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Contingency Management Interventions for HIV, Tuberculosis, and Hepatitis Control Among Individuals With Substance Use Disorders: A Systematized Review

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ABSTRACT

Hepatitis, HIV and tuberculosis are significant and costly public health problems that disproportionately affect individuals with substance use disorders (SUDs). Incentive-based treatment approaches (i.e., contingency management; CM) are highly effective at reducing drug use. The primary aim of this report is to review the extant literature that examines the efficacy of CM interventions for the prevention, diagnosis and treatment of hepatitis, HIV and tuberculosis among individuals with SUDs. A literature search identified 23 controlled studies on this topic. In approximately 85% of the studies, CM produced significantly better adherence to prevention, diagnosis and treatment-related medical services, with adherence rates averaging almost 35% higher among patients receiving incentives vs. control condition participants. Findings from these studies parallel the results of a meta-analysis of CM interventions for the treatment of SUDs. The results also suggest that the principles that underlie the efficacy of CM generalize across infectious disease and substance abuse treatment behaviors. The application of additional principles from the literature on CM for treatment of SUDs to interventions targeting infectious disease control would be beneficial. Further development and dissemination of these interventions has the potential to greatly impact public health.

1. Introduction

Infectious diseases are among the most costly public health problems globally. Although many infectious conditions disproportionately affect developing nations, hepatitis B, hepatitis C, human immunodeficiency virus (HIV) and tuberculosis (TB) persist in developed countries at levels that pose serious threats to the public health. Collectively, almost 100,000 new cases of these diseases are diagnosed annually in the U.S. alone (CDC, 2014b, 2015b; CDC, 2014a, 2015a). These conditions pose a considerable burden; as one example, HIV accounts for almost 14,000 deaths (CDC, 2015c) and costs over $36 billion annually (Hutchinson et al., 2006). These conditions persist despite being relatively easy to prevent (e.g., through vaccination or behavioral precautions to prevent transmission; Alter, 2003; Moses, Vlahov, & Normand, 1995), diagnose, and treat using pharmacological agents (CDC, 2011). Although considerable medical progress has been made, these conditions continue to negatively affect public health, largely because of poor adherence to medical recommendations. Thus, the development of new methods to improve adherence is a public health priority.

Individuals with substance use disorders (SUDs) are disproportionately affected by hepatitis, HIV, and TB. The National Institute of Drug Abuse (NIDA) considers drug abuse and HIV "intertwined epidemics" (NIDA, 2012), and emphasizes the close links between substance abuse and hepatitis (NIDA, 2013) and TB infection (NIDA, 1998). Individuals with SUDs are more likely to become infected because they engage in risky sexual and drug taking behaviors that transmit HIV and hepatitis, and because socioeconomic disadvantage often places them in crowded conditions in which TB is more easily transmitted (Getahun, Gunneberg, Sculier, Verster, & Raviglione, 2012; Kral et al., 2001; Paul et al., 1993). As a result, the prevalence of hepatitis, HIV and TB infections are considerably higher among individuals with SUDs (Befrits et al., 1995; Booth, Kwiatkowski, & Chitwood, 2000; Des Jarlais et al., 2007; Durante, Selwyn, & O'Connor, 1998; Hagen et al., 2001; Howard, Klein, Schoenbaum, & Gourevitch, 2002; Nelson et al., 2011; Petry, 1999; Rehm et al., 2009) than in the general U.S. population (CDC, 2015a, 2015b, 2015c). Individuals with SUDs also are more likely to be co-infected with two or more of these conditions and/or to acquire drug-resistant strains of HIV and TB (e.g., Atkinson, Paul, Sloan, Curtis, &

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Miller, 2009; McCance-Katz et al., 2002; Manosuthi et al., 2006; Perri et al., 2011). Co-infection and drug resistance leads to accelerated morbidity and mortality and overall greater threats to public health.

The elevated prevalence of hepatitis, HIV, and TB among individuals with SUDs underscores the limited success of widely disseminated efforts to reduce transmission within this vulnerable population. For example, the hepatitis B vaccination series provides long-term protection from infection to greater than 90% of those who complete it (CDC, 2006). Although population-wide vaccination began in 1982, many injection drug users remain unvaccinated (CDC, 2015a, 2015b, 2015c; Ladak, Gjelsvik, Feller, Rosenthal, & Montague, 2012), in part because many who are offered the vaccine never start or fail to complete all three doses of the series (e.g., Hwang et al., 2010). Efforts to diagnose these conditions among individuals with SUDs have frequently met with limited success. Screening for TB involves a simple skin test that requires patients to return 48–72 hours later to have the test site read, followed by chest x-rays if the skin test is positive. Unfortunately, less than half of individuals with SUDs return to have skin tests read (FitzGerald et al., 1999) and only one third of those who do return and test positive follow through with chest x-ray referrals (Perlman et al., 2003). Likewise, hepatitis, HIV and TB can be effectively treated with pharmacotherapy, but individuals with SUDs often begin treatment late and are unable to achieve the high rates of medication adherence required for successful treatment outcomes (Arnsten et al., 2001; Batki, Gruber, Bradley, Bradley, & Delucchi, 2002; Chaisson et al., 2001).

Behavioral economics may help us understand why rates of infection remain high and treatment outcomes are generally poor among individuals with SUDs. Prevention (e.g., completing the hepatitis B vaccination series), diagnosis (e.g., completing diagnostic testing for TB) and treatment (e.g., taking antiretroviral medication to suppress HIV) requires individuals to engage in an immediate and effortful behavior (e.g., go to a vaccine clinic, pick up medications from a pharmacy) in order to prevent or improve outcomes that are delayed and probabilistic (e.g., greater likelihood of premature morbidity or mortality). Delay discounting describes the tendency to devalue future outcomes; the longer outcomes are delayed, the less influence they exert over present behavior. A substantial body of literature demonstrates that individuals with SUDs discount delayed outcomes more steeply than non-substance using individuals (cf. Reynolds, 2006), including greater discounting of future health (Petry, 2003). Steeper discounting may partially explain why individuals with SUDs have particular difficulty adhering to medical recommendations: the positive consequences are far too delayed to have much control over immediate actions. Thus, behavioral economic theory suggests that interventions that involve immediate positive consequences for engaging in desired medical behaviors may be particularly effective for infectious disease control among individuals with SUDs.

Incentive-based interventions, such as contingency management (CM), are among the most reliable and efficacious means to promote behavior change among individuals with SUDs. These interventions offer incentives for engaging in positive health behaviors. There is an extensive literature on incentive-based treatments to promote abstinence from alcohol and drugs. In CM interventions, patients receive incentives, often vouchers with monetary value that can be exchanged for retail items, contingent upon satisfying a predetermined therapeutic goal (Higgins, Silverman, & Heil, 2008). Many studies have demonstrated that CM effectively promotes drug abstinence and other therapeutic changes (e.g., clinic attendance, participation in vocational training, adherence to addiction pharmacotherapy) among individuals in treatment for SUDs. Several reviews have been published on CM for the treatment for SUDs, synthesizing this literature as it has grown (e.g., Hartzler, Lash, & Roll, 2012; Stitzer & Petry, 2006). A comprehensive meta-analysis of 40 studies of CM interventions for the treatment of SUDs found consistent evidence of a positive treatment effect across drug classes and treatment behaviors (Lussier, Heil, Mongeon, Badger, & Higgins, 2006). This meta-analysis also investigated how various incentive parameters moderate intervention efficacy, demonstrating that higher magnitude incentives and incentives delivered after shorter delays are associated with larger treatment effect sizes. Individual laboratory studies have also identified other potential moderators. For example, incentive schedules in which payments escalate in magnitude with each successful completion of a target behavior are more effective than schedules where payment magnitude is fixed (Roll & Higgins, 2000; Roll, Higgins, & Badger, 1996) and cash incentives are more effective than non-cash incentives of equivalent monetary value (Festinger, Marlowe, Dugosh, Croft, & Arabia, 2008; Vandrey, Bigelow, & Stitzer, 2007).

We are aware of only two reviews of CM interventions for infectious disease specifically among individuals with SUDs: one summarized only the HIV literature (3 studies; Haug & Sorensen, 2006) and the other only the TB literature (11 studies; Lutge, Wiysonge, Knight, & Volmink, 2012). The low rates of adherence among individuals with SUDs are not unique to HIV and TB, but also apply to the prevention of hepatitis B and treatment of hepatitis C. Therefore, the primary aim of this review is to provide a comprehensive analysis of the literature on CM interventions targeting the prevention, diagnosis and treatment of hepatitis, HIV and TB among individuals with SUDs. This review examines overall efficacy of these interventions and begins to explore the incentive characteristics that moderate efficacy. The discussion aims to synthesize the findings and underscore where they may inform future development of improved interventions for the control of hepatitis, HIV and TB.

2. Methods

2.1. Literature search and study selection

The present report describes the results of a systematized review, which incorporates many, but not all, of the elements of a systematic review while stopping short of a full systematic review of the literature. Systematized reviews are often conducted when many elements of a systematic review can be incorporated, but resource constraints do not allow for a full systematic review, as was the case here. Literature searches were conducted using PubMed, MEDLINE and Google Scholar using the terms: “”incentives,” “payments” and “monetary” combined with terms relevant to infectious disease and SUDs generally (“adherence,” “alcohol,” “diagnosis,” “disease,” “drug users,” “substance abuse,” “infectious,” “methadone,” “prevention,” “treatment” and “virus”) and terms specific to infectious disease (“AIDS,” “hepatitis,” “HBV,” “HCV,” “HIV,” “HTLV-1,” “Mtb,” “TB” and “tuberculosis”) using the Boolean operator AND. The reference sections of published articles that met inclusion criteria were reviewed to ensure that all relevant articles were identified. Searches were limited to articles that were written in English, published in peer-reviewed journals and were available in full-text (either in print or electronically) as of June 2015, when the final search was run. The abstracts of relevant search results were initially identified by ESH, reviewed by ESH and SHH and, if deemed relevant, proceeded to full-text review.

Full-text review and data extraction were performed by three authors (ESH, AKM and SHH) and disagreements regarding inclusion/exclusion were resolved through discussion. Identified studies were included in this review if they met six criteria: (1) the intervention(s) directly targeted medical prevention, diagnosis or treatment of hepatitis B, hepatitis C, HIV or tuberculosis; (2) the incentive(s) offered were of quantifiable monetary value; studies that delivered incentives of non-quantifiable value (e.g., methadone doses contingent on TB medication adherence) were excluded; (3) the incentive(s) were delivered contingent upon objectively verified occurrence of the desired target behavior; (4) studies targeted individuals with SUDs or another high-risk population with a substantial percentage (≥33%) of the study sample had an SUD, allowing us to include additional studies with findings that are likely generalizable to individuals with SUDs; (5) studies were either randomized controlled

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