

# BMJ Open Propensity-matched study of enhanced primary care on contact with the criminal justice system among individuals recently released from prison to New Haven

Emily A Wang,<sup>1</sup> Hsiu-ju Lin,<sup>2,3</sup> Jenerius A Aminawung,<sup>1</sup> Susan H Busch,<sup>4</sup> Colleen Gallagher,<sup>5</sup> Kathleen Maurer,<sup>5</sup> Lisa Puglisi,<sup>1</sup> Shira Shavit,<sup>6</sup> Linda Frisman<sup>2,3</sup>

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For numbered affiliations see end of article.

**Correspondence to**  
Professor Emily A Wang;  
[emily.wang@yale.edu](mailto:emily.wang@yale.edu)

## ABSTRACT

**Background** Health systems can be integral to addressing population health, including persons with incarceration exposure. Few studies have comprehensively integrated state-wide data to assess how the primary care system can impact criminal justice outcomes. We examined whether enhanced primary care can decrease future contact with the criminal justice system among individuals just released from prison.

**Methods** We linked administrative data (2013–2016) of Connecticut Department of Correction, Department of Mental Health and Addiction Services, Department of Social Service, Court Support Services Division, and Department of Public Health to conduct a quasi-experimental study using propensity score matching of 94 participants who received enhanced primary care in Transitions Clinic to 94 controls not exposed to the programme. The propensity score included 23 variables, which encompassed participants' medical and incarceration history and service utilisation. The main outcomes were reincarceration rates and days incarcerated in the first year from the index date, which was either enrolment in the Transitions Clinic programme or release from prison in the control group.

**Results** The odds of reincarceration, including arrests and new convictions, were similar for the two groups, but Transitions Clinic participants had lower odds of returning to prison for a parole or probation technical violation (adjusted OR: 0.38; 95% CI 0.16 to 0.93) compared with the control group. Further, Transitions Clinic participants had fewer incarceration days (incidence rate ratio: 0.55; 95% CI 0.35 to 0.84) compared with the control group.

**Conclusions** Enhanced primary care for individuals just released from prison can reduce reincarceration for technical violations and shorten time spent within correctional facilities. This study shows how community health systems may play a role in current strategies to reduce prison populations.

## INTRODUCTION

Over 20 million individuals living in the USA have a history of imprisonment.<sup>1</sup> Incarcerated

## Strengths and limitations of this study

- This is one of the first studies evaluating the efficacy of a primary care-based intervention on future criminal justice system contact, including arrest, reincarceration and length of time incarcerated.
- The study uses comprehensive correctional system administrative data, inclusive of jails and prisons, and data on probation and parole.
- The study merges administrative data from an integrated correctional system, community corrections, state-sponsored insurance for individuals of low socioeconomic status, state-sponsored mental health and substance use treatment, and death indices to provide for robust construction of propensity score and measurement of primary outcomes.
- Causal associations are limited by use of propensity score methodology as opposed to experimental randomisation of treatment.
- Choice of variables used in the construction of the propensity scores does not include individual characteristics like housing status and social support, or individual symptomatology like depression, nor the characteristics of communities to which people return.

persons have worse health compared with the general population, with higher rates of chronic diseases and a high risk of hospitalisation and death immediately following release.<sup>2</sup> Reasons for these health disparities likely include the extreme conditions of incarceration, trauma, social isolation, poverty, as well as the systematic barriers to obtaining employment, housing, food and healthcare following release.<sup>3–6</sup> An astounding 66% of those released from prison will be reincarcerated within 5 years.<sup>7</sup> Cycling in and out of prison is among the least healthy exposures in this population and traditionally has not been addressed in the primary care setting.<sup>8,9</sup>

While repeated contact with the criminal justice system is in large part driven by police, prosecutorial and judicial practices, individuals' health may contribute to our country's high rates of repeated imprisonment. Untreated substance use and mental illness are associated with repeated incarceration, or recidivism,<sup>10–12</sup> with the correlated argument that the lack of primary care and behavioural healthcare may also contribute to our nation's unparalleled recidivism rate. Before the passage of the Affordable Care Act, most individuals with a history of incarceration were either uninsured at release or did not have the financial resources to pay for healthcare.<sup>13</sup> The Medicaid expansion in 2014, which provided insurance and thus access to primary care and substance use and mental health treatment to justice-involved populations, was touted as an opportunity to potentially reduce recidivism and the costs of incarceration.<sup>14–16</sup> Two recent articles have empirically demonstrated how Medicaid expansion is associated with decreased crime at the county level.<sup>17 18</sup> But past randomised or quasi-experimental studies of linkage to primary care or primary care-based interventions have not found any effect on reducing future jail time of participants enrolled.<sup>19–23</sup>

To date, efforts to systematically address incarceration as a social determinant of health within the community health system are limited, although emerging in the USA and Australia.<sup>24</sup> The Transitions Clinic Network (TCN) is the largest consortium of primary care clinics in the USA that aims to increase access to primary care services and improve health and well-being among high-risk, chronically ill people recently released from incarceration.<sup>25</sup> We used data from a single programme of the TCN to examine whether enhanced primary care can decrease future contact with the criminal justice system among individuals with chronic medical conditions just released from prison.

## METHODS

### Setting

The TCN is a national consortium of 29 primary care centres that serves the health needs of individuals returning from incarceration.<sup>25</sup> The TCN programme is intended to provide primary care to anyone released from a correctional facility with a chronic health condition or is older than 50 years of age. Health conditions include physical health (hepatitis C, hypertension, diabetes), mental health (depression, post-traumatic stress disorder, schizophrenia) or substance use disorders (opioid use disorder). Interdisciplinary teams are the crux of the TCN model, where community health workers with personal histories of incarceration are embedded within primary care teams to identify and support patients returning home from incarceration who are at risk for poor health outcomes. Community health workers interact with patients in and out of the clinic to address re-entry-related social determinants of health, such as housing, food access or employment, and link patients with community agencies. They

use their personal experience of incarceration to educate the healthcare team about patients' challenges, facilitate patient–provider communication, and help patients navigate and build trust in the medical system. TCN programmes also address patients' behavioural health needs at each visit and make appropriate referrals to substance abuse and mental health treatment, as well as advocate on patients' behalf in interactions with the criminal justice system, especially courts, probation and parole when appropriate. For this study, we excluded individuals who already had a primary care provider (ie, already had established care in the community) or were moving out of the state. Individuals were referred to the TCN programme by the correctional system prior to discharge, from community service providers or identified through outreach of the community health workers. We assessed the impact of the TCN programme on criminal justice outcomes among patients released from the Connecticut Department of Correction (DOC) prison system who received primary care from May 2013 to February 2016 as part of a larger multisite cohort study funded by the Center for Medicare and Medicaid Innovation. Participants provided informed consent for this study, which is described elsewhere.<sup>25</sup>

### Study population

We used propensity score matching<sup>26</sup> to identify individuals who were comparable with TCN patients but were released from prison during the same period to an urban area similar to the one where the TCN programme was located. We matched participants by demographic, clinical and behavioural characteristics based on their likelihood of receiving care in the TCN programme. To obtain participant characteristics used in propensity matching, we linked administrative data from Connecticut DOC to data from Connecticut Medicaid and Department of Mental Health and Addiction Services (DMHAS). Identifiers used in the linkage included date of birth, first name, last name, social security number, gender and race/ethnicity. We used the Link King application, which employs both deterministic and probabilistic matching algorithms, to identify if the interagencies' records are from the same individual.<sup>27</sup> We abstracted participants' demographics, criminal justice history and needs assessment scores from the DOC data; chronic medical conditions prior to their most recent incarceration through Medicaid service claims; and mental health and substance use treatment history from the DMHAS data.

From the linked data, we included the following variables in the logistic regression to estimate the propensity scores: participant demographics (eg, gender, race/ethnicity and age at release), release year, DOC medical, mental health, substance use and criminal justice needs assessment scores (including violence, sentence length, discipline record and gang involvement), criminal justice involvement history (including having a felony record, the percentage of one's life interacting with the DOC), type of release (under supervision or end of sentence),

mental health and substance abuse diagnosis and treatment history, including proportion of one's life as a client of DMHAS, having any chronic condition, total number of chronic conditions, having 1 of 17 medical conditions included in the Charlson Comorbidity Index,<sup>28</sup> the weighted Charlson Comorbidity Index score,<sup>29</sup> and three common chronic conditions among individuals with a history of incarceration, but not otherwise included in the comorbidity index score: other gastrointestinal symptoms, opioid use disorder and alcohol use disorder.

We then used a greedy matching algorithm to match TCN cases to controls, in which the TCN cases were ordered and sequentially matched to the nearest matching non-TCN cases, one at a time without replacement.<sup>30–32</sup> We chose a 1:1 case-control match method rather than inverse weighting or stratification because it produced the most balanced distribution of covariates for our sample.<sup>31</sup> The index date was the TCN enrolment date for TCN programme participants, and the first DOC release date during the study window, 2012–2015, for the control group. Our final study sample comprised 94 patients who received enhanced primary care in the TCN programme and 94 propensity-matched controls.

### Measures

Our primary outcome of interest was reincarceration within 12 months from the index date, as imprisonment is both a disruption in healthcare, employment and family life, and a driver of societal costs. We also assessed metrics that affect changes in prison or jail populations, including arrests and length of stay in correctional facilities.<sup>33</sup> Finally, we examined imprisonment due to new and technical violations (violations of the condition of parole or probation), which is a focus of many state criminal justice reform efforts. We ascertained these outcomes from the Connecticut DOC and Court Support Services Division administrative data.

The secondary outcomes of this study included preventable emergency department (ED) visits, hospitalisations and length of hospital stay, which we ascertained from Medicaid and DMHAS administrative data. We applied the Agency for Healthcare Research and Quality's Prevention Quality Indicators (PQI) to categorise the primary diagnoses into preventable ED visits and hospitalisations. PQIs are population-based measures that can be used with hospital administrative data to identify quality of care for 'ambulatory care-sensitive conditions', ones for which primary care can potentially prevent the need for hospitalisation or for which early intervention can prevent more severe disease.<sup>34 35</sup> Primary and secondary outcomes were specified a priori of analyses.

### Statistical analysis

The study aimed to include a total of at least 170 individuals: 36 individuals per group would provide approximately 95% power to detect a difference in the mean number of days incarcerated comparing the treatment and comparison group, assuming that individuals in

the TCN programme would spend 50% less time incarcerated (effect size=35 days). Eighty-one individuals per group would provide 80% power to detect a 50% difference in the proportion of people who are convicted for new or technical violations between the treatment and comparison group.

We compared individuals who received services at TCN with the pool of potential controls using t-tests and  $\chi^2$  analysis on sociodemographics, chronic conditions, criminal justice and mental health history, and again following identification of the propensity-matched sample to ensure a balance of covariates. We then compared criminal justice contact and preventable healthcare utilisation between the two groups using t-tests and  $\chi^2$  analysis as appropriate. Next, we used logistic regression and zero-inflated negative binomial (ZINB)<sup>36</sup> regression models, depending on the distribution of the outcome variable, to evaluate reincarceration, arrests, incarceration days, preventable ED visits, hospitalisations and length of stay during the 12-month period following the index date. We elected to use the zero-inflated Poisson (ZIP) or ZINB models because our observed outcome data have excess zeros (ZIP) and exhibit an overdispersion distribution (ZINB).<sup>37</sup> We adjusted for length of time in the hospital for the criminal justice outcomes and time incarcerated for the healthcare utilisation outcomes. We considered p values of equal to or less than 0.05 statistically significant. All statistical analyses were performed using SAS V.9.4.

### Patient involvement

Patient members of our TCN community advisory board, TCN community health workers and individuals with histories of incarceration were involved in developing the research question. They were not involved in planning the design and conduct of the study. We have iteratively shared the progress of this study and our results to our TCN advisory board, inclusive of patients and individuals with histories of incarceration. We plan to disseminate these findings more widely to study participants and patients of the TCN at large.

### RESULTS

In the unmatched study population, TCN programme participants were older and more likely to be white compared with those in the comparison group. TCN programme participants were sicker, had higher individual medical, mental health and criminal justice composite needs scores, a higher prevalence of inpatient treatment for mental health conditions, and a higher prevalence of alcohol use disorder compared with the comparison group. After the match, the groups were balanced, except for one TCN case that could not be matched and was discarded from the analysis (table 1).

Table 2 shows contact with the criminal justice system and preventable healthcare utilisation within a year following index date for the TCN and the matched

**Table 1** Participant characteristics by study group: pre and post propensity score matching

	Prematch n (%) or mean ( $\pm$ SD)			Postmatch n (%) or mean ( $\pm$ SD)	
	TCN (n=95)	Control (n=2594)		TCN (n=94)†	Control (n=94)
<b>Release year</b>					
2012	1 (1.1)	465 (17.9)	***	1 (1.1)	0 (0)
2013	30 (31.6)	616 (23.7)		29 (30.1)	23 (24.5)
2014	61 (64.2)	841 (32.4)		61 (64.9)	68 (72.3)
2015	3 (3.2)	672 (25.9)		3 (3.2)	3 (3.2)
Male	76 (80)	2294 (88.4)	**	76 (80.9)	75 (79.8)
<b>Race/Ethnicity</b>					
White	30 (31.6)	191 (7.4)	***	29 (30.9)	31 (33.0)
Black	51 (53.7)	1271 (49.0)		51 (54.3)	48 (51.1)
Hispanic	14 (14.7)	1125 (43.4)		14 (14.9)	15 (16.0)
Age (at release)	42.6 ( $\pm$ 10.3)	37.53 ( $\pm$ 10.5)	***	42.6 ( $\pm$ 10.4)	40.5 ( $\pm$ 10.8)
<b>DOC assessment score</b>					
Mental health	2.0 ( $\pm$ 0.8)	1.7 ( $\pm$ 0.8)	***	2.0 ( $\pm$ 0.8)	2.1 ( $\pm$ 0.9)
Substance abuse	3.4 ( $\pm$ 1.2)	3.0 ( $\pm$ 1.3)	***	3.4 ( $\pm$ 1.2)	3.4 ( $\pm$ 1.2)
Education	2.4 ( $\pm$ 0.8)	2.7 ( $\pm$ 0.9)	**	2.4 ( $\pm$ 0.8)	2.7 ( $\pm$ 0.9)
Vocation	3.2 ( $\pm$ 0.7)	3.3 ( $\pm$ 0.7)	*	3.2 ( $\pm$ 0.7)	3.2 ( $\pm$ 0.8)
Crime severity	2.4 ( $\pm$ 1.1)	2.1 ( $\pm$ 1.1)	**	2.4 ( $\pm$ 1.1)	2.6 ( $\pm$ 1.2)
Medical problems	2.48 ( $\pm$ 0.8)	1.9 ( $\pm$ 0.9)	***	2.5 ( $\pm$ 0.8)	2.4 ( $\pm$ 1.0)
Index incarceration days	242.8 ( $\pm$ 309.8)	148.9 ( $\pm$ 312.6)	**	239.9 ( $\pm$ 312.4)	306.3 ( $\pm$ 1109.9)
<b>Release type</b>					
Under supervision	38 (41.1)	388 (15.0)		38 (40.9)	34 (36.2)
Other	56 (58.9)	2206 (85.0)		55 (59.1)	60 (63.3)
Proportion of life spent in DOC	42 ( $\pm$ 19.9)	37.7 ( $\pm$ 19.0)	*	41.9 ( $\pm$ 20.0)	41.6 ( $\pm$ 19.2)
<b>Behavioural health history</b>					
Any inpatient, mental health	14 (14.7)	103 (4.0)	***	13 (13.8)	11 (11.7)
Proportion life involved with DMHAS	17.9 ( $\pm$ 15.2)	12.7 ( $\pm$ 11.2)	***	17.4 ( $\pm$ 14.6)	18.0 ( $\pm$ 12.2)
<b>Medical chronic condition</b>					
Myocardial infarction	5 (5.3)	33 (1.3)	**	5 (5.3)	4 (4.3)
Dementia	3 (3.2)	8 (0.3)	***	3 (3.2)	1 (1.1)
Diabetes with or without complications	20 (21.1)	294 (11.3)	**	19 (20.2)	15 (16.0)
Moderate or severe liver disease	5 (5.3)	17 (0.7)	***	5 (5.3)	4 (4.3)
Other GI conditions	52 (54.7)	1116 (43.0)	*	51 (54.4)	53 (56.4)
Opioid abuse/dependence	37 (38.9)	733 (28.3)	*	36 (38.3)	37 (39.4)
Alcohol abuse/dependence	51 (53.7)	861 (33.2)	***	50 (53.2)	50 (53.2)
Weighted CCI score	2.0 ( $\pm$ 3.0)	1.25 ( $\pm$ 2.1)	*	2.0 ( $\pm$ 3.0)	2.5 ( $\pm$ 3.4)
Total number of chronic conditions	1.1 ( $\pm$ 1.6)	0.8 ( $\pm$ 1.2)	**	1.1 ( $\pm$ 1.6)	1.3 ( $\pm$ 1.7)

Boldface indicates statistical significance (\* $p$ ≤0.05, \*\* $p$ ≤0.01, \*\*\* $p$ ≤0.0001).

†One TCN case was excluded from the analysis since no matching case could be identified.

CCI, Charlson Comorbidity Index; DMHAS, Department of Mental Health and Addiction Services; DOC, Department of Correction; GI, gastrointestinal; TCN, Transitions Clinic Network.

comparison group. There were no differences in the rate of imprisonment, arrests or new convictions between the TCN and comparison group. The TCN group had fewer parole or probation technical violation (17% vs 33%,

$p$ <0.05) compared with the control group. The TCN group, on average, spent fewer days reincarcerated (101 vs 187 days,  $p$ <0.001) compared with the comparison group. The percentage of participants in either arm who

**Table 2** Criminal justice contact and preventable healthcare utilisation within 12 months

	TCN (n=94) n (%) or mean	Controls (n=94) n (%) or mean	Mean or percentage difference (95% CI)	
<b>Incarceration</b>				
Any arrest	22 (23.4)	14 (14.9)	8.5 (−2.8 to 19.6)	
New conviction	3 (3.2)	8 (8.5)	−5.3 (−13.0 to 1.8)	
Parole/Probation violations	16 (17.0)	31 (33.0)	−16 (−27.6 to −3.6)	*
Days incarcerated (among those who are reincarcerated)	101.1	187.4	−86.3 (−136.3 to −36.4)	***
<b>Preventable hospitalisation</b>				
Any inpatient care	12 (12.8)	6 (6.4)	6.4 (−2.3 to 15.3)	
Inpatient days (among those who are hospitalised)	12.3	24.7	−12.4 (−49.9 to 23.1)	
Inpatient episodes	2.9	4.3	−1.4 (−8.0 to 5.2)	
<b>Preventable ED visits</b>				
Any ED use	20 (21.3)	19 (20.2)	1.1 (−10.5 to 12.7)	
Number of ED visits	1.9	2.2	−0.3 (−1.8 to 1.2)	

Boldface indicates statistical significance (\* $p \leq 0.05$ , \*\*\* $p \leq 0.0001$ ). ED, emergency department; TCN, Transitions Clinic Network.

had any preventable hospitalisations and ED visits was similar.

In the zero-inflation component of the ZINB model, after adjusting for inpatient days, the odds of reincarceration or rearrest were similar for both groups (table 3). In logistic regression models, being in the TCN group was associated with a 62% decrease in the odds of returning to incarceration for parole or probation violations compared with the control group (adjusted OR=0.38; 95% CI 0.16 to 0.93). The number of days spent incarcerated was also significantly less for individuals seen in the TCN programme compared with the matched controls (adjusted incidence rate ratio [IRR]=0.55; 95% CI 0.35 to 0.84), after adjusting for hospitalisation days.

Among those who had been hospitalised, and after adjusting for incarceration days, the TCN group had significantly fewer episodes of preventable hospitalisations (IRR=0.46; 95% CI 0.24 to 0.89) and shorter length of hospital stay (IRR=0.41; 95% CI 0.35 to 0.84) compared with the matched comparison group. The number of preventable ED episodes was similar for both groups.

## DISCUSSION

We found that participants of an enhanced primary care-based programme for individuals just released from prison spent 45% fewer days incarcerated in a correctional facility in the 12 months following release compared with the matched comparison group that was not enrolled in such a programme. So for the 94 individuals who were in the control group, more than 2300 days incarcerated would be spared if they had participated in a TCN programme. Currently, strategies for reducing the numbers of individuals incarcerated focus

on public safety, criminal justice and sentencing reform, such as eliminating cash bail and mandatory sentencing and reducing parole violations (usually in the form of parole policy reform). However, expansion of enhanced primary care programmes for individuals released from prison could also be an additional strategy to reduce the correctional facility population.

TCN programmes may reduce the length of stay in a correctional facility in several ways. One possibility is that the TCN programme connects participants to inpatient and outpatient substance use treatment programmes, thus leading to decreased number of days incarcerated through an alternative sentence. Also, TCN patients, having received treatment for mental health, substance use and physical health conditions while in the community, may be less disruptive once reincarcerated or have developed a social support network, such that they are able to make bail sooner and be released. Future research should explore the mechanisms by which participation in the TCN programme is associated with decreased time reincarcerated.

We did not find any differences between arrest rates and new conviction rates. The TCN programme serves individuals who have already been incarcerated and who have had sizeable interactions with the criminal justice system previously. Reducing arrests or imprisonments may be more difficult to achieve for a primary care programme that is focused on patient health and well-being and not just engagement with the criminal justice system. We did find, however, that individuals who participated in the TCN programme returned to DOC less for parole or probation violations compared with those in the matched comparison group. One possible reason is

**Table 3** Adjusted associations between participation in TCN and criminal justice contact and preventable healthcare utilisation\*

	Criminal justice contact				Preventable acute care visits			
	Incarceration	Rearrest	Convictions	Inpatient episodes	Inpatient days	ED episodes		
<b>Zero inflation component: OR (95% CI)</b>								
TCN patients (ref=controls)	0.69 (0.36 to 1.32)	0.84 (0.18 to 3.94)	-	0.41 (0.15 to 1.19)	0.48 (0.36 to 1.32)	0.65 (0.21 to 1.99)		
Hospitalisation days	1.00 (0.98 to 1.02)	0.98 (0.96 to 1.01)	-	-	-	1.01 (0.97 to 1.01)		
Incarceration days	-	1.00 (0.99 to 1.01)	-	1.00 (1.00 to 1.01)	1.00 (1.00 to 1.01)	1.01 (1.01 to 1.02)		
<b>Count component: IRR (95% CI)</b>								
TCN patients (ref=controls)	0.55 (0.35 to 0.84)	1.86 (0.77 to 4.35)	-	0.46 (0.24 to 0.89)	0.41 (0.35 to 0.8)	0.65 (0.33 to 1.29)		
Hospitalisation days	2.71 (2.66 to 2.77)	1.01 (0.99 to 1.02)	-	-	-	1.01 (1.01 to 1.02)		
Incarceration days	-	1.01 (1.00 to 1.02)	-	1.01 (1.00 to 1.01)	1.01 (1.00 to 1.01)	1.01 (1.00 to 1.01)		
<b>Logistic regression, OR (95% CI)</b>								
TCN patients (ref=controls)	-	-	Parole violation 0.38 (0.16 to 0.93)	New conviction 0.35 (0.09 to 1.42)	-	-		
Hospitalisation days	-	-	1.00 (1.00 to 1.03)	1.00 (1.00 to 1.03)	-	-		
Incarceration days	-	-	1.01 (1.00 to 1.01)	1.01 (1.00 to 1.01)	-	-		

The zero inflation component predicts the probability of the experimental group NOT having the outcome; an OR >1 reflects a lower likelihood of the outcome (incarceration, arrests, hospitalisations, ED visits) occurring in the experimental group. The count component predicts the number of days incarcerated or hospitalised.

\*All models are adjusted for the time at risk for the potential outcome. So hospitalisation days' analyses are adjusted for time incarcerated, and incarceration days' analyses are adjusted for time hospitalised.

†Logistic regression model estimates.

ED, emergency department; IRR, incidence risk ratio; ref, reference group; TCN, Transitions Clinic Network.

that TCN programme providers communicate regularly (when given permission by their patients) with criminal justice entities, especially parole and probation officers. These relationships may be important in identifying alternatives to reincarceration for technical violations, including enrolling patients in substance use treatment when individuals have relapsed to drug use. If we estimate that nationally there are at least 61 000 individuals who are in correctional facilities for parole or probation technical violations,<sup>38</sup> engaging them into programmes similar to the TCN in community health centres nationwide could prevent an additional 20 000 incarcerations per year.

A surprising finding is that the TCN programme did not have an impact on reducing preventable ED utilisation. In a past study using randomised design in San Francisco, we found that individuals who were randomly assigned to the TCN programme in San Francisco had almost 50% fewer all-cause ED visits compared with the group that was randomised to get expedited primary care in a safety-net primary care clinic.<sup>22</sup> One explanation may be that the majority in the matched comparison group were still seen in primary care and thus did not have more ED visits or visits for preventable conditions.

Notably, among those who were hospitalised, individuals in the TCN programme did have fewer numbers of hospitalisations for conditions that are preventable with engagement in primary care, compared with those in the matched comparator group. One possible reason is that TCN community health workers provide significant support around medication management and adherence, chronic disease self-management, and helping patients address their housing, food insecurity and employment needs, which may reduce hospitalisations. Other studies of community health workers have found similar effects on hospital readmissions.<sup>39</sup> Also, we found that participants of the TCN programme had almost 60% shorter lengths of hospital stay compared with the control group. TCN teams coordinated with inpatient teams to ensure smooth discharges to home and close primary care follow-up, which may account for shorter time hospitalised.

This study moves the field forward in its use of data and measurement of outcomes. It is among the first exploring how the health system can play a role in addressing incarceration as a social determinant of health. We were able to link data across a state with an integrated jail and prison system (meaning all correctional facilities fall under the authority of a single agency), so measuring criminal justice contact is more reliable and accurate. In doing so, we were able to measure days incarcerated as an important outcome, given that any time spent incarcerated can have an impact on individual health outcomes, employment and housing. In most jurisdictions, these data systems are not interconnected, so evaluations historically have been unable to determine programme impact across the full spectrum of affected services. We could achieve this given strong state agency partnerships, which enable data linkages. There is a significant need for more experimental studies that shift away from solely health system-centric

outcomes such as ED visits, inpatient utilisation, and associated costs of care or reimbursements to consider outcomes which reflect service use across multiple health and social service systems, including hospitals, clinics, substance use and mental health services, and criminal justice systems, but also ambulance services, shelters and community-based agencies. Additionally, future studies should explore the impact of these programmes on those measures, as well as patient quality of life and well-being, metrics rarely used in studies of justice-involved populations, but often used to justify the use of pharmacological therapies or provision of other clinical services. A broader range of outcomes would enable us to understand the full impact of primary care-based programmes on the health of individuals just released from prison.

### Limitations

A few limitations of this study should be noted. The choice of variables used in the construction of the propensity scores was limited by those measured in the administrative databases. For instance, we did not have measures of individual characteristics like housing status and social support, or individual symptomatology like depression and post-traumatic stress disorder, nor the characteristics of communities to which people return, which have been shown to be associated with future contact with the criminal justice system. Nonetheless, our propensity score did include variables most likely to be important confounders in the relationship between receipt of TCN programme and recidivism, including time incarcerated, number of comorbidities, and DOC violence and severity of crime scores. Further, the use of propensity score to identify a comparison group also limits our ability to control for possible volunteer bias of participants in TCN. While we did find that engagement in primary care (percentage of participants with two or more visits in 12 months) was equal in both arms, it is possible that individuals in TCN programme were more connected to community programmes, which was why there was less criminal justice involvement. A randomised trial would be important to conduct to bolster our findings. We followed individuals for 12 months, and many complex interventions do not show efficacy until after one or multiple years. It is possible that setting the index date on prison release for the controls and at enrolment for the TCN group would introduce bias if hospitalisations, ED visits and reincarcerations are more common immediately following release. That said, the average number of days for TCN participants between release to enrolment is about 48 days, and the majority of the control group (85%–95%) did not have inpatient hospitalisations, ED visits or time incarcerated until 48 days after their jail release dates. So how soon they experienced hospitalisations, ED visits and reincarcerations after release date did not seem to bias our conclusions. Lastly, we conducted this evaluation within a single and unified state system and acknowledge that our findings may not be generalisable to other state and local healthcare and criminal justice systems.

## CONCLUSION

We found that an enhanced primary care-based programme showed reductions in future contact with the criminal justice system by reducing length of time imprisoned and technical violations for individuals just released from prison. Modest investments in primary care infrastructure for programmes targeting individuals just released from prison may lead to efficiencies in health-care utilisation, but also reduced criminal justice contact, leading to improved health overall.

### Author affiliations

<sup>1</sup>Internal Medicine, Yale University School of Medicine, New Haven, Connecticut, USA

<sup>2</sup>School of Social Work, University of Connecticut System, Storrs, Connecticut, USA

<sup>3</sup>Research Division, Connecticut Department of Mental Health and Addiction Services, Hartford, Connecticut, USA

<sup>4</sup>Yale University School of Public Health, New Haven, Connecticut, USA

<sup>5</sup>Connecticut Department of Correction, Wethersfield, Connecticut, USA

<sup>6</sup>Family and Community Medicine, University of California, San Francisco, California, USA

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