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ARTICLE

An Ancillary Effect of Patient Navigation Following Detox: Fewer Arrests

Robert Rosenman[1], Carolyn Noonan[1], Clemma Muller[1], Rich Maclehose[2], Jodi Trojan[3], Erin Poole[4] and Spero M. Manson[4]

[1]The Institute for Research and Education to Advance Community Health, Elson S. Floyd College of Medicine, Washington State University, Seattle, WA, USA
[2]Division of Epidemiology and Community Health, School of Public Health, University of Minnesota Twin Cities, Minneapolis, MN, USA
[3]Gateways to Recovery, Fairbanks, AK, USA
[4]Centers for American Indian and Alaskan Native Health, Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, USA
Corresponding author: Robert Rosenman; Email: yamaka@wsu.edu

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Abstract
Patient navigation (PN) is increasingly used to help people overcome barriers to accessing health care. In a recent trial, PN was added to motivational interviewing (MI) to help patients discharged from detoxification (detox) transition to follow-up care. The goal was to test whether PN in addition to MI increased transition rates and reduced subsequent readmissions into detox compared with MI alone. Results demonstrated little evidence of a treatment effect on either of these two outcomes, but post hoc exploratory analyses showed that patients who received PN were less likely to be arrested in the year following discharge than patients who did not receive PN. In addition, the group that received PN had fewer multiple arrests resulting in a lower average number of arrests per person. These findings are hypothesis-generating and need replication for conclusive inference. Nevertheless, economic analysis indicates that PN after detox could be a cost-beneficial intervention to reduce arrests among a population at high risk for involvement in the criminal justice system.

1. Introduction

Detoxification to manage acute alcohol or opioid withdrawal should be only the first step toward long-term recovery from addiction (Hayashida, 1998). Successful transition to subsequent treatment has been shown to delay or prevent readmission to detoxification, providing an effective means to slow the "revolving door" of repeated detoxification discharges and readmissions (McCarty *et al.*, 2000; Richman *et al.*, 1984; Annis *et al.*, 1978; Mark *et al.*, 2006; Callaghan *et al.*, 2003; Larson *et al.*, 2012). The failure to transition to further care is a key predictor of detoxification readmission (Li *et al.*, 2008).

Patient navigation (PN) is provided by specialized care managers or recovery support navigators, who provide one-on-one guidance for patients by trained navigators (Freeman *et al.*, 2011), and has been shown to be an effective intervention for promoting transition to further care for various health outcomes (Drake *et al.*, 2015; Paskett *et al.*, 2016; Petereit *et al.*, 2016; Shommu *et al.*, 2016). PN might be especially appropriate for individuals leaving alcohol detoxification by removing barriers, improving communication, coordinating care and providing critical support to patients who might otherwise be too overwhelmed to make a successful transition (Freeman *et al.*, 2011). Lee *et al.* (2020) provided a review of the relatively sparse literature on using patient navigation for patients leaving detox. They confirmed the general finding that patients who received PN were significantly more likely to transition to continuity of care after discharge from detox than those with treatment as usual.

In this paper, we review the results of a randomized trial of patient navigation among a group of patients discharged from detox in Fairbanks, Alaska. Unlike the general effectiveness of PN following detox that was found by Lee *et al.*, (2020) and in the studies they reviewed, preliminary analysis of our trial did not find PN to be effective for our primary outcomes (transition to post-detox care within 30 days, and likelihood of being readmitted to detox). However, when conducting post hoc analyses of secondary outcomes, we observed an ancillary effect of PN: individuals receiving PN and motivational interviewing (MI) were less likely to be arrested in the 6- and 12-month periods following discharge from detox when compared to a group that received only MI. In addition, the group that received PN had fewer multiple arrests. Overall, the average arrests per person were lower.

With regard to PN impact on arrests, our findings differ from those of Kelly *et al.*, (2020) (see also Schwartz *et al.*, 2016; Schwartz *et al.*, 2020) and from McLellan (2005), the only study we found using arrests as the primary outcome. In McLellan's randomized trial, the treatment included starting methadone treatment in jail for adults with opioid use disorder. A subset of the treatment group (the group starting methadone treatments in jail) also received PN. They found that the likelihood of arrest within 12 months of release from jail did not differ whether PN was included in the treatment or not, nor did time to rearrest. These disparate findings underscore the need for rigorous effectiveness trials to test the impact of PN delivered both in and outside of carceral settings for preventing future arrests after detoxification.

2. Study and sample

Our study was conducted in partnership with the Fairbanks Native Association (FNA) at its Gateway to Recovery (GTR) detoxification program. We began enrolling participants in June 2019 and enrolled the last participant in May 2022. After COVID restrictions took effect on March 16, 2020, staffing shortages and suspended admissions and treatments significantly slowed enrollments through 2020. A full closure of the detox facility in May 2022 due to staffing challenges meant we could no longer enroll new participants, though follow-up data collection continued. The study concluded with the last data collection follow-up in January 2023.

To be eligible, patients had to be 18 years old or older on admission to detoxification with an expected discharge from the GTR detoxification unit within the next 72 hours, not previously enrolled in the randomized controlled trial and without comorbid physical or mental health conditions that would delay transition to post-detox care. Prospective participants were evaluated to ensure they were willing and cognitively able to provide informed consent and complete all study procedures. Patients were approached for study enrollment only after they completed the detoxification process but before they were discharged. Although the original intent of the study was to enroll only individuals in detox for alcohol abuse, some individuals with drugs as the primary substance being abused were enrolled. People who agreed to participate provided written informed consent, including permission to extract data from their electronic medical records and to obtain data on their treatment from other FNA programs and recovery support services. After completing baseline data collection, individuals were randomized into either the control or treatment group. Randomization was 1:1 to the control or treatment group and performed in blocks of 6, 8 or 12 to mask the next assignment from the study team and ensure equal allocation to the study arms throughout the enrollment period. Participants were contacted for follow-up data collection 6 and 12 months after baseline. Participants received a $20 gift card for each follow-up data collection.

All individuals in the study, both treatment and control, were provided with MI. This decision was based on our community partner's insistence that all patients receive some potential benefit from inclusion in the study. MI is an evidence-based practice that helps patients understand, explore and resolve their ambivalence about behavior change through a construct of a continuum of stages: pre-contemplation, contemplation, preparation, action, maintenance and termination (Schilling *et al.*, 2002). Motivational strategies are tailored to each patient's stage of readiness. A small body of research suggests that MI may be effective for promoting transition to treatment for detoxification patients (Blondell *et al.*, 2011). MI for all participants was provided prior to randomization in the detox facility.

The treatment group additionally received PN immediately prior to discharge or shortly after and then at least once per week, either by phone or in-person, for 30-days or until the participant successfully enrolled in substance use treatment (SUT). PN is a patient-centered strategy that helps patients move through complex and often disconnected healthcare systems in a timely way (Freeman *et al.*, 2011). Patient navigators work one-on-one with clients to help them complete the appropriate care by encouraging commitment and adherence to medical treatment. They help clients access social services, facilitate communication between the patient and caregivers, and prompt re-engagement in care as needed. It has been shown to be an effective way to improve the care and outcomes of such health conditions as cancer, diabetes, hypertension and asthma (Thompson *et al.*, 2007; Martin *et al.*, 2009; Balcazar *et al.*, 2009).

In this study, PNs were community members who received ongoing specialized training in PN with the goal of reducing barriers and supporting the transition of participants to long-term SUT. PN sessions conducted in the detox facility were 45–60 minutes and took place in a private setting to ensure confidentiality and to make the participant as comfortable as possible. Since PN offer tailored support, the number and length of subsequent PN sessions varied and were dependent on the complexity of the participant's case, their motivation, and their desire to engage with the Navigator. There was no specific script for the PN sessions, but they included active guidance on the required steps for transition to long-term SUT, scheduling necessary medical appointments and discussion of barriers to the process, including treatment costs, transportation and family support. After the PN session, the Navigator often continued to work on the participant's behalf to address barriers discussed in the session and cultivate resources. This included contacting local, regional and even national SUT facilities about open beds, completing required paperwork for treatment, contacting family and identifying financial resources available to the participants. Every

Table 1. *Demographics*

Variable	Control (n = 100)	Treatment (n = 99)	Difference t-test (p-value)
Age	43.2	46.2	−1.71 (0.09)
Male	65.0%	70.3%	−0.85 (0.40)
Alaska Native or American Indian	67.0%	69.7%	−0.41 (0.68)
In detox for alcohol	90.3%	89.9%	0.02 (0.98)
Education			
Less than high school	13.0%	14.1%	−0.23 (0.82)
High school diploma or GED	57.0%	48.5%	1.20 (0.23)
Some college, vocational or Bachelor's degree	30.0%	37.4%	−1.10 (0.27)

effort was made to keep participants with the same PN for all PN sessions to facilitate rapport and consistency of support.

A total of 206 eligible individuals provided informed consent for this study, of whom $N = 2$ later withdrew from the study (all data was excluded for these individuals). Arrest data through 12 months following the baseline visit were available for $N = 199$ individuals (five individuals died during the study time frame and were excluded) who comprise the sample for this analysis. One hundred individuals were in the control group and 99 were in the treatment group. Table 1 compares age, sex, reason for being in detox, whether the individual is Alaska Native or American Indian (AN/AI) and education for the control and treatment groups. The treatment group was slightly older, and more often male and there were some slight differences in education. Participants in the treatment group were less likely to have a GED or high school degree and showed a greater tendency toward higher education.

Primary outcome data were collected via electronic medical records. After the randomized controlled trial was completed, the study team collected information on arrests and incarceration through a review of publicly available online resources for court dates, arrests and days in jail for study participants.[1] This analysis looks at how adding PN to MI changed the probability of arrest and the average number of arrests per participant.

3. Analytical Approach and Results

As noted above, the study found no difference in the primary outcomes (enrollment in post-detox treatment within 30 days of discharge, and readmission to detox within one year) between the control and treatment groups. To set the stage for our focus in this paper, arrests, we first briefly provide a statistical analysis of the primary outcomes with a 95% confidence interval of the difference in the percentage of each group who achieved each outcome. It is on this basis that we find no support that PN was effective in these outcomes. Next, we move

[1] Two sources for identifying arrests were used. VINE® (https://vinelink.vineapps.com/search/AK/Personhttps) is a victim notification network, funded by state and local agencies, where citizens can access information about offenders or criminal cases in US jails and prisons. We also accessed arrest and incarceration information through the Official Alaska Judiciary website of the Alaska court system (https://courts.alaska.gov/main/search-cases.htm).

into our main analysis, comparing the control and treatment groups on two outcomes: 1) the likelihood that an individual was arrested and 2) the average number of arrests per participant. Each outcome was evaluated at 6- and 12 months following discharge from the detoxification facility. To estimate the association between treatment and arrest, we fit logistic models with arrest as the dependent variable. Separate models were fit for 6 and 12 months of follow up. To estimate the association between treatment and number of arrests, separate Poisson and Negative Binomial regression models were fit for both 6 and 12 months of follow-up. Poisson models used robust standard errors. After model estimation, we estimated the marginal effects of PN on the probability of arrest and the average number of arrests. For the subsequent economic analysis, we measured the incremental cost of PN based on the resources used at GTR. This cost was contrasted with the cost savings that result from fewer arrests, where the cost of an arrest was culled from the literature dealing with the cost of the criminal justice system. We show PN can be construed as cost-beneficial based solely on the reduction of arrests. We also calculated the incremental cost-effectiveness ratio which indicated PN was highly cost-effective. All analysis was repeated for the subsample in detox with alcohol as the primary substance being abused.

3.1 Primary Outcomes

As noted earlier, the study found no support that PN affected the primary outcomes of the original study; successful transition to appropriate follow-up care within 30 days after discharge and reduction in detoxification readmissions within 1 year. In the end, we had 103 individuals in the control group and 101 in the treatment group. Twenty-four (23.3%) in the control group transitioned to appropriate treatment within 30 days, compared to 21 (20.8%) of people in the treatment group. The percentage difference was −2.5% with a 95% confidence interval of [−13.9%, 8.9%].

Nor was there evidence that PN had an impact on readmissions to detox within 12-months of discharge. Fifty-five (53.4%) individuals in the control group were readmitted to detox within 12-months compared to 51 (50.5%) from the treatment group. This difference, −2.9%, has a 95% confidence interval of [−16.6%, 10.8%].

3.2 Statistical Analysis of Arrests

Tables 2A and 2B show the distribution of arrests among individuals who participated in the trial, separated by control and treatment, at 6 months and 12 months. Most trial participants were not arrested in the 12 months following their discharge. After 6 months 173 had not been arrested and 26 had been arrested. During the next 6 months, 15 more were arrested. A higher percentage of those receiving PN avoided arrest in both periods. Perhaps more striking is the difference in multiple arrests. After 6 months, 12 individuals who were in the control group had 2 or more arrests, while only 1 individual from the treatment group was arrested more than once. After 12 months, 13 individuals from the control group had multiple arrests while 6 from the treatment group did and the control group had twice as many individuals with three or more arrests than in the treatment group.[2]

[2] Participants in post-detox care are subject to more controlled, restrictive environments, and hence may have less opportunity to be arrested than those not in post-detox care. However, PN did not result in any difference in time to

Table 2A. *Distribution of arrests within 6 months of discharge*

Number	Control	Treatment	Total
0	81	92	173
1	7	6	13
2	6	0	6
3	4	1	5
4	1	0	1
5	1	0	1
Total	100	99	199

Table 2B. *Distribution of arrests within 12 months of discharge*

Number of Arrests	Control	Treatment	Total
0	76	82	158
1	11	11	22
2	5	2	7
3	4	3	7
4	2	0	2
5	1	0	1
6	0	1	1
7	1	0	1
Total	100	99	199

Table 3A. *Mean arrests, all study participants (n = 199)*

	Control	Treatment	Treatment minus control	*T* or *Z*[1]	*p*-Value
Arrested within 6 months of discharge	0.19	0.07	−0.12	2.50	0.01
Arrested within 12 months of discharge	0.24	0.17	−0.07	1.19	0.24
Average number of arrests within 6 months of discharge	0.40	0.09	−0.31	2.98	<0.01
Average number of arrests within 12 months of discharge	0.53	0.30	−0.23	1.53	0.12

[1]*Z*-test used for proportions arrested, *T*-test used for average number of arrests.

or likelihood of entering post-detox care between the control and treatment groups. Hence, being in post-detox care does not explain the differences between the control and treatment groups for the likelihood and frequency of arrest.

Table 3B. *Mean arrests, in detox for alcohol (n = 179)*

	Control	Treatment	Diff	*T* or *Z*[1]	*p*-Value
Arrested within 6 months of discharge	0.18	0.08	−0.10	1.98	0.05
Arrested within 12 months of discharge	0.22	0.15	−0.08	1.31	0.19
Average number of arrests within 6 months of discharge	0.40	0.10	−0.30	2.65	<0.01
Average number of arrests within 12 months of discharge	0.53	0.19	−0.34	2.39	0.02

[1]*Z*-test used for proportions arrested, *T*-test used for average number of arrests.

Simple t-tests (different variances) were used to compare control and treatment arms with regard to: arrests within 6 months of discharge, arrests within 12 months of discharge, average number of arrests within 6 months of discharge, and average number of arrests within 12 months of discharge. Table 3A reports these numbers and t-tests for differences between the control and treatment groups for all participants in our trial while Table 3B reports these same numbers for the subsample of individuals in detox only for alcohol. We find at 6 months those in the control group were 12 percent more likely to be arrested at least once than those who received PN. This difference is statistically significant with a p-value of 0.01. At 12 months the difference attenuated to 7 percent and the difference is no longer statistically significant at the conventional 0.05 significance threshold. This same pattern holds for those in GTR for alcohol, with a difference of 10 per cent at 6 months and 8 per cent at 12 months. The former difference is statistically significant with a *p*-value of 0.05.

Because of more multiple arrests in the control arm, the average number of arrests per individual shows a greater difference. Using all trial participants, at 6 months the control group had 0.31 (*p*-value <0.01) more arrests on average than the treatment group. At 12 months the difference fell to 0.23 (*p*-value = 0.12). For trial participants in detox for alcohol, at 6 months the control had 0.30 (*p*-value <0.01) more arrests on average than the treatment group. At 12 months, the difference increased to 0.34 (*p*-value = 0.02). These differences provide the marginal effect on arrests of adding PN to MI for individuals leaving detox that does not adjust for additional variables.

Marginal effects that adjusted for additional variables were estimated using probit regression for whether an individual was arrested at least once at the 6 month and 12 month follow-up periods, and with Poisson and Negative Binomial regressions for the number of times an individual had been arrested at each of those anniversaries of discharge from GTR. Conditioning variables included age, sex, whether an individual is AI/AN and education level. To avoid small cell values that threw out some observations, post-secondary vocational and obtaining a 2-year degree were combined into a single category which was then used as the reference for education (i.e. it was the excluded category). Being in GTR for alcohol detox was controlled in two different ways: it was included as a dummy variable and all observations were used, and then the regressions (minus the alcohol dummy) were run on a subsample of only those in GTR for alcohol. Full regression results (reported in the Appendix to this paper) were then used to compute the average marginal effects of treatment.

Table 4. *Marginal effect of treatment on probability of arrest*

Arrested within 6 months of discharge[1] (n = 199)	Arrested within 6 months of discharge[2], Alcohol only (n = 179)	Arrested within 12 months of discharge[1] (n = 199)	Arrested within 12 months of discharge[2], Alcohol only (n = 179)
−0.12** (−0.20, −0.03)	−0.10** (−0.19, −0.00)	−0.07 (−0.18, 0.04)	−0.08 (−0.19, 0.03)

***(*p*-value < 0.01)
**(*p*-value < 0.05)
*(*p*-value < 0.10).
95% confidence intervals in parentheses.
[1]Conditioning variables include age, sex, Alaska Native/American Indian race, education, in detox due to alcohol only
[2]Conditioning variable include age, sex, Alaska Native/American Indian race, education.

At 6 months, PN decreased the probability of arrest by 12 per cent (95% CI: −0.20, −0.03) when all observations were used and 10 per cent (−0.19, −0.00) when only those in GTR for alcohol were used (Table 4). Both were significant at the conventional 0.05 significance threshold. At 12 months, the differences fell to 7 percent with all observations and 8 per cent when just those in GTR for alcohol were used. Neither estimate was statistically significant at the conventional 0.05 significance threshold. The marginal effects of PN on the average number of arrests per individual were mostly significant at the conventional 0.05 significance threshold and were mostly consistent between the Poisson and Negative Binomial regressions (Table 5). Results for the effect of the treatment arm on an average number of arrests suggest that PN reduced average arrests per individual by about 0.34 (95% CI: −0.64, −0.04) at 12 months after discharge which is the same as the unadjusted difference.[3]

4 Economic analysis

Fewer arrests bring obvious value to affected individuals and the community. Being arrested carries significant monetary and social costs. From a societal perspective, if arrests (even for less serious transgressions like public drunkenness, vagrancy or disorderly conduct) are closely correlated with actual criminal behavior, a reduction in arrests indicates that criminal behavior is also reduced. Within the context of our study, where both treatment and control groups were discharged into the same community, it is reasonable to surmise that a difference in the arrest rates and frequency indicates less criminal activity.

Nonetheless, the policy implications of finding that PN decreases the rate of arrest and frequency of arrests per discharge depend crucially on an economic analysis. Without an impact of outcomes, no treatment has policy relevance. But policy relevance is equally dependent on the treatment being shown to be cost-effective as policymakers who face

[3] As noted in footnote 2, successful transition to treatment usually entailed approximately 30 days in a controlled facility, thereby limiting exposure to opportunities to engage in criminal behavior and subsequent arrest. Hence for robustness in the regression analysis we tested if successful transition within 30 days of discharge, 60 months of discharge and 12 months of discharge had any impact on arrests. There was no evidence to support these impacts.

Table 5. *Marginal effect of treatment on average number of arrests*

Poisson regression			
Average number of arrests within 6 months of discharge	Average number of arrests within 6 months of discharge Alcohol only	Average number of arrests within 12 months of discharge	Average number of arrests within 12 months of discharge Alcohol only
−0.31*** (−0.51, −0.11)	−0.31*** (−0.54, −0.08)	−0.24* (−0.52, 0.03)	−0.36** (−0.65, −0.07)
Negative binomial regression			
Average number of arrests within 6 months of discharge	Average number of arrests within 6 months of discharge Alcohol only	Average number of arrests within 12 months of discharge	Average number of arrests within 12 months of discharge Alcohol only
−0.30*** (−0.49, −0.11)	−0.28*** (−0.49, −0.07)	−0.34** (−0.64, −0.04)	−0.34*** (−0.61, −0.06)

***(*p*-value < 0.01
**(*p*-value < 0.05)
*(*p*-value < 0.10).
95% confidence intervals in parentheses.

limited budgets must choose among alternative uses of available resources. In this section, we first consider the cost of PN in our trial. We then use this metric in cost-effectiveness and cost–benefit analyses.

4.1 The cost of PN

The consensus of the patient navigators and the administration at GTR is that the cost of patient PN and, by extension of MI since the patient navigators also performed MI, was the cost of the personnel only. Existing facilities were sufficient to offer MI and PN to all individuals seen at GTR without crowding or congestion of interview rooms, and additional supervision and administrative costs were essentially non-existent. The average hourly cost for patient navigators, including benefits, was $36.87.

The time spent on MI and PN was measured directly during the trial. All navigator's time spent directly on these activities, including time meeting with people exiting detox, follow-up contacts and activities, and time spent on unsuccessful contacts were recorded for every effort made by a patient navigator. Times were recorded for both MI and PN events. Time spent on PN was measured in three ways:

1. Using only activities clearly identified as PN, the average spent on each individual was calculated. This average was 72 minutes.
2. The other two approaches used time spent on both the control and treatment groups.

Table 6. *Threshold values for the cost of an arrest for PN to be cost-beneficial over 12 Months: various scenarios*

Reduction in arrests→	All participants		Alcohol only	
Cost of PN per person↓	0.24	0.34	0.36	0.34
$41.79	$174	$123	$116	$123
$44.86	$187	$132	$125	$132

a. First, we compared the average time per individual devoted by patient navigators for each group. For those in the control group total time spent averaged 52 minutes. Since the control group received only MI, this is an estimate of MI time requirement. For the treatment group, the total time spent was 120 minutes. Assuming the time spent on MI activities was identical for individuals (which was verified by the next method) in both the control and treatment groups, this would mean PN activities took 68 minutes on average.
b. Next, we compared sessions clearly identified as MI, including individuals in both the control and treatment groups. With this measure, the average time spent on MI was 47 minutes. The control group averaged 44 minutes, and the treatment group 50 minutes. Using the MI time requirement of 47 minutes, PN took 73 minutes.

Our range of time requirements for PN is thus 68 to 73 minutes. Using the average hourly cost of PNs, the average cost of PN is between $41.79 and $44.86 per individual. The midpoint between these two is $43.33. This compares favorably to the $50 cost per PN session found by Zarkin *et al.*, (2020), especially as their estimate included the costs of facility space and administration.

4.2 Cost–Benefit analysis

PN saves money if the cost savings from fewer arrests exceeds the cost of providing PN. This can be expressed as $R \times C > D$ where R is the average reduction in arrests during that period, C is the cost of an arrest and D is the average cost of PN. For example, using the unadjusted average reduction in arrests per individual at 12 months (in detox for alcohol) of 0.34 and the midpoint of our estimate of the cost of doing a PN, $43.33, PN is cost-beneficial if $C > \$127.44$. Table 6 provides the threshold values for the cost of an arrest for various reductions in arrests following PN based on the marginal effects estimated in the *t*-tests and regressions, and the range of the cost of doing PN estimated above. These threshold values range from a low of $123 for the largest reduction and the lowest cost of doing a PN to $187 when the smallest marginal effect and largest cost of doing a PN are used.

4.3 Cost-Effectiveness analysis

Table 7 presents incremental cost-effectiveness ratios (ICERs) for the predicted number of arrests following discharge and the predicted total number of arrests following discharge.

Table 7. *Incremental cost effectiveness ratio over 12 months*

Arm	Per person intervention cost	Probability an individual is arrested at least once	Average number of arrests	ICER of proportion arrested	ICER of number of arrests
No PN	0	0.24	0.53	—	—
PN	$43.33	0.17	0.30	$619	$188

Both are based on the mean (unconditional) differences between groups that were tested in Tables 3A and 3B.[4] For the cost of treatment we use $43.33, the average of the two ways the cost of PN was calculated. We computed ICERs only for the 12-month time horizon.

Individuals in the control group had a 0.24 unconditional probability of being arrested within 12 months of discharge. The probability for individuals in the treatment group was 0.17, a net difference of 0.07. Hence, the ICER for an individual being arrested at least once in the 12 months following discharge is $619. The average number of arrests in the 12 months following detox for people in the control group was 0.53, and 0.30 for those in the treatment group, resulting in an ICER of $188.

To place these numbers in context, suppose 100 individuals leaving GTR receive PN. The cost of that additional treatment for the group is $4333. Because they received PN, we would expect only 17 would be arrested at least once over the subsequent 12 months, compared to the expected 24 that would have had at least one arrest over that period. Dividing $4333 by 7 results in a cost per arrest avoided of $619. Similarly, the expected reduction in the *total* number of arrests in this group falls from 53 to 30, a reduction of 23, and a cost per arrest avoided of $188. We note that the threshold values reported in Table 6 are also the ICERs for avoiding arrests using the specific pay rate and marginal effect. The ICER using the probit regression for being arrested at least once in the 12 months following detox discharge is $542.

5. Discussion

Our results indicate that PN for individuals leaving detox reduces the probability of arrest and the mean number of arrests, at least in the short term. The ICER from these reductions indicates that the cost of avoiding an arrest for a 12-month period was $619. The cost of reducing the average number of arrests by one arrest is even lower, only $188. To know if these values provide a cost-effective program for reducing arrests among people coming out of detox, these costs would have to be compared to other anti-crime (i.e. anti-arrest) programs that could be applied more generally and to larger populations.

Conversely, the cost–benefit analysis offers direct support for implementing PN after detox. The economic analysis identified a range of values for the cost of an arrest over which PN would show a social net benefit. In the following discussion, we focus on the *direct* cost of an arrest. Direct costs include the pay for police officers and others involved in the arrest,

[4] The implied marginal impact of PN using the difference in mean values is smaller than the marginal effects found from the regression analysis. Using the mean differences thus presents the most conservative estimates of ICER.

transportation of the arrested person to a detention center or jail, processing and booking fees, costs related to court hearings and other expenses.[5] While the personal costs of an arrest in dollars, time, life disruption and other aspects might be large (even for such minor crimes like vagrancy, public intoxication or trespassing), we do not consider them here, thus giving a very conservative cost–benefit analysis based only on the social resources that are used when an individual is arrested.

There is surprisingly little public information available about the direct costs of an arrest, and what is available varies greatly. The National Juvenile Justice Center (Chaidez, 2012) estimates that the cost of police officers' time for processing a juvenile arrest in Los Angeles County is $396. Rand Corporation estimates that the law enforcement costs per property crime in Alaska is $939 and the court and legal services costs are $810. In a randomized control trial of starting methadone in jail for individuals with opioid use disorder, Zarkin *et al*. (2020), Table 3, reported the cost of an arrest in Baltimore is $198. Hirschel and Dean (1995) calculated the direct personnel cost of arrest (including police, magistrates and pretrial release) in 1987 in Charlotte, NC was $121 (Table 3), which is $321.50 in 2023 dollars.[6] Using data from 2017, Miller *et al*. (2021) found the public services (including police) and adjudication and sanctioning costs of crimes like drunkenness, disorderly conduct and vagrancy were $1307 per crime. Finally, Aos *et al*. (2001), estimated the police costs per arrest for a drug offense to be $1890 and $764 for a misdemeanor, while court and prosecutor costs were $1675 and $336 (in 2001 dollars), respectively. All these estimates for the cost of an arrest, even while most exclude costs associated with punishment such as jail or probation, surpass the threshold values shown in Table 6, indicating, based on social resources alone, that adding PN to MI for this population has a large net economic benefit. If the avoided costs of crime and personal costs to the arrestee were included, this conclusion would be even stronger.

There is, however, an additional issue when considering whether it is worthwhile to use PN after detox as an arrest-reducing policy; the distribution of costs and benefits. The cost of providing PN at discharge from detox, as implemented in our trial, falls on the detox facility. As noted above, reducing arrests is not part of its charge. The benefits from lower arrests accrue elsewhere, to local police and judicial system in direct cost savings, and, as noted but not counted in our analysis, for the individuals exiting detox. Even if the detox facility is taxpayer-supported, significant political issues would have to be overcome before the benefits and costs accrue to the same institution. But this is a political question, not one of treatment effectiveness or economic viability.

We still must address a key question: Why did PN reduce arrests while not showing an effect on the primary outcomes of time to enter treatment and additional times in detox within 12 months of discharge? One explanation could be that in fact, PN is not effective for reducing arrests, and that the between-group difference and statistically significant p-value we observed reflect Type I error. This concern is especially relevant for *post hoc* analyses of outcomes that were not the *a priori* target for improvement. However, the potential value to public health and safety if PN is effective in preventing arrests warrants speculation on explanatory mechanisms to guide future research that can conclusively address this question. As noted at the beginning of this paper, PN may be especially appropriate for alcohol

[5] The cost of the crime that underlies an arrest is thought to greatly exceeds the direct cost.

[6] Not included in this estimate are the costs associated with defense and jail time.

detoxification by removing barriers, improving communication, coordinating care and providing critical support to patients who might otherwise be too overwhelmed to make a successful transition. We believe it achieves these goals, enabling the individual post-discharge to better connect to community and support systems, which is one possible explanation for the reduction in arrests.

Why then, we ask again, does not this improved connection to community also translate to a better show in our primary outcomes? The answer may be from two sources. First, individuals may face delays because of the cost of treatment. Even those with insurance might require preapproval and other barriers that delay or prevent treatment. Individuals who needed to rely on public sources of funding could face even greater delays and obstacles.

Second, there is a severe shortage of drug and alcohol treatment slots. Nationally, only 10 per cent of people with addictions receive treatment (Vestal, 2015). The Substance Abuse and Mental Health Services Administration of the US Department of Health and Human Services reports that in 2016 over 15.5 million people over the age of 12 needed alcohol treatment in the United States but only 1.2 million received it. For AI/AN, 152,000 people needed treatment but only 19,000 received it (SAMHSA, 2016). In Anchorage, a 2019 community assessment on substance abuse indicated there is a lack of treatment options for substance abuse, noting, "It's the exception rather than the rule that someone knows where to go, takes the step, *and there is treatment available without delay.*" (Anchorage, 2019 and Pacho, 2018, emphasis added).

While PN may have helped individuals know where to go and what steps to take, the shortage of available treatment may prevent an individual from receiving it. Hence, PN may not help people get into treatment within 30 days of being discharged from detox, nor help by lowering recidivism, even if an individual seeks treatment. In short, the lack of difference in our primary outcomes between the control and treatment groups may be from a supply shortage for post-detox care. As noted in Section 3.1, over 20% of individuals in our study (20.8% from the treatment group, and 23.3% from the control group) transitioned to treatment after detox. Although these numbers are high relative to individuals getting treatment nationally, they are not directly comparable. Individuals in our study are coming out of detox; the national numbers are for all addicts and/or alcoholics. Plausibly, the improved connectiveness and support that comes from PN is reflected by the reduction in the number of arrests, while shortages of post-detox drug treatment prevented PN from improving the study's primary outcomes.

There is another, more general lesson from this study. Interventions like PN can have unintended and perhaps unpredictable side effects. When analyzing the cost-effectiveness and cost-benefits of interventions, analysts should evaluate both intended and unintended consequences.

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Appendix

Appendix Table 1: Probit regression of arrested within 6 months of discharge, all participants

Probit regression	Number of obs = 199
	Wald chi^2(6) = 12.58
	Prob > chi^2 = 0.0831
Log pseudolikelihood = −69.467148	Pseudo R^2 = 0.0994

	Coefficient	Robust std. err.	Z	$P > \|z\|$	[95% conf. interval]	
MI + Navigation	−0.6189045	0.2400655	−2.58	0.010	−1.089424	−0.1483847
Age	−0.0021892	0.0102564	−0.21	0.831	−0.0222913	0.017913
Male	0.6106719	0.2710143	2.25	0.024	0.0794937	1.14185
Alaska Native/ American Indian	0.5143075	0.2784964	1.85	0.065	−0.0315354	1.06015
HS/GED	−0.0461731	0.3374229	−0.14	0.891	−0.7075097	0.6151636
Any post-HS schooling	−0.3064802	0.3968907	−0.77	0.440	−1.084372	0.4714112
Alcohol						
In detox for alcohol	−0.2406993	0.394796	−0.61	0.542	−1.014485	−5330867
_cons	−1.25803	0.638518	−1.97	0.049	−2.509502	−0.0065573

Appendix Table 2: Probit regression of arrested within 12 months of discharge, all participants

Probit regression	Number of obs = 199
	Wald chi^2(7) = 14.68
	Prob > chi^2 = 0.0403
Log pseudolikelihood = −93.608571	Pseudo R^2 = 0.0752

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
MI + Navigation	−0.3047025	0.2076341	−1.47	0.142	−0.7116578	0.1022528
Age	−0.0037078	0.0085826	−0.43	0.666	−0.0205293	0.0131137
Male	0.5803621	0.2322023	2.50	0.012	0.125254	1.03547
Alaska Native/ American Indian	0.5224702	0.2458298	2.13	0.034	0.0406526	1.004288
HS/GED	−0.2552601	0.3168322	−0.81	0.420	−0.8762398	0.3657195
Any post-HS schooling	−0.1206368	0.3453183	−0.35	0.727	−0.7974483	0.5561746
Alcohol						
In detox for alcohol	−0.8788279	0.3496204	−2.51	0.012	−1.564071	−0.1935845
_cons	−0.3512298	0.532744	−0.66	0.510	−1.395389	0.6929293

Appendix Table 3: Probit regression of arrested within 6 months of discharge, alcohol only

Probit regression	Number of obs = 179
	Wald chi^2(6) = 10.45
	Prob > chi^2 = 0.1071
Log pseudolikelihood = −61.708012	Pseudo R^2 = 0.1011

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
MI + Navigation	−0.507132	0.2585691	−1.96	0.050	−1.013918	−0.0003458
Age	−0.0057135	0.0106883	−0.53	0.593	−0.0266622	0.0152352
Male	0.5208623	0.2736302	1.90	0.057	−0.0154431	1.057168
Alaska Native/ American Indian	0.7880678	0.3795168	2.08	0.08	0.0442285	1.531907
HS/GED	−0.2341778	0.3518992	−0.67	0.506	−0.9238876	0.455532
Any post-HS schooling	−0.3654646	0.4010101	−0.91	0.362	−1.15143	0.4205007
_cons	−1.420831	0.7440387	−1.91	0.056	−2.87912	0.0374578

Appendix Table 4: Probit regression of arrested within 12 months of discharge, alcohol only

Probit regression	Number of obs = 179
	Wald $chi^2(6) = 11.42$
	Prob > $chi^2 = 0.0761$
Log pseudolikelihood = −81.001532	Pseudo $R^2 = 0.0532$

	Coefficient	Robust std. err.	z	P > |z|	[95% conf. interval]	
MI + navigation	−0.3352862	0.2250953	−1.49	0.136	−0.7764649	0.1058925
age	−0.003387	0.0093759	−0.36	0.718	−0.0217634	0.0149895
Male	0.5150675	0.243447	2.12	0.034	0.0379201	0.0022149
Alaska Native/ American Indian	0.4786341	0.2700328	1.77	0.076	−0.0506205	1.007889
HS/GED	−0.4533685	0.3308069	−1.37	0.171	−1101738	0.195001
Any post-HS schooling	−0.2815525	0.3575494	−0.79	0.431	−0.9823365	0.4192316
_cons	−0.9927661	0.6184308	−1.61	0.108	−2.204868	0.219336

Appendix Table 5: Poisson regression of average number of arrests within 6 months of discharge

Poisson regression	Number of obs = 199
	Wald $chi^2(7) = 22.74$
	Prob > $chi^2 = 0.0019$
Log pseudolikelihood = −117.75495	Pseudo $R^2 = 0.1514$

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−1.487919	0.4951147	−3.01	0.003	−2.458326	−0.5175123
Age	−0.0052518	0.0188328	−0.28	0.780	−0.0421634	0.0316598
Male	0.9396641	0.4796303	1.96	0.050	−0.000394	1.879722
Alaska Native/ American Indian	0.5369678	0.6098706	0.88	0.379	−0.6583566	1.732292
HS/GED	−0.5058155	0.5944544	−0.85	0.395	−1.670925	0.6592937
Any post-HS schooling	−0.1.542074	0.7474652	−2.06	0.039	−3.007079	−0.0770691
Alcohol						
In detox for alcohol	0.2787469	0.6740911	0.41	0.679	−1.042447	1.599941
_cons	−1.392884	1.099164	−1.27	0.205	−3.547207	0.7614389

Appendix Table 6: Poisson regression of average number of arrests within 12 months of discharge

Poisson regression	Number of obs = 199
	Wald chi^2(7) = 21.70
	Prob > chi^2 = 0.0029
Log pseudolikelihood = −182.77255	Pseudo R^2 = 0.0826

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−0.5967659	0.3328207	−1.79	0.073	−1.249082	0.0555506
Age	−0.0032264	0.013645	−0.24	0.813	−0.0299701	0.0235173
Male	0.8214801	0.4050545	2.03	0.043	0.0275878	1.615372
Alaska Native/ American Indian	0.6953457	0.5387652	1.22	0.221	−0.4194136	1.810105
HS/GED	−0.090879	0.531399	−0.17	0.864	−1.132402	0.9506438
Any post-HS schooling	−0.3271035	0.5807824	−0.56	0.573	−1.465416	0.811209
Alcohol						
In detox for alcohol	−1.143849	0.5891365	−1.94	0.052	−2.298535	0.0108376
_cons	−0.4687872	0.7533712	−0.62	0.534	−1.945368	1.007793

Appendix Table 7: Negative binomial regression of average number of arrests within 6 months of discharge

Negative binomial regression	Number of obs = 199
	Wald chi^2(7) = 21.79
Dispersion: mean	Prob > chi^2 = 0.0028
Log pseudolikelihood = −102.93852	Pseudo R^2 = 0.0792

	Coefficient	Robust std. err.	Z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−1.427516	0.4504028	−3.17	0.002	−2.310289	−0.5447427
age	−0.0060819	0.0175489	−0.35	0.729	−0.0404772	0.0283133
Male	1.117781	0.4907839	2.28	0.023	0.1558625	2.0797
Alaska Native/ American Indian	0.7646367	0.5791678	1.32	0.187	−0.3705113	1.899785
HS/GED	−0.4026239	0.5334256	−0.75	0.450	−1.448119	0.6428711
Any post-HS schooling	−1.250884	0.710991	−1.76	0.079	−2.644401	0.1426326
Alcohol						
In detox for alcohol	.1280222	0.6823789	0.19	0.851	−1.209416	1.46546
_cons	−1.671562	0.9503688	−1.76	0.079	−3.534251	0.1911262
lnalpha	1.315094	0.3566285			0.6161152	2.0114073
Alpha	3.725102	1.328477			1.85172	7.493779

Appendix Table 8: Negative binomial regression of average number of arrests within 12 months of discharge

lnalpha |	1.248829	.2924209	.6756948	1.821964
alpha |	3.486259	1.019455	1.965398	6.183991
LR test of alpha = 0: chibar^2(01) = 63.07			Prob > = chibar^2 = 0.000	

Negative binomial regression	Number of obs = 199
	Wald chi^2(7) = 18.91
Dispersion: mean	Prob > chi^2 = 0.0085
Log pseudolikelihood = −152.29085	Pseudo R^2 = 0.0409

 https://doi.org/10.1017/bca.2024.24

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−0.8242071	0.3316622	−2.49	0.013	−1.474253	−0.1741611
Age	−0.0054423	0.0156652	−0.35	0.728	−0.0361455	0.0252609
Male	0.8668087	0.4152142	2.09	0.037	0.0530038	1.680614
Alaska Native/ American Indian	0.6844965	0.4885141	1.40	0.161	−0.2729734	1.641966
HS/GED	−0.3612298	0.4846227	−0.75	0.456	−1.311073	0.5886133
Any post-HS schooling	−0.410715	0.5552839	−0.74	0.460	−1.499051	0.6776216
Alcohol						
In detox for alcohol	−1.217662	0.477784	−2.55	0.011	−2.154102	−.2812229
_cons	−0.0668698	0.74179	−0.09	0.928	−1.520751	1.38
lnalpha	1.231251	.298378			0.6464412	1.816062
Alpha	3.425513	1.022098			1.908736	6.147599

Appendix Table 9: Poisson regression of average number of arrests within 6 months of discharge, alcohol only.

Poisson regression	Number of obs = 179
	Wald $chi^2(6)$ = 17.92
	Prob > chi^2 = 0.0064
Log pseudolikelihood = −107.91392	Pseudo R^2 = 0.1538

	Coefficient	Robust std. err.	Z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−1.410846	0.5207326	−2.71	0.007	−2.431463	−0.3902291
Age	−0.0067367	0.0206709	−0.33	0.744	−0.0472509	0.0337774
Male	0.8667025	0.4843162	1.79	0.074	−0.0825399	1.815945
Alaska Native/ American Indian	0.9121731	0.9076047	1.01	0.315	−0.8666994	2.691046
HS/GED	−0.7380569	0.6155907	−1.20	0.231	−1.944593	0.4684787
Any post-HS schooling						
_cons	−1.176432	1.262299	−0.93	0.351	−3.650492	1.297628

Appendix Table 10: Poisson regression of average number of arrests within 12 months of discharge, alcohol only

Poisson regression	Number of obs = 179
	Wald chi^2(6) = 13.03
	Prob > chi^2 = 0.0425
Log pseudolikelihood = −150.35373	Pseudo R^2 = 0.0811

	Coefficient	Robust std. err.	Z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−1.070827	0.3955163	−2.71	0.007	−1.846024	−0.2956289
Age	−0.0012675	0.0181425	−0.07	0.944	−0.0368262	0.0342912
Male	0.7358258	0.4339886	1.70	0.090	−0.1147761	1.586428
Alaska Native/ American Indian	0.2056545	0.6133419	0.34	0.737	−0.9964735	1.407783
HS/GED	−0.5444025	0.5660889	−0.96	0.336	−1.653916	0.5651113
Any post-HS schooling	−0.914625	0.5586813	−1.64	0.102	−2.009638	0.1803527
_cons	−0.68	1.012676	−0.67	0.502	−2.664809	1.304809

Appendix Table 11: Negative binomial regression of average number of arrests within 6 months of discharge, alcohol only

Negative binomial regression	Number of obs = 179
	Wald chi^2(6) = 16.90
Dispersion: mean	Prob > chi^2 = 0.0097
Log pseudolikelihood = −93.209036	Pseudo R^2 = 0.0740

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−1.278736	0.4754114	−2.69	0.007	−2.210525	−0.346947
Age	−0.0046274	0.0195136	−0.24	0.813	−0.0428734	0.0336187

Continued

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
Male	0.9898553	0.5120003	1.93	0.053	−0.0136468	1.993357
Alaska Native/ American Indian	1.030286	0.7263156	1.42	0.156	−0.3932665	2.453838
HS/GED	−0.5356009	0.5490527	−0.98	0.329	−1.611724	0.5405226
Any post-HS schooling	−1.26819	0.701738	−1.81	0.071	−2.643571	0.1071911
_cons	−1.69635	1.073997	−1.57	0.114	−3.801346	0.4086451
lnalpha	1.421626	0.380127			0.6765911	2.166662
alpha	4.143854	1.575191			1.96716	8.729094

Appendix Table 12: Negative binomial regression of average number of arrests within 12 months of discharge, alcohol only

Alpha |	3.791456	1.260235	1.976408	7.273365
LR test of alpha = 0: chibar^2(01) = 48.50			Prob > = chibar^2 = 0.000 alpha	

Negative binomial regression	Number of obs = 179
	Wald chi^2(6) = 13.64
Dispersion: mean	Prob > chi^2 = 0.0339
Log pseudolikelihood = −125.9368	Pseudo R^2 = 0.0360

	Coefficient	Robust std. err.	z	$P > \|z\|$	[95% conf. interval]	
MI + navigation	−0.9959298	0.3771114	−2.65	0.008	−1.735055	−0.256805
age	−0.0028748	0.0173023	−0.17	0.868	−0.0367867	0.0310372
Male	0.785425	0.4737835	1.66	0.097	−0.1431735	1.714024
Alaska Native/ American Indian	0.3405856	0.5220655	0.65	0.514	−0.682644	1.363815
HS/GED	−0.604735	0.5008294	−1.21	0.227	−1.5343	0.3768725
Any post-HS schooling	−0.7017374	0.6088862	−1.15	0.249	−1.895132	0.4916575
_cons	−0.8039673	0.8967487	−0.90	0.249	−2.561562	0.9536277
lnalpha	1.349037	0.3041642			0.7528866	1.945188
Alpha	3.853714	1.172162			2.12312	6.994949

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