Addiction Research & Theory

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iart20

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To cite this article: Maulika Kohli, Vanessa Serrano, Jessica L. Montoya, Ben Gouaux, Joseph Hampton Atkinson & David J. Moore (2022): Daily self-report of substance use via text message corresponds to retrospective assessment in people with HIV who use methamphetamine, Addiction Research & Theory, DOI: 10.1080/16066359.2022.2101639

To link to this article: https://doi.org/10.1080/16066359.2022.2101639

Published online: 01 Aug 2022.

ADDICTION RESEARCH & THEORY
https://doi.org/10.1080/16066359.2022.2101639

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RESEARCH PAPER

Daily self-report of substance use via text message corresponds to retrospective assessment in people with HIV who use methamphetamine

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ABSTRACT

Methamphetamine use is highly prevalent among people with HIV (PWH). Substance use is difficult to assess accurately and is often evaluated using a timeline follow-back interview (TLFB). One significant limitation of the TLFB is its long retrospective recall period (e.g. remembering use over a 30-day period). Self-report via text messaging offers a remote and potentially efficacious method of assessing methamphetamine use at a time closer to actual use. The aim of this secondary analysis is to evaluate the concordance between TLFB- and text message-reported methamphetamine use in a sample of 57 PWH; and by neurocognitive impairment status. Daily text messages evaluated methamphetamine use in the previous 24 h. Participants completed a TLFB covering the past 30 days to assess methamphetamine use frequency. There was a significant correlation between TLFB and daily text message reports ($\rho = 0.617$, $p < .001$). Results of matched paired *t*-tests showed comparability in mean reports of methamphetamine use between assessment methods (text-based frequency = 28%, TLFB frequency = 31%; $p = .328$). Although results approached significance, there were no differences in the neurocognitively impaired group between assessment methods (text message reported frequency = 28%, TLFB reported frequency = 39%; $p = .062$). Results reveal strong correspondence between TLFB and text message assessment of methamphetamine use. There may be benefits to using text messaging for substance use assessment and opportunities for interventions to improve important health behaviors (e.g. antiretroviral therapy adherence) that are strongly linked to substance use behaviors.

ARTICLE HISTORY
Received 13 September 2021
Revised 10 July 2022
Accepted 11 July 2022

KEYWORDS
mHealth; methamphetamine; short message service; HIV/AIDS; self-report; mobile phone

1. Introduction

Methamphetamine is a highly addictive stimulant drug and particularly prevalent among people with HIV (PWH) (Buchacz et al. 2005; Colfax and Shoptaw 2005; Cohen 2012; Galbraith 2015). As a stimulant, methamphetamine induces heightened levels of impulsivity and decreases behavioral inhibition (Fitzpatrick et al. 2020). Among PWH, methamphetamine use poses a significant barrier to antiretroviral therapy (ART) adherence, which is critical for preventing the spread of HIV and controlling HIV disease progression (Dombrowski et al. 2015). Research investigating the association between methamphetamine use and ART non-adherence suggests that using methamphetamine on any given day increases the odds of ART non-adherence on that day by 2.3 times (Parsons et al. 2013). Therefore, accurate and daily monitoring of methamphetamine use is critical to better understanding intervention targets for improving health outcomes among PWH.

Methamphetamine use is commonly assessed using the Timeline Follow-back interview (TLFB). TLFB is an in-person, calendar-based interview in which individuals retrospectively report patterns and frequency of substance use (e.g. days of use and daily quantity) over a specified time. Extant literature supports the reliability and validity of TLFB across a variety of populations, including community residents and adults with severe mental illness and/or substance use disorder (Sobell and Sobell 1992; Fals-Stewart et al. 2000; Carey et al. 2004). Among PWH, results examining the reliability of TLFB interview to assess substance use have been mixed. Several studies support the use of TLFB to assess the frequency and quantity of substance use (e.g. amphetamines, cocaine, heroin, alcohol) (Sobell and Sobell 1992; Fals-Stewart et al. 2000; Carey et al. 2004; Delker et al. 2016; Wray et al. 2016; Dulin et al. 2017) while other studies suggest that TLFB may be susceptible to recall bias and inaccurate reporting (Dulin et al. 2017; Merrill et al. 2020). TLFB estimates are most likely to be accurate when assessing for binges or no drinking versus retrospectively reporting a varied pattern of alcohol use. Longer latencies in TLFB reporting also lead to less accuracy (Dulin et al. 2017). Research also suggests that retrospective accounts of alcohol use may underestimate actual daily alcohol consumption (Monk et al. 2015). Such findings raise questions for the utility

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of TLFB to assess other substances among PWH, including methamphetamine.

Measuring the frequency of methamphetamine use poses significant challenges. These challenges include the sensitive nature of methamphetamine use disclosure, variability in methamphetamine use over time, and limitations to retrospective assessment among people who use methamphetamine. First, individuals may be apprehensive to disclose methamphetamine use at an in-person interview considering the legal implications of methamphetamine possession. Consequently, individuals may be less likely to accurately report use (Harrison 1997; Latkin et al. 2016). Next, TLFB assessment of methamphetamine use, as aggregate values of use within a specified time, do not capture daily variability in the quantity, frequency, and context of use (e.g. environmental context, social influences, and mood) (Parsons et al. 2013). Lastly, studies in PWH suggest that methamphetamine use may have detrimental effects on neuronal injury and neurocognition, specifically in the domains of learning, recall, and motor skills (Chang et al. 2005; Rippeth et al., 2004). Therefore, methamphetamine use may negatively impact retrospective recall ability which is critical for accurate reporting via TLFB (Rogers and Robbins 2001; Dean et al. 2013). Using computer-assisted self-interview (CASI) approaches eliminates some of the concerns articulated above, but does not resolve problems with a long retrospective recall bias. Therefore, alternative methods of reliably capturing methamphetamine use, as close to 'real time' as possible, are indicated.

Mobile health (mHealth) technologies offer a potentially efficacious medium for remotely monitoring and assessing methamphetamine use at instances proximal to use, without some of the challenges of TLFB assessments. Specifically, the use of mHealth technologies may eliminate longer retrospective recall biases with assessment of methamphetamine use at frequent intervals. Considering the ubiquity of smartphones in the United States, it may be feasible to collect daily data (e.g. methamphetamine use and mood) via short-messaging service (SMS; text message) (Pew Research Center 2018).

Reflecting substance use broadly, recent studies implementing smartphone-based assessment of substance use among persons without HIV have shown relatively high rates of intervention adherence ($M = 75.1\%$) (Jones et al. 2019). Text messages allow for real-time intervention and the responses serve as a potential self-monitoring intervention in their own right, particularly for substance users. Specific to methamphetamine use, interventions among men who have sex with men, a population at increased risk for HIV transmission, have utilized automated text messages and found reductions in methamphetamine use and risk behavior (Reback et al. 2012, 2018; Reback, Fletcher, Swendeman, et al. 2019; Rubenis et al. 2021). Furthermore, automated text messaging (versus text messaging a peer health educator) has been found to balance positive clinical outcomes (e.g. reductions in methamphetamine use) with cost effectiveness (Reback, Fletcher, et al. 2019). These studies demonstrate the clinical utility and feasibility of using text messages to monitor and potentially decrease methamphetamine use through behavioral awareness. Ultimately, assessing and monitoring potential risk factors and daily methamphetamine use via text-messaging may enable earlier relapse prevention, guide substance use interventions, and increase engagement in substance use treatment compared to self-reported TLFB at less frequent intervals.

Recent research supports the use of mHealth interventions to reduce HIV transmission risk behaviors and promote ART adherence among PWH; however, the use of mHealth technology to collect daily substance use has not been extensively tested among exclusively PWH who use methamphetamine (Cooper et al. 2017; Ameri et al. 2020). Considering the widespread use of mobile phones and the clinical benefits of collecting accurate reports of methamphetamine use, the goal of the present study is to evaluate the correlation between TLFB and text message-reported methamphetamine use. Additionally, we explored whether correlations between these assessment methods differed between neurocognitively unimpaired and impaired persons given that methamphetamine use may compromise cognitive abilities.

2. Methods

2.1. Participants

Participants in this study were selected from those who enrolled in a 2-arm, 6-week, pilot randomized clinical trial of Individualized Texting for Adherence Building (iTAB) conducted at the University of California, San Diego, HIV Neurobehavioral Research Program from 2012 to 2014 (Moore et al. 2018). Detailed results and intervention development for the iTAB intervention and associated medication adherence outcomes are previously described by our group (Moore et al. 2013, 2015; Montoya et al. 2014).

The present study was a secondary analysis that compared to TLFB assessment of substance use with text-based reports of substance use. Of the total 75 participants in the previously reported studies, 71 completed the study. Fourteen participants were excluded if they were lost to follow-up, withdrew from the study, or had missing data essential to the current study. 57 participants had appropriate data for the current study. Inclusion criteria were documented positive HIV serostatus, age 18 years or older at enrollment, an active prescription for ART, self-reported methamphetamine use within the last 30 days, and lifetime diagnosis of methamphetamine use disorder as determined by the Composite International Diagnostic Interview (World Health Organization 1998). The Composite International Diagnostic Interview (CIDI, v2.1), a fully-structured, computer-based interview (World Health Organization 1998). DSM-IV criteria were used for abuse or dependence diagnoses as the parent grant was funded before the DSM-5 was published. DSM-IV criteria for substance abuse (including methamphetamine) are met when participants report recurrent substance despite legal, interpersonal, work-related, and safety problems. DSM-IV criteria for substance dependence (including methamphetamine) are met when participants endorse symptoms of tolerance, withdrawal, and impaired control over substance use (Yoo-Jeong et al. 2020). To align

with DSM-5 criteria, lifetime diagnosis of methamphetamine use disorder was assigned if DSM-IV criteria for methamphetamine abuse or dependence were ever met in life.

Study exclusion criteria were minimal (e.g. not willing to respond to daily text message prompts) to enhance generalizability and recruitment feasibility, considering that many participants also had several co-occurring conditions (e.g. depression, hepatitis C virus). The study received approval from the local Institutional Review Board and participants provided written informed consent.

Individuals who did not own a cell phone or did not have text messaging plan were loaned a study cell phone with a texting plan. Participants who owned a cell phone used their own phones and were reimbursed for costs associated with the study that exceeded their regular cell phone use. Monetary incentives were given for the initial ($50) and post-intervention ($60) assessments.

2.2. Text messages to assess daily methamphetamine use

Daily text messages were sent to all participants to evaluate methamphetamine use in the previous 24 hours. Results from focus groups conducted among Black and Hispanic PWH who use methamphetamine revealed that participants' primary concerns were related to legal consequences of methamphetamine use disclosure, considering text messaging is an open and unsecure platform (Pasipanodya et al. 2020). As such, participants suggested that methamphetamine use assessment be coded and asked indirectly. This is consistent with other text-messaging interventions among people who use illicit substances (Ingersoll et al. 2014; Tofighi et al. 2017). For example, Ingersoll et al. (2014) created a discrete and indirect method of assessing substance use in the form of a weather question, 'how were the skies in the past 24 hours? Respond SKIES clear, cloudy, rainy, snowy, or other' which refers to different substance types. This method was selected by initial participants in their study due to privacy concerns. Therefore, for the current study design, the word 'methamphetamine' or variants of it were not included in text messages. a proxy for a direct question about methamphetamine was sent: 'Have you done anything in the past 24 hours? (Y) yes (N) no.' Participants received this text message daily at 9:00 a.m. At the first study visit, participants were trained that this daily text was in reference to their methamphetamine use, and all participants were explicitly recruited into the study because of their methamphetamine use. The proportion of days a participant endorsed methamphetamine use (# of days endorsing meth use/# of texts responded to) was calculated for each participant.

2.3. 30-Day timeline follow-back substance use interview

At the end of the 6-week trial, participants were administered a TLFB to assess methamphetamine use, both frequency and quantity, in the last 30 days. Given that our standardized TLFB questionnaire covers the last 30 days, we only analyzed the 30 days of text message data immediately preceding the administration of the TLFB assessment in order to allow for direct comparisons between the TLFB and text messaging data.

2.4. Neuromedical and neurocognitive assessments

Participants underwent a neuromedical evaluation focusing on HIV disease characteristics by a study physician and were administered a comprehensive neuropsychological test battery assessing seven neurocognitive domains: verbal fluency, executive function, processing speed, learning, delayed recall, working memory, and motor skills. This is a well-validated battery designed in accordance with the international consensus conference recommendations (i.e. Frascati criteria) for HIV-associated Neurocognitive Disorders (Antinori et al. 2007; Heaton et al. 2010). Raw scores from individual neurocognitive tasks were converted to demographically adjusted *T*-scores using the best available normative standards (Cherner et al. 2007; Heaton et al. 2003, 2004). *T*-scores are then converted to deficit scores ranging from 0 (no impairment) to 5 (severe impairment). The deficit scores are averaged to create a global deficit score (GDS). A GDS greater than or equal to 0.5 was considered neurocognitively impaired, and less than 0.5 neurocognitively unimpaired (Blackstone et al. 2012). A dichotomized global neurocognitive impairment variable (neurocognitively impaired *vs.* unimpaired) was used in analyses.

2.5. Statistical analyses

Positive versus negative responses (i.e. methamphetamine 'use' versus 'nonuse') to the methamphetamine text messages were compared using a matched-paired *t*-test. Nonparametric Spearman's rho correlations were used to examine the correlation between TLFB reported number of days of methamphetamine use and (i) number of text messages reporting methamphetamine use, (ii) number of text messages reporting no methamphetamine use, and (iii) number of non-responses to text messages. Matched paired *t*-tests were used to evaluate mean differences between TLFB and text message-reported methamphetamine use. Exploratory analyses investigated the same correlations by neurocognitive impairment status (impaired versus not impaired). Power analysis was conducted using GPower (Erdfelder et al. 1996). These analyses will be powered ($1-\beta = 0.95$) to detect medium effect sizes ($d = 0.50$), with a two-tailed $\alpha = 0.05$. Statistical analyses were performed using JMP Pro version 14.0.0 (JMP®, Version *<14.0.0>*. SAS Institute Inc., Cary, NC, 1989–2007).

3. Results

3.1. Demographics and sample characteristics

Demographic and clinical characteristics of the sample are provided in Table 1. Participants were primarily males with some college education and about 45% reported being non-

Table 1. Demographic and sample characteristics.

	Total sample ($N = 57$)
Demographics	
Age (years)	46.2 (8.0)
Education (years)	13.5 (2.9)
Sex (male)	54 (94.7%)
Race/ethnicity (non-Hispanic White)	26 (45.6%)
Neurocognition	
Neurocognitive impairment status (impaired)	24 (42.1%)
HIV Disease Characteristics	
CD4 count[a]	507 [378-692]
Nadir CD4 count	200 [33-378]
Detectable plasma viral load[b]	16 (28.6%)
History of AIDS	30 (54.5%)
Estimated years of infection	10.2 [4.5-16.7]
Methamphetamine Use Characteristics	
Age of first methamphetamine use	21.7 (11.8)
Proportion of days used via TLFB	0.20 [0.10–0.45]
Proportion of days used via iTAB[c]	0.19 [0.04–0.47]

Note. Values are presented as *M*(*SD*), *MDN* [IQR], or *N*(%).
[a]$N = 17$.
[b]Defined as >50 copies/mL in plasma.
[c]The proportion of days a participant endorsed methamphetamine use calculated as # of days endorsing meth use/# of text responses.

Hispanic White. With respect to HIV disease characteristics, over half had an AIDS diagnosis and approximately one-third had detectable HIV viral loads. In terms of neurocognitive performance, 33 participants met criteria for being neurocognitively unimpaired and 24 participants met criteria for being neurocognitively impaired. Participants were monitored for approximately 32 days ($Mdn = 32$, IQR [23,40]); however, only the 30 days of text message data immediately preceding the administration of the TLFB assessment were used in analyses.

3.2. Text message assessment of methamphetamine use

A pie chart illustrating text message response rates in the 30 days prior to administration of the TLFB assessment is depicted in Figure 1. Across all 57 participants, a total of 1734 text messages to assess methamphetamine use were sent and 1310 responses were received. The overall mean response rate to methamphetamine use text messages was 76.3% ($M = 22.9$ responses per participant) and the mean nonresponse rate was 24.5% ($M = 7.4$ non-responses per participant). Among participants who responded to methamphetamine use texts, participants were more likely to report not using methamphetamine ('no': 72.2%) compared to using methamphetamine ('yes': 27.8%; $t(56) = -5.7$, $p < .001$). Forty-five participants (79%) reported using methamphetamine via text-message at least once during the study period.

3.3 30-Day timeline follow-back assessment of methamphetamine use

Based on the 30-day TLFB interview, participants reported methamphetamine use 31% of the time ($M = 9.4$ days, $SD = 8.9$) during the 30-day study period (overlapping with the time period of the text message methamphetamine use reporting). Of participants who responded to methamphetamine use texts, there were 12 participants who reported

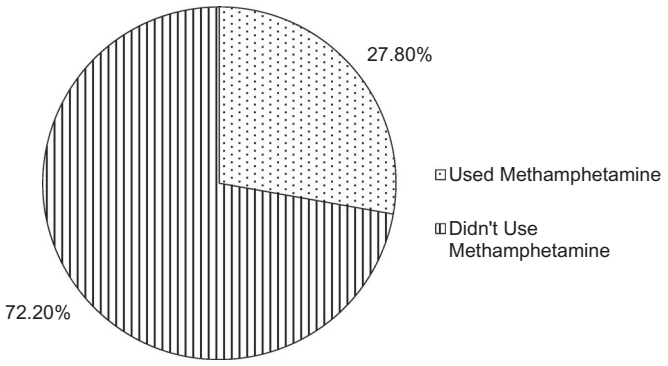

Figure 1. Responses to methamphetamine use texts ($n = 1734$).

methamphetamine use on the TLFB but not via text message.

3.4. Convergent validity of text message responses and 30-day timeline follow-back interview

Nonparametric correlation analysis revealed a statistically significant positive correlation between TLFB reported number of days of methamphetamine use and number of text messages reporting methamphetamine use ($\rho = 0.620$, $p < .001$; Figure 2). Additional nonparametric correlation analysis indicated a statistically significant negative correlation between TLFB reported number of days of methamphetamine use and text message reported number of days reporting no methamphetamine use ($\rho = -0.620$, $p < .001$). TLFB reported number of days of methamphetamine use was not associated with text message reported number of days with no-responses ($\rho = 0.166$, $p = .218$). Finally, results of matched paired *t*-tests did not reveal significant differences in mean reports of methamphetamine use between assessment methods (# of days endorsing meth use/# of texts responded to; text message reported frequency = 27.8%, TLFB reported frequency = 31.3%; $t(56) = 0.99$, $p = 328$).

Exploratory analyses were conducted to examine the correspondence between methamphetamine use assessment methods by neurocognitive impairment status. Nonparametric correlation analysis showed a statistically significant positive correlation between TLFB reported number of days of methamphetamine use and number of text messages reporting methamphetamine use in both neurocognitively unimpaired ($\rho = 0.551$, $p < .001$) and impaired groups ($\rho = 0.709$, $p < .001$). Nonparametric correlations also revealed significant negative correlations between TLFB reported methamphetamine use and number of text messages reporting no methamphetamine use in both neurocognitively unimpaired ($\rho = -0.551$, $p < .001$) and impaired ($\rho = -0.709$, $p < .001$) groups. There were no associations between TLFB reported methamphetamine use and non-responses to text messages across neurocognitive status groups.

Results of matched paired *t*-tests approached statistical significance; however, showed no significant differences in mean reports of methamphetamine use in the neurocognitively impaired group between assessment methods (text message reported frequency = 28%, TLFB reported frequency = 39%; $t(23) = 1.96$, $p = .062$) such that neurocognitively impaired

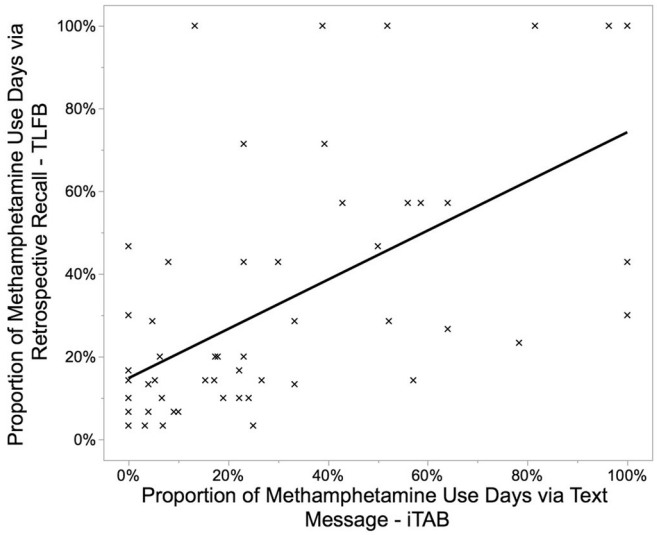

Figure 2. Correlation between TLFB reports of methamphetamine use and text message responses of methamphetamine use.

participants reported slightly more methamphetamine use via TLFB compared to text message. There were no significant differences in mean reports of methamphetamine use between assessment methods in the neurocognitively unimpaired group (text message reported frequency = 27%, TLFB reported frequency = 26%; $t(32) = -0.36$, $p = .719$).

4. Discussion

The purpose of this study was to evaluate the correspondence between 30-day TLFB assessment and 30-day daily text message assessment of methamphetamine use among PWH with a lifetime history of methamphetamine use disorder. Participant adherence to the iTAB text messages was overall high, with a mean response rate of 76.3% and nonresponse rate of 24.5%. This is consistent with other studies using ecological momentary assessments among persons without HIV and among substance users, (Moore et al. 2017; Jones et al. 2019). Of the text message responses to methamphetamine use, participants were more likely to report not using methamphetamine compared to using methamphetamine. We found a significant positive correlation between 30-day TLFB and daily text message assessment of methamphetamine use during the same 30-day period. Results indicate correspondence between methamphetamine use assessment methods among both neurocognitively unimpaired and impaired individuals speaking to the validity of using text messages in the context of neuropsychological impairment. Taken together, these findings support the convergent validity of text message measured methamphetamine use among PWH.

Daily text message assessment of methamphetamine use, in combination with other ecological momentary assessment (EMA) data (e.g. mood, environment, everyday activities), may allow researchers to explore more nuanced research questions to better understand predictors of health, mood, and behaviors. For instance, Kuerbis et al. (2019) utilized daily EMA online surveys to investigate daily factors associated with daily substance use (i.e. alcohol, marijuana, other drugs) and chronic pain in older PWH and found that greater daily alcohol use was associated with daily reports of pain. Daily text message assessment of methamphetamine use may also be integrated into real-time interventions for reducing methamphetamine use. According to a recent systematic review ($n = 5$), brief (i.e. 2–8 week) text message interventions on high-risk sexual behaviors in methamphetamine users were associated with decreased rates of methamphetamine use and high-risk sexual behaviors (e.g. decreased condomless anal intercourse) associated with HIV infection (Ameri et al. 2020).

Although results of this study indicate concordance between daily text message and TLFB assessment of methamphetamine, results across the broader substance use literature have been more variable (Phillips et al. 2014; Horvath et al. 2017; Ameri et al. 2020). For example, Paolillo et al. (2018) examined the validity of EMA to assess cannabis and alcohol use against self-reported baseline TLFB among older persons with and without HIV in a 14-day study. Findings support the convergent validity of EMA surveys such that cannabis and alcohol use reported via EMA were significantly related to self-reported substance use at baseline. Conversely, among a sample of cigarette smokers, TLFB reports of weekly cigarette use were significantly higher than daily EMA records of cigarette smoking, with participants demonstrating a digit bias of reporting quantities rounded to units of 10 (Shiffman 2009). Another study evaluating the reliability and validity of daily reports compared to 14-day recall of health-related quality of life, ART adherence, substance use, and sexual encounters among PWH found evidence of overreporting habitual behaviors (i.e. tobacco use) and underreporting socially undesirable behaviors (i.e. unprotected sex and alcohol use) (Swendeman et al. 2015). Other studies have found significantly higher frequency of substance use, including methamphetamine use, through EMA and text-messaging compared to retrospective recall reports (Phillips et al. 2014; Rowe et al. 2016).

Considering the variability in findings across the literature, there may be other factors related to methamphetamine use, HIV disease, and neurocognition that may explain this response bias. Studies have shown that methamphetamine has neurotoxic effects on the brain such that both acute and long-term use disrupts neurotransmitter function in the dopaminergic system and damages terminal ends of neurons in brain regions (i.e. frontostriatal structures, limbic structures, and orbitofrontal cortex) that are implicated in cognitive functioning (Simon et al. 2002; Scott et al. 2007; Rusyniak 2013). HIV infection is associated with neurotoxic effects on the central nervous system which may impose increased vulnerability to neurocognitive impairment among methamphetamine using PWH (Lawrence and Major 2002; Kaul 2008). Studies examining brain abnormalities and neurocognition among PWH with concurrent methamphetamine use suggest independent and additive effects with greater neuronal injury and neurocognitive deficits, particularly in the domains of learning, recall, and motor skills (Chang et al. 2005; Rippeth et al. 2004). Considering TLFB assessments heavily rely on retrospective recall reports, and

the compounding detrimental effects of HIV disease, methamphetamine use, and aging on the brain, chronic long-term methamphetamine use may affect recall ability. Although results among our sample of neurocognitively impaired PWH were non-significant, the effect of long-term methamphetamine use as PWH continue to age warrants further investigation. Furthermore, the mixed findings across the literature could be attributable to the differential effects of substances on retrospective recall. Therefore, the validity of daily text message assessment may differ depending on the substance assessed.

The current study is not without limitations. While the current study evaluated the validity of text-message assessment of methamphetamine against the TLFB questionnaire, there are alternative methods of capturing methamphetamine that could be used to validate text-message assessment such as biological markers via urine toxicology or the CASI. Furthermore, there are alternative statistical methods to evaluating the validity that could be utilized including multilevel modeling and controlling for family-wise error rate. Future work may explore the validity of text-message assessment against these alternative assessment methods using different statistical approaches.

Although participants were generally responsive to text messaging regarding methamphetamine use, there is a possibility that non-responsiveness was due to methamphetamine use, which may lead to an underestimate of methamphetamine use. Text messages were typically sent to participants in the morning. Therefore, there is a possibility that non-response was due to methamphetamine use after the daily text message was sent. Considering non-response reasons were not specifically assessed, we chose to not to posit whether non-response days were indicative of methamphetamine use or nonuse. Additionally, the design of the text message assessment of methamphetamine use (i.e. binary use/no use) did not allow for follow-up questions regarding the quantity of methamphetamine use in the last 24 h, and numerous questions may discourage reporting. Comparatively, TLFB allows for both the assessment of methamphetamine use frequency and quantity. Furthermore, the current study did not investigate associations or relationships between individual characteristics (e.g. demographic, behavioral, psychosocial, environmental) and non-response to text messages, which may elucidate potential predictors of non-response. Future work may address associations such as methamphetamine use and education level, psychiatric diagnoses, social support, and geographic location.

Although we investigated whether correlations between TLFB and text message assessment differed between neurocognitively unimpaired and impaired persons, it remains difficult to determine the extent to which cognitive impairment relates to HIV and methamphetamine use. To our knowledge, there have not been any studies investigating this approach among individuals with cognitive impairment. Additional research with a larger sample of cognitively impaired and unimpaired adults would allow for greater power to detect significant results and exploration of more nuanced research questions (e.g. does validity of methamphetamine reporting via text-message rely on specific cognitive domains?).

In terms of mHealth methodology, there may be more advanced ways to capture daily methamphetamine use using smartphones and wearables compared to text messaging such as geospatial tracking, interactive prompts, push notifications via a smartphone application, biosensors, and breathalyzers. Given the study's broad inclusion criteria and limited exclusion criteria, these results may be considered difficult to replicate in other populations of interest; however, our sample demographic characteristics generally represent the population of PWH well. Finally, despite robust findings within our sample, future studies among large samples of women, or with equal sample sizes by sex will expand the generalizability of this study to women.

5. Conclusions

Taken together, results reveal strong correspondence between text message assessment and TLFB reports of methamphetamine use among PWH. TLFB poses significant limitations to accurately capturing methamphetamine use including disclosure concerns, limitations of data collection, and reliance on retrospective recall. Text-messaging remains one of the primary methods of digital communication and is the most frequently used smartphone feature, despite the growth of other digital communication channels (Pew Research Center 2018). Therefore, it is likely that text-message assessment of substance use will remain a viable assessment tool for the foreseeable future, especially if it corresponds to biological markers of substance use. Given the results of the current study support the validity of substance use assessment via text-message, there may be opportunities for interventions to improve important health behaviors (e.g. ART adherence) that are strongly linked to substance use behaviors by monitoring substance use more closely through texting.

Respective Contributions: Authors Maulika Kohli and David J. Moore designed the study. Maulika Kohli and Vanessa Serrano conducted literature searches and provided summaries of previous research studies. Maulika Kohli conducted the statistical analysis. Maulika Kohli and Vanessa Serrano wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by NIDA award R34DA031058 (Moore, PI). Additional infrastructure support was provided by NIDA P50 DA026306 (Igor Grant, PI) and NIMH P30 MH062512 (Robert Heaton, PI). Stipend support to MK is funded by the National Institute on Alcohol Abuse and Alcoholism of the National Institutes of Health under Award Number T32AA013525 and National Institute on Aging under Award Number F31 AG074838. VS and JLM were supported by

NIDA T32 DA031098; JLM was also supported by R25 MH108389. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The funders had no role in study design, data collection and analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

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