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## Commentary

## Looking to the empirical literature on the potential for financial incentives to enhance adherence with COVID-19 vaccination

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## ABSTRACT

COVID-19 vaccination efforts are underway offering hope for saving lives and eliminating the pandemic. The most promising vaccines require two injections separated 3-4 weeks apart. To achieve herd immunity, 70-90% of the population or perhaps more must be inoculated. Anticipation of adherence challenges has generated commentaries on strategies to enhance adherence including financial incentives. A notable gap in these commentaries is any discussion of the scientific evidence regarding the efficacy of financial incentives for increasing vaccine adherence. This commentary addresses that gap. There is a body of controlled trials on incentivizing vaccine adherence, mostly to the hepatitis B virus (HBV) vaccine among injection drug users (IDUs). Prevalence of HBV infection is increasing as part of the opioid addiction crisis. The HBV vaccine entails a three-dose regimen (typically 0, 1, and 6 months) which has created adherence challenges among IDUs. Systematic literature reviews document significant benefit of financial incentives. For example, a 2019 meta-analysis (Tressler & Bhandari, 2019) examined 11 controlled trials examining HBV-vaccine adherence strategies, including financial incentives, accelerated dosing schedules, and case-management/enhanced services. Financial incentives were most effective resulting in a 7-fold increase in adherence to the vaccination regimen relative to no financial incentives (OR, 7.01; 95% CI, 2.88-17.06). Additional reviews provide further support for the efficacy of financial incentives for promoting adherence with vaccination (HBV & influenza). Overall, this literature suggests that financial incentives could be helpful in promoting the high levels of adherence to COVID-19 vaccines that experts project will be necessary for herd immunity.

COVID-19 vaccination efforts are underway in the U.S. and globally, offering hope for saving lives and eventually eliminating this devastating pandemic. The most promising vaccines, including two approved for use in the U.S. (PfizerBioNTech and Moderna), require two injections separated 3-4 weeks apart. Additionally, to achieve herd immunity, infectious disease policy experts estimate that between 70-90% of the population will need to be inoculated (McNeil Jr, 2020, <https://www.nytimes.com/2020/12/24/health/herd-immunity-covid-coronavirus.html>). Those two features of this effort, vaccines requiring multiple injections separated in time and the need for adherence in the vast majority of the population, are likely to result in substantive adherence challenges especially among segments of the population who are already disproportionately burdened by the pandemic (e.g., socioeconomically disadvantaged populations, those with co-morbid conditions).

This scenario has generated commentaries on the need for explicit efforts to enhance adherence including the potential need for financial incentives. For example, U.S. Presidential candidates John Delaney and

Andrew Yang have recommended offering a \$1,500 stimulus check for being vaccinated while economists Robert Litan and N. Gregory Mankiw have opined that an incentive of at least \$1,000 would be necessary (Zeballos-Roig, 2020, <https://www.businessinsider.com/covid-19-vaccine-payment-economists-stimulus-recovery-coronavirus-aid-2020-11>). As another example, behavioral economists Loewenstein and Cryder (2020, <https://www.nytimes.com/2020/12/14/upshot/covid-vaccine-payment.html>) acknowledged the need for incentives, recommending naturalistic incentives such as making air travel or access to large public events contingent on evidence of being vaccinated but expressed concerns that financial incentives could perversely undermine motivation to get vaccinated among the more altruistically inclined or exacerbate suspicion regarding the risk of vaccination among those who are already skeptical about vaccines. Surprisingly, what was not discussed in these commentaries is what the extant scientific literature has to say regarding the efficacy of financial incentives for increasing adherence to vaccines and other preventive therapeutic regimens. The purpose of this commentary is to begin to

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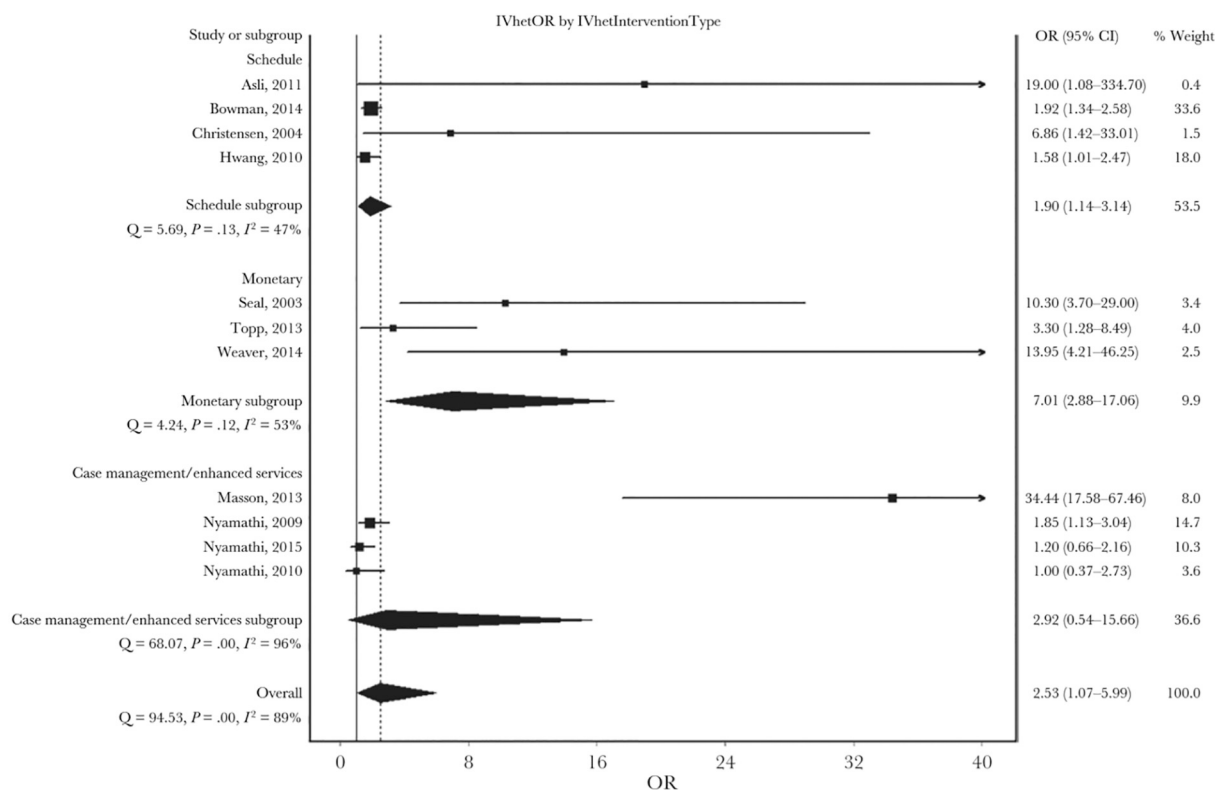


Fig. 1. Forest plot of subgroup analysis by intervention type using the Inverse Heterogeneity Model. Abbreviations: IVhet OR, Inverse Heterogeneity Model odds ratio; OR, odds ratio. Reprinted with permission from Tressler and Bhandari, 2019.

address that gap.

Individuals addicted to illicit drugs such as cocaine and heroin are a group often faced with a range of barriers including co-morbid medical conditions and socioeconomic instability that can make adherence to preventive medical regimens highly challenging. Yet that is the group in which there is the greatest amount of sound scientific evidence that modest financial incentives can indeed enhance vaccine adherence. The U.S. opioid crisis and associated increases in injection drug use (IDU) has resulted in a rise in acute hepatitis B viral (HBV) infection, a potentially fatal condition should infection become chronic. An efficacious vaccine for HBV infection is available but entails a three-dose regimen (typically 0, 1, and 6 months). Because of the substantive challenges of gaining adherence in the IDU population, a series of strategies to enhance completion of the dosing regimen have been investigated in controlled trials. A 2019 systematic review and meta-analysis of that literature (Tressler and Bhandari, 2019) examined 11 controlled trials examining adherence strategies, including modest financial incentives (mean maximal total earnings: \$136 (range=44-120), accelerated dosing schedules, and case-management/enhanced services. Financial incentives were most effective resulting in a 7-fold increase in adherence (OR, 7.01; 95% CI, 2.88-17.06). Accelerated dosing schedules were also effective resulting in almost a 2-fold increase (OR, 1.90; 95% CI, 1.14-3.14), while case-management/enhanced services failed to significantly increase adherence (OR, 2.92; 95% CI, 0.54-15.66) (Fig. 1). Two additional systematic reviews also support the efficacy of modest financial incentives for promoting adherence with vaccination (HBV & influenza) as well as tuberculosis screening which of course is not vaccination but also entails a multiple-visit regimen often directed at IDU users and other socioeconomically unstable or disadvantaged populations (Giles et al., 2014; Herrmann et al., 2017).

Importantly, the efficacy of modest financial incentives for improving vaccine adherence described above is consistent with a considerably larger body of evidence supporting their efficacy in promoting abstinence from addictive drug use (Davis et al., 2016) and

weight loss (Pope et al., 2018). Indeed, the amount of evidence from controlled studies supporting their efficacy for increasing abstinence from drug use or improvements in other therapeutic targets among those with addictions is striking. The Davis et al. (2016) review was the third in a systematic series on this topic that cumulatively examined 176 controlled studies published in peer-reviewed journals between 1991 through 2014 of which 151 (86%) reported statistically significant improvements in the target behavior. By any standard with which we are familiar, that is a substantial degree of empirical support for efficacy. While the literature on controlled studies examining the efficacy of financial incentives for promoting weight loss is not as large, it too is extensive dating back to the 1970s and consistently positive (Jeffery, 2012; Pope et al., 2018). Indeed, it is safe to say that there is a general consensus among experts in both research areas that incentives work while available. Where questions arise is regarding the sustainability of therapeutic gains once the incentives are discontinued. Of course, that concern regarding relapse is largely if not exclusively obviated when used to promote vaccine adherence. We know of no evidence that the use of financial incentives in these applications has perverse or unintended adverse consequences.

Overall, we believe the scientific literature strongly supports consideration of financial incentives as an evidence-based strategy for enhancing adherence to COVID-19 vaccines should the much-anticipated adherence challenges indeed arise. Financial incentives, perhaps targeted at disadvantaged populations, in combination with the type of naturalistic incentives discussed by Loewenstein and Cryder (2020), may be a prudent course to take. Importantly, there is sound empirical evidence demonstrating that the effect size of financial incentives increases as a positive function of the amount offered and decreases as a function of temporal delays in providing the incentives upon task completion (Lussier et al., 2006). Thus, the magnitude and immediacy of incentives is worth keeping in mind as the challenge of gaining sufficient adherence to achieve herd immunity plays out. Determining the optimal incentive value necessary to achieve sufficient vaccine

adherence is an empirical question best answered by experimental investigation of incentivizing COVID-19 vaccines. The extant literature would suggest that the \$1,000-\$1,500 incentives proposed by Delaney, Yang, and others would likely be highly effective, but also perhaps unnecessarily excessive. The modest values used in the HBV trials discussed above offer an evidence-based starting point but are perhaps too modest considering the importance to population health of gaining high levels of adherence in this instance. If forced to estimate based on the literature, we would anticipate that incentives in the range of \$300 across both injections delivered with minimal delay (i.e., delivered by the pharmacy immediately following injection) would promote high levels of adherence, perhaps offering \$100 for the first injection and \$200 for the second if completed within the recommended time frame would be a good starting place (Roll and Higgins, 2000). For example, \$100 cash incentives have been shown to generate surprisingly high levels of adherence in what are known as brief abstinence tests in highly addicted IDUs (e.g., Robles et al., 2000). It is important to reiterate again that the optimal value of incentives and how to distribute them across the two vaccine doses is an empirical question. However, in the absence of such information, \$100 delivered immediately after the first injection and \$200 after the second seems to like a reasonable estimate based on the empirical literature on incentives to promote adherence with vaccines and other preventive health regimens.

#### Declaration of interest

The authors have no conflicts of interest to declare.

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