The effectiveness of virtual reality based interventions for symptoms of anxiety and depression: A meta-analysis

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Supplementary Method: Complete search string

Search string Pubmed: "virtual reality"[Title/Abstract] AND ("therapy"[Title/Abstract] OR "exposure"[Title/Abstract] OR "intervention"[Title/Abstract] OR "treatment"[Title/Abstract])

Limits: randomized trials

Search date: August 10th, 2016

Hits: 229

Supplementary Results: List of included studies

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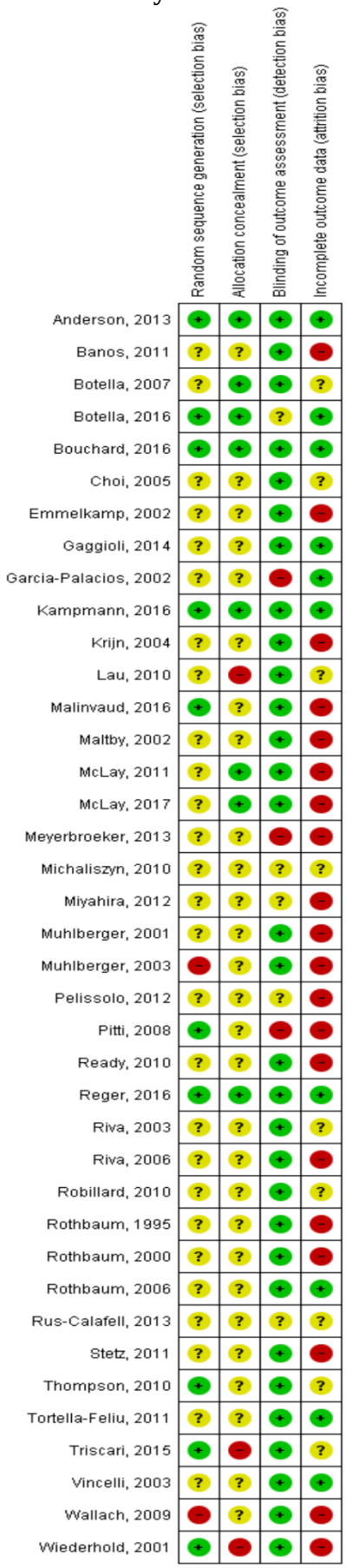
Supplementary Figure S1. Risk of bias summary: review authors' judgments about each risk of bias item for each included study



Supplementary Table S1. Tools for participant interaction with the virtual environment

Study	Mental health problem[a]	VR system (visual interaction)[b]	VR interaction tools	Measure of immersion/presence[c]	Number of tools
Anderson, 2013	Social Anxiety	HMD	visual feedback, sound, participant speeches	NR	3
Banos, 2011	Mixed disorder	VR room	visual feedback, sound, navigation via wireless pad	NR	4
Botella, 2007	PD + AG	HMD	visual feedback, sound, navigation, mouse, interoceptive stimulation (e.g., breathing difficulties, tunnel vision)	NR	5
Botella, 2016	Spider Phobia	HMD	visual feedback, augmented reality (3D spiders superimposed on real world elements)	NR	2
Bouchard, 2016	Social Anxiety	HMD	visual feedback, sound, navigation, mouse, participant speeches, sitting/standing posture	PQ; GPQ; relationship with treatment outcomes not reported	6
Choi, 2005	PD + AG	HMD	visual feedback, navigation, joystick	NR	3
Emmelkamp, 2002	Acrophobia	HMD	visual feedback, railing to hold on to	NR	2
Gaggioli, 2014	Stress	HMD	visual feedback, sound, navigation, joystick	NR	4

Garcia-Palacios, 2002	Spider Phobia	HMD	visual feedback, sound, simulated VR hand for touching the spiders, tactile feedback	NR	4
Kampmann, 2016	Social Anxiety	HMD	visual feedback, sound, participant conversation with VR characters	NR	3
Krijn, 2004	Acrophobia	HMD/CV	visual feedback	IPQ; Presence not correlated to treatment outcomes	1
Lau, 2010	Ward orientation	PC	visual feedback, sound, navigation, keyboard/mouse	NR	4
Malinvaud, 2016	Tinnitus	HMD	visual feedback, sound, navigation, interaction via trackers	NR	4
Maltby, 2002	Flight Anxiety	HMD	visual feedback, sound, navigation, interaction via joystick	NR	4
McLay, 2011	PTSD	HMD	visual feedback, sound, navigation, joystick	NR	4
McLay, 2017	PTSD	HMD	visual feedback, sound, navigation, joystick, vibration, smells	NR	6
Meyerbroeker, 2013	PD + AG	HMD/CV	visual feedback, sound	NR	2
Michaliszyn, 2010	Spider Phobia	HMD	visual feedback, sound, navigation via handheld wireless mouse	PQ-F; High mean presence	3
Miyahira, 2012	PTSD	HMD	visual feedback, sound, kinesthetic stimuli	NR	3

Muhlberger, 2001	Flight Anxiety	HMD	visual feedback, sound, motion, acceleration/deceleration simulation via motion base with 6 dof	NR	4
Muhlberger, 2003	Flight Anxiety	HMD	visual feedback, sound, motion, acceleration/deceleration simulation via motion base with 6 dof	NR	4
Pelissolo, 2012	PD + AG	HMD	visual feedback, unclear sound rendering, unclear navigation device	NR	Unclear
Pitti, 2008	PD + AG.	CV	visual feedback, unclear sound rendering, unclear navigation device	NR	Unclear
Ready, 2010	PTSD	HMD	visual feedback, sound, navigation via joystick	NR	3
Reger, 2016	PTSD	HMD	visual feedback, sound, navigation via joystick+ mock rifle, vibration simulation via platform with low bass speakers	NR	4
Riva, 2003	BED	HMD	visual feedback, unclear sound rendering device, navigation via joystick	NR	Unclear
Riva, 2006	Severe Obesity	HMD	visual feedback, unclear sound rendering device, navigation via joystick	NR	Unclear
Robillard, 2010	Social Anxiety	HMD	visual feedback, unclear sound rendering device, unclear on navigation device	NR	Unclear
Rothbaum, 1995	Acrophobia	HMD	visual feedback, unclear sound rendering device, platform with railing, virtual hand, tactile feedback	NR	4

Rothbaum, 2000	Flight Anxiety	HMD	visual feedback, sound, vibration simulated via chair-integrated subwoofer, airline seatbelt	NR	4
Rothbaum, 2006	Flight Anxiety	HMD	visual feedback, sound, vibration simulated via chair-integrated subwoofer, airline seatbelt	NR	4
Rus-Calafell, 2013	Flight Anxiety	HMD	visual feedback, sound, navigation via mouse	PRJQ; Presence not correlated to treatment effectiveness	3
Stetz, 2011	Stress	Screen	visual feedback, sound	UQO-PQ, low mean presence	2
Thompson, 2011	Tiredness/Mood	HMD	visual feedback, sound	*Ad-hoc* scale, relationship with treatment outcomes not reported	2
Tortella-Feliu, 2011	Flight Anxiety	HMD	visual feedback, sound, navigation via mouse	NR	3
Triscari, 2015	Flight Anxiety	N/R	unclear	NR	Unclear
Vincelli, 2003	PD + AG.	HMD	visual feedback, sound, navigation, joystick	NR	4
Wallach, 2009	Social Anxiety	HMD	visual feedback, sound, participant speeches	NR	3
Wiederhold, 2001	Flight Anxiety	HMD	visual feedback	NR	1

[a] PD = panic disorder; ED = eating disorder; BED = binge eating disorder; AG = agoraphobia; PTSD = post-traumatic stress disorder
[b] HMD = head-mounted display; CV = Cave-type system;
[c] NR = not reported; PQ = Presence Questionnaire; GPQ = Gatineau Presence Questionnaire; IPQ = Igroup Presence Questionnaire; PQ-F = Presence Questionnaire, French version; PRJQ = Presence and Reality Judgment Questionnaire; UQO-PQ = Université du Québec en Outaouais Presence Questionnaire

Supplementary Table S2. Study characteristics regarding drop-outs and remaining participants in each treatment arm

Study	N_{drop} VR[a]	N_{remain} VR[b]	N_{drop} P.C[c]	N_{remain} P.C.[d]	N_{drop} A.I.[e]	N_{remain} A.I.[f]
Anderson, 2013	8	32	9	19	15	33
Banos, 2011	6	19	///[h]	///	5	20
Botella, 2007	0	12	0	13	0	12
Botella, 2016	0	32	///	///	0	31
Bouchard, 2016	2	15	4	16	4	18
Choi, 2005	0	20	///	///	0	20
Emmelkamp, 2002	N.C.[g]	N.C.	N.C.	N.C.	N.C.	N.C.
Gaggioli, 2014	0	40	0	39	0	42
Garcia-Palacios, 2002	0	12	0	11	///	///
Kampmann, 2016	5	15	4	16	3	17
Krijn, 2004	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Lau, 2010	0	27	0	27	///	///
Malinvaud, 2016	11	50	4	25	14	44
Maltby, 2002	2	18	0	23	///	///
McLay, 2011	0	10	1	9	///	///
McLay, 2017	7	36	///	///	0	38
Meyerbroeker, 2013	11	16	2	16	10	15
Michaliszyn, 2010	2	14	///	///	2	14
Miyahira, 2012	17	12	3	10	///	///
Muhlberger, 2001	0	15	2	13	///	///
Muhlberger, 2003	4	26	///	///	4	11
Pelissolo, 2012	10	33	12	20	10	34
Pitti, 2008	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Ready, 2010	1	5	1	4	///	///
Reger, 2016	24	30	7	47	22	32
Riva, 2003	0	9	0	9	0	9
Riva, 2006	1	56	0	53	2	52
Robillard, 2010	0	14	0	15	0	16
Rothbaum, 1995	2	10	1	7	///	///
Rothbaum, 2000	3	12	0	15	1	14
Rothbaum, 2006	4	25	0	25	4	25
Rus-Calafell, 2013	0	7	///	///	0	8
Stetz, 2011	0	30	0	30	///	///
Thompson, 2010	0	12	0	11	0	12
Tortella-Feliu, 2011	2	17	///	///	2	18
Triscari, 2015	0	21	///	///	0	22

Vincelli, 2003	0	4	0	4	0	4
Wallach, 2009	6	28	15	18	3	42
Wiederhold, 2001	3	6	///	///	1	8

[a] Number of participants that dropped out in the VR-enhanced (VR) treatment arm

[b] Number of remaining participants in the VR-enhanced (VR) treatment arm

[c] Number of participants that dropped out in the Passive Control (P.C.) treatment arm

[d] Number of remaining participants in the Passive Control (P.C.) treatment arm

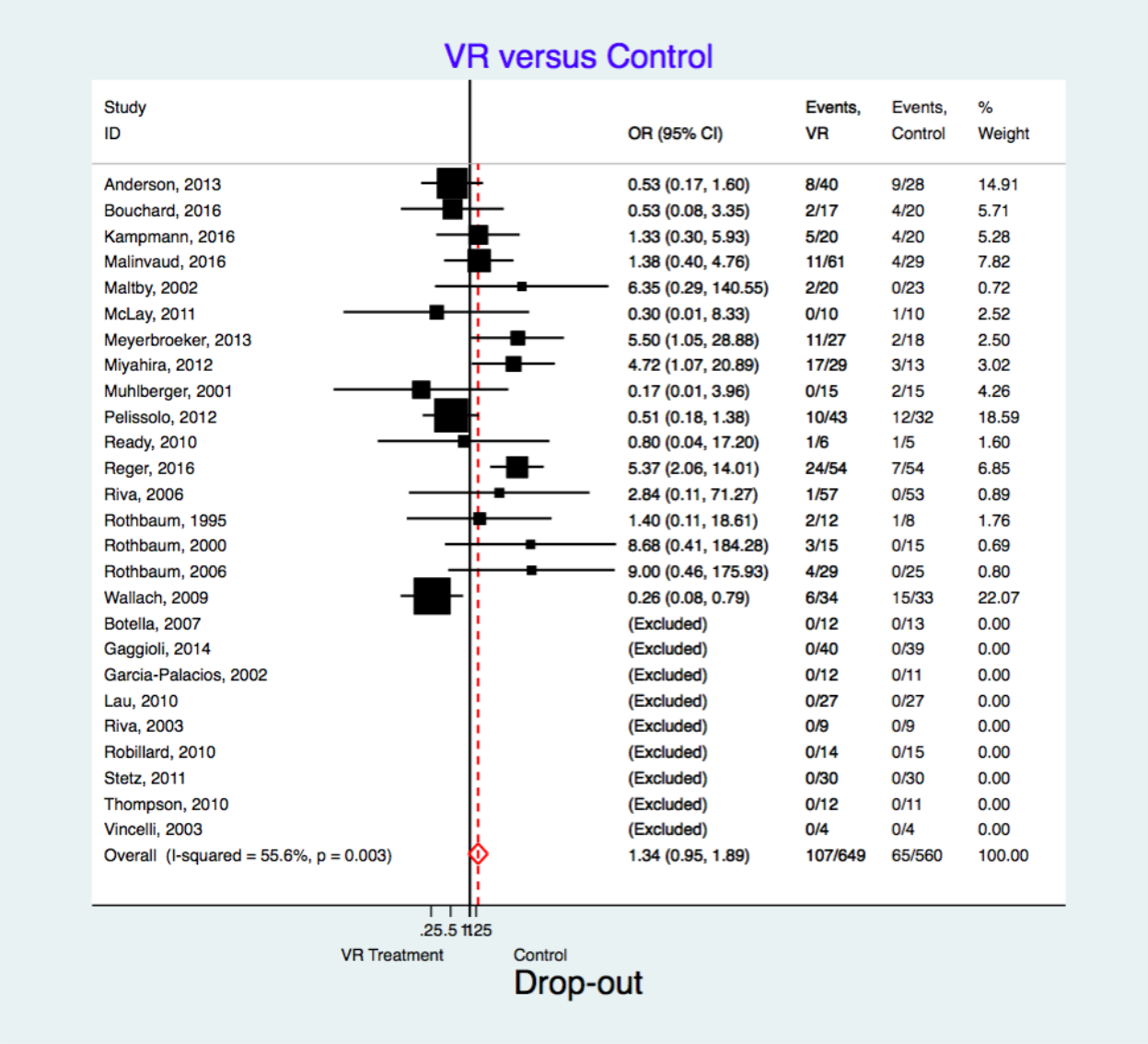
[e] Number of participants that dropped out in the Active intervention (A.I.) treatment arm

[f] Number of remaining participants in the Active intervention (A.I.) treatment arm

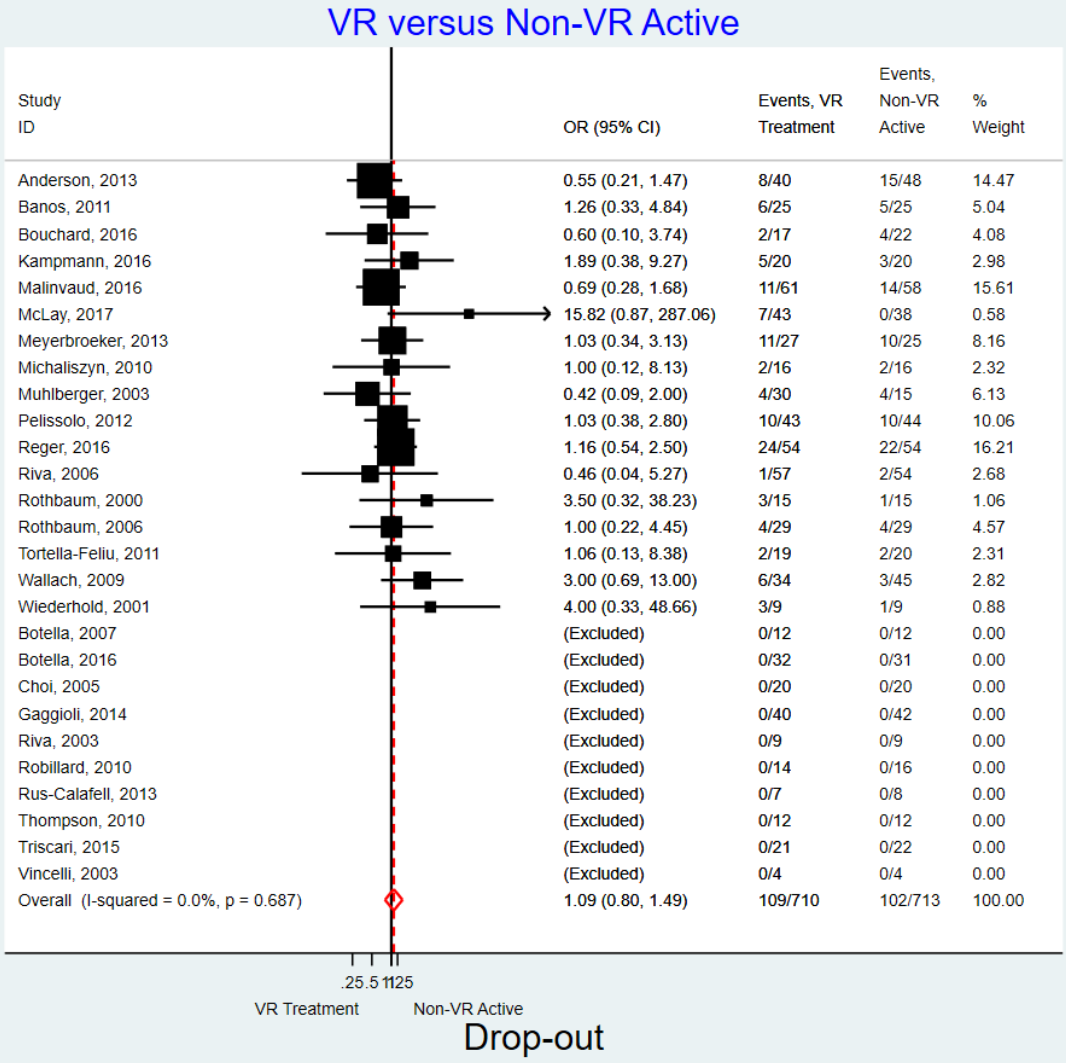
[g] N.C. = not conclusive (the number of participants that dropped out from each treatment arm could not be determined)

[h] /// = the study did not have the respective treatment arm

Supplementary Figure S2. Forest plot: Odds ratio post-test for VR-enhanced therapy versus control conditions at post-treatment for drop-outs

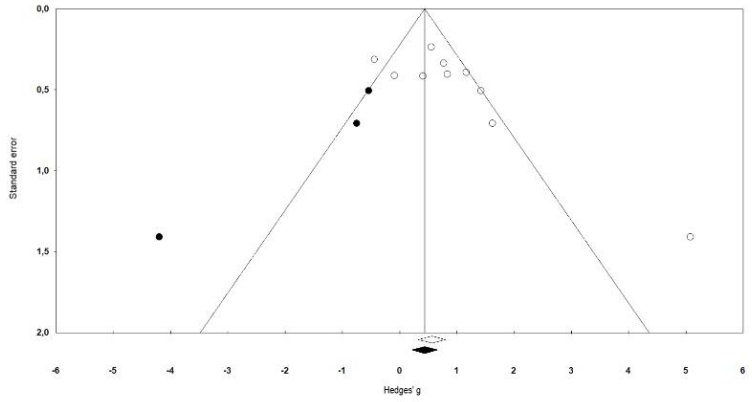


Supplementary Figure S3. Forest plot: Odds ratio post-test for VR-enhanced therapy versus non-VR active psychological treatments for drop-outs

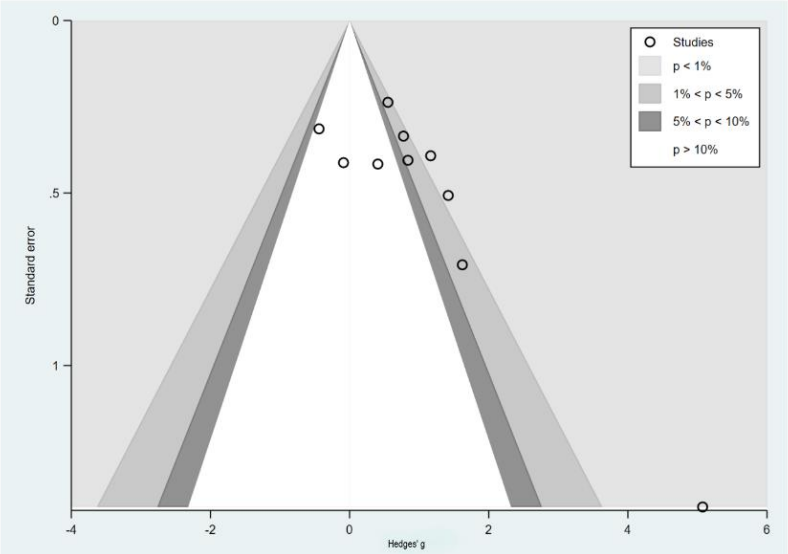


Supplementary Figure S4. Funnel plots for comparison between VR-enhanced therapy and control conditions for depression outcomes: A) Trim and fill adjusted (white circles, observed studies; black circles, imputed studies); B) Contour-enhanced funnel plot; C) Galbraith plot

A



B



C