

Financial incentives for changing health behaviours among adults

A Rapid Review

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Key Messages

1. Financial incentives are effective for changing health behaviours among adults in the short term.
 - Cash or voucher incentives are effective, while other incentive formats are not effective.
 - As follow-up time increases, the effectiveness of financial incentives diminishes.
 - High deprivation among recipients increases the effect of financial incentives.
2. When **all behaviours** are combined, financial incentives are effective in the short term and medium term; the effect diminishes over time. Financial incentives are not effective in the long term.
3. For **smoking cessation**, financial incentives are effective in the short term, there is mixed evidence in the medium term, and they are ineffective in the long term.
4. For **physical activity**, financial incentives are effective in the short term, and are not effective in the medium term.
5. For **healthy eating/physical activity indicators**, financial incentives are effective in the short and medium term, and are not effective in the long term.
6. For **attendance at vaccination or screening**, financial incentives are effective in the short term.

Executive Summary

Research Question

What is the effectiveness of direct and indirect financial incentives for changing health promoting and risk behaviours among adults?

Context

Many Peel residents engage in unhealthy behaviours that may increase their risk of chronic diseases. Given the complexity of factors that influence health behaviour, Peel Public Health is considering innovative ways to meet program goals and objectives. Financial incentives are an approach used to encourage participation in health promotion activities and programs, and there may be potential for financial incentives to influence health behaviour change.

Methods and Results

A search for published and grey literature returned 205 results. After assessing relevance, quality, and overlap, four systematic reviews were included in this review.

Synthesis of Findings

Financial incentives are effective for changing health behaviours among adults in the short term. Cash or voucher incentives are effective, while other incentive formats are not effective. As follow-up time increases, the effectiveness of financial incentives diminishes. High deprivation among recipients increases the effect of financial incentives.

When all behaviours are combined, financial incentives are effective in the short term and medium term; the effect diminishes over time. For smoking cessation, financial incentives are effective in the short term, and there is mixed evidence in the medium term. For physical activity, financial incentives are effective in the short term. For healthy eating/physical activity indicators, financial incentives are effective in the short and medium term. For attendance at vaccination or screening, financial incentives are effective in the short term. Financial incentives are generally not effective in the long term.

Recommendations

Peel Public Health should:

1. Consider the use of financial incentives in the form of cash or vouchers, when short-term behaviour change among adults is the program goal.
 - Financial incentives may be considered for short-term behaviour change particularly for populations with high deprivation.
2. Share the findings of this rapid review with internal staff and managers as well as external stakeholders who may use financial incentives to change health behaviour.
3. Carefully consider the local context, community and political preferences, public health resources, as well as the research evidence in the development, promotion, implementation, and evaluation of interventions that use financial incentives.

Glossary of Terms¹

Aggregative rewards are rewards that are offered at the end of the intervention period rather than with each achievement throughout the intervention period.

Certain rewards are non-lottery-based rewards.

Deposit refund refers to the return of money deposited by participants.

Guaranteed rewards are non-lottery-based rewards.

Non-guaranteed rewards are lottery-based rewards.

Uncertain rewards are lottery-based rewards.

¹ Terms and definitions are from in the included reviews.

1 Issue

Peel Public Health (PPH) is committed to enhancing the health status of the population through policy and program initiatives.(1) PPH uses a population health approach to protect and promote the health of Peel residents, and where necessary offers targeted interventions in response to specific community needs. Various health promotion programs aim to change health behaviours and improve population health.(2) However, changing health-related behaviours is difficult.(3) Offering financial incentives is one intervention used to encourage behaviour change; however the effectiveness of this intervention has not been examined at PPH. This rapid review aims to determine whether direct and indirect financial incentive interventions are effective for changing health promoting and risk behaviours among adults.

Anecdote

At a meeting in October 2016, PPH staff attended a presentation about Carrot Rewards, a mobile app that allows users to earn points from loyalty rewards programs (e.g., Aeroplan Miles, SCENE, Petro-Points, More Rewards) for participating in activities that encourage healthy behaviours.(4) Based on the information presented, management and staff in the Chronic Disease and Injury Prevention Division became interested in whether offering incentives could improve health promoting behaviour.

2 Context

Local data from the Canadian Community Health Survey indicate that many Peel residents engage in unhealthy behaviours that may increase their risk of chronic diseases. For example, in 2011/2012, 53% of Peel residents (aged 12 and older) were

inactive, and 60% did not meet the recommendations for daily intake of vegetables and fruit (five servings per day).(5,6) In the same time period, 14% of Peel residents smoked tobacco, and 64% of Peel residents consumed alcohol.(7,8)

Financial incentives are an approach used to encourage participation in health promotion activities and programs. In Canada, approximately 61% of employers offer some type of incentive (e.g., raffles/lucky draws, gifts, vacation days/paid time off, and cash) to boost workplace health program participation rates.(9,10) Recently, the Public Health Agency of Canada launched the Carrot Rewards program in British Columbia, Newfoundland and Labrador, and Ontario, to encourage healthy behaviours among program participants.(11,12) At the Region of Peel, *Your Healthy Workplace* program provides indirect financial incentives (e.g., gym membership discounts, transit discount) to encourage healthy behaviours among Region of Peel employees. PPH has also used financial incentives at the Healthy Start and Teen Prenatal Supper Club. Pregnant and post-partum women in need who attend these prenatal nutrition programs receive two bus tickets (if needed) to increase program accessibility, prenatal vitamins, and a \$15 grocery voucher each week; incentives are funded by a partner organization.

Given that there is potential for financial incentives to encourage program participation and influence behaviour change, PPH sought to determine the effectiveness of financial incentives for changing health promoting and risk behaviours among adults. Moreover, to identify the types of financial incentives that are effective, and the factors that influence their implementation and effectiveness.

3 Literature Review Question

What is the effectiveness of direct and indirect financial incentives for changing health promoting and risk behaviours among adults?

P – Population	Adults
I – Intervention	Financial incentives (direct and indirect)
C – Comparison	No incentives
O – Outcome	Risk behaviour Health promoting behaviour

4 Literature Search

In January 2017, a public health librarian conducted a search of published literature for systematic reviews and guidelines. The search was limited to the past four years due to the volume of results retrieved. Databases searched were: PsychInfo, Cochrane Database of Systematic Reviews, Medline, Healthstar, Global Health, and Sociological Abstracts (see Appendix A).

Two members of the review team searched the following grey literature sources: Turning Research Into Practice (TRIP), National Institute for Health and Care Excellence (NICE), Centers for Disease Control and Prevention (CDC), Health Canada, and National Guideline Clearinghouse.

5 Relevance Assessment

Two reviewers independently screened titles and abstracts to assess the relevance of the search results. Two reviewers also conducted full text review of the published and

grey literature. Discrepancies were discussed until consensus was reached. Articles were assessed for relevance using the following criteria:

- Inclusion criteria: guideline or systematic review; published from 2013 onwards (past 4 years); English language; focused on the adult (age 18+) general population; focused on the effectiveness of direct or indirect financial incentives or rewards intervention; focused on risk or health promoting behaviours.
- Exclusion criteria: targeting physicians or other health professionals; focused on management and treatment of clinical conditions; focused only on financial disincentives; developing countries; duplicates.

6 Results of the Search

Searches identified 205 articles (see Appendix B). Following removal of 108 duplicates and 80 non-relevant articles, full text of 17 articles was assessed, and 10 articles were excluded. Six systematic reviews and one guideline were selected for quality appraisal.

7 Critical Appraisal

A minimum of two reviewers independently appraised the quality of the six systematic reviews and one guideline using the Health Evidence Quality Assessment tool and the AGREE II tool, respectively. Discrepancies in appraisal scores were resolved through discussion until consensus was reached.

Four systematic reviews received strong quality rating and were included in this review. Two systematic reviews were excluded due to low quality. The guideline received strong quality rating, but was excluded due to study overlap; specifically, the studies

referenced for the evidence statement on financial incentives are included in two recent systematic reviews that are part of this rapid review.

8 Description of Included Studies

All four systematic reviews, which included a total of 96 studies, examined the effectiveness of financial incentives for changing health behaviours among adults. The effectiveness of financial incentives was assessed for overall behaviour change [2 systematic reviews (SRs)], smoking cessation (3 SRs), physical activity (3 SRs), indicators for healthy eating/ physical activity (1 SR), and attendance for vaccination or screening (1 SR). The types of financial incentives included cash, vouchers, deposit-refund, lottery or raffle tickets, and cumulative points exchangeable for vouchers. Although there was some overlap of the included studies across the reviews, each of the included reviews addressed some unique behaviour, aspect of the incentive, or intervention implementation. Only information on the adult general population was extracted. Further details regarding the included studies can be found in the Data Extraction Tables (see Appendix C).

Cahill, K., et al. (2015). Incentives for smoking cessation.(13)

The objective of this Cochrane systematic review (rated strong quality) was to determine whether financial incentives and contingency management programs^{II} led to higher smoking cessation at six to 24 months follow-up. The authors identified 30 randomized controlled trial (RCT) or clustered RCT studies, 21 of those studies were of

^{II} In contingent programs, rewards can be given and scaled depending on the participant's success of a quit attempt; in non-contingent programs, rewards can be given for program attendance and at follow-up appointments, regardless of the participant's success of a quit attempt.

adult smokers and nine studies were of pregnant smokers. Financial incentives included cash payments, deposits refunded for abstinence, lottery or raffle tickets, combination of cash payments and prize draws, or cumulative points which could be exchanged for vouchers. The primary outcome was smoking cessation that was objectively measured through biochemical verification. The secondary outcomes were adverse events or unintended consequences. The follow-up period ranged from six months to 24 months from intervention start. Most studies took place in health clinics/centres or workplaces. Other settings included academic institutions as well as urban and rural communities.

Giles, E.L., et al. (2014). The effectiveness of financial incentives for health behaviour change: systematic review and meta-analysis.(14)

This systematic review (rated strong quality) explored the effectiveness of financial incentive interventions for encouraging health behaviour change. The authors also examined whether the effects varied with the type of behaviour incentivised, follow-up time, or incentive value. Sixteen RCT or clustered RCT studies were identified. Financial incentives included certain rewards (e.g., cash rewards, vouchers, deposit-refund) and uncertain rewards (e.g., entry into lotteries). The review assessed overall behaviour change (i.e., smoking cessation, attendance for vaccination and screening, and physical activity) as well as the specific behaviour. Measures of outcomes were smoking cessation (objectively measured through biochemical verification); attendance for vaccination and screening (breast or cervical screening and tuberculin skin testing); and physical activity (minutes and number of steps measured by pedometer). For the smoking cessation studies, the intervention period ranged from two weeks to 24 months and the post intervention follow-up period ranged from four weeks to 24 months. Most

studies on attendance for vaccination or screening had no prolonged intervention or follow-up period. For the physical activity studies, final follow-up was immediately following the four week intervention period. Study settings included community, workplace, and outpatient clinics.

Mantzari, E., et al. (2015). Personal financial incentives for changing habitual health-related behaviors: A systematic review and meta-analysis.(15)

The objectives of the systematic review (rated strong quality) were to determine the effectiveness of financial incentives on behaviour change among adults and whether the effectiveness was modified by target behaviour, incentive value, attainment certainty, and recipients' deprivation^{III} level. The authors identified 39 RCT studies. Financial incentives included certain rewards (i.e., all incentives excluding lotteries), uncertain rewards (i.e., lotteries) and a combination of the two. The review assessed overall behaviour change (i.e., smoking cessation, healthy eating and/or physical activity indicators, and physical activity) and whether each behaviour was attained and sustained. Measures of outcomes were smoking cessation (self-reported or objectively measured through biochemical verification); healthy eating/physical activity indicators (body weight, blood cholesterol, or haemoglobin levels); and physical activity (self-reported minutes of physical activity, and attendance record for exercise sessions). No attributes or contextual factors that influence outcomes were assessed or reported. The follow-up period for smoking cessation studies ranged from three months to 24 months from baseline. Indicators for healthy eating and/or physical activity were assessed at 16 weeks to 30 months from baseline, and physical activity was assessed at 24 weeks to

^{III} Deprivation level was categorized based on information available in the included studies (e.g., income, employment, education, ethnicity, social economic status scores).

18 months from baseline. Most studies took place in the community, followed by the workplace, the medical/health, and the academic settings.

Mitchell, M.S., et al. (2013). Financial incentives for exercise adherence in adults.(16)

The objective of the systematic review (rated strong quality) was to determine if financial incentives increased exercise adherence in adults in the short and long term, and whether design features moderated effectiveness. The authors identified 11 RCT studies. Financial incentives included cash or non-cash rewards with a monetary value (not items with small monetary value, e.g., ribbons) provided directly to individuals. The outcomes measured were exercise session attendance, aerobic minutes, energy expenditure, and aerobic fitness. Duration of exercise session attendance studies was between four weeks and 26 weeks. Study settings included community, universities/colleges, and workplace.

9 Synthesis of Findings

Financial incentives are effective for changing health behaviours among adults in the short term^{IV}.

- **Cash or voucher incentives are effective, while other incentive formats are not effective.**
- **As follow-up time increases, the effectiveness of financial incentives diminishes.**
- **High deprivation among recipients increases the effect of financial incentives.**

Refer to Table 1.

^{IV} In the research, short term is generally up to 6 months; medium term is 6 – 18 months; and long term is greater than 18 months.

Table 1. Effectiveness of financial incentives for behaviour change

Financial incentives ^v	Outcomes				
	Overall behaviour ^{vi}	Smoking cessation	Physical activity	Indicators for healthy eating/ physical activity ^{vii}	Attendance for vaccination or screening
Overall conclusion	+	+	+, –	+	+
Follow-up^{viii}					
≤6 months	+	+	+	+	+
>6 to 12 months	+	+	NM	+	NM
>12 to 18 months	+	+, –	–	–	NM
>18 to 24 months	–	–	NM	–	NM
Longest follow-up ^{ix}	+	+	NM	NM	NM
Attributes and contextual factors	<ul style="list-style-type: none"> As follow-up time increases, the effect size decreases. At >6-12 months, high deprivation (e.g., income, employment, education, ethnicity, SES scores) increases incentive effects. There is mixed evidence on the association between incentive value and effect size. Certainty of rewards does not influence the effect of financial incentives at any time points. 	<ul style="list-style-type: none"> Length of follow-up time did not change the effect. Cash incentives are effective at >6 months; other incentive formats are not. Guaranteed rewards (i.e., cash or vouchers) vs. chance rewards do not change the effect. Low value incentive is effective; as incentive value increases the effect size also increases at ≤6 months, and not at >6months. Reward-based and deposit-refund-based incentives are effective; however, reward-based incentives are more effective than deposit-refund incentives. 	<ul style="list-style-type: none"> Financial incentives (ranged \$2.79 to \$46.82 per week) are effective; larger incentives yield larger effects. Lower-income adults accumulated more aerobic minutes than higher-income adults. Behaviour change was sustained only for participants who were inactive at baseline. Assured cash rewards are effective. Aggregative rewards (i.e., rewards that are offered at the end of the intervention period rather than with each achievement) are effective. Lottery-based rewards have no effect. When behaviour change was objectively assessed, incentives were effective; whereas financial incentives had no effect on self-reported behaviour. 	Not reported.	<ul style="list-style-type: none"> Cash or vouchers alone are effective. Cash plus motivational sessions are effective. Incentive value is not associated with effect size.

Effective (+); no effect (–); not measured (NM).

^v Financial incentives include cash, deposits refunded, lottery/ prize draws, vouchers for goods and services, and cumulative points that could be exchanged to vouchers.

^{vi} Overall behaviour includes smoking cessation, physical activity, attendance for vaccination or screening, and indicators for healthy eating/ physical activity.

^{vii} Healthy eating/ physical activity indicators: body weight, blood cholesterol, or haemoglobin levels.

^{viii} Follow-up includes time from intervention start and time of post-intervention follow-up.

^{ix} Longest time point: immediate to 24 months for overall behaviour (14); and six to 24 months for smoking cessation (13).

Overall behaviour

When all behaviours are combined, financial incentives are effective in the short term and medium term; the effect diminishes over time. Financial incentives are not effective in the long term.

When all longest time points were analyzed together (range from immediate follow-up to 24 months), adults who received financial incentives were 1.62 times more likely to change overall behaviour^X compared to the control group [risk ratio (RR) 1.62, 95%CI 1.38 to 1.91].(14) When the influence of follow-up time was examined, as follow-up time increased, the effect sizes decreased, though the strength of this association was weak.(14) At six months follow-up, adults who received financial incentives were 1.70 times more likely to change overall behaviour [odds ratio (OR) 1.70, 95%CI 1.42 to 2.02]; at six to 12 months follow-up, adults who received financial incentives were 1.59 times more likely to change overall behaviour (OR 1.59, 95%CI 1.21 to 2.08); at 12 to 18 months follow-up, adults who received financial incentives were 1.53 times more likely to change overall behaviour than the control group (OR 1.53, 95%CI 1.05 to 2.23). At 18 months and beyond, there was no effect on behaviour.(15) Overall behaviour change was sustained up to, but not beyond, 3 months after incentive removal.(15)

Overall behaviour change increased when participants with high deprivation were compared to those with low deprivation, but only at six to 12 months (OR 2.17, 95%CI 1.22 to 3.85), and not when other factors were included in the analysis.(15) It is unclear

^X Overall behaviour includes smoking cessation, physical activity, attendance for vaccination or screening, and indicators for healthy eating/ physical activity

from this evidence whether incentive value influences effect size.(14,15) Certainty of rewards did not influence the effect of financial incentives at any time point.(15)

Smoking Cessation

Financial incentives are effective at increasing smoking cessation.

- **Financial incentives are effective in the short term.**
- **There is mixed evidence on the effectiveness of financial incentive in the medium term.**
- **Financial incentives are ineffective in the long term.**

When all longest time points were analyzed together (range six to 24 months), adults who received financial incentives were 1.42 times more likely to abstain from smoking than the control group (adjusted OR 1.42, 95%CI 1.19 to 1.69).(13) When follow-up time was analyzed at up to and greater than six months, the length of follow-up time did not change the effect.(14) Financial incentives increased smoking cessation at six months follow-up (adjusted OR^{XI} 1.72, 95%CI 1.43 to 2.08; RR 2.48, 95%CI 1.77 to 3.46; and OR 1.80, 95%CI 1.37 to 2.37).(13-15) At six to 12 months follow-up, two of three reviews found that financial incentives increased smoking cessation (RR 1.50, 95%CI 1.05 to 2.14; OR 1.59, 95%CI 1.21 to 2.08).(14,15) At 12 to 18 months follow-up, the evidence is unclear on whether financial incentives influenced smoking cessation.(13,15) At 18 months follow-up and beyond, financial incentives were not effective for smoking cessation.(13,15)

^{XI} Adjustment was for cluster randomisation.

Cash incentives were effective for smoking cessation in the short and medium term.(13,14) In sensitivity analysis, there was no difference between guaranteed rewards (i.e., cash or vouchers including cumulative points exchangeable for vouchers) and chance rewards (i.e., lotteries, prize draws) on smoking cessation.(13) Cash only incentives were more effective than other formats on smoking cessation.(14) Even low value incentives (<\$400) increased smoking cessation compared to the control. (15) As incentive value increases, the effect increases at up to six months but not longer than six months.(14,15)

A rewards-based approach (e.g., cash) was effective for smoking cessation at 12 months.(13) Both rewards-based approach and deposit-refund-based approach increased smoking cessation at six months.(13) However, rewards-based approaches were more effective compared to deposit-based approaches for smoking cessation at 12 months.(13)

Physical Activity

Financial incentives increase physical activity in the short term, and are not effective in the medium term.

In two of three reviews, financial incentives increased physical activity in adults at up to six months (average of 16 minutes more of physical activity per day; 11.55% increase in exercise session attendance; OR 1.29, 95%CI 0.97 to 1.72).(14-16) At longer than six months, financial incentives did not increase physical activity.(15)

Financial incentives (ranged \$2.79 to \$46.82 per week) were effective.(16) The effect of financial incentives was greater when the incentives were larger.(16) Financial

incentives were more effective for lower income adults compared to higher income adults.(16) Following incentives removal, there were sustained effects of financial incentives on exercise adherence levels for adults who were previously inactive compared to those who were previously active.(16)

Assured cash rewards, aggregative rewards (i.e., rewards that are offered at the end of the intervention period rather than with each achievement), and rewards contingent on objectively assessed behaviours all increased physical activity.(16) Lottery-based rewards and rewards contingent on self-reported behaviour did not increase physical activity.(16)

Indicators for Healthy Eating/ Physical Activity

Financial incentives improve healthy eating/physical activity indicators in the short and medium term and are not effective in the long term.

At six months, adults who received financial incentives were 1.66 times more likely to show improved healthy eating/physical activity indicators (i.e., body weight, blood cholesterol, or haemoglobin levels) than the control group (OR 1.66, 95%CI 1.28 to 2.15).(15) At six to 12 months, adults who received financial incentives were 1.39 times more likely to show improved healthy eating/physical activity indicators than the control group (OR 1.39, 95%CI 1.03 to 1.88).(15) Beyond 12 months, financial incentives did not improve healthy eating/physical activity indicators.(15)

Attendance for Vaccination or Screening

Financial incentives are effective for attendance at vaccination or screening in the short term.

Adults who received financial incentives were 1.92 times more likely to attend sessions for vaccination or screening than the control group (RR 1.92, 95%CI 1.46 to 2.53).(14)

Cash plus motivational sessions (RR 2.75, 95%CI 1.84 to 4.13) were more effective than cash or vouchers alone (RR 1.77, 95%CI 1.33 to 2.53) in subgroup analysis.(14)

Incentive value was not associated with an increase in attendance for vaccination or screening, however there was little variation in incentive value.(14)

10 Applicability and Transferability

The rapid review project team met with PPH managers and supervisors to discuss the applicability and transferability of the findings and recommendations from this report. A summary of key points from the facilitated discussion is provided below:

Political acceptability

- The political acceptance of financial incentives could be mixed and depends on factors such as: the target population, the funding source of the incentives, the incentives offered, and the desired behavioural outcome.
- An investment in financial incentives for short term outcomes may be misaligned with current strategic priorities. The research demonstrates that financial incentives are generally effective for short term outcomes, but behaviours such

as smoking cessation, physical activity, and healthy eating require long term and sustained change for health benefits.

Social acceptability

- Financial incentives will likely be socially acceptable by those who are offered the incentives and socially unacceptable by those who are not offered the incentives. If an entire population is offered incentives, then the incentives would be more socially acceptable than if incentives were only offered to a subgroup of the population.
- There may be ethical considerations for offering financial incentives to highly deprived population subgroups for changing health behaviour; For instance, low income individuals receiving the incentives may become financially dependent on the incentives. Furthermore, financial incentives may influence individuals to provide consent for program participation.
- Clear rationale for offering incentive-based program must be communicated to the public. Eligibility criteria for participating in incentive-based programs must be clearly identified if targeting at-risk populations.
- Confidentiality should be considered when gathering personal information to monitor and track results of the financial incentive intervention.

Available resources

- Clear policy and procedure for providing financial incentive interventions would need to be established. Staff resources would be required for program

development, promotion, implementation and evaluation. Collaboration across the department (e.g., human services, communications, and information technology) would also be required to support programs.

- For accountability and reporting purposes, a coordinated tracking system that is not onerous on staff time would need to be in place to track the disbursement of financial incentives.

Organizational expertise and capacity

- Offering financial incentives to individuals for changing health behaviour is inconsistent with the population health approach. Providing financial incentives at the systems level (e.g., discounts on developmental charges to encourage the building of healthy communities) may be more relevant to the population health approach.
- Organizational barriers include lack of alignment with the population health approach, competing priorities, budget constraints, ethical considerations, capacity to support technology-based interventions and mobile apps, and internal and external communication processes.
- There are incentive programs available to the public which aim to promote products rather than to promote health. A greater understanding of publicly available incentive programs is warranted to determine whether the incentive program of interest would have an impact in the presence of competing programs, and to assess whether to endorse an existing incentive program.

Transferability

- The rapid review focuses on the adult general population, while also providing insight on adults with high deprivation. The findings are not generalizable to other subpopulations (e.g., children, pregnant women, or newcomers).
- The use of financial incentives may apply to short-term interventions (e.g., vaccination), but not long-term interventions for smoking cessation, healthy eating, or physical activity.
- Each health-related program area may have different priority populations. Clear criteria must be established to determine eligibility to participate in the financial incentive intervention; the criteria may differ depending on the behavioural outcome of interest.

11 Recommendations

Peel Public Health should:

1. Consider the use of financial incentives in the form of cash or vouchers, when short-term behaviour change among adults is the program goal.
 - Financial incentives may be considered for short term behaviour change particularly for populations with high deprivation.
2. Share the findings of this rapid review with internal staff and managers as well as external stakeholders who may use financial incentives to change health behaviour.

3. Carefully consider the local context, community and political preferences, public health resources, as well as the research evidence in the development, promotion, implementation, and evaluation of interventions that use financial incentives.

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Appendices

Appendix A: Search Strategy

Appendix B: Literature Search Flowchart

Appendix C: Data Extraction Tables

Appendix D: Applicability & Transferability Worksheet

Appendix A: Search Strategy

Ovid Search

Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to January 18, 2017>, Global Health <1973 to 2017 Week 02>, Ovid Healthstar <1966 to November 2016>, Ovid MEDLINE(R) <1946 to December Week 1 2016>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <January 19, 2017>, PsycINFO <2002 to January Week 3 2017>

- 1 behaviour*.ti,ab. (502788)
- 2 behavior*.ti,ab. (1609653)
- 3 exp health behavior/ (323621)
- 4 exp choice behavior/ (106539)
- 5 1 or 2 or 3 or 4 (2411400)
- 6 exp reward/ (29011)
- 7 reward*.ti,ab. (100581)
- 8 incentive*.ti,ab. (58498)
- 9 exp reimbursement, incentive/ (7653)
- 10 exp reinforcement schedule/ (10856)
- 11 6 or 7 or 8 or 9 or 10 (174269)
- 12 5 and 11 (62383)
- 13 limit 12 to yr="2006 -Current" (46520)
- 14 review*.ti,ab. (3447704)
- 15 meta analys*.ti,ab. (233377)
- 16 synthes*.ti,ab. (1237321)
- 17 guideline*.ti,ab. (545015)
- 18 14 or 15 or 16 or 17 (5080452)
- 19 13 and 18 (6382)
- 20 material.ti,ab. (733455)
- 21 financial.ti,ab. (168394)
- 22 monetary.ti,ab. (17400)
- 23 20 or 21 or 22 (912123)
- 24 19 and 23 (764)
- 25 reward*.ti. (21931)
- 26 incentive*.ti. (11847)
- 27 25 or 26 (33438)
- 28 24 and 27 (261)
- 29 limit 28 to yr="2011 -Current" (221)
- 30 limit 29 to yr="2013 -Current" (159)

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Search ID#	Search Terms	Search Options	Actions
<input type="checkbox"/> S9	S7 AND S6	Limiters - Date of Publication: 20130101-20161231 Search modes - Boolean/Phrase	View Results (17) View Details Edit
<input type="checkbox"/> S8	S7 AND S6	Search modes - Boolean/Phrase	View Results (88) View Details Edit
<input type="checkbox"/> S7	AB behav*	Search modes - Boolean/Phrase	View Results (168,661) View Details Edit
<input type="checkbox"/> S6	S5 AND S2	Search modes - Boolean/Phrase	View Results (448) View Details Edit
<input type="checkbox"/> S5	S4 OR S3 OR S1	Search modes - Boolean/Phrase	View Results (4,334) View Details Edit
<input type="checkbox"/> S4	DE "REINFORCEMENT (Psychology)"	Search modes - Boolean/Phrase	View Results (852) View Details Edit
<input type="checkbox"/> S3	DE "REWARD (Psychology)"	Search modes - Boolean/Phrase	View Results (447) View Details Edit
<input type="checkbox"/> S2	AB material OR AB financial OR AB monetary	Search modes - Boolean/Phrase	View Results (88,305) View Details Edit
<input type="checkbox"/> S1	TI reward* OR TI incentive*	Search modes - Boolean/Phrase	View Results (3,298) View Details Edit

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4:16 PM
2017-01-20

Grey Literature Search

Sources	Search Terms	Hits	Results*	Potentially relevant (carried to full text review)	Relevant
TRIP database	(Adult*) AND (financial incentive* OR reward*) AND ("risk behaviour" OR "risk behavior" OR "health behaviour" OR "health behavior")	125	6	0	0
NICE guidance	(Adult*) AND (financial incentive* OR reward*) AND ("risk behaviour" OR "risk behavior" OR "health behaviour" OR "health behavior")	11	5	5	1
Health Canada	(Adult*) AND ("financial incentive*" OR "reward*") AND ("risk behaviour" OR "risk behavior" OR "health behaviour" OR "health behavior")	3	0	0	0
Centers for Disease Control and Prevention (CDC)	(Adult*) AND (financial incentive* OR reward*) AND ("risk behaviour" OR "risk behavior" OR "health behaviour" OR "health behavior")	47	0	0	0
National Guideline Clearinghouse	(Adult*) AND (financial incentive* OR reward*) AND ("risk behaviour" OR "risk behavior" OR "health behaviour" OR "health behavior")	23	18	0	0
	TOTAL	209 hits	29 results	5 potentially relevant	1 relevant

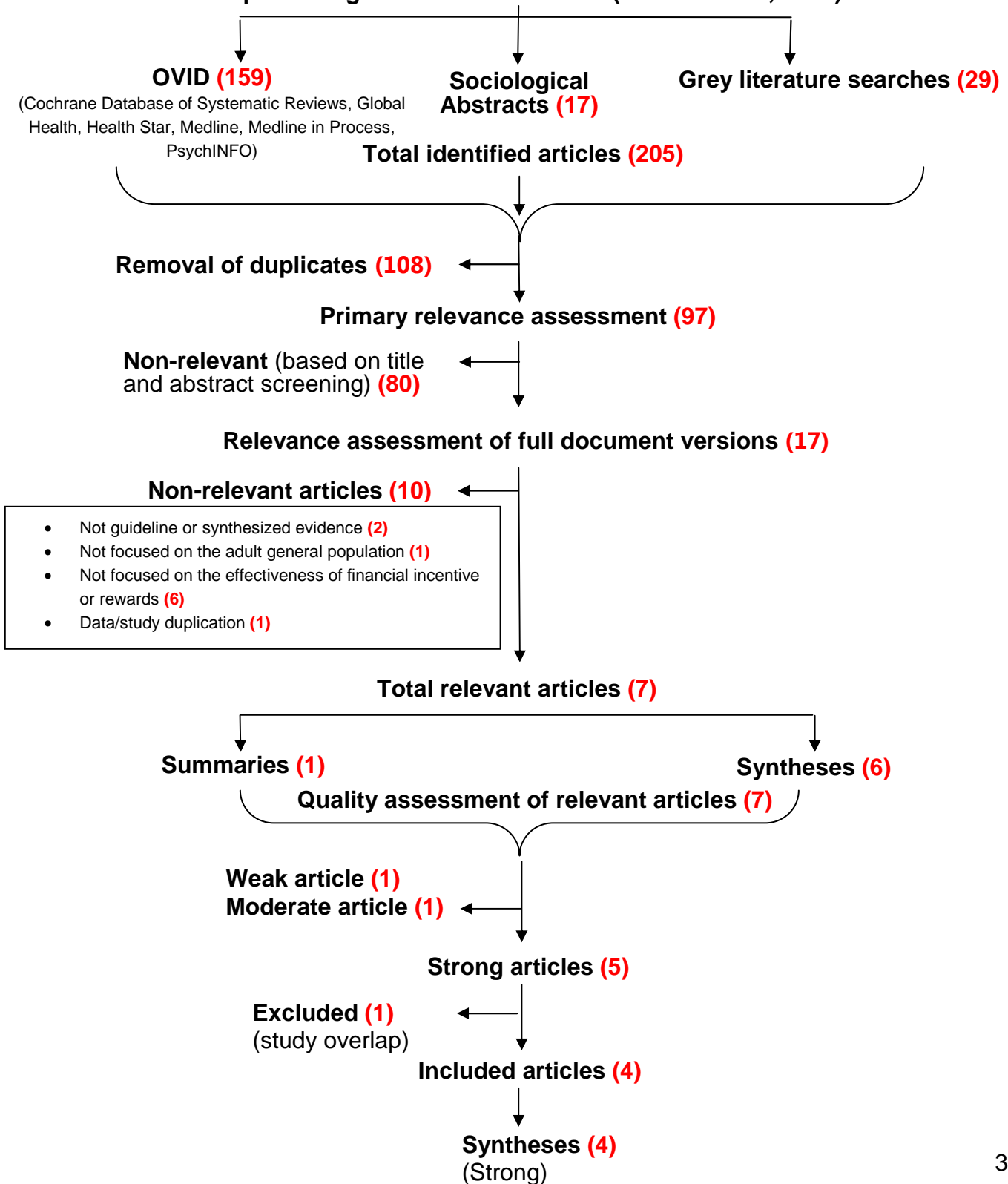
*Excluded publications before 2013, duplicates, and documents that are not reviews or guidelines.

Search conducted on January 17, 2017

Relevancy assessment completed on February 01, 2017

Appendix B: Literature Search Flowchart

What is the effectiveness of direct and indirect financial incentives for changing health promoting and risk behaviours? (December 22, 2016)



Appendix C: Data Extraction Tables

Data Extraction	
Last revised: May 25, 2017	
Systematic Review #1 Cahill, K., et al. (2015). Incentives for smoking cessation. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004307.pub5/full	
General Information and Quality Rating	
Country	England. Total 30 studies: 23 studies were conducted in USA, 4 in UK, 1 in Spain, 1 in Thailand, and 1 in Philippines.
Health Evidence Quality Tool	9/10 (strong) by two independent reviewers (HKD & JM)
Details of the Review	
Objective	<ul style="list-style-type: none"> To determine whether incentives and contingency management programmes lead to higher long-term smoking cessation rates.
Number of primary studies included	<ul style="list-style-type: none"> 30 studies: <ul style="list-style-type: none"> - 21 studies on adult smokers (8413 participants) - 9 studies on pregnant smokers (1783 participants)^{xii}
Types of studies included	<ul style="list-style-type: none"> Randomized controlled trials Cluster randomized controlled trials
Search period	<ul style="list-style-type: none"> Updated search from previous review (Cahill & Perera, 2011) until December 2014. Two additional trials published in 2015 were added during the review process.
Number of databases searched	<ul style="list-style-type: none"> Four electronic databases: MEDLINE, Embase, Cumulated Index to Nursing and Allied Health Literature (CINAHL), and PsycINFO Screened reference lists Searched trials registries Consulted with experts
Inclusion/exclusion criteria	<p>Inclusion criteria:</p> <ul style="list-style-type: none"> Randomized controlled trials allocating individuals, communities, workplaces, or groups within workplaces to intervention or to control conditions; Controlled trials with baseline measures and post-intervention outcomes. Adult smokers, in any setting (e.g., community, academic institutions, and worksites); Pregnant women who smoke. Incentive schemes, lotteries, raffles, and contingent or non-

^{xii} Data not extracted for studies of pregnant women.

	<p>contingent payments to reward cessation and abstinence in smoking cessation programs.</p> <ul style="list-style-type: none"> • Primary outcome: cessation rates; Secondary outcome; adverse events or unintended consequences; For mixed population studies, abstinence had to be assessed at a minimum of six months from the start of the intervention, whether or not they were biochemically validated. <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • Adolescent smokers only. • Effectiveness of incentives or rewards to healthcare workers (physicians, nurses) for the delivery of smoking cessation interventions. • Effectiveness of reimbursement to patients for smoking cessation treatment costs. • No report on cessation rates.
Quality of included studies	<ul style="list-style-type: none"> • Evaluated the risk of bias using methods described in the Cochrane handbook. Domains assessed: random sequence generation; allocation concealment; blinding of participants, personnel and outcome assessors; incomplete outcome data; and other potential risk of bias. Each domain was rated high, low, or unclear. • The quality of the body of evidence for each particular outcome was rated using GRADE. • Low quality^{xiii} of evidence for smoking cessation in mixed populations at longest follow-up point (17 studies)
Characteristics of the studies included in review	
Study population	<ul style="list-style-type: none"> • Adult smokers, also termed 'mixed population' (21 studies)
Study settings	<ul style="list-style-type: none"> • Clinics or health centres (10 studies) • Villages served by community health workers (1 study) • Academic institution (2 studies) • Urban community (1 study) • Worksites (7 studies)
Description of interventions	<ul style="list-style-type: none"> • Incentives include: <ul style="list-style-type: none"> ○ Cash payments upon verified abstinence (9 studies). ○ Deposits refunded for abstinence over the course of the program (6 studies).

^{xiii} GRADE Working Group grades of evidence:

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

	<ul style="list-style-type: none"> ○ Lottery or raffle tickets (3 studies). ○ Combination of cash payments with one or more site-wide prize draws (2 studies); one of these studies also included a prize draw for 'buddies', who supported smokers trying to quit. ○ Cumulative points for consecutive confirmed tests for abstinence; the points could be exchanged to vouchers for local goods and services (1 study).
Outcome measures	<ul style="list-style-type: none"> ● Primary outcome: cessation rates, measured as point prevalence and sustained abstinence. ● Secondary outcome: adverse events or unintended consequence. ● Follow-up for mixed population studies ranged from a maximum of 6 months to a maximum of 24 months from intervention start. ● All included studies used some form of biochemical verification (e.g., blood sample, breath sample, urine sample) to confirm the smoking status of those claiming abstinence.
Results of the Review	
Main results	<p>Smoking Cessation</p> <ul style="list-style-type: none"> ● Adults who received personal financial incentives had significantly increased odds of smoking cessation at longest follow-up point (17 studies) and at 6 months from intervention start (16 studies) compared to the control group: <ul style="list-style-type: none"> ○ Measured at longest follow-up point (ranged from 6 to 24 months): adjusted^{XIV} odds ratio (OR) 1.42; 95%CI 1.19 to 1.69; I²=33%. ○ 6 months: adjusted OR 1.72; 95%CI 1.43 to 2.08; I²=51%. ● Personal financial incentives had no effect on smoking cessation at 12 months (6 studies), 18 months (1 study), and 24 months (2 studies): <ul style="list-style-type: none"> ○ 12 months: adjusted OR 1.17; 95%CI 0.94 to 1.46; I²=56%. ○ 18 months: adjusted OR 1.59; 95%CI 0.89 to 2.83; I²= not applicable. ○ 24 months: adjusted OR 1.29; 95%CI 0.93 to 1.79; I²=0%. <p>By types of incentives</p> <ul style="list-style-type: none"> ● To assess the impact of guaranteed rewards (cash or vouchers, including one study of cumulative points exchangeable for vouchers) versus non-guaranteed rewards (lotteries, prize draws), a sensitivity analysis was conducted by removing trials that used non-guaranteed rewards from the

^{XIV} Adjustment was for cluster randomization where appropriate; the authors did not provide detail on the types of clustering which were adjusted for.

	<p>meta-analyses (longest follow-up: removed 3 trials; 6 month: removed 2 trials; 12 month: removed 1 trial).</p> <ul style="list-style-type: none"> ○ Results showed the effect of guaranteed rewards remains significant at longest follow-up point (OR 1.43, 95%CI 1.16 to 1.76, I²=42%) and 6 months (OR 1.63, 95%CI 1.32 to 2.02, I²=54%). ○ The effect of guaranteed rewards remains insignificant at 12 months (OR 1.28, 95%CI 1.00 to 1.65, I²=57%, p=0.05). ● One study found: <ul style="list-style-type: none"> ○ Adults who received rewards-based interventions had significantly more instances of sustained abstinence than the control group at 6 months and at 12 months (data not shown). ○ Adults who received deposit-refund-based interventions had significantly more instances of sustained abstinence than the control group at 6 months (data not shown). ○ Adult smokers who took part in a rewards-based intervention had increased odds of quitting smoking at 12 months compared to those who were in a deposit-refund-based intervention (OR 1.76; 95%CI 1.22 to 2.53). <p><i>Secondary outcomes</i></p> <p>Costs</p> <ul style="list-style-type: none"> ● Two studies estimated the average cost per quitter from the intervention, which ranged from 281 USD to 890 USD per quitter. ● One study estimated an additional cost of 5186 USD to hire a smoker vs. non-smoker; one study estimated a savings of 3400 USD per quitter per year to an employer. <p>Harms or disbenefits</p> <ul style="list-style-type: none"> ● One study considered whether smoking cessation may have worsened the condition in participants with schizophrenia or other serious mental illness, but found no evidence of harm at 36 weeks follow-up; one study reported a participant being hospitalized for alcohol-related heart, liver and lung problems, not associated with the intervention.
<p>Comments and limitations</p>	<ul style="list-style-type: none"> ● Eight of the 21 mixed population studies presented results as percentages only; raw outcome data, particularly in the older studies, were often difficult to extract. ● The authors noted that the results from some of the mixed population studies may not be readily generalizable to other populations of smokers: <ul style="list-style-type: none"> ○ The two largest included studies, which reported high methodological standards, enrolled employees of large

	<p>American companies who were predominately white, with high levels of education and income.</p> <ul style="list-style-type: none">○ One community based study reported unusually high quit rate for the control group; the population may have represented 'low-hanging fruits' (easy quitters). <p>Overall conclusion</p> <ul style="list-style-type: none">• Incentives significantly increased smoking cessation while they are in place, but the typical relapse pattern is likely to re-establish itself once incentives are removed.
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Data Extraction	
Last revised: April 5, 2017	
Systematic Review #2 Giles, E.L., et al. (2014). The effectiveness of financial incentives for health behavior change: systematic review and meta-analysis. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0090347	
General Information and Quality Rating	
Country	England. Majority of the studies were conducted in USA (14 studies).
Health Evidence Quality Tool	10/10 (strong) by three independent reviewers (HKD, JM & LG)
Details of the Review	
Objectives	<ul style="list-style-type: none"> • To conduct a systematic review of the effectiveness of financial incentive interventions for encouraging healthy behaviour change. • To explore whether effects vary according to the type of behaviour incentivised, follow-up time after incentive withdrawal, incentive value, or format of the incentive itself.
Number of primary studies included	<ul style="list-style-type: none"> • 16 studies (total number of participants not provided)
Types of studies included	<ul style="list-style-type: none"> • Randomized controlled trials • Cluster randomized controlled trials
Search period	<ul style="list-style-type: none"> • Inception to April 2012
Number of databases searched	<ul style="list-style-type: none"> • Nine electronic databases: MEDLINE, Embase, Science Citation Index, CINAHL, Social Science Citation Index; PsychINFO, Applied Social Science Index and Abstracts, International Bibliography for the Social Sciences, and The Cochrane Library. • Google • Manual searches of online research registers • Relevant National Academic Mailing List groups • Screened reference lists • Citation searches of included papers
Inclusion/exclusion criteria	<p>Inclusion criteria:</p> <ul style="list-style-type: none"> • Randomized controlled trials, cluster randomized controlled trials, controlled before and after studies or interrupted time series analyses. • Non-clinical adult populations, living in high-income countries. • Financial incentives: cash, cash-like rewards, or penalties contingent on behaviour change or non-change. • Usual care, no intervention • Smoking cessation, physical activity, alcohol consumption, safe

	<p>sun behaviours, safe sex behaviours, healthy food behaviours, attendance for screening or vaccination.</p> <ul style="list-style-type: none"> • Objective or validated self-reported measures • All languages (English language title and abstract) <p>Exclusion criteria:</p> <ul style="list-style-type: none"> • Studies that used process markers of change only (e.g., weight loss, but not physical activity or diet).
Quality of included studies	<ul style="list-style-type: none"> • Risk of bias was assessed using the Cochrane Risk of Bias Review Guidelines. Domains assessed: allocation sequence; allocation concealment; baseline outcomes; baseline characteristics; outcome data; blinding; contamination; outcome reporting; and other bias. Each domain was rated high, low, or unclear. • Most included studies had low or unclear risk of bias in most domains. • The main potential sources of bias were: allocation sequence and allocation concealment, and possible selection bias. • One study had high risk of bias in relation to allocation sequence, allocation concealment, and baseline characteristics; this study was not included in meta-analyses or meta-regression due to insufficient data.
Characteristics of the studies included in review	
Study population	<ul style="list-style-type: none"> • Adults, non-clinical (16 studies).
Study settings	<ul style="list-style-type: none"> • Community – not workplace (6 studies) • Community – workplace (6 studies) • Workplace (2 studies) • Outpatient (2 studies)
Description of interventions	<ul style="list-style-type: none"> • Certain rewards: <ul style="list-style-type: none"> ○ Cash rewards and/or vouchers exchangeable for a specific range of goods or services (13 studies) ○ Deposit contracts (2 studies) • Uncertain rewards (e.g. entry into lotteries) contingent on behaviour change in addition to certain rewards (2 studies). • The total value of certain financial incentive payments that study participants could receive for successful behaviour change ranged from \$5.16 to \$786 (in 2011 \$US); this does not include any payments for study participation. • Intervention period: <ul style="list-style-type: none"> ○ smoking cessation studies ranged from 2 weeks to 24 months; ○ most attendance for vaccination and screening studies had no prolonged intervention; One study had an assessment period of 24 weeks for repeated attendance for a series of

	injections; ○ the physical activity study had a four week intervention period.
Outcome measures	<ul style="list-style-type: none"> ● Smoking cessation (10 studies): <ul style="list-style-type: none"> ○ all studies used some form of biochemical verification to confirm smoking status; ○ post intervention follow-up period ranged from four weeks to 24 months. ● Attendance for vaccination and screening (5 studies) <ul style="list-style-type: none"> ○ studies measured attendance for vaccination, breast or cervical screening, TD skin test reading; ○ most studies had no follow-up period; ● Physical activity (1 study) <ul style="list-style-type: none"> ○ study measured number of steps and minutes of physical activity; ○ study had a final follow-up immediately following the four week intervention period.

Results of the Review

Main results	<p>Smoking cessation</p> <ul style="list-style-type: none"> ● Adults who received financial incentives had a significantly increased likelihood of smoking cessation at ≤6 months and at >6months follow-up compared to the control group: <ul style="list-style-type: none"> ○ ≤6 months follow-up (8 studies): Risk ratio (RR) 2.48; 95%CI 1.77 to 3.46; I²=21%. ○ >6 months follow-up (6 studies): RR 1.50; 95%CI 1.05 to 2.14; I²=76%. ● Subgroup analysis by incentive type suggested that cash-only incentives significantly increased the likelihood of smoking cessation at >6 months follow-up, but no effect between other incentive formats and the likelihood of smoking cessation at >6 months follow-up: <ul style="list-style-type: none"> ○ Cash-only incentives (5 studies): RR 1.57; 95%CI 1.06 to 2.32; I²=83%. ○ Other incentive formats (1 study): RR 1.16; 95%CI 0.45 to 2.94; I²=0%. ● As the incentive value increased, the effect size for smoking cessation also increased (positively associated) at >6 months follow-up (8 comparisons: coefficient 0.001; 95%CI 0.0002 to 0.003). Incentive value was not associated with the effect size for smoking cessation at ≤6 months follow-up (13 comparisons: beta -0.003; 95%CI -0.001 to 0.0008). ● Follow-up period was not associated with the effect size for smoking cessation at ≤6 months follow-up (13 comparisons: beta -0.003; 95%CI -0.01 to 0.003) and at >6 months follow-up (8 comparisons: coefficient 0.0005; 95%CI -0.002 to 0.001).
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	<p>Attendance for vaccination or screening</p> <ul style="list-style-type: none"> • Adults who receive financial incentives had a significantly increased likelihood of attendance for vaccination or screening compared to the control group (4 studies): RR 1.92; 95%CI 1.46 to 2.53; $I^2=89\%$. <ul style="list-style-type: none"> ○ Subgroup analysis by incentive type suggested that cash or vouchers alone, as well as cash and motivational sessions, are effective in increasing the likelihood of attendance for vaccination or screening compared to control group; Cash plus other motivational components may be more effective than cash or vouchers alone on the attendance for vaccination or screening: <ul style="list-style-type: none"> - Cash or vouchers alone (4 studies): RR 1.77; 95%CI 1.33 to 2.35; $I^2=89\%$. - Cash & motivational sessions (1 study): RR 2.75; 95%CI 1.84 to 4.13; $I^2=0\%$. • Minimal variation in incentive value was not associated with the effect size for attendance for vaccination or screening (9 comparisons: coefficient -0.0004; 95%CI -0.004 to 0.003). <p>Physical Activity</p> <ul style="list-style-type: none"> • One study showed statistically significant increase in average daily physical activity (an average of 16 more minutes per day) amongst participants who were in the financial incentive arm than those in the control arm (results not shown). <p>All behaviours (smoking cessation, attendance for vaccinations or screening, and physical activity combined)</p> <ul style="list-style-type: none"> • Adults who receive financial incentives had a significantly increased likelihood of all behaviours at longest follow-up point compared to the control group: <ul style="list-style-type: none"> ○ Longest follow-up point (14 studies): RR 1.62; 95%CI 1.38 to 1.91; $I^2=84\%$. • As the follow-up period increased, the effect size for all behaviours also decreased (negatively associated) at longest follow-up point (25 comparisons: coefficient -0.001; 95%CI -0.002 to -0.0002). • As the incentive value increased, the effect size for all behaviours also decreased (negatively associated)^{XV} at longest follow-up point (25 comparisons: coefficient -0.001; 95%CI -0.002 to -0.0001).
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^{XV} The authors noted that in the meta-regression analysis of all behaviours combined, the decreasing effect on all behaviours as the incentive value increases may have been confounded by the effect of follow-up period.

<p>Comments and limitations</p>	<ul style="list-style-type: none"> • The review found few controlled studies exploring the effect of health promoting financial incentives (HPFI) on a small number of behaviours. • Studies are US based, potentially limiting the generalisability to other cultures and contexts. • There were gaps in the range of incentive values and follow-up periods within the included studies. • The review did not explore whether the effect of HPFI varied according to recipient characteristics (e.g. age, gender, socio-economic position). • Only studies comparing HPFI to usual care or no intervention were included; it is not clear how HPFI compare to other interventions. • Considerable heterogeneity was found within some meta-analyses. • Contour enhanced funnel plots showed low risk of publication bias for smoking cessation comparisons at ≤ 6 months follow-up and at > 6 months follow-up, and no evidence of publication bias for attendance for vaccination or screening comparisons and physical activity comparisons. • Authors were not able to conduct a multi-variate meta-regression analysis to account for possible confounding effects of incentive value and follow-up period on all behaviours. <p>Overall conclusion</p> <ul style="list-style-type: none"> • HPFI are more effective than usual care or no intervention at encouraging healthy behaviour change amongst non-clinical adult populations living in high income countries. • There was some evidence that effects decrease as post-intervention follow-up increases and as incentive value increases.
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Data Extraction	
Last revised: May 24, 2017	
Systematic Review #3 Mantzari, E., et al., (2015). Personal financial incentives for changing habitual health-related behaviors: A systematic review and meta-analysis. http://www.sciencedirect.com/science/article/pii/S0091743515000729	
General Information and Quality Rating	
Country	England <ul style="list-style-type: none"> Majority of the studies were conducted in USA (36 studies)
Health Evidence Quality Tool	9/10 (strong) by three independent reviewers (HKD, JM & SW)
Details of the Review	
Objectives	To estimate whether: <ul style="list-style-type: none"> Financial incentives achieve sustained changes in smoking, eating, alcohol consumption and physical activity; Effectiveness is modified by: <ol style="list-style-type: none"> the target behaviour; incentive value and attainment certainty; recipients' deprivation level.
Number of primary studies included	<ul style="list-style-type: none"> 39 studies (13,282 participants)
Type of studies included	<ul style="list-style-type: none"> Randomized controlled trials
Search period	<ul style="list-style-type: none"> Inception to July 2012
Number of databases searched	<ul style="list-style-type: none"> Eight databases: MEDLINE, Embase, PsycINFO, CINAHL, SCOPUS, EconLit, the Cochrane Central Register of Controlled Trials, and the Cochrane Database of Systematic Reviews Reference lists of relevant papers Grey literature resources (HMIC, online clinical trials registers, Google Scholar and websites of key organizations)
Inclusion/exclusion criteria	<p>Inclusion criteria:</p> <ul style="list-style-type: none"> Randomized controlled trials Adults Offer financial incentives and assess outcomes related to the target behaviours at a minimum of six months from baseline Target behaviours: smoking cessation, healthier eating, reduced alcohol consumption, and increased physical activity All languages <p>Exclusion criteria:</p> <ul style="list-style-type: none"> Multi-component interventions precluding assessment of the independent effects of incentives

	<ul style="list-style-type: none"> • Incentives of symbolic or no monetary value or not contingent on achievement of target outcomes
Quality of included studies	<ul style="list-style-type: none"> • The Cochrane Collaboration risk of bias tool was used. • Most studies had unclear risk of bias for random sequence generation, allocation concealment, as well as blinding of participants and personnel. • Most studies had low risk of bias for standardization of study procedures, blinding of outcome assessment, and reliability of outcome measures. • One study had high risk of recruitment bias.
Characteristics of the studies included in review	
Study population	<ul style="list-style-type: none"> • Adults • Smoking cessation studies included adults and pregnant smokers
Study settings	<ul style="list-style-type: none"> • Community (15 studies) • Workplaces (12 studies) • Medical/health settings (11 studies) • Academic (1 study)
Description of interventions	<ul style="list-style-type: none"> • Duration of financial incentive schemes ranged from three weeks to 18 months in all studies. • Offered incentives alongside concurrent intervention components to change target behaviours (e.g., counselling, self-help manuals, brochures, professional advice, nicotine replacement therapy) (30 studies). • Incentives were classified according to their overall value as either 'low' (<\$400) or 'high' (≥\$400): <ul style="list-style-type: none"> ○ Low incentive value (20 studies). ○ High incentive value (18 studies). ○ One study included two groups differing in their classification of value. • Incentives were classified according to their type as 'certain' (all incentives excluding lotteries) or 'uncertain' (lotteries): <ul style="list-style-type: none"> ○ Certain (32 studies). ○ Uncertain (4 studies). ○ Combination of certain and uncertain (2 studies). ○ One study included two groups differing in incentive attainment certainty. • Participants' deprivation level was classified at the study level as either 'high' or 'other' based on any relevant information available in the included reports (e.g. income, employment, education, ethnicity, SES scores): <ul style="list-style-type: none"> ○ High deprivation (12 studies). ○ Other (22 studies). ○ Cannot be classified (5 studies).

Outcome measures	<ul style="list-style-type: none"> • Attainment of pre-specified target levels of behaviour-change. Target behaviours include: <ul style="list-style-type: none"> ○ Smoking cessation (follow-up period ranged from 3 months to 24 months from baseline); ○ Healthy eating and/or physical activity indicators (i.e., body weight, blood cholesterol, or haemoglobin levels) (follow-up period ranged from 16 weeks to 30 months from baseline); ○ Physical activity (follow-up period ranged from 24 weeks to 18 months from baseline). • 19 studies focused on smoking cessation; 15 studies on healthy eating and/or physical activity indicators; 2 studies on physical activity; and 3 studies on multiple behaviours.
Results of the Review	
Main results	<p>Overall behaviour change</p> <p><u>Attaining^{XVI} overall behaviour change</u></p> <ul style="list-style-type: none"> • Adults who received personal financial incentives had significantly increased odds of attaining overall behaviour change at 6 months, >6-12 months, and >12-18 months from intervention start compared to the control group: <ul style="list-style-type: none"> ○ 6 months (33 comparisons): OR 1.70; 95%CI 1.42 to 2.02; I²=39%. ○ >6-12 months (28 comparisons): OR 1.59; 95%CI 1.21 to 2.08; I²=66%. ○ >12-18 months (13 comparisons): OR 1.53; 95%CI 1.05 to 2.23; I²=64%. • Personal financial incentives had no effect on attaining overall behaviour change among adults at >18 months from intervention start: <ul style="list-style-type: none"> ○ >18 months (5 comparisons): OR 1.04; 95%CI 0.88 to 1.21; I²= 0%. <p><u>Sustaining^{XVII} overall behaviour change</u></p> <ul style="list-style-type: none"> • Adults who received personal financial incentives had significantly increased odds of sustaining changes to overall behaviour at >2-3 months after incentive removal compared to the control group: <ul style="list-style-type: none"> ○ >2-3 months (11 comparisons): OR 2.11; 95%CI 1.21 to 3.67; I²=51%. • Personal financial incentives had no effect on sustaining overall behaviour change among adults at >3-6 months, and >6 months after incentive removal:

^{XVI} Behaviour attainment is measured at 6 months, >6-12 months, >12-18 months, and >18 months from the start of the intervention.

^{XVII} Behaviour sustainment is measured at >2-3 months, >3-6 months, and 6 months after the removal of incentives.

- **>3-6 months** (9 comparisons): OR 1.31; 95%CI 0.90 to 1.90; $I^2=46\%$.
- **>6 months** (13 comparisons): OR 1.10; 95%CI 0.95 to 1.27; $I^2=0\%$.

Smoking cessation

Attaining smoking cessation

- Adults who received personal financial incentives had significantly increased odds of attaining smoking cessation at 6 months, >6-12 months, and >12-18 months from intervention start compared to the control group:
 - **6 months** (21 comparisons): OR 1.80; 95%CI 1.37 to 2.37; $I^2=52\%$.
 - **>6-12 months** (17 comparisons): OR 1.67; 95%CI 1.13 to 2.45; $I^2=79\%$.
 - **>12-18 months** (6 comparisons): OR 2.69; 95%CI 1.39 to 5.23; $I^2=61\%$.
- Personal financial incentives had no effect on attaining smoking cessation among adults at >18 months from intervention start:
 - **>18 months** (3 comparisons): OR 1.06; 95%CI 0.90 to 1.25; $I^2=0\%$.

Sustaining smoking cessation

- Adults who received personal financial incentives had significantly increased odds of sustaining smoking cessation at >2-3 months after incentive removal compared to the control group:
 - **>2-3 months** (7 comparisons): OR 2.57; 95%CI 1.20 to 5.54; $I^2=54\%$.
- Personal financial incentives had no effect on sustaining smoking cessation among adults at >3-6 months and >6 months after incentive removal:
 - **>3-6 months** (9 comparisons): OR 1.31; 95%CI 0.90 to 1.90; $I^2=46\%$.
 - **>6 months** (7 comparisons): OR 1.16; 95%CI 0.94 to 1.43; $I^2=15\%$.

Indicators for healthier eating/physical activity (i.e., body weight, blood cholesterol, or haemoglobin levels)

Attaining target indicators for healthier eating/physical activity

- Adults who received personal financial incentives had significantly increased odds of attaining target indicators of healthier eating and/or physical activity at 6 months and >6-12 months from intervention start compared to the control group:

	<ul style="list-style-type: none"> ○ 6 months (8 comparisons): OR 1.66; 95%CI 1.28 to 2.15; $I^2=0\%$. ○ >6-12 months (11 comparisons): OR 1.39; 95%CI 1.03 to 1.88; $I^2=0\%$. ● Personal financial incentives had no effect on attaining target indicators of healthier eating and/or physical activity among adults at >12-18 months and >18 months from intervention start: <ul style="list-style-type: none"> ○ >12-18 months (5 comparisons): OR 1.20; 95%CI 0.81 to 1.78; $I^2=0\%$. ○ >18 months (2 comparisons): OR 0.77; 95%CI 0.43 to 1.37; $I^2=0\%$. <p><u>Sustaining target indicators for healthier eating/physical activity</u></p> <ul style="list-style-type: none"> ● Personal financial incentives had no effect on sustaining target indicators of healthier eating and/or physical activity at >2-3 months and >6 months after incentive removal: <ul style="list-style-type: none"> ○ >2-3 months (3 comparisons): OR 1.99; 95%CI 0.53 to 7.42; $I^2=0\%$. ○ >3-6 months: not measured. ○ >6 months (6 comparisons): OR 1.11; 95%CI 0.76 to 1.63; $I^2=0\%$. <p>Physical activity</p> <p><u>Attaining target levels of physical activity</u></p> <ul style="list-style-type: none"> ● Personal financial incentives had no effect on attaining target levels of physical activity: <ul style="list-style-type: none"> ○ 6 months (4 comparisons): OR 1.29; 95%CI 0.97 to 1.72; $I^2=0\%$. ○ >6-12 months: not measured. ○ >12-18 months (2 comparisons): OR 0.75; 95%CI 0.41 to 1.34; $I^2=0\%$. ○ >18 months: not measured. <p><u>Sustaining target levels of physical activity</u></p> <ul style="list-style-type: none"> ● Personal financial incentives had no effect on sustaining target levels of physical activity: <ul style="list-style-type: none"> ○ >2-3 months (1 comparison): OR 1.21; 95%CI 0.85 to 1.71; $I^2=$not applicable. ○ >3-6 months: not measured. ○ >6 months: not measured. <p>Effect modifiers</p> <ul style="list-style-type: none"> ● The target behaviour, incentive value and attainment certainty did not independently modify the effect of financial incentives at
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	<p>any of the time-points. Both univariable and multivariable meta-regression produced similar results.</p> <ul style="list-style-type: none"> • High deprivation significantly increased the effects of financial incentives at >6-12 months compared to low deprivation (OR 2.17; 95%CI 1.22 to 3.85), but not at other time points, as shown in the univariable analysis; the modifying effect of participants' deprivation level was not significant in the multivariable analysis when other factors (e.g., behaviour, attainment certainty, monetary value, etc.) were accounted for (OR 2.31; 95%CI 0.68 to 7.85). • High value incentives were associated with a greater increase in smoking cessation than lower value incentives; an interaction was found to be statistically significant at 6 months from intervention start (further data were not provided). • Low value incentive significantly increased smoking cessation: <ul style="list-style-type: none"> ○ Smoking cessation studies using low value incentives (10 comparisons): OR 1.49; 95%CI 1.22 to 1.98.
<p>Comments and limitations</p>	<ul style="list-style-type: none"> • Small number of studies and associated lack of statistical power for certain comparisons, which restricts the conclusions that can be drawn with regard to: <ul style="list-style-type: none"> ○ the sustained impact of financial incentives on overall behaviour beyond 18 months; ○ the impact of financial incentives on physical activity; and ○ the role of certain of the targeted effect modifiers. • Given the lack of eligible studies on alcohol consumption, findings cannot be applied to all habitual health-related behaviours. • The roles of many other potential effect modifiers, such as whether the incentive schemes involved the use of deposit contracts, were not examined. <p>Overall conclusion</p> <ul style="list-style-type: none"> • Personal financial incentives can change habitual health-related behaviours. <ul style="list-style-type: none"> ○ Overall behaviour change: <ul style="list-style-type: none"> - Increased the attainment of overall behaviour change up to 18 months from baseline. - Increased the sustainment of overall behaviour change up to three months post-removal. ○ Smoking cessation: <ul style="list-style-type: none"> - Increased the attainment of smoking cessation up to 18 months from baseline. - Increased the sustainment of smoking cessation three months post-removal. ○ Indicators for healthier eating and/or physical activity:

	<ul style="list-style-type: none">- Increased the attainment of target indicators for healthier eating and/or physical activity up to 12 months from baseline.- No effect on the sustainment of target indicators for healthier eating and/or physical activity.o Physical activity:<ul style="list-style-type: none">- No effect on the attainment and sustainment of target levels of physical activity.• The role of personal financial incentives in reducing non-communicable disease burden is potentially limited, given the current evidence that effects are not sustained beyond three months after incentive removal.
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Data Extraction	
Last revised: March 24, 2017	
Systematic Review #4 Mitchell, M.S., et al. (2013). Financial incentives for exercise adherence in adults. http://www.sciencedirect.com/science/article/pii/S0749379713004364	
General Information and Quality Rating	
Country	Canada. <ul style="list-style-type: none"> Majority of the studies were conducted in USA (9 studies), 1 in Canada and 1 in UK.
Health Evidence Quality Tool	9/10 (strong by three independent reviewers (HKD, JM & SW))
Details of the Review	
Objectives	<ul style="list-style-type: none"> To determine if financial incentives increase exercise adherence in adults in the short term and whether this increase can be sustained over the long term. To explore financial incentive design features that may moderate effectiveness.
Number of primary studies included	<ul style="list-style-type: none"> 11 studies
Type of studies included	<ul style="list-style-type: none"> Randomized controlled trials
Search period	<ul style="list-style-type: none"> From inception to June 2012 MEDLINE was searched again in January 2013
Number of databases searched	<ul style="list-style-type: none"> 15 electronic databases: MEDLINE; Embase; PsychINFO; All EBM; HealthSTAR; Scopus; Social Sciences Abstracts; Web of knowledge/science; CINAHL; Econlit; Psycharticles; Ageline; Allied and complementary medicine; Physical Education Index; and SPORTdiscuss Cochrane Database of Systematic Reviews Consulted with experts Screened reference lists
Inclusion/exclusion criteria	<p>Inclusion criteria:</p> <ul style="list-style-type: none"> Randomized controlled trials Adults (aged ≥ 18 years) Financial incentives provided contingent on a pre-specified exercise behaviour or outcome Pre-specified exercise behaviour or outcome (e.g., exercise session attendance, aerobic fitness) <p>Exclusion criteria:</p> <ul style="list-style-type: none"> Non-randomized studies Studies evaluating the impact of subsidies (e.g., tax credits)

	and disincentives (e.g., fiscal penalties)
Quality of included studies	<ul style="list-style-type: none"> • The Effective Public Health Practice Project (EPHPP) Quality Assessment Tool for Quantitative Studies (QATool) was used. Domain assessed: selection bias; study design; confounders; blinding; data collection methods; and withdrawals and dropouts. Each domain was rated strong, weak or moderate. • Overall rating of study quality: <ul style="list-style-type: none"> ○ Weak (3 studies) ○ Moderate (6 studies) ○ Strong (2 studies)
Characteristics of the studies included in review	
Study population	Adults
Study settings	<ul style="list-style-type: none"> • Community • Universities/Colleges • Workplace
Description of interventions	<ul style="list-style-type: none"> • Financial incentives were defined as any cash or noncash reward with a monetary value (not items with negligible monetary value, e.g., ribbons) provided directly to individuals
Outcome measures	<ul style="list-style-type: none"> • Exercise session attendance • Aerobic minutes • Energy expenditure • Aerobic fitness • Duration of exercise session attendance studies were between four weeks to 26 weeks.
Results of the Review	
Main results	<p>Exercise session attendance^{xviii}:</p> <ul style="list-style-type: none"> • Adults who received financial incentives attended more exercise sessions over a period of 4-26 weeks compared to the control group: <ul style="list-style-type: none"> ○ 4- 26 weeks (5 studies): Weighted mean difference^{xix} (WMD) 11.55%; 95%CI 5.61% to 17.50%; I²=0. ○ The finding was consistent in the subsample meta-analysis which also excluded high risk of bias studies: WMD 11.75%; 95%CI 4.60% to 18.96%. <p>Exercise adherence overall (qualitative synthesis of all included studies)</p> <ul style="list-style-type: none"> • Adults who received financial incentives had increased

^{xviii} The meta-analysis of subsample of studies included studies on exercise session attendance, and excluded outlier studies as well as studies on other outcomes; studies were excluded due to heterogeneity, and lack of comparable data for data pooling.

^{xix} Means were expressed in percent sessions attended in order to control for varying attendance expectations (e.g., two per week, four per week). Percentages of sessions attended were pooled using a weighted mean difference.

exercise adherence compared to the control group (positive effect = 8 studies – 1 strong, 4 moderate, 3 weak; null effect studies = 3 studies – 1 strong, 2 moderate).

- Six of the eight positive effect studies tested financial incentive effectiveness in the short term only (≤ 3 months).
- Two of the three studies which monitored exercise adherence after incentives removal found that previously active adults (i.e., those who were exercising regularly at baseline) exhibited a drop in exercise session attendance following incentives removal, while previously inactive adults had persisting levels of exercise adherence following incentives removal.

Design feature attributes

Type of assessment

- The majority of positive effect studies (7 of 8 studies) rewarded objectively assessed behaviours. Studies that rewarded objectively assessed behaviours include: supervised exercise session attendance (2 studies); computerized gym attendance (4 studies); aerobic minutes by pedometer (1 study).
- The majority of null effect studies (2 of 3 studies) rewarded financial incentives contingent on self-reported behaviours.

Probability of reward distribution

- All studies (7 of 7 studies) that offered assured or “sure thing” financial incentives produced favourable effect.
- Three of the four studies that implemented likelihood-, or lottery- based financial incentives (whether exclusively or combined with an assured incentive) did not show increased exercise adherence.

Quantity of benefit

- All of the interventions (4 studies) that targeted previously inactive adults yielded a positive effect.
- In positive effect studies, financial incentives ranged from \$2.79 to \$46.82 per week.
- Larger incentives (i.e., \$26.75-\$46.82 per week) appeared to yield larger effects.

Dispensing type

- The majority of the positive effect studies dispensed incentives at the end of the intervention period (aggregative dispensing type), rather than with each achievement (reset dispensing type).
- 10 of the 11 included studies offered aggregative incentives.

	<p><u>Promising design features attributes</u></p> <ul style="list-style-type: none"> • Promising design feature attributes that may optimize effectiveness of the intervention were identified: <ul style="list-style-type: none"> ○ Incentive schemes incorporating indexed/escalating incentives; ○ Cash/reimbursement-type incentives; ○ Escrow incentives (i.e., deposit contracts). <p><u>Personal income levels</u></p> <ul style="list-style-type: none"> • One study reported that lower-income adults (<\$50,000, in 2008 dollars) accumulated more aerobic minutes than higher-income adults (>\$50,000 in 2008 dollars) in the presence of financial contingency.
<p>Comments and limitations</p>	<ul style="list-style-type: none"> • The authors noted that poor intervention designs and inadequate outcome measures are factors that may have contributed to the differential effect of incentive on the classes of behaviour (e.g., increase in exercise session attendance, but not overall physical activity level). • The applicability of the overall finding is limited by the homogeneity of study population characteristics and the wide range of incentive design feature attributes in the included studies. • Vulnerable groups (e.g., people with chronic diseases or low-social economic status) in particular were under-represented in the included studies, limiting the generalizability of the results to predominately young, white, healthy, and educated U.S. adults. • Given the scarcity of research examining incentives for exercise, the data are insufficient to draw conclusions regarding the influence of incentive design features and contextual factors (e.g., income-level, baseline activity levels) on incentive effectiveness. • There is limited evidence to draw conclusion regarding long-term incentive interventions (>6 months). • The search strategy was limited to English-only studies, language bias might be present. • There is potential for publication bias given the reliance on searching electronic databases, which may miss relevant grey literature. • All nonrandomized studies were excluded, which limited the number of studies included in the review. <p>Overall conclusion</p> <ul style="list-style-type: none"> • Financial incentives increase exercise session attendance for

	<p>interventions up to 6 months in duration.</p> <ul style="list-style-type: none">• A simple count of positive (n=8) and null (n=3) effect studies also suggests that financial incentives can increase exercise adherence in adults in the short term (<6 months).
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Appendix D: Applicability and Transferability Worksheet



eidm evidence-informed decision making

Starting/Modifying a Program Applicability and Transferability Worksheet

Factors	Questions	Notes
Applicability (feasibility)		
Political acceptability or leverage	<ul style="list-style-type: none"> • Will the intervention be allowed or supported in current political climate? • What will the public relations impact be for local government? • Will this program enhance the stature of the organization? <ul style="list-style-type: none"> ◦ <i>For example, are there reasons to do the program that relate to increasing the profile and/or create a positive image of public health?</i> • Will the public and target groups accept and support the intervention in its current format? 	
Social acceptability	<ul style="list-style-type: none"> • Will the target population find the intervention socially acceptable? Is it ethical? <ul style="list-style-type: none"> ◦ <i>Consider how the program would be perceived by the population.</i> ◦ <i>Consider the language and tone of the key messages.</i> ◦ <i>Consider any assumptions you might have made about the population. Are they supported by the literature?</i> ◦ <i>Consider the impact of your program and key messages on non-target groups.</i> 	



<p>Available essential resources (personnel and financial)</p>	<ul style="list-style-type: none"> • Who/what is available/essential for the local implementation? • Are they adequately trained? If not, is training available and affordable? • What is needed to tailor the intervention locally? • What are the full costs? <ul style="list-style-type: none"> ◦ Consider: in-kind staffing, supplies, systems, space requirements for staff, training, and technology/administrative supports. • Are the incremental health benefits worth the costs of the intervention? <ul style="list-style-type: none"> ◦ Consider any available cost-benefit analyses that could help gauge the health benefits of the intervention. ◦ Consider the cost of the program relative to the number of people that benefit/receive the intervention. 	
<p>Organizational expertise and capacity</p>	<ul style="list-style-type: none"> • Is the intervention to be offered in line with Peel Public Health's 10-Year Strategic Plan (i.e., 2009-2019, 'Staying Ahead of the Curve')? • Does the intervention conform to existing legislation or regulations (either local or provincial)? • Does the intervention overlap with existing programs or is it symbiotic (i.e., both internally and externally)? • Does the intervention lend itself to cross-departmental/divisional collaboration? • Any organizational barriers/structural issues or approval processes to be addressed? • Is the organization motivated (learning organization)? <ul style="list-style-type: none"> ◦ Consider organizational capacity/readiness and internal supports for staff learning. 	



Transferability (generalizability)		
Magnitude of health issue in local setting	<ul style="list-style-type: none"> • What is the baseline prevalence of the health issue locally? • What is the difference in prevalence of the health issue (risk status) between study and local settings? <ul style="list-style-type: none"> ◦ Consider the Comprehensive Health Status Report, and related epidemiological reports. 	
Magnitude of the “reach” and cost effectiveness of the intervention above	<ul style="list-style-type: none"> • Will the intervention appropriately reach the priority population(s)? <ul style="list-style-type: none"> ◦ What will be the coverage of the priority population(s)? 	
Target population characteristics	<ul style="list-style-type: none"> • Are they comparable to the study population? • Will any difference in characteristics (e.g., ethnicity, socio-demographic variables, number of persons affected) impact intervention effectiveness locally? <ul style="list-style-type: none"> ◦ Consider if there are any important differences between the studies and the population in Peel (i.e., consider demographic, behavioural and other contextual factors). 	
<p>Proposed Direction (after considering the above factors):</p> 		

Form Completed by: _____

Worksheet adapted from: Buffet C., Ciliska D., and Thomas H. National Collaborating Centre for Methods and Tools. November 2007. *Can I Use this Evidence in my Program Decision? - Assessing Applicability and Transferability of Evidence.*