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The effect of monetary incentives on physical activity goal achievement. A systematic review and meta-analysis
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- 6-10 percent of non-communicable diseases are accountable to „pandemic“ physical inactivity (Kohl, 2012)
- 39 percent of adults are overweight (WHO, 2017)
- Estimated yearly economic burden is \$53.8 billion (Ding et al., 2016)
- 23 percent of adults and 81 percent of adolescents don't reach physical activity goals (WHO, 2018)

Recommendations:

- 150 minutes of moderate (WHO, 2014) or 75 minutes of vigorous physical activity per week (HHS)
- 10,000 steps/day threshold in research (Tudor-Locke, 2014)

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- Positive effects of monetary incentives on the increase of steps or gym visits are known, but not whether these increases are driven by top performers or all participants
- Combination of the degree of target achievement (DTA) and absolute goal achievement (dichotomous) offers a more wholesome picture
- Inclusion of interventions with step and attendance goals

How well do financial incentives perform concerning the goal achievement of physical activity goals?

What hinders people to be physically active?

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- Reasons: lack of time, embarrassment, inability for vigorous exercise and lack of enjoyment (Andersen, 1999)
- Biases:
 - Present bias
 - Loss aversion
 - Over-optimism
 - Salience
 - Herd-behavior and image motivation
 - Fresh start
 - Numerosity

Monetary incentive types:

- Direct gift
- Lottery
- Credit

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RCTs		Intervention period		Objectively measured
Systematic Review and meta-analysis				
Monetary incentives received by performing individuals		Goal setting		Diverse settings

Maximum goal achievement was used as relation

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Study/ Participant Characteristics	Country/ Type/ behavioral theories	Goal criteria/ EPHPP Rating	Groups (n)	Intervention (expected incentive value per day)	Interven- tion length	Objective Outcomes & Measure- ments	Reported Main Results
Beatty and Katare, 2018 University freshmen Age: NR (mean: 18.06 years) Female: 51 percent BMI: ≥ 27 kg/m ² Income: NR	USA Lottery Present bias Salience Fresh start	Eligible for lottery each day subject visits recreation center with a maximum of 5 visits per week Moderate	Control (635) T1 (297) T2 (296)	T1, T2: Email every Monday with information on probability of winning and value of gift card; information about benefits of exercising and the respective recreation center T1: lottery with a 1 percent chance of winning for every visit; incentive amount was \$10.83 in weeks 1 to 4, \$32.49 in weeks 5 to 7 and \$64.98 in weeks 8 to 9 (students did not know that the value will increase over time); expected daily payouts of \$0.08 to \$0.46 (\$0.19) T2: lottery with a 1 percent chance of winning for every visit, incentive amount was \$21.66 in weeks 1 to 4, \$64.98 in weeks 5 to 7 and \$129.96 in weeks 8 to 9 (students did not that the value will increase over time); expected daily payouts of \$0.15 to \$0.93 (\$0.39)	Pre-Intervention: 1 week Intervention: 10 weeks	Physical activity (atten- dance) Attendance logs	Baseline: mean 1.17 (Control) and 1.07 (T1 & T2) visits Intervention: T2[†] performed best; there were no significant differences between Control, T1

Systematic literature review

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Combined Age: 18-85 years (mean adjusted for sample size: 34.72 years) Female: 55.85 percent BMI and income not applicable	USA (24)	Present bias (30)	N (10635)	Direct gift (19)	Range of intervention length: 2-26 weeks	Attendance goals (16)
	The Netherlands (2)	Salience (17)	Subjects in control groups (3418)	Lottery (11)		Step goals (12)
	Singapore (2)	Loss aversion (12)		Credit (3)		
	Canada (1)	Over-optimism (9)	Subjects in monetary treatments (6628)	Daily incentive value range: \$0.11-\$71.00	Mean intervention length: 12.37 weeks	Duration (4)
	Northern Ireland (1)	Fresh start (9)		Mean daily incentive value: \$3.37		
		Herd behavior (4)		Median daily incentive value: \$1.82	Median intervention length: 12.5 weeks	
		Endowment effect (3)			Assessment of baseline activity: 15	
		Numerosity (1)				
		Moderate (29)				
		Weak (1)				

Figure 1: Pooled random-effects analysis of mean differences in degree of target achievement during the intervention period

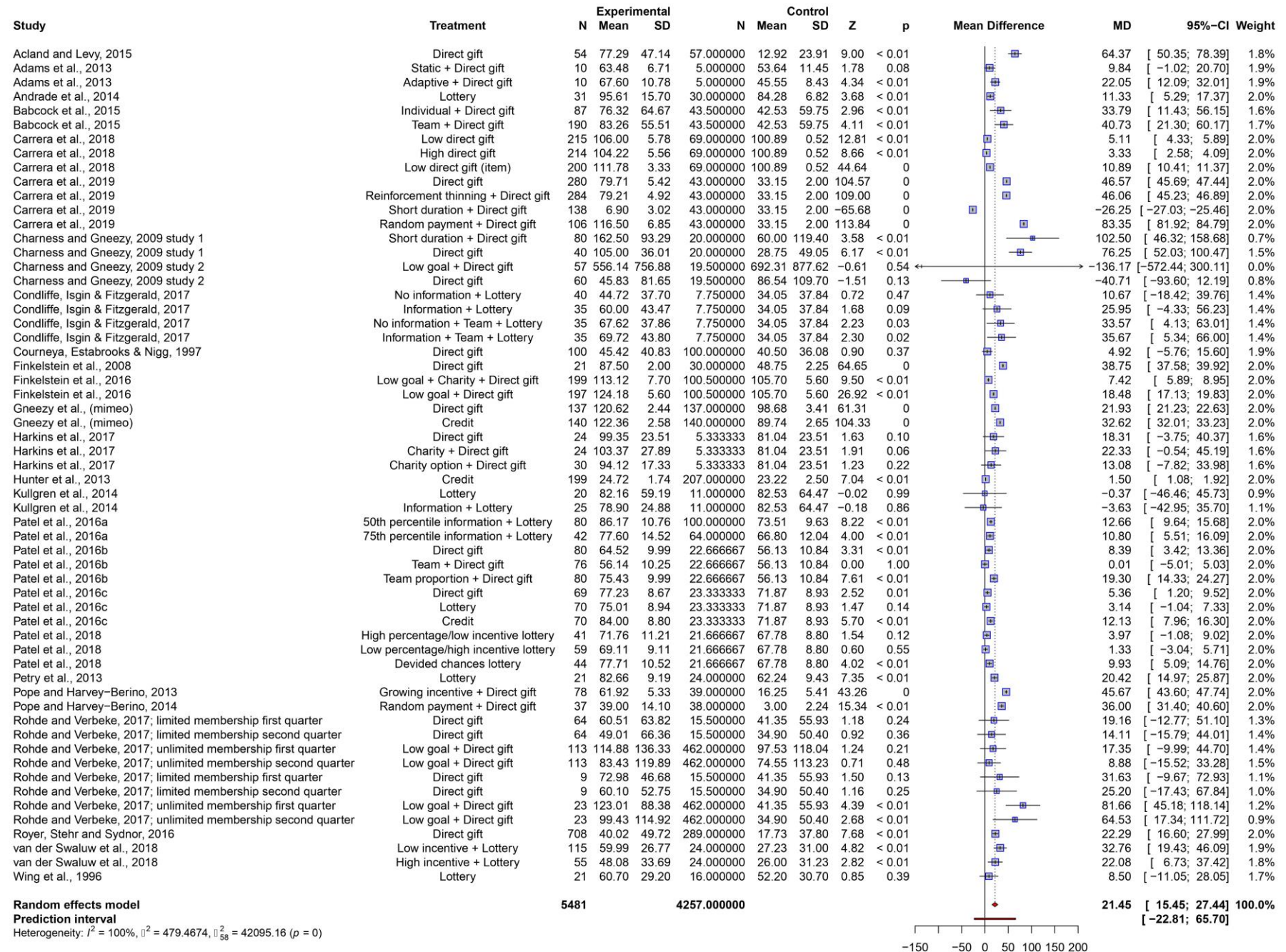
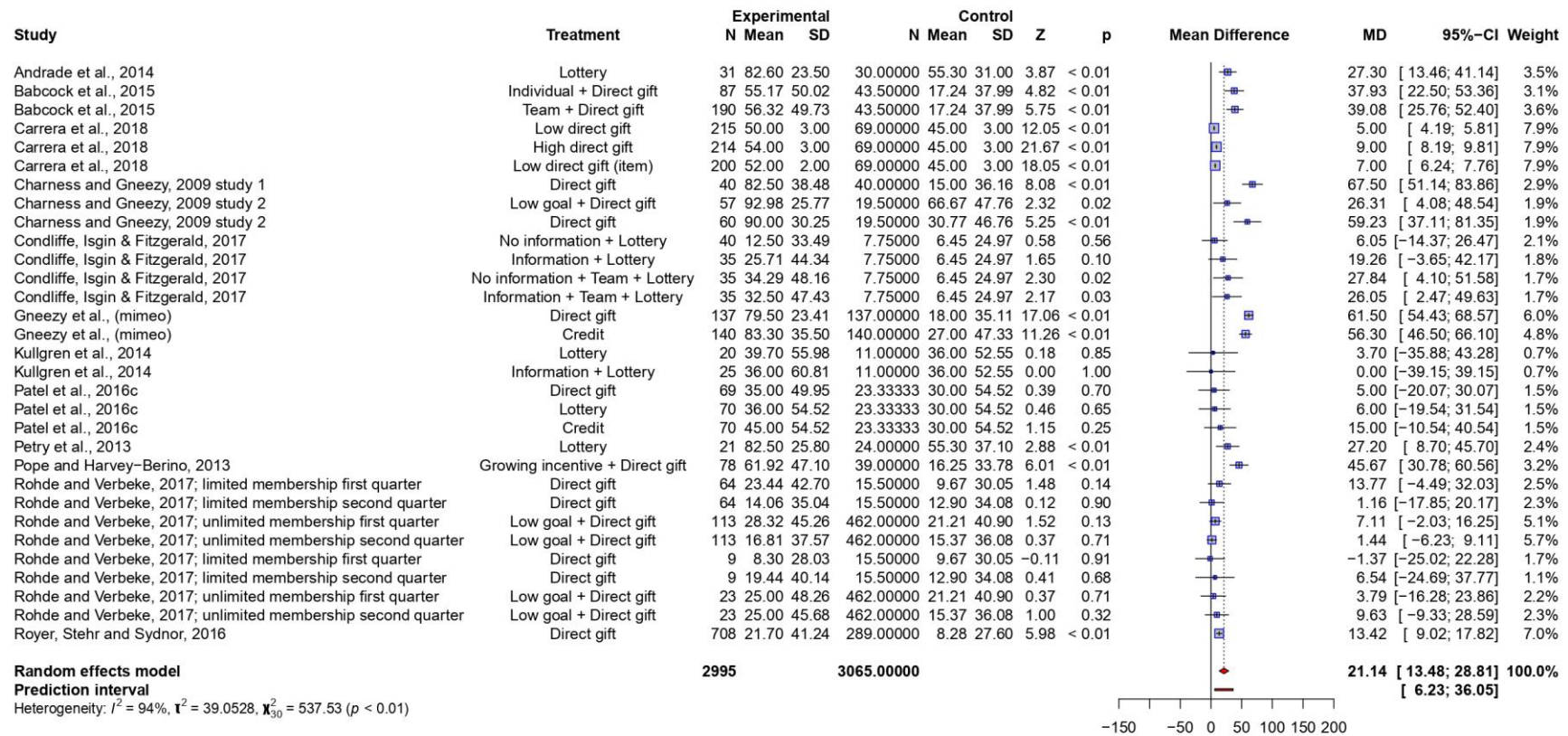


Figure 2: Pooled random-effects analysis of mean differences in absolute target achievement during the intervention period



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Table 2: Pooled random-effects analysis of mean differences in degree of target achievement during the intervention period concerning subgroup variables

Variable	Classification	Effect sizes	Pooled mean difference of DTA in percent (95% CI)	Heterogeneity (I^2 in percent)
Average age	< 25 years	13	41.90 (28.20; 55.61)	$Q = 52; I^2 = 76.8$
	25-60 years	37	16.80 (9.80; 23.81)	$Q = 34585; I^2 = 99.9$
	> 60 years	9	25.09 (16.89; 33.28)	$Q = 803; I^2 = 99.0$

Predictors included in meta-regression based on subgroup analysis:

- Age, incentive value, activity type, intervention type, intervention length, pre-intervention activity

Table 3: Random-effects meta-regression of mean differences in degree of target achievement during the intervention period

Predictor	1	2	3	4	5	6
Constant	32.06 (9.57) ^a ***	29.92 (9.21) **	12.00 (15.69)	9.69 (16.65)	-15.49 (16.57)	-18.45 (16.76)
Age	-0.28 (0.22)	-0.45 (0.23) *	-0.13 (0.32)	-0.13 (0.33)	-0.15 (0.26)	-0.24 (0.26)
Incentive value		4.39 (2.09) *	3.09 (2.70)	2.89 (2.75)	5.08 (2.28) **	6.17 (2.43) **
Activity type			15.77 (9.05)*	14.86 (9.47)	28.77 (9.41) ***	23.84 (10.15) **
Intervention type				4.55 (8.66)	-3.44 (7.42)	-7.89 (8.17)
Intervention length					1.67 (0.69) **	1.93 (0.72) **
Pre-intervention activity						8.32 (6.30)
<i>Model summary</i>						
R ²	0	0.09	0	0	0.34	0.34
K ^b	55	53	51	50	50	50

^a The unstandardized regression coefficient with the standard error in brackets is given

^b k is the number of effect sizes included in the regression model

*p<.1; **p<.05; ***p<.01

Table 4: Random-effects meta-regression of mean differences in absolute target achievement during the intervention period

Predictor	1	2	3	4	5	6
Constant	-1.47 (5.07) ^a	-5.72 (5.05)	75.65 (11.95) ***	90.78 (12.18) ***	-8.53 (3.54) **	6.49 (5.17)
Age	0.55 (0.13) ***	0.35 (0.14) **	-0.76 (0.20) ***	-1.2 (0.22) ***		
Incentive value		5.59 (0.91) ***	4.14 (0.75) ***	3.84 (0.69) ***	7.74 (0.80) ***	5.65 (0.89) ***
Activity type			-46.04 (5.75) ***	-63.00 (6.34) ***		
Intervention type				18.04 (5.00) ***		
Intervention length					1.49 (0.31) ***	1.45 (0.30) ***
Pre-intervention activity						-10.65 (2.64) ***
<i>Model summary</i>						
R ²	0.29	0.43	0.77	0.84	0.57	0.69
K ^b	28	27	27	26	30	30

^a The unstandardized regression coefficient with the standard error in brackets is given

^b k is the number of effect sizes included in the regression model

*p<.1; **p<.05; ***p<.01

- Egger's test:
 - no significant asymmetry in DTA funnel plot
 - Significant asymmetry in absolute goal achievement funnel plot
- Trim and fill procedure

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Figure 3: Trim and fill funnel plot of the degree of target achievement

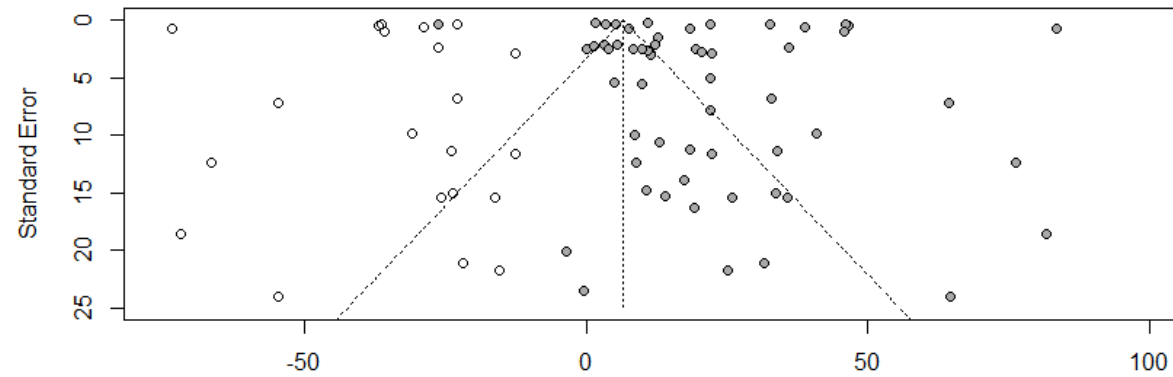
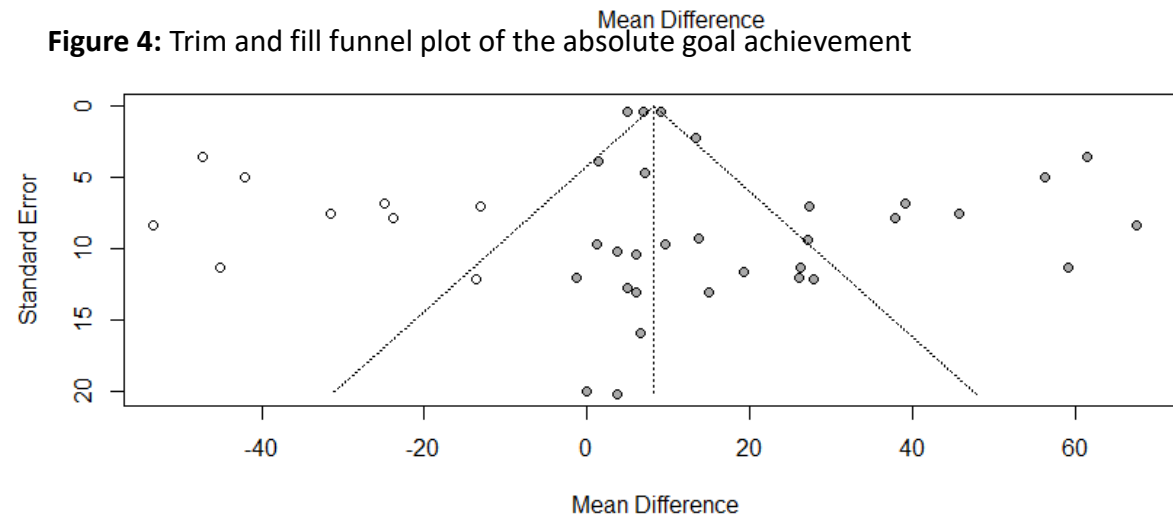


Figure 4: Trim and fill funnel plot of the absolute goal achievement



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- Monetary incentives have positive impact in intervention phase
- Combination of degree of target achievement and absolute goal achievement offers a more detailed view
- Missing data is currently being acquired

Long-term impact?
Cost efficiency?
Other activity types?

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