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## How effective is virtual reality technology in palliative care? A systematic review and meta-analysis

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Care and support through terminal illness

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What is VR?





Feasibility VR study Aim: To review the feasibility and effectiveness of VR intervention within a palliative care setting.

**Databases:** from inception up until 26th March 2021:

- Ovid platform: Medline, Embase, AMED, PsycINFO (OVID)
- CINAHL (EBSCOhost)
- Cochrane Central Register of Controlled Trials (CENTRAL)
- Web of Science
- OpenGrey unpublished work.

**Search terms:** The search combined two concepts:

1) "Palliative care" and 2) "Virtual reality".









#### Figure 1. PRISMA flowchart



Country: 5 USA, 1 Spain, 1 Japan, 1 UK.

**Date:** 2012 – 2021

**Setting:** 3 hospital inpatient, 1 outpatient, 1 multiple, 3 palliative care (either hospice or ward).

Participant Characteristics									
Diagnosis	Geno	Ago							
Diagnosis		Male	Female	Age					
	n (%)	n (%)		Mean (SD)					
Cancer	19 (100)	10 (53)	9 (47)	60.9 (14.5)					
Cancer	14 (61)								
Heart failure	7 (30)	11 (48)	12 (52)	47.7 (17.1)					
End-stage renal	2 (9)								
Cancer	12 (100)	5 (42)	7 (58)	24-65+*					
Dementia	25 (100)	3 (12)	22 (88)	85 (8.9)					
Heart failure	88 (100)	44 (50)	44 (50)	56 (13.2)					
Cancer	8 (67)								
Heart failure	2 (17)	4 (22)	0 (67)	72 (16)					
Bronchiectasis	1 (8)	4 (55)	0(07)	72 (10)					
Pneumonia	1 (8)								
Cancer	20 (100)	14 (70)	6 (30)	72.3 (11.9)					
Cancer	15 (75)	6 (20)	14 (70)	66*					
Other	5 (25)	0 (50)	14(70)	00					

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First Author	Intervention	Comparator	Technology	Duration of treatment	Follow-up
Randomised Contro	olled Trials		· ·	÷	•
Groninger	Guided walk-in virtual environment with narration	Active control (guided imagery)	Oculus Go VR headset	One 10-min session	Same day
Perna	Personalised VR experience based on participants preference	Non- personalised VR experiences	Google Daydream headset; Google Pixel XL smartphone and headphones.	e Daydream headset; Google (L smartphone and Four 4-min/wk phones.	
Non-Randomised C	ontrolled trials				
Baños	Navigation through virtual environment to induce joy and relaxation	Pre-post data	LCD screen connected to a computer; headphone, keyboard, mouse	Four 30-min sessions/1 wk	4 times/wk
Brungardt	Virtual-based music therapy with customised soundtrack	None	Oculus Go VR headset	One approx. 30-min session	Same day
Dang	VR-based life review using synchronised personalised avatar	Pre-post data	MoCap (Motion capture device); VocingHan hardware; Logitech wireless headset	One approx. 30-min session	1-month
Ferguson	VR-based 360-degree beach viewing	Pre-post data	Lenovo's Mirage Solo VR headset with business edition	One 30-min session	3-5 hours after invention (behavioural changes only)
Johnson	VR still images /animated videos viewing using 1 or more VR applications in Oculus Library	Pre-post data	Samsung Gear VR	One 30-min session	None
Niki	VR travel to the destination according to participants' wishes	Pre-post data	VR headset HTC VIVE and VR software Google Earth VR	One 30-min session (time shortened or extended as needed)	None

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	First Authors									
	Brungardt	Dang	Ferguson	Baños	Groninger	Johnson	Niki	Perna		
Domains										
Feasibility	$\checkmark$	$\checkmark$		$\checkmark$				$\checkmark$		
Acceptability	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
Usability	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$				
Pain		$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
Mood				$\sqrt{1}$						
Anxiety		$\checkmark$		$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		
Depression		$\checkmark$				$\checkmark$	$\checkmark$	$\checkmark$		
Psychological wellbeing		$\checkmark$				$\checkmark$	$\checkmark$	$\checkmark$		
Other physical symptoms		$\sqrt{4}$		√2	$\sqrt{3}$	$\sqrt{4}$	$\sqrt{4}$	$\sqrt{4}$		
Other <sup>5</sup>		$\checkmark$	$\checkmark$		$\checkmark$					

<sup>1</sup> Consisted of 7 items: joy, sadness, anxiety, relax, vigor (1 "not at all" to 7 "completely"), general mood (scale of 1-7 where 7 was equivalent to positive mood and well-being), and subjective mood change (from -3 "much worse" to +3 "much better")

<sup>2</sup> Consisted of fatigue, pain, and physical discomfort (0 "not at all" to 10 "very much so").

<sup>3</sup> Subdomains of the FACIT-Pal-14: shortness of breath, distress (0 "not at all" to 4 "very much").

<sup>4</sup> As measured by the ESAS-r.

<sup>5</sup> Dang et al., included measures of Health-related quality of life, symptom burden, and spiritual wellbeing; Ferguson et al., measured behavioural changes after the VR session; Groninger et al. also measured quality of life.

Feasibility and acceptability



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#### **Patient outcomes**

	After VR Before VR		Hedges's g								
Staay	N Mean SD N Mean SD		with 95% CI								
Pain	)			Nausea			(	Depression			
Johnson et al	12 1.42 2.02 12 1.75 1.96	<b>-</b>	-0.16 [ -0.93, 0.61]	Johnson et al	12 1.42 1.68 12 1.25 1.71		— 0.10 [ -0.68, 0.87]	Depression	12 275 322 12 350 337		-0.221-0.00 0.561
Niki et al	20 1.15 2.03 20 2.35 2.25	— <b>—</b> —	-0.55 [ -1.17, 0.07]	Niki et al	20 0.05 0.22 20 0.10 0.31	<b></b>	-0.18[-0.79, 0.43]	Niki ot ol			1.02 [ 1.69 0.39]
Perna et al	24 2.04 2.61 24 3.46 2.70	<b>-</b>	-0.53 [ -1.09, 0.04]	Perna et al	24 0 21 0 66 24 0 71 1 71		-0.38[-0.94 0.18]	Niki et al	20 0.40 0.82 20 2.45 2.65		-1.03 [ -1.06, -0.36]
Groninger et al	52 3.80 2.40 52 6.80 1.60		-1.46 [ -1.89, -1.03]	Hotorogonoity: 7 <sup>2</sup>	$= 0.00 \ 1^2 = 0.00\% \ H^2 = 1.00$		0.20[0.57,0.16]	Perna et al	24 1.71 2.60 24 3.08 3.06		-0.47 [ -1.04, 0.09]
Banos et al	19 206 294 19 233 248		-0.10[-0.72 0.53]	Theterogeneity. T	= 0.00, T = 0.00 %, H = 1.00		-0.20[-0.07, 0.10]	Heterogeneity: T <sup>*</sup> = 0.05, I <sup>*</sup> = 28.99%, H <sup>*</sup> = 1.41			-0.60 [ -1.04, -0.15]
Heterogeneity: T <sup>2</sup>	$= 0.31$ , $l^2 = 77.69\%$ , $H^2 = 4.48$		-0.59 [ -1.15, -0.04]	Test of $\Theta_i = \Theta_j$ : Q(	2) = 0.96, p = 0.62			Test of $\theta_i = \theta_j$ : Q(2)	2) = 2.82, p = 0.24		
Test of $\theta_i = \theta_j$ : Q(4	l) = 17.93, p = 0.00			Appetite				Anxiety			
				Johnson et al	12 3.58 3.20 12 5.08 3.12		-0.46 [ -1.24, 0.33]	Johnson et al	12 2 83 3 19 12 3 25 2 80		-0 14 [ -0 91 0 64]
Tiredness				Niki et al	20 1.60 2.60 20 2.85 3.66		-0.39[-1.00 0.23]	Niki ot al	20 0.80 1.51 20 2.60 0.80	-	1 46 [ 2 15 0 77]
Johnson et al	12 3.58 3.09 12 5.33 3.47		-0.51 [ -1.30, 0.27]	Porno ot al	24 2 70 4 11 24 2 20 4 09		0.12[0.69 0.44]	Niki et al	20 0.80 1.51 20 2.00 0.80 -		-1.40 [ -2.13, -0.77]
Niki et al	20 1.35 1.90 20 2.90 2.71		-0.65 [ -1.27, -0.03]	Ferna et al	$= 0.00 \ l^2 = 0.00\% \ l^2 = 4.00$		-0.12 [ -0.00, 0.44]	Perna et al	24 2.17 2.57 24 3.96 2.79		-0.66 [ -1.23, -0.08]
Perna et al	24 2.33 2.66 24 4.71 2.80		-0.86 [ -1.440.27]	Heterogeneity: T	= 0.00, 1 <sup>-</sup> = 0.00%, H <sup>-</sup> = 1.00		-0.29 [ -0.65, 0.08]	Banos et al	19 1.84 1.37 19 1.89 1.48		-0.03 [ -0.66, 0.59]
Banos et al	19 3 11 3 30 19 3 28 2 15		-0.06[-0.88_0.56]	Test of $\theta_i = \theta_j$ : Q(	2) = 0.63, p = 0.73			Heterogeneity: T <sup>2</sup> =	= 0.28, 1 <sup>2</sup> = 71.70%, H <sup>2</sup> = 3.53		-0.57 [ -1.19, 0.04]
Hotorogonoity: 7 <sup>2</sup>	$= 0.02 \ l^2 = 15.37\% \ H^2 = 1.18$		0.53[0.99 0.19]					Test of $\theta_i = \theta_j$ : Q(3)	3) = 10.60, p = 0.01	107510	
Test of 0 = 0 : 0(	- 0.02, 1 - 15.57 %, H - 1.16		-0.55 [ -0.66, -0.16]	Shortness of bre	Path						
Test of $\Theta_i = \Theta_j$ : Q(3)	3) = 3.54, p = 0.32			Johnson of al	12 3.42 2.87 12 3.33 2.74	<b>B</b>	— 0.03 [ -0.74, 0.80]	Well-being			
Description				Niki et al	20 0.35 0.99 20 1.74 2.73	<b></b>	-0.66 [ -1.29, -0.04]	Johnson et al	12 5.00 2.22 12 5.00 1.13	s <del></del>	0.00 [ -0.77, 0.77]
Drowsiness				Perna et al	24 1.46 2.57 24 2.46 3.26		-0.34 [ -0.90, 0.23]	Niki et al	20 2.20 1.99 20 4.50 2.78	<b></b>	-0.93 [ -1.57, -0.29]
Johnson et al	12 2.25 1.91 12 3.67 3.03		-0.54 [ -1.33, 0.25]	Groninger et al	52 1.60 1.30 52 1.90 1.40		-0.22 [ -0.60, 0.16]	Perna et al	24 2.38 2.22 24 4.75 2.54		-0.98 [ -1.57, -0.39]
Niki et al	20 1.35 2.30 20 2.70 2.87		-0.51 [ -1.13, 0.11]	Heterogeneity: $r^2 = 0.00 \ l^2 = 0.00\% \ H^2 = 1.00$			-0.30[-0.56 -0.03]		Heterogeneity: $r^2 = 0.14$ , $l^2 = 55.44\%$ , $H^2 = 2.24$		
Perna et al	24 1.92 2.70 24 3.46 2.95	-	-0.54 [ -1.10, 0.03]	Test of A = A: O(	3) = 2.19, p = 0.53			Tot of $P = Q \cdot Q(2) = 4.40$ p = 0.11			0.000[
Heterogeneity: T <sup>2</sup>	= 0.00, I <sup>2</sup> = 0.00%, H <sup>2</sup> = 1.00		-0.53 [ -0.90, -0.16]	Test of $\theta_i = \theta_j$ : Q(	5) - 2.13, p - 0.33			$1051010_i - 0_j$ . Q(2	ε/ = τ.το, μ = 0.11		
Test of $\theta_i = \theta_i$ : Q(2)	2) = 0.01, p = 1.00										



#### Conclusions



VR in palliative care is feasible and acceptable.

VR could be an adjuvant non-pharmacological therapy for symptoms such as anxiety, pain, or depression.

**MORE RESEARCH NEEDED** 



### Thank you!

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