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# Which effective virtual reality (VR) interventions exist for the prevention and rehabilitation of intimate partner violence (IPV)?

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**Purpose:** Prevention and rehabilitation of intimate partner violence (IPV) is a very important topic due to its high prevalence, visibility, and potential to generate negative consequences in survivor's physical and mental health. Previous interventions have used traditional, explicit approaches giving mixed results for both prevention and rehabilitation. However, the number of implicit interventions using technological innovations, specifically virtual reality (VR), is limited in this field. In this review, we aim to find the existing literature on immersive VR targeting prevention or rehabilitation of IPV.

**Method:** The search used several databases: PsycINFO by EBSCOHost, and Medline by PubMed, specifically set to find IPV intervention articles, published after 2010, that included VR in their intervention.

**Results:** 11 studies met all of the eligibility criteria and were included in the review.

**Conclusion:** VR has overall proven useful to tackle the prevention and rehabilitation of intimate partner violence, as it offers the unique possibility of experiencing a variety of situations from a different perspective, in a safe and controlled environment. Therefore, it is a tool which has great potential for transformation, as it allows for experiential and implicit learning.

## KEYWORDS

virtual reality, intimate partner violence, prevention, rehabilitation, immersive, domestic violence

## 1 Introduction

The main goal of this study is to find out whether virtual reality (VR) could be a good tool to reduce intimate partner violence (IPV). Specifically, we aim to answer the following questions: a) Is VR an effective tool to prevent IPV?, b) Is VR a good tool to intervene in IPV, both in perpetrators and survivors? c) Is VR a good tool to improve bystander behavior in IPV situations? In order to do so, we have performed a systematic review to find the current state of VR treatment for IPV.

## 1.1 VR interventions in mental health and forensic settings

VR has been used for several mental health interventions. The underlying idea is that someone can stand and move in a computer-generated world, and feel immersed (Rothbaum et al., 2006; Botella et al., 2007; Fox et al., 2009; Baños et al., 2011; Bordnick et al., 2011; Repetto et al., 2013). That is, feel that they are in the real world while being somewhere else. VR treatment has been applied to tackle different psychiatric disorders, such as anxiety disorders, specific phobias, Post Traumatic Stress Disorder (PTSD), schizophrenia, Obsessive-Compulsive Disorder (OCD), eating disorders and autism, and has shown promising results (Turner and Casey, 2014; Valmaggia et al., 2016; Maples-Keller et al., 2017). VR as a treatment in mental healthcare settings has the ability to include dynamic yet controlled multisensory interactive situations, as well as register and analyze users' behavioral responses. It therefore offers realistic situations, makes the treatment very personal through the adaptability of the VR-environment, motivates patients because it provides them with something new and different, and is a good tool for patients who have trouble with imagining or visualization (Riva, 2009; Maples-Keller et al., 2017). VR has the added benefit of facilitating learning, changing attitudes, and modifying behavior indirectly, as opposed to explicit interventions, where participants are directly given information and are aware of what is that they are learning. Thus, in this review we view VR interventions as implicit interventions.

VR has also been used in forensic settings. Forensic settings are defined, for the purpose of this paper, as correctional settings for people who have been accused of an offense. The characteristics of forensic mental healthcare patients (i.e., limited insight in their own health and diseases, not compliant to their treatment, heterogenous psychopathology and offending behavior, low levels of literacy, and low motivation for treatment) (Kip et al., 2020), make VR a potentially useful tool. Interactive, non-immersive, computerized case simulations have previously been explored in these settings and research has cautiously indicated that such programs may be beneficial (Arborelius et al., 2013; Kip et al., 2018; Sygel and Wallinius, 2021). However, immersive VR simulations can be an even bigger step forward for correctional rehabilitation (Ticknor, 2019). VR may facilitate treatment and reintegration of offenders into society through treatment of psychiatric disorders (e.g., using VR cognitive behavioral therapy), teaching necessary skills, providing feedback, and making virtual treatment groups possible (Sygel and Wallinius, 2021). Our aim with this paper is to see whether VR can also be an effective tool both in the prevention and treatment of IPV, within the perpetrators and the survivors. We want to find out whether the special benefits of VR produce a stronger effect than other types of interventions.

In the following pages we will review what has been done in terms of prevention and intervention of IPV in general. Regarding prevention, we will first review general interventions, followed by bystander interventions, and then delve into recent technological innovations in prevention. Shifting our focus to rehabilitation, we will explore interventions designed for both perpetrators and survivors separately, and end that section discussing technological advances in the treatment of IPV.

## 1.2 Prevention

### 1.2.1 General interventions for the prevention of IPV

Interventions for Intimate Partner Violence (IPV) have grown over the past 2 decades. In countries around the world, interventions for IPV have been developed and delivered with the goal of preventing or at least reducing the prevalence of this form of violence.

Existing robust programs address the acceptability of violence and simultaneously tackle the root causes of violence, which include societal norms related to gender dynamics, the acceptance of violence, and women's financial reliance on men. These programs, like "Stepping Stones", additionally teach participants a new set of skills, ranging from recognizing healthy relationships and employing conflict resolution techniques, to enhancing empathy, managing anger, making decisions, asserting oneself, improving communication skills, providing education about dating violence, and implementing strategies for emotional regulation (Arango et al., 2014; Ellsberg et al., 2018; Gibbs et al., 2020). These activities are mainly carried out in classrooms and hospitals, are either face-to-face and/or by computer, and include both individual and group formats. It is clear that programs involving multiple stakeholders have been proven to be the most effective ones. Other approaches focusing on changing norms have involved awareness-raising campaigns and small group workshops, often accompanied by community engagement activities, such as street theatre, posters, and behavior change and communication strategies (Heise, 2011).

Included within the prevention of IPV we find bystander interventions. The bystander approach suggests that individuals can intervene in public settings when observing situations involving interpersonal violence or sexual violence (Banyard et al., 2004; McMahan et al., 2011). Evaluations of bystander intervention programs in the literature largely focus on the issue of sexual violence but offer a foundation for the development of effective IPV-focused bystander programs, which have seen an increase in recent years (Park and Kim, 2023). Existing multiple programs have demonstrated long-term changes in men's attitudes and behavior, including decreases in rape myth acceptance and likelihood of raping, increases in empathy towards rape victims, increases in willingness to curtail sexist comments, and increases in the disposition to offer support to rape victims (Foubert, 2000; Banyard et al., 2007), as well as more willingness to intervene (Katz and Moore, 2013; McMahan et al., 2014).

### 1.2.2 Technological interventions for the prevention of IPV

With technological interventions being a focus on today's scientific climate, one wonders whether these kinds of interventions could also be used to target IPV. The term "mHealth", or mobile health, refers to the utilization of mobile phones or other wireless technology in providing medical care. Some programs using phone applications have been developed, which have shown a reduction in psychological and physical dating violence among college students (Glass et al., 2015). However, evidence for efficacy compared to conventional IPV prevention

approaches is limited (Martinez and Rey, 2014; Anderson et al., 2021).

Recent intervention programs have included non-immersive video simulations for IPV prevention, which have shown to be effective in improving relationship quality, reducing odds of perpetration, increasing bystander behavior, and recognizing signs of violence in non-violent population (Kleinsasser et al., 2015; Kearney, 2018; Peskin et al., 2019; Doss et al., 2020). A recent computerized program, designed for couples who had experienced violence, was delivered through the Web called WISER (Writing to Improve Selfin-Relations), which included videos of violent relationships and the writing of a story about the participants' own relationship. The intervention demonstrated to be feasible, decreased psychological and physical dating violence, increased constructive communication, and improved relationship satisfaction in men (Draucker et al., 2019).

These kinds of interventions tend to use a more active approach (i.e., those that engage the user), which some researchers have concluded are more effective than passive psychoeducation strategies (i.e., merely listening and receiving information) (Albarracin et al., 2005).

## 1.3 Rehabilitation

### 1.3.1 General interventions for the treatment of IPV—perpetrators

To address the issue of repeated intimate partner violence (IPV) by perpetrators, it is common for individuals who have been arrested for IPV to be mandated by the court to engage in batterer intervention programs (Stuart et al., 2007). The prevailing intervention model for IPV perpetrators in the USA is the “Duluth Model,” which aims to modify patriarchal and sexist beliefs that are believed to contribute to IPV perpetration (Pence and Paymar, 1993; Gondolf, 2007). Other interventions, including Cognitive Behavioral Therapy (CBT) groups have also been used to treat IPV perpetrators. In practice, most programs incorporate parts of both the Duluth Model and CBT programs (Babcock et al., 2004).

Moreover, it is thought that differentiating perpetrators by certain typology could help with the effectiveness of these programs. These programs usually focus on understanding gender roles, being more emotionally engaging, being less conflictual in friendships and intimate relationships and improving their economic position (Ellsberg et al., 2015). Research findings suggest that some subtypes, characterized by high levels of personality traits like borderline, avoidant, and antisocial tendencies, have poor outcomes in standard batterer interventions. Different subtypes exhibit varying success in completing treatment and avoiding further violence, with some being more likely to drop out of treatment and experience re-arrest following treatment (Holtzworth-Munroe and Meehan, 2000; Cantos et al., 2015). The findings emphasize the need to tailor interventions based on the specific subtype of batterer to improve treatment effectiveness. For example, Saunders (1996) analyzed data comparing cognitive-behavioral-feminist treatment with a new process-psychodynamic treatment. It was observed that batterers with high antisocial scores benefited more from structured cognitive-behavioral interventions, whereas those with high dependency scores showed better progress with the new intervention approach (Saunders, 1996). A more recent

study suggested a shift in approach emphasizing individualized interventions based on factors like demographics, perpetrator types, readiness to change, and co-occurring problems such as substance abuse and mental health issues. This personalized approach is crucial to enhance treatment efficacy and prevent further victimization (Butters et al., 2021).

To date, intervention programs developed to address IPV have been evaluated with mixed results. A meta-analytic review of domestic violence treatment by Babcock et al. (2004) found that current interventions, including those based on the Duluth model have minimal impact on reducing recidivism. The authors argued that these interventions should not simply be abandoned but suggested that, as no one treatment method was proven superior to the others, further research should be conducted and components should be added to the existing interventions, which could also be individualized for specific patients (Babcock et al., 2004).

### 1.3.2 General interventions for treatment of IPV experience—survivors

When talking about treatment of IPV, we do not only focus on reducing perpetrators' violent behavior, but also on helping survivors deal with the consequences of an abusive relationship and reducing their risk of suffering violence again. Previous research has indicated that both empowerment-based advocacy and cognitively focused clinical interventions demonstrate positive physical and mental health changes. Specifically, the interventions for survivors include improving problem-solving strategies, decision-making, and changing the survivor's distorted self-thinking and self-perception (Trabold et al., 2018).

### 1.3.3 Technological interventions for treatment of IPV

Realistic computer simulations not only have potential for the prevention of IPV as previously mentioned, but also for the rehabilitation of IPV offenders, as it can help activate, motivate, and emotionally engage users. This contributes to the possibility of building knowledge, better understanding of the simulated experience, better confidence in one's own ability to solve problems, and better memory (Courteille et al., 2008; Botezatu et al., 2010; Pantziaras et al., 2012). A study in 2014 used computerized case simulation for the treatment of men convicted of IPV, and found beneficial results (Sygel et al., 2014) for the rehabilitation of offenders. Simulations also have the amazing ability of creating potential for instruction, by creating a realistic world in which the user can be exposed to different contextual factors and practice behaviors which would be too dangerous or rare to practice in real life (Bell et al., 2008).

There is currently limited evidence regarding VR or immersive computerized simulation interventions for either the prevention or rehabilitation of IPV. However, some studies do exist. The goal of this review is to shed light on those studies and see whether they could be a strong option for tackling the current IPV issue. VR interventions have the benefit of being able to adapt to specific people, therefore providing a much-needed cost-effective individualized treatment. Moreover, VR has the added value of embodiment (i.e., feeling like you are part of a different body) through an avatar, which can induce different emotions, and could thus have a greater impact on the user (Slater and Sanchez-Vives, 2016).

## 2 Materials and methods

The systematic review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, PRISMA guidelines.

### 2.1 Search strategy

In order to evaluate which effective VR interventions exist for the prevention and rehabilitation of IPV, we established the search terms with the highest number of possible synonyms. The general search expression was (“Intimate partner violence (MeSH)” OR “Dating violence (MeSH)” OR “Spouse abuse (MeSH)” OR “Intimate partner abuse (MeSH)” OR “Domestic violence” OR “gender violence” OR “IPV”) AND (“Virtual Reality (MeSH)” OR “Virtual Reality, Educational (MeSH)” OR “Educational Virtual Realities (MeSH)” OR “Educational Virtual Reality (MeSH)” OR “Virtual Reality Immersion Therapy (MeSH)” OR “Virtual Reality Therapy (MeSH)” OR “Reality Therapies, Virtual (MeSH)” OR “Reality Therapy, Virtual (MeSH)” OR “Therapies, Virtual Reality (MeSH)” OR “Therapy, Virtual Reality (MeSH)” OR “Virtual Reality Therapies (MeSH)” OR “Virtual reality intervention” OR “VR intervention” OR “360 video”).

The search used several databases: PsycINFO by EBSCOHost, and Medline by PubMed. The specific syntaxes for the databases are in [Supplementary Appendix S1](#).

Lastly, we reviewed the references in the selected studies in order to identify potential studies of interest that were missed during the database search, but no new ones were found.

### 2.2 Inclusion criteria and selection process of the studies

Inclusion criteria for the current review were the following a) Participants must be over 14 years old; b) The study must be published in English, Spanish or Catalan; c) The study must have an experimental or quasi-experimental design d) The study must evaluate the effectiveness of VR interventions for the prevention or rehabilitation of IPV; e) The study must have been published after 2010, and f) the study must have used VR. Exclusion criteria included studies with participants under 14 years old, reviews, observations, single case studies, and studies with non-immersive videos. Location or sample size were not part of the exclusion criteria.

The selection process was carried out by the author of the review, doing a first selection based on the title and abstract of the studies and the final selection based on the full text of some studies and of those that did not give enough information in their title or abstract.

### 2.3 Data extraction

A data extraction protocol was designed for the selected studies. The registered information was the following: authors, publication year, research design, demographic characteristics of the target population (forensic or community, gender, age, and sexual orientation when available), number of participants, type of

outcome, instruments that were used to analyze the main study variables, type of intervention (prevention, early intervention, or rehabilitation), conclusions, length of treatment with VR, length of control group intervention, and type of control group (waitlist, active, or delayed). Data extraction was carried out by the author.

### 2.4 Bias risk assessment

The risk of bias of the included articles in the review was evaluated by the author of the review applying the checklists recommended by The Joanna Briggs Institute (JBI) for Randomized Controlled Trials (RCT) and Quasi-Experiments ([Table 1](#) and [Table 2](#)).

### 2.5 Data analysis strategy

A narrative summary of the results was carried out of the studies regarding the effectiveness of VR or other interactive interventions for the prevention and rehabilitation of IPV. The main effectiveness results and conclusions were shown in a table, and future research opportunities were discussed.

## 3 Results

[Figure 1](#) summarizes the complete search and selection process of the current review.

Starting with the 126 studies initially located with the search engines, 12 were removed for being duplicated, and therefore 114 studies were left. After a quick view, 71 studies were removed for various reasons (mainly due to lack of relevance to the study topic). Careful reading of the remaining 43 studies was carried out. Out of these 43 studies left, 31 were excluded because they were not intervention studies, and 1 because it was a qualitative study, therefore not meeting an inclusion criterion. Instead, they were observations of the issue or reviews. Lastly, 1 study had to be excluded because we could not find the full article ([Wu and Chen, 2022](#)), and therefore could not include it in the review. Finally, 11 studies met all of the eligibility criteria and were included in the review.

Results are represented in three different tables. In [Table 3](#), relevant information of the review is represented (i.e., Study’s research design, Type of study population—forensic or community, Number of participants, Age range of participants, Gender of participants, Type of outcome, Measures/Instruments used, Conclusions, Type of intervention, Length of treatment with VR, Length of control group intervention, Type of control group). Overall, studies represent 539 participants of a wide range of ages (i.e., university students, high school students, students, and participants in community ranging from 14 to 63 years old). 8 of the 11 studies recruited participants from the community, while 3 focused on offenders. Moreover, none of the studies directly stated or asked for participants’ sexual orientation, although heterosexuality can be assumed by having male participants watch female victim avatars. In regards to gender, six studies recruited only male participants, two studies only female participants, and two studies recruited both males

TABLE 1 Bias risk assessment for RCTs.

Study	True randomization?	Allocation concealed?	Treatment groups similar at baseline?	Participants blind to treatment assignment?	Those delivering treatment blind to treatment assignment?	Outcomes assessors blind to treatment assignment?	Treatment groups treated identically?	Differences between groups in terms of their follow up described and analyzed?	Participants analyzed in the groups to which they are randomized?	Outcomes measured in the same way for treatment?	Outcomes measured in a reliable way?	Appropriate statistical analyses used?	Trial design appropriate, and any deviations from the standard RCT design?
Rowe et al. (2015)	Yes	Yes	Yes	No	No	?	No	Yes	Most did (6% not)	Yes	Yes	Yes	Yes
Lee and Cha (2021)	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Klein Tuente et al. (2020)	Yes	Yes	Yes	Yes, at baseline	No	Some	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rawski et al. (2022)	Yes	Yes	Yes	No	No	No	No	NA	Yes	Yes	Yes	Yes	Yes
Gonzalez-Liencrees et als (2020)	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Neyret et al. (2020)	Yes	Yes	Not entirely (more controls knew about Miligran exp)	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

and females. One study did not specify the gender of the participants, but they did state they were recruiting offenders from a forensic center (Klein Tuente et al., 2020).

In terms of gender effects on outcome, working with male patients/female patients (i.e., previous experience with IPV) cannot be compared, since for the studies recruiting forensic participants, only men were recruited as offenders, not women. Women “patients” (i.e., having experienced IPV) were recruited for studies with survivors, which did not include any men.

Regarding male or female non-clinical participants (i.e., community, no previous experience in IPV), gender differences were not analyzed in either of the studies (De Borst et al., 2020; Rawski et al., 2022). However, in De Borst et al. (2020), it is stated that it could be interesting to investigate whether for female participants it is easier to place themselves in the victims’ shoes than for the male participants.

In terms of the measures being used, three studies included a measure of intimate partner violence (both physical or psychological) or aggression (Rowe et al., 2015; Klein Tuente et al., 2020; Seinfeld et al., 2020). It is important to note that all three studies had a slightly different focus. The first two studies focused specifically on the prevention of dating violence targeted towards community participants. However, the interventions used VR differently. While Seinfeld et al. (2020) focused on exploring the brain responses, aggressive behaviors and attitudes of male college students with low sensitivity to recognize female fearful faces, Rowe et al. (2015) focused on increasing assertive behaviors from teenage girls. Lastly, Klein Tuente et al. (2020) focused on the rehabilitation of offenders directly targeting aggressive behavior. While the reduction of aggressive behavior is a common goal in all IPV rehabilitation (i.e., treatment) studies, some assessed it using more indirect measures. VR offers the opportunity to literally feel like you are in someone else’s shoes, so these latter studies targeted empathy, perspective taking, and emotion recognition, a common practice within IPV, since these constructs are indirectly linked to aggressive behavior. Three rehabilitation studies (Seinfeld et al., 2018; Gonzalez-Liencrees et al., 2020; Seinfeld et al., 2023) and three prevention studies (De Borst et al., 2020; Seinfeld et al., 2020; Ventura et al., 2021) have included these measures through interventions using embodiment of a female victim. Lastly et al., 2020 used VR in order to measure if prior embodiment with the victim of a sexual harassment situation could modify conformity when administering shocks to a woman. According to the authors, this could suggest that body ownership over a virtual body introduces another level of psychological proximity which contributes to the concept of shared identity (Neyret et al., 2020). The more we relate to someone, the more willing we are to help them (Levine et al., 2005; Slater et al., 2013).

In terms of the type of intervention, seven studies focused on prevention, and five studies focused on rehabilitation. While most prevention studies focused on increasing assertiveness skills and empathy to prevent being the victim or the offender of IPV or sexual harassment (Ventura et al., 2021; Rowe et al., 2015; De Borst et al., 2020), one study sought to help reduce sexual harassment by training bystanders (Rawski et al., 2022), and another one focused on trying to explore group aggression and bystander behavior through embodiment with a victim of sexual harassment (Neyret et al., 2020). Regarding rehabilitation studies, most were done with the purpose of reducing offenders’ risk of IPV or aggressive behavior (Seinfeld et al., 2018; Gonzalez-Liencrees et al., 2020; Klein Tuente et al., 2020; Seinfeld et al., 2023), while one study

TABLE 2 Bias risk assessment for quasi-experiments.

Study	Is it clear what is the "cause" and what is the "effect"?	Similar participants	Similar treatment other than intervention of interest	Control group?	Multiple measurements of the outcome both pre and post the intervention	Follow up complete, or differences between groups described and analyzed	Outcomes of participants included in any comparisons measured in the same way	Outcomes measured in a reliable way	Appropriate statistical analyses used
Seinfeld et al. (2020)	Yes	Yes	Yes	No	Yes	NA	Yes	Yes	Yes
Seinfeld et al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seinfeld et al. (2023)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ventura et al. (2021)	Yes	Yes	Yes	No	Yes	NA	Yes	Yes	Yes
De Borst et al. (2020)	Yes	Yes	Yes	No	Yes	NA	Yes	Yes	Yes

focused on the rehabilitation of sexual violence survivors (Lee and Cha, 2021).

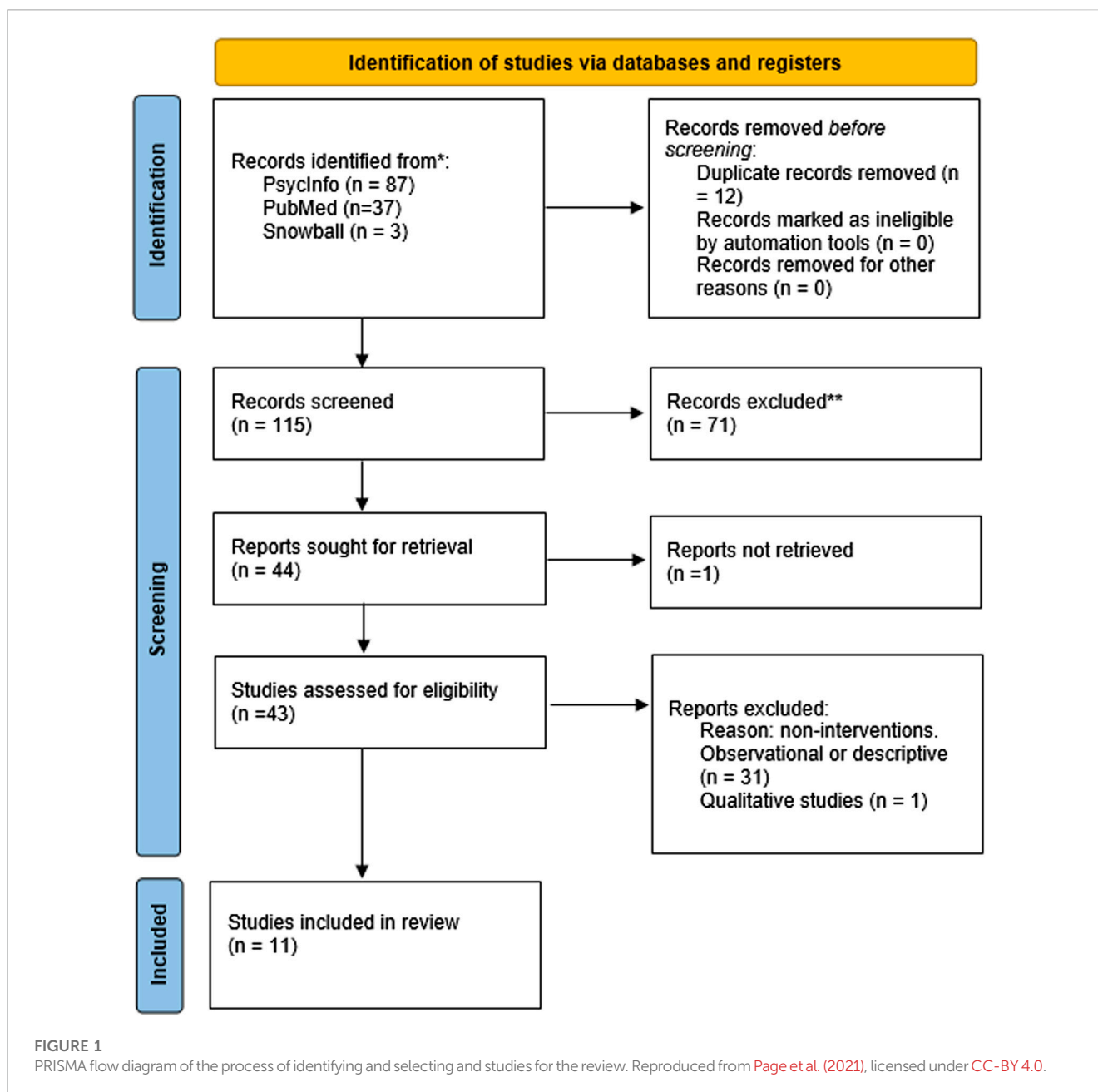
Regarding types of participants, the studies could be divided into either community (i.e., with no prior history of perpetuating IPV) (eight studies) or forensic (i.e., participants with history of perpetuating IPV—offenders) (three studies). Among those who had recruited participants from the community, one study specifically recruited women who had been survivors of IPV (“Community (survivors)” on the table). Among those who had recruited offenders, one study specifically recruited men who were inpatients at the time of the study, while the other two recruited men who were convicted and sentenced to attend a domestic violence intervention program. Regarding VR treatment length, most studies included a single VR session, where participants embodied an avatar for a few minutes and experiencing an IPV scene as a victim through the eyes of the avatar (Seinfeld et al., 2020; Gonzalez-Liencrees et al., 2020; Seinfeld et al., 2018; Seinfeld et al., 2023; Ventura et al., 2021, De Borst et al., 2020). In Rawski et al., 2022 one short training session was also used, but participants watched the situation as a bystander. Additionally, in Neyret et al., 2020, participants encountered a different VR scenario in two different days, one in which they were either a woman victim of sexual harassment, or part of a group of men who were perpetrating the harassment, and the other virtual environment where they had to decide whether to obey the virtual experimenter’s orders of shocking a woman for getting answers wrong. On the other hand, in Klein Tuenté et al., 2020, participants had several sessions and VR was used as a way for them to learn new social skills. The environment and interactions were controlled by the therapist, so treatment was more personalized than in other studies. Similarly, in Lee and Cha, 2021, VR was used as a way of delivering meditation exercises also during several weeks.

## 4 Discussion and conclusion

Focusing on the question at hand (i.e., which effective VR interventions exist for the prevention and rehabilitation of IPV), we can extract several conclusions from the analyzed studies.

### 4.1 VR and empathy

First, virtually experiencing a domestic violence situation from the perspective of the victim can result in an enhancement of fear recognition in female faces, both in forensic and in community population (Seinfeld et al., 2018; Seinfeld et al., 2020). Moreover, this type of experience is able to physically change brain areas that are related to socio-cognitive processing and to the perception of emotional expressions (Seinfeld et al., 2018; Seinfeld et al., 2020; De Borst et al., 2020). Thus, VR could be a useful tool to increase empathy in those who might have it underdeveloped, and therefore reduce intimate partner violence. Moreover, the effect of perspective taking and identification with the victim is more easily achieved if the participant directly embodies the victim from first-person perspective than if they are merely observing the scene as a third-person (Gonzalez-Liencrees et al., 2020). However, third-person perspective can still have an effect as well, especially if



participants are indirectly affected by the violence even if it is not directly targeted at them. In fact, when participants embody a child that is put in a situation of abuse and violence from the father avatar to the mother avatar, where they are standing next to the mother, there is an increase in emotion recognition of angry faces and physiological reactions (Seinfeld et al., 2023). Emotion recognition outcomes are important as they can increase the ability to empathize with the victim and therefore decrease perpetration. The effect that VR has on the increasing empathy and perspective taking is higher than simply reading about a situation and imagining it is happening to them (Ventura et al., 2021). VR has also been used to attempt to change implicit gender bias, with participants embodying a gender different than their own and experiencing sexual harassment, and has shown promising results (Wu and Chen, 2022).

## 4.2 VR and aggressive behavior

While the positive effect of VR in perspective taking, emotion recognition and identification with the victim is clear, evidence is mixed regarding a decrease on actual aggressive behavior. A study by Klein Tuente et al. showed that self-reported or observed aggressive behavior did not significantly decrease with VR compared to a control group. Moreover, while VR does seem to decrease hostility, anger control, and non-planning impulsiveness, these effects are not maintained in time (Klein Tuente et al., 2020; Neyret et al., 2020) suggested that by allowing participants to take part in being a woman victim of sexual harassment by a group of men, and then being asked by a group of men to harm another woman, they could psychologically identify with the woman, become aware of the

TABLE 3 Main results.

Title	Authors	Type of participants	N	Age range	Gender	Sexual orientation	Type of outcome	Main conclusions	Type of intervention
Being the victim of virtual abuse changes default mode network responses to emotional expressions	Seinfeld et al. (2020)	Community	14	Mean: 20 (college students)	Males (M)	N/S (not specified)	Fear face recognition, brain responses, empathy, aggressiveness (physical, verbal, anger, and hostility), participants' opinion of VR	Virtually experiencing a domestic violence situation from the perspective of the victim has an impact on brain areas related to socio-cognitive processing and to the perception of emotional expressions	Prevention
Reducing sexual victimization among adolescent girls: A randomized controlled pilot trial of My Voice, My Choice	Rowe et al. (2015)	Community	83	14–18. Mean: 15.63 (high school students)	Females (F)	N/S	Dating violence (sexual, relational, verbal-emotional, physical, and threats)	Teaching adolescent girls how to assertively resist unwanted sexual in an IVE, can reduce risk of sexual victimization for a 3-month period following the intervention	Prevention (victimization)
Being the Victim of Intimate Partner Violence in Virtual Reality: First-Versus Third-Person Perspective	Gonzalez-Liencres et al. (2020)	Community	27	18–64. Mean first-person group: 31.8. Mean third-person group: 31.36	M	NS. Probably Heterosexual (watched female's avatar)	1) Perspective taking, 2) identification with the victim	The potential for batterer rehabilitation originates from presence and identification with the victim, which in turn is more easily, but not exclusively, achieved through 1PP	Rehabilitation
Offenders become the victim in virtual reality: impact of changing perspective in domestic violence	Seinfeld et al. (2018)	Forensic	39	21–61. Mean experiment group: 38.75 Mean control group: 35.95	M	N/S	Emotion recognition, social desirability, empathy, asses VR experience	Experiencing a virtual situation of domestic abuse from the perspective of the victim can result in an enhancement of fear recognition by the offenders	Rehabilitation (offenders)
Domestic Violence From a Child Perspective: Impact of an Immersive Virtual Reality Experience on Men With a History of Intimate Partner Violent Behavior	Seinfeld et al. (2023)	Forensic	50	24–63	M	Heterosexual	Emotion recognition, physiological reactions (heart rate deceleration), assess perceptions of VR experience, social desirability	Embodiment from a child's perspective impacts the recognition of angry facial expressions. Also, males with a history of partner aggression have larger physiological responses during an explicit violent event (when the virtual abuser threw a telephone) compared with controls, while their physiological reactions are less pronounced when the virtual abuser invaded the victim's personal space	Rehabilitation (offenders)
How Does It Feel to Be a Woman Victim of Sexual Harassment? The Effect of 360°-Video-Based Virtual Reality on Empathy and Related Variables	Ventura et al. (2021)	Community	44	Mean: 26.2	M	N/S	Empathy and related concepts to reduce Sexual Harassment	There is a superiority of the 360°-video experience over the narrative in increasing empathy, sense of oneness, and perspective taking toward a female victim of Sexual Harassment	Prevention
A Mobile Healing Program Using Virtual Reality for Sexual Violence Survivors: A Randomized Controlled Pilot Study	Lee and Cha (2021)	Community (survivors)	34	18–24	F	N/S	Social support, negative impact of sexual violence on survivors, suicidal ideation	Significant improvements were found among participants in the areas of perceived support, negative impact from sexual violence, and suicidal ideation	Rehabilitation (survivors)
Virtual Reality Aggression Prevention Therapy (VRAPT) versus Waiting List Control for Forensic Psychiatric Inpatients: A Multicenter Randomized Controlled Trial	Klein Tuente et al. (2020)	Forensic	128	Mean treatment group: 39.4 Mean control group: 38	N/S	N/S	Aggression, social dysfunction, impulsivity, hostility, anger, type of aggression, and hostile attribution bias	Compared to waiting list, VRAPT did not significantly decrease in self-reported or observed aggressive behavior (primary outcomes). Hostility, anger control, and non-planning impulsiveness improved	Rehabilitation (offenders)

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TABLE 3 (Continued) Main results.

Title	Authors	Type of participants	N	Age range	Gender	Sexual orientation	Type of outcome	Main conclusions	Type of intervention
								significantly in the VRAPT group compared to the control group at post-treatment. Improvements were not maintained at 3-month follow-up. Results suggest that VRAPT does not decrease aggressive behavior in forensic inpatients. However, there are indications that VRAPT temporarily influences anger control skills, impulsivity and hostility	
First-Person Virtual Embodiment Modulates the Cortical Network that Encodes the Bodily Self and Its Surrounding Space during the Experience of Domestic Violence	De Borst et al. (2020)	Community	20	18–28	All	N/S	Identification with the victim, embodiment, and brain activity associated with the monitoring of the body and surrounding space and the experience of threat	1PP embodiment training enhances experience from the viewpoint of the virtual victim, which is accompanied by synchronization in the fronto-parietal network to predict actions toward the body, and in the AMG to signal the proximity of the stimulus	Prevention
Sexual harassment bystander training effectiveness: Experimentally comparing 2D video to virtual reality practice	Rawski et al. (2022)	Community	100	Mean: 27.83	All	N/S	Indicators of training effectiveness: (1) motivation to learn, (2) practice quantity, (3) negative attitudes toward training, (4) training-related knowledge, and (5) intentions to engage in bystander interventions in response to future SH incidents. Response options: (I) Intervene - causing a distraction or removing the target from the situation, (D) Direct—confronting the harasser and telling them to stop, (E) Elevate - formally reporting the harassment to an authority figure, (A) Approach - offering social support to the target after the incident	Individuals are equally motivated to learn, accumulate equal knowledge, and exhibit equal levels of backlash attitudes in both the VR and 2D conditions. However, VR practice that follows the content of a 2D video training program increases informal, nonconfrontational, and widely applicable bystander response options (i.e., Intervene and Approach responses) that represent lower social risk for bystanders while still supporting targets of harassment	Prevention (Bystanders)
An Embodied Perspective as a Victim of Sexual Harassment in Virtual Reality Reduces Action Conformity in a Later Milgram Obedience Scenario	Neyret et al. (2020)	Community	60	Mean: 24.6	Male	N/S	Conformity and aggression in Milgram Scenario (number of shocks administered), Heart rate, body ownership	Those who had been embodied as a woman victim in a sexual harassment scene gave about half the number of shocks than those who had embodied a man who belonged to a group of men that were perpetrating sexual harassment	Prevention
Title	Authors	Instruments	Technological devices		Length of treatment with VR	Length of control group intervention	Type of control group		
Being the victim of virtual abuse changes default mode network responses to emotional expressions	Seinfeld et al. (2020)	Neuroimage (fMRI scan) Self-report Questionnaires (Karolinska Directed Emotional Faces inventory, Interpersonal Reactivity Index, Buss-Perry	Head mounted display (Oculus Rift DK2)		Single VR session - Less than 30 min (unclear how long the scene was)	N/A	N/A		

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TABLE 3 (Continued) Main results.

Title	Authors	Instruments	Technological devices	Length of treatment with VR	Length of control group intervention	Type of control group
		Aggressiveness Questionnaire, and a VR questionnaire to assess participants' opinion about different aspects of the virtual experience)				
Reducing sexual victimization among adolescent girls: A randomized controlled pilot trial of My Voice, My Choice	Rowe et al. (2015)	Self-report Questionnaires (Conflict in Adolescent Dating Relationships Inventory (CADRI), Trauma Symptom Checklist, Participant Satisfaction and Engagement in MVMC, and intervention fidelity)	VR Headset (unspecified)	Single 90 min group session (30 min with facilitators, 60 min practical part with VR simulations, that were 2–3 min long each)	N/A	Waitlist
Being the Victim of Intimate Partner Violence in Virtual Reality: First-Versus Person Perspective	Gonzalez-Liencre et al. (2020)	Observation (Video of participants during VR experience) Physiological responses (ECG, GSR) Self-report Questionnaire (VR experience) Interview (VR experience) Implicit Association Test	Head mounted display (NVIS nVisor SX111)	Single VR session in 1pp (first-person perspective) IPV scene: 3 min, prior to that, about 1 min for participants to get accustomed to VR.	Same as treatment group, in 3pp	Active
Offenders become the victim in virtual reality: impact of changing perspective in domestic violence	Seinfeld et al. (2018)	Emotion recognition (Face-Body Compound emotion recognition test) Self-report Questionnaires (Interpersonal Reactivity Index - IRI, VR experience)	Head mounted display (not specified in article but likely same as Seinfeld et al. (2020)—Oculus Rift DK2)	Single VR session: IPV scene: 3:20 min. Prior to that, 2 min to get accustomed to VR	Same as treatment group, but with non-offenders	Active
Domestic Violence From a Child Perspective: Impact of an Immersive Virtual Reality Experience on Men With a History of Intimate Partner Violent Behavior	Seinfeld et al., et al. (2023)	Emotion recognition (Face-Body Compound emotion recognition test), physiological reactions (heart rate deceleration) Self-report Questionnaires (VR experience, social desirability, IRI)	Head mounted display (not specified in article but likely same as Seinfeld et al. (2020)—Oculus Rift DK2) Full-body tracking suit	Single VR session: IPV scene: 2:30 min, and 2:30 min to get accustomed to VR	Same as treatment group, but with non-offenders	Active
How Does It Feel to Be a Woman Victim of Sexual Harassment? The Effect of 360°-Video-Based Virtual Reality on Empathy and Related Variables	Ventura et al. (2021)	Self-report Questionnaires (Machismo and Caballerismo scale, IRI, Toronto Alexithymia scale, Social Desirability scale, Empathy scale, Attitude toward Gender-based Violence scale, Inclusion of Other in Self Scale, Perspective-taking scale)	VR GLASS FOV: 120° on an iPhone 6 with the VR option	Single VR session: Length not specified in text, but short IPV scenarios, similar to above studies	N/A	N/A
A Mobile Healing Program Using Virtual Reality for Sexual Violence Survivors: A Randomized Controlled Pilot Study	Lee and Cha (2021)	Self-report Questionnaires (Korean version of Perceived Social Support Scale, Long term negative impact of sexual violence to adolescents, Korean version of the Suicidal Ideation questionnaire)	Portable 6.5 cm × 6.5 cm × 4 cm reflection pyramid with adhesive rubber feet that created a holographic effect with mobile phones	4 weeks intervention. 3D hologram guiding a meditation, including reflective writing and listening to survival stories on their smartphones twice a week. 15–20 min each meditation	Same as treatment group, but received a link with an audio-guided meditation instead	Active

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TABLE 3 (Continued) Main results.

Title	Authors	Instruments	Technological devices	Length of treatment with VR	Length of control group intervention	Type of control group
Virtual Reality Aggression Prevention Therapy (VRAPT) <i>versus</i> Waiting List Control for Forensic Psychiatric Inpatients: A Multicenter Randomized Controlled Trial	Klein Tuente et al. (2020)	Observation (Social Dysfunction and Aggression Scale completed by staff)_ZSelf-report Questionnaires (Aggression Questionnaire-AVL, Barratt Impulsiveness Scale, Buss-Durkee Hostility Inventory-Dutch, Novaco Anger Scale and Provocation Inventory, State-Trait  Anger Expression Inventory-2, Reactive-Proactive Questionnaire Hostile Interpretation Bias Task Physiological responses (HR and GSR)	Head mounted display (Oculus Rift 2)	16 individual biweekly sessions that lasted on average 1 hour, including short review of the previous session, clarification of a step of the Social Information Processing model, VR exercise, and discussing the VR exercise	N/A	Waitlist
First-Person Virtual Embodiment Modulates the Cortical Network that Encodes the Bodily Self and Its Surrounding Space during the Experience of Domestic Violence	De Borst et al. (2020)	Neuroimaging (fMRI) Questionnaires (VR experience)	Head mounted display (Oculus Rift DK2)	Two VR sessions 1 week apart: 1pp and 3pp - two auditory stimuli of 2:08 min each of with instructions to follow in VR, - IPV scene: 2:37 min	N/A	N/A
Sexual harassment bystander training effectiveness: Experimentally comparing 2D video to virtual reality practice	Rawski et al. (2022)	Practice Quantity Questionnaires (Motivation to learn, Knowledge of sexual harassment and bystander intervention, Negative attitudes against sexual harassment, Bystander response intentions)	Google Cardboard VR viewer on participants' personal smartphone	Single VR session: Sexual Harassment scene: 11s + bystander IDEA response (for participants to choose) average video length 28.4s = 39.4s 10 min instructional video of how to use VR	Same as treatment, but in video format and without the 10 min instructional video	Active
An Embodied Perspective as a Victim of Sexual Harassment in Virtual Reality Reduces Action Conformity in a Later Milgram Obedience Scenario	Neyret et al. (2020)	Body tracking via Optitrack motion capture system, head and hand movements via HTC Vive 'Lighthouse' base stations, ECG signal Questionnaires (Demographics questionnaire, NEO-FFI, Spanish Adaptation of the Illinois Sexual Harassment Myth Acceptance questionnaire, Sexual Harassment Attitude Scale, Autonomic Perception Questionnaire -APQ)	Vive head-mounted-display (HMD) made by HTC	- initial adaptation: 150s in each session in an empty bar - 1 VR session of SH (phase 1 and 2—answering questionnaires orally), 1 week later VR session of Milgram experiment (shock session)	Control group: same procedure, but only experienced empty bar for 150 s, not SH harassment scenes. Milgram experiment stayed the same 1 week later	

illegitimacy of the behavior of the perpetrators of sexual harassment, and thus avoid doing such behavior.

### 4.3 VR and assertiveness

VR is a useful tool to train individuals to act more assertively in situations of sexual violence, reducing the risk of sexual victimization, psychological victimization, and psychological distress (Rowe et al., 2015). However, no significant reduction of risk was observed for physical violence or threats. Future studies could expand this finding and apply VR to reduce other kinds of violence.

### 4.4 VR and bystander behavior

Regarding the effect of VR in bystander behavior, participants in the VR group were more likely than the video group to report intentions to engage in indirect, non-confrontational interventions, such as “intervening” (i.e., causing a distraction or removing the target from the situation), or “approaching” (i.e., offering social support to the target after the incident) (Rawski et al., 2022). In fact, a recent review by Park and Kim (2023) concluded that traditional offline methods, VR, and web-based methods significantly improved bystander outcomes (i.e., awareness, definition, responsibility, bystander efficacy, gender norms/attitudes, intention to intervene, and action to intervene), while videos did not.

### 4.5 Implications and future directions

There are several implications to this review.

First, studies that focused on rehabilitation interventions in the forensic context have shown that VR could be a potential tool to reduce recidivism by increasing empathy within the forensic population (Seinfeld et al., 2018; Gonzalez-Liencrea et al., 2020; Seinfeld et al., 2018; Seinfeld et al., 2023; Ventura et al., 2021; De Borst et al., 2020). However, we would need future longitudinal studies following the forensic population to see whether these interventions directly have an effect on recidivism. Furthermore, it is important to mention the difficulty of running interventions within rehabilitation programs within the forensic setting, which is one explanation for the short number of articles found. Participants in most rehabilitation interventions included in this review are forensic population, that are usually in prison and difficult to be motivated to do the intervention voluntarily. Therefore, those participants typically want to be part of the rehabilitation program in general, and more specifically do the VR intervention, to show an improvement in their behavior and rehabilitation and thus, to obtain prison benefits (e.g., permission to go out). As such, this population tends to rate high on social desirability, reducing the reliability of the studies. In treating this kind of population, indirect interventions such as the VR we have seen in this review, become even more advantageous (Sanz Fernández et al., 2018; Seinfeld et al., 2018; Johnston, 2021). Future research should include more VR interventions in the context of rehabilitation

programs in the community setting to be able to compare its impact in the community vs. in a forensic setting.

Second, in this review we have seen how different usages of VR can be advantageous for specific population groups. Specifically, using VR as a prevention tool has proven to be effective with young adults (Rowe et al., 2015; Neyret et al., 2020; Seinfeld et al., 2020; Lee and Cha, 2021; Rawski et al., 2022). Institutions could benefit from using VR in educational settings in order to reduce psychological violence (increasing empathy), prevent victimization (assertiveness training), decrease sexual harassment, and increase bystander behavior.

Third, studies mentioned in this review have shown that VR can change implicit gender bias (Wu and Chen, 2022). This is a crucial result to design interventions that would tackle gender stereotypes and promote gender equality. More studies are needed that use VR to change implicit gender bias. It is important that those studies include both genders in order to be able to detect the impact of the intervention and possible gender differences. Similarly, only men were recruited as offenders when applying the intervention with forensic participants, and only women for studies with survivors. Future research should attempt to recruit both genders for studies with offenders and with survivors in order to assess any gender differences.

Fourth, and along the same lines, studies should aim at being more diverse, especially in terms of sexual orientation. Future research should take sexual orientation into account, include participants who are homosexual and bisexual, and study the impact of the intervention and possible sexual orientation differences.

Fifth, while quantitative studies inform us of the results in a general sense, future research should also include qualitative studies to be able to specifically see the impact of VR on an individual level, and thus have a more comprehensive idea of the effect of VR on IPV. Along the same lines, it is crucial to include behavioral changes measures to assess reduction in violent behavior (in terms of both aggression and victimization).

Lastly, both the context and the duration of the VR intervention are important factors to consider, as they might have an impact on the final results. In regards to the context, we would need to see whether the intervention mainly only uses VR, or if it is included in a longer/more comprehensive intervention in the context of a rehabilitation or prevention program. In terms of the duration of the VR intervention, we have to consider whether it is a one-off intervention lasting a few hours or whether it is a longer intervention, spanning multiple days. Future research should include longer interventions to obtain a higher effect, as well as tailor them to specific target groups, according to the results found in Klein Tuente et al. (2020).

A similar narrative review by Johnston et al. (2023) was recently published about this topic, focusing on the effectiveness of embodiment and perspective taking in general, and more specifically in IPV. Johnston et al. (2023) concluded that the integration of validated VR embodiment technology inspired by neuroscience could positively contribute to IPV rehabilitation processes. Our present study has built on the result of Johnston et al. (2023) by conducting a systematic review to analyze the studies that have used VR in the context of IPV. Both Johnston et al. (2023)'s

study and the present study give a comprehensive understanding of the use of VR in contexts of IPV.

## 4.6 Conclusion

Overall, there are few interventions using VR to tackle the prevention or rehabilitation of IPV, and many still use more traditional approaches. The specific strategies and content used to reduce IPV is different in VR compared with more traditional IPV interventions. As mentioned previously, in most VR interventions the main focus was more on indirectly changing attitudes and enhancing emotional recognition by experiencing being a victim themselves, or part of an abusive scene, through embodiment (i.e., implicit interventions) (Seinfeld et al., 2018; Gonzalez-Liencrez et al., 2020; Neyret et al., 2020; Seinfeld et al., 2023; Ventura et al., 2021; De Borst et al., 2020).

In contrast, as mentioned in the introduction, most of the traditional interventions or online programs, were focused on directly training participants on the identification of healthy relationships, and on the development of techniques of conflict resolution, empathy, anger management, making decisions, assertiveness, communication skills, psychoeducation about dating violence and emotion regulation strategies (i.e., explicit interventions) (Arango et al., 2014; Sygel et al., 2014; Levesque et al., 2016; Ellsberg et al., 2018; Kearney, 2018; Draucker et al., 2019; Peskin et al., 2019; Doss et al., 2020; Gibbs et al., 2020). Specifically, some of these studies that do not use VR are still using technology, showing several videos (mostly as part of a broader online or computer program) in order to model behavior, train perspective taking, or educate participants in what should not be done (Sygel et al., 2014; Levesque et al., 2016; Kearney, 2018; Draucker et al., 2019; Peskin et al., 2019; Doss et al., 2020). These technological interventions have overall proven more useful to tackle intimate partner violence than traditional non-technological educational interventions, although the effects have mostly been seen as a reduction of psychological violence, and not physical violence (Sygel et al., 2014; Levesque et al., 2016; Kearney, 2018; Draucker et al., 2019; Peskin et al., 2019; Doss et al., 2020).

However, although these programs have effect sizes similar to VR interventions (Sygel et al., 2014; Rowe et al., 2015; Levesque et al., 2016; Kearney, 2018; Seinfeld et al., 2018; Draucker et al., 2019; Peskin et al., 2019; Doss et al., 2020; Gonzalez-Liencrez et al., 2020; Klein Tunte et al., 2020; De Borst et al., 2020; Seinfeld et al., 2020; Lee and Cha, 2021; Ventura et al., 2021; Rawski et al., 2022; Seinfeld et al., 2023), future research

should evaluate whether the immersive aspect of VR, and more specifically the increased outcomes of perspective taking achieved with embodiment, has a significant added value in reducing aggressive behavior compared to those more traditional non-immersive video programs by comparing them in equal conditions.

## Author contributions

AB-A: Conceptualization, Investigation, Writing—original draft, Writing—review and editing. BV: Conceptualization, Methodology, Writing—review and editing. CP-T: Writing—review and editing. J-ML: Writing—review and editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frvir.2023.1263545/full#supplementary-material>

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