Sustained impacts of North Carolina prison therapeutic diversion units on behavioral outcomes, mental health, self-injury, and restrictive housing readmission

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ABSTRACT

Therapeutic Diversion Units (TDUs) in North Carolina prisons are intended to reduce cycling of individuals with mental health conditions through restrictive housing (i.e., solitary confinement). This paper investigates if previously identified benefits of TDU are sustained when individuals return to the general prison population. Using administrative data on 3170 people, we compare individuals placed in TDUs to TDU-eligible individuals (i.e., individuals with mental health needs) placed in restrictive housing. We use survival analysis methods to estimate hazard ratios (HRs) with confidence intervals (CIs), controlling for confounders. Compared to restrictive housing placement, TDU placement reduced the hazard of infractions (HR: 0.66; 95% CI: 0.52, 0.84) and subsequent restrictive housing placement (HR: 0.64; 95% CI: 0.55, 0.73) but increased the hazard of self-harm (HR: 2.67; 95% CI: 1.66, 4.29) upon program release to the general prison population. These findings suggest a need for additional investments and research on restrictive housing diversion programming, including post-diversion program supports.

Incarcerated persons have disproportionately high levels of mental health disorders, compared to their non-incarcerated counterparts, that are often negatively impacted by incarceration (Prins and Draper, 2009; Yoon et al., 2017). Despite the availability of mental health treatment in prison (North Carolina Department of Public Safety, 2020), certain aspects of incarceration can inherently pose mental health challenges. In particular, restrictive housing (i.e., solitary confinement, administrative segregation, supermax) (Reiter et al., 2020) is associated with exacerbated mental health symptoms (American Public Health Association, 2013; Cloud et al., 2015). Restrictive housing contributes to feelings of dehumanization and loss of identity and is associated with post-traumatic stress disorder, suicidal ideation, self-injury, depression, and anxiety (Reiter et al., 2020; Kaba et al., 2014; Hagan et al., 2018; Bonner, 2006; Smith, 2006; Morgan et al., 2016; Toch, 2002). Notably, people with existing mental health disorders are disproportionately placed in restrictive housing, potentially worsening symptoms (American Public Health Association, 2013; Cloud et al., 2015). Exposure to restrictive housing is associated with self-injury, suicidal ideation, hyper-responsivity to stimuli, and aggression (Reiter et al., 2020; Kaba et al., 2014; Bonner, 2006; Smith, 2006; Grassian, 1983). Moreover, compared to individuals without a history of restrictive housing assignment, those with a history have nearly 2.5 times the risk of mortality five years following prison release due to elevated risks of suicide and opioid overdose death, causes of death often associated with poor mental health (Wildeman and Andersen, 2020; Brinkley-Rubinstein et al., 2019).

Restrictive housing placement inherently reduces access to beneficial prison programming. When in restrictive housing, individuals typically spend $\geq$22 h a day in their cell with limited access to prison programs, personal property, media, and visitation (Mears, 2016). While individuals may access necessary services such as mental health and substance use disorder treatment and/or educational programming,

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engagement is typically constrained due to the bounds of restrictive housing. Such limited access serves as another impediment to improved social and health outcomes (Cho and Tyler, 2013; Duwe and Clark, 2014; Taxman et al., 2014).

Some jurisdictions have developed and implemented restrictive housing diversion programs for individuals with mental illness. Programs in Colorado, Pennsylvania, and Virginia prisons as well as New York City and Broward County, Florida jails, provide increased out-of-cell time compared to restrictive housing, therapeutic programming, recreational opportunities, and staff mental health training (Hagar et al., 2008; Glowa-Kollisch et al., 2016; Vera Institute for Justice, 2020). Few studies have evaluated the effectiveness of these programs.

As an alternative to restrictive housing for individuals with mental illness in state prisons, the North Carolina Department of Public Safety (NC DPS) developed Therapeutic Diversion Units (TDUs). TDUs, operative since May 2016, are multidisciplinary treatment units. TDUs are intended to admit incarcerated persons who have high levels of mental health needs and who have repeatedly cycled through restrictive housing or have spent long periods in restrictive housing. Treatment and program opportunities offered in TDUs are designed to decrease violence, self-harm, and behavioral problems.

TDU staff locate and screen potentially appropriate participants, making use of both comprehensive criteria-based identification and direct staff-to-TDU referral. TDU psychologists access a state-wide listing of individuals defined as eligible by predetermined criteria, including current assignment to restrictive housing and current psychiatric and behavioral health treatment needs. TDU psychologists may also be contacted directly by mental health clinicians with referrals. Screening priorities include mental illness severity, time spent in restrictive housing, and time until release from prison. Screening clinicians may access health or prison records, engage in staff consultation, and/or utilize direct contact sessions with the individual.

TDU programming primarily includes cognitive-behavioral-oriented interactive journals with coinciding group activities, as well as psychoeducational materials regarding symptom and illness management and criminal thinking and behavior. All participants receive an individualized treatment plan and have regular individual therapy, psychiatric medication management, and review meetings with the treatment team. Each TDU is staffed with a multidisciplinary team, including at least one psychologist, behavioral health support staff, correctional officers, and nursing professionals. Psychologists provide individual and group therapy, and support staff conduct other group activities. All TDU participants are offered an incentive system from which they may earn rewards (e.g., brand-name shampoo, additional phone calls) for positive engagement. As participants successfully progress through the program, their out-of-cell and unrestrained time increases and their incentive-earning potential may as well. Participants typically complete the TDU program in six to twelve months at which point they become eligible for transfer to the least restrictive environment feasible, typically the general prison population. While the majority of participants complete TDU or are released from prison during its course, a small portion are discontinued from the program due to disruptive behavior or individual withdrawal.

In an earlier analysis, comparing individuals in TDUs to TDU-eligible individuals in restrictive housing, we found strong associations between TDUs and reduced rates of infractions, inpatient mental health admissions, and self-harm outcomes (Remch et al., 2021). However, no studies have evaluated the sustained impacts of TDUs on these outcomes after individuals leave the program and return to the general prison population. The objective of this analysis was to assess the impact of TDUs, as compared to restrictive housing, on infractions, inpatient mental health admissions, self-harm, and subsequent admission to restrictive housing, following release from the program assignment and return to the general prison population.

1. Methods

1.1. Data

We conducted a prospective cohort study using data from NC DPS. Data elements included date of birth, sex, race, ethnicity, prison entry and (if applicable) exit dates, dates of any infractions, mental health grades, restrictive housing placement dates, and TDU assignment dates. We obtained data through April 30th, 2019 on all incarcerations for adults released from prison between 2000 and 2018 and adults admitted to TDUs.

1.2. Exposure to TDU placement

To study potential sustained effects of TDUs and restrictive housing, we compared outcomes following discharge from TDU and restrictive housing assignments, when persons had returned to the general prison population.

We defined TDU enrollment, consistent with TDU enrollment guidelines, as days spent in a TDU if, during that same incarceration, the enrollee had previously spent time in restrictive housing and if they had a mental health grade of three or higher (M3+, discussed in detail below) at the start of their TDU assignment. As TDU admissions are made through interdisciplinary consultation and on case-by-case bases, individuals are occasionally admitted who have mental health needs but do not meet M3+ criteria or who have not been in restrictive housing. We excluded these enrollees from analyses (11%) to allow for better exchangeability between the TDU enrolled and TDU-eligible restrictive housing groups. We defined TDU-eligible restrictive housing as restrictive housing that occurred on or after May 1st, 2016 during which the individual had a mental health grade of M3+. This date was chosen to align restrictive housing dates with dates during which TDUs were operational. We did not include individuals who were previously enrolled in TDU in the TDU-eligible restrictive housing group.

1.3. Outcomes

We examined the hazard of first occurrence of each outcome during the first 90 days following TDU discharge ("post-TDU") and TDU-eligible restrictive housing discharge ("post-restrictive housing") into the general prison population.

1.3.1. Infractions

We examined infractions internally adjudicated by NC DPS as "guilty." All infractions are assigned a code with the prefix A (e.g., participating in a riot, assault of an offender or staff), B (e.g., drug use, threatening to harm staff), or C (e.g., failing to report to a work or program assignment) (North Carolina Department of Public Safety, 2020). A-level infractions are the most severe. We assessed infractions overall and by level.

1.3.2. Inpatient mental health admissions

Offender mental health is regularly assessed by NC DPS clinicians using a five-level scale (M1 to M5). An M1 grade indicates no current need for behavioral health treatment, an M2 grade indicates placement on an outpatient behavioral health caseload (e.g. psychologist, licensed clinical social worker) without coinciding psychiatric care, an M3 grade indicates placement on both an outpatient behavioral health caseload and coinciding psychiatric care, and an M4 grade indicates placement in a long-term residential mental health treatment unit due to a significant mental health disorder with significant impairment in functioning (North Carolina Department of Public Safety, 2011). An M5 grade indicates placement in an acute inpatient psychiatric stabilization unit (e.g., active psychosis, suicidal intent). We defined inpatient mental health admission as an M5 grade.

1.3.3. Self-injury

Self-injury has been systematically captured in the NC DPS electronic health record since September 1st, 2016. For these outcomes, we only included person-time on individuals released from a TDU or restrictive housing on or after September 1st, 2016. We defined a self-injury *incident* as any self-injury event or any communication of intent to self-injure. Self-injury *events* were a subset of these incidents where an individual self-injured.

1.3.4. Restrictive housing

We assessed any subsequent placement in restrictive housing after the index release from restrictive housing or TDU.

1.4. Statistical analysis

We calculated the prevalence of demographic and incarceration-related characteristics, stratified by exposure (i.e., post-TDU and post-restrictive housing) and weighted by person-days contributed at each level of exposure. We calculated unadjusted and adjusted sub-distribution hazard ratios (HRs) for the first occurrence of each of the outcomes within 90 days post-TDU or post-restrictive housing, utilizing the Fine-Gray survival model (Fine and Gray, 1999; Lau et al., 2009). We followed participants until the first occurrence of the event of interest. Censoring events included April 30th, 2019 (the administrative end of the study period), 90 days post release from the index placement in TDU or restrictive housing, death, or discharge from prison. Competing events included, when not the outcome of interst, an M5 event and entry into restrictive housing, TDU, modified housing, or a rehabilitative diversion unit (another unique diversionary program). We did not include time spent in these five settings because each are controlled environments with significantly altered outcome opportunity. We assessed outcomes during the first 90 days because after this point, the sample size of individuals in the general prison population who had not experienced the event of interest, a censoring event, or a competing event began to diminish such that the risk set was small, and made up of individuals who were no longer representative of the larger study population.

We also produced cumulative incidence ("risk") functions for first events, while accounting for censoring and competing events, among people entering the general prison population from restrictive housing and TDUs.

We adjusted for potential sources of confounding using stabilized inverse probability of treatment weights (IPTW). We used a directed acyclic graph (DAG) to select variables used to construct weights (Supplemental Fig. 1). To define the causal relations modeled in the DAG, we used prior empirical evidence, expectations based on behavioral theory, and subject matter expertise. Based on the DAG, we used variables measured at the beginning of a TDU or TDU-eligible restrictive housing to build weights and included sex, mental health grade, number of infractions per day in that incarceration, number of days with an M3+ per days in that incarceration, number of days spent in restrictive housing per day in that incarceration, number of days left of the incarceration, and highest substance use treatment recommendation during that incarceration. Supplemental Table 1 demonstrates balance on these confounders using these stabilized IPTWs.

In a supplemental analysis, we compared post-TDU and post-restrictive housing rates of infractions, inpatient mental health admissions, self-harm, and future restrictive housing during the first 14, 30, and 90 days in the general prison population using Poisson regression with generalized estimating equations to account for the correlation within individuals who contribute person-days during multiple exposure periods. Unlike the primary analysis, which assessed the hazard of the *first* event (i.e., time-to-event analyses), here we assessed the rate of *all* events during time periods of interest.

This study was approved by the University of North Carolina at Chapel Hill's Institutional Review Board (approval #19–2193) and NC DPS (approval #HS1911–02).

2. Results

Analyses included 3170 people (Table 1). A small number were imprisoned more than once during the study period; therefore, TDU and restrictive housing placements took place across 3256 incarcerations. Because individuals could contribute person-time following multiple restrictive housing placements, the post-restrictive housing data follows 7794 restrictive housing placements. Most person-days were contributed by people ages of 26–50 years and by males. Equal numbers were contributed by white, non-Hispanic and Black, non-Hispanic individuals. The mean number of days incarcerated was 1225.9 (median: 618.0) for people in the post-restrictive housing group and 1966.4 (median: 1208.0) for those in the post-TDU group. On average, post-restrictive housing individuals had spent 282.5 (median: 47.0) days in restrictive housing, and post-TDU individuals had spent 738.7 (median: 345.0) days.

The cumulative incidence functions (Fig. 1 and Supplemental Fig. 2) highlight the variation in magnitude and incidence of the outcomes. For example, at 30 days there had been 36 infractions in the post-TDU group but only 6 inpatient mental health admissions.

2.1. Infractions

The incidence of most types of infractions were lower post-TDU than post-restrictive housing. The adjusted HR (aHR) of first infraction was 0.66 (95% CI: 0.52, 0.84) indicating that the hazard of first infraction post-TDU was 0.66 times the hazard post-restrictive housing (Table 2). This can also be interpreted as 52% lower than the hazard post-restrictive housing (i.e., ((1/aHR)-1)*100%). The aHRs for B-level and C-level infractions were 0.74 (95% CI: 0.56, 0.98) and 0.50 (95% CI: 0.33, 0.77), respectively, indicating hazards were 35% and 100% lower post-TDU compared to post-restrictive housing. The incidence of the most severe A-level infractions was similar post-TDU and post-restrictive housing (aHR 0.97; 95% CI: 0.68, 1.37).

2.2. Inpatient mental health admissions

The incidence of inpatient mental health admission was somewhat elevated post-TDU, relative to post-restrictive housing (aHR:1.38 (95% CI: 0.63, 3.01)). However, due to the small number of events, the confidence interval was relatively wide (imprecise).

2.3. Self-harm

TDU placements were associated with increased incidence of self-harm incidents (aHR: 2.67 (95% CI: 1.66, 4.29)). The results were similar for the subset of specific self-harm events (aHR: 2.94 (95% CI: 1.41, 6.14)).

2.4. Restrictive housing

TDU placement reduced the incidence of subsequent placement in restrictive housing (aHR: 0.64 (95% CI: 0.55, 0.73)), with a hazard that was 22% lower post-TDU than post-restrictive housing.

2.5. Supplemental analyses

Supplemental analyses of the 14-, 30-, and 90-day rates of infraction, self-harm, and inpatient mental health admissions were similar to the primary analysis in terms of direction of effects (Supplemental Table 2). In terms of magnitude of effects, differences between post-TDU and post-restrictive housing were generally most pronounced during the first two weeks in the general prison population, and the two groups became more similar over time. Rate ratios for return to restrictive housing also

Table 1
Characteristics of people with post-Therapeutic Diversion Unit (TDU) time and of people with post-restrictive housing time who had been eligible for a TDU in North Carolina prisons, 2016–2019.

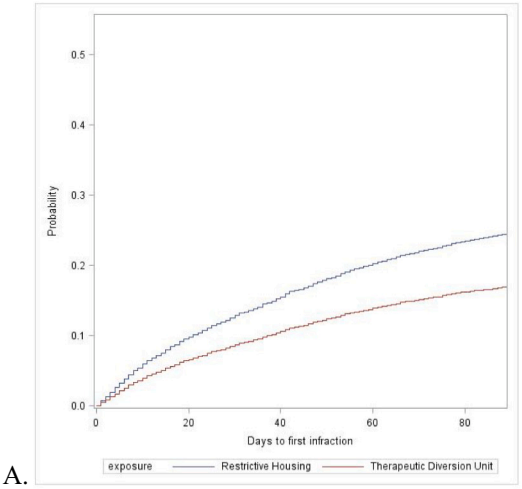
	Total	Post-restrictive housing	Post-therapeutic diversion unit
Number of people	3170	3103	317
Number of incarcerations	3256	3175	317
Number of placements*	8111	7794	317
Total days of follow-up (%)	431,517 (100.0)	414,070 (96.0)	17,447 (4.0)
	Percent of person-days		
Age, years [a]			
18–25	12.6	12.3	20.5
26–50	76.4	76.5	74.1
51+	11.0	11.2	5.4
Sex [b]			
Male	86.1	86.3	80.4
Female	13.9	13.7	19.6
Race [b, c]			
White, non-Hispanic	48.2	48.2	48.5
Black, non-Hispanic	46.8	46.7	48.1
Hispanic	1.6	1.6	1.6
Others	3.4	3.5	1.9
Self-report individual SES [b, d]			
Middle or high income	34.1	34.1	34.6
Low income	51.7	51.6	54.9
Poverty	14.2	14.4	10.6
Employment at arrest [b, d]			
Employed	39.1	39.3	36.0
Unemployed	60.9	60.7	64.0
Highest level of education completed [b, c]			
< 12 years	76.3	76.1	79.3
12+ years	23.7	23.9	20.6
Substance use disorder treatment recommendation [e]			
None	55.0	55.2	50.8
Education	9.4	9.5	6.5
Intermediate or long-term	35.6	35.3	42.7
Gang affiliation [f]			
None	93.3	93.6	88.1
Any	6.7	6.4	11.9
Conviction [g]			
Acts leading to death or intending to cause death	17.0	16.8	21.5
Acts causing harm or intending to cause harm to the person	11.3	11.2	12.4
Injurious acts of a sexual nature	10.2	10.2	10.8
Acts of violence or threatened violence against a person that involve property	11.6	11.4	15.9
Acts against property only	9.7	9.8	7.7
Acts involving controlled substances	7.4	7.3	9.4
Acts involving fraud, deception, or corruption	2.6	2.5	5.1
Acts against public order and authority	1.7	1.7	0.2
Acts against public safety and national security	1.7	1.7	1.3
Acts against the natural environment or against animals	0.1	0.1	0.0
Other criminal acts not elsewhere classified	25.5	26.0	14.7
Unknown	1.3	1.3	0.8
	Mean (25th percentile, median, 75th percentile) among person-days contributed		
Number of previous incarcerations [b]	3.1 (1.0, 2.0, 4.0)	3.1 (1.0, 2.0, 4.0)	2.5 (0.0, 2.0, 4.0)
Number of infractions / 1000 days incarcerated [i]	15.3 (3.7, 9.3, 18.2)	15.1 (3.6, 9.1, 17.9)	20.4 (7.7, 13.3, 24.2)
Number of days incarcerated in current period of incarceration [h]	1257.1 (233.0, 639.0, 1708.0)	1225.9 (221.0, 618.0, 1683.0)	1966.4 (589.0, 1208.0, 2513.0)
Expected days left of current incarceration [a, i]	942.2 (278.0, 601.0, 1129.0)	934.2 (275.0, 596.0, 1120.5)	1122.9 (369.0, 818.5, 1269.5)
Days with mental health score 3+ (M3+) / 1000 days incarcerated [h]	731.7 (534.1, 885.7, 977.3)	733.4 (537.3, 888.4, 977.5)	693.2 (453.7, 777.8, 972.2)
Days in restrictive housing [h]	301.7 (2.0, 51.0, 272.0)	282.5 (2.0, 47.0, 248.0)	738.7 (112.0, 345.0, 808.0)
Days in restrictive housing / 1000 days incarcerated [h]	177.2 (6.6, 87.1, 265.3)	166.5 3.7, 83.1, 243.4)	418.4 (146.9, 399.3, 663.6)

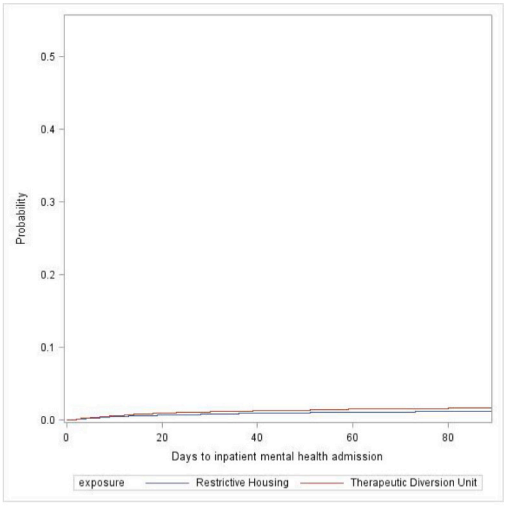
* Individuals could contribute person-time following more than one restrictive housing placement, so the number of post-restrictive housing placements exceeds the number of unique individuals.
[a] Calculated at the beginning of each eligibility period.
[b] Measured at the beginning of the relevant incarceration period.
[c] Data missing for people who combined contribute <1% of person-days.
[d] Data missing for people who combined contribute <5% of person-days.
[e] Substance use disorder treatment recommendation made by NC DPS based on structured assessments, with length of recommended treatment based on disorder severity.
[f] The highest level of gang affiliation recorded in the prison record during this incarceration by the beginning of the eligibility period. The lowest level of gang affiliation, called "affiliate" is not represented here due to incomplete information about timing. "Any" indicates V1-V3 levels of gang affiliation which roughly translate to the degree of involvement in a gang and DPS's assessment of potential for disruption of the secure and orderly operation of the prison where V1 poses the least threat and V3 poses the greatest.
[g] Based on classification of crime for statistical purposes (short version) presented in: National Academies of sciences, engineering, and medicine. 2016. *Modernizing crime statistics: Report 1: Defining and classifying crime*. Washington, DC: The National Academies Press. https://doi.org/10.17226/23492
[g] The highest level of gang affiliation recorded in the prison record during this incarceration by the beginning of the eligibility period. The lowest level of gang affiliation, called "affiliate" is not represented here due to incomplete information about timing. "Any" indicates V1-V3 levels of gang affiliation which roughly translate to the degree of involvement in a gang and DPS's assessment of potential for disruption of the secure and orderly operation of the prison where V1 poses the least threat and V3 poses the greatest.
[h] Describes events or days during that incarceration up through the eligibility period.
[i] Calculated as days until planned release, if such a date existed in the record and had not yet passed. Otherwise, calculated as the days until the person was released. And finally, if no meaningful planned release date was in the record and the person had not been released, this was calculated as the difference between the number of days incarcerated and the median length of incarceration for people who were charged with the same primary charge and who had been incarcerated at least as long as this person.

indicated a similar pattern to hazard ratios in that rates were lower post-TDU, as compared to post-restrictive housing. In contrast to the other outcomes, these rate ratios remained relatively stable over the 14-, 30-, and 90-day time periods, indicating a sustained reduction in return to restrictive housing post-TDU compared to post-restrictive housing.

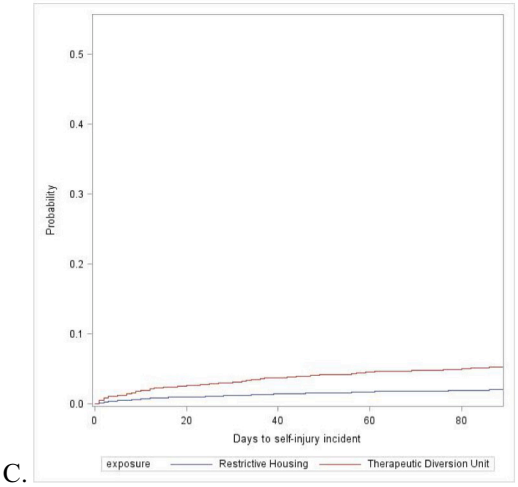
3. Discussion

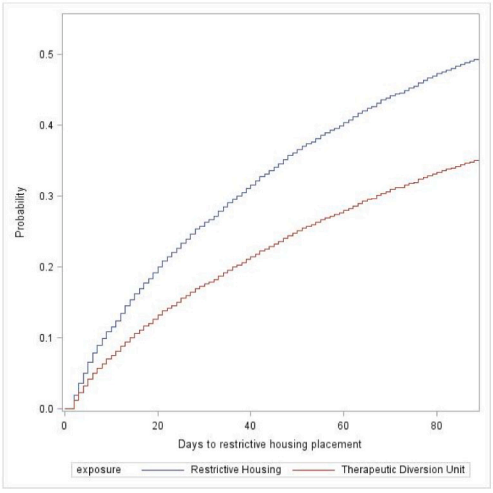
In the NC state prison system, there were thousands of people who were eligible for TDUs from 2016 to 2019, although most were never enrolled. These individuals had both sustained high levels of mental





		Days to first infraction			Days to first inpatient mental health admission		
		14	30	90	14	30	90
RH	Crude N events	577	975	1776	41	61	88
	Wtd proportion	0.08	0.13	0.24	0.01	0.01	0.01
	(95% CI)	(0.07, 0.08)	(0.12, 0.14)	(0.24, 0.25)	(0.00, 0.01)	(0.01, 0.01)	(0.01, 0.02)
TDU	Crude N events	21	36	66	4	6	7
	Wtd proportion	0.05	0.09	0.17	0.01	0.01	0.02
	(95% CI)	(0.04, 0.07)	(0.07, 0.11)	(0.14, 0.21)	(0.00, 0.03)	(0.00, 0.03)	(0.01, 0.05)





		Days to first self-injury incident			Days to first restrictive housing placement		
		14	30	90	14	30	90
RH	Crude N events	55	76	127	1180	1191	3620
	Wtd proportion	0.01	0.01	0.02	0.15	0.26	0.50
	(95% CI)	(0.01, 0.01)	(0.01, 0.01)	(0.02, 0.02)	(0.15, 0.16)	(0.25, 0.27)	(0.48, 0.51)
TDU	Crude N events	14	18	27	41	68	109
	Wtd proportion	0.02	0.03	0.05	0.10	0.18	0.35
	(95% CI)	(0.01, 0.04)	(0.02, 0.05)	(0.03, 0.08)	(0.08, 0.12)	(0.15, 0.21)	(0.30, 0.41)

Fig. 1. Weighted cumulative incidence functions of time to first event among people entering the general prison population from restrictive housing and Therapeutic Diversion Units (TDUs). Events are infractions (Panel A), inpatient mental health admissions (B), self-injury incidents (C), and restrictive housing placements (D). Note. Cumulative incidence functions are weighted using inverse probability of treatment weights (IPTW) accounting for the following confounding variables: sex, mental health grade, number of infractions divided by the number of days in that incarceration, number of days with a mental health grade of 3 or higher divided by the number of days in that incarceration, number of days spent in restrictive housing divided by the number of days in that incarceration, number of days left of their incarceration, and highest substance use treatment recommendation to date during that incarceration made by NC DPS.
RH, restrictive housing; TDU, Therapeutic Diversion Unit; Wtd, Weighted.

health needs as well as significant exposure to restrictive housing. The TDU program, designed to provide intensive intervention for these individuals and demonstrated in our previous research to be effective in improving behavioral and mental health outcomes during program enrollment (Remch et al., 2021) has the potential to provide enrollees with skills that could allow for sustained benefits beyond the duration of the program. Overall, we found mixed effects in terms of post-TDU outcomes. Prior TDU enrollment had a positive effect on B- and C-level post-release infractions and restrictive housing readmissions, relative to restrictive housing. However, prior TDU enrollment had a

Table 2
Hazard Ratios for effect of placement in a Therapeutic Diversion Unit (TDU) compared to placement in restrictive housing, for first of each outcome within 90 days of exit from a TDU or restrictive housing, North Carolina state prisons, 2016–2019.

Outcome of interest	Unadjusted HR (95% CI) for TDU vs. restrictive housing	Adjusted[a] HR (95% CI) for TDU vs. restrictive housing
Infractions		
Any infractions		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	0.93 (0.76, 1.13)	0.66 (0.52, 0.84)
A infractions		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	1.26 (0.93, 1.71)	0.97 (0.68, 1.37)
B infractions		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	1.04 (0.83, 1.32)	0.74 (0.56, 0.98)
C infractions		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	0.79 (0.56, 1.11)	0.50 (0.33, 0.77)
Inpatient mental health admissions		
M5 events		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	1.37 (0.64, 2.96)	1.38 (0.63, 3.01)
Self-harm		
Self-injury incident		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	4.04 (2.71, 6.02)	2.67 (1.66, 4.29)
Self-injury attempt		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	4.30 (2.31, 8.03)	2.94 (1.41, 6.14)
Restrictive housing		
Restrictive housing admission		
Post-restrictive housing	1.00 (reference)	1.00 (reference)
Post-TDU	0.82 (0.72, 0.93)	0.64 (0.55, 0.73)

[a] Adjusted for sex, mental health grade, number of infractions divided by the number of days in that incarceration, number of days with a mental health grade of 3 or higher divided by the number of days in that incarceration, number of days spent in restrictive housing divided by the number of days in that incarceration, number of days left of their incarceration, and highest substance use treatment recommendation to date during that incarceration made by NC DPS. All variables were measured at TDU-entry for people contributing post-TDU person-days or start of TDU-eligible restrictive housing for people contributing post-restrictive housing person-days, except for sex which was measured at prison entry.

negative impact on self-harm and no benefit in terms of A-level infractions and inpatient mental health admissions, relative to restrictive housing.

Infractions can result in admission to restrictive housing. Therefore, it was not surprising that the reduction in the incidence of all infractions post-TDU was accompanied by a reduced hazard of restrictive housing admission. These findings indicate that TDUs are an effective tool for preventing future restrictive housing assignment. Our weighted cumulative incidence curves indicate that at just one month following program release, 26% of the post-restrictive housing group, as compared to 18% of the post-TDU group, had already experienced a restrictive housing readmission. This finding is substantial, given the known association between restrictive housing placement and adverse mental health outcomes (Reiter et al., 2020; Kaba et al., 2014; Hagan et al., 2018; Bonner, 2006; Smith, 2006; Morgan et al., 2016; Toch, 2002; Miller and Young, 1997; Haney, 2003). Given our finding that TDUs reduce the incidence of future restrictive housing admission, continued implementation and evaluation of TDUs and other diversion programs is warranted.

Inpatient mental health admissions represent a severe mental health-related outcome. We previously found that current enrollment in TDUs was associated with a protective effect on inpatient mental health admissions, as compared to restrictive housing (Remch et al., 2021). However, findings from the current analyses indicate that following release from these environments, the hazard of inpatient mental health admissions was potentially elevated post-TDU compared to post-restrictive housing. Notably, the estimate was imprecise due to the low prevalence of inpatient mental health admission. Thus, further research is warranted.

In prior analyses, we found that TDU enrollees demonstrated a considerably reduced rate of self-injury while enrolled in the program, as compared to their peers in restrictive housing (Remch et al., 2021). In this analysis, we found an increased rate of self-injury post-TDU compared to post-restrictive housing. These findings indicate that the previously observed benefits of TDU on self-injury may not persist after release from the program and that self-injury outcomes occur more quickly post-TDU compared to post-restrictive housing. Lack of sustained impacts on self-injury outcomes is consistent with prior research of psychological interventions in prisons which show that initial treatment benefits, including reduced depression and anxiety, were not sustained three and six months post-intervention (Yoon et al., 2017). We hypothesize that individuals leaving TDU experience a notable reduction in therapeutic and treatment-oriented support services and that this disruption in services leaves some vulnerable to a regression in symptoms. Although TDU tapers services throughout the program, we speculate that individuals would benefit from sustained availability of mental health treatment programming following TDU completion to support continued therapeutic gains.

A specific modality of sustained but less intensive treatment exposure may exist within NC prisons' outpatient treatment unit model. These units, already in operation, are less intensive than TDU and provide a structured environment with behavioral health staff and mental health services. NC Prisons is currently exploring utilization and expansion of this model for post-TDU stability and safety as a potential pathway to specifically support the needs of many individuals for whom the TDU is designed. We hypothesize that bolstered use of these units might support the ongoing stability and wellness post-TDU; that future evaluation of these efforts is warranted.

Other restrictive housing diversion programs nationwide have not been thoroughly evaluated and none, to our knowledge, have evaluated sustained program impacts after completion of the diversion programs. However, there have been some evaluations of other psychological interventions for individuals in prison. In a meta-analysis of psychological interventions in prisons, while interventions showed initial effectiveness, for depression, anxiety, psychopathology, trauma, and anger or hostility, there was no continued effect of treatment three and six months post-intervention (Yoon et al., 2017).

3.1. Limitations

Results should be interpreted in the context of limitations. In development of IPTWs, we attempted to account for measured factors known to affect TDU selection and hypothesized to affect our outcomes. However, TDU selection is a complex decision in which clinicians weigh many factors including perceived likelihood of success in the TDU, and not all of these factors can be measured, leading to so-called "residual confounding." For example, mental illness severity, captured primarily through clinician notes and staff consultation, may not be perfectly measured in mental health grades. Additionally, the accuracy of analyses depends on data completeness. While administrative dates are likely to be very accurate, other data are subject to potential missingness. For example, in order for infractions data to be accurate, an

infraction must be observed and documented by staff. While it is possible that there are some missing data, this missingness is unlikely to be systematically related to TDU or restrictive housing placement, and thus would not result in bias in our prospective design. We recognize that individuals with mental illness may feel vulnerable in prison. We suspect that some small proportion of individuals with mental illness may seek protection in what they perceive to be the safest environment in the prison including restrictive housing, TDU, or an inpatient mental health treatment unit. It is possible that the outcomes we investigate here are ways in which some individuals create avenues for safety and access to mental health treatment. Our analyses are unable to account for this potential "reverse causation" bias. Finally, prison systems vary in their populations and policies. These results may not be generalizable to other prison systems, with different practices around restrictive housing, mental health treatment, and infractions.

4. Conclusions

Overall, we found sustained positive impacts of TDUs on subsequent B- and C-level infractions and restrictive housing re-admissions. However, results did not support sustained impacts regarding previously identified immediate benefits of TDUs (Remch et al., 2021) on the more severe A-level infractions, inpatient mental health admissions, and self-injury. Additional research is warranted to investigate factors that may contribute to improving these treatment outcomes. For example, efforts are needed to pilot and evaluate additional restrictive housing diversion programming and post-diversion program supports with sustained mental health services. Additionally, while TDUs were associated with a reduced incidence of restrictive housing readmission, as compared to those coming from a recent restrictive housing episode, we still observed that more than a third were readmitted to restrictive housing within the first three months following TDU release. Additional work is needed to reduce restrictive housing, both by limiting the circumstances under which and length for which restrictive housing is assigned and by providing alternatives for incarcerated individuals with mental health disorders that address their mental and behavioral health needs.

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Charles Mautz and Gary Junker are employed by the NC Department of Public Safety and were involved in the development and implementation of the TDU program evaluated here. No other financial disclosures were reported by the authors of this paper.

Credit author statement

Molly Remch: Formal analysis, Methodology, Writing – original draft, Writing – review and editing. **Charles Mautz:** Data curation, Writing – original draft, Writing – review & editing. **Anna E. Austin:** Methodology, Writing – original draft, Writing – review & editing. **Gary Junker:** Conceptualization, Writing – review & editing. **Stephen W. Marshall:** Methodology, Writing – review & editing. **Scott Proescholdbell:** Conceptualization, Writing – review & editing. **Rebecca B. Naumann:** Conceptualization, Funding acquisition, Methodology, Writing – review & editing.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Charles Mautz and Gary Junker are employed by the NC Department of Public Safety and were involved in the development and implementation of the TDU program evaluated here. No other financial disclosures were reported by the authors of this paper.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2022.107318.

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