

# Best Evidence Summaries of Topics in Mental Healthcare

**BEST** *in* **MH** *clinical question-answering service*

## Question

“In adults in the general population, how effective are financial incentives, compared to no incentives or any other intervention, in improving and/or increasing adherence to physical activity?”

## Clarification of question using PICO structure

*Patients:* Adults in the general population  
*Intervention:* Financial incentives  
*Comparator:* No incentives or any other intervention  
*Outcome:* Improving and/or increasing adherence to physical activity

## **Clinical and research implications**

Evidence from one systematic review (SR) and one relatively small randomised controlled trial (RCT), both with 'low' risk of bias, indicates that financial incentives increase adherence to physical activity in the short-term (four-weeks to six-months) amongst healthy, white, educated, middle to high-income, USA-residing adults. It remains unanswered if financial incentives increase physical activity-adherence in the longer-term and amongst different populations (e.g. non-white populations with lower health and socioeconomic status). Although a quasi-experimental Belfast (Northern Ireland) office-based workplace study concluded that financial incentives did not increase physical activity in adults, risk of bias is 'unclear' due to much unreported quality criteria information. Therefore the reliability of evidence from this particular study is uncertain.

### **What does the evidence say?**

#### ***Number of included studies/reviews (number of participants)***

We identified one SR that met the PICO criteria for this question (Mitchell et al. (2013)), which included eleven RCTs with a total of 1453 participants (sample sizes of RCTs ranged from 15 to 365).

We further identified two experimental studies – one RCT (Finkelstein et al. (2008)) and one quasi-experimental study (Hunter et al. (2013)) – with a total of 457 participants that met the PICO criteria for this question. The RCT (51 participants) was included in the SR described above. The RCT was included in a simple 'vote count' of positive and null-effect studies in the SR but was excluded from the meta-analysis.

#### ***Main Findings***

The SR pooled data in a meta-analysis of the eight included studies that reported the same outcome of 'mean exercise-session attendance' (Mitchell et al. (2013)). These studies ranged from four to 26 weeks in duration with a total of 554 participants. The best estimate from the meta-analysis showed that financial incentives increased exercise-session attendance for short-duration interventions by 11.55% (95% CI=5.61%, 17.50%). A qualitative synthesis of all eleven included studies using simple 'vote counting' also showed that financial incentives increased short-term exercise adherence in adults, with eight positive (including the RCT described above (Finkelstein et al. (2008))) and three null effect RCTs.

Findings of the four-week RCT indicated that compared to the control group, financial incentives led to over sixteen more aerobic minutes per day ( $p < 0.001$ ) (Finkelstein et al. (2008)).

Findings of the quasi-experimental study revealed no significant differences in amount of physical activity between the financial-incentive intervention group and the no-incentive control group at twelve-week or six-month assessments (Hunter et al. (2013)).

Further findings are reported below in the 'Results' table.

#### ***Authors Conclusions***

The SR concluded that financial incentives increase exercise-session attendance in adults in the short-term (i.e. interventions up to six months in duration) (Mitchell et al. (2013)).

The authors of the RCT concluded that modest financial incentives linked to aerobic minutes are an effective way of increasing walking amongst a convenience sample of sedentary adults aged 50 years or older over a four-week period (Finkelstein et al. (2008)).

The authors of the quasi-experimental study concluded that financial incentives did not increase physical activity in adults compared to self-monitoring physical activity alone (Hunter et al. (2013)).

### ***Reliability of conclusions/Strength of evidence***

The SR was assigned an overall rating of 'low' risk of bias (Mitchell et al. (2013)). Grey literature may have been missed and the search was restricted to English-only studies, so language and publication bias may have been present. However, hand-searching of references and contact with international experts attempted to minimise some of this bias. Bias in the review process may also have been present –although search results were screened independently by at least two reviewers, inclusion assessment was carried out by one reviewer with consultation with a second reviewer if unclear, and no information was provided regarding data extraction and quality assessment processes. The majority of included studies showing a positive effect did so in the short-term only (four to twelve weeks). Furthermore, the homogenous study populations of included studies means applicability of findings are limited predominantly to healthy, white, educated, young, USA-residing adults.

The RCT was considered to have an overall risk bias of 'low' (Finkelstein et al. (2008)). However it should be noted that the study duration was relatively short and sample size was small.

Furthermore, the generalisability of the findings is restricted to healthy, white, educated, middle to high-income, USA-residing older adults.

The quasi-experimental study was rated overall as 'unclear' risk of bias as much of the information relating to the quality criteria was unreported (Hunter et al. (2013)). The authors refer to 'computer-generated random allocation' and 'sealed envelopes to ensure concealment of allocation'. However, 'all participants in Building A were assigned to the Incentive Group, and those in Building B were assigned to the No Incentive Group'. It therefore appears that worksites rather than participants were randomised. The authors report intention-to-treat analysis with six-month follow-up data from 84% of participants. However, the primary outcome was measured until week-twelve only and the authors do not report any data relating to percentage/number of participants data was available from at this point including any attrition information. Results are also unclear as data reported within the abstract, table and main results section narrative do not match up. The primary outcome of 'physical activity minutes' is reported (both in the abstract and main narrative of the article) to be measured up until week-twelve only. However, exactly the same data values are reported for month-six (both in the abstract and main results table) as they are for week-six (in the results section narrative). It is unclear from this conflicting reporting which time point – week-six or month-six – these data values are correct for.

Further risk of bias ratings by each criterion are reported in the 'Risk of Bias' tables below.

### **What do guidelines say?**

Neither NICE nor SIGN guidelines discuss the use of financial incentives for improving adherence to physical activity.

**Date question received:** 10/03/2014  
**Date searches conducted:** 10/03/2014  
**Date answer completed:** 24/03/2014

## **References**

### ***Systematic reviews***

Mitchell, M.S., Goodman, J.M., Alter, D.A., John, L.K., Oh, P.I., Pakosh, M.T. and Faulkner, G.E. (2013) Financial Incentives for Exercise Adherence in Adults. Systematic Review and Meta-Analysis. *American Journal of Preventative Medicine* 45 (5) pp.658-657.

### ***Randomised controlled trials***

Finkelstein, E.A., Brown, D.S., Brown, D.R. and Buchner, D.M. (2008) A randomized study of financial incentives to increase physical activity among sedentary older adults. *Preventative Medicine* 47 pp.182-187.

Hunter, R.F., Tully, M.A., Davis, M., Stevenson, M. and Kee, F. (2013) Physical Activity Loyalty Cards for Behavior Change. A Quasi-Experimental Study. *American Journal of Preventative Medicine* 45 (1) pp.56-63.

## Results

### *Systematic Reviews*

Author (year)	Search Date	Inclusion criteria	Number of included studies	Summary of results	Risk of bias
Mitchell et al. (2013)	June 2012 and January 2013	<p>P: Healthy, community dwelling adults aged <math>\geq 18</math> years (n=1453)</p> <p>I: Financial incentives on exercise where incentives were contingent on a pre-specified exercise behaviour or outcome. Financial incentives were defined as any cash or noncash reward with a monetary value provided directly to individuals.</p> <p>C: No financial incentives</p> <p>O: Exercise adherence.</p>	11	<p><b>Quality of Evidence:</b></p> <p>The Effective Public Health Practice Project Quality assessment Tool for Quantitative Studies was applied to all included studies</p> <p>6 studies rated 'moderate' quality 3 studies rated 'weak' quality 2 studies rated 'strong' quality</p> <p><b>Meta-analysis:</b></p> <p>Outcomes were not comparable enough to pool data from all studies. A meta-analysis of 8 studies (4-26 weeks, n=554) reporting the same outcome of 'mean exercise-session attendance' was conducted:</p> <p>Heterogeneity between studies was present (<math>\chi^2=280.55</math>, <math>df=7</math>, <math>p&lt;0.00001</math>, <math>I^2=98\%</math>). A sensitivity analysis excluding the two 'weak' quality studies did not reduce heterogeneity (<math>\chi^2=250.37</math>, <math>df=4</math>, <math>p&lt;0.00001</math>, <math>I^2=98\%</math>). A</p>	Low

			<p>sensitivity analysis excluding the outlying study (2 observations) considerably reduced heterogeneity (<math>\chi^2=2.05</math>, <math>df=5</math>, <math>p&lt;0.84</math>, <math>I^2=0\%</math>).</p> <p>Pooled results favoured the intervention condition with the use of financial incentives associated with an increase in exercise-session attendance of 11.55% (95% CI=5.61%, 17.50%), <math>z=3.81</math>, <math>p&lt;0.0001</math>. The effect estimate remained after excluding studies at high-risk of bias: WMD=11.75% (95% CI=4.60%, 18.96%), <math>z=3.22</math>, <math>p&lt;0.001</math></p> <p><b>Qualitative analysis:</b> A qualitative synthesis of all included studies using a 'vote count' was conducted:</p> <p>A simple count of positive (<math>n=8</math>) and null (<math>n=3</math>) effect studies indicates that financial incentives can increase exercise adherence in adults.</p> <p>Of the 8 positive effect studies, 3 were rated 'weak' quality, 4 'moderate' and 1 'strong'.</p> <p>6 of the 8 positive effect studies tested intervention effectiveness in the short-term (<math>\leq 3</math> months) only.</p>	
--	--	--	--	--

				<p>Of the 3 null effect studies, 2 were rated 'moderate' quality and 1 'strong'.</p> <p>Of 3 studies monitoring exercise adherence following the withdrawal of incentives, 2 showed persisting levels of adherence but only for the previously inactive. Previously active participants showed a drop in attendance following the intervention.</p>	
--	--	--	--	---	--

**Randomised controlled trials**

<b>Author (year)</b>	<b>Inclusion criteria</b>	<b>Number of participants</b>	<b>Summary of results</b>	<b>Risk of bias</b>
Finkelstein et al. (2008)	<p>P: Adults aged ≥50 in North Carolina who were currently exercising for less than two hours per week and, if exercising, engaging in walking as their primary form of exercise.</p> <p>I: Fixed payment of \$50 plus up to \$25 more per week depending on the number of weekly aerobic minutes, defined as 10+ minutes of continuous walking or jogging.</p> <p>C: Fixed payment of \$75</p> <p>O: Change in physical activity levels, self-reported and measured by a pedometer.</p>	N=51 (control n=30, treatment n=21)	<p>No differences in socio-demographic characteristics between the control and intervention arms were statistically significant (at p&lt;0.1 level or greater)</p> <p>Linear regression analysis was used to test the effect of incentives on average daily aerobic minutes while controlling for limited socio-demographic factor that may affect walking behaviour.</p> <p><b>Average Daily Aerobic Minutes</b> [Mean, Standard Error]</p> <p>Week 1: C [21.3, 1.7]; I [35.0, 1.8]  Week 2: C [20.3, 2.0]; I [34.0, 1.8]  Week 3: C [18.4, 1.6]; I [34.7, 1.8]</p>	Low

		<p>Week 4: C [18.0, 1.5]; I [36.1, 1.7]  Weeks 1-4: C [19.5, 0.8]; I [35.0, 0.9]</p> <p><b>Random Effects Regression of Daily Aerobic Minutes, controlling for within-person correlations between weeks</b>  [Estimated Coefficient, Standard Error] (p-value)</p> <p>Statically significantly more aerobic minutes per day were logged by those in the intervention arm compared with control arm; Non-graduates compared with college graduates; part-time employed, homemaker, disabled/unable to work compared with full-time employed; and those with less than \$50000 household incomes compared with those with \$50000 or more:</p> <ul style="list-style-type: none"> <li>- Treatment Group [16.15, 3.32] (p&lt;0.01)</li> <li>- 4-year College Degree or Higher [-11.31, 3.55] (p&lt;0.01)</li> <li>- Part-time Employed, Homemaker, Disabled/Unable to Work [9.98, 4.73] (p&lt;0.10)</li> <li>- Annual Household Income <math>\geq</math> \$50000 [-7.43, 3.71] (p&lt;0.10)</li> </ul> <p>There were no statistically significant differences on the characteristics of week, gender, age, retired/not working</p> <p><b>% meeting public health guidelines for physical activity during all 4 weeks</b> [Mean %, Standard Error] (p-value)</p> <p>Statically significantly more participants in the Intervention arm compared with Control arm logged at least 30 aerobic</p>	
--	--	--	--

			<p>minutes per day for at least three, five and seven days per week:</p> <p>≥30 min per day, ≥3 days per week: C [20.0, 0.1]; I [57.1, 0.1] (p&lt;0.05)</p> <p>≥30 min per day, ≥5 days per week: C [6.7 0.0]; I [38.1, 0.1] (p&lt;0.05)</p> <p>≥30 min per day, ≥7 days per week: C [0.0, 0.0]; I [19.0, 0.1] (p&lt;0.05)</p>	
Hunter et al. (2013)	<p>P: Adults, aged 16-65 years, from a work place setting (office-based) in Northern Ireland, being based at the worksite ≥4 days/week and ≥6 hours/day and being able to complete 15 minutes of moderate-paced walking (self-report).</p> <p>I: Financial incentives (retail vouchers) given for minutes of physical activity completed over a 12 week period via a loyalty card.</p> <p>C: Loyalty card used to self-monitor physical activity levels but not able to earn points or obtain incentives.</p> <p>O: Minutes of physical activity, measured through a novel tracking system and self report.</p>	N=406 (Control n=207, intervention n=199)	<p>Statistical analyses were based on intention-to-treat. Groups were compared at baselines using independent samples t-test for continuous data and chi-square test for discrete data. ANCOVA (using baseline physical activity as the covariate to account for regression to the mean and differences at baseline) was used for between-group differences using minutes of physical activity per week.</p> <p><b>Mean minutes of Physical Activity per week</b> [95% Confidence Intervals] (p value)</p> <p>No significant differences between groups were detected at week 12 or month six:</p> <p>Week 12: I = 17.52 [12.49, 22.56]; C = 16.63 [11.76, 21.51] (p=0.59)</p> <p>Week 6: I = 26.18 [12.49, 22.56]; C = 16.63 [11.76, 21.51] (p=0.59)</p> <p>Month 6: I = 26.18 [20.06, 32.29]; C = 24.00 [17.45, 30.54] (p=0.45)</p>	Unclear

			<p>Please note that authors report the same results above for week 6 and month 6. It is unclear from conflicting reporting which is correct.</p> <p><b>Mean self-reported workplace minutes of physical activity per week</b> (using Global Physical Activity Questionnaire) [95% Confidence Intervals] (p value)</p> <p>No significant differences between groups were detected at week 12 or month six:</p> <p>Week 12: I = 22.49 [-2.58, 47.55]; C = 35.02 [10.64, 59.41] (p=0.48) Month 6: I = 23.45 [13.91, 32.98]; C = 10.73 [1.02, 20.47] (p=0.07)</p>	
--	--	--	---	--

## Risk of Bias

### Systematic reviews

Author (year)	Risk of Bias				
	Inclusion criteria	Searches	Review Process	Quality assessment	Synthesis
Mitchell et al. (2013)					

### Randomised controlled trials

Study	RISK OF BIAS					
	Random allocation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective Reporting
Finkelstein et al. (2008)			N/A			
Hunter et al. (2013)			N/A			

 Low Risk

 High Risk

 Unclear Risk

## Search Details

Source	Search Strategy	Number of hits	Relevant evidence identified
<b>SRs and Guidelines</b>			
NICE	physical activity AND incentives	68	
DARE	(financial adj2 incentives) IN DARE 42 Delete 2 (voucher*) IN DARE 26 Delete 3 (reward*) IN DARE 48 Delete 4 MeSH DESCRIPTOR Reward EXPLODE ALL TREES 15 Delete 5 MeSH DESCRIPTOR Motivation EXPLODE ALL TREES 162 Delete 6 MeSH DESCRIPTOR Gift Giving EXPLODE ALL TREES 1 Delete 7 #1 OR #2 OR #3 OR #4 OR #5 OR #6 264 Delete 8 ((physical OR habitual) adj2 (activit* OR fitness)) IN DARE 703 Delete 9 (exercise OR exercize OR exertion OR sport*) IN DARE 2474 Delete 10 MeSH DESCRIPTOR Sports EXPLODE ALL TREES 444 Delete 11 MeSH DESCRIPTOR Exercise EXPLODE ALL TREES 923 Delete 12 MeSH DESCRIPTOR Physical Exertion EXPLODE ALL TREES 16 Delete 13 MeSH DESCRIPTOR Motor Activity EXPLODE ALL TREES 1054 Delete 14 MeSH DESCRIPTOR Physical Fitness EXPLODE ALL TREES 146 Delete 15 #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 3024 Delete 16 #7 AND #15	45	
<b>Primary studies</b>			
CENTRAL	#1 "financial incentives" 259	52	

	#2 "financial rewards" 20 #3 "economic incentives" 35 #4 "economic rewards" 0 #5 reimbursement 1726 #6 payment* 1147 #7 monetary 3308 #8 "financial gain" 23 #9 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 5647 #10 "physical activity" 7181 #11 exercise 43458 #12 sport 10646 #13 MeSH descriptor: [Motor Activity] explode all trees 14652 #14 MeSH descriptor: [Exercise] explode all trees 12693 #15 MeSH descriptor: [Sports] explode all trees 9216 #16 #10 or #11 or #12 or #13 or #14 or #15 52921 #17 #9 and #16 1339		
Embase	1. EMBASE; "financial incentives".ti,ab; 2523 results. 2. EMBASE; "financial rewards".ti,ab; 205 results. 3. EMBASE; "economic incentives".ti,ab; 691 results. 4. EMBASE; "economic rewards".ti,ab; 41 results. 5. EMBASE; reimbursement*.ti,ab; 20086 results. 6. EMBASE; REIMBURSEMENT/; 36319 results. 7. EMBASE; 1 OR 2 OR 3 OR 4 OR 5 OR 6; 46731 results. 8. EMBASE; "physical activity".ti,ab; 68434 results. 9. EMBASE; exp PHYSICAL ACTIVITY/; 222279 results. 10. EMBASE; exp EXERCISE/; 198083 results. 11. EMBASE; exp SPORT/; 95632 results. 12. EMBASE; exercise.ti,ab; 206161 results. 13. EMBASE; sport*.ti,ab; 55589 results.	111	

	<p>14. EMBASE; 8 OR 9 OR 10 OR 11 OR 12 OR 13; 539525 results.</p> <p>15. EMBASE; 7 AND 14; 693 results.</p> <p>16. EMBASE; random*.tw; 848204 results.</p> <p>17. EMBASE; factorial*.tw; 22143 results.</p> <p>18. EMBASE; placebo*.tw; 192053 results.</p> <p>19. EMBASE; (crossover* OR cross-over*).tw; 66790 results.</p> <p>20. EMBASE; (doubl* adj3 blind*).tw; 137409 results.</p> <p>21. EMBASE; (singl* adj3 blind*).tw; 16051 results.</p> <p>22. EMBASE; assign*.tw; 230037 results.</p> <p>23. EMBASE; allocat*.tw; 80028 results.</p> <p>24. EMBASE; volunteer*.tw; 170847 results.</p> <p>25. EMBASE; CROSSOVER PROCEDURE/; 38055 results.</p> <p>26. EMBASE; DOUBLE-BLIND PROCEDURE/; 111871 results.</p> <p>27. EMBASE; SINGLE-BLIND PROCEDURE/; 17910 results.</p> <p>28. EMBASE; RANDOMIZED CONTROLLED TRIAL/; 336876 results.</p> <p>29. EMBASE; 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28; 1359756 results.</p> <p>30. EMBASE; 15 AND 29; 111 results.</p>		
Medline	<p>31. MEDLINE; "financial incentives".ti,ab; 2248 results.</p> <p>32. MEDLINE; "financial rewards".ti,ab; 198 results.</p> <p>33. MEDLINE; "economic incentives".ti,ab; 581 results.</p> <p>34. MEDLINE; "economic rewards".ti,ab; 44 results.</p> <p>35. MEDLINE; reimbursement*.ti,ab; 15103 results.</p> <p>38. MEDLINE; REIMBURSEMENT, INCENTIVE/; 3008 results.</p> <p>39. MEDLINE; 31 OR 32 OR 33 OR 34 OR 35 OR 38; 20322 results.</p> <p>40. MEDLINE; "physical activity".ti,ab; 54547 results.</p> <p>41. MEDLINE; exercise.ti,ab; 172054 results.</p> <p>42. MEDLINE; sport*.ti,ab; 41900 results.</p> <p>43. MEDLINE; exp PHYSICAL ACTIVITY/; 190016 results.</p> <p>44. MEDLINE; exp EXERCISE/; 115594 results.</p>	52	

	<p>45. MEDLINE; exp SPORT/; 124523 results.</p> <p>46. MEDLINE; 40 OR 41 OR 42 OR 43 OR 44 OR 45; 401904 results.</p> <p>47. MEDLINE; 39 AND 46; 256 results.</p> <p>48. MEDLINE; "randomized controlled trial".pt; 367278 results.</p> <p>49. MEDLINE; "controlled clinical trial".pt; 87861 results.</p> <p>50. MEDLINE; placebo.ab; 151492 results.</p> <p>51. MEDLINE; random*.ab; 678100 results.</p> <p>52. MEDLINE; trial.ti; 123219 results.</p> <p>53. MEDLINE; CLINICAL TRIALS AS TOPIC/; 168639 results.</p> <p>54. MEDLINE; 48 OR 49 OR 50 OR 51 OR 52 OR 53; 1047891 results.</p> <p>55. MEDLINE; exp ANIMALS/ NOT HUMANS/; 3901065 results.</p> <p>56. MEDLINE; 54 NOT 55; 957536 results.</p> <p>57. MEDLINE; 47 AND 56; 52 results.</p>		
CINAHL	<p>58. CINAHL; "financial incentives".ti,ab; 772 results.</p> <p>59. CINAHL; "financial rewards".ti,ab; 76 results.</p> <p>60. CINAHL; "economic incentives".ti,ab; 109 results.</p> <p>61. CINAHL; "economic rewards".ti,ab; 7 results.</p> <p>62. CINAHL; reimbursement*.ti,ab; 5509 results.</p> <p>63. CINAHL; 58 OR 59 OR 60 OR 61 OR 62; 6390 results.</p> <p>64. CINAHL; "physical activity".ti,ab; 17934 results.</p> <p>65. CINAHL; exercise.ti,ab; 41716 results.</p> <p>66. CINAHL; sport*.ti,ab; 15686 results.</p> <p>67. CINAHL; PHYSICAL ACTIVITY/; 16852 results.</p> <p>68. CINAHL; EXERCISE/; 21911 results.</p> <p>69. CINAHL; 64 OR 65 OR 66 OR 67 OR 68; 85701 results.</p> <p>70. CINAHL; 63 AND 69; 76 results.</p> <p>71. CINAHL; (RCT OR random* OR trial).ti; 40609 results.</p> <p>72. CINAHL; "clinical trial".pt; 51153 results.</p> <p>73. CINAHL; 71 OR 72; 79421 results.</p> <p>74. CINAHL; 70 AND 73; 7 results.</p>	7	
<b>Summary</b>	<b>NA</b>	<b>NA</b>	

## **Disclaimer**

BEST in MH answers to clinical questions are for information purposes only. BEST in MH does not make recommendations. Individual health care providers are responsible for assessing the applicability of BEST in MH answers to their clinical practice. BEST in MH is not responsible or liable for, directly or indirectly, any form of damage resulting from the use/misuse of information contained in or implied by these documents. Links to other sites are provided for information purposes only. BEST in MH cannot accept responsibility for the content of linked sites.