USE OF VIRTUAL REALITY BASED THERAPY IN THE ELDERLY

ISRCTN11923623.

ABSTRACT AND RESULTS *(february, 18, 2021)*

The functional capacity of institutionalised older people can be maintained or improved through multicomponent intervention programmes. The use of non-specific virtual reality systems (or exergames) is an emerging intervention that has rapidly proliferated in geriatric and gerontological settings, with the aim of optimising the motor, cognitive and functional capacity of older people. However, it is unclear whether the performance of activities of daily living can be improved with exergame-based intervention.

The aim of this study is to find out the impact of intervention with non-specific virtual reality systems on daily performance, as well as on physical and cognitive function and life satisfaction in institutionalised older people.

This study is a multicentre, randomised clinical trial with 40 elderly people assigned to two groups, an exergame group (GEX) and a control group (CG).

The flow diagram (fig.1) showing participants involved at each stage of the study (namely enrolment, intervention allocation, follow-up, and data analysis).

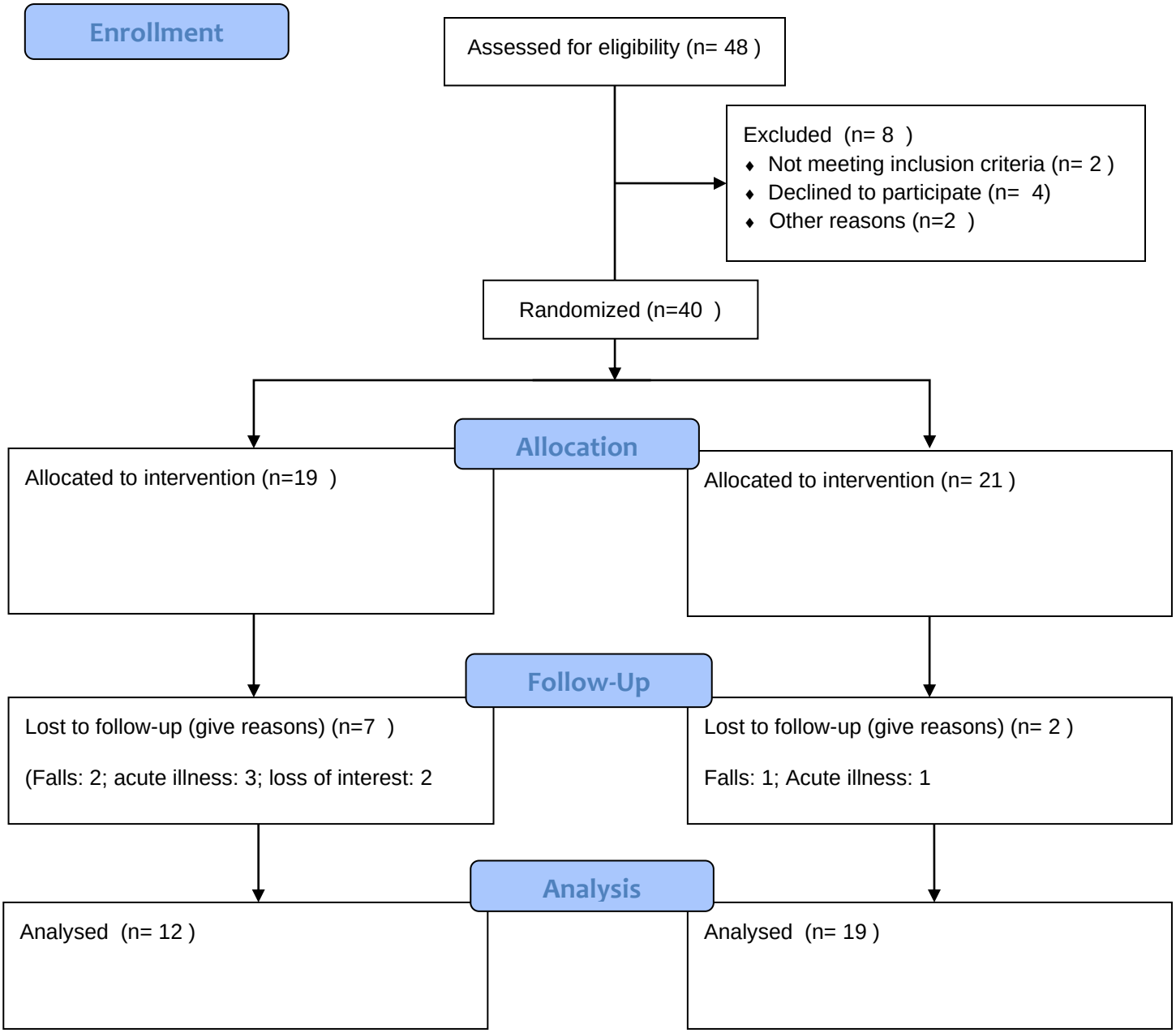
The table 1 is a tabular summary showing baseline demographic and clinical characteristics of the participants.

Table 1. Socio-demographic characteristics of study participants

	Control group	Experimental group	Media	P
Age (yearss) (m ± SD)	85±7,64	86,0±7,39	85,7 ±7,4	0,689
Gender (n, %)				0,454
Man	7 (36,8%)	6 (54,5%)	5	
Woman	12 (63,2%)	(45,5%)		
Marrital Status				
Single	1(5,3%)	3 (27,3%)	4 (13,3%)	
Married	4 (21,1%)	1 (9,1%)	5 (16,7%)	0,710
Widowed	12 (68,4)	7(63,6)	20 (66,7%)	
Separated/divorced	1 (5,3)		1 (3,3,%)	
Number of children (m ± SD)	2,3±1,60	1,9±1,92	2,20 ± 1,7	0,448
Profession (n, %):				
Service	8 (42,1%)	4 (36,4%)	12 (40%)	0,842
House wife	5 (26,3%)	4 (36,4%)	9 (30%)	
Agriculture	3 (15,8%)	2 (18,2%)	5 (16%)	
Construction	2 (10,5%)	1 (9,1%)	3 (10%)	
Industry	1 (5,3%)	0 (0%)	1 (3,3,%)	
Academic level (n, %):				
less than 5 years	8 (42,1%)	2 (18,2%)	10 (33%)	0,690
Can read and write	5 (26,3%)	7 (63,6%)	12 (40%)	
More tan 5 years	3 (15,8%)	1 (9,1%)	4 (13,3%)	
Cannot read and write	2 (10,5%)	0 (0%)	2 (6,7%)	
Bachiller	1 (5,3%)	1 (9,1%)	2 (6,7%)	

CONSORT
TRANSPARENT REPORTING of TRIALS

CONSORT 2010 Flow Diagram



Use of PCde ordenador (n, %):				
Knows the computer, but does not use it	15 (79,9%)	5 (45,5%)	20 (66,7%)	0,657
Don't know	3 (15,8%)	4 (36,4%)	7 (23,3)	
Weekly use	1 (5,3%)	2 (18,2%)	3 (10%)	
Mobile phone use (n, %):				
Knows about the device, but does not use it	11 (57,9%)	4 (36,4%)	15 (50%)	0,299
Weekly use	4 (21,1%)	2 (18,2%)	6 (20%)	
Daily use	2 (10,5%)	4 (36,4%)	6 (20%)	
Bi-weekly or monthly use	2 (10,5%)	1 (9,1%)	3(10%)	

Physical activity (Senior Fitness Test, SFT; Time Up Go, TUG; Tinetti Test), cognitive function (Mini Cognitive Examination, MEC), performance of activities of daily living (Barthel Index, IB; Assessment Motor and Skills Process, AMPS), perceived life satisfaction (Philadelphia Moral Life Satisfaction Scale), perceived self-assessment of occupational performance (ad hoc questionnaire design) and satisfaction with the use of exergames were assessed. Tables 2, 3 and 4 show the results obtained after the intervention with the virtual reality systems.

The intervention was conducted for 14 weeks with a frequency of two sessions per week. The GEX received treatment sessions with commercial exergames in addition to the usual treatment with physiotherapy and occupational therapy. The CG received treatment as usual and no additional treatment. A mixed model analysis of variance (ANOVA) and effect size revealed that the exergame intervention was effective in improving gait in the experimental group (TUG: p=0.04; 2 =0.347) and performance of activities of daily living (motor AMPS= 0.004 AMPS processing=0.008). Significant differences were found in 3 motor skills ("grasps" P=0.004; "coordinates"=0.025; "moves"=0.007) and 7 processing skills ("follows the target", p=0.002; "handles with care", p=0.000; "finishes", p=0.015; "picks up", p=0.000; "notices/responds", p=0.018; "adjusts" (p=0.004) and "accommodates" (p=0.028).

Positive effects in favour of the experimental group were also found in four tests of the SFT: right unipodal balance (p=0.001), left unipodal balance (p=0.046), lower limb strength (p=0.008), aerobic endurance (p=0.000) and upper limb strength (p=0.011). No differences were found in the Barthel Test, Tinetti and three SFT tests (endurance, agility and gait speed). In cognitive status outcome measures (p=0.009) and life satisfaction (p=0.003) differences were found between groups, in favour of the experimental group. The GEX reported feeling more competent after the intervention in toileting, bathing, ambulation and functional mobility activities. They also reported that the exergames were fun, dynamic and good for health.

In conclusion, this study suggests that exergames may be a feasible and beneficial resource to improve the performance of activities of daily living, functional mobility, cognitive status and life satisfaction of institutionalised older people.

Table 2. Tinetti and TUG Test							
	EG PRE m± SD	**EG POST m± SD**	**p**	**CG PRE m± SD**	**CG POST m± SD**	**p**	**p**
Tinetti m ±SD	22,1 ±3,44	22,1±4.03	1.00	21,7 ±4,97	18.8 ±5.06	0.006*	0.059
Tinetti < 19 points	31% (4)	33 % (4)	-	41 % (7)	55.6% (10)	-	-
Tinetti 19-24 pontis	46 % (6)	33 % (4)	-	41 % (7)	27.2 % (5)	-	-
Tinetti >24 points	23 % (10)	33 % (4)	-	18 % (3)	16,6 % (3)	-	-
TUG	18.1 ±10,48	16.4 ± 9.72	0.044*	22,4 ±8,24	22.1±10.1	0.856	0.562
TUG> 12 s	75% (9)	58% (7)		88% (16)	88% (16)		-
TUG< 12 S	25% (3)	42% (5)		12 % (2)	12% (2)		-

CG: control group; EG: experimental group; TUG: timed up go;
m ± SD: Media ± Starndad desviation; IC95%: Confiance intervnale: 95%

Table 3. Barthel index and Assessment motor and process skills (AMPS)								
	Pre-intervention		**Postintervention**		**Post/pre difference (CI95%)**	**ANOVA**		**η^2**
	N	**m ± DT**	**N**	**m ± DT**		**F**	**P**	
Barthel Index								
CG	15	94,1±4,01	15	91,3±7,11	**-2,8 (-7,37 a -0,30)**	3,89	**0,069**	0,217
EG	10	94,8±10,67	10	94,6±10,66	-0,2 (-0,65 a 0,25)	1,00	0,343	0,100
					-			
AMPS								
CG	19	0,23±0,61	19	0,01±0,46	-0,2 (-0,53 a 0,09)	2,07	0,167	0,103
EG	11	0,25±0,61	11	0,52±0,66	**0,2 (0,09 a 0,45)**	11,02	**0,008**	0,524
Test AMPS habilidades motoras								
CG	19	0,16±1,13	19	-0,51±1,35	**-0,6 (-1,11 a -0,24)**	10,71	**0,004**	0,373
EG	11	0,44±1,32	11	1,08±1,52	**0,63 (0,23 a 1,04)**	12,15	**0,006**	0,549

CG : Control Group; EG: Experimental Group; m ± SD: Media ± Stanadar desviation
CI95%: Confiance interval al 95%

Table 4. Senior Fitness Test						ANOVA		
	N	m ± SD	N	m ± SD	Post intervention/Pre intervención differende Media (CI95%)	F	P	η^2 parcial
Static balance right								
CG	18	1,6±1,51	18	0,7±1,43	**-0,87 (-1,50 a -0,25)**	8,73	**0,009**	0,339
EG	10	4,5±4,66	10	5,0±2,97	0,52 (-1,64 a 2,68)	0,29	0,600	0,032
p (intrasubjects)					-0,1 (-1,01 a 0,65)	2,99	0,096	0,103
p (intersubjects)						14,74	**0,001**	0,362
Static balance left								
CG	18	2,5±3,27	18	1,5±3,61	**-1,0 (-1,94 a -0,07)**	5,15	**0,036**	0,233
EG	10	4,7±4,91	10	5,8±5,21	1,0 (-0,74 a 2,94)	1,82	0,209	0,169
p (intrasubjects)					**0,04 (-0,82 a 0,91)**	6,19	**0,020**	0,193
p (intersubjects)						4,38	**0,046**	0,144
Trasnfers								
CG	18	9,1±4,00	18	8,7±4,56	-0,4 (-1,67 a 0,78)	0,58	0,457	0,033
EG	10	10,8±2,30	10	13,5±3,65	**2,7 (1,43 a 3,96)**	23,35	**0,001**	0,722
p (intrasubjects)					**1,1 (-0,21 a 2,04)**	12,46	**0,002**	0,324
p (intersubjects)						4,71	**0,039**	0,154
Resistance Test								
CG	18	30,0±34,90	18	37,7±41,23	7,6 (-23,11 a 7,88)	1,07	0,315	0,059
EG	10	45,6±19,66	10	59,1±28,37	13,5 (-5,68 a 32,68)	2,56	0,146	0,220
p (intrasubjects)					10,5 (-1,49 a 22,61)	2,52	0,620	0,010
p (intersubjects)						2,34	0,138	0,083
Agility Test								
CG	18	18,7±11,5	18	21,6±13,29	**2,9 (0,46 a 5,33)**	6,29	**0,022**	0,270
EG	10	13,4±9,73	10	13,4±9,27	-0,0 (-1,33 a 1,32)	0,00	0,991	0,000
p (intrasubjects)					1,4 (-0,22 a 3,11)	3,21	0,085	0,110
p (intersubjects)						2,23	0,147	0,079
Walking speed								
CG	18	44,8±30,56	18	42,4±30,15	-2,4 (-11,69 a 6,88)	0,29	0,592	0,017
EG	10	36,9±34,84	10	21,9±11,83	-14,9 (-44,36 a 14,51)	1,31	0,281	0,128
p (intrasubjects)					-8,6 (-20,23 a 2,90)	1,23	0,276	0,045
p (intersubjects)						2,06	0,163	0,073

Aerobic resistance								
CG	18	167,4±102,94	18	160,6±113,82	-6,8 (-21,46 a 7,82)	0,96	0,340	0,054
EG	9	363,1±162,31	9	424,1±181,82	**100,0 (12,67 a 187,37)**	6,97	**0,030**	0,446
p (intrasubjects)		Revisar datos		Revisar datos	**46,6 (17,71 a 75,49)**	14,50	**0,001**	0,367
p (intersubjects)						22,77	**0,000**	0,447
Strength right upper limb								
CG	18	13,5±4,51	18	13,1±5,02	-0,4 (-1,48 a 0,59)	0,81	0,380	0,046
EG	10	13,3±5,45	10	16,9±4,04	**3,6 (1,59 a 5,7)**	16,19	**0,003**	0,643
p (intrasubjects)					**1,6 (0,63 a 2,57)**	18,87	**0,000**	0,421
p (intersubjects)						0,96	0,336	0,036
Strength left upper limb								
CG	18	14,2±2,82	18	12,7±5,65	-1,4 (-3,71 a 0,76)	1,92	0,183	0,102
EG	9	16,2±3,23	9	18,9±3,44	**2,6 (0,45 a 4,87)**	7,75	**0,024**	0,492
p (intrasubjects)					**-0,6 (-1,1 a 2,3)**	6,26	**0,019**	0,200
p (intersubjects)						7,61	**0,011**	0,233
Straight Lower Limbs Flexibility Test (right)								
CG	16	-3,1±8,54	16	-2,7±8,30	0,3 (-1,81 a 2,59)	0,14	0,713	0,009
EG	9	-15,1±6,03	9	-3,0±9,16	**12,1 (4,99 a 12,21)**	15,39	**0,004**	0,658
p (intrasubjects)					**6,2 (3,48 a 9,0)**	19,29	**0,000**	0,456
p (intersubjects)						3,78	0,064	0,141
Straight Lower Limbs Flexibility Test (left)								
CG	16	-4,4±9,85	16	-5,4±8,95	-0,9 (-2,89 a 0,99)	1,08	0,314	0,067
EG	10	-12,6±9,01	10	-4,8±7,48	**7,8 (-13,04 a -2,65)**	11,67	**0,008**	0,565
p (intrasubjects)					**3,4 (1,24 a 5,65)**	16,95	**0,000**	0,414
p (intersubjects)						1,19	0,285	0,047
Upper Limbs Flexibility Test								
CG	18	-21,5±9,92	18	-22,8±10,72	-1,2 (-2,68 a 0,12)	3,69	0,071	0,179
EG	9	-19,9±14,01	9	-19,7±8,64	0,2 (-8,79 a 9,19)	0,00	0,960	0,000
p (intrasubjects)					-0,5 (-3,48 a 2,41)	0,26	0,610	0,011
p (intersubjects)						0,32	0,572	0,013