mijn thesis verwerkt heb, zodat we van elkaar kunnen leren. Heb je nog verdere vragen? We gaan dan verder.

Onderwerpen	Subonderwerpen	Vragen
Achtergrond	Functie	Bij welke organisatie(s) ben je werkzaam?
		Wat is je huidige functie binnen deze organisatie?
		Hoe ben je verbonden aan de forensische psychiatrie?
	Bekendheid begeleiding	*In het interview wordt er onderscheid gemaakt tussen het begeleiden of behandelen van patiënten. Ben je bekend met deze termen?*
	Bij het behandelen van een patiënt wordt er gericht een behandeling of onderzoek ingezet om een patiënt te diagnosticeren of symptomen/gedrag te veranderen. Begeleiding van een patiënt is meer gericht op het functioneren van de patiënt in het dagelijks leven. Bepaalde praktische of communicatieve vaardigheden worden dan door zorgverleners met patiënten geoefend en verbeterd.	
	Eigen ervaring	Zou je wat meer kunnen vertellen over de ervaring die je hebt met CleVR?

We gaan eerst met behulp van een paar vragen bespreken wat de meerwaarde van CleVR kan zijn in een forensische psychiatrische kliniek.

Meerwaarde CleVR	Meerwaarde algemeen	Welke meerwaarde biedt CleVR momenteel aan forensische zorg?
		Welke meerwaarde zou CleVR nog kunnen gaan bieden?
	Meerwaarde begeleiding	Wat is jouw visie over het gebruiken van CleVR voor het begeleiden van patiënten?
		Welke meerwaarde zou CleVR als begeleiding kunnen bieden in de kliniek?
		Heb je ook in de forensische zorg deze meerwaarde tot uiting zien komen?

Voor het gemak maak ik bij de volgende paar vragen onderscheid tussen drie fasen in het klinische zorgproces: Opname, behandelproces en verlof & ontslag. We kijken in de fases hoe

CleVR gebruikt kan worden en wat daarbij de barrières zijn. Denk hierbij bijvoorbeeld aan barrières voor de gebruikers, organisatie en technologie.		
Achtergrond	Bekendheid termen zorgproces	Ben je bekend met de fases in het klinische zorgproces (opname, behandelproces, verlof & ontslag)? **Opname:** Patiënt is nog niet in beeld bij de behandelaren/zorgverleners in de kliniek. Patiënt geïntroduceerd worden en wennen aan de afdeling/kliniek. **Behandelproces:** Indicatie en behandeldoelen voor de zijn duidelijk bij de zorgverleners en behandelaren. Interventies en behandelingen kunnen gericht worden ingezet. **Verlof:** Eerste keer begeleid of onbegeleid verlof. **Ontslag**: Behandeling is afgerond of opnameplicht loopt af. Ontslagdatum van de patiënt staat gepland.
Opname	Gebruik opname	Hoe wordt of kan CleVR tijdens de opname van een patiënt ingezet worden?
	Barrières opname	Wat zijn ervaren of potentiële barrières voor het inzetten van CleVR bij opname?
	Strategieën opname	Hoe kan dit aangepakt worden?
Behandelproces	Gebruik behandelproces	Hoe wordt of kan CleVR tijdens het behandelproces ingezet als behandeling?
		Hoe wordt of kan CleVR tijdens het behandelproces ingezet als begeleiding?
	Barrières behandelproces	Wat zijn ervaren of potentiële barrières voor het inzetten van CleVR tijdens het behandelproces?
	Strategieën behandelproces	Hoe kan dit aangepakt worden?
Verlof	Gebruik verlof	Wat is de rol van CleVR of hoe kan CleVR een rol spelen in het verlofproces van een patiënt?
	Barrières verlof	Wat zijn ervaren of potentiële barrières voor het inzetten van CleVR op deze manier?
	Strategieën verlof	Hoe kan dit aangepakt worden?
Ontslag	Gebruik ontslag	Hoe kan CleVR worden gebruikt tijdens het ondernemen van stappen voor ontslag van een patiënt?

	Barrières ontslag	Wat zijn ervaren of potentiële barrières voor het inzetten van CleVR voor ontslag?
	Strategieën ontslag	Hoe kan dit aangepakt worden?

In de volgende paar vragen gaan we ons nog verder verdiepen in de mogelijke barrières bij de implementatie van CleVR.

Barrières implementatie	Barrières technologie	In hoeverre vind je de huidige versie van CleVR geschikt voor het begeleiden van patiënten?
	Strategieën technologie	Wat zou er nog toegevoegd of veranderd kunnen worden om dit aan te pakken?
	Barrières zorgverleners	Denk je dat alle zorgprofessionals kunnen werken met CleVR?
	Strategieën	Wat zou er nodig zijn om zorgprofessionals zo goed mogelijk te ondersteunen in het werken met CleVR?
	Strategieën	Welke tips zou je organisaties geven die aan de slag gaan met de implementatie van CleVR in de kliniek?
	Barrières overig	*Barrières organisatie of patiënten aanbod geweest?*

Dit waren alle vragen, bedankt voor je tijd en heb je verder nog wat aanvullingen of wil je nog iets anders kwijt.

Appendix E: Reference Desk Research

Authors, year, county	Type of reference and their aim	Reference obtained from	Focus reference
Materials, HCPs involved in Guiding Inpatients (RQ1)			
Transfore, 2019; The Netherlands (36)	Work Instruction: Describing the tasks and responsibilities of the personal guides for patients in the clinical departments of Transfore.	Transfore's personnel platform	HCP's task description
Transfore, 2019; The Netherlands (37)	Work Instruction: Describing the tasks of personal guides from the preparation of a patient's admission to their departure.	Transfore's personnel platform	HCP's task description
Transfore, 2019; The Netherlands (38)	Work Instruction: Describing the work processes within both forFACT teams, aiming to enhance efficiency and effectiveness.	Transfore's personnel platform	HCP's task description
Transfore, 2019; The Netherlands (39)	Work Instruction: Helps HCPs to prepare and execute the admission of a patient at FPK Transfore.	Transfore's personnel platform	HCP's task description
Transfore, 2019; The Netherlands (40)	Overview functions: An overview of all positions with their corresponding tasks within the Dimence Group.	Transfore's personnel platform	HCP's task description
Materials, CleVR's Potential Value in Addressing Inpatient Care Improvements (RQ2 & RQ3)			
H. Kip, 2021; The	Thesis Hanneke Kip: The added value of eHealth in treatment of offenders: Improving the development, implementation, and evaluation of technology in forensic mental healthcare	Researchers engaged in a VR project at Transfore	Analyzing eHealth in general partly focusing VR

Netherlands (4)			
N. Meurkens et al., 2022; The Netherlands (9)	Guide Kwaliteit Forensisch Zorg (KFZ): Development of a guideline for going on leave assessment in forensic psychiatric departments	The KFZ database*	Improving forensic care
V. de Vogel, P. Schaftenaar & M. Clercx, 2019; The Netherlands (11)	Pre-call study: Continuity in forensic mental health care: What do professionals and clients need?	The KFZ-database	Improving forensic care
K. Weerink, 2017; The Netherlands (21)	Qualitive study: Developing Virtual Reality in forensic mental healthcare, a contextual inquiry	Researchers engaged in a VR project at Transfore	Studying VR in general
GGZ Ecademy; The Netherlands (14)	E-learning: Introduction to a healthy living and working environment forensic learning pathway	Transfore's personnel platform	Improving forensic care
M. Boone, M. Althoff & F. Koenraadt, 2018; The Netherlands (15)	Literature study: Stimulating a living environment that minimizes detention-related harm and encourages responsible reintegration into society	Transfore's personnel platform	Improving forensic care
N. Bults, M. Schimmel &	The Quality Framework for Forensic Care (QFFC): Describes all forensic healthcare developments in recent years in the field of quality improvement	The KFZ-database	Improving forensic care

J. Vos, 2022; The Netherlands (12)			

Materials, CleVR's Main Barriers and Associated Strategies (RQ4 & RQ5)

M. Kouijzer et al., 2023; The Netherlands (27)	Scoping review: Examines the current state of implementing VR technology in healthcare settings and provide a concise overview of related factors.	Researchers engaged in a VR project at Transfore	Implementing VR in general
C. Arissen et al., 2022; The Netherlands (41)	Feasibility study: Identify facilitator and barriers for implementation of virtual reality therapy (VRT) in addiction treatment	CleVR.net	Implementing VR intervention using CleVR's software
H. Kip et al., 2023; The Netherlands (27)	Qualitive case study: Identifying relevant implementation factors, accompanying objectives and strategies, and points of improvement for the implementation of VR in mental healthcare	Researchers engaged in a VR project at Transfore	Implementing VR intervention using CleVR's software
C. Hendriks et al., 2023; The Netherlands (10)	Retrospective observational cohort study: VReedom, training for authorized leave of absence through virtual reality	CleVR.net	Analyzing a VR intervention using Wander (360-degree street-view) and CleVR's software
S. Klein Tuente, 2020; The Netherlands (13)	Thesis Stéphanie Klein Tuente: Understanding aggression and treating forensic psychiatric inpatients with Virtual Reality	Researchers engaged in a VR project at Transfore	Analyzing VRAPT-intervention using CleVR's software
D. Ivarsson et al., 2023;	Pilot study: Pinpointing change in virtual reality assisted treatment for violent offenders	CleVR.net	Analyzing VRAPT-intervention using CleVR's software

Sweden (20)			
F. R. González Moraga et al., 2022; Sweden (28)	Manuscript: New Developments in Virtual Reality-Assisted Treatment of Aggression in Forensic Settings: The Case of VRAPT	CleVR.net	Analyzing VRAPT-intervention using CleVR's software
K. Sygel & M. Wallinius, 2021; Sweden (23)	Systematic review: Clinically relevant assessment and treatment methods applying immersive VR in forensic or adjacent clinical settings, were analyzed.	CleVR.net	Analyzing VR in general

* The KFZ-database granted access to additional material obtained from a researcher involved in a VR project at Transfore

Appendix F: Expert Perspectives on CleVR Deployment in Healthcare

Expert	Admission	Treatment	Discharge
1	''On one hand, as you mentioned, it's an entirely new environment, and clients may suddenly have leave, perhaps for a few days. In that case, you can use CleVR to let the client get accustomed to the process, still from the safe environment of the clinic, but allowing them to become familiar with what they can do.'' ''On the other hand, I also think that in this initial phase, it is valuable for assessing triggers. So, to see how far someone is in the process but also what triggers them. We are now entering a completely different phase of the treatment, and they might gain more freedoms. But what do we still need to take into account?''	''It's really about mapping what triggers someone. In the treatment phase, you focus a lot on practicing how to deal with those triggers—building coping skills and rehearsing strategies for real-life settings. [...] I believe practicing new behaviors and dealing with intense situations is crucial in the treatment phase, along with reflecting on your own behavior and adjusting accordingly.'' ''Yes, I think there's real value in exposure, as we discussed earlier. If, beforehand, you discuss what someone finds challenging or what they will be doing tomorrow, you can go through it in VR first. This way, you create a bit of expectation management and can assess: Okay, what challenges are you still facing? Shall we practice it here first? We can then discuss how it went tomorrow in the real situation.''	''Yes, I think you can use it again, similar to how you started with it as an assessment tool. Now, you can look at it as an assessment tool to see how someone reacts to certain situations. Are they responding effectively and using coping skills on their own? Do they need assistance? If everything is going well, you can use it as a check or an exercise to evaluate if someone is truly ready to handle it on their own.''
2	''At the moment, VR is often not used during admission because it is a time when a trusting relationship is established with patients, and a lot of diagnostics are conducted. However, I believe that in the future, VR could be very interesting for diagnostics. In fact, I think it could be a very suitable tool for that purpose. It is a very good observational tool, in my opinion.''	''Especially training for exposure to social situations because some patients find it challenging. Putting on such a VR headset is almost a training in itself. It involves building trust in your social therapists or your art therapist. Patients need to trust that when they put on the VR headset and enter that virtual world, it is safe. Many patients find this experience quite nerve-	

''Currently, it is not used at all in this phase, and I think this is mainly because patients are still vulnerable during this stage. They may not yet fully understand what we want, and VR is often seen as an additional tool at the moment.''

''Alternatively, it could also be used for treatment progress. However, admission is more focused on the primary question of understanding what is happening and determining the appropriate treatment.''

wracking, and sometimes this becomes a training goal in itself.''

''Primarily, there are skill training sessions where patients practice difficult situations and then discuss how it affects them, what emotions it triggers, and how they could respond differently. This is the most common use at the moment—training sessions of this nature.''

''Looking ahead, there is potential for more structured treatments using VR. This could involve protocolized treatments, which I see as a promising direction for the future.''

''Another potential use is for practicing general life skills in a virtual setting. This could be interesting as well.''

''I would consider using it more as a preparation for the leave process. For example, if someone is going on leave for the first time, it could be beneficial to have an intermediate step where they can engage in a conversation with a child in a virtual setting. It could also be used during a leave situation to replay a difficult scenario that the patient encountered.''

''Specifically for preparing for leave, it is highly suitable. However, as a complete replacement for leave, that might be a step too far.''

| 3 | ''Some patients are declared fully legally irresponsible and go directly to a forensic psychiatric clinic. It's quite something to end up on the | ''When a particular situation arises, how to apply it, and how to deal with it. Yes, you can certainly go through it again | I think that when you've reached that point, where you're heading towards conditional or even |

admission ward of a forensic psychiatric clinic. There's a lot happening there. So, it's beneficial if you can prepare people for such situations.''

beforehand with a VR set, and of course, afterward, when something unexpected has happened, something that didn't go quite right, you can replay it during the debrief.''

''There are, of course, many incidents on units, both big and small, and there are always debriefs and recovery discussions afterward about such incidents. That's part of the process, and it's good, but you never have the opportunity to go through it again and really practice what was discussed at that moment and what seemed to be needed. Yes, VR offers many opportunities to replay a situation with the patient.''

''Yes, and I can also imagine that as a caregiver, you sometimes have incidents that may have shocked you or that you are dealing with personally, and then you can potentially replay them with a colleague to process them as a professional.''

''These are often underestimated. These are enormous steps for patients, and it is very good to prepare them. If you can use VR for discussing and preparing, it is very, very valuable, I think. And it can help improve leaves more smoothly, too. That is, of course, beneficial for the duration of the treatment trajectory.''

unconditional discharge, well, then you should have gotten someone to the point where they can really stand on their own, and VR is no longer a structural application. At most, you could say, but occasionally at the initiative of that person themselves. That's also part of their independent existence. So, I have my doubts about that; I would be cautious about it myself.

| 4 | '''Yes, I find that challenging because, during the admission phase, landing and stabilizing take precedence. In this case, CleVR doesn't have the | ''I think you can align very much with someone's goals. So, suppose there is a treatment question, a support question, | ''Yes, of course, you have learned many skills during the treatment, but undoubtedly, when you are |

	capabilities for relaxation exercises or similar activities.'' ''I would also find it nerve-wracking if someone in the admission phase, whom I don't know, puts on a VR headset. If they have a short fuse, they might react impulsively. So, during the admission phase, when I worked in the clinic, the focus was on stabilizing, calming down, and getting used to the routine.'' ''I believe it would be more suitable during the treatment phase. I would be more inclined to use it there unless there are possibilities for relaxation exercises. There's also other software that takes the form of a game, combining relaxation with gaming. In that case, I would be more inclined to use such an approach, rather than practicing new and potentially stressful situations when someone is still highly anxious.''	then I think you can approach it in many ways, but that depends, I think, on the support question and the treatment question of the team and the patient.'' ''Yes, certainly, I think you can use VR in almost every treatment, yes, and for almost every treatment goal.''	discharged, you will encounter new things, and being able to solidify or practice them a bit more could, I think, be of added value.''
5	''When you ask clinicians from both inpatient and outpatient settings, they often feel that it should not be used in the initial phase of treatment.'' ''I think you can use this in the initial phase, but in a low-threshold manner. For example, you can practice in the environment or walk through the surroundings, [...] you are already becoming familiar with the environment itself.'' ''Yes, I think especially for the patient, not just for the HCPs or, in the end, for example, the health insurance to see how much the patients improve.''	''On one hand, you could consider it as a replacement for certain treatment components [...] that it might be easier for that person to practice in VR, as you don't necessarily see people right in front of you but are in your own world again.'' ''A valuable addition is that you typically discuss leave when they are already on leave. And then you discuss like well, what are maybe challenging moments that you will encounter. Whereas now, you could actually practice that, so while you discuss those challenging moments.''	''By practicing the things that are going well. So, the things you've actually learned. That part of showing, like, initially, you dealt with aggression this way, now you handle it like this.'' ''You can practice [...], with the things that you need to do to distract you, [...] before discharge and then also look at it. Like, these are still points that you might need to take with you in an outpatient setting.''

6	''I wouldn't do that in the first few weeks, you know. Yeah, really, only when it's clear what the purpose is, you know. So, we must have a significant goal, and that's usually, you know, when someone is admitted, yeah, then you first have a kind of, you know, a bit of stabilization or something.'' ''Yes, I said we indeed need a very clear goal during that admission phase for why you might use that. [...] you would really have to tailor it. So, I say I wouldn't rule out that it can't be used, but it would have to be so tailored, you know.''	''There are no specific protocols on how exactly to implement it, so it's still very open, so to speak.'' ''But I find it especially beneficial to really reenact situations. So, if you've received tools in treatment or have truly learned how to approach things differently or learned techniques, you play them out in such a world, and then you immediately see if it really works.'' ''Especially when it comes to guiding someone who has learned skills. Consider a situation where they can demonstrate that, how they apply it. Then you can have a conversation about it. Like, I notice that you're doing this or that. Yeah, we can approach it differently, or on which areas do we still need to teach something?'' ''I think especially very customized, like, What is the goal of someone going on leave? Well, simulate that in such a world. You can respond immediately and practice situations someone might encounter or where the difficult points lie. It's a kind of preparation for leave.''	''So, I think you can just address the issues that are still relevant in that regard. For instance, if someone is being discharged and still needs, for example, probation supervision [...] in the VR, having a conversation about how to approach that.''
HCPs		
1	''You need to have a clear understanding first of what the problem is, what problem areas exist, so the orientation phase comes first. It's not that CleVR provides input for that, but I do think that in the orientation phase, you can quickly determine if CleVR is suitable for this person. If you see potential,	''Once you move towards the leave phase, I probably wouldn't use it directly during admission.''	

	then you can also use it to gain insight subsequently''
2	''I think if you want to assess someone for leave, or if you are considering expanding their leave privileges, you can create a situation where, for example, someone is experiencing more cravings or a tendency towards drugs.'' ''Or if it doesn't feel comfortable for you to go on leave with someone, you can engage in role-playing together during leave. I think that if you feel uneasy or have doubts about whether the person is honest or capable of going through the leave smoothly, this approach could be beneficial.''
3	''When the patient finds it very difficult to go outside, restraining themselves.''
4	''Well, when it comes to treatment, during admission, I think you get a clear understanding of the support needed. If someone says, I just find it very difficult to go somewhere, to enter a place, to initiate contact, well, then you can practice. You know, okay, you're entering a restaurant. How are you going to handle it? You're in a supermarket. How are you going to handle it? Show me.''
5	''In treatment, maybe even with leaves or permissions, you could say, 'You have difficulty with, let's say, weed, alcohol, or certain substances. You're going to a party soon, and you know there will be fellow

	users or people you know who use. And you struggle with saying no. How should we approach this?' Often in conversations, you know, we usually discuss it, and they say, 'Oh no, I can handle it, it'll be fine.' But if you practice it like this, you can better see where the difficulty lies. What triggers it? You can understand it more effectively. So, maybe you end up saying yes because you feel the atmosphere.''
6	''That would be fantastic, for example, if you have a weekly session with a patient, and you can, […] But, for instance, a job interview that someone has to attend – why not go through it together? A bit like role-playing, which is also more relaxed, […] You can feel, 'Oh yes, an office, it's been a while because I've been admitted for some time.' Oh yes, this is how it looks nowadays. Well, I think that could be helpful.''
7	''If you notice that someone has specific triggers that really upset them.''
8	''Well, I would definitely use it with very anxious patients, as well as those who are very withdrawn. Or if we ourselves think the risks are quite significant. Let's just go together, take a look together and see, okay? Does this work? What can we glean from this?''
9	''I think it's excellent that you can practice it first before actually exposing someone

to that. Well, no, I find that exposure very
interesting''

Appendix G: Main Barriers & Strategies Categorized by the NASS Framework

Table 40: Main Barriers Categorized by the NASS Framework

The illness or condition When forensic patients enter a forensic inpatient clinic, their fragility and in**stability** can make it challenging or inadvisable for patients to participate in interventions.	***The technology*** Participants find CleVR's software unrealistic and limited in terms of environment options. This raises uncertainties about the **VR world's design** performance. Besides that, participants perceive the software as less **user-friendly**, primarily due to its demanding nature for healthcare professionals.
The value proposition Organizations may find it challenging to afford CleVR software due to its high **financial costs**, particularly when its cost-effectiveness is uncertain.	***The intended adopters*** The success of CleVR may be hindered by the intervention's **uncertain benefits**, casting doubt on both its effectiveness and cost-effectiveness. Furthermore this can increase resistance from both patients and HCPs, diminishing **user motivation**. Usage may also be hindered by **time** constraints arising from demanding shifts and staffing shortages. This also poses a challenge for the recruitment of HCPs to undergo training for effectively using the technology.
The organization CleVR's optional and **disorganized use** without specific goals restricts its application. Causing users are not prompted to engage with the technology.	***The external context*** -

Table 11: CleVR's Main Barriers and Implementation Strategies Categorized by the NASS Framework Categories

The illness or condition *Barrier:* Patient fragility and instability *Strategy:* **More research** and **patient screening** can contribute to understanding how and if the technology can be personalized based on individual patient characteristics, conditions, and symptoms.	***The technology*** *Barrier*: Insufficient VR world's design and lack of user-friendliness *Strategy:* **Technology updates** have the potential to enhance the environment's realism and offer more options for personalization. Besides that, it can address any user experience issues related to user-friendliness. Still, if users encounter any obstacles in using the technology, **VR expert(s), training** and **protocols or guides** can provide support on how to overcome these challenges.

The value proposition

Barrier: High financial costs

Strategy: **More research** can offer insights into the cost-effectiveness of the intervention. This information may demonstrate that the technology's value exceeds its costs.

The organization

Barrier: Disorganized use

CleVR also must become **integrated in work process**, with **protocols or guides, VR expert(s)** and **training** offering support and directives on how the intervention can be used. These documents include recommendations and requirements outlining when, how and for whom CleVR can be used. This is also beneficial for **screening patients** to ensure correct usage. Next to that **planned VR sessions**, ensures more organized usage of the technology.

The intended adopters

Barrier: Uncertain benefits, low user motivation, limited time

Strategy: To familiarize and inform users with potential usage, a gradual **introduction to the technology** will be implemented. HCPs intending to use CleVR will undergo **training** that provides them with information and exercises to enable them to work with CleVR. This training continues in practice, where they are prompted to use CleVR to complete their training. Additionally, **VR expert(s)** can motivate HCPs before, during and after this training by informing staff with benefits of the technology. The VR expert serves as a point of contact for healthcare providers and oversees the correct usage, addressing any challenges users may encounter. Additionally, more research can offer valuable insights into the benefits of CleVR and address the uncertainties that users may have about the technology. Additionally, by incorporating **planned VR sessions**, HCPs are assigned specific time slots to engage with the technology. This approach decreases the risk of HCPs having limited time to engage with it. Moreover, additional benefits of the technology may come to light when **more research** is conducted.

The external context

-