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Phosphatidylethanol (PEth) Levels among Incarcerated Women: The Influence of Pre-incarceration Alcohol Consumption and Length of Abstinence

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Abstract

Background—Phosphatidylethanol (PEth) is a direct biomarker for alcohol that is formed shortly after alcohol use and may remain detectable in blood for weeks after alcohol consumption. There is little research on alcohol use factors that influence PEth elimination, especially among women.

Methods—Data were collected from 116 alcohol use-disordered women who were recently incarcerated. We used a two-part model with logistic and linear components to examine whether alcohol consumption in the two weeks prior to incarceration and days since last alcoholic drink

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(operationalized as abstinence days prior to incarceration + days incarcerated) were associated with PEth detectability (>8ng/mL) and level (ng/mL) in blood.

Results—Participants reported drinking an average of 10 drinks per day in the two weeks prior to incarceration. Days since last drink was negatively associated with PEth level (OR = 0.97, 95% CI = 0.93; 0.99) and being PEth detectable (OR = 0.96, 95% CI = 0.91; 0.99). Quantity of alcohol consumed prior to jail admission was associated with PEth detection (OR = 1.08; 95% CI = 1.03; 1.16), but not PEth level.

Conclusions—Days since last alcoholic drink and drinks per day both influenced PEth detectability, but only days since last drink predicted PEth level among a large sample of women with alcohol use disorder in the criminal justice system.

Keywords

Phosphatidylethanol (PEth); alcohol; elimination; women; incarceration

Introduction

Phosphatidylethanol (PEth) is a phospholipid that forms in red blood cell membranes in the presence of ethanol (Gnann et al., 2012). PEth has been used as a direct biomarker of alcohol ingestion. Numerous studies (see Viel et al. 2012 for review) show that PEth levels can be used as a marker for alcohol consumption (Hahn et al., 2012), chronic excessive alcohol use (Kummer et al., 2016b), episodic/binge drinking (Francis et al., 2015; Piano et al., 2015), and moderate drinking (Jain et al., 2014; Kechagias et al., 2015) in clinical and non-clinical populations. PEth is a useful direct alcohol biomarker because it stays present in the blood long after alcohol consumption has ended (Viel et al., 2012). Laboratory studies and studies of patients entering alcohol detoxification find that PEth starts to deteriorate as soon as 6 hours after cessation of alcohol consumption (Gnann et al., 2012). PEth levels often have an initial sharp decline, which gradually levels off over the course of several weeks (Winkler et al., 2013). PEth has a half-life of about 4 days among chronic heavy drinkers (Varga et al., 2000) and up to 12 or 13 days among social/moderate drinkers (e.g., single doses of 0.25 and 0.50 g/kg of alcohol; Gnann et al., 2012; Javors et al., 2016). Studies show individual variability in PEth elimination rates (i.e., time between last drink and PEth drops below limit of quantification; Hahn et al. 2016; Javors et al. 2016), highlighting the importance of examining individual factors that influence PEth detectability and levels after alcohol cessation.

There is limited research on alcohol use factors that influence the detection and amount of PEth in blood after a period of abstinence. Some studies suggest that the number of days since alcohol was last consumed prior to a PEth test is related to PEth level (i.e., as PEth deteriorates in the absence of alcohol). For instance, PEth detection decreases as a function of abstinence length, and therefore PEth sensitivity (i.e., ability to detect a positive PEth level; >8 ng/mL) is as low as 67% after 14 days of abstinence (Wurst et al., 2010) and 43% after 28 days of abstinence (Wurst et al., 2010). However, this and other studies examining PEth elimination hold abstinence days constant, observing PEth at intervals (e.g., 1 day, 3 days, 7 days, 14 days, 21 days) throughout a brief abstinence period (Winkler et al., 2013;

Wurst et al., 2010), which does not capture the influence that each additional abstinence day has on PEth detectability. Also, prior studies have not systematically examined the relationship between abstinence length and amount of PEth in blood (as opposed to detectability), which provides additional information about the elimination process. To better understand how PEth is eliminated from blood across a period of abstinence, more information about days since last drink and PEth detectability/level over periods of abstinence longer than 21 days is needed.

Another factor thought to influence PEth elimination is quantity of alcohol consumed prior to abstinence. The quantity of alcohol consumed in alcohol administration trials has been moderately correlated with PEth levels at the end of a 19-day abstinence period (Winkler et al., 2013). In addition, initial PEth levels at the start of an abstinence period appear to be related to PEth half-life and rate of elimination (Javors et al., 2016; Varga et al., 2000), but studies have not analyzed the effect of pre-detoxification alcohol consumption on PEth levels.

Present Study

There is a need for additional research that accounts for alcohol use factors (e.g., days since last drink was consumed, amount of alcohol consumed) that may influence PEth level and detection after a period of abstinence (Hahn et al., 2016a, 2012). Moreover, as noted in other studies, there is a need to expand the investigation of PEth and other alcohol biomarkers to more diverse settings and populations to increase generalizability of laboratory studies. In addition, research examining PEth elimination has rarely included women, or has drawn from very small samples (i.e., less than 10 women; Winkler et al. 2013; Wurst et al. 2010). This study aims to examine two specific factors –amount of alcohol consumed before abstinence and days since last drink–that may influence PEth detection and levels after abstinence among a large, diverse sample of alcohol-dependent women who have recently become incarcerated. Given that alcohol intoxication often prompts arrest and individuals undergo forced abstinence during incarceration, the jail drawn from here presents a unique clinical setting to examine PEth elimination.

Materials and Methods

Participants and Procedures

These data were drawn from an ongoing randomized controlled trial (RCT) that evaluates the effectiveness of an intervention to reduce alcohol use among women with alcohol use disorder (AUD) returning to the community from jail by promoting linkage to 12-step self-help groups (Johnson et al., 2017). Eligible participants: 1) were in the participating jail and anticipated they would be released within the next two months; 2) were 18 years of age or older; 3) lived within 20 miles of our research offices and planned to remain in the area for the next 6 months; 4) met 3 or more DSM-5 criteria for AUD in the last 90 days; 5) did not expect to attend residential alcohol or drug treatment upon release; and 6) spoke English. Enrollment at the jail for this sample took place between May 2014 and October 2016. Research staff had access to the jail facility only 4 hours per weekday (no weekends) with two private rooms available for interviewing. Researchers attempted to screen all women

shortly after their intake at the jail; however, screening was in some cases delayed due to a variety of factors. Often women were at court or otherwise unavailable (sleeping, exercising outside, in the infirmary) when researchers were able to access the jail. Some women did not feel comfortable meeting with a researcher soon after intake, and were only willing to be screened once they had seen the researchers several times and became familiar with them. Thus, while the original RCT goal was to gather PEth within 24 hours of incarceration to use as a baseline measure for future reductions in drinking as assessed during the ongoing trial, the timing of enrollment (and therefore PEth testing at the baseline interview) was opportunistic.

Potential participants were informed that: (1) a decision not to participate in the research will have no impact on their status or expected length of stay at the jail; (2) the study has a Certificate of Confidentiality; and (3) no information provided during the study will be shared with jail staff, officers of the court, parole officers, or others in the criminal justice system. We asked participants if they would like us to read the consent forms aloud. The study protocol was reviewed and approved by the Butler Hospital institutional review board for the protection of human subjects in research, and complied with the special protections pertaining to behavioral research involving prisoners (OHRP, 2005).

Research staff approached 340 women for the RCT, and 5 refused to be screened, leaving 335 screened of whom 214 were ineligible; the most common reasons for ineligibility were expecting to be sentenced to more than 60 days ($n = 84$), no AUD ($n = 69$), and expecting to be released to residential treatment ($n = 68$). The remaining 121 were consented, enrolled, and completed the baseline assessment. Four participants refused the PEth blood test following the assessment due to fear/dislike of needles and one participant completed the fingerstick but produced an inadequate blood sample for PEth analysis. Thus, the final sample includes 116 women.

Measures

Demographics—Age, race/ethnicity, years of education, and the presence of Hepatitis C virus (HCV) were assessed via self-report.

Pre-incarceration Alcohol Use—Self-reported alcohol use in the two weeks prior to incarceration was assessed using the Timeline Followback (TLFB) calendar-based interview (Ehrman 1994; Miller 1995; Sobell, & Sobell 1992) at the baseline assessment point (in jail). The TLFB is a reliable and valid method for assessing alcohol use (Johnson & Zlotnick, 2008; Stein et al., 2002; Zlotnick et al., 2009). Participants answered the following question as part of the TLFB calendar interview: “In the two weeks prior to your arrest, how much alcohol did you drink each day?” and then discussed each day of the week to prompt recall. One standard drink was defined as one beer, one 5-ounce glass of wine, or 1.5 ounces of hard liquor. As a measure of total alcohol consumption, we calculated the average number of drinks consumed on each of the 14 days prior to jail admission.

Days Since Last Alcoholic Drink—Days since last alcoholic drink was measured as the sum of days between entering the jail and PEth testing, plus any abstinence days reported immediately prior to incarceration on the TLFB. This measure assumed participants did not

consume alcohol while incarcerated, as access to alcohol in jail facilities is illegal and rarely occurs.

PEth Level—The PEth test was performed following the instructions from the United States Drug Testing Laboratory (USDTL), using a finger prick blood spot sample (http://www.usdtl.com/testing/PEth-alcohol-test-labs). Dried blood spots were collected, prepared, dried, and stored using the methods outlined in Gruner, Stambouli, & Ross (2015), which has yielded almost perfect correlation with whole blood testing for PEth homologue 16:0/18:1 (Kummer et al., 2016a). PEth concentration was determined from dried blood spots using the liquid chromatography tandem mass spectrometric method (LC-MS/MS) developed by Jones et al. (2011) to detect 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphoethanol in dried blood spots (Jones et al., 2011). This method has frequently been used to determine PEth level in other studies (Bakhireva et al., 2014; Faller et al., 2011). The lower limit of quantification was 8 ng/mL. The PEth homologue 16:0/18:1 is the most common PEth species (comprises 40% of total PEth; Helander & Zheng, 2009) with a limit of quantification that falls between 8 to 10 ng/mL (Hahn et al., 2016a).

Research assistants used a lancet to prick participants' fingers and allowed the drop of blood to come into contact with the collection circle on the card. Research assistants were instructed to allow the collection paper to wick blood out of the puncture site, and not to press the participants' finger against the collection paper or layer successive drops of blood. Blood spots were sent to USDTL in Des Plaines, IL, for testing. Any level above 8 ng/mL was scored as positive/detectable, and any level below 8 ng/mL was not quantifiable and considered negative.

Analysis

We present descriptive statistics to summarize characteristics of the sample and scatterplots to illustrate the association between observed PEth levels and days since last drink and average drinks / TLFB day. We generated scatterplots (Figure 1A-1B) to describe the association between PEth level and days of alcohol abstinence and average drinks / TLFB day. These graphs also include a locally weighted scatterplot smoother (lowess) regression plot. Because the processes generating PEth detection may not be the same as processes generating the magnitude of PEth levels among participants with detectable PEth, we used a two-part model (TPM) (Belotti et al. 2015). A logit model was used to estimate the effect of days since last drink and average drinks per TLFB day on the likelihood of having a detectable PEth, and conditional on having a detectable PEth, linear regression was used to estimate the effect of these covariates on mean PEth level. Because PEth levels in our sample were positively skewed and to account for the potential non-linear elimination of PEth (Winkler et al., 2013), we evaluated the log-transformed PEth values. We report Odds-ratios (OR) for the logit part of the model and exponentiated regression coefficients for the regression part of the model. The latter give the estimated factor change in the expected mean PEth level. These coefficients are sometimes expressed as the percent change in the expected mean (e.g., exp(b) = 1.05 means the expected mean increases by about 5% for each 1 unit increase in the predictor). Our primary predictor variables were days since last

reported drink prior to PEth testing, and the quantity of alcohol consumed during the 2 weeks prior to arrest.

Results

Sample

Sample descriptives, average drinks consumed per day, average number of days since last drink, average PEth level, and percent of women with undetectable PEth are reported in Table 1. The mean PEth level was 110.0 ng/mL (± 107.2, Median = 79.0) among persons (n = 78) with a detectable PEth. The lowest observed detectable PEth was 9.06 ng/mL.

To describe the full abstinence period under examination (i.e., 1-54 days), we present the percentage of individuals who were PEth detectable and mean PEth level by weeks of abstinence (see Table 2). The percentage of persons with detectable PEth levels decreased from 82.1% during the first week of abstinence, to 33.3% among persons who had been abstinent for 21 or more days. Mean and median PEth levels also decreased over the reporting period.

Because we found a relatively high proportion of women who reported drinking within the week prior to testing to have undetectable PEth, we also compared our primary variables (i.e., quantity of alcohol consumed, number of days since last drink) among women with and without detectable PEth. Women with detectable PEth levels had significantly higher mean drinks per day ($t = -2.25$, $p = .021$) and significantly fewer abstinence days ($t = 2.34$, $p = .021$) than those with undetectable PEth levels. Women with detectable PEth levels drank an average of 11.9 (±13.0) drinks, while those with undetectable PEth drank an average of 6.76 (SD = 5.51) drinks per day in the two weeks prior to jail admission. Women with detectable PEth averaged 10.2 (± 8.80) days since their last drink compared to 14.9 (±12.28) days for women with an undetectable PEth.

Finally, because there was a high percentage of women in our sample with Hepatitis C virus (HCV), we investigated sample characteristics by HCV status. Participants with HCV were significantly older ($t = -2.76$, p = .007), had significantly ($t = 2.25$, $p = .027$) lower (29.5 vs. 83.8) mean PEth levels, and on average had more days since last drink ($t = -2.52$, $p = .013$; 16.8 vs. 10.7) than participants without HCV (which may be due to more incarceration days, not more abstinence days prior to incarceration). Participants with HCV did not differ from those without HCV in the total amount of alcohol consumed in the 2 weeks prior to coming into jail.

Correlations of PEth Level with Alcohol Use Factors

Figures 1A and 1B plot observed PEth levels by days of abstinence and average drinks per TLFB day, respectively. These figures also give lowess regressions of PEth level on each of these factors. PEth levels appear to decrease as days since last drink increases (Spearman's $r_s = -0.28$, p = .002); after about 20 days of abstinence, most PEth levels are at or near the threshold of being detectable. Figure 1B also suggests a weak trend of increasing PEth levels as average drinks per day increases (Spearman's $r_s = .18$, $p = .054$). Figures 1A and 1B show

raw data only; neither adjusts for values of the complimentary variable or for the floor effect of detectability.

Regression Analysis

Table 3 shows results for a TPM with main effects for days since last drink and average drinks per day. Each additional abstinence day was associated with 0.96 (95% CI 0.91; 0.99, $p < .05$) factor decrease in the odds of having a detectable PEth. Each additional drink per day was associated with a 1.08 (95% CI 1.03; 1.16, $p < .05$) factor increase in the odds of having a detectable PEth. Among participants with a detectable PEth, each additional day of abstinence was associated with a 0.97 (95% CI 0.93; 0.99, $p < .05$) factor decrease (i.e., 3% decrease) in the expected mean PEth level. Mean drinks per day was not associated significantly with PEth level among women with a detectable PEth.

To examine other alcohol consumption variables that may have a stronger association with PEth levels, we conducted a post-hoc analysis substituting drinks per *drinking* day and percentage of *heavy drinking days* in place of average drinks per TLFB day in the regression model. The scatterplots in Figures 2A and 2B show that PEth level was positively related to drinks per drinking day (Spearman's $r_s = .24$, $p = .008$) and unrelated to percentage of heavy drinking days (Spearman's $r_s = .08$, $p = .406$). When each of these variables was substituted in the regression analysis, results were substantively consistent with average drinks / TLFB day.

As a secondary analysis, we further investigated observed sample differences among women with and without HCV. We split our sample to examine the TPM separately by HCV status. Among participants with HCV, neither quantity of alcohol use nor days since last drink significantly predicted PEth detection or level. Results with respect to the likelihood of having a detectable PEth were generally consistent with those found for participants without HCV. However, the substantive magnitude of the association between days of abstinence and PEth level among those with detectable PEth was much weaker for participants with HCV (exp(b) = 1.00, 95% CI = 0.97; 1.04, $p > .05$) than participants without HCV (exp(b) = 0.94; 95%CI 0.91; 0.98, $p < .05$) Even with the small sample size, a formal test for the first order interaction of HCV status and days of abstinence predicting PEth level was statistically significant ($z = 2.52$, $p = .012$), meaning that the relationship between days of abstinence and PEth level was significantly smaller for participants with HCV than for participants without HCV.

Discussion

The Influence of Days Since Last Drink on PEth

Using a naturalistic experiment with varying days of abstinence due to incarceration among women with AUD, this study showed that PEth levels varied as a function of days since last drink. Participants with more days since their last alcoholic drink were less likely to have a detectable PEth, even accounting for the amount of alcohol consumed. Results of a linear model showed that among women with a detectable PEth, on average, each additional day since last drink was associated with a significant 3% decrease per day in the mean PEth

level, consistent with studies showing a gradual decline of PEth levels over more restricted periods of abstinence (Varga et al., 2000; Winkler et al., 2013). This study is the first to examine the relationship of days since last drink with PEth levels among a large sample of women, and thus provides useful information about the degree to which PEth levels decline with each abstinence day. Our study suggests that PEth stays present in blood for longer periods than previously observed. Specifically, PEth has been detected in blood up to 28 days after alcohol consumption among alcohol-dependent patients undergoing withdrawal or detoxification (Winkler et al., 2013; Wurst et al., 2010) and up to 21 days among people who drank moderate amounts of alcohol (Gnann et al., 2012). Further, one study showed that PEth was detected in two patients who reported 6 weeks of abstinence (Stewart, Koch, Willner, Anton, & Reuben, 2015) and Hahn and colleagues (2012) found two individuals with a detectable PEth who reported abstinence in the past 21 days, but did report drinking in the previous 90 days. This study examined the longest abstinence period thus far (i.e., up to 54 days) and found that three women had detectable PEth levels between 21 and 54 days of abstinence (although 6 women did not during the same period of abstinence).

The Influence of Alcohol Consumption

Quantity of self-reported alcohol consumption (i.e., standard drinks in the 2 weeks prior to incarceration) was associated with increased odds of detecting PEth. However, among those with detectable PEth, it did not predict magnitude of PEth levels in either sample, after controlling for number of days since one's last drink. It is notable that the women in this study were all diagnosed with AUD and most reported drinking heavily–an average of over 10 drinks per day in the two weeks prior to incarceration (and 44.8% of women reported all heavy drinking days on TLFB). Indeed, drinks per TLFB day and drinks per drinking day were highly correlated in this sample (Pearson's $r = .932$, $p < .001$), as were drinks per TLFB day and heavy drinking days (Pearson's $r = .51$, $p < .001$). Some studies suggest that PEth may be eliminated more quickly among people who consume more alcohol (e.g., people with alcohol dependence; Varga et al. 2000), while others show that alcohol consumption may be weakly correlated with PEth levels (Viel et al., 2012). Also, there is a wide PEth variability among drinkers, especially at the higher level of alcohol use (Hahn et al., 2012). Therefore, days since last drink may be more important than quantity of alcohol consumed among people who cross a certain threshold of heavy drinking. Quantity of alcohol consumed and days since last drink may be equally important among social or moderate drinkers. Thus, future research examining these questions with individuals who have less severe alcohol use problems might utilize a variety of alcohol consumption variables (e.g., drinks per drinking day, drinks per day, percentage of heavy drinking days) to best capture the influence of binge or episodic alcohol consumption on PEth levels after a period of abstinence. This study suggests that among women with AUD, regardless of the amount of alcohol consumed prior to the abstinence period, the number of days since last drink influences the amount of PEth detected, given a detectable PEth test. A different possible explanation is that there may be less measurement error for days since last drink than quantity of alcohol consumed, if the former is easier to remember.

PEth Undetectable Women

A significant minority (n = 38, 32.8%) of women in this sample had undetectable PEth, despite that 66% of these 38 women reported consuming large quantities of alcohol in the two weeks prior to the PEth test, 18% reported consuming alcohol between 15 and 28 days prior to the PEth test, and 16% reported consuming alcohol between 28 and 54 days prior to the PEth test. This represents a false-negative rate of 32.8%. While some studies show a false-negative rate of 0% on the first day of detoxification (Wurst et al., 2010), other studies have shown a false-negative rate of up to 20% on the first day of detoxification among people with chronic alcoholism (Varga et al., 2000). Further, many studies have noted that although PEth has good sensitivity, it is not perfect (Hahn et al., 2016a). A t-test showed that participants with detectable PEth reported significantly fewer abstinence days compared to those with undetectable PEth (t (114) = 2.34, p = .01). This finding suggests the importance of investigating other individual-level factors affecting the rate of metabolism that can influence PEth elimination. Finally, it cannot be ruled out that these 38 women did not consume alcohol as recently as they reported due to difficulties in recall. These are important directions for future research.

There was a high rate of HCV among women in this sample (compared to rates in the general population), and results of a secondary analysis showed that days since last drink and quantity of alcohol consumed were similarly (though not significantly) related to PEth detection among participants with and without HCV but that days since last drink was not related to PEth level in blood for women with HCV. It is important to note that we had a small sample of women with HCV and models may have been underpowered. In addition, differences in incarceration length prior to PEth testing between women with and without HCV may have influenced our results. Therefore, more research is needed to understand the role of liver-damaging conditions on PEth elimination. Studies examining alcohol biomarkers often exclude patients with HCV and other chronic liver diseases. However, recent research highlights the importance of not only understanding the utility of PEth testing among individuals with these health conditions (Stewart et al., 2015), but also the ways in which these conditions may affect PEth elimination (Hahn et al., 2016b). This is especially important to consider in diverse populations/settings such as the criminal justice system, where there is a heightened prevalence of HCV. Future research should continue to examine the role of liver-damaging conditions such as HCV that may influence PEth elimination, alongside investigation of alcohol use factors (Wurst et al., 2010).

Limitations

Though this study draws upon a large sample of diverse women in the criminal justice system to examine the influence of alcohol use factors on PEth elimination, it is not without limitations. Limitations of this study involve the way in which alcohol consumption was assessed. Alcohol use was self-reported, which may introduce recall bias in quantity or timing of alcohol use prior to incarceration, although this sample drank heavily and daily in nearly all cases, mitigating this concern. Though the TLFB assessment has many strengths, we did not assess *ethanol* quantity, which may have been more precise than standard drinks. In addition, we did not have data on initial PEth level (at the start of the abstinence period) and therefore were unable to calculate half-life and incorporate this as a relevant factor in

our models. Future research should incorporate PEth starting level and half-life in models examining factors associated with PEth elimination. Finally, our all-female sample is a notable strength of this study, however, these findings may not apply to men and should be replicated with male samples.

Conclusions and Future Directions

Days since last alcoholic drink and drinks per day both influenced the degree to which PEth was detectable among women with alcohol use disorder who were abstinent during incarceration. Days since last alcoholic drink (but not drinks per day) significantly predicted PEth level. This study extends research on alcohol use factors that influence PEth elimination, and suggests that future research should consider the role of liver-damaging conditions as well as a wider range of alcohol consumption prior to abstinence. Results demonstrate the practicality of PEth as an alcohol biomarker in diverse settings and populations such as justice-involved women (Hahn et al., 2016a; Muyindike et al., 2017). Specifically, PEth may be a useful tool for assessing alcohol use upon incarceration, among people who are arrested for alcohol-related offenses (and who may be likely to underreport their alcohol use).

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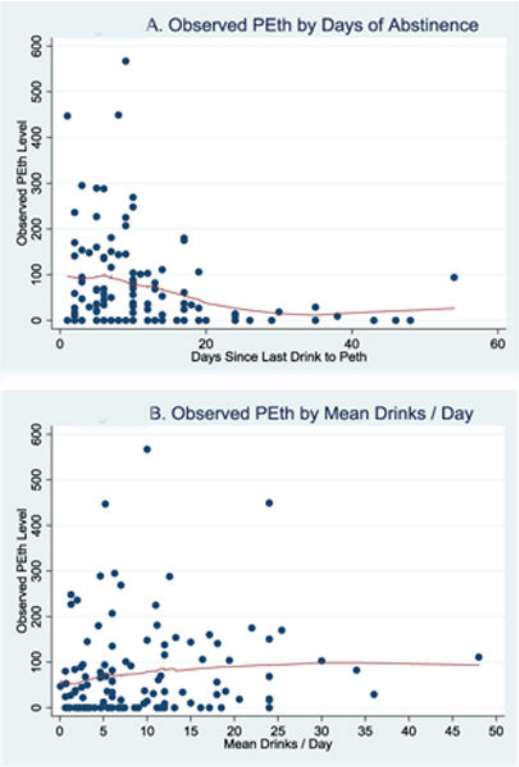

Figure 1.
A-B Scatterplots of PEth Level across Abstinence Days and Average Drinks Per Day.

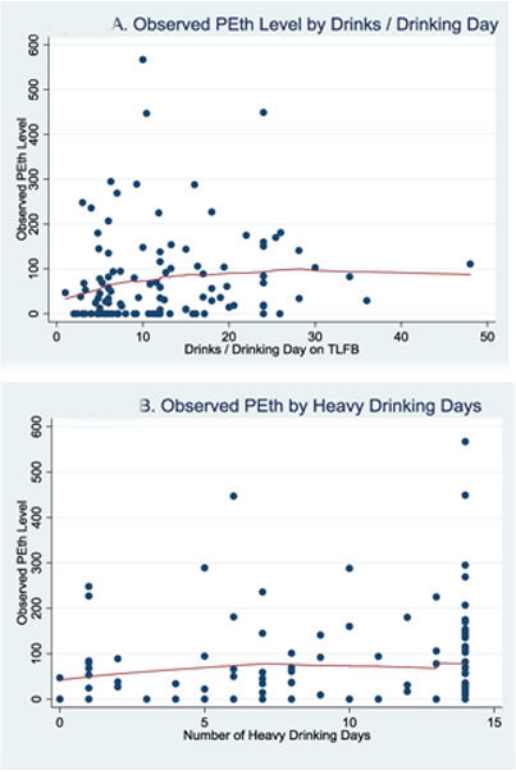

Figure 2.
A-B Scatterplots of PEth Level across Drinks Per Drinking Day and Heavy Drinking Days.

Table 1

Sample Descriptives (n=116).

	n (%)	Mean (± SD)	Median	Range
Age		36.6 (± 9.65)	36	18 - 61
Ethnicity (Hispanic)	9 (7.8%)			
Race/Ethnicity				
White	80 (69.6%)			
Black	14 (12.2%)			
Other	21 (18.3%)			
Education		11.9 (± 2.35)	12	7 - 21
HCV Present	21 (18.3%)			
Drink Days Before Incarceration (1-14)		10.2 (± 11.4)	6.5	1 - 14
Average Drinks / Day		9.92 (± 11.4)	6.0	0.1 – 91.3
PEth Undetectable (< 8mg/nl)	38 (32.8%)			
PEth Level (n = 116[a])		74.0 (± 101.9)	34.7	0 – 567
Days Since Last Drink at Time of PEth		11.8 (± 10.3)	10	1 –54

[a]Includes 30 participants with undetectable PEth levels. One person was missing on race/ethnicity.

Table 2

Percent with Detectable PEth Level and Mean (± SD) and Median PEth Level by Days of Alcohol Abstinence (n = 95).

	Days of Abstinence			
PEth	**1 - 7**	**8 - 14**	**15 -21**	**> 21**
n (%) Detectable	32 (82.1%)	24 (64.9%)	6 (60.0%)	3 (33.3%)
Mean (± SD)	102.7 (104.0)	90.3 (± 126.4)	57.3 (± 71.8)	4.67 (±7.40)
Median	68	56	26	0
Observed n	39	37	10	9

Table 3

Two-Part Model Predicting the Likelihood of a Detectable (> 8ng/ml) PEth Level and Log-Transformed Mean PEth Levels by Days Since Last Drink and Drinks / TLFB Day in the 14 Days Prior to Jail Admission.

	Logit Model (Odds of detectable PEth; *n*=95)		**Regression Model (Mean PEth if PEth detectable; *n*=65)**	
	OR	**95%CI[a]**	**exp(b)**	**95%CI[a]**
Days Abstinent	0.96*	(0.91;.0.99)	0.97*	(0.93; 0.99)
Avg. Drinks / TLFB Day	1.08*	(1.03; 1.16)	0.99	(0.98; 1.01)

[a]95% confidence interval estimated by bias-corrected and accelerated bootstrap resampling (5,000 replications). Coefficients are considered statistically significant if the estimated confidence interval excludes 1 for odds-ratios or the exponentiated linear regression coefficient