## Supplementary material

## Appendix A

Pre-specified sensitivity analyses relating to objective 1 (effectiveness in low SES groups)

Low SES subgroup analysis comparing apps with a sole PA focus versus those without

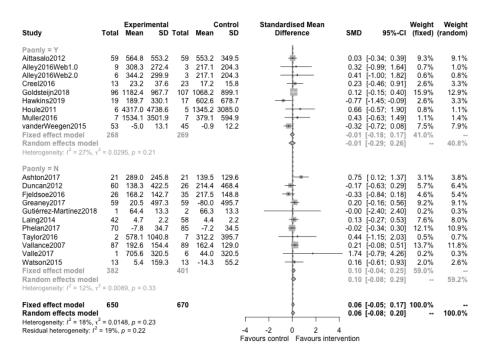


Figure 1: Low SES participants in studies split by whether the app had a sole PA focus or not

#### Low SES subgroup analysis comparing between countries

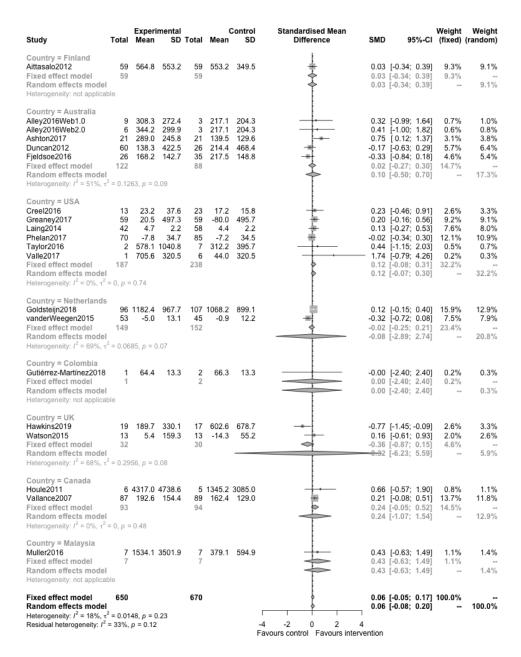


Figure 2: Low SES participants in studies split by country

## Low SES subgroup analysis by outcome

There were too few studies for each outcome type to subgroup meaningfully.

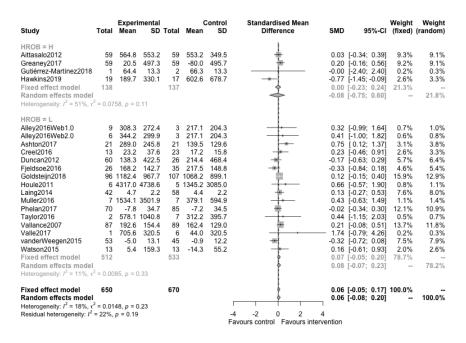


Figure 3: Low SES participants in studies split by whether the studies were at high risk of bias or not

#### Low SES subgroup analysis by age groups

Age group categorisation and reporting did not allow combining into groups for sub-group analysis.

## Low SES subgroup analysis by healthy or general population/versus chronic disease populations

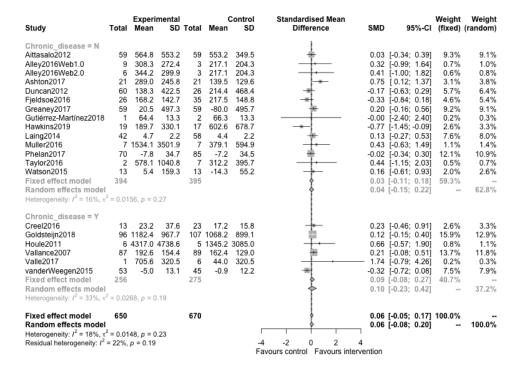


Figure 4: Low SES participants in studies split by whether the study populations where suffering fron chronic disease or not

# Low SES subgroup analysis by duration of app exposure (less than 3 months, 3-6, more than 6 months)

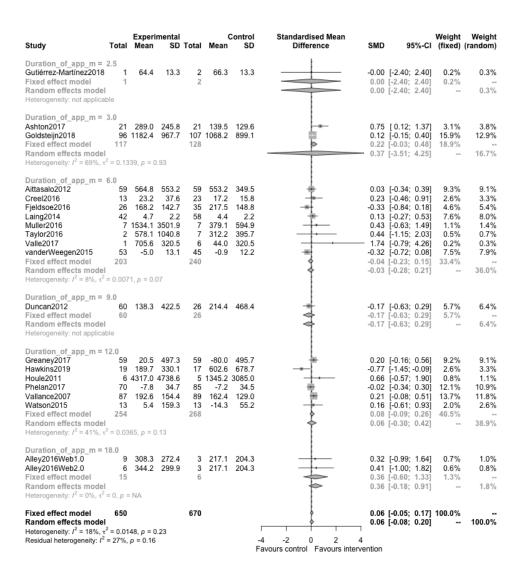


Figure 5: Low SES participants in studies split by duration of app exposure

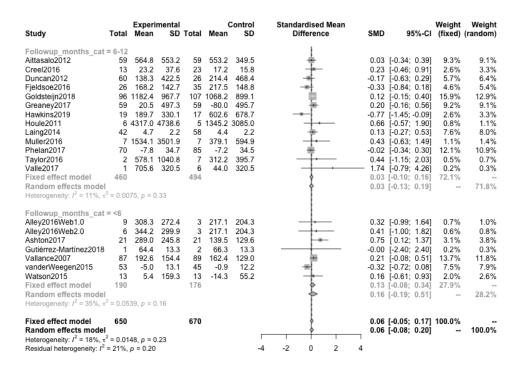


Figure 6: Low SES participants in studies split by length of follow-up

## Low SES subgroup analysis by pregnancy

Not performed due to lack of studies.

## Low SES Behaviour change subgroups

#### Low SES- Goals and planning versus not

Study T	otal	Experi Mean	mental SD	Total		Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)
Goals_and_planning = N Gutiérrez-Martinez2018 Muller2016 Taylor2016 Vallance2007 Fixed effect model Random effects model Heterogeneity: I <sup>2</sup> = 0%, τ <sup>2</sup> =	1 7 2 87 97	192.6	13.3 3501.9 1040.8 154.4	2 7 7 89 105	66.3 379.1 312.2 162.4	13.3 594.9 395.7 129.0	***	0.43 0.44 0.21 0.23	[-2.40; 2.40] [-0.63; 1.49] [-1.15; 2.03] [-0.08; 0.51] [-0.05; 0.51] [ 0.10; 0.36]	1.1% 0.5%	0.3% 1.4% 0.7% 11.8%  14.2%
Goals_and_planning = Y Aittasalo2012 Alley2016Web1.0 Alley2016Web2.0 Ashton2017 Creel2016 Duncan2012 Fjeldsoe2016 Goldsteijn2018 Greaney2017 Hawkins2019 Houle2011 Laing2014 Phelan2017 Valle2017 vanderWeegen2015 Watson2015 Fixed effect model Random effects model Heterogeneity: I² = 30%, r² =	59 9 6 21 13 60 26 96 59 19 6 42 70 1 53 13 553	564.8 308.3 344.2 289.0 23.2 138.3 168.2 1182.4 20.5 189.7 4317.0 4.7 -7.8 705.6 -5.0 5.4	2.2 34.7 320.5 13.1 159.3	59 17	553.2 217.1 217.1 139.5 17.2 214.4 217.5 1068.2 -80.0 602.6 1345.2 4.4 -7.2 44.0 -0.9 -14.3	349.5 204.3 204.3 129.6 15.8 468.4 148.8 899.1 495.7 678.7 3085.0 2.2 34.5 320.5 12.2 55.2	***	0.32 0.41 0.75 0.23 -0.17 -0.33 0.12 0.20 -0.77 0.66 0.13 -0.02 1.74 -0.32 0.16 0.03	[-0.34; 0.39] [-0.99; 1.64] [-1.00; 1.82] [-0.12; 1.37] [-0.46; 0.91] [-0.63; 0.29] [-0.15; 0.40] [-0.16; 0.56] [-1.45; -0.09] [-0.57; 1.90] [-0.27; 0.53] [-0.34; 0.30] [-0.79; 4.26] [-0.79; 4.26] [-0.72; 0.08] [-0.61; 0.93] [-0.09; 0.15] [-0.15; 0.20]	0.7% 0.6% 3.1% 2.6% 5.7% 4.6% 15.9% 9.2% 2.6% 0.8% 7.6% 12.1% 0.2% 7.5%	9.1% 1.0% 0.8% 3.8% 3.3% 6.4% 5.4% 12.9% 9.1% 8.0% 10.9% 0.3% 7.9% 2.6%
Fixed effect model Random effects model Heterogeneity: $J^2 = 18\%$ , $\tau^2 = Residual$ heterogeneity: $J^2 = Residual$				670			-4 -2 0 2 4 Favours control Favours interve	0.06	[-0.05; 0.17] [-0.08; 0.20]	100.0%	100.0%

Figure 7: Low SES participants in studies split by whether they employed goals and planning as a behaviour change technique or not

#### Low SES- Feedback and monitoring versus not

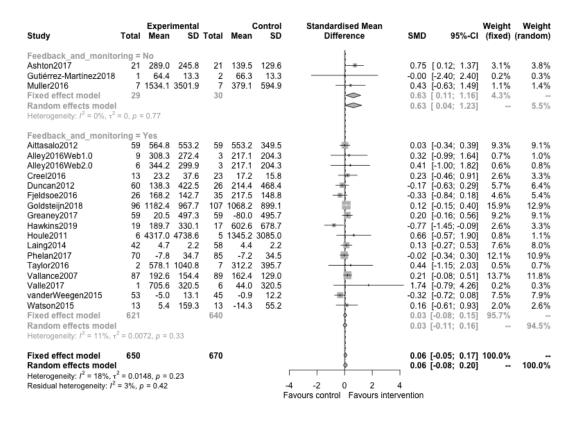


Figure 8: Low SES participants in studies split by whether they employed feedback and monitoring as a behaviour change technique or not

#### Low SES- Sharing knowledge versus not

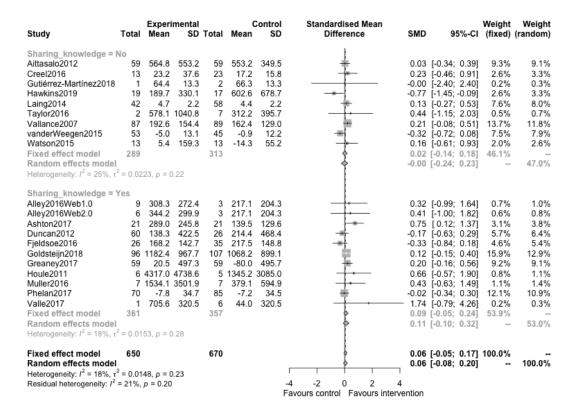


Figure 9: Low SES participants in studies split by whether they employed sharing knowledge as a behaviour change technique or not

#### Low SES- Natural consequences versus not

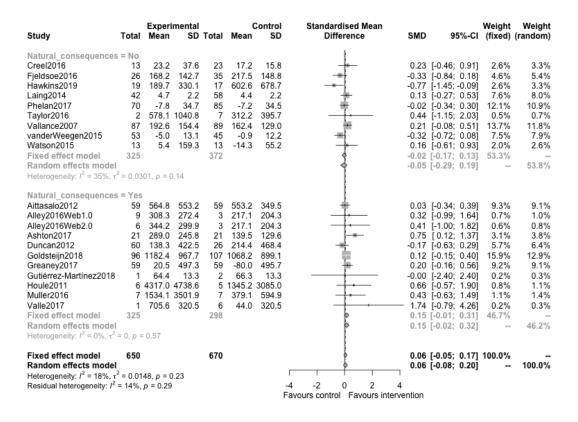


Figure 10: Low SES participants in studies split by whether they employed natural consequences as a behaviour change technique or not

#### Low SES- Comparison of behaviour versus not

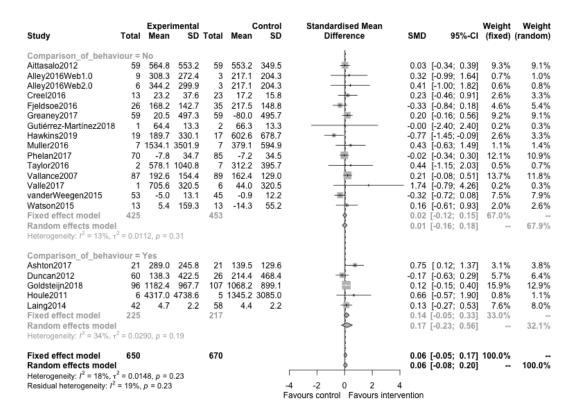


Figure 11: Low SES participants in studies split by whether they employed comparison of behaviour as a behaviour change technique or not

#### Low SES- Reward and threat versus not

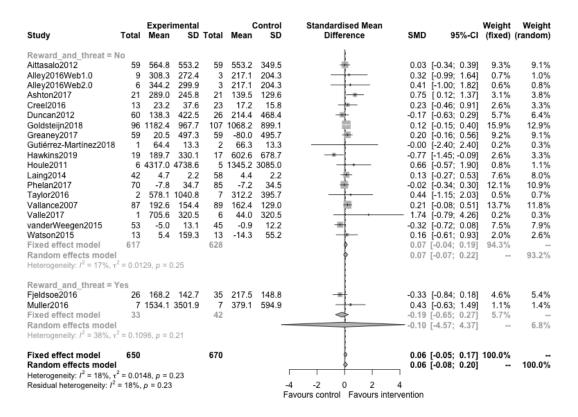


Figure 12: Low SES participants in studies split by whether they employed reward and threat as a behaviour change technique or not

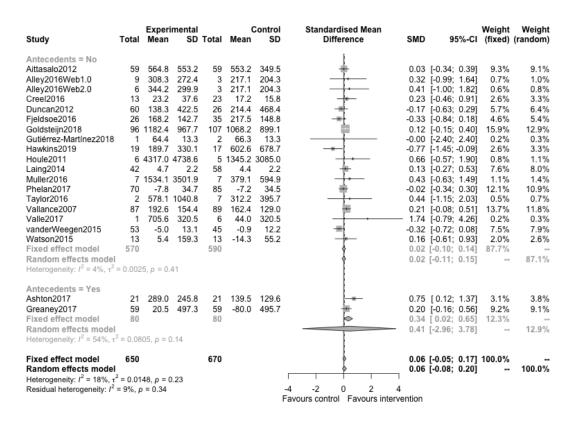


Figure 13: Low SES participants in studies split by whether they employed antecedents as a behaviour change technique or not

## Appendix B

#### Exploration of publication bias in studies of low SES participants

There is no evidence of publication case (p-value = 0.52).

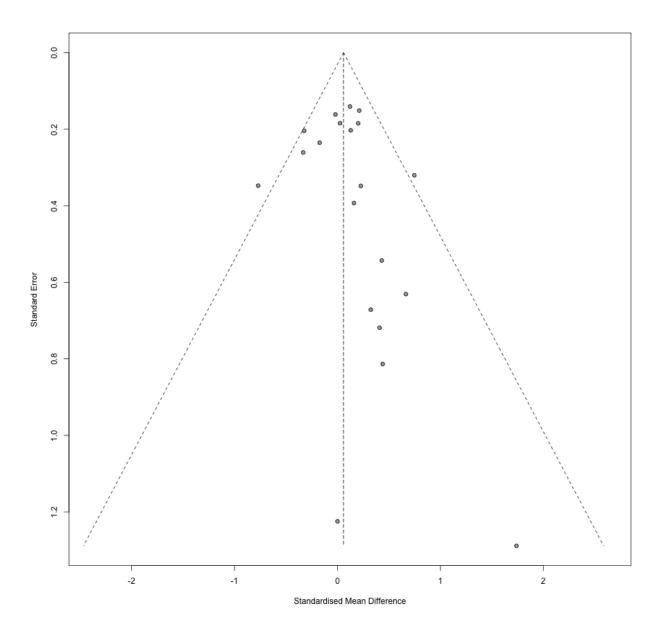


Figure 14: Funnel plot for low SES studies

## Appendix C

Pre-specified sensitivity analyses relating to objective 2 (effectiveness in high SES groups)

High SES subgroup analysis comparing apps with a sole PA focus versus those without

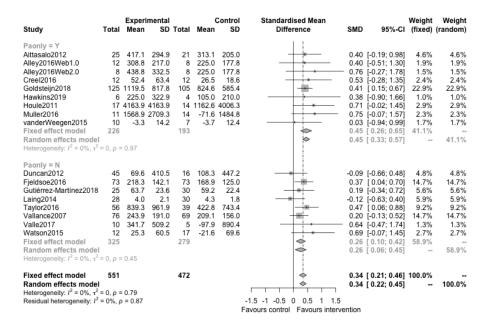


Figure 15: High SES participants in studies split by whether the app had a sole PA focus or not

High SES subgroup analysis comparing between countries

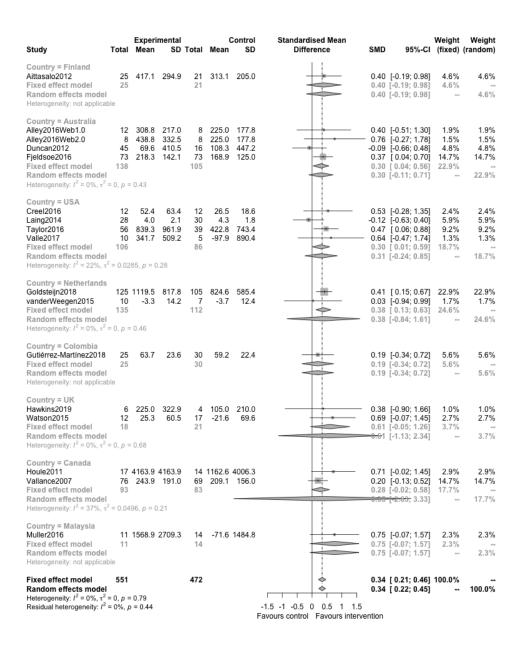


Figure 16: High SES participants in studies split by country

## High SES subgroup analysis by outcome

There were too few studies for each outcome type to subgroup meaningfully.

High SES subgroup analysis by high risk of bias

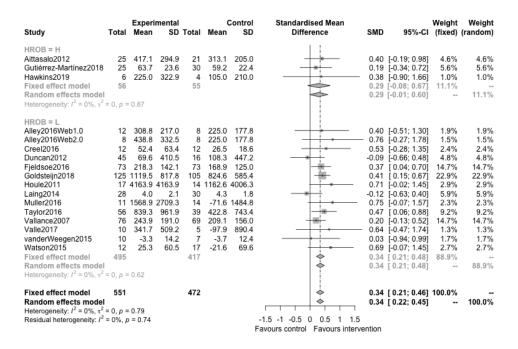


Figure 17: High SES participants in studies split by whether the studies were at high risk of bias or not

#### High SES subgroup analysis by age groups

Age group categorisation and reporting did not allow combining into groups for sub-group analysis.

High SES subgroup analysis by healthy or general population/versus chronic disease populations

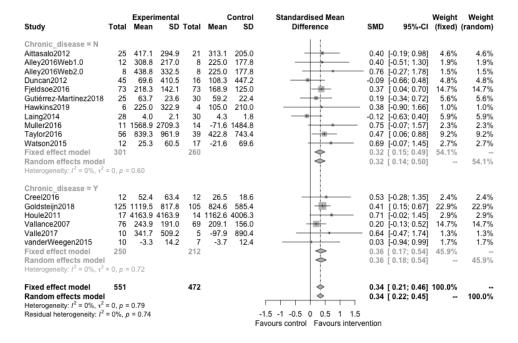


Figure 18: High SES participants in studies split by whether the study populations where suffering fron chronic disease or not

# High SES subgroup analysis by duration of app exposure (less than 3 months, 3-6, more than 6 months)

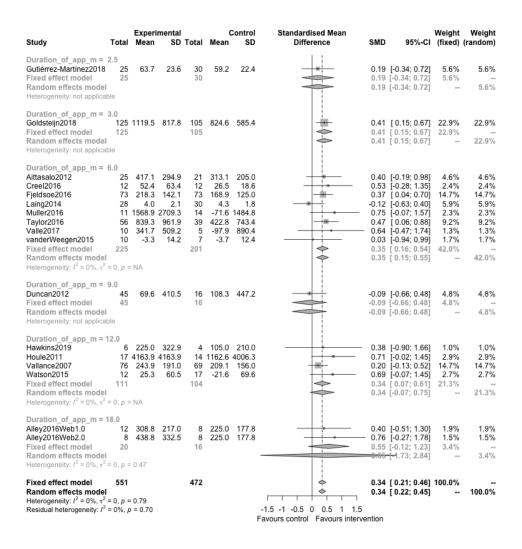


Figure 19: High SES participants in studies split by duration of app exposure

High SES subgroup analysis by duration of follow-up

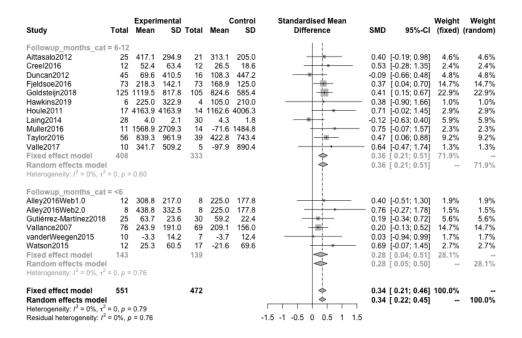


Figure 20: High SES participants in studies split by length of follow-up

## ${\bf High~SES~subgroup~analysis~by~pregnancy}$

Not performed due to lack of studies.

## High SES - Behaviour change subgroups

#### High SES- Goals and planning versus not

Study	Total	Experi Mean	imental SD	Total		Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)
Goals_and_planning = Gutiérrez-Martinez2018 Muller2016 Taylor2016 Vallance2007 Fixed effect model Random effects model Heterogeneity: I² = 0%, τ²	25 11 56 76 168	63.7 1568.9 839.3 243.9	961.9	30 14 39 69 152	59.2 -71.6 422.8 209.1	22.4 1484.8 743.4 156.0	***************************************	0.75 0.47 0.20 0.32	[-0.34; 0.72] [-0.07; 1.57] [ 0.06; 0.88] [-0.13; 0.52] [ 0.09; 0.54] [ 0.00; 0.63]	5.6% 2.3% 9.2% 14.7% 31.8%	5.6% 2.3% 9.2% 14.7%  31.8%
Goals_and_planning = Aittasalo2012 Alley2016Web1.0 Alley2016Web2.0 Creel2016 Duncan2012 Fjeldsoe2016 Goldsteijn2018 Hawkins2019 Houle2011 Laing2014 Valle2017 vanderWeegen2015 Watson2015 Fixed effect model Random effects model Heterogeneity: I² = 0%, x²	25 12 8 12 45 73 125 6 17 28 10 10 12 383	417.1 308.8 438.8 52.4 69.6 218.3 1119.5 225.0 4163.9 4.0 341.7 -3.3 25.3		21 8 8 12 16 73 105 4 14 30 5 7 17	313.1 225.0 225.0 26.5 108.3 168.9 824.6 105.0 1162.6 4.3 -97.9 -3.7 -21.6	205.0 177.8 177.8 18.6 447.2 125.0 585.4 210.0 4006.3 1.8 890.4 12.4 69.6	***	0.40 - 0.76 0.53 -0.09 0.37 0.41 0.38 0.71 -0.12 - 0.64 0.03 0.69 0.35	[-0.19; 0.98] [-0.51; 1.30] [-0.27; 1.78] [-0.28; 1.35] [-0.66; 0.48] [-0.04; 0.70] [-0.15; 0.67] [-0.90; 1.66] [-0.02; 1.45] [-0.63; 0.40] [-0.47; 1.74] [-0.49; 0.99] [-0.07; 1.45] [-0.20; 0.50] [-0.20; 0.49]	4.6% 1.9% 1.5% 2.4% 4.8% 14.7% 22.9% 1.0% 5.9% 5.9% 1.3% 1.7% 2.7% 68.2%	4.6% 1.9% 1.5% 2.4% 4.8% 14.7% 22.9% 1.0% 2.9% 5.9% 1.3% 1.7% 2.7%
Fixed effect model Random effects model Heterogeneity: $I^2 = 0\%$ , $\chi^2$ Residual heterogeneity: $I^2$	= 0, p =			472			-1.5 -1 -0.5 0 0.5 1 1.5 Favours control Favours interv	0.34	[ 0.21; 0.46] [ 0.22; 0.45]	100.0%	 100.0%

Figure 21: High SES participants in studies split by whether they employed goals and planning as a behaviour change technique or not

High SES- Feedback and monitoring versus not

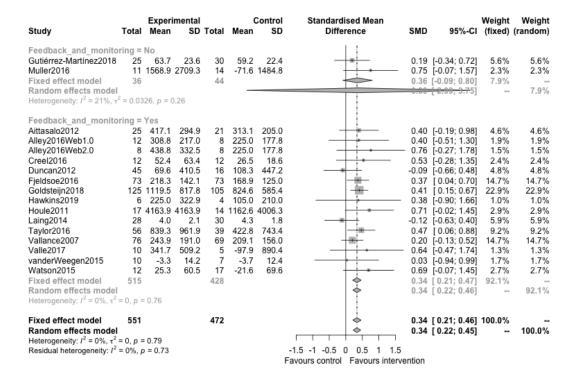


Figure 22: High SES participants in studies split by whether they employed feedback and monitoring as a behaviour change technique or not

High SES- Sharing knowledge versus not

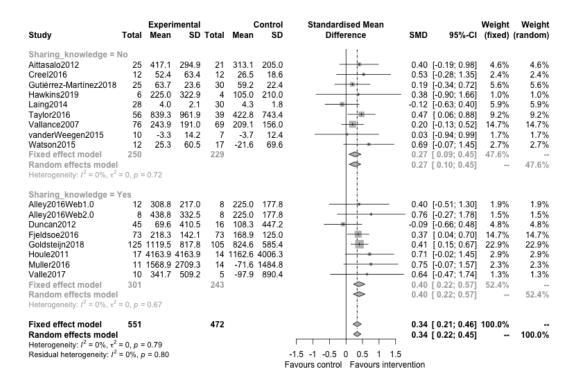


Figure 23: High SES participants in studies split by whether they employed sharing knowledge as a behaviour change technique or not

High SES- Natural consequences versus not

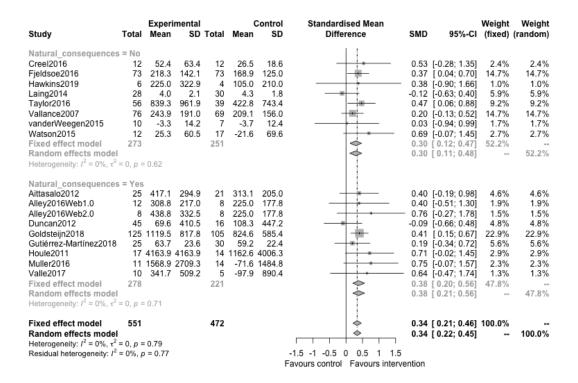


Figure 24: High SES participants in studies split by whether they employed natural consequences as a behaviour change technique or not

High SES- Comparison of behaviour versus not

Study	Total	Experi Mean	mental SD	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight (fixed)	Weight (random)	
Comparison of behaviour = No												
Aittasalo2012	25	417.1	294.9	21	313.1	205.0		0.40	[-0.19; 0.98]	4.6%	4.6%	
Alley2016Web1.0	12	308.8	217.0	- 8	225.0	177.8			[-0.13, 0.30]	1.9%	1.9%	
Allev2016Web2.0	8	438.8	332.5	8	225.0	177.8			[-0.27; 1.78]	1.5%	1.5%	
Creel2016	12	52.4	63.4	12	26.5	18.6			[-0.28; 1.35]	2.4%	2.4%	
Fjeldsoe2016	73	218.3	142.1	73	168.9	125.0			[ 0.04; 0.70]	14.7%	14.7%	
Gutiérrez-Martínez2018	25	63.7	23.6	30	59.2	22.4			[-0.34; 0.72]	5.6%	5.6%	
Hawkins2019	- 6	225.0	322.9	4	105.0	210.0			[-0.90; 1.66]	1.0%	1.0%	
Muller2016	11	1568.9	2709.3	14		1484.8	<b>-</b>		[-0.07: 1.57]	2.3%	2.3%	
Taylor2016	56	839.3	961.9	39	422.8	743.4	- <del></del>		[ 0.06; 0.88]	9.2%	9.2%	
Vallance2007	76	243.9	191.0	69	209.1	156.0	<del> =:</del> -		[-0.13; 0.52]	14.7%	14.7%	
Valle2017	10	341.7	509.2	5	-97.9	890.4	<del>-   •</del>	- 0.64	[-0.47; 1.74]	1.3%	1.3%	
vanderWeegen2015	10	-3.3	14.2	7	-3.7	12.4		0.03	[-0.94; 0.99]	1.7%	1.7%	
Watson2015	12	25.3	60.5	17	-21.6	69.6		0.69	[-0.07; 1.45]	2.7%	2.7%	
Fixed effect model	336			307			<b>*</b>	0.37	[ 0.21; 0.53]	63.4%		
Random effects model							<b>*</b>	0.37	[ 0.26; 0.48]		63.4%	
Heterogeneity: $I^2 = 0\%$ , $\tau^2$	= 0, p =	0.97										
Comparison_of_behav	iour =	Yes										
Duncan2012	45	69.6	410.5	16	108.3	447.2		-0.09	[-0.66; 0.48]	4.8%	4.8%	
Goldsteijn2018	125	1119.5	817.8	105	824.6	585.4	<del>-in</del>		[ 0.15; 0.67]	22.9%	22.9%	
Houle2011	17	4163.9	4163.9	14	1162.6	4006.3		0.71	[-0.02; 1.45]	2.9%	2.9%	
Laing2014	28	4.0	2.1	30	4.3	1.8		-0.12	[-0.63; 0.40]	5.9%	5.9%	
Fixed effect model	215			165			<b> </b>	0.28	[ 0.07; 0.49]	36.6%		
Random effects model								0.22	[-0.36; 0.80]		36.6%	
Heterogeneity: $I^2 = 51\%$ , $\tau$	$^{2} = 0.06$	35, p = 0	).10									
Fixed effect model	551			472			🕹	0.34	[ 0.21; 0.46]	100.0%	-	
Random effects model							<b></b>		[ 0.22; 0.45]		100.0%	
Heterogeneity: $I^2 = 0\%$ , $\tau^2$		0.79						0.54	[,]		.00.070	
Residual heterogeneity: I2	= 0%, p	= 0.77					-1.5 -1 -0.5 0 0.5 1 1.5	5				
							Favours control Favours inter	vention				

Figure 25: High SES participants in studies split by whether they employed comparison of behaviour as a behaviour change technique or not

High SES- Reward and threat versus not

Study	Total	Experi Mean	imental	Total	Mean	Control SD	Standardised Mean Difference	SMD	95%-CI	Weight	Weight (random)
otuuy	Total	mean	OD	lotui	Mean	OD	Dilleterioe	OIIID	3370-01	(IIXCU)	(random)
Reward and threat = No											
Aittasalo2012	25	417.1	294.9	21	313.1	205.0	++-	0.40	[-0.19; 0.98]	4.6%	4.6%
Alley2016Web1.0	12	308.8	217.0	8	225.0	177.8		- 0.40	[-0.51; 1.30]	1.9%	1.9%
Alley2016Web2.0	8	438.8	332.5	8	225.0	177.8	++-	0.76	[-0.27; 1.78]	1.5%	1.5%
Creel2016	12	52.4	63.4	12	26.5	18.6	<del>    •</del>	— 0.53	[-0.28; 1.35]	2.4%	2.4%
Duncan2012	45	69.6	410.5	16	108.3	447.2		-0.09	[-0.66; 0.48]	4.8%	4.8%
Goldsteijn2018		1119.5	817.8	105	824.6	585.4	<del>-   -   -   -   -   -   -   -   -   -</del>		[ 0.15; 0.67]	22.9%	22.9%
Gutiérrez-Martínez2018		63.7	23.6	30	59.2	22.4			[-0.34; 0.72]	5.6%	5.6%
Hawkins2019	.6	225.0	322.9	. 4	105.0	210.0			[-0.90; 1.66]	1.0%	1.0%
Houle2011		4163.9			1162.6				[-0.02; 1.45]	2.9%	2.9%
Laing2014	28	4.0	2.1	30	4.3	1.8			[-0.63; 0.40]	5.9%	5.9%
Taylor2016	56	839.3	961.9	39	422.8	743.4			[ 0.06; 0.88]	9.2%	9.2%
Vallance2007 Valle2017	76 10	243.9 341.7	191.0 509.2	69 5	209.1 -97.9	156.0 890.4	T-1		[-0.13; 0.52]	14.7%	14.7%
vanderWeegen2015	10	-3.3	14.2	7	-3.7	12.4			[-0.47; 1.74] [-0.94; 0.99]	1.3% 1.7%	1.3% 1.7%
Watson2015	12	25.3	60.5	17	-21.6	69.6			[-0.94, 0.99]	2.7%	2.7%
Fixed effect model	467	20.0	00.5	385	-21.0	03.0			[ 0.18; 0.46]	83.0%	2.7 /0
Random effects model				505					[ 0.19; 0.45]	00.070	83.0%
Heterogeneity: $I^2 = 0\%$ , $\tau^2$		0.75					1	0.02	[ 0.10, 0.40]		00.070
ristorogenisty. 7 = 070, c	- 0, p	0.70									
Reward and threat = '	Yes										
Fieldsoe2016	73	218.3	142.1	73	168.9	125.0	- <del>is</del> -	0.37	[ 0.04; 0.70]	14.7%	14.7%
Muller2016	11	1568.9	2709.3	14	-71.6	1484.8	++-	— 0.75	[-0.07; 1.57]	2.3%	2.3%
Fixed effect model	84			87				0.42	[ 0.12; 0.72]	17.0%	
Random effects model								0.42	[-1.26; 2.10]		17.0%
Heterogeneity: $I^2 = 0\%$ , $\tau^2$	= 0, p =	0.39									
Fixed effect model	551			472			•		[ 0.21; 0.46]	100.0%	-
Random effects model							<b>*</b>	0.34	[ 0.22; 0.45]		100.0%
Heterogeneity: $I^2 = 0\%$ , $\tau^2$							45 4 05 0 05 4	4.5			
Residual heterogeneity: I <sup>2</sup>	= 0%, p	2 = 0.76					-1.5 -1 -0.5 0 0.5 1 Favours control Favours i	1.5			
							ravours control Favours i	ntervention			

Figure 26: High SES participants in studies split by whether they employed reward and threat as a behaviour change technique or not

High SES- Antecedents versus not

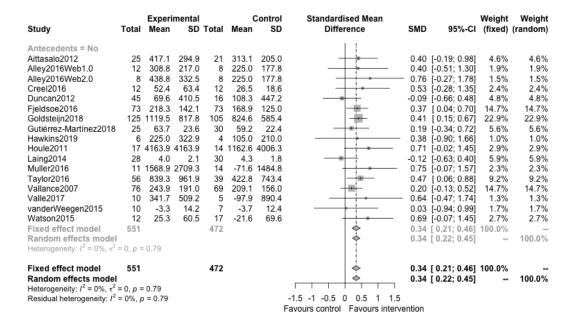


Figure 27: High SES participants in studies split by whether they employed antecedents as a behaviour change technique or not

## Appendix D

## Exploration of publication bias in studies of low SES participants

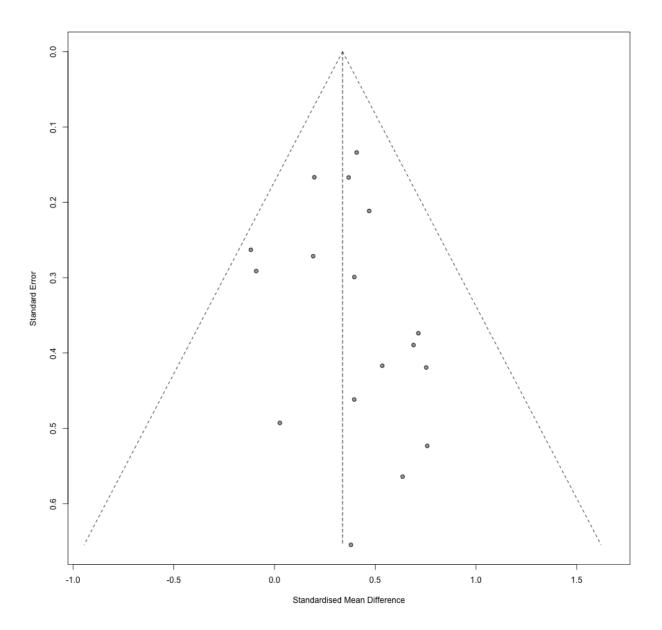


Figure 28: Funnel plot for low SES studies

There is no evidence of publication case (p-value = 0.86).

## Appendix E

Post-hoc exploration of difference between objective and self-report physical activity

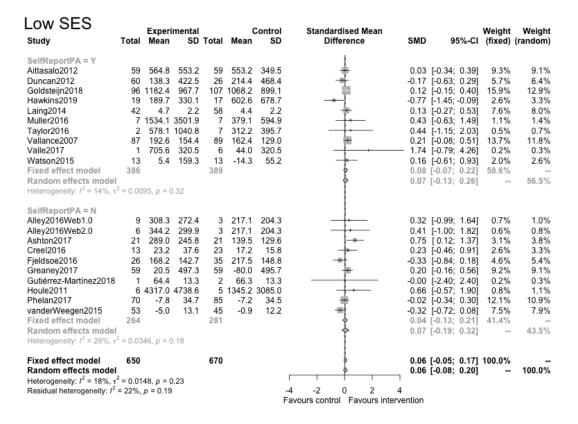


Figure 29: Post-hoc sensitivity analysis exploring differences by self-report versus objectively measured physical activity in low SES groups

## High SES

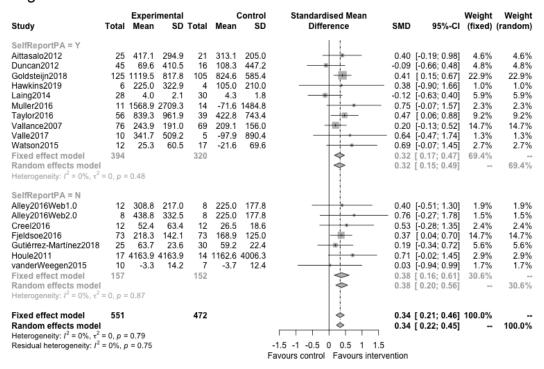


Figure 30: Post-hoc sensitivity analysis exploring differences by self-report versus objectively measured physical activity in high SES groups

#### Low SES

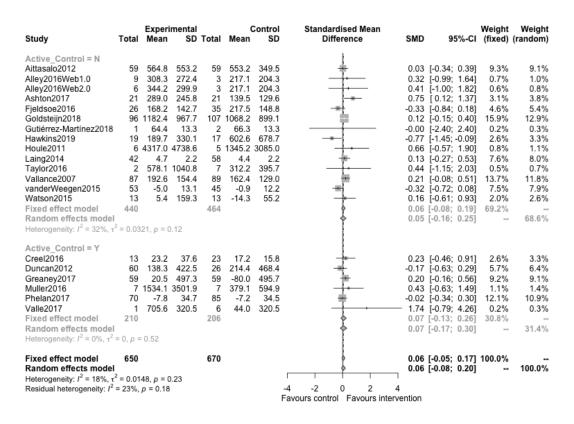


Figure 31: Post-hoc sensitivity analysis exploring differences by active versus inactive controls in low SES groups

## High SES

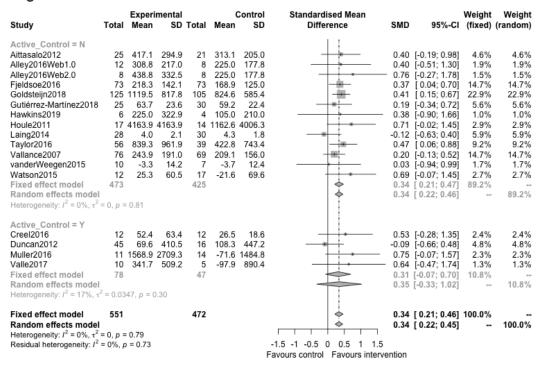


Figure 32: Post-hoc sensitivity analysis exploring differences by active versus inactive controls in high SES groups