Effectiveness of virtual reality interventions to reduce pre-operative anxiety in adult surgical patients in the pre-operative period: Systematic review and meta-analysis

Supplement 1: Methodological quality of included randomised controlled trials

Author (year)	Was true randomisation used for assignment of participants to treatment groups? **Q1**	Was allocation to treatment groups concealed? **Q2**	Were treatment groups similar at the baseline? **Q3**	Were participants blind to treatment assignment? **Q4**	Were those delivering treatment blind to treatment assignment? **Q5**	Were outcomes assessors blind to treatment assignment? **Q6**	Were treatment groups treated identically other than the intervention of interest? **Q7**	Was follow up complete and, if not, were differences between groups in terms of their follow up adequately described and analysed? **Q8**	Were participants analysed in the groups to which they were randomised? **Q9**	Were outcomes measured in the same way for treatment groups? **Q10**	Were outcomes measured in a reliable way? **Q11**	Was appropriate statistical analysis used? **Q12**	Was the trial design appropriate, and any deviations from the standard RCT design (individual randomisation, parallel groups) accounted for in the conduct and analysis of the trial? **Q13**
Kapikiran et al. (2021)[1]	Y	Y	Y	Y	U	U	Y	Y	Y	Y	Y	Y	Y
Keshvari et al. (2021)[2]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Robertson et al. (2017)[3]	Y	Y	Y	Y	N	U	Y	N	Y	Y	Y	Y	Y
Turrado et al. (2021)[4]	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y
Vogt et al. (2021)[5]	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y
%	100	100	100	100	60	40	100	60	100	100	100	100	100

Y = Yes, N = No, U = Unclear

Supplement 2: Characteristics of included studies

Author (year) Country of origin	Study design Setting	Participants	Intervention type and frequency/duration Comparator	Clinical outcome measures (COM), assessment tools/ equipment and measurement points	Outcome values
Kapikiran et al. (2022)[1] Turkey	RCT Patient room at a hospital clinic	120 pre-operative patients (aged 18–60 years) before liver transplant surgery VR: n = 60 CG: n = 60	VR: training video (combining visual and audio) via head-mounted device for 34 minutes (frequency not stated) CG: standard care ASSQ and SNCS scores	COM: anxiety, patient satisfaction Tools: ASSQ, SNCS Measurement points: ASSQ 24–36 hours before surgery ASSQ 8–12 hours before surgery SNCS 48–72 hours after to surgery	VR: ASSQ Pre-test 37.61 ± 5.16 Post-test 28.96 ± 3.95 VR: SNCS Pre-test 66.61 ± 5.34 Post-test 79.35 ± 5.23 CG: ASSQ Pre-test 37.60 ± 5.24 Post-test 36.66 ± 4.05 CG: SNCS Pre-test 66.54 ± 6.97 Post-test 68.58 ± 5.87
Keshvari et al. (2021)[2] Iran	RCT Outpatients, Heshmat Cardiac Disease Hospital, Iran	80 pre-operative patients scheduled for coronary angiography VR: n = 40 CG: n = 40	VR: nature video with soft music, birdsong, and waterfall via 360-degree VR video headset, Huawei mobile phone and headphone for music for 5 minutes once 5 minutes before start of surgery CG: standard care STAI (short form), HR, RR, SBP, DBP	COM: anxiety Tool: STAI Equipment: Casio digital watch (HR, RR), Easy life hand-held sphygmomanometer (BP) Measurement points: STAI, HR, RR, BP 10 minutes prior to start of surgery STAI, HR, RR, BP immediately after the intervention	STAI: VR(1) 3.144 (14.9) VR(2) 2.131 (13.07) CG(1) 3.233 (14.4) CG(2) 3.529 (15.1) HR: VR(1) 71.6 (5.334) VR(2) 69.43 (4.230) CG(1) 7.21* (4.562) CG(2) 7.4* (4.224) RR: VR(1) 18.93 (0.997) VR(2) 18.68 (0.829) CG(1) 18.58 (1.466) CG(2) 18.53 (1.396) SBP: VR(1) 135.63 (20.730) VR(2) 125.25 (18.115) CG(1) 130 (20.646) CG(2) 12/* (20.121) DBP: VR(1) 79 (9.001) VR(2) 76.63 (10.025) CG(1) 78.2 (8.883) CG(2) 77.3 (10.252)
Robertson et al. (2017)[3] Australia	RCT with three groups Pre-operative waiting area at a private hospital	60 pre-operative patients (aged 17–82) scheduled for arthroscopic surgery (22 females, 38 males) VRH: n = 20 VRiP: n = 20 CG: n = 20	VRH: virtual beach immersion with audio recording of narrated muscle relaxation technique via headsets and a pair of acoustic noise cancelling headphones for 9 minutes (frequency not stated) VRiP: videos of beaches on an iPad 4 Retina with with audio recording of narrated muscle relaxation technique via acoustic noise cancelling headphones for 9 minutes (frequency not stated) CG: standard care Initial BP, HR, GSR	COM: anxiety, skin conductance (emotional arousal) Tool: HADS Equipment: standard hospital digital BP and HR monitors, GSR sensor Measurement points: HADS 9 minutes before intervention BP, HR, GSR - entire 9-minute period before intervention HADS, BP, HR, GSR after intervention.	VRH: HADS -1.60 (2.33) SBP -0.32 (11.57) DBP 5.06 (13.89) HR 0.16 (5.2) GSR -4.79 (55.47) VRiP: HADS -1.47 (2.63) SBP -0.32 (11.57) DBP 5.06 (13.89) HR -2.16 (5) GSR -3.97 (48.81) CG: HADS -0.32 (1.63) SBP -1.05 (13.84) DBP -0.74 (9.67) HR 1.05 (5.84) GSR 54.35 (113.38)

Author (year) Country of origin	Study design Setting	Participants	Intervention type and frequency/duration Comparator	Clinical outcome measures (COM), assessment tools/ equipment and measurement points	Outcome values
Turrado et al. (2021)[4] Spain	RCT (prospective trial) Gastrointestinal surgery department hospital clinic	126 newly diagnosed colorectal cancer patients (aged 41 to 86 years) scheduled for elective surgery (46 females, 80 males) VR: n = 58 CG: n = 68	VR: video of perioperative stages from admission to discharge via 3D VR glasses and VR App, duration 16:34 minutes, unlimited access CG: standard care STAIS, HADS	COM: depression, anxiety (state and trait) Tools: STAIS-AS, STAIS-AT, HADS-A, HADS-D Measurement points: unspecified point before admission to hospital (VR and CG) day before surgical procedure (VR only)	HAD-D VR(1): 4.00 (3.00–7.00) VR(2): 2.00 (2.00–4.00) CG(1): 5.00 (3.00–7.00) HAD-A VR(1): 8.00 (7.00–11.00) VR(2): 5.00 (4.00–6.00) CG(1): 7.00 (6.00–8.00) STAIS-AS VR(1): 20.00 (17.00–24.00) VR(2): 11.50 (7.00–14.00) CG(1): 22.00 (19.00–24.00) STAIS-AT VR(1): 18.00 (15.00–23.00) VR(2): 13.00 (11.00–16.00) CG(1): 18.50 (16.00–23.00)
Vogt et al. (2021)[5] Germany	RCT Clinic of anaesthesiology in a university hospital	80 pre-operative patients scheduled for surgery under general anaesthesia VR: n = 40 CG: n = 40	VR: virtual operation room tour video via VR glasses, duration 6:28 minutes, frequency not stated CG: standard care STOA-S, STOA-T	COM: state anxiety, trait anxiety Tools: STOA-S, STOA-T (questionnaire designed in-house) Measurement points: before surgery 48 hours after surgery	STOA-S Affective (n = 71) VR(1): 10.49 ± 4.61 CG(1): 10.83 ± 4.09 STOA-S Cognitive (n = 67) VR(1): 10.88 ± 4.32 CG(1): 10.70 ± 4.38 STOA-S Affective (n = 68) VR(2): 8.53 ±4.95 CG(2): 7.91 ± 3.26 STOA-S Cognitive (n=71) VR(2): 9.11 ± 4.19 CG(2): 9.171 ± 4.00

RCT = randomised controlled trial, VR = virtual reality intervention group, CG = control group, SNCS = Satisfaction with nursing care scale, ASSQ = Anxiety specific to surgery questionnaire, STAI = State–trait anxiety inventory, HR = heart rate, RR = respiratory rate, SBP = systolic blood pressure, DBP = diastolic blood pressure, VRH = virtual reality using headset, VRiP = virtual reality using iPad, GSR = galvanic skin response, HADS = Hospital anxiety and depression scale, STAI-AS = State–trait anxiety inventory for adults (state form), STAI-AT = State–trait anxiety inventory for adults (trait form), HADS-A = Hospital anxiety and depression scale (anxiety subscale), HADS-D = Hospital anxiety and depression scale (depression subscale), STOA-S = State–trait operation anxiety (state form), STOA-T = State–trait operation anxiety (trait form)

* Values as published in original study.

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