Transgender-related stigma and gender minority stress-related health disparities in Aotearoa New Zealand: hypercholesterolemia, hypertension, myocardial infarction, stroke, diabetes, and general health

*Jaimie F. Veale**

Trans Health Research Lab, Te Kura Whatu Oho Mauri/School of Psychology, University of Waikato, Aotearoa/New Zealand

The Lancet Regional Health - Western Pacific 2023;■: 100816

Published Online XXX https://doi.org/10.1016/j.lanwpc.2023.100816

Summary

Background Research has found that transgender-related enacted stigma—including discrimination, harassment, violence, cyberbullying, community rejection, and conversion efforts—is associated with negative mental health among transgender people. Transgender people also experience physical health disparities that could be due to chronic gender minority stress caused by stigma and prejudice.

Methods We compared a large New Zealand national survey of transgender participants with the New Zealand Health Survey (NZHS) with age and ethnicity weightings on stress-related health conditions and indicators. We conducted multivariate logistic regression to test associations between transgender-related enacted stigma and physical health conditions and indicators, controlling for age, gender, ethnicity, gender affirming hormone use, and alcohol and tobacco use.

Findings Transgender participants had a greater likelihood of ever having hypertension (63%, 95% CI 41%–89%), a myocardial infarction (98%, 6%–271%), a stroke (104%, 2%–311%), hypercholesteremia 148% (114%–188%), and current poor or fair general health (128%, 107%–151%). There were no significant differences for diabetes. Compared with those scoring at the 10th percentile on transgender-related enacted stigma, those at the 90th percentile were more likely to have had hypertension (81%, 36%–140%), hypercholesteremia (54%, 20%–98), and poor/fair health (75%, 45%–110%).

Interpretation We found large disparities for stress-related physical health conditions and indicators, and transgender people who experienced higher transgender-related enacted stigma had a significantly increased prevalence of these negative outcomes. Our findings highlight the need for health professionals to consider gender minority stress and for interventions and policy/law reforms to address transgender-related stigma.

Funding The Health Research Council of New Zealand and Rule Foundation.

Copyright © 2023 The Author. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords: Transgender; Gender diverse; Health disparities; Gender minority stress; Stigma; Hypertension; Myocardial infarction; Stroke; Cholesterol; Diabetes

Introduction

Minority stress theory suggests that marginalized minority groups experience an increased burden of mental and physical health issues due to the cumulative effect of stigma and prejudice they face on a regular basis. This allostatic load from chronic stress can lead to significant health disparities and negative outcomes[1]; for example, psychosocial stress may be comparable to smoking as a risk factor for of myocardial infarction.[2] Research has shown that stressful experiences associated with stigma or prejudice for a minority group may be more stressful than similar events that are not associated with stigma or prejudice.[1] Stressful experiences of stigma and prejudice—enacted as discrimination, harassment, and violence—could also cause hypervigilance to such future experiences and increased sensitivity to rejection, which may result in dysregulated inflammatory system responses.[3]

*Corresponding author. School of Psychology, Private Bag 3105, Hamilton, 3240, New Zealand.
E-mail address: jveale@waikato.ac.nz.

Research in context

Evidence before this study

Evidence suggests that gender minority stress experienced by transgender people—due to stigma, prejudice, and violence—is associated with mental health symptoms. Research on other minority groups has also uncovered that minority stress is associated with greater likelihood of negative physical health outcomes. Studies have also found that transgender people are more likely to report stress-related physical health conditions and indicators.

Added value of this study

This study provides the first evidence linking transgender-related enacted stigma to a broad range of stress-related physical health conditions and indicators. The findings also add to our understanding of the extent of the disparities faced by transgender people for hypertension, myocardial infarction, stroke, hypercholesterolemia, and general health.

Implications of all the available evidence

Medical professionals should be aware of the health disparities that transgender people face and account for potential gender minority stress when monitoring health and providing care. We need interventions and policies to reduce transgender-related stigma and gender minority stress as well as address the health disparities faced by transgender people.

Gender minority stress theory has been applied to transgender people to explain mental health disparities.[4] Transgender people are those whose genders (binary or nonbinary) differ from societal expectations based on their sex assigned at birth. Many studies have shown that transgender people's experiences of enacted stigma and prejudice are associated with depression, anxiety, non-suicidal self-injury, and suicide attempts.[5]

Based on existing evidence, it is reasonable to hypothesize that gender minority stress could also negatively affect the *physical* health of transgender people. Among sexual minorities (e.g., gay, lesbian, and bisexual people), enacted stigma and prejudice experiences are associated with a greater likelihood of physical health problems, including acute symptoms and chronic diseases,[3,6] and this topic has also been widely examined among racial/ethnic minorities.[7] There has been limited research, however, on this topic among transgender people. Flentje and colleagues showed that transgender people who reported prejudice/discrimination or physical/sexual violence due to being a sexual or gender minority had lower self-reported physical health.[8] From the TransPop study—which utilized a U.S. national population sample—Poteat and colleagues found a positive association between cardiovascular disease and both general everyday discrimination and adverse childhood experiences, but these effects did not reach statistical significance. The authors attributed this to their study's statistical power, limited to 114 transgender participants.[9]

There is also a large body of evidence to suggest that transgender people face physical health disparities for health conditions and indicators that are associated with stress exposure.[10,11] Results from TransPop showed that transgender participants were more likely to report ulcers, asthma, sleep disorders, poor physical health days, and that their overall health was poor or fair, although they were no more likely than cisgender participants to report hypercholesterolemia or COPD.[11] The main focus of this article is on cardiovascular disease and associated risk factors; this is due to high-quality population data being available for these stress-related health conditions and indicators for the current study.

Evidence for diabetes is mixed, with clinical studies finding that risk of type 2 diabetes may be elevated by commencement of gender-affirming hormones (GAH).[12,13] Research with population-based samples, however, has not found disparities for diabetes.[10] The TransPop study even found lower rates of diabetes among transgender participants, although they did not adjust for age or other covariates.[11]

A population-based sample of over 3000 transgender participants in the U.S. Behavioral Risk Factor Surveillance System (BRFSS), found that trans men and women were less likely to report hypertension than cisgender women and men respectively.[10] A recent systematic review found that there was not enough evidence to conclude that GAH use has an impact on hypertension.[14]

There is also emerging evidence of disparities for myocardial infraction and stroke among transgender people. The BRFSS found elevated rates of self-reported myocardial infraction compared with the cisgender population among both trans men and trans women, although the prevalence was particularly high for trans men.[10] Another retrospective study of Kaiser health records showed transfeminine patients had higher rates of both ischemic stroke and myocardial infraction than matched cisgender women but not cisgender men, with no differences between transmasculine patients and matched cisgender patients.[15] The TransPop study did not find health disparities among transgender participants for cardiovascular disease, although this study had less statistical power.[9]

The aim of this research is to uncover further evidence for physical health disparities among transgender people from a large national community sample and to examine whether participants who experienced of transgender-related stigma are more likely to have stress-related health conditions and indicators.

Methods

Procedure

Counting Ourselves: The Aotearoa New Zealand Trans and Nonbinary Health Survey was conducted from July to September 2018, open to participants who were transgender, aged 14 and older, and living in Aotearoa New Zealand. The survey had 330 questions that asked about a broad range of health indicators and social determinants of health. Questions were largely sourced from surveys with national population-based estimates, such as the New Zealand Health Survey (NZHS), and other international transgender health surveys. Participants were recruited via social media, health professionals, and community organizations, and almost all (99%) chose to complete the survey online. Of the 1178 valid responses we received, 891 participants (76%) completed questions about physical health outcomes and indicators. Counting Ourselves is led by transgender people and included a diverse transgender community advisory group. The survey received approval from the New Zealand Health and Disability Ethics Committee (18/NTB/66/AM01). We have not examined stress-related physical health conditions and outcomes in previous publications from the Counting Ourselves project. Veale and colleagues outline further details of the study protocol.[16]

For general population comparisons, we used the 2018–2019 NZHS,[17] which had a population-based sample of 13,572 participants aged 15 and older.

Table 1 outlines Counting Ourselves participants' demographics, alcohol, and tobacco use in comparison with the NZHS. Counting Ourselves participants were more likely to be younger, European or Other ethnicity, and less likely to be Asian. Differences in alcohol use are likely due to the Counting Ourselves sample having a greater proportion of younger participants who tended to drink alcohol less frequently.

	Counting Ourselves	New Zealand Health Survey
Age (years)	n = 873[a]	n = 13,572
15–24	43%	17%
25–34	29%	18%
35–44	11%	15%
45–54	8%	16%
55 and older	9%	34%
Gender[b]	n = 891	n = 13,572
Men	29%	49%
Women	30%	51%
Nonbinary	42%	–
Race/ethnicity	n = 891	n = 13,572
NZ European and other	81%	68%
Māori	13%	12%
Pacific Islander	3%	6%
Asian	4%	14%
Alcohol four or more times/week	7%	17%
Current smokers	20%	15%

[a]18 Counting Ourselves participants aged 14 excluded as New Zealand Health Survey does not include this age. [b]Men include trans men in Counting Ourselves and those recorded as male in the NZHS; women include trans women in Counting Ourselves and those recorded as female in the NZHS; the NZHS did not have an option for nonbinary genders.

Table 1: **Demographic, alcohol use, and smoking comparisons between Counting Ourselves and New Zealand Health Survey participants.**

Measures

Stress-related health conditions and indicators

We used an SF-12[18] item for participants to rate their health in general as "poor," "fair," "good," "very good," or "excellent." We also used questions from the NZHS[17] to ask participants if they had ever been told by a doctor that they have "high blood pressure (excluding during pregnancy)," a "heart attack," a "stroke (excluding 'mini-stroke' or transient ischaemic attack (TIA))," "diabetes (excluding during pregnancy)," and "high cholesterol levels in your blood." Response options for the NZHS included "yes," "no," and "don't know;" Counting Ourselves only included "yes" and "no" response options.

Enacted stigma index

Using 11 questions, we asked participants if, due to them being transgender, they had ever been discriminated against, verbally harassed, physically attacked, cyberbullied, rejected from religious communities, evicted, or made homeless due to violence, or had a professional attempt to make them cisgender (conversion effort). Enacted stigma index scores were the sum of each participant's reported experiences.

Using the expectation maximization method, we imputed missing data only for participants who had scores on at least one of the index items. Data were imputed for 1.5% to 9.5% of responses (this range being due to some questions not applying to all participants). Tan and colleagues give more details of the missing data imputation method and the exact wording of the questions in this index.[19]

Gender-affirming hormone use

We asked participants if they were currently taking "masculinising or feminising hormones or anti-androgens."

Alcohol and tobacco use

Participants were asked if they had ever smoked, and if they had, we asked them "on average, how many cigarettes do you smoke a day?" The 6-point scale ranged from participants who had never smoked to "11 or more a day."

We used the Alcohol Use Disorders Identification Test (AUDIT) question: "how often do you have a drink containing alcohol?"[20] The 5-point scale ranged from

having not drank alcohol in the past year through to "four or more times per week."

Material hardship

Participants were asked if in the past year to keep costs down they had a range of 6 experiences, for example "gone without fresh fruit or vegetables" and "put up with feeling cold." These items were taken from the New Zealand General Social Survey and response items included "not at all," "a little," and "a lot."

Data analysis

To assess disparities, we compared the Counting Ourselves sample with the NZHS sample weighted to reflect Counting Ourselves' age and ethnic distribution. See Supplementary Table S1 for the weights, with weights greater than 1 indicating higher weighting than the original NZHS sample (e.g., younger participants, who were a higher proportion of the Counting Ourselves sample) and weights less than 1 indicating lower weighting than the original NZHS sample (e.g., Asian participants, who were a lower proportion of the Counting Ourselves sample). Comparisons between Counting Ourselves and NZHS only included participants aged 15–74 because the NZHS did not include 14-year-olds and there were only five Counting Ourselves participants aged older than 74, making accurate weighting difficult in the older age group. We calculated confidence intervals using the modified Wald method.[21]

Using SPSS version 27, we conducted multivariate regression analyses to test whether the Enacted Stigma Index was associated with physical health variables, with age, gender, ethnicity, GAH use, and alcohol and tobacco use included as covariates. We scaled Enacted Stigma Index scores to compare the prevalence for those scoring at the 90th percentile (who scored 5) with those at the 10th percentile (who scored 0). In order to calculate adjusted relative prevalence ratios, we used robust (modified) Poisson regression.[22] We removed up to 33 cases with data missing on any of the predictor or criterion variables in the models (listwise deletion).

We also conducted ANOVAs to examine Enacted Stigma Index average score differences between ethnic groups.

Results

Table 2 outlines disparities between Counting Ourselves and NZHS (weighted to match Counting Ourselves' age and ethnicity distribution) samples among participants aged 15–74. Counting Ourselves participants were more likely than weighted NZHS participants to have ever been told by a doctor they had hypertension (RR 1.63, 95% CI 1.41–1.89, $P < 0.001$), myocardial infarction (RR 1.98, 95% CI 1.06–3.71, $z = 2.13$, $P = 0.03$), a stroke (RR 2.04, 95% CI 1.02–4.11, $P = 0.04$), high cholesterol levels (RR 2.48, 95% CI 2.14–2.88, $P < 0.001$), and poor or fair general health (RR 2.28, 95% CI 2.07–2.51, $P < 0.001$). There were no significant differences for diabetes (RR 1.21, 95% CI 0.81–1.81, $P = 0.35$). While there were gender differences in these disparities, our further regression analyses outlined in Tables 3 and 4 show that some of these gender differences did not remain after controlling for GAH use and other covariates. Disparities by age groups can be found in Supplementary Table S2.

In Tables 3 and 4, results of regression analyses with the Enacted Stigma Index and other covariates predicting health conditions and indicators among Counting Ourselves participants are reported. The Enacted Stigma Index was positively associated with hypertension, high cholesterol, and general poor/fair health. After controlling for covariates, we only found statistically significant gender differences for cholesterol and general health. Age was negatively associated with poor/fair health but positively associated with all the other health conditions or indicators. Pacific Islanders and those who had taken testosterone-based GAH were more likely to report high cholesterol. Those reporting poor/fair health were more likely to smoke and less likely to have used testosterone-based GAH.

Due to cells with low numbers of cases, we combined testosterone-based and estrogen-based GAH groups for analyses of myocardial infarction and stroke, and combined Māori, Pacific Island, and Asian groups for all analyses outlined in Table 4. Smoking was positively associated with myocardial infarction, and Māori, Pacific Island, and Asian ethnicities combined were more likely to report diabetes. We repeated all analyses in Tables 3 and 4 with multiple imputation for missing data and including material hardship as predictors in the models; these changes did not alter the effect sizes in any meaningful way or the inferences of the findings.

We found statistically significant differences between ethnic groups in Counting Ourselves on the Enacted Stigma Index, $F(4,854) = 5.87$, $P < 0.001$. New Zealand European Pākehā (White) participants had the lowest average number of enacted stigma experiences ($M = 2.10$, 95% CI 1.95–2.25), followed by Asian ($M = 2.15$, 95% CI 1.23–3.07), Māori ($M = 2.51$, 95% CI 2.09–2.93), Pacific Islander ($M = 3.29$, 95% CI 2.16–4.43), and other ethnic groups ($M = 3.84$, 95% CI 2.65–5.05).

Discussion

Health disparities

After adjusting for age and ethnicity differences, transgender participants were more likely than the general population to report poor/fair health and that a doctor had ever told them they had hypertension, myocardial infarction, a stroke, or hypercholesterolemia. Effect sizes were particularly high for hypertension and general poor/fair health, where confidence intervals ranged

Counting Ourselves			New Zealand Health Survey[a]		
Hypertension					
Gender	n	% (95% CI)	Gender	n	Weighted % (95% CI)
Trans women and nonbinary AMAB	337	26.1% (21.7%–31.1%)	Women	6594	11.3% (10.5%–12.1%)
Trans men and nonbinary AFAB	527	13.7% (11.0%–16.9%)	Men	5449	11.5% (10.7%–12.4%)
Total	864	18.5% (16.1%–21.3%)	Total	12,045	11.4% (10.8%–12.0%)
Myocardial infarction					
Trans women and nonbinary AMAB	340	2.1% (0.9%–4.3%)	Women	6595	0.5% (0.4%–0.7%)
Trans men and nonbinary AFAB	526	0.8% (0.2%–2.0%)	Men	5448	0.8% (0.6%–1.1%)
Total	866	1.3% (0.7%–2.3%)	Total	12,045	0.6% (0.5%–0.8%)
Stroke					
Trans women and nonbinary AMAB	339	1.8% (0.7%–3.9%)	Women	6595	0.6% (0.5%–0.8%)
Trans men and nonbinary AFAB	525	0.5% (0.1%–1.8%)	Men	5449	0.4% (0.3%–0.6%)
Total	864	1.0% (0.5%–2.0%)	Total	12,046	0.5% (0.4%–0.7%)
Diabetes					
Trans women and nonbinary AMAB	338	6.2% (4.1%–9.4%)	Women	6594	2.7% (2.3%–3.1%)
Trans men and nonbinary AFAB	524	0.8% (0.2%–2.0%)	Men	5448	2.0% (1.6%–2.4%)
Total	862	2.9% (2.0%–4.3%)	Total	12,044	2.4% (2.1%–2.7%)[a]
High cholesterol					
Trans women and nonbinary AMAB	339	27.4% (23.0%–32.4%)	Women	6594	7.4% (6.8%–8.0%)
Trans men and nonbinary AFAB	527	15.2% (12.4%–18.5%)	Men	5449	8.9% (8.2%–9.7%)
Total	866	20.0% (17.5%–22.8%)	Total	12,043	8.1% (7.6%–8.6%)[a]
General poor or fair health					
Trans women and nonbinary AMAB	340	30.3% (25.7%–35.4%)	Women	6590	17.0% (16.1%–17.9%)
Trans men and nonbinary AFAB	523	40.0% (35.9%–44.2%)	Men	5447	14.9% (14.0%–15.8%)
Total	863	36.2% (33.0%–39.4%)	Total	12,037	16.0% (15.4%–16.7%)

Note: Only cases aged 15–74 included. AMAB, Assigned male at birth, AFAB, Assigned female at birth. [a]Cases weighted to match Counting Ourselves' age and racial/ethnic distribution.

Table 2: **Health condition and indicator disparities between Counting Ourselves and New Zealand Health Survey participants.**

	Hypertension			Hypercholesterolemia			General poor/fair health		
	b	aRPR (95% CI)	*P*	*b*	aRPR (95% CI)	*P*	*b*	aRPR (95% CI)	*P*
Enacted Stigma Index	0.59	1.81 (1.36, 2.40)	<0.001	0.43	1.54 (1.20, 1.98)	<0.001	0.56	1.75 (1.45, 2.10)	<0.001
Age (years)	0.04	1.04 (1.03, 1.05)	<0.001	0.05	1.05 (1.04, 1.06)	<0.001	−0.02	0.98 (0.98, 0.99)	<0.001
Ethnicity									
European/other (ref)									
Māori	0.12	1.13 (0.78, 1.63)	0.531	0.02	1.02 (0.69, 1.51)	0.912	0.15	1.16 (0.92,1.46)	0.207
Pacific Islander	0.08	1.08 (0.45, 2.56)	0.865	0.80	2.21 (1.23, 4.00)	0.009	−0.04	0.96 (0.65, 1.43)	0.857
Asian	−1.29	0.28 (0.04, 1.83)	0.182	0.36	1.43 (0.83, 2.46)	0.198	−0.29	0.75 (0.41, 1.36)	0.341
Gender and sex assigned at birth									
Trans man or nonbinary AFAB (ref)									
Trans woman or nonbinary AMAB	0.18	1.19 (0.74, 1.93)	0.474	0.70	2.01 (1.22, 3.32)	0.006	−0.35	0.71 (0.52, 0.96)	0.026
Alcohol use	0.09	1.10 (0.98, 1.23)	0.115	−0.01	0.99 (0.90, 1.10)	0.842	−0.02	0.98 (0.90, 1.07)	0.703
Smoking	0.04	1.04 (0.94, 1.15)	0.432	−0.01	0.99 (0.90, 1.09)	0.852	0.15	1.16 (1.09, 1.24)	<0.001
Gender affirming hormones ever									
No (ref)									
Testosterone-based	0.18	1.19 (0.75, 1.89)	0.454	1.02	2.77 (1.78, 4.31)	<0.001	−0.38	0.68 (0.54, 0.93)	0.002
Estrogen-based	0.03	1.03 (0.69, 1.52)	0.894	−0.28	0.75 (0.53, 1.08)	0.125	0.03	1.03 (0.74, 1.45)	0.863
n	833			833			830		

aRPR, Adjusted relative prevalence ratio; AFAB, Assigned female at birth; AMAB, Assigned male at birth.

Table 3: **Enacted Stigma Index and covariates predicting hypertension, cholesterol, and general health.**

	Myocardial infarction			Stroke			Diabetes		
	b	aRPR (95% CI)	*P*	*b*	aRPR (95% CI)	*P*	*b*	aRPR (95% CI)	*P*
Enacted Stigma Index	1.03	2.80 (0.78, 10.11)	0.116	0.80	2.22 (0.57, 8.65)	0.251	0.33	1.39 (0.62, 3.14)	0.426
Age (years)	0.09	1.10 (1.06, 1.13)	<0.001	0.10	1.10 (1.06, 1.14)	<0.001	0.04	1.04 (1.02, 1.07)	<0.001
Ethnicity									
European/other (ref)									
Māori, Pacific Island, or Asian	−1.01	0.36 (0.03, 4.32)	0.423	0.02	1.02 (0.08, 13.97)	0.988	0.94	2.57 (1.12, 5.82)	0.024
Gender and sex assigned at birth									
Trans man or nonbinary AFAB (ref)									
Trans woman or nonbinary AMAB	−0.14	0.87 (0.22, 3.48)	0.844	0.17	1.19 (0.34, 4.15)	0.788	1.57	4.78 (0.92, 24.84)	0.063
Alcohol use	−0.19	0.83 (0.54, 1.25)	0.367	0.13	1.14 (0.68, 1.93)	0.617	−0.01	0.99 (0.74, 1.34)	0.962
Smoking	0.40	1.50 (1.07, 2.09)	0.019	−0.29	0.75 (0.55, 1.03)	0.076	0.05	1.05 (0.79, 1.40)	0.752
Gender affirming hormones ever									
No (ref)									
Yes	0.37	1.45 (0.51, 4.10)	0.485	0.52	1.68 (0.48, 5.90)	0.421	1.30[a]	1.14 (0.16, 8.29)	0.898
							1.87[b]	1.21 (0.49, 2.98)	.685
n	832			830			831		

aRPR, Adjusted relative prevalence ratio; AFAB, Assigned female at birth; AMAB, Assigned male at birth. [a]Testosterone-based hormones. [b]Estrogen-based hormones.

Table 4: **Enacted Stigma Index and covariates predicting myocardial infarction, stroke, and diabetes.**

from approximately two to three times greater prevalence, and these may have been underestimates due to transgender people being more likely to postpone or avoid care due to anticipated stigma and other barriers.[9,16] We found no significant disparity for diabetes, which aligns with other nonclinical studies of transgender people.[10,11] This research adds to our knowledge of the extent of physical health disparities that transgender people face by examining a wide range of stress-related health conditions and indicators in a large national community sample.

The overall hypercholesterolemia disparities and greater prevalence of hypercholesterolemia among trans women and nonbinary participants assigned male at birth were not found in the TransPop[11] and BRFSS studies,[10] although TransPop had fewer participants and neither study adjusted for age, GAH usage, or other covariates. Differences between our findings and other published research should be considered in the context of different healthcare systems, ethnic, and other social determinants of health between the US and Aotearoa New Zealand.[23] The greater rate of hypercholesterolemia among participants who had taken testosterone aligns with clinical research that has found increased LDL cholesterol after testosterone initiation.[24]

The myocardial infarction disparities shown in our study align with the BRFSS research, although they found higher rates among trans men.[10] Disparities for myocardial infarction and stroke in our study align with clinical studies,[15] although we did not see an association with estrogen-based GAH found in clinical research. Cardiovascular disease risk may be higher for people living with HIV, but we did not control for HIV status in this research because fewer than 1% of the sample was HIV positive,[16] which is likely to be due to the low rate of HIV infection in Aotearoa New Zealand.

TransPop also found disparities for reporting poor or fair general health and that these disparities were largest for transmasculine participants.[11] We found participants taking testosterone-based GAH reported better general health, which may indicate that participants took a holistic view of general health—including mental health and wellbeing—in their rating of their general health.

Transgender-related enacted stigma

Our study shows that participants who reported transgender-related enacted stigma—experiences of discrimination, harassment, violence, cyberbullying, community rejection, and conversion efforts—had a greater likelihood of stress-related physical health outcomes. After adjusting for demographic and alcohol and tobacco use covariates, compared with those at the 10th percentile, transgender people at the 90th percentile of the Enacted Stigma Index were more likely to have hypertension, hypercholesterolemia, and poor/fair general health. Adjusted relative prevalence ratios ranged from 51% to 81% increased prevalence, with 95% confidence intervals ranging from 21% to 140% increased prevalence. This finding is consistent with evidence that enacted stigma is associated with physical health outcomes in other minority groups.[6–8] This is the physiological responses that would be expected from chronic (gender minority) stress,[6,10,24,25] including dysregulated immune functioning,[3] increased blood pressure, heart rate, and glucose levels,[26] and decreased insulin sensitivity.[12] In particular, elevated cortisol levels and inflammatory cytokines, have been associated with an increased risk of cardiovascular events.[26–28]

The Enacted Stigma Index was not a statistically significant predictor of myocardial infarction, stroke, and diabetes. For myocardial infarction and stroke, this could be due to the low prevalence of these events meaning that we required a larger sample size to detect this effect; the width of the confidence intervals for these analyses indicated that with our sample size, we required a prevalence ratio greater than three for a statistically significant result. Although our myocardial infarction and stroke findings were nonsignificant, our research still raises concern about the potential effect of gender minority stress on these serious health events: We found prevalence ratios of more than two for both myocardial infarction and stroke, as well as a correlation between the Enacted Stigma Index and hypercholesterolemia and hypertension, both of which are known risk factors for myocardial infarction and stroke.[29]

To provide an additional intersectional perspective, we examined differences between ethnic groups in their average Enacted Stigma Index scores. Our results showed that Māori, Pacific Islander, and other marginalized ethnic groups faced higher levels of transgender-related enacted stigma. Additionally, our regression analyses showed that after accounting for other model variables, Pacific Islanders were more likely to have hypercholesterolemia and a combined Māori, Pacific Islander, and Asian ethnic group were more likely to have diabetes. These health disparities have been found in other research of largely cisgender populations in Aotearoa New Zealand,[30] and they are best understood within a context of continued structural racism and inequity stemming from European colonization in Aotearoa New Zealand, which has resulted in Māori and other non-European ethnic groups facing higher levels of poverty, healthy food access barriers, cultural and linguistic barriers that hinder healthcare access and quality, and other disadvantage.[23,31]

This is the first research to show statistically significant evidence of a relationship between transgender-related enacted stigma experiences and a range of physical health conditions and indicators that could result from gender minority stress. We cannot confirm causal explanations due to the correlational design of this study; however, the alternative direction of causation seems unlikely, and we statistically controlled many third variables that could also provide plausible explanations. It is also unlikely that the results of this study were affected by participants' subjective responding, as could be the case for studies that rely on than subjective ratings of participants' health, since we used doctor diagnoses (which likely relied on biological markers) for most of the health outcomes we studied.

A limitation of this research is the Counting Ourselves study's convenience sample, which is likely to have over-represented New Zealand European (White) participants. We also had a large proportion of younger participants, although this was likely to reflect the younger age distribution of the transgender population.[11] Despite using ethnicity and age weightings for our disparities analysis and including demographic covariates in the regression analyses, it is not certain how generalizable our results are to the wider transgender population in Aotearoa New Zealand. Additionally, the NZHS provided a "don't know" response option to health condition and indicator questions, while Counting Ourselves participants were not given this option. This is unlikely to have had a substantial effect on the results, as the proportions of "don't know" responses were low, ranging from less than 0.1% for diabetes and general health status to 1.8% for cholesterol.

The potential effects of gender minority stress on physical health can be further explored through future research on:

- biomarker physical health indicators, particularly for blood pressure and cholesterol
- a broader range of stress-related health conditions or indicators, such as asthma and ulcers
- the role of anticipated or perceived transgender-related stigma, as a fear or expectation of negative treatment, which is likely to have a significant negative impact alongside enacted transgender-related stigma
- a broader range social determinants of health, such as other drug use and transgender people's barriers to accessing general healthcare[32] and engaging in physical activities, especially gender-segregated activities[33,34]
- analyses to explore the amount that these physical health disparities are directly due to effects of gender minority stress or indirectly due to other effects such as socioeconomic status, substance use, mental health, or educational opportunities
- the buffering effect of social support or perpetuating effect of substance use, sleep quality, and internalization of negative messages about transgender people
- the connection between physical health and structural stigma, which includes laws and policies that disadvantage transgender people

These research findings have implications for medical practice and policies. Medical professionals working with transgender people should provide regular cardiovascular risk assessments[35] and be aware of these disparities and consider the potential impact of gender minority stress. Researchers have indicated the need for stigma-reduction interventions, policy changes, and law reforms to address the stigma that leads to gender minority stress and mental health disparities.[36] Our findings demonstrate that these changes could also be important for addressing the physical health disparities that transgender people face.

Conclusions

This study found that transgender people face physical health disparities for health conditions and indicators that may be expected due to gender minority stress. We found that negative physical health outcomes were more common among those with high transgender-related enacted stigma experiences, such as discrimination, harassment, and violence. To reduce the health disparities in this population, we need policy and law changes to fight the stigma that leads to gender minority stress and medical professionals should monitor health conditions and indicators related to gender minority stress.

Contributors

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Data sharing statement

Researchers who provide a methodologically-sound proposal that aligns with the goal of advancing the health of transgender people will be given access to the data collected for the study. This includes anonymous individual participant data, a data dictionary, statistical analysis protocol, and analytic code. Proposals will be considered immediately following publication and ending 5 years following article publication. To gain access, data requestors will need to sign a data access agreement. Proposals should be directed to jveale@waikato.ac.nz.

Declaration of interests

No conflicts of interest exist.

Acknowledgements

This work was supported by the Health Research Council of New Zealand (17/587) and the Rule Foundation. These funding sources played no role in the writing of the manuscript or the decision to submit it for publication. We have not been paid to write this article by a pharmaceutical company or other agency.

Access to data used in this study was provided by Statistics New Zealand under conditions designed to keep individual information secure in accordance with requirements of the Statistics Act 1975. The opinions presented are those of the author(s) and do not necessarily represent an official view of Statistics New Zealand.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lanwpc.2023.100816.

References

1 Frost DM, Lehavot K, Meyer IH. Minority stress and physical health among sexual minority individuals. *J Behav Med*. 2015;38:1–8.
2 Rosengren A, Hawken S, Ôunpuu S, et al. Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): case-control study. *Lancet*. 2004;364:953–962.
3 Lick DJ, Durso LE, Johnson KL. Minority stress and physical health among sexual minorities. *Perspect Psychol Sci*. 2013;8:521–548.
4 Hendricks ML, Testa RJ. A conceptual framework for clinical work with transgender and gender nonconforming clients: an adaptation of the Minority Stress Model. *Prof Psychol Res Pract*. 2012;43:460–467.
5 Valentine SE, Shipherd JC. A systematic review of social stress and mental health among transgender and gender non-conforming people in the United States. *Clin Psychol Rev*. 2018;66:24–38.
6 Flentje A, Heck NC, Brennan JM, Meyer IH. The relationship between minority stress and biological outcomes: a systematic review. *J Behav Med*. 2020;43:673–694.
7 Chae DH, Walters KL. Racial discrimination and racial identity attitudes in relation to self-rated health and physical pain and impairment among two-spirit American Indians/Alaska Natives. *Am J Public Health*. 2009;99:S144–S151.
8 Flentje A, Clark KD, Cicero E, et al. Minority stress, structural stigma, and physical health among sexual and gender minority individuals: examining the relative strength of the relationships. *Ann Behav Med*. 2022;56:573–591.
9 Poteat TC, Divsalar S, Streed CG, Feldman JL, Bockting WO, Meyer IH. Cardiovascular disease in a population-based sample of transgender and cisgender adults. *Am J Prev Med*. 2021;61:804–811.
10 Alzahrani T, Nguyen T, Ryan A, et al. Cardiovascular disease risk factors and myocardial infarction in the transgender population. *Circ Cardiovasc Qual Outcomes*. 2019;12:e005597.
11 Feldman JL, Luhur WE, Herman JL, Poteat T, Meyer IH. Health and health care access in the US transgender population health (TransPop) survey. *Andrology*. 2021;9:1707–1718.
12 Maru J, Millington K, Carswell J. Greater than expected prevalence of type 1 diabetes mellitus found in an urban gender program. *Transgend Health*. 2021;6:57–60.
13 Wierckx K, Elaut E, Declercq E, et al. Prevalence of cardiovascular disease and cancer during cross-sex hormone therapy in a large cohort of trans persons: a case-control study. *Eur J Endocrinol*. 2013;169:471–478.
14 Connelly PJ, Clark A, Touyz RM, Delles C. Transgender adults, gender-affirming hormone therapy and blood pressure: a systematic review. *J Hypertens*. 2021;39:223–230.
15 Getahun D, Nash R, Flanders WD, et al. Cross-sex hormones and acute cardiovascular events in transgender persons. *Ann Intern Med*. 2018;169:205–213.
16 Veale JF, Byrne JL, Tan KKH, et al. *Counting Ourselves: the health and wellbeing of trans and non-binary people in Aotearoa New Zealand*. Hamilton, New Zealand: Transgender Health Research Lab; 2019. https://countingourselves.nz/wp-content/uploads/2020/01/Counting-Ourselves_Report-Dec-19-Online.pdf.
17 Ministry of Health. *Methodology report 2018/19: New Zealand health survey*. Wellington, New Zealand: Ministry of Health; 2019. https://www.health.govt.nz/system/files/documents/publications/methodology-report-2018-19-new-zealand-health-survey-nov19.pdf.
18 Ware JE, Kosinski M, Keller SD. A 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. *Med Care*. 1996;34:220–233.
19 Tan KKH, Treharne GJ, Ellis SJ, Schmidt JM, Veale JF. Enacted stigma experiences and protective factors are strongly associated with mental health outcomes of transgender people in Aotearoa/New Zealand. *Int J Transgender Health*. 2021;22:269–280.
20 Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*. 1993;88:791–804.
21 Agresti A, Coull BA. Approximate is better than "exact" for interval estimation of binomial proportions. *Am Stat*. 1998;52:119–126.
22 Zou G. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol*. 2004;159:702–706.
23 Chin MH, King PT, Jones RG, et al. Lessons for achieving health equity comparing Aotearoa/New Zealand and the United States. *Health Pol*. 2018;122:837–853.
24 Streed CG, Beach LB, Caceres BA, et al. Assessing and addressing cardiovascular health in people who are transgender and gender diverse: a scientific statement from the American Heart Association. *Circulation*. 2021;144:e136–e148.
25 Diaz M, Rosendale M. Diagnosis, treatment, and prevention of stroke in transgender adults. *Curr Treat Options Neurol*. 2022;24:409–428.
26 Kivimäki M, Steptoe A. Effects of stress on the development and progression of cardiovascular disease. *Nat Rev Cardiol*. 2018;15:215–229.
27 Whitworth JA, Williamson PM, Mangos G, Kelly JJ. Cardiovascular consequences of cortisol excess. *Vasc Health Risk Manag*. 2005;1:291–299.
28 Walker BR. Glucocorticoids and cardiovascular disease. *Eur J Endocrinol*. 2007;157:545–559.
29 Oliveira GBF, Avezum A, Roever L. Cardiovascular disease burden: evolving knowledge of risk factors in myocardial infarction and stroke through population-based research and perspectives in global prevention. *Front Cardiovasc Med*. 2015;2. https://www.frontiersin.org/articles/10.3389/fcvm.2015.00032. Accessed January 11, 2023.
30 Atlantis E, Joshy G, Williams M, Simmons D. Diabetes among Māori and other ethnic groups in New Zealand. In: Dagogo-Jack S, ed. *Diabetes mellitus in developing countries and underserved communities*. Cham: Springer International Publishing; 2017:165–190.

31 Miner-Williams W. Racial inequities in cardiovascular disease in New Zealand. *Divers Equal Health Care*. 2017;14:23–33.
32 Safer JD, Coleman E, Feldman J, et al. Barriers to healthcare for transgender individuals. *Curr Opin Endocrinol Diabetes Obes*. 2016;23:168.
33 Bishop A, Overcash F, McGuire J, Reicks M. Diet and physical activity behaviors among adolescent transgender students: school survey results. *J Adolesc Health*. 2020;66:484–490.
34 Downing JM, Przedworski JM. Health of transgender adults in the U.S., 2014–2016. *Am J Prev Med*. 2018;55:336–344.
35 Coleman E, Radix AE, Bouman WP, et al. Standards of care for the health of transgender and gender diverse people, version 8. *Int J Transgend Health*. 2022;23:S1–S259.
36 White Hughto JM, Reisner SL, Pachankis JE. Transgender stigma and health: a critical review of stigma determinants, mechanisms, and interventions. *Soc Sci Med*. 2015;147:222–231.