Financial reinforcers for improving medication adherence: findings from a meta-analysis
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CRD summary
The authors concluded that financial reinforcement interventions were beneficial for improving medication adherence. The conclusion reflects the evidence presented but potential methodological limitations, an absence of validity assessment and uncertainties surrounding the appropriateness of pooling data from diverse studies mean this conclusion may not be reliable.

Authors’ objectives
To assess the effectiveness of financial reinforcers for enhancing adherence to medication.

Searching
PubMed and PsycINFO were searched to April 2011. Search terms were reported. Reference lists of retrieved articles were searched for additional studies.

Study selection
Randomised and non randomised comparator studies that assessed the effectiveness of financially based reinforcers for medication adherence were eligible for inclusion. Financial reinforcers could include money, goods (such as bus tokens or food) or vouchers redeemable for goods. Studies were excluded if the reinforcer was access to treatment, reductions or eliminations of co-payments or was solely based on reimbursement payments (such as for travel expenses or patient time). Studies that reinforced appointment-keeping only, used only a single event incentive for medication ingestion (such as single vaccination) or did not provide enough information to derive an adherence effect size were excluded.

Included studies assessed adherence to medications for tuberculosis, substance abuse, human immunodeficiency virus, hepatitis C, schizophrenia and stroke prevention. Most studies provided cash or vouchers as financial reinforcers. Comparator interventions included usual care, adherence counselling or therapy and historical controls. Where reported the maximum financial reinforcement given ranged from US $60 to $1,172. Study duration ranged from three to 52 weeks. Medication adherence was assessed using various measures including doses taken, treatment or medication duration, treatment completed, appointments kept and treatment success.

It appeared that at least two reviewers were involved in study selection. Disagreements were resolved by consensus.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Data were extracted to enable calculation of effect size (using Hedge’s correction) and 95% confidence intervals (CI) based on (in preference order) raw data, means and standard deviations and test statistics. Effect sizes were averaged when studies included more than one reinforcer or adherence outcome to create one effect size per sample.

The authors did not state how many reviewers extracted these data.

Methods of synthesis
Effect sizes (Hedge’s d) were combined using the inverse variance weighted mean effect size. Statistical heterogeneity was assessed using the Q and I² statistics. Modified weighted least squared regression was used to explore statistical heterogeneity due to randomisation status and duration, magnitude and frequency of reinforcement. Publication bias was assessed using the failsafe N, representing the estimated number of studies finding no effect needed to lower the effect size to a small effect (d=0.20).

Results of the review
Twenty-one studies (3,976 participants) were included in the review. Fifteen studies were randomised and six were
Reinforcement interventions significantly improved adherence compared to control (effect size 0.77, 95% CI 0.70 to 0.84; p<0.001; 21 studies; I²=93%). Significant heterogeneity in effect sizes was explained by randomisation status and duration, magnitude and frequency of reinforcement.

The effect size remained statistically significant for randomised studies only and non randomised studies only; randomised studies had a significantly smaller effect size than non randomised studies. Interventions that were longer in duration, provided average reinforcement of $50 or more per week and reinforced patients at least weekly resulted in larger effect sizes.

The failsafe N value was 60.

**Authors’ conclusions**
Financial reinforcement interventions were beneficial for improving medication adherence.

**CRD commentary**
The review question was clear. Inclusion criteria were well specified for study design and intervention. Several relevant sources were searched. It was unclear whether language restrictions were applied so language bias could not be assessed. The lack of a search for unpublished studies may have resulted in some studies being missed. It appeared that procedures were in place to reduce the possibility of reviewer error and bias during study selection of studies; it was unclear whether this also applied to data extraction. Study quality was not assessed and this limited interpretation of reliability of the findings. The authors provided study details for medical condition, interventions and outcomes assessed. There was little information on participants. Pooling the results may not have been appropriate given the differences between studies in study design, medical conditions and methods used to assess adherence.

The authors’ conclusion reflects the evidence presented but potential methodological limitations, the absence of validity assessment and uncertainties surrounding the appropriateness of pooling data from diverse studies mean this conclusion may not be reliable.

**Implications of the review for practice and research**

**Practice:** The authors stated that decisions about which patients received financial reinforcers needed to consider equity, possibilities of unintended behaviours and costs and benefits of treatment.

**Research:** The authors stated that reinforcement magnitude and frequency should be considered when designing reinforcement interventions to enhance medication adherence. There was a need for more research on financial reinforcement for diseases that require chronic medication administration (including hypertension, high cholesterol, asthma and type II diabetes).

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