Published in final edited form as:

Psychol Addict Behav. 2017 December ; 31(8): 897–906. doi:10.1037/adb0000287.

Contingency management treatment for substance use disorders: How far has it come, and where does it need to go?

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Abstract

Contingency management (CM) interventions consistently improve substance abuse treatment outcomes, yet CM remains a highly controversial intervention and is rarely implemented in practice settings. This paper briefly outlines the evidence base of CM and then describes four of the most often cited concerns about it: philosophical, motivational, durability, and economic. Data supporting and refuting each of these issues are reviewed. The paper concludes with suggestions to address these matters and other important areas for CM research and implementation, with the aims of improving uptake of this efficacious intervention in practice settings and outcomes of patients with substance use disorders.

Keywords

contingency management; behavioral treatments; substance use disorders; review

Contingency management (CM) is a behavioral therapy, based on operant conditioning principles, that provides tangible reinforcers for evidence of behavior change. In the case of substance use disorders, it most often involves delivery of monetary-based reinforcers for submission of drug negative urine samples. Research on this intervention dates back over 30 years and consistently shows that CM improves drug abuse treatment outcomes (Higgins, Silverman, & Heil, 2008; Petry, 2012). Importantly, CM is efficacious for numerous substance use disorders, it can be implemented alongside virtually any platform psychotherapy or pharmacotherapy, and it is efficacious regardless of patients' characteristics or pre-existing conditions (e.g., Lussier, Heil, Mongeon, Badger, & Higgins 2006; Prendergast, Podus, Finney, Greenwell, & Roll 2006).

Despite the positive impact of CM and its generalization to a wide range of populations and settings, clinicians and the public sometimes hold negative views of this treatment and

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express concerns that it does not lead to long-term benefits. Implementation into clinical practice has been slow, but is growing. This paper initially summarizes the empirical evidence for CM and then describes the primary concerns about this treatment. It concludes by suggesting areas for future research and implementation efforts.

1. Efficacy of CM

Numerous trials and meta-analyses (Benishek et al., 2014; Griffith, Rowan-Szal, Roark, & Simpson 2000; Lussier et al., 2006; Prendergast et al., 2006) demonstrate the efficacy of CM for improving outcomes of patients with substance use disorders. Compared to other psychosocial treatments, CM has the largest effect size of Cohen's $d = 0.58$, while the next largest effect size for relapse prevention interventions is substantially lower at $d = 0.32$ (Dutra et al., 2008). In terms of an intuitive example, the National Drug Abuse Treatment Clinical Trials Network study (Petry et al., 2005a) randomized 415 patients with stimulant use disorders to standard care at community clinics or to standard care plus CM. Patients receiving CM achieved an average of 4.4 weeks of objectively verified continuous stimulant abstinence versus 2.6 weeks for patients receiving standard care alone. In stimulant abusing methadone patients, another large Clinical Trials Network study (Peirce et al., 2006) similarly found significant differences in durations of abstinence (2.8 weeks for CM versus 1.7 weeks for standard care), and proportions of samples stimulant negative (54.4% for CM and 38.7% for standard care). The odds ratio was 1.9 (95% confidence interval = 1.4–2.6), indicating that CM nearly doubled the likelihood of stimulant negative samples.

Contingency management is efficacious in treating a variety of substance use disorders, including stimulant, opioid, marijuana, nicotine, and polydrug use disorders (Benishek et al., 2014; Cahill, Hartmann-Boyce, & Perera 2015; Gates, Sabioni, Copeland, Le Foll, & Gowing 2016; Lussier et al., 2006; Prendergast et al., 2006; Schierenberg, van Amsterdam, van den Brink, & Goudriaan 2012). There is less research in the context of CM for treating alcohol use disorders, primarily because of limited ability to quantify alcohol use objectively (Higgins & Petry, 1999). Nevertheless, recent technology to assess alcohol use over longer durations of time and in the natural environment is expanding the application of CM to this population as well (Alessi & Petry, 2013; Barnett, Tidey, Murphy, Swift, & Colby 2011; Dougherty et al., 2015ab; McDonell et al., 2012).

Contingency management is effective regardless of patients' background characteristics, pre-existing conditions, or presenting problems. Studies evaluating the influence of demographics such as age, sex, race/ethnicity, or income (Barry, Sullivan, & Petry 2009; Rash, Dephilippis, McKay, Drapkin, & Petry 2013; Rash, Olmstead, & Petry 2009; Rash & Petry 2015; Weiss & Petry 2011) or psychopathology including posttraumatic stress disorder, antisocial personality disorder, psychotic disorders, or general psychiatric symptoms (e.g., Ford, Hawke, Alessi, Ledgerwood, & Petry 2007; Hertzberg et al., 2013; Mancino, McGaugh, Feldman, Poling, & Oliveto 2010; McDonell et al., 2013; Messina, Farabee, & Rawson 2003; Petry, Alessi, & Rash 2013ab; Petry, Ford, & Barry 2011; Tidey, Rohsenow, Kaplan, Swift, & Reid 2011) reveal benefits of CM. Similarly, CM improves outcomes compared to usual care among patients with issues like criminal justice system involvement, medical comorbidities, previous treatment attempts, unemployment, and

homelessness (Petry, Rash, & Easton 2011; Rash, Alessi, & Petry 2008; Schumacher et al., 2007; Silverman, DeFulio, & Sigurdsson 2012; Walter & Petry 2015). We are aware of no studies demonstrating adverse outcomes of CM relative to standard care in any population.

Furthermore, CM can be applied in virtually any context or setting and alongside any other form of treatment. It has been evaluated as an adjunct to standard care in community clinics (e.g., Petry et al., 2004, 2005a; Petry, Alessi, & Ledgerwood 2012ab; Petry, Alessi, Marx, Austin, & Tardif 2005b; Petry, Martin, & Simcic 2005c), including methadone maintenance clinics (e.g., Petry et al., 2005c; Petry, Alessi, Barry, & Carroll 2015a; Peirce et al., 2006), with intensive treatments such as Community Reinforcement Approach (e.g., Higgins et al., 2003, 2007), or other interventions such as cognitive-behavioral and motivational enhancement therapies (e.g., Budney, Higgins, Radonovich, & Novy 2000; Budney, Moore, Rocha, & Higgins 2006; Carroll et al., 2006, 2012), with computerized therapies (Bickel, Marsch, Buchhalter, & Badger 2008; Budney et al., 2015; Campbell et al., 2014; Christensen et al., 2014; Ondersma et al., 2012), and pharmacotherapies (e.g., Alessi, Rash, & Petry 2016; Carroll et al., 2016; Cooney et al., 2017; Rohsenow, Martin, Tidey, Colby, & Monti 2017; Poling et al., 2006). Although CM can be integrated alongside virtually any other therapy and almost always demonstrates benefits compared to standard care or other platform therapies, it does not always yield synergistic effects with other treatments (Carroll et al., 2012; Godley et al., 2014).

Nevertheless, benefits of CM are noted even when controlling for therapist time and attention (Petry, Martin, Cooney, & Kranzler 2000; Petry et al., 2012ab) and availability of equal monetary amounts non-contingent on abstinence (Barnett et al., 2011; Higgins et al., 1994, 2003, 2014; Higgins, Wong, Badger, Ogden, & Dantona 2000; Sigmon et al., 2016). Contingency management is listed in the National Registry of Evidence Based Practices (http://legacy.nreppadmin.net/ViewIntervention.aspx?id=344), and the Veterans Administration is implementing it throughout the United States (Petry, DePhilippis, Rash, Drapkin, & McKay 2014). In the United Kingdom, it is included in the National Institute for Health and Clinical Excellence guidelines (NICE, 2007). It has also been successfully applied in other European countries as well as Brazil and China (Chen et al., 2013; Etter & Schmid 2016; Hser et al., 2011; Miguel et al., 2016; Petitjean et al., 2014; Secades-Villa, Garcia-Rodriguez, & Fernandez-Hermida 2015; Wang et al., 2014).

Hundreds of studies of CM, as well as recent systematic reviews (e.g., Davis et al., 2016; Stanger, Lansing, & Budney 2016), have been published, along with meta-analyses demonstrating its efficacy (Benishek et al., 2014; Cahill et al., 2015; Castells et al., 2009; Dutra et al., 2008; Gates et al., 2016; Griffith et al., 2000; Lussier et al., 2006; Prendergast et al., 2006; Schumacher et al., 2007; Terplan & Lui, 2007). The National Institute on Drug Abuse Clinical Trials Network created CM dissemination products (http://ctndisseminationlibrary.org/) and Addiction Technology and Transfer Centers have supported adoption initiatives (e.g., Squires, Gumbley & Storti 2008). Despite consistent benefits and increasing efforts toward dissemination, many clinicians, the public, and even some researchers question the utility of CM. Although its usage has increased in recent years, CM remains the least implemented of the empirically-based treatments (Benishek, Kirby, Dugosh, & Padovano 2010; Herbeck, Hser, & Teruya 2008; McGovern, Fox, Xie, &

Drake 2004). There are numerous reasons for this lack of clinical uptake, and addressing these concerns directly may ultimately enhance the application of this intervention and improve treatment outcomes.

2. Concerns about CM

Clinical treatment settings have not widely embraced CM for reasons ranging from philosophical to theoretical and practical. This section outlines these issues as well as evidence supporting or refuting them.

a. Concordance with usual care treatment approaches

The primary underpinnings of substance abuse treatment in the United States are 12-step. Between 60% and 75% of clinics consider 12-step to be their primary treatment approach (Roman & Johnson 2004ab), and most encourage 12-step participation and use these principles in the context of standard care (Substance Abuse and Mental Health Services Administration, 2013). Orientation to a 12-step philosophy is negatively associated with acceptance and use of CM and tangible reinforcers (Aletraris, Shelton, & Roman 2015; Ducharme, Knudsen, Abraham, & Roman 2010; McGovern et al., 2004). Clinicians with a 12-step orientation perceive more problems with implementing CM than counselors with others orientations (Rash et al., 2012), including both philosophical (e.g., “CM doesn’t address the underlying cause of addiction”) and practical (e.g., “I do not have time to administer CM in a therapy session”) barriers.

There are no known published data to suggest that CM adversely impacts participation in 12-step meetings or 12-step oriented care. To the contrary, CM has been evaluated alongside 12-step oriented treatment, including professionally-delivered Twelve Step Facilitation (Petry, Weinstock, Alessi, Lewis, & Dieckhaus 2010), and it improves outcomes when administered with 12-step care in community clinics (Petry et al., 2000, 2004, 2005abc, 2006bc, 2011bc, 2012ab; Petry, Alessi, Hanson, & Sierra 2007; Petry, Barry, Alessi, Rounsaville, & Carroll 2012c). Therefore, even though CM may not address deep-seated beliefs about causes of addiction, it still improves substance abuse treatment outcomes.

Moreover, CM shares principles with 12-steps practices. Most 12-step meetings start with introductions that include, and publicly recognize, each day of abstinence as a success. CM is built upon this same premise–each day of abstinence is something to be celebrated. In the case of CM, periods of abstinence are reinforced with tangible reinforcers along with verbal praise and recognition. In 12-step treatment, all three of these types of reinforcers are also provided, although the tangible reinforcers are of lower monetary value such as sobriety pins. Coffee and food are available at meetings, intended to encourage attendance, in a similar vein as the tangible reinforcers associated with CM. When clinicians see the similarities between reinforcers associated with 12-step meetings and CM and directly experience the impact that tangible reinforcers can make in encouraging recovery behaviors, some clinicians become proponents and champions of CM (Petry et al., 2005c; Petry, Martin, & Finocche, 2001; Petry & Simcic 2002).

b. Motivation to change

Another concern is that CM, with its emphasis on external reinforcement, may impede intrinsic motivation to change. Intrinsic motivation refers to one's desire to do something because it is self-fulfilling, while extrinsic motivation relates to doing something to obtain an item of value or to avoid punishment. Cognitive evaluation theory proposes that external reinforcers, that shift causality from internal factors to those outside the person, reduce feelings of autonomy and competence necessary for behavior change (Deci & Ryan 1985; Ryan & Deci 2000). Accordingly, this theory predicts behavior should return to its initial state once reinforcers are removed (Deci, Koestner, & Ryan 1999).

Empirical evidence is mixed about whether external rewards impact intrinsic motivation. In non-clinical contexts, providing external rewards to complete tasks such as puzzles or games may undermine intrinsic motivation and subsequent participation in them (Deci et al., 1999). However, for behaviors that rarely occur on their own or that are challenging in nature, external rewards may enhance engagement in them (Cameron, Banko, & Pierce 2001). Different associations may also relate to whether reinforcers are provided for attempting a task, finishing it, or reaching some threshold of performance (Cameron et al., 2001). Furthermore, most studies of the effects of external rewards were conducted in children or college students, not patients with serious physical or mental disorders. The manner in which external rewards impact internal motivations in patients receiving interventions that tangibly reward health behaviors remains unclear.

Promberger and Marteau (2013) examined studies that provided reinforcers for health-related behaviors and concluded they did not undermine intrinsic motivation. To the contrary, they found that, for health behaviors that depend upon self-control, provision of external reinforcers can increase feelings of competence, which in turn may improve intrinsic motivation. In terms of CM for substance use disorders specifically, only a handful of trials have investigated internal motivation, and only one known study found results consistent with the hypothesis that CM may decrease internal motivation. In a trial of detoxified patients with opioid use disorder (Carroll, Sinha, Nich, Babuscio, & Rounsaville 2002), patients randomized to CM conditions that reinforced opioid abstinence and ingestion of naltrexone had declines over time in scores on a readiness to change substance use questionnaire, whereas scores rose in participants in a standard care condition. Three other studies (Budney et al., 2000; Ledgerwood & Petry 2006; Litt, Kadden, Kabela-Cormier, & Petry 2008) found no differences over time on scores of readiness to change substance use between patients receiving CM and other forms of treatment. Thus, the bulk of available evidence suggests that CM does not have adverse effects on reducing motivation to change substance use behaviors, and objective behavioral data (i.e., urinalysis tests) clearly indicate that it has beneficial effects on actual substance use behaviors.

c. Durability of effects

A related concern about CM, predicted by cognitive evaluation theory, is that external reinforcers will undermine long-term behavior change. Many studies have evaluated post-intervention effects of CM on substance use months after external reinforcement ceases, but most are underpowered to detect long term changes. Although meta-analyses find effects of

CM are not sustained at long term follow-ups (Benishek et al., 2014; Prendergast et al., 2006), an increasing number of studies demonstrate benefits of CM months after treatment ends (Alessi, Hanson, Wieners, & Petry 2007; Carroll et al., 2016; Halpern et al., 2015; Higgins et al., 2000, 2007; Higgins, Heil, & Lussier 2004; Kadden, Litt, Kabela-Cormier, & Petry 2007; Kendzor et al., 2015; McDonell et al., 2013; McKay et al., 2010; Petitjean et al., 2014; Petry, Andrade, Barry, & Byrne 2013c; Petry, Alessi, Byrne, & White 2015b; Petry & Martin 2002; Petry et al., 2005c; Reback et al., 2010; Roll, Chudzynski, Cameron, Howell, & McPherson 2013; Secades-Villa et al., 2011; Secades-Villa, Garcia-Rodriguez, Lopez-Nunez, Alonso-Perez, & Fernandez-Hermida 2014; Schottenfeld, Moore, & Pantalon 2011; Winhusen et al., 2014). A recent review (Davis et al., 2016) reported that 29% of studies that evaluated long-term effects of CM found that it retained significant benefits even after reinforcers were no longer delivered.

Perhaps most importantly, there are no data to suggest that patients who earlier received CM have *poorer* long term substance use outcomes than patients who never received CM. All the data indicate that providing CM either results in no significant change or reductions in drug use relative to treatments without CM at long term follow-ups. Thus, decades of research clearly indicate excellent short term benefits of CM, and no or possibly some long term improvements with this treatment.

d. Economics

Finally, clinic administrators, policy makers, and payers express concern about the economics (i.e., cost, benefit, and reimbursement) of CM. Providing tangible reinforcers increases costs of treatment, especially because CM is typically an add-on to usual care. In addition to direct costs of the reinforcers that range up to $300-$1200 per person for 12-week courses of treatment (e.g., Higgins et al., 1994, 2000, 2003; Petry et al., 2005abc, 2012abc), there are administrative costs that include time spent purchasing and tracking delivery of reinforcers, time spent meeting with patients to review sample results and award reinforcers, and costs for frequent urinalysis testing (Olmstead & Petry 2009; Olmstead, Sindelar, Easton, & Carroll 2007a). Moreover, the incremental costs attributable to CM can be unpredictable depending on the patients' success and, in the case of prize CM, the "luck of the draw." The average per patient cost of adding CM to usual care ranged by nearly a factor of two– from $306 to $582– across the eight clinics in the National Drug Abuse Treatment Clinical Trials Network study (Olmstead, Sindelar, & Petry 2007b).

Of course, there is more to the economics than just the cost of CM. To the extent that CM leads to improvements in negative externalities associated with substance use disorders, CM may result in societal benefits. For example, Olmstead, Sindelar and Petry (2007c) found that, compared to usual care, the incremental cost of CM to lengthen the longest duration of abstinence in stimulant abusers was $258 per week per patient. From a societal perspective, this seems to be a very good investment inasmuch as a typical active stimulant abuser very likely costs society much more than $258 per week in the form of criminal activity, spread of disease, and declines in both workplace productivity and family functioning (Gordon, Tinsley, Godfrey, & Parrott 2006). There remains, however, a dearth of information on the cost-effectiveness of CM and substance abuse treatments more generally.

On balance, it appears that the societal benefits of adding CM to usual care likely outweigh its costs, at least for illicit substance use disorders. So, why is CM not being used more often? The answer is simple – reimbursement. The vast majority of the assumed societal benefits of CM accrue to neither the clinics that provide CM nor the payers who pay for treatment (US Department of Health and Human Services, 2011). Even large payers (commercial insurers, Medicaid, Medicare) benefit little from reductions in crime, or other negative behaviors, that may result from providing CM. Because clinics do not receive reimbursement for the extra testing or reinforcers needed to promote abstinence using CM, they have no economic incentive to do so. Moreover, even if clinicians want to provide CM, they cannot do so without adequate financial support. In the presence of myriad and substantial negative externalities associated with substance use disorders, it is challenging to get all CM beneficiaries to contribute their "fair share" to the reimbursement of CM treatment.

3. Next steps

Contingency management is clearly efficacious for promoting abstinence and, therefore, merits consideration for adoption. Implementation efforts should consider common concerns about CM, as well as important understudied aspects related to this intervention. In addition, implementation science should be consulted because adoption of even non-controversial evidence-based practices can be slow (e.g., Lash, Timko, Curran, McKay, & Burden 2011; Sorensen & Kosten, 2011).

More efforts should promote understanding of CM and its benefits, as many clinicians do not believe CM improves outcomes (Benishek et al., 2010; Herbeck et al., 2008). In part, this lack of understanding relates to the technical nature of research reports. Providing clear and interpretable information is one essential step, and both brief educational approaches (Benishek et al., 2010) and more extensive in-person training workshops (e.g., Rash, et al., 2013) show promise in changing knowledge and attitudes about CM. Training efforts should directly address concerns about CM, including issues related to motivation to change and its durability. They should emphasize that long-term change is not possible without first achieving abstinence and no psychosocial intervention does as well as CM in promoting abstinence during treatment. Furthermore, aligning reinforcement principles with 12-step and standard care procedures is key, as well as emphasizing its effects in virtually all patient populations (see Petry, 2012). Kropp, Lewis, and Winhusen (2017) provide an example of an implementation effort to integrate CM with 12-step treatment, and voices from non-research perspectives may be more convincing to clinicians than technical research reports. Other examples of implementation efforts provide valuable information on how CM can be tailored to unique needs of a clinic and population (Fitzsimons, Tuten, Borsuk, Lookatch, & Hanks 2015; Hartzler 2015; Kellogg et al., 2005; Lott & Jencius 2009; Petry et al., 2014; Sigmon & Stitzer 2005; Squires et al., 2008; Walker et al., 2010). In implementation science more generally, Damschroder and Hagedorn (2011) likewise note the need to adapt evidence-based practices to the broader context, distinguishing the core from the adaptable components.

In clinics that adopt CM, training and supervision are paramount to ensure core aspects of CM are retained. Only about half of clinics providing CM arranged for in-house or off-site training (Olmstead, Abraham, Martino, & Roman 2012). Clinician skill in administering CM impacts patient outcomes (Hartzler, Beadnell, & Donovan 2017; Petry et al., 2012a), and supervision can maintain fidelity over time (Petry et al., 2012ab). Most implementation efforts were developed in collaboration with research experts (e.g., Hartzler, 2015; Petry et al., 2014), and strategies that provide greater reach include web-based modules and phone consultation (Petry et al., 2014).

Technology may not only enhance training and supervision but also delivery of CM. Cell phone and drug testing technologies allow for frequent assessment and reinforcement of alcohol and cigarette abstinence in the natural environment. These approaches are efficacious and acceptable to patients (Alessi & Petry 2013; Alessi & Rash 2017; Alessi et al., 2016; Kong 2013), as are Internet-based reinforcement procedures (Carpenter et al., 2015; Dallery & Glenn 2005; Dallery, Glenn, & Raiff 2007; Dallery, Raiff, & Grabinski 2013; Hertzberg et al., 2013; Meredith, Grabinski, & Dallery 2011; Raiff, Jarvis, Turturici, & Dallery 2013; Reynolds et al., 2015; Stoops et al., 2009). Coupling these technologies with mobile reinforcement procedures may support abstinence in real-time and lead to more effective and efficient delivery of CM, which may enhance and extend its benefits.

In terms of the economics of CM, implementation science also provides key lessons. Successful implementation of an intervention is driven by an interplay of external (e.g., reimbursement) and internal (e.g., therapist desires to address patients' needs) factors (Sorensen et al., 2011), but much of what we know about CM implementation is related to internal barriers to implementation. Manuel et al. (2011) note that the most effective implementation efforts in substance abuse treatment have involved organizationally focused approaches, rather than provider initiated ones. In other words, organization-wide support or mandates were associated with better adoption. Before any agency is likely willing or able to implement CM, research will need to proceed along three fronts: cost, benefit, and reimbursement. First, addressing costs of reinforcers is critical for implementing this intervention. Even in its simplest format, CM involves direct costs of reinforcers and drug use testing, and currently there are no methods to support these costs in clinical settings. If reinforcers are of too minimal a value or sample testing becomes too infrequent, the procedure becomes less effective (Prendergast et al., 2006; Lussier et al., 2006). Providing chances to win prizes of varying magnitudes is an efficacious strategy (Petry et al., 2005b, 2007, 2015a). Other strategies may include reinforcing only a proportion of patients rather than each individual (Alessi et al., 2007; Ledgerwood, Alessi, Hanson, Godley, & Petry 2008; Petry et al., 2001) and arranging interdependent group contingencies (Meredith et al., 2011; Meredith & Dallery 2013). In short, a better understanding of the minimal necessary reinforcement cost to achieve specific patient outcomes would be useful.

Second, studies estimating societal benefits of CM are lacking (e.g., Shearer, Tie, & Byford 2015). Ideally, such studies will measure and monetize the value of improvements in the negative externalities associated with substance use disorders, in both the long and short run, as well as to whom such benefits accrue. Without such information, it is impossible for

policy makers and payers to know the full value that CM confers to society, or who should be responsible for paying for it.

Third, formal mechanisms are needed by which clinics are adequately reimbursed to provide CM. Such mechanisms include ways to identify and tap the beneficiaries of CM to contribute their share of the treatment costs, government subsidies, or some combination thereof. As a practical matter, this is much easier said than done. Yet, there is hope. Screening and brief interventions for alcohol use have been reimbursed by commercial insurance, Medicare, and Medicaid for years (Neighbors, Barnett, Rohsenow, Colby, & Monti 2010; Bray et al., 2014; SAMHSA, 2016). These services are reimbursed by private and public payers, begging the question as to why they are not for CM.

Researchers and public research funds have invested decades into designing and evaluating CM interventions, and CM clearly is beneficial for improving substance use treatment outcomes when it is administered appropriately. It is now up to policy makers to ensure that substance use treatment patients receive this efficacious intervention and that the intervention is delivered in a manner similar to which it is known to be efficacious. In no other medical field would a clinic, hospital, or provider be expected to cover costs of additional testing and treatment without reimbursement. Extensive adoption and implementation of CM by substance abuse treatment clinics will require that reimbursement procedures and policies are consistent with other medical and psychiatric specialties. It may also necessitate development of methods to ensure that, when CM is administered, it is done according to methods known to be efficacious, including appropriate magnitudes and frequencies of reinforcement. Perhaps what CM needs most is a well-placed champion to break down barriers to reimbursement at the federal level before implementation efforts can be expected to be widespread.

Acknowledgments

Preparation of this report was supported in part by NIH grants: R01-DA13444, P50-DA09241, P60-AA03510, R01-HD075630, R01-AA021446, R01-AA023502, R21-DA03189, and K23DA034879.

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