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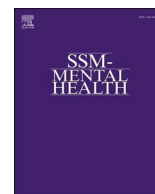
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Intersectional analysis of suicide risk among transgender and non-binary people

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ABSTRACT

Transgender and non-binary (TNB) people experience high rates of suicidal thoughts and behaviors, but less is known about how suicide risk varies within TNB communities. We investigated variation in suicidality among TNB people across intersecting social identities and positions. This study uses data from Trans PULSE Canada, a 2019 community-based survey of TNB people aged 14+ in Canada. Among 2054 participants aged 16+, conditional inference trees (CTREE) were used to identify subgroups with varying levels of past-year suicidal ideation and suicide attempts. Twelve predictor variables were chosen through literature review and community knowledge based on their relevance to suicide risk. Findings show that over the past year, 30.2 % of participants reported suicidal ideation and 4.2 % reported a suicide attempt. Six subgroups with varying levels of past-year suicidal ideation were identified, with a higher prevalence of ideation among those with lower educational attainment (particularly youth aged 16–24; 49.4 %) and among college-educated participants who identified as disabled (38.3 %). The CTREE for past-year suicide attempts identified variation across three subgroups: participants aged 16–19 (11.0 % attempted), and those aged 20+ with or without a history of sex work (8.4 % and 2.5 %, respectively). In conclusion, past-year suicidal ideation and attempts were high compared to general population estimates, although somewhat lower than in previous Canadian TNB studies. Suicide attempts were concentrated among those aged 16–19, and amongst those 20+ with a history of sex work. Suicide prevention research should investigate individual and structural level interventions to reduce disproportionate suicide risk among these groups.

1. Introduction

Suicide risk among transgender and non-binary (TNB) people is a public health crisis. The prevalence of suicidal ideation and attempts is consistently higher among TNB people as compared to the broader population (McNeil et al., 2017). For example, the 2015 United States (US) Transgender Survey (n = 27,715) found that 48 % of TNB people experienced suicidal thoughts and 7 % had a suicide attempt in the past-year (James et al., 2016). Trans PULSE Ontario, a 2009 respondent-driven sampling study (N = 380), found that 35 % of transgender people in Ontario, Canada reported suicidal ideation while 11 % had attempted suicide over the previous year (Bauer et al., 2015).

In comparison, the 2020 Canadian Community Health Survey found that 2.6 % and 0.3 % of the general population aged 15+ in Canada experienced past-year suicidal ideation and attempts, respectively (Canada, 2022).

Factors that contribute to higher rates of suicidality among TNB people may include stigma, discrimination, and gender dysphoria (Bauer et al., 2015; Pellicane and Ciesla, 2022; Wolford-Clevenger et al., 2018). The minority stress theory seeks to distinguish the excess stress that members of stigmatized social groups – particularly lesbian, gay, and bisexual individuals – are exposed to (Brooks, 1981; Meyer, 2003). In other words, experiences of discrimination, expectations of rejection, and internalized homophobia can create stressful social environments

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that can exacerbate mental health problems (Meyer, 2003). The framework has been extended to TNB people who may be subjected to minority stress through external events, primarily through discrimination resulting from gender expression, gender non-affirmation, and transphobia at interpersonal and societal levels (Hendricks and Testa, 2012). Relatedly, gender dysphoria is distress resulting from the discrepancy between a person's gender identity and their sex assigned at birth (Cooper et al., 2020). Distress is often the result of body dysphoria and may also appear alongside isolation, anticipation of transphobia, and internalized transphobia (Cooper et al., 2020). Feelings of distress and exposure to chronic stressors may have consequences such as suicidal ideation, behaviors, and non-suicidal self-injurious behaviors (Botelho et al., 2023; Cooper et al., 2020).

Due to discrimination and barriers to mental health care services, many minoritized and marginalized groups have elevated levels of suicidal ideation and behaviors, such as some racially/ethnically minoritized groups, sexual minorities, people with disabilities, and those living in rural areas (CDC, 2024a, 2024b). For example, minoritized groups may experience social and economic deprivation that affects their ability to find affordable mental health providers or providers who are well-versed in their experiences of discrimination (Bastos et al., 2018; Ferlatte et al., 2019). However, it is important to note that these factors in isolation cannot accurately depict a complete picture of suicide risk.

The term intersectionality was introduced into legal scholarship to highlight the exclusion of Black women from both antiracist and anti-sexist policy, although the term is not exclusive to the intersection of race and gender (Bowleg, 2012; Crenshaw, 2015). Intersectionality as a theoretical framework acknowledges that health and social inequalities are influenced by the interlocking of systems of oppression (e.g., sexism and racism) (Bauer et al., 2021; Bowleg, 2012; Collins, 2015; Davis, 2008). Despite the overall increase in intersectionality-informed research, seldom does TNB health research incorporate an intersectional framework (Wesp et al., 2019).

Prior research has examined suicide risk across single axes of race/ethnicity, education, and income among TNB people (Adams and Vincent, 2019; Yockey et al., 2022), but research using an intersectional lens is lacking. Some research has applied an intersectional lens to suicide risk in non-TNB populations. For example, studies have found higher rates of suicide attempts for both Black and white non-Hispanic adolescent females compared to Hispanic adolescent females (McCoy and Kohlbeck, 2022) and higher levels of suicidal ideation and behaviors among Hispanic and non-Hispanic Black bisexual women living in nonmetropolitan areas compared to other intersections of gender, sexual orientation, race and ethnicity, and rurality (Forrest et al., 2023). However, these studies have not addressed intersections with gender minority status. Additionally, some quantitative intersectionality studies may have oversimplified or misinterpreted intersectionality's core tenets (Bauer et al., 2021). For example, the latter study discussed their results in the context of systems of oppression and social power, while the former study did not do this or provide a definition of intersectionality – the former study's methods only enabled analysis of cross-coded identity/position groups.

When considering suicidal ideation and attempts, it is important to recognize that distinct processes drive these outcomes. Several ideation-to-action theories distinguish suicidal ideation and attempts, including the interpersonal theory of suicide (IPTS). The IPTS posits that the co-occurrence of feelings of thwarted belongingness and perceived burdensomeness, when experienced as intractable, results in the motivation to die by suicide (Van Orden et al., 2010). The capability of suicidal behavior, sometimes termed acquired capability, may result in part from repeated exposure to fearful or physically painful events (Van Orden et al., 2010). The theory assumes that lethal or near-lethal suicide attempts result from a combination of the desire to die by suicide and acquired capability (Van Orden et al., 2010). Some research has applied IPTS concepts to TNB populations. One study noted that among a convenience sample of transgender and gender nonconforming people,

pathways exist in which constructs from the gender minority stress and resilience model (e.g., internal and external stressors) and the IPTS are related, and contribute to suicidal ideation among transgender and gender nonconforming people (Testa et al., 2017).

In this paper, we consider the IPTS and intersectionality together to interpret suicidality through an intersectional lens. Studies investigating the impact of intersecting social identities and positions on suicide risk can promote suicide prevention by shifting focus away from individual-level processes and instead focusing on root causes (e.g., power and oppression) that affect marginalized groups (Forrest et al., 2023). We expect variation in suicide risk across social identities and positions because social power impacts risk factors for suicide, including those posited by the IPTS. Previous work by members of our team has conceptualized IPTS factors as mediators of the relationship between TNB social exclusion and suicidality (Bauer et al., 2015). Other previous work has integrated these two models to understand suicidality among Black children (Opara et al., 2020), noting that Black children may experience thwarted belongingness and perceived burdensomeness because of their immediate environment and community (e.g., living in poverty or being abused), which are influenced by broader systems of oppression (e.g., racism and classism) (Opara et al., 2020). The goal of this paper is to investigate variations in suicidal ideation and attempts among TNB people across intersecting social identities and positions.

2. Methods

Data source and population. Trans PULSE Canada was a community-based participatory research study on transgender and non-binary health. A detailed description of the study methodology has been published elsewhere (Schein et al., 2021). Eligible participants were 14 years or older, had a gender identity different from their sex assigned at birth, and lived in Canada. Recruitment for the survey took place online, in-person at community events, and through outreach by Peer Research Associates. Data collection occurred from August to October 2019 via paper copy, online, or in-person with a Peer Research Associate. The survey could be taken in English or French, and participants could choose between the full-length survey (~60 min) or a short form (~10 min). The Trans PULSE Canada 2019 survey was approved by ethics boards at Western University, Unity Health Toronto, and Wilfrid Laurier University.

These analyses included only participants who completed the full-length survey and provided outcome data. The sample was also restricted to those aged 16 or older as socioeconomic-related variables may not apply (e.g., household income was not asked among those under 16).

Outcomes. This analysis used binary outcomes of past-year suicide attempts and past-year suicidal ideation (yes/no). The outcomes were measured through survey items that asked separately whether the participant had seriously considered (or attempted) suicide in their life and the past 12 months. Participants were only categorized as having a past-year suicide attempt if they indicated that during one of their past-year attempts, they intended to die, as the lack of intent would be considered non-suicidal self-injury.

Exposures. Twelve exposure variables were chosen through literature review and community knowledge based on their potential to predict suicidal ideation and attempts, their relevance to the TNB community, and how they reflect social power. First, the majority-TNB study team identified nine priority populations of focus (Indigenous gender-diverse people, immigrants, sex workers, people living in rural or remote areas, older adults, youth, non-binary people, and people with disabilities) for the Trans PULSE Canada study. In addition to variables reflecting these priority populations, we also selected sexual orientation, household income, housing status, education level, and visibility as TNB based on prior research demonstrating that these factors contribute to disparities in suicidality and other mental health outcomes (Adams and Vincent, 2019; Forrest et al., 2023; Glick et al., 2020; Tabler et al., 2021).

The 12 exposure variables were age, ethnoracial group, gender, sexual orientation, urbanicity, household income, housing status, education level, immigration history, disability status, sex work history, and visibility as TNB. Age was categorized as 16–19, 20–24, 25–34, 35–49, or 50+ years. Ethnoracial group categories included non-Indigenous white, non-Indigenous racialized, and Indigenous, and was based on two questions – whether the participant identified as or is treated as a person of color, and whether they were Indigenous to Canada (i.e., First Nations, Inuit, or Métis). Gender was categorized into five categories: (1) trans woman, (2) trans man, (3) non-binary assigned male at birth (AMAB), (4) non-binary assigned female at birth (AFAB), and (5) Indigenous or other cultural gender, based on separate questions about sex assigned at birth and gender identity. Sexual orientation included the following three categories: (1) straight/heterosexual, (2) lesbian, gay, bisexual, queer, or pansexual, and (3) asexual or another identity. For the income variable, participants were classified as living in low-income or not-low-income households based on the Statistics Canada low-income measure (S. C. Government of Canada, 2017). However, if a participant was aged 17–25 and did not provide household income information they were categorized as not applicable. Participants' highest level of education was coded as: (1) high school diploma or less, (2) some college/university/CEGEP (College of General and Professional Teaching), (3) completed college/university degree or CEGEP, and (4) graduate/professional degree (in progress or complete). Participants were also asked if they had done sex work or exchanged sex for money or other resources (e.g., shelter, food, etc.) and were then classified as non-sex-workers, current sex workers, or former sex workers. Visibility as TNB refers to how often the participant thought that cisgender (someone whose gender is the same as their sex assigned at birth) people knew they were TNB without being told (all the time, more than half of the time, less than half of the time, and never). The remaining variables were coded as binary: self-identification as disabled or living with a disability, immigration history (i.e., born in Canada), housing status (stable vs unstable), and urbanicity (rural vs urban).

Statistical analysis. We used conditional inference trees (CTREE) to define subgroups with varying frequencies of suicidal ideation and attempts. CTREE has been shown to perform well amongst data-driven exploratory analysis methods at predicting intersection-specific outcomes (Mahendran et al., 2022). CTREE is a type of decision tree that uses recursive partitioning of independent variables (Venkatasubramaniam et al., 2017). Groups are defined by a series of binary splits using a specified significance level. The final decision tree includes a set of terminal nodes, comprised of combinations of independent variables and their respective predictive outcome values.

Decision trees are unique from traditional regression methods in that they support complex, non-linear relationships. They automatically identify significant combinations of variables rather than requiring that the researcher pre-specify main effects and interaction terms, as in regression analyses (del Río-González et al., 2021). This is particularly helpful for exploratory intersectional work to identify interactions of social identities and positions that are not pre-specified. CTREE also includes observations with missing data, thus minimizing case loss. After the algorithm decides on a splitting variable, an observation with a missing variable is randomly assigned based on the proportions of the split (e.g., a 50/50 split of observations across a variable will result in 50/50 probability of being assigned to the left or right of the node).

Two separate CTREE models were run for suicidal ideation and attempts. An initial alpha value of 0.05 was indicated and stopping criterion was dictated by the adjustment of the significance threshold using a Bonferroni correction. Weights were applied to adjust the full-length survey data to the demographics of all Trans PULSE Canada participants (short and full-length survey participants). Variables used to create survey weights included current sex work status, ethnoracial group, language of survey completion, self-identification as autistic or neurodivergent, and low-income status. As some of the variables used to create survey weights were also exposure variables, we also ran

unweighted CTREE models as a sensitivity analysis. Data cleaning was conducted in SAS software, v9.4 (SAS Institute Inc, n.d.). CTREE analyses were completed in R Studio v2024.04.2 + 764 using the package 'partykit' (Hothorn et al., n.d.; RStudio Team, 2024).

3. Results

The Trans PULSE Canada study surveyed a total of 2873 TNB participants. After excluding short-form respondents ($n = 392$), 14–15 year-olds ($n = 66$), and those who did not provide outcome data ($n = 357$ missing both outcomes, 8 missing ideation only, and 4 missing attempts only), the analytic sample sizes were 2050 for suicidal ideation and 2054 for suicide attempts. Demographic information (weighted % and unweighted N) for the analytic sample for suicide attempts is presented in Table 1. In the weighted sample, 30.2 % reported past-year suicidal ideation, and 4.2 % reported a past-year suicide attempt. Most participants were aged 20–49 (81.1 %) and non-Indigenous white (80.5 %). About half (48.2 %) were trans men or women while 48.1 % were non-binary. A majority of the sample identified as lesbian, gay, bisexual, queer, or pansexual (68.5 %). Fifteen percent were current or former sex workers. Bivariate associations of the predictor variables with outcomes are provided in Supplementary Table 1.

Figs. 1 and 2 show conditional inference trees depicting the relationship between past-year suicidal ideation and attempts and the twelve potential predictor variables. Results from sensitivity analyses conducted with unweighted data produced negligible differences (i.e., identified subgroups remained the same and prevalence of outcomes did not deviate more than 1 %). As shown in Fig. 1, six terminal nodes were identified for suicidal ideation; the prevalence of suicidal ideation for these groups is shown in Table 2. Education was the initial splitting variable for suicidal ideation in the full sample, splitting those with a high school diploma or less from those with higher education. Those with a high school diploma or less were further split by age. Among participants with a high school diploma or less and aged 16–24, 49.4 % reported past-year suicidal ideation (terminal node 3), as compared to 30.7 % of their peers aged 25 or above (terminal node 4). Among those with more than a high school degree, the sample was split further by disability status. Those who completed some college/university or higher and identified as disabled reported a 38.3 % prevalence of past-year suicidal ideation (terminal node 11). Those who did not identify as disabled were split again by education level. Among non-disabled participants who completed some college or university, 30.2 % reported past-year suicidal ideation (terminal node 7). Those who completed college/university were further split by low-income status – 19.0 % of those who were not low-income and 28.3 % who were low-income (or NA) reported past-year suicidal ideation (terminal nodes 9 and 10, respectively).

Three terminal nodes were identified for suicide attempts (Fig. 2); prevalences are shown in Table 3. The initial splitting variable was age, splitting those aged 16–19 from those 20+. Eleven percent of those aged 16–19 indicated a past-year suicide attempt (terminal node 2). For those aged 20+, the next strongest predictor of suicide attempts was sex work history. Those aged 20+ who were current or former sex workers reported an 8.4 % prevalence of past-year attempts, compared to 2.5 % of those aged 20+ with no such history (terminal nodes 4 and 5, respectively).

4. Discussion

In this study of TNB people in Canada, we found high levels of past-year suicidal ideation (30.2 %) and attempts (4.2 %). The prevalence of suicidal ideation in this sample was consistent with earlier Ontario data on transgender people, but the prevalence of attempts was lower in our sample. In the 2009 Trans PULSE Ontario study, 35.0 % and 11.0 % reported past-year suicidal ideation and attempts, respectively (Bauer et al., 2015). Although data from Trans PULSE Ontario and the current

Table 1

Characteristics of study participants included in analytic sample for conditional inference trees with suicide attempts as outcome (n = 2054).¹

	Unweighted N (Weighted %) ²
Past-year suicide attempt	
Yes	86 (4.2 %)
No	1968 (95.9 %)
Past-year suicidal ideation	
Yes	619 (30.2 %)
No	1427 (69.6 %)
Age	
16–19	210 (10.1 %)
20–24	457 (22.4 %)
25–34	781 (38.1 %)
35–49	424 (20.6 %)
50+	182 (8.9 %)
Ethnoracial group	
Non-Indigenous white	1665 (80.5 %)
Non-Indigenous racialized	216 (11.1 %)
Indigenous	155 (7.6 %)
Gender	
Trans woman	498 (24.7 %)
Trans man	487 (23.5 %)
Non-binary assigned male at birth	175 (8.6 %)
Non-binary assigned female at birth	819 (39.5 %)
Indigenous or other cultural gender	44 (2.2 %)
Sexual orientation	
Straight/heterosexual	83 (4.2 %)
Lesbian, gay, bisexual, queer, or pansexual	1403 (68.5 %)
Asexual or other	564 (27.2 %)
Low-income household	
Yes	881 (43.6 %)
No	1033 (49.7 %)
Not applicable ³	102 (5.0 %)
Education level	
High school diploma or less	392 (19.3 %)
Some college, university, or CEGEP	550 (26.9 %)
Completed college/university degree, or CEGEP	739 (35.9 %)
Graduate/professional degree (in progress or complete)	368 (17.7 %)
Sex work history	
Current sex worker	76 (5.5 %)
Former sex worker	204 (9.7 %)
No sex work history	1731 (82.9 %)
Visibility as trans	
All of the time	60 (3.0 %)
More than half of the time	479 (23.5 %)
Less than half of the time	757 (36.8 %)
Never	737 (35.8 %)
Disability status	
Yes	420 (20.4 %)
No	1634 (79.6 %)
Immigration history	
Yes	264 (13.1 %)
No	1782 (86.6 %)
Housing status	
Stable	1818 (88.5 %)
Unstable	200 (9.9 %)
Urbanicity	
Urban	1881 (91.7 %)
Rural	130 (6.3 %)

1. Because of the large overlap between samples for suicidal ideation (n = 2050) and suicide attempts (n = 2054), we have presented the larger sample here.

2. Percentages may not add up to 100 % because of missing data.

3. Those under the age of 25 who did not provide income information were categorized as "not applicable".

study are not directly comparable, this may suggest a reduction in the prevalence of suicide attempts over time. While suicide attempts were defined more narrowly in our study (i.e., limited to those who indicated an intent to die), there was still a reduction in suicide attempts after removing this criterion in this sample (5.2 %). A reduction in suicide attempts is plausible, considering the substantial policy changes implemented to increase social inclusion of TNB people in Canada in

recent years (e.g., gender identity and expression added to the Canadian Human Rights Act) (Government of Canada, 2017; Parliament of Canada, 2017), but future research should formally investigate whether suicide attempts have indeed declined over time.

We identified six groups with varying risk of suicidal ideation and three groups with varying risk of suicide attempts. Those who were younger tended to report more past-year suicide attempts and ideation. Educational attainment, disability status, and low-income status additionally predicted suicidal ideation while history of sex work predicted suicide attempts. Our findings of very high levels of suicidal ideation and attempts among youth are consistent with other TNB health studies. Data from the 2014 Canadian Trans Youth Health Survey (n = 600, aged 19–25) reported that 40.0 % and 11.3 % experienced suicidal thoughts and at least one attempt in the past-year (Veale et al., 2017). Previous research has shown risk factors for suicide among TNB youth to include family rejection, harassment at school, and homelessness (Austin et al., 2022; Bochicchio et al., 2021). In contrast, parental support, access to medical intervention, and less frequent experiences of transphobia contribute to decreased risk of suicide (Austin et al., 2022; Bochicchio et al., 2021). In addition, older adults may have lower rates of suicidal thoughts and behavior because of resilience and self-esteem that increases with age (Koziara et al., 2022). Future interventions should focus on these protective factors for TNB youth.

While age was a predictor of both suicidal ideation and attempts, it intersected with different social positions to predict each outcome. Sex work was a prominent predictor of suicide attempts among those aged 20+, consistent with research finding high levels of suicidality among transgender and cisgender sex workers. A study of trans women with a history of sex work in California (N = 573) reported a 55.6 % prevalence of lifetime suicidal ideation, and among those, 61.4 % reported a suicide attempt (Nemoto et al., 2011). According to a 2020 meta-analysis of cisgender female sex workers in low- and middle-income countries (N = 24,940), 22.8 % and 6.3 % experienced recent suicidal ideation and attempts, respectively (Beattie et al., 2020). TNB sex workers may experience higher levels of suicidality because of the increased stigma they experience as a result of transphobia, HIV/AIDS stigma, racism, and classism (Squires, 2024). These systems of oppression may impact exposure to violence, engagement in substance use, poverty, and access to social support (Squires, 2024).

Education was the primary predictor of suicidal ideation. These results are comparable to those reported in transgender and cisgender populations, where lower education levels have been associated with suicide risk. A meta-analysis of 96,809 participants from European studies found a negative association between suicidal ideation and education level (OR = 0.86, 95 % CI: 0.75–1.00) (Ludwig et al., 2024). It is speculated that higher education may increase self-efficacy and social capital (Phillips and Hempstead, 2017). Education can also increase employment opportunities and access to mental health care, including resources available on college campuses (Ludwig et al., 2024; Steele et al., 2007). Lower self-efficacy, social capital, and access to care, in combination with TNB-specific stressors, may contribute to suicidal ideation by increasing feelings of hopelessness or thwarted belongingness. However, it is important to note that it is difficult to disaggregate the effects of age and education level in our study; the split along educational attainment may partly reflect that 16–24-year-olds had the highest level of suicide ideation. Future studies should examine the effect of education on suicidal ideation among TNB youth and adults.

Disability status and household income were also associated with past-year suicidal ideation among those who completed some college/university. Participants in low-income households were more likely to report past-year suicidal ideation, consistent with other studies among TNB people (Adams and Vincent, 2019; Yockey et al., 2022). Financial hardship may increase feelings of hopelessness (Yockey et al., 2022). Poverty may also inhibit access to gender-affirming medical care, which can be protective against suicidality (Adams and Vincent, 2019). Those who identified as disabled also reported higher levels of suicidal

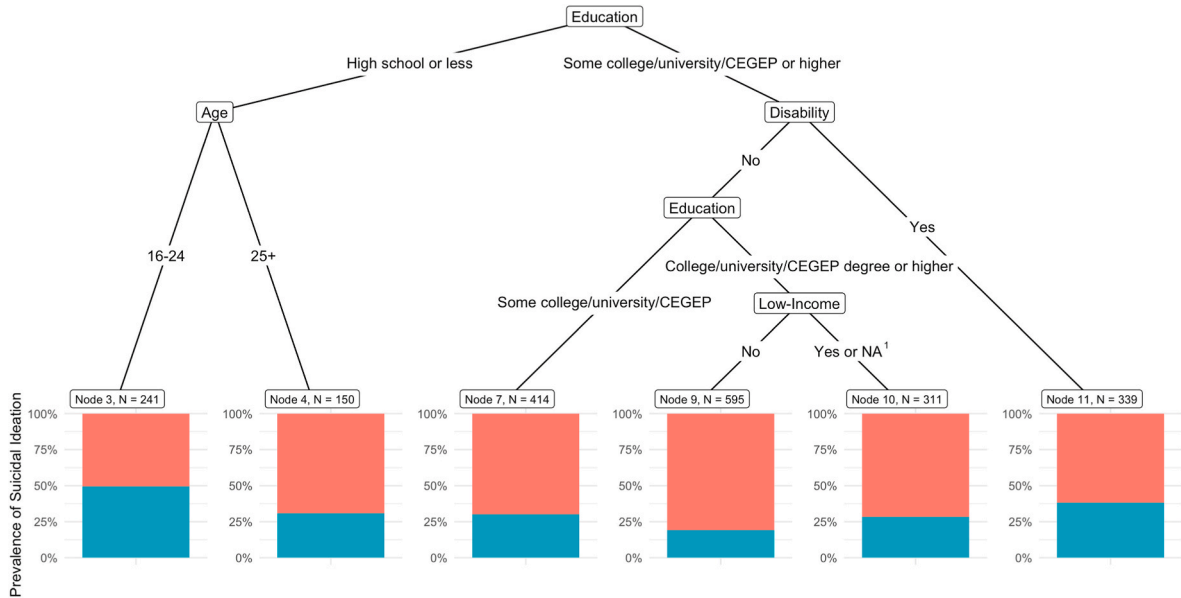


Fig. 1. Conditional inference tree depicting groups with significant variation in suicidal ideation in the Trans PULSE Canada study (n = 2050).
1. Not applicable applies to participants aged 17–25 who did not provide income information.

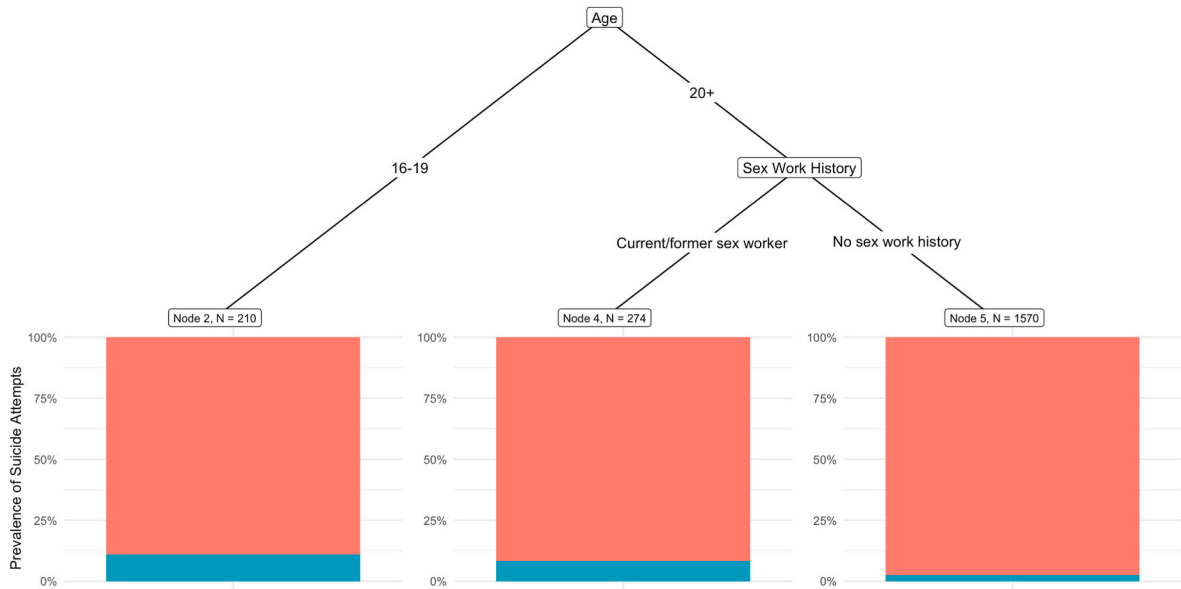


Fig. 2. Conditional inference tree depicting groups with significant variation in suicide attempts in the Trans PULSE Canada study (n = 2054).

ideation. This is comparable to the results of a systematic review comprised of 45 studies examining the association between functional disability (i.e., having limitations or needing assistance for daily activities) and suicidal ideation (Lutz and Fiske, 2018). Disability may influence feelings of perceived burdensomeness and thwarted belongingness, particularly because of greater reliance on others to complete daily tasks and social isolation related to ableism and activity limitations (Lutz and Fiske, 2018).

Our analyses were guided by the Interpersonal Theory of Suicide (IPTS), and thus we interpret the results of the suicide attempt model with reference to the concept of acquired capability in its pathway. For example, we noted that increased exposure to violence and substance use among TNB sex workers may contribute to feelings of thwarted belongingness and perceived burdensomeness. However, repeated exposure to physically harmful or fear-inducing events can contribute to the acquired capability for suicide, which may explain the disparity in

suicide attempts for sex workers. In contrast, educational attainment was a significant splitting variable for suicidal ideation but not attempts. While lower educational attainment may lead to limited resources (e.g., social capital and mental health care) and thus feelings of thwarted belongingness and perceived burdensomeness, it would not affect acquired capability for suicide.

The integration of an intersectional lens with this work also illustrates how social power can influence TNB suicide risk. The use of conditional inference tree methods in this study, in comparison to traditional regression models, allowed us to identify significant intersections of social identities and positions without having to pre-specify interaction terms. Therefore, our analyses expand beyond the social categories of race and gender most often used in intersectional analyses (Bauer et al., 2021; Collins, 2015), and address additional axes of power such as age, disability, and sex work status. In doing so, we provide ways to reframe solutions to systemic issues. For example, while

Table 2
Subgroups as defined by conditional inference trees and respective prevalence of suicidal ideation.

Terminal Node #	Intersection subgroups	N	Outcome prevalence
Left branch			
3	Education (High school or less) → Age (16–24)	241	49.4 %
4	Education (High school or less) → Age (25+)	150	30.7 %
Right branch			
7	Education (Some college/university/CEGEP or higher) → Disability (No) → Education (Some college/university/CEGEP)	414	30.2 %
9	Education (Some college/university/CEGEP or higher) → Disability (No) → Education (College/university/CEGEP degree or higher) → Low-income (No)	595	19.0 %
10	Education (Some college/university/CEGEP or higher) → Disability (No) → Education (College/university/CEGEP degree or higher) → Low-income (Yes or NA)	311	28.3 %
11	Education (Some college/university/CEGEP or higher) → Disability (Yes)	339	38.3 %

Table 3
Subgroups as defined by conditional inference trees and respective prevalence of suicide attempts.

Terminal Node #	Intersection subgroups	N	Outcome prevalence
Left branch			
2	Age (16–19)	210	11.0 %
Right branch			
4	Age (20+) → Sex work history (Current/former sex worker)	274	8.4 %
5	Age (20+) → Sex work history (No sex work history)	1570	2.5 %

suicide prevention efforts for TNB people should address experiences at the intersection of race and gender, our finding that sex work history was associated with higher suicide risk highlights that prevention efforts must additionally address experiences unique to sex work, which necessarily involves attending to intersections with racism and trans-misogyny, as sex work is more common among transfeminine and racially minoritized TNB people (Nowotny and Graves, 2013; Scheim, Ayden I. et al., 2023; Walsh et al., 2015). Further, sex workers are not only impacted by multiple forms of stigma, but structures of social power (e.g., education and employment) that shape one’s involvement in, and type of sex work conducted (Wesp et al., 2019). Therefore, systemic solutions should focus on intersections of systems of oppression and power.

The CTREE models did not split based on ethnoracial group, gender, sexual orientation, urbanicity, housing status, immigration history, or visibility as TNB. Although we did not identify subgroups including these variables, this does not equate to a lack of importance of these factors in suicide risk amongst TNB people. CTREE splits are conditional on each other, with subsequent splits being based on the strongest predictor within the existing node (e.g., sex work is the strongest predictor of suicide attempts among those aged 20+ but is not necessarily the strongest predictor among specific ethnoracial groups). Another factor to consider is that tests for groups with small sample sizes (e.g., rural participants) may have been underpowered, and only larger differences could be detected. In cisgender populations, race/ethnicity and

gender have been associated with suicide risk (Berkelmans et al., 2021; Curtin et al., 2022). It is possible that some social identities and positions, such as gender and sexual orientation, do not impact suicidality among TNB people in the same way that they do for cisgender people. A systematic review reported inconsistent findings regarding gender differences in suicidal ideation and attempts among transgender people (McNeil et al., 2017). In contrast, research consistently shows cisgender women to have higher rates of suicidal ideation and attempts and cisgender men to have higher rates of completed suicide (Miranda-Mendizabal et al., 2019; Schrijvers et al., 2012).

Our findings should be interpreted considering several limitations. First, because this survey was administered among survivors of suicide, survival bias may be present if the characteristics of TNB people who die by suicide differ from those with non-fatal attempts. Because of the relatively small number of suicide attempts overall, important associations may have gone undetected due to insufficient statistical power. Our sample size also does not allow us to assess model performance, as this is only recommended with large datasets that can be separated into training and test sets (Robette, 2022). Although the CTREE algorithm allows us to include observations with missing variables, we did not compare the results with imputed data to a complete case analysis because a minority of cases were complete. We also cannot calculate confidence intervals with the CTREE algorithm, and because convenience sampling was used, we caution against generalizing these results to the TNB population. Given the cross-sectional nature of this study, we also cannot establish temporal order between variables, however the use of past-year outcomes limits the potential for reverse causality. Although conditional inference trees can address confounders (Venkatasubramaniam et al., 2017), the purpose of this analysis was to describe variation within the population and not to assess causation.

5. Conclusion

Greater attention may be warranted towards groups with higher risk of suicidal ideation and attempts, such as younger individuals, those with a history of sex work, those with lower levels of education, and those who identify as disabled. Future research should examine individual-level and structural interventions to reduce disproportionate suicide risk in these groups. Our results suggest the need for researchers and policymakers to give greater attention to the transgender and non-binary community given the high rates of past-year suicidal ideation and attempts overall.

CRedit authorship contribution statement

Heather Santos: Conceptualization, Formal analysis, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. **Greta R. Bauer:** Conceptualization, Data curation, Funding acquisition, Investigation, Supervision, Validation, Writing – review & editing. **Thomas Joiner:** Conceptualization, Validation, Writing – review & editing. **Agus Surachman:** Conceptualization, Validation, Writing – review & editing. **Félice Lê-Scherban:** Conceptualization, Supervision, Validation, Writing – review & editing. **Ayden I. Scheim:** Conceptualization, Data curation, Investigation, Methodology, Supervision, Validation, Writing – review & editing.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmmh.2025.100496>.

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