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The Calculating for an Adequate Systems Tool (CAST): A Low-Cost and Effective Tool to Improve a Community's Substance Use Disorder Care Preparedness

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Title Page

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The opioid crisis is a public health problem that has continued to affect North Dakota, despite the decreasing opioid prescribing rate after the March 2016 release of Center for Disease Control's "Guidelines for prescribing opioids for chronic pain" (1–3). Exploring solutions to the opioid crisis has been complicated by North Dakota's rural nature, which encompasses geographic, technological, and staffing challenges. While the focus has been on finding solutions, existing resources in a community can play a prominent role in combatting this crisis. However, it can be difficult to analyze how rural communities are faring compared to more urbanized populations in terms of available data (4). To help quantify rural community preparedness, the authors suggest using a relatively new tool, The Calculating for an Adequate Systems Tool (CAST), which was initially developed by Green et al in 2016 (5). CAST uses demographics, social, and community indicators to produce a regional risk score for hospitalization due to substance use disorders (SUDs) and highlights which community's SUD care system resource areas are lacking or redundant. For example, a community may learn that improving educational outcomes may have a larger impact addressing alcohol abuse than building a new detox facility.

A vast majority of the required data for CAST is freely available online, making the tool accessible and low-cost. When specific data was not available through online resources, the study authors discussed with the CAST authors and developed proxies to adapt the tool to match the data available for the study subject, the rural community of Towner County, ND. The authors studied Towner County because, anecdotally, it was proclaimed as a success story in the opioid epidemic in North Dakota. Specifically, by using CAST, the authors identified elements of success in this example, redundant areas regarding resource utilization, and areas to improve resource allocation. These results were reviewed with Towner County community leaders to assist with short and long-term planning to improve behavioral health.

Methods

CAST is built on the four Substance Abuse and Mental Health Services Administration (SAMHSA) Continuum of Care categories (6), to which the authors added a fifth, *Referral*, with components that were tested and validated. Thus, the final categories include *Promotion, Prevention, Referral, Treatment* and *Recovery*. CAST assesses all these 5 categories and their components.

The information needed to quantitatively measure the above-mentioned components was obtained and incorporated in Table 1 using the CAST 2.1 Manual, made available to us by Green et al. (7). The authors will refer to it as "*The Manual*" for the rest of this paper.

The Manual uses a mixed methods approach for assessing county-level SUDs care systems: secondary data from national databases and information from key community leaders.

Table 1 inputs secondary data found in the U.S. Census Bureau American Community Survey 5-year estimates from 2013-2017 and other databases. This data includes disparities (gender and race) and determinants: rurality, high school drop-out rate, veteran population, household poverty prevalence, education level, death of spouse stress level, prevalence of health insurance, presence of social associations, alcohol outlet density, violent crime level, designation of the county as a high incidence drug trafficking area (HIDTA), access to physical activity, and percentage of the population that is age 18 or below.

Thus organized, the data is integrated into an Excel spreadsheet, the CAST 2.1 Tool proper https://www.cdc.gov/pcd/issues/2016/docs/16_0190_Appendix.xlsx. Essentially, this Tool is a calculator that uses mathematical formulas from health modeling and analytics to calculate a weighted score for each of its components.

These scores are then compared to accepted decision-making models based on known impact of factors to a desired outcome in the SUD continuum of care. The comparisons will reflect a need or an excess of resources for that specific component.

Data is also utilized to calculate a county risk level of hospitalization due to drug/alcohol diagnosis. This county risk level was compared to the national median rate of hospitalization for SUDs. Because the recommended national median rate of hospitalization data was not available at the time of the study, the most recent national average was utilized as a proxy to interpret the county risk level produced by CAST. The national average of hospitalization for SUD was 1,064 per 100,000, cited from the 2013-2015 data from the Healthcare Cost and Utilization Project (HCUP) (8) using alcohol, opioid, and cannabis as the top three most common substances.

In addition to disparities and determinants data, CAST calculates the usage rates for the five most commonly misused or abused substances according to the National Survey on Drug Use and Health (NSDUH) (9). These usage rates are not included in the overall risk score but are calculated to further help the community have an estimate of its SUD burden. As defined by *The Manual*, the five substance categories are alcohol (heavy alcohol use in the past month), cannabis, cocaine, opioid misuse (heroin), and pain reliever (including prescription opioids) and prescription psychotropics in the past year. Of note, the default national usage rates from 2016 from NSDUH that were originally in the CAST spreadsheet were updated to the North Dakota 2017-2018 NSDUH (9).

Table 1. Description of Towner County Community Characteristics Methods of Calculations (Demographics, Social, and Community Indicators of SUDs)

Community Characteristic	Method	Data Source
Percentage of the adult population that is male	Number of males who are age 18 and over divided by the total population who is age 18 and over.	Table S0101 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (10)

Percentage of the population that is non-White	This percentage was calculated by subtracting those who "identify with one race as White" from 100 to get the total percentage of those who do not identify as White.	Table DP05 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (11)
Percentage of county that is rural	Towner County is 100% rural as defined by the U.S. Census Bureau because its population is "outside Census Places with a population greater than or equal to 2500."	Economic Research Service, USDA (U.S. Census Bureau, 2007) (12)
High school drop-out rate	Number of people 25 and over without a high school diploma divided by the total number of people 25 and over.	Table S1501 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (13)
Veteran population	Count, as listed.	Table S2101 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (14)
Percentage of households with income below $35,000	The sum of the percentages of households whose income was less than $35,000.	Table S1901 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (15)
Percentage of the population with a college degree	Percentage listed for "those with a bachelor's degree or higher."	Table S1501 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (13)
Percentage of the population that is widowed or divorced	The sum of the number of widowed and number of divorced individuals, divided by the total population over the age 15 years.	Table S1201 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (16)
Percentage uninsured	As listed.	Table S2701 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (17)
Association rate	This rate was calculated by	Social Capital Variables

	adding up the amount of religious, professional, political, and business associations using data from the U.S. Census with NAICS code 813. This number was then divided by the population of Towner County and then multiplied by 100,000 to find the association rate per 100,000 people.	(PennState College of Agricultural Sciences, 2017) (18) Table S0101 ACS (2017 5-Yr) (U.S. Census Bureau 2018) (10)
Region designated as a high-density drug trafficking area	The Midwest HIDTA (High Intensity Drug Trafficking Area) program considered Towner County to not be a high drug trafficking area in North Dakota.	High Intensity Drug Trafficking Areas Program (National HIDTA Assistance Center NHAC, 2018) (19)
Alcohol outlet density rate	Since North Dakota does not collect data on alcohol outlet density, the authors used a proxy: The number of establishments with liquor licenses (20) divided by the total number of establishments in Towner County (21).	Current License List for Alcoholic Beverages (North Dakota State Government, 2019) (20) 2016 SUSB Annual Data Tables by Establishment Industry (US Census Bureau, 2018) (21)
Violent crime rate	This rate was developed using the 5-year rate provided by the Towner County Community Profile.	Towner County Community Health Profile (Miller et al, North Dakota Dept of Health Services, 2018) (22)
Percentage of population with access to physical activity	Defined as “individuals that reside in a census block that is within a half mile of a park or reside in a rural census block that is within three miles of a recreational facility.”	North Dakota County Health Rankings Reports (University of Wisconsin Population Health Institute, 2017) (23)
Percentage of the population that is age 18 or below	As listed.	Table S0101 ACS (2017 5-Yr) (U.S. Census Bureau, 2018) (10)

ACS = American Community Survey

NAICS = North American Industry Classification System (NAICS, pronounced Nakes)
USDA= United States Department of Agriculture

The next step was to input the substance use rates listed in Table 4.

The authors used the SAMHSA 2017-2018 National Survey on Drug Use and Health for North Dakota data. When a specific *Manual* category did not match available data from SAMHSA, the authors used proxies under Dr. Green's guidance. Instead of *The Manual's* "Heavy Alcohol" category, the authors used SAMHSA's "Binge Alcohol Use," defined as "drinking five or more drinks (for males) or four or more drinks (for females) on the same occasion (i.e., at the same time or within a couple of hours of each other) on at least 1 day in the past 30 days."

No proxies were needed for Marijuana and Cocaine Use Disorder; information was directly available.

The Manual's "Opioid Misuse" category was translated into SAMHSA's "Heroin used last year", as there was no category specific for opioids on SAMHSA's database. This category excluded prescription opioids, since they are included in the "Pain Reliever and prescription psychotherapeutics misuse" category: "Misuse of prescription psychotherapeutics is defined as use in any way not directed by a doctor, including use without a prescription of one's own; use in greater amounts, more often, or longer than told; or use in any other way not directed by a doctor. Prescription psychotherapeutics do not include over-the-counter drugs."

The last step was to input the Behavioral Health and SUDs care services available in Towner County, which the authors listed in Table 2 "Regional Need".

Table 2. Regional Need for Behavioral Health Care Services in Towner County

Continuum of Care Category	**Description and unit of data collection according to *The Manual***	**Data Collection Method**
Promotion		

Marketing Advertisement	"Intentional, informational campaigns that use advertising theories to alert community members of a substance use problem and/or treatment program." Unit: Single advertisements	The number of substance abuse advertisements and articles that were posted on the Towner County Public Health Department (TCPHD) (24) Facebook page per week multiplied by 52.
Media Advocacy Events	"Organized in-person gatherings aimed at raising awareness about a potential problem related to behavioral health or substance abuse in the community." Unit: single events	A count of four events per year was confirmed by TCPHD.
Community Coalitions	"An intentional collective of local organizational leaders who are non-profit, in politics, or in business who receive and allocate grant funding to prevent substance use, abuse, and/or dependence." Unit: Single coalitions	Correspondence with both institutions identified TCPHD along with Heartview Foundation (25) in Cando to be the community's one coalition.
Prevention		
School-based prevention programs	"Evidence-based substance use prevention or mental health promotion programs provided in schools for children 12 years and older." Unit: Evidence-based programs being implemented within schools	Correspondence with the TCPHD and the North Star school site (26) (the main school district in Towner County) yielded Parents Lead and Youth Mental Health First Aid as the two existing programs.
Community-based prevention programs	"Evidence-based substance use prevention or mental health promotion programs provided by non-profit or social service agencies for community members." Unit: Evidence-based programs being implemented within community setting	Correspondence with TCPHD confirmed that at least one parent event happens per year.

Housing Vouchers for homeless residents	Including those managed by public housing agencies, used to establish low-income residents a higher degree of neighborhood mobility. Unit: Individual vouchers	The number of housing voucher programs were recorded as listed on Towner County Housing Authority website (27).
Needle Exchange	"A social service that provides IV drug users hypodermic needles and accessories for little to no cost." Unit: Needle exchange locations	Correspondence with TCPHD established that the first location was made in July 2019.
Prescription Drug Disposal Events/Location	"Places where officials of permanent return programs collected these drugs." Unit: Drug disposal locations	NABP drug disposal locator site (28) for Towner County confirmed two locations. Communication with TCPHD also confirmed two Take Back Program events.
Referral		
Adult Specialty Courts	"Courts that provided substance abuse treatment, case management, and supervision, not including mental health courts unless specific services were provided for individuals with co-occurring conditions." Unit: Courts	The North Dakota Court System website (29) did not state any specialty adult courts for Towner County.
Youth Specialty Courts	"Courts that provided substance abuse treatment, case management, and supervision for juveniles, not including mental health courts unless specific services were provided for individuals with co-occurring conditions." Unit: Courts	The North Dakota Court System website (30) did not state any specialty juvenile courts for Towner County.
Primary Care Doctors with Substance Abuse training	"Primary care doctors who have received or attended specific training for substance	There were no primary care doctors identified by SAMHSA (31) and the

	abuse recognition and willing to engage in short interventions." Unit: Individual doctor	American Society of Addiction Medicine directory (32) who had received or attended this type of training.
Mental Health Awareness Trained Police	"Police officers serving a community who have received additional education and training on how to recognize and respond to mental health needs." Unit: Individual officer	Correspondence with the sheriff of Towner County: no police officers with formal training on how to address and respond to mental health needs.
Social Workers	"Social workers who have received training or education related to the identification of substance abuse and/or mental health disorders." Unit: Individual social workers	Correspondence with Heartview staff about the current number of Social Licensed social workers with substance abuse or mental health focus.
Treatment		
Inpatient		
Detoxification	"Facilities providing in hospital or residential detoxification."	SAMHSA treatment locator site (33) and confirmed by correspondence with Heartview staff.
24-hour/Intensive Day treatment	"Facilities providing non-residential, psychiatric care programs, lasting two or more hours per day for 3 or more days per week."	SAMHSA treatment locator site (33) and confirmed by correspondence with Heartview staff.
Short term (30 days or fewer)	"Facilities providing less than 30 days of non-acute care in a setting with treatment services for alcohol and other drug abuse and dependency."	SAMHSA treatment locator site (33) and confirmed by correspondence with Heartview staff.
Long-term (more than 30 days)	"Facilities providing 30 days or more of non-acute care in a setting with treatment services for alcohol and other drug abuse and dependency."	SAMHSA treatment locator site (33) and confirmed by correspondence with Heartview staff.

Outpatient		
Detoxification	"Facilities providing outpatient or ambulatory detoxification."	SAMHSA treatment locator site (33) and confirmed by correspondence with Heartview staff.
Counselors	"Counselors licensed by the state to assist clients with drug and alcohol issues."	Correspondence with Heartview staff and local community members, as the U.S. Bureau of Labor statistics included data only for the East North Dakota non-metropolitan area (34).
Psychiatrists	"Psychiatrists listed as specializing in substance abuse and addiction issues."	Correspondence with local community members.
Psychologists	"Psychologists listed as specializing in substance abuse and addiction issues."	Correspondence with Heartview staff and local community members.
Opioid Treatment Program (OTP)	"Offer[ing] daily supervised dosing of methadone and increasingly of buprenorphine."	SAMHSA treatment locator site (33) and correspondence with local community members.
Office based opiate substitution (OBOT)	"Provid[ing] medication on a prescribed weekly or monthly basis, is limited to buprenorphine."	Correspondence with Heartview staff and local community members.
Recovery		
Religious or spiritual advisors for those who have been involved with treatment in the past 5 years	"Individual, religious or spiritual professionals providing substance abuse therapy and counseling."	Correspondence with local community members; they reported that there is a single member of the clergy who is trained specifically in mental health and substance abuse.
Twelve-step groups for those who have been involved with treatment in the past 5 years	"Number of substance abuse support groups offered weekly."	Correspondence with local community members. They described two Alcoholic Anonymous groups, one

		Narcotics Anonymous group and one Celebrate Recovery group. All meet regularly in Cando, ND.
Transportation for those receiving treatment	"Number of vouchers provided within a year to assist those seeking treatment."	Correspondence with Heartview staff and local community members.
Employment support for those receiving treatment	"Number of programs offered by each responding or reported group."	SAMHSA treatment locator site (32) and correspondence with local community members.
Educational support for those who have completed treatment in the past 3 years	"Number of programs offered by each responding group."	Available adult learning centers at https://www.nd.gov/dpi/ (35) and confirmed by correspondence with local community members.
Parenting education for individuals with a use disorder	"Number of programs offered by each responding group."	Correspondence with local community members.
Housing Assistance	"Number of programs offered by each responding group."	SAMHSA treatment locator site (33), confirmed by correspondence with Heartview staff and local community members.
Insurance Assistance	"Individual professional who provide insurance enrollment support."	www.healthcare.gov (36) and confirmed by local community members.

NABP = National Association of Boards of Pharmacy
SAMHSA = Substance Abuse Mental Health Services Administration
TCPHD = Towner County Public Health Department
*Heartview = Heartview Foundation is the largest private, non-profit treatment facility for alcohol and substance use disorders in ND

The Manual describes three levels for the aggregated and calculated risk for a given community in comparison to the national median for hospitalization due to drug/alcohol diagnosis and suggests an action for each level. Low risk (green) is equal to or lower than the national median, and no further action is suggested. Medium risk (yellow) is between 0-25% above that of the national

median, and *The Manual* suggests examining the indicators listed on the Community Characteristics Tab "to see if you can work to address any of the social characteristics that are contributing to the overall risk score." High risk (red) is more than 25% above the national median, and *The Manual* suggests "considering undertaking a full analysis of the indicators, comparing proportions and the rates to those of the reference values (national averages) and work to identify local partnerships and coordination efforts to address the potentially chronic social and community determinants of disparities in the community."

Results

Following the above-described methods, the authors found the following values that describe Towner County's Regional Characteristics (Table 3) and Substance Usage Rates (Table 4).

Table 3: County Characteristics of Towner County

CAST: Behavioral Health Service Capacity Calculator		
Region Characteristics	**Data Entry**	**Hospitalization Risk Contribution**
Total Population	2,258	
Percent of adult population that is male	50.4	1
Percent of population that is non-White	8.3	0
Percent of county that is rural	100	3
High school dropout rate	6.6	0
Veteran population	158	0

Percent of households with income below $35,000	33	0
Percent of population with a college degree	18.1	0
Percent of population that is widowed or divorced	16.4	0
Percent of the population that is uninsured	8.7	0
Association rate per 100,000 people	220	0
Region designated as a high incidence drug trafficking area	0	0
Alcohol outlet density rate per 100 non-alcohol businesses	12.8	9
Violent crime rate per 100,000 people	88	0
Percent of population with access to physical activity	52	0
Percent of the population that is age 18 or below	24.1*	0
Total		**13**

*This percentage is written as a percent for consistency; it is used in the Calculator as a decimal

Table 4: Substance Usage Rates for North Dakota:

Total Population of Region						

2258	**Usage rates**	**Total Estimated # of users in region**	**Total estimated # of users in region with use disorders**	**Estimated # of users in region who will receive treatment**	**Estimated # of users in region needing but not receiving treatment in past year**	**Percentage of users with use disorder who are needing but not receiving treatment in the past year**
Alcohol	34.1%	769	128	11	118	92%
Marijuana	12.2%	275	79	2	64	81%
Cocaine	1.6%	36	36	1	29	80%
Opioid Misuse (Heroin used last year)	0.4%	9	9	2	7	77%
Pain Reliever (including prescription opioids) and prescription psychotherapeutics	3.8%	86	16	3	13	81%
Totals		1045	192	18	166	86%

Of note, the Table 4 information is "ideally used to support development of a comprehensive substance abuse care system, but not intended to explicitly enable planning of services to treat individuals with a certain addiction" (*The Manual*). Interestingly, it appears that alcohol users who need treatment but are not receiving treatment is the category with the highest need. The total percent of users who need treatment but are not receiving treatment across all drug users is 86%.

According to *The Manual*, the "adjusted community need" is based on the proportion of the population that is estimated to want to use the program or component. The values in the "adjusted community need" column were subtracted from the values in the "observed community totals" column to calculate the "estimated need" column, which was then used to assess the number of resources in the community in rapport to a specific community component.

Table 5. Results: Calculations of Regional Need for Behavioral Healthcare Services

CAST 2.1 Results: Calculations of Regional Need for Behavioral Health Care Services					
Components	**Maximum Community Need**	**Program Usage Rate**	**Adjusted community need**	**Observed Community Totals**	**Estimated Need**
Promotion					
Marketing Advertisements	14	*85%*	12	104	92
Media Advocacy Events	9	*3%*	0	4	4
Community Coalitions	0	*7%*	0	1	1
Prevention					
School-based prevention programs	0	*93%*	0	2	2
Community-based prevention programs	5	*12%*	1	2	1
Housing Vouchers for homeless residents	40	*20%*	8	10	2
Needle Exchange	0	*45%*	0	1	1
Prescription Drug Disposal Events/Locations	0	*60%*	0	4	4
Referral					
Adult Specialty Courts	1	*1%*	0	0	0
Youth Specialty Courts	0	*1%*	0	0	0
Primary Care Doctors w/ SUD training	0	*10%*	0	0	0
MH Awareness Trained Police	0	*100%*	0	0	0
Social Workers	1	*87%*	1	1	0
Treatment					
Inpatient					
Detoxification	0	*13%*	0	0	0

24-hour/Intensive Day treatment	**0**	*8%*	0	1	1
Short-term (30 days or fewer)	**1**	*5%*	0	1	1
Long-term (more than 30 days)	**1**	*6%*	0	1	1
Outpatient					
Detoxification	**0**	*13%*	0	1	1
Counselors	**2**	*35%*	1	4	3
Psychiatrists	**2**	*27%*	0	0	0
Psychologists	**2**	*4%*	0	1	1
Opioid Treatment program (OTP)	**0**	*25%*	0	0	0
Office based opiate substitution (OBOT)	**1**	*25%*	0	1	1
Recovery Support					
Religious or spiritual advisors for those who have been involved with treatment in the past 5 years	**7**	*11%*	1	1	0
12-step groups for those who have been involved with treatment in the past 5 years	**2**	*30%*	1	4	3
Transportation for those receiving treatment	**462**	*14%*	65	5	-60
Employment support for those receiving treatment	**2**	*5%*	0	1	1
Educational support for those who have completed treatment in the past 3 years	**0**	*14%*	0	0	0
Parenting education for individuals with SUD	**8**	*7%*	1	0	-1
Housing Assistance	**2**	*7%*	0	1	1

Insurance Assistance	1	*43%*	0	2	2

MH – Mental Health
SUD – Substance Use Disorder

A few regional characteristics and social and behavioral health resources were found to be on the positive end of the spectrum. Despite Towner County being considered 100% rural with a very small population of 2,258 (Table 5), they did have a very active behavioral health marketing campaign which greatly exceeded their estimated *Promotion* need by having 104 advertisements (adjusted need: 12), 4 media advocacy events (adjusted need: 0), and one community coalition (adjusted need: 0) (Table 5). They also appeared to do well in terms of community *Prevention* programs, housing vouchers, needle exchange programs, and prescription drug disposal events/locations by meeting the adjusted community need for each of those categories (Table 5).

Among the five continuum of care categories, the authors found deficiencies in *Referral* (no mental health awareness training for police, nor specialty courts) and *Recovery*; the latter appeared to be the most in need. The number of vouchers for transportation for those needing treatment was lacking by 60 vouchers for the 65 adjusted vouchers needed for this community. There were also no educational support programs for those who have completed treatment in the past 3 years as well as no parenting education for individuals with SUD.

The authors found the Towner County Region Risk of Hospitalization for Drug or Alcohol Related Cause to be 13, which is compiled from the county regional characteristics data from Table 3. This is a medium (yellow) risk score, estimating a 0-25% increase in hospitalization rate for drug or alcohol related causes in comparison to the national median in 2016.

Discussion

By using CAST, this tool can give the current count of resources that are available and can provide suggestions for more cost-effective ways to improve treatment options. Upon looking at

the results from the Behavioral Health Resources table (Table 5), it appears that Towner County is doing relatively well in the *Promotion, Prevention* and *Treatment* categories. Given the rurality of Towner County, having the Heartview Foundation and an active public health office are remarkable resources for individuals suffering from SUD. Categories that could be improved upon are *Referral* and *Recovery* support.

In the *Referral* category, mental health awareness training for police may make a difference: world-wide, there are various programs that have educated police officers that disruptive behaviors may be the result of prior traumas or mental illness. Partnership with mental health providers has also been beneficial (37). Referral to the mental health care system instead of the prison system lowers the rate of arrests and lowers the recidivism rate, by providing people with more mature coping skills that will help them avoid escalations in the future (38).

Increased mental health awareness in law enforcement may also make better use of the court system, particularly specialty courts, which are lacking in Towner County. The community leaders expressed determination to remedy these detected deficiencies.

Implementing training for primary care doctors to provide SUD treatment may be a reasonable proposition. The current medication assisted treatment (MAT) trainings require 24 hours. Mid-level providers: nurse practitioners (NPs), physician assistants (PAs), certified nurse specialists (CNSs), certified registered nurse anesthetists (CRNAs), and certified nurse midwives (CNMs) are also qualified to provide MAT once they complete the 24-hour training. State laws may require them to be supervised or work in collaboration with a qualifying physician. However, hiring social workers to boost the referral system may be more difficult to accomplish in a rural state. In addition, the authors did not factor in the expansion of telehealth, which may bring in locally the resources that are sorely needed.

In terms of *Recovery*, the authors identified transportation as a barrier to patients seeking care, due to Towner County's rurality. Healthcare insurance policies are an additional barrier: to qualify for transportation vouchers, the recipient is typically un or underinsured, creating a barrier to receiving care at Heartview. Correspondence with the community leaders indicated that offering transportation vouchers would significantly improve access to substance use treatment programs; the authors therefore advocate for changes in insurance coverage policy.

The tool determined a lack of educational support programs for those who have completed treatment. The nearest vocational center is in Devils Lake, ND, located 36 miles in the neighboring county. In discussing with community leaders, a solution may be to implement these types of programs at Towner County's Heartview Foundation, possibly in conjunction with the center in Devils Lake. They commented that a strategy proven to reduce relapse rates and improve social integration would be helpful to a vulnerable population with limited transportation means.

The tool also recognized a need for parenting education courses for individuals with SUD. It appears Towner County does have some parenting classes sporadically offered at the school, but it was noted that these are not well attended. More frequent and regular parent education programs for individuals with SUD would be beneficial. Empowering parents to talk to their children regarding substance use could be an effective adjunct strategy for school-based prevention programs (39).

Because the risk of hospitalization score is based on the county regional characteristics (Table 3), the authors noted that variables that appeared to contribute the most were the percentage of male inhabitants, the rurality of Towner County, and the alcohol outlet density. Their risk contributions were 1, 3, and 9 respectively (Table 3), which constituted the total risk score of 13. While the first two characteristics are relatively immovable social determinants, the density of

alcohol outlets is susceptible to change. Because a score of 13 is considered a medium risk score, *The Manual* suggests an evaluation of resources as per above.

Limitations of the study included, as expected, difficulty obtaining appropriate, accurate data sources. While *The Manual* provided good references to start, several resources did not apply to Towner County itself, especially due to its rurality. For example, there was difficulty determining the current number of social workers within Towner County. To minimize inaccurate data, the authors verified many of the community indicators by personal correspondence with individuals from the Towner County public health office, sheriff's office, and Heartview Foundation. When replicating the study using a larger population, personal correspondence with community members may not be as feasible, nor as reliable.

Proxies had to be made as well to fill in missing data categories. For example, North Dakota does not regulate the alcohol outlet density, so a proxy had to be developed to include the number of liquor licenses per number of establishments. This proxy could have affected the risk score calculation, as it was a major component to the risk contribution (9 points out of 13). The authors express their appreciation for Dr. Green's input in building all the proxies.

The authors pondered the question of telehealth, especially for psychiatric care, psychotherapy, and MAT for opioid use disorders. Due to the current fluidity of the telehealth-related legislation and its large implications on availability of care, the authors elected to not include it as a component for quantifying the number of providers available in the capacity calculator.

It was also broached by the community members that Towner County services several neighboring counties, which makes it difficult to account for the availability/need ratio when

assessing a single county. On the other hand, this factor has been persistent and reflects the real service needs of Towner County.

The authors discussed the results with the community leaders, who provided insight on what areas would be most feasible to improve: strengthening peer support, having more primary care providers willing to do MAT, and developing more housing options. Although these suggestions are valuable ways to assist people with SUDs, they are a large undertaking.

Despite these limitations, this tool could provide a useful framework for both urban and rural communities to investigate current needs and identify resources that are already available, or even redundant, for treatment of SUDs. A large portion of the needed data may rely on personal correspondence, and is, in the authors' experience, crucial to obtain accurate information. Given the low cost of resources that are needed for this type of report and having *The Manual* as a guide to help researchers start their information search, CAST provides a way to quantify need, visualizes well-placed resources, and identifies areas of improvement. Further research opportunities may include comparison of different rural counties, studying the outcomes of training mid-level providers in MAT, and validation of proxies proposed or used in this article.

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Compliance with Ethical Standards

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical Approval This study did not involve human or animal subjects; it consisted of a secondary analysis of data available on public domain. IRB approval was not obtained for this study.

Any Applicable Disclaimer Statements None.

References:

1. Encinosa W, Bernard D, Selden TM. Opioid and non-opioid analgesic prescribing before and after the CDC's 2016 opioid guideline. Int J Health Econ Manag. 2021 May 8;1–52.

2. Guy GPJ, Zhang K, Schieber LZ, Young R, Dowell D. County-Level Opioid Prescribing in the United States, 2015 and 2017. JAMA Intern Med. 2019 Apr 1;179(4):574–6.

3. Schieber LZ, Guy GPJ, Seth P, Young R, Mattson CL, Mikosz CA, et al. Trends and Patterns of Geographic Variation in Opioid Prescribing Practices by State, United States, 2006-2017. JAMA Netw Open. 2019 Mar 1;2(3):e190665.

4. Gale JA, Hansen AY, Elbaum Williamson M. Rural Opioid Abuse Prevention and Treatment Strategies: The Experience in Four States - Rural Health Research Gateway [Internet]. Rural Health Research Gateway. 2017 [cited 2020 Apr 14]. Available from: https://www.ruralhealthresearch.org/publications/1108

5. Green B. A Tool for Assessing a Community's Capacity for Substance Abuse Care. Prev Chronic Dis [Internet]. 2016 [cited 2020 Nov 23];13. Available from: https://www.cdc.gov/pcd/issues/2016/16_0190.htm

6. Springer JF, Phillips J. The Institute Of Medicine Framework and its Implication for the Advancement of Prevention Policy, Programs, and Practice. In Center for Applied Research Solution; 2007. Available from: http://ca-sdfsc.org/docs/resources/SDFSC_IOM_Policy.pdf

7. Green B, Lyerla R, Stroup D, Jones K. Calculating an Adequate System Tool. (CAST) Manual. 2016; Available from: https://www.cdc.gov/pcd/issues/2016/16_0190.htm

8. Agency for Healthcare Research and Quality. Statistical Brief #245. Geographic Variation in Substance-Related Inpatient Stays Across States and Counties in the United States, 2013-2015. Healthcare Cost and Utilization Project (HCUP). [Internet]. U.S. Department of Health and Human Services; 2018 [cited 2020 Apr 14]. Available from: https://www.hcup-us.ahrq.gov/reports/statbriefs/sb245-Substance-Inpatient-Stays-Across-US-Counties.jsp

9. Center for Behavioral Health Statistics and Quality. 2017-2018 National Survey on Drug Use and Health: Model-Based Prevalence Estimates (50 States and the District of Columbia) [Internet]. Substance Abuse Mental Health Services Administration (SAMHSA); 2018 [cited 2020 Apr 14]. Available from: https://www.samhsa.gov/data/sites/default/files/reports/rpt23235/2k18SAEExcelTabs/NSDUHsaePercents2018.pdf

10. U.S. Census Bureau. 2013-2017: American Community Survey 5-Year Estimates, Age and Sex [Internet]. 2018 [cited 2020 Apr 14]. Available from: https://data.census.gov/cedsci/table?q=s0101&g=0500000US38095&tid=ACSST5Y2017.S0101&hidePreview=true

11. U.S. Census Bureau. 2013-2017: American Community Survey 5-Year Estimates, ACS Demographic and Housing Estimates [Internet]. 2018 [cited 2020 Apr 14]. Available from:

https://data.census.gov/cedsci/table?q=dp05&g=0500000US38095&tid=ACSDP5Y2017.DP05&hidePreview=true

12. U.S. Dept. of Agriculture. North Dakota - Rural Definitions: State-Level Maps [Internet]. U.S. Census Bureau; 2012 [cited 2020 Apr 14]. Available from: USDA-https://www.ers.usda.gov/webdocs/DataFiles/53180/25588_ND.pdf?v=0

13. U.S. Census Bureau. 2013-2017: American Community Survey 5-Year Estimates: Educational Attainment [Internet]. 2018 [cited 2020 Apr 14]. Available from: https://data.census.gov/cedsci/table?g=0500000US38095&tid=ACSST5Y2017.S1501&hidePreview=true

14. U.S. Census Bureau. 2013-2017: American Community Survey 5-Year Estimates, Veteran Status [Internet]. 2018 [cited 2020 Apr 14]. Available from: https://data.census.gov/cedsci/table?g=0100000US&tid=ACSST5Y2017.S2101&hidePreview=true

15. U.S. Census Bureau. 2013-2017: American Community Survey 5-Year Estimates, Income in the Past 12 Months [Internet]. 2018 [cited 2020 Apr 14]. Available from: https://data.census.gov/cedsci/table?g=0500000US38095&tid=ACSST5Y2017.S1901&hidePreview=true

16. U.S. Census Bureau. 2013-2017: American Community Survey 5-Year Estimates, Marital Status [Internet]. 2018 [cited 2020 Apr 14]. Available from: https://data.census.gov/cedsci/table?g=0500000US38095&tid=ACSST5Y2017.S1201&hidePreview=true

17. U.S. Census Bureau. 2013-2017: American Community Survey, 5-Year Estimates, Selected Characteristics of Health Insurance Coverage in The United States [Internet]. 2018 [cited 2020 Apr 14]. Available from: https://data.census.gov/cedsci/table?g=0500000US38095&tid=ACSST5Y2017.S2701&hidePreview=true

18. PennState College of Agricultural Sciences. Social Capital Variables Spreadsheet for 2014 [Internet]. The Pennsylvania State University; 2017 [cited 2020 Nov 22]. Available from: https://aese.psu.edu/nercrd/community/social-capital-resources/social-capital-variables-for-2014/social-capital-variables-spreadsheet-for-2014/view

19. National HIDTA Assistance Center NHAC. High Intensity Drug Trafficking Areas Program 2018 [Internet]. 2018 [cited 2020 Apr 14]. Available from: https://www.nhac.org/news/HIDTA_Counties.htm

20. North Dakota Office of Attorney General. Current License List for Alcoholic Beverages [Internet]. North Dakota State Government; 2019 [cited 2020 Apr 14]. Available from: https://attorneygeneral.nd.gov/sites/ag/files/documents/Gaming/Licensees-AlcoholicBeverage.pdf)

21. U.S. Census Bureau. Number of Firms, Number of Establishments, Employment, and Annual Payroll by Enterprise Employment Size for Counties, Totals: 2016 [Internet]. 2016 SUSB Annual Data Tables by Establishment Industry. 2018 [cited 2020 Apr 14]. Available from: https://www.census.gov/data/tables/2016/econ/susb/2016-susb-annual.html

22. Miller TK, Pinks K. Towner County Community Health Profile [Internet]. North Dakota Department of Health; 2018 [cited 2020 Sep 20]. Available from: http://www.ndhealth.gov/HealthData/CommunityHealthProfiles/Towner%20County%20Community%20Profile.pdf?ver=5

23. University of Wisconsin Population Health Institute. Access to exercise opportunities in North Dakota [Internet]. County Health Rankings & Roadmaps. 2017 [cited 2020 Apr 14]. Available from: https://www.countyhealthrankings.org/app/north-dakota/2017/measure/factors/132/data

24. Towner County Public Health Department. Towner County Courthouse | Public Health [Internet]. [cited 2020 May 21]. Available from: https://www.tccounty.com/public-health

25. Heartview Foundation - Home [Internet]. [cited 2021 Sep 23]. Available from: https://heartview.org/

26. North Star Schools - Home Page [Internet]. [cited 2020 Nov 23]. Available from: http://www.northstar.k12.nd.us

27. Affordable Housing Online. Towner County Housing Authority, Cando, North Dakota [Internet]. [cited 2021 Sep 23]. Available from: https://affordablehousingonline.com/housing-authority/North-Dakota/Towner-County-Housing-Authority/ND009

28. National Association of Boards of Pharmacy NABP. Drug Disposal Locator Tool [Internet]. Safe.Pharmacy. [cited 2020 Apr 14]. Available from: https://safe.pharmacy/drug-disposal/

29. State of North Dakota Courts. North Dakota Court System - Adult Hybrid DWI/Drug Courts [Internet]. [cited 2020 Apr 14]. Available from: https://www.ndcourts.gov/other-courts/adult-hybrid-dwi-drug-court

30. State of North Dakota Courts. North Dakota Court System - Juvenile Drug Court [Internet]. [cited 2020 Apr 14]. Available from: https://www.ndcourts.gov/other-courts/juvenile-drug-court

31. Substance Abuse Mental Health Services Administration (SAMHSA). Buprenorphine Treatment Practitioner Locator [Internet]. [cited 2020 Apr 14]. Available from: https://www.samhsa.gov/medication-assisted-treatment/practitioner-program-data/treatment-practitioner-locator

32. American Society of Addiction Medicine (ASAM). ASAM Member Portal [Internet]. [cited 2020 Apr 14]. Available from: https://asam.users.membersuite.com/community/physician-directory

33. Substance Abuse Mental Health Service Administration (SAMHSA). Map - SAMHSA Behavioral Health Treatment Services Locator [Internet]. [cited 2020 Apr 14]. Available from: https://findtreatment.samhsa.gov/locator

34. U.S. Dept. of Labor. East North Dakota nonmetropolitan area - OEWS Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates [Internet]. [cited 2020 Apr 14]. Available from: https://www.bls.gov/oes/current/oes_3800007.htm#21-0000

35. North Dakota Dept. of Public Instruction (NDDPI). Adult Learning Centers Interactive map of the ALC's in North Dakota. [Internet]. North Dakota State Government; [cited 2020 Apr 14]. Available from: https://www.nd.gov/Dpi/

36. U.S. Centers for Medicare & Medicaid Services. Official site of Affordable Care Act [Internet]. HealthCare.gov. [cited 2020 Apr 14]. Available from: https://www.healthcare.gov/

37. Krameddine YI, Silverstone PH. How to Improve Interactions between Police and the Mentally Ill. Front Psychiatry [Internet]. 2014;5:186. Available from: https://europepmc.org/articles/PMC4294132

38. Janopaul-Naylor E, Morin SL, Mullin B, Lee E, Barrett JG. Promising Approaches to Police-Mental Health Partnerships to Improve Service Utilization for At-Risk Youth. Transl Issues Psychol Sci. 2019;5(2):206–15.

39. Garcia-Huidobro D, Doty JL, Davis L, Borowsky IW, Allen ML. For Whom Do Parenting Interventions to Prevent Adolescent Substance Use Work? Prev Sci [Internet]. 2018 May 1;19(4):570–8. Available from: https://doi.org/10.1007/s11121-017-0853-6