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Walden University
2018

Abstract

The Relationship between Isolation, Distress, and Medical Care among Transgender

Coloradoans

by

Charles Tinnell

MSPH, University of Colorado, 1986

BA, University of Florida, 1973

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

Walden University

February 2018

Abstract

In Colorado in 2014, suicidal ideation or suicide attempts occurred up to 10 times more frequently among transgender persons than the general population. This reality occurred within a milieu of stigma that included transgender persons' negative perceptions of healthcare, a higher incidence of psychological distress, and an uncertain role for social isolation in their well-being. The purpose of this quantitative study was to explore the interactions between social isolation, supportive medical care, and psychological distress within the framework of Meyer's minority stress theory. Data were acquired from the 2014 Colorado Transgender Health Survey conducted by the One Colorado Education Fund ($n = 417$). These survey data were analyzed using multivariate techniques and structural equation modeling. Key findings were that psychological health and social integration were positively related ($p < .001$), supportive medical care and psychological health were positively related ($p = .016$) and influenced by race and gender identity ($p = .05$), and, social integration and supportive medical care were not significantly associated. Access to medical care and disease history influenced these relationships ($p < .001$), and 5 distinct gender identity/race groups emerged. The positive social change implications stemming from this study include recommendations for healthcare and policy-making bodies to improve understanding regarding gender and racial disparities in medical and psychological healthcare, to expand collection of gender identity and victimization data, to improve availability of adequate insurance coverage, and, to foster employment and housing equity. Implementation of these recommendations may improve the lives of transgender Coloradans.

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Dedication

To Beverly, Ada, and Theodore: I dedicate this dissertation to you, knowing that words are inadequate to express the depth of my love for you all and my gratitude for the inspiration, motivation, and joy that I have found on the long walk we have shared.

Ad majorem Dei gloriam

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To Dr. Karen Shafer: You have been immensely patient with the many drafts and re-writes submitted as this dissertation took shape. Your guidance brought a diffuse topic into sharp focus and your editing brought clarity to verbosity. Thank you!

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Chapter 1: Introduction to the Study

Introduction

Many transgender persons are invisible, isolated, and alone. In addition to the

daily reality of overt discrimination that is often accompanied by lethal violence, these

persons often do not receive appropriate care from a healthcare system that many

perceive as so uncaring that they avoid it even in times of need. In Colorado, in 2014,

transgender persons experienced depression and suicide at rates above those of cisgender

(nontransgender) persons, and were less likely to have access to supportive medical care

(One-Colorado, 2014). Societal stigma towards transgender persons was found in the

healthcare system also, and may have fostered reluctance on the part of these persons to

seek care and may have exacerbated potentially treatable psychological conditions.

Although the healthcare of transgender persons has been the subject of social and

academic interest (Institute of Medicine [IOM], 2011), these persons were invisible in

most epidemiologic or policy-oriented datasets. Using secondary analyses of data

collected in 2014 from an anonymous survey of self-identified transgender persons in

Colorado, this study examined the relationships in this group between three constructs:

Social isolation, supportive medical care, and psychological distress. The interactions of

these constructs reflected the varied effects that societal stressors such as discrimination

had on an individual's perception of well-being in a society that largely stigmatized

gender variance. Investigation of the dynamics of social isolation, psychological distress,

and the lack of supportive medical care (all of which are known risk factors for suicide)

supported existing approaches to reduce the burden of psychological distress that

transgender Coloradoans reported by identifying important characteristics of these relationships. Creative approaches to positive social change were enhanced through the gradual building of a valid evidence-base for policy development.

Transgender persons were often invisible or hidden in most databases, and were likely to be poorly understood (Bauer, Scheim, Deutsch, & Massarella, 2014). Even if self-imposed isolation as a form of avoidance coping seemingly protected an individual, it also further limited the help that could be offered to that individual (Budge, Adelson, & Howard, 2013). The three constructs (social isolation, supportive medical care, and psychological distress) that formed the foundation for this study were key vantage points from which to promote social change through awareness and education, through seemingly simple and intuitive principles derived from empirical research. For example, social isolation is best mitigated by support from other human beings, especially parents; studies of medical care have shown that provider attitudes have conferred potential for help and harm; studies of psychological distress have shown the depth of despair often expressed by people who are at the margins of society and subjected to the most intense stigmatization.

Social change can lead to policy change, and vice versa. The widespread influence of healthcare made this a good arena for the productive application of the results of this study. For example, policies and initiatives informed by this study would promote increased clinical competence in the care of transgender patients and influence community-wide practice standards. Further, advocacy for improvements in health insurance for transgender persons as well as other socially marginalized persons could

result in improved access to competent and supportive care, as well as coverage for

transition-related treatments. The results of this study also supported the importance of

periodic assessments of locally-focused studies regarding the health-related and social

experiences of transgender persons.

In this chapter, key aspects of this study are introduced. First, the problem this

study addressed is described with background information. Then, the purpose of the study

is explained and the research question and hypotheses are presented. Next, the

theoretical and conceptual foundations of the study are briefly examined, along with

explanations and definitions of key terms and concepts used in the study. Finally, the

nature, scope, and limitations of the study are considered, and the significance of the

study and its potential to foster social change are set forth.

Background

The effects of stress in gender-variant persons, especially stress from social

adversity such as discrimination, have been increasingly acknowledged across all social

strata and in many health conditions (IOM, 2011). The health of members of minority

groups may be influenced by the dehumanizing effects of prejudice (Blosnich, Farmer,

Lee, Silenzio, & Bowen, 2014; Kteily, Bruneau, Waytz, & Cotterill, 2015). Gender- and

sexuality-based social and structural discrimination is well-documented (Bauer, Zong,

Scheim, Hammond, & Thind, 2015; Snelgrove, Jasudavisius, Rowe, Head, & Bauer,

2012).

In this study, the interactions between social isolation, psychological distress, and

supportive medical care in transgender persons were investigated from the perspective of

minority stress theory (MST). In addition to MST, this study drew on a broad foundation

of research that included the psychological and biological origins and effects of stress

(especially stress from discrimination), the effects of stress in transgender persons and

members of other minority groups, the influence of socioeconomic status on well-being,

and the role of physical health as a determinant and a result of stress.

Psychological distress is a well-documented risk factor for suicide in transgender

persons (Bauer, Scheim, Pyne, Travers, & Hammond, 2015; Hendricks & Testa, 2012;

Grant et al., 2011). The elevated rates of psychological distress (especially suicidal

ideation and attempts) and victimization that were reported in transgender Coloradoans

also occur nationally (Grant et al., 2011). Like somatic illness, evidence of poor mental

health is found in any culture. The impairment associated with mental illness is the

largest source of disability in developed countries (Reeves et al., 2011). Psychological

distress, in this study, represented conditions (e.g., anxiety, depression, and suicidal

ideation) that were associated with age, gender, socioeconomics, access to medical care,

disease history, and behavioral characteristics.

In the second decade of the 21st century, rates of suicide were increasing in the

United States and were recognized as a major public health problem (David-Ferdon et al.,

2016; World Health Organization [WHO], 2014). Suicidal ideation or attempts and less

severe forms of self-harm were found in transgender persons (Dickey, Reisner, &

Juntunen, 2015; Reisner, Vetters et al., 2015), in other sexual minorities (Muehlenkamp,

Hilt, Ehlinger, & McMillan, 2015), and in those who experienced social exclusion due to

homelessness (Moskowitz, Stein, & Lightfoot, 2013). Suicide-related events may have

been 20 times higher in transgender persons or those with gender identity disorder, based on Veterans Administration (VA) data (Blosnich et al., 2013). Suicide was related to stigma (Perez-Brumer, Hatzenbuehler, Oldenburg, & Bockting, 2015) and violent (or hate crime) victimization (Duncan & Hatzenbuehler, 2014; Goldblum et al., 2012; Hendricks & Testa, 2012; House, Van Horn, Coppeans, & Stepleman, 2011; Ioerger, Henry, Chen, Cigularov, & Tomazic, 2015; Lehavot & Simoni, 2011; Testa et al., 2012). The perception of victimization also has been shown to occur because of bullying (Hatzenbuehler, Duncan, & Johnson, 2015; Reisner, Greytak, Parsons, & Ybarra, 2015; Vaillancourt et al., 2011).

The interpersonal theory of suicide (IPTS) included two characteristics of suicidal ideation, inability to achieve social connections (thwarted belongingness) and feelings of being a burden to others (perceived burdensomeness), which were directly related to social interactions. Thwarted belongingness has been shown to lead to social isolation, and may be accompanied by peer rejection or the more detrimental rejection from one's family (Barr, Budge, & Adelson, 2016; Bauer, Scheim et al., 2015). The perception of burdensomeness has been accompanied by feelings of self-hatred (Grossman, Park, & Russell, 2016), akin to the internalized homophobia or internalized transphobia that is predicted by the MST (Meyer, 2003a). IPTS-based psychological mechanisms have complemented the social focus of the MST which has broadened the scope of discrimination-related research (see Baams, Grossman, & Russell, 2015; Barboza, Dominguez, & Chance, 2016; Hatzenbuehler, 2009; Rood, Puckett, Pantalone, & Bradford, 2015; Seelman, 2016).

A key predictor of suicide, depression, has been reliably measured (Jia, Zack, Thompson, Crosby, & Gottesman, 2015; Kroenke, 2001) and has been shown to be multifactorial, especially in sexual minorities (Mustanski & Liu, 2013). Depression is often intersectional, as when obesity has occurred in a minority person (Peterson, Matthews, Copps-Smith, & Conard, 2016). Bauer, Flanders, MacLeod, and Ross (2016) found syndemic (i.e., co-existing and interrelated) relationships between substance abuse and discrimination, and independent societal biases against mental illness and substance abuse. Substance abuse, including alcohol abuse, has been frequently associated with maladaptive responses to stress in transgender and other gender minority persons (Reisner, Greytak et al., 2015) and the occurrence of multiple intersecting sources of stress (Flentje, Heck, & Sorensen, 2014; Keuroghlian, Reisner, White, & Weiss, 2015).

The association between social isolation, lack of social support, and depression is not only a problem in stigmatized groups (Butcher, Hooley, & Mineka, 2014). However, in transgender or gender-variant persons, in conjunction with stigma, social isolation has been a component of suicidal ideation (Baams et al., 2015; Bauer, Scheim et al., 2015; Moody & Smith, 2013; Yadegarfard, Ho, & Bahramabadian, 2013). The lack of reliable definitions for social isolation and social support has led to ambiguous research findings (IOM, 2014; Zavaleta, Samuel, & Mills, 2014). For example, social support (not differentiated with respect to peer or parent) was found to be protective against suicide in transgender persons (Yadegarfard et al., 2013), but the relative importance of peers and parents (i.e., whether peer-based support was as protective as parental support) has not been not consistent (Bauer, Scheim et al., 2015; Bockting, Miner, Swinburne Romine,

Hamilton, & Coleman, 2013). Family rejection has outweighed social benefits (i.e., tolerance, income, education, employment) in the occurrence of suicidal ideation among transgender youth and adults (Yadegarfard et al., 2013; Klein & Golub, 2016). Ybarra, Mitchell, Palmer, and Reisner (2015) noted that in-person social support was more beneficial than online sources.

Failure of transgender persons to seek appropriate medical care as well as their inability to find supportive medical care has been acknowledged as risk factors for suicidal behavior and other harmful outcomes (Bauer, Scheim et al., 2015; Huot et al., 2013; Xavier et al., 2013). Transgender persons have reported discrimination or lack of support in healthcare encounters and subsequent avoidance of healthcare (Bauer et al., 2014; Grant et al., 2011; One-Colorado, 2014; Poteat, German, & Kerrigan, 2013). Even in states perceived to be more open to gender diversity, such as Hawai'i, healthcare discrimination has been reported (Stotzer, Ka'opua, & Diaz, 2014). Even though transgender patients were likely to have multiple physical, psychological, or wellness issues, some of which may be overlooked if such issues are not specifically sought or addressed by providers (Brennan et al., 2012; Cole, Logan, & Walker, 2011; Zucker, Lawrence, & Kreukels, 2016), the respondents to the survey, however, expressed general wellness comparable to that of the Colorado population (One-Colorado, 2014).

Studies of healthcare providers have corroborated the perceptions of bias reported by transgender persons (McIntyre, Daley, Rutherford, & Ross, 2011; Snelgrove et al., 2012). Lack of supportive medical care has led to delays in care and the failure to treat life-threatening conditions appropriately (Bauer, Scheim et al., 2015; Huot et al., 2013;

Xavier et al., 2013). Sometimes, discriminatory behavior has been overt (Bauer, Scheim et al., 2015), and may have involved the use (or nonuse) of correct pronouns (Hagen & Galupo, 2014).

Failure to provide supportive medical care to transgender patients may have been due to lack of familiarity with the medical needs of these persons. Gender identity disorder (a codable diagnosis in the International Classification of Diseases versions 9 [ICD-9] and 10 [ICD-10], and Diagnostic and Statistical Manual of Mental Disorders, version 5 [DSM-5]) has been poorly understood and controversial (Byne et al., 2012; Davy, 2015; Meier, Pardo, Labuski, & Babcock, 2013). Gender-related clinical data (such as risk of cancer, cardiovascular disease, or dose-response effects) have been insufficient to guide treatment decisions (Nieder, Elaut, Richards, & Dekker, 2016; Feldman et al., 2016). Professional groups (e.g., for psychologists, emergency physicians, and nurses) have worked to improve provider awareness (American Psychological Association [APA], 2015; Brown & Fu, 2014; Lim, Brown, & Jones, 2013).

The onset of gender dysphoria has been shown to occur during the elementary school years. In preadolescent transgender persons, almost 9 years (on average) may have elapsed from onset (i.e., first awareness) until disclosure (Olson, Schrager, Belzer, Simons, & Clark, 2015). Recognizing this, provider-oriented educational efforts have addressed the needs of children and adolescents as well as adults (Gridley et al., 2016; Mustanski, 2011; Radix & Silva, 2014; Steever & Cooper-Serber, 2013).

At the other end of the life spectrum, an aging gender-variant population has begun to impact Medicare (Kattari & Hasche, 2016) and end-of-life decisions (Cartwright, Hughes, & Lienert, 2012). Also, older transgender persons are known to experience a variety of transition-associated issues that may only develop over time, such as gender-specific cancers (Bauer & Hammond, 2015; Quinn et al., 2015). Stereotyping the needs of gender-variant persons has reflected societal ignorance of the differences between the gender identities of transgender persons and those of lesbian, gay, or bisexual (LGB) persons (Shipherd, Maguen, Skidmore, & Abramovitz, 2011; Worthen, 2013). This study corroborated the pitfalls of stereotyping; gender identity significantly accounted for variations in health experiences and attitudes, as seen in Chapter 4.

Discrimination or ignorance in healthcare settings has induced some transgender persons to avoid seeking needed healthcare (Bauer et al., 2014; Grant et al., 2011). This underutilization of health services may be detrimental for some, since transgender persons have been found to have higher incidence of potentially treatable psychological problems (Poteat et al., 2013; Yadegarfard et al., 2013).

With the lack of supportive medical care linked to psychological harm in transgender persons (Bauer, Scheim et al., 2015) and with the lack of social support (as a surrogate for social isolation) linked to psychological harm in transgender persons (Budge, Adelson et al., 2013), a gap in knowledge existed concerning how social isolation and supportive medical care interacted in the context of psychological distress in transgender persons. This study addressed this gap within a framework of MST by examining these three factors in a self-selected group of transgender Coloradoans who

responded to an anonymous 2014 survey (see One-Colorado, 2014). The information

provided by this survey was the only source of detailed health-related data that reflected

the Colorado social climate of that time. Further, since social isolation was seldom

explicitly defined in the literature, analysis of the elements of a broader conception of

social isolation (e.g., partnership status, employment, education, income, and physical

activity) in this study attempted to elucidate the dynamics of minority stress in

transgender Coloradoans. This attempt was partially successful.

With few, if any, sources of local information on the health of transgender

Coloradoans, this study could address the research question and hypotheses in a way that

was meaningful at the community level. In a national study of transgender and gender-

variant persons, suicide and major psychological symptomatology have been found, as

are underemployment and social discrimination, and it has also been found that the

healthcare system is a source of discrimination (Grant et al., 2011). The survey

conducted in Colorado corroborated those national findings (see One-Colorado, 2014)

and offered a recent and accurate local source of health-related information that allowed

deeper exploration of the social and psychological dynamics that may have accounted for

those findings in Colorado. By examining three known risk factors for suicide (social

isolation, lack of supportive medical care, and psychological distress), subjective and

external stressors that affected transgender Coloradoans were uncovered that could

inform programs and policies to improve their lives and the provision of healthcare in

that state.

Problem Statement

The problems that this study sought to address were the negative perceptions that Colorado transgender persons had of their healthcare, the higher incidence of psychological distress in this group relative to the Colorado public, and the uncertain role that social isolation may have played in these problems. These negative perceptions may have been a result or a cause of psychological distress, and may have been exacerbated by social isolation. These problems existed in Colorado's tolerant but nevertheless stigmatizing social environment in which suicide was relatively common. In Colorado, suicidal ideation or suicide attempts occurred as much as 10 times more frequently in the transgender population than in the general population (One-Colorado, 2014).

Minority stress theory suggested that the influence of stigma and discrimination (Baams et al., 2015; Hendricks & Testa, 2012; IOM, 2011) may influence social isolation, lack of supportive medical care, and psychological distress, although the dynamics of such interactions were uncertain. Psychological distress was a well-reported risk factor for suicide in transgender persons (Bauer, Scheim et al., 2015; Grant et al., 2011; Hendricks & Testa, 2012). Failure of transgender persons to seek appropriate medical care as well as their inability to find supportive medical care has been increasingly acknowledged as a risk factor for suicidal behavior and other harmful outcomes (Bauer, Scheim et al., 2015; Huot et al., 2013; Xavier et al., 2013). Likewise, social isolation (often defined as the absence of social support) has been considered a component of suicidal ideation in transgender persons (Bauer, Scheim et al., 2015; Moody & Smith, 2013; Yadegarfard et al., 2013).

As noted above, the gap in knowledge that this study sought to close concerned the interrelated effects of social isolation, psychological distress, and supportive medical care in transgender persons. There were several ways to close this gap in knowledge. First, this study explored the research question and hypotheses with data collected from a particular time and place (Colorado in 2014). Within the limitations of the study, the results were broadly applicable to other demographically-similar areas. Such specificity was an asset to policy development by providing Colorado decision-makers with unique local data. Another way this study helped to close this literature gap (lack of knowledge regarding the interrelated effects of social isolation, psychological distress, and supportive medical care in transgender persons) and contribute to the literature was by setting the research problem and questions within the framework of MST. By testing hypotheses built around this theoretical framework, aspects and predictions of that theory, such as the importance of interpersonal support, were supported or refuted.

Purpose of the Study

The purpose of this quantitative study was to explore the interactions that existed between social isolation, supportive medical care, and psychological distress within the framework of MST. This study was undertaken using a dataset collected from a cohort of transgender Coloradoans who responded to a detailed survey on health status and access to healthcare. Previous descriptive analyses of this survey identified disparities in access to healthcare and health status and also identified discrimination in health services (One-Colorado, 2014). MST centered social stress in a complex web of socioeconomic, psychological, and medical influences. Since any of the three primary concepts of the

study may have influenced the others in varied ways, the statistical relationships between these concepts has partially provided information about their underlying dynamics.

Research Question and Hypotheses

For this study, the three main constructs identified from the literature (psychological distress, social isolation, and supportive medical care) were operationalized for analysis. Thus, the acronyms for social isolation (SI), psychological distress (PSY), and supportive medical care (SMC) refer only to the measured variables defined by the survey data used in this study.

The research question of this study was: What were the relationships between measures of social isolation (SI), psychological distress (PSY), and supportive medical care (SMC) among the transgender Coloradoans who participated in the One Colorado survey?

This question was evaluated with three core hypotheses. Each hypothesis examined the relationship between one of the measured variables (PSY, SI, or SMC) and the other two, after identifying and mitigating demographic, medical, and behavioral control variables. In this strategy, one null hypothesis and three alternative hypotheses formed the foundation of the research plan.

H0: There was no relationship between SI, PSY, and SMC in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

H1a: A positive association existed between PSY and SI in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

H1b: A positive association existed between PSY and SMC in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

H1c: A positive association existed between SI and SMC in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

Theoretical Foundation

The premise of MST was that social stress from discrimination decreased psychological well-being in persons who belonged to a gender minority group (Meyer, 2003a). For gender-variant persons, MST predicted the person's expectation of rejection, concealment of one's identity as a minority person, and the acquisition of self-directed stigma (internalized homophobia). The simplicity of MST allowed its adaptation to situations beyond its original focus on psychological distress in homosexuals (Meyer, 2003a), such as the effects of adversity and social stressors on psychological health and stigma-related psychological distress in transgender persons.

The principal theorists of this broadened perspective included the developer of MST Meyer (1995; 2003a), Dohrenwend (1998; 2000), and Thoits (2010), each of whom have investigated a wide range of medical and psychological effects of prejudice and adversity. In seminal investigations, Meyer studied the psychological responses of homosexual men to events related to discrimination, rejection, and violence (Meyer, 1995) and theorized a model of the psychological response to discrimination, stigma, and prejudice in lesbian, gay, and bisexual (LGB) persons (Meyer, 2003a). In the minority stress model, the stressor (discrimination) is influenced (i.e., mediated or moderated) by various factors via one or more pathways which ultimately lead to negative mental health

outcomes. Measurement validity was a key challenge, due to a person's individual (subjective) responses to stress, the influence of difficult-to-characterize structural discrimination experienced by the person, and the difficulty in isolating the effects of more serious forms of discrimination, such as violence, against the backdrop of everyday stressors, such as difficulties with finding a taxi (Meyer, 2003b).

From the study of natural situations of adversity, concepts such as controllability, predictability, and duration of exposure emerged as measurable characteristics of stress-health relationships (Dohrenwend, 2000). Thoits (2010) identified the role of acute and chronic sources of stress over the life course, the multifactorial (social, psychological, and physical) pathways for the measurable harm associated with stress, the disproportionate effect of stress on minority groups, and the contagion-like endemicity that can lead to partner, family, or social symptomatology. Thoits (2010) also identified the importance of confidence, controllability, predictability, and social support in the mitigation of harm.

According to MST, social stress (principally due to discrimination) experienced by members of a minority group like gender-variant persons leads to negative psychological outcomes, such as depression or suicide. The theorized pathway from antecedent (social stress) to outcome (psychological distress) predicted three mediating/moderating intermediate conditions: Expectation of rejection, concealment of one's identity as a minority person, and, for gender-variant persons, internalized homophobia.

Meyer (2003a), in forming a more parsimonious view of the cognitive processes that appraise and interpret stress, differentiated objective (social or distal) sources of stress and subjective (psychological or proximal) sources by their relative nearness to observable psychological distress. Further, Meyer postulated that the effects of social stress are cumulative and affected by covariates such as age, race, or gender. While not specifically addressed in Meyer's model of the MST, other authors investigated the geography-based effects of gender- or sexuality-related stigma at the community level (Hatzenbuehler, Bellatorre et al., 2014), the state level (Hatzenbuehler & McLaughlin, 2014), and in rural areas of the U.S. (McCarthy, Fisher, Irwin, Coleman, & Pelster, 2014; Swank, Frost, & Fahs, 2012). Hatzenbuehler (2009) provided a broad approach to the statistical modeling and analysis of multifactorial stress-related psychological outcomes, termed the psychological mediation framework (PMF), by attempting to disentangle mediating or moderating effects of psychological factors such as emotional or cognitive stability. However, such differences were nonspecific and prone to measurement variation, which fostered interpretational ambiguity.

MST was developed to account for the aggregate effects of stress, and thus was not particularly applicable to individual psychopathology. In Meyer's view, social stress was a "generic" not a "specific" pathogen (Meyer, 2010, p. 1218). However, Schwartz and Meyer (2010) acknowledged that the accuracy of MST had not been fully resolved, despite the intuitive appeal of this theory. The purported effects of stress were difficult to consistently and unambiguously isolate and replication was difficult (see Bauer, Flanders, MacLeod, & Ross, 2016; Budge, Adelson et al., 2013; Budge, Rossman, & Howard,

2014; Conron, Scott, Stowell, & Landers, 2012; Frost & Meyer, 2012; Hoffman, 2014; Shipherd et al., 2011). In trying to explain the ambiguity of research findings, Schwartz and Meyer (2010) noted that the criteria for causality may be too rigid. A less rigid approach in Schwartz and Meyer's view would be to focus on between-group analyses of cross-sectional data and establish etiology based on "convergence of findings" from robust between-group studies (p. 1116).

Chapter 2 discusses the MST and related concepts in more detail by showing that the known biological and psychological characteristics of the stress response (identified through experimental and epidemiological methods) supported a role for discrimination-induced stress in psychopathology as well as physical pathology. Thus, the MST may have value in identifying stress mechanisms at physiological levels in addition to the psychological levels studied in Meyer's seminal works (Meyer, 1993; 2003a). Refinement of the MST also occurred when the mitigating effect of resilience (a form of adaptation that suppresses negative outcomes) was considered (Marin et al., 2011; Thoits, 2010). Also discussed in Chapter 2 is evidence that discrimination has led to stress, that stress has exhibited age-related effects, that stress is measurable, and that stress has been ameliorated pharmacologically. Research findings are presented that demonstrated that for transgender persons the lack of supportive medical care and social isolation were adversities that have been independently linked to psychological harm. It was therefore desirable to know how social isolation and supportive medical care interacted in the context of psychological distress in a vulnerable minority population; the MST suggested the possible importance of this triad to the well-being of transgender persons.

However, psychological constructs such as social isolation, have presented formidable measurement challenges (Schwartz & Meyer, 2010). The measurement of social isolation exemplifies the challenges of research involving 'fuzzy' social concepts (Chen & Yao, 2015, p. 781); rigorous dependent-independent models were less useful due to the likelihood of large measurement error, partially because of the imperfect operational definitions of imprecise concepts. The variability in the definition of social isolation made explicit capture of this information in a hidden population difficult, if not impossible; there was no specific survey item to capture social isolation in the One-Colorado dataset. Even though social isolation was not explicitly identifiable in the dataset, conceptualizing social isolation as a latent, or unmeasured, variable was theoretically consistent with the MST. The PMF developed by Hatzenbuehler (2009) provided general guidance to the analysis of latent psychological constructs by showing that unmeasured mediation/moderation pathways may be inferred from an MST antecedent-outcome process. Structural equation modeling was an appropriate approach for the analysis of interacting latent and manifest (observed) factors (Blunch, 2013, p. 5; Byrne, 1998, p. 4).

Nature of the Study

This study used quasi-experimental statistical methods to perform secondary analyses of cross-sectional health data collected anonymously in 2014 from a survey of transgender persons in Colorado. The survey responses were obtained from convenience (i.e., nonprobabilistic and nonrandom) sampling of self-described transgender Coloradoans. As O'Sullivan, Rassel, and Berner (2012) noted, even without

randomization, cross-sectional data can be statistically manipulated to simulate

independent and dependent relationships and comparison groups. Thus, this study's

design (not experimental due to lack of randomization and not preexperimental due to the

use of comparison groups) was fundamentally quasi-experimental. While it was not

possible to establish causal relationships from the survey data due to the lack of temporal

sequence information, analyses supported or refuted assertions derived from the

predictions of MST, following the between-group approach suggested by Schwartz and

Meyer (2010).

The three interdependent concepts of primary interest in this study were

psychological distress, social isolation, and supportive medical care and any of the three

concepts could have been independent, dependent, covariate, mediating, or moderating

with respect to the others. For this study, psychological distress (anxiety, depression,

and/or suicidality) was hypothesized to be the most important dependent variable.

Psychological distress, especially suicidality (suicidal ideation or behavior) and

depression, were more common in transgender persons (Blosnich et al., 2013; Jia et al.,

2015). Social isolation was difficult to measure directly and was variably defined in the

literature (Zavaleta et al., 2014). In this study, social isolation was conceptualized as a

latent variable identified by relationship characteristics, activity, and socioeconomic

characteristics. In this study, medical care was supportive when it lacked prejudice as

perceived by the respondent. Transgender persons frequently reported the perception of

discrimination from healthcare providers (Bauer et al., 2014; Grant et al., 2011; One-

Colorado, 2014; Poteat et al., 2013) and providers have acknowledged deficiencies in the

mental health treatment of transgender persons (McIntyre et al., 2011), and in access to services and resources, provider knowledge, and transition-related ethics (Snelgrove et al., 2012).

Demographic, medical, and behavioral variables could potentially have influenced social isolation, psychological distress, and supportive medical care as covariates, mediators, or moderators (i.e., as control variables). Other variables, especially those using the Healthy Days methodology (Centers for Disease Control and Prevention [CDC], 2000; Horner-Johnson, Krahn, Andresen, & Hall, 2009), that reflected the respondent perceptions of physical and mental health and well-being are particularly important in the analysis of stress-health processes, and transgender persons' use of transition-related medical or surgical care may also have been particularly important in understanding their psychological well-being, especially over time (Dhejne et al., 2011; Dhejne, Öberg, Arver, & Landén, 2014). Some control variables, such as age, race, or gender, may have been intersectional sources of discrimination (Hoffman, 2014; Meyer, 2003a). The control variables for this study were age group, race, ethnicity, gender, the time since routine medical checkups, cardiovascular or respiratory history, metabolic disease history, transition-related medical or surgical care, alcohol abuse, drug abuse, and tobacco use.

The One Colorado Educational Fund (OCEF) granted access to the survey data that were analyzed in this study. There were four parts to the analysis: Data quality evaluation, index construction and validity testing, hypothesis testing, and supplemental analyses. Index construction was a key component of the data analysis plan and involved

the creation of composite (custom) ordinal variables that addressed the primary

constructs (psychological distress, social isolation, and supportive medical care) and

certain control variables. These composite variables were constructed with five or more

levels to achieve approximate ordinal normality (Byrne, 1998; Rhemtulla, Brosseau-

Liard, & Savalei, 2012). Factor analysis was used to identify a latent construct for social

isolation, since this construct was not explicitly collected in the survey dataset and was

variably defined in the literature. In the hypothesis testing phase, multivariate procedures

were used to evaluate the hypothesized relationships between the three primary variables.

In the fourth part of the data analysis plan, structural equation modeling (SEM) and

moderation/mediation analyses were used to clarify ambiguous relationships uncovered

in earlier analyses.

Definitions

Bigender (two-spirit): Two coexisting genders. A Native American term, *two-spirit,* indicates a bigender person (APA, 2015; One-Colorado, 2014).

Cisgender: Gender identity that is consistent with birth gender in someone who does not identify as transgender (APA, 2015; One-Colorado, 2014).

Gender dysphoria: A psychiatric term to identify psychological discomfort arising from the difference between one's birth sex and gender identity. In the DSM–5, *gender dysphoria* replaces the diagnosis formerly termed *gender identity disorder* (APA, 2015).

Gender fluid: Variable, nonbinary gender identity or expression (APA, 2015).

Gender identity: the internal, subjective sense of maleness, femaleness, or an alternative, which may be different than one's sex at birth (APA, 2015).

Gender queer: A nonbinary gender identity (APA, 2015).

Sex: The gender assignment based on the external genitalia at birth. Even though in many persons gender assignment may be obvious, the appearance of external genitalia may be ambiguous (APA, 2015).

Social integration: For this study, social integration was defined by the indicators that identify social relationships in a manner consistent with the social determinants of health (Heiman & Artiga, 2015; Office of Disease Prevention and Health Promotion [ODPHP], 2017). In this study, these indicators are survey items that captured information on social networks, disability, and socioeconomic status. The term *social integration* was used to connote the opposite of social isolation, since the concept of social isolation was difficult to operationalize due to the limitations of the dataset. This study identified a latent construct for social isolation/integration found within the indicators that reflected socioeconomic status, relationships, and activity.

Transgender (trans): The condition whereby a person's "gender identity or expression differs from [the] social norms for those of their birth sex" (Bauer et al., 2014, p. 720). Gender identity is complex and, for many persons, not easily described as a binary formula (Nagoshi, Brzuzy, & Terrell, 2012). As transgender persons become more visible in society, the societal understanding of gender diversity is becoming more rooted in science, but data regarding the biology of gender identity are inconclusive (Erickson-Schroth, 2013; Hoekzema et al., 2015; Joel et al., 2015; Kim, Kim, & Jeong,

2015). The term *transgender* is ambiguous for some gender-variant persons, even though these persons self-identified as transgender in the One-Colorado survey. This may present an ethical problem regarding both accuracy and respect for the respondents' intentions. James et al. (2016) concluded, with respect to the 2015 U.S. Transgender Survey, that for the sake of clarity and despite differences in its precise meaning, the single term *transgender* is suitable for research purposes to describe gender variance not identifiable as lesbian, gay, or bisexual.

Transgender man (transman, trans man, FtM): A person whose birth gender was female and identifies as or who has transitioned to male (APA, 2015; One-Colorado, 2014).

Transgender woman (transwoman, trans woman, MtF): A person whose birth gender was male and identifies as or who has transitioned to female (APA, 2015; One-Colorado, 2014).

Transition: The process of altering one's appearance or behavior to be more congruent with one's gender identity. A social transition may involve changes in one's gender-related external appearance and behavior such as style of clothing or use of pronouns. A medical transition, through hormone therapy or surgery, alters one's biochemical or physical characteristics (APA, 2015).

Transsexual: A transgender person. This term is sometimes used to indicate a person is undergoing transition (One-Colorado, 2014).

Assumptions

In this study, there were assumptions that reflected the data and the secondary nature of the study, as well as methodological assumptions related to the analytic methodology. The initial assumption made for this study was that the respondents answered truthfully and correctly. While there was no way to definitively evaluate this assumption, research supported its validity. Gender-variant persons have welcomed the ability to have their gender identities appropriately recognized and respected in health information systems (Bjarnadottir, Bockting, & Dowding, 2016; Cahill et al., 2014; Cahill, Baker, Deutsch, Keatley, & Makadon, 2016; Callahan et al., 2015). However, even if this assumption was upheld, uncertainty regarding the meanings of survey items could have led to measurement error.

The second assumption was that the data had not been corrupted prior to the acquisition of the dataset for this study. This assumption also was likely to be valid, since internal consistency was reasonably assessed by thorough data quality evaluation during the first phase of the analysis. Accuracy of the information presented to the public was a key goal of the One-Colorado survey and the broad findings of those analyses (such as the increased occurrence of suicidal ideation and socioeconomic disadvantage) were consistent with the findings of other research (see Conron et al., 2012; Grant et al., 2011).

The assumption was also made that, despite the secondary nature of the study, an index of social isolation could be reliably constructed. This assumption was less solid for methodological and practical reasons. Methodologically, the variation in meanings

ascribed to social isolation (i.e., as the dearth of social networks or interactions, as the

absence of social support, or as an aspect of social capital) and the acknowledged

measurement difficulties associated with the concept of social isolation (see IOM, 2014;

Zavaleta et al., 2014) made it difficult to operationalize. Although other researchers had

consistently reported the importance of this concept (despite its variability), findings

diverged with respect to how social isolation exerted its influence. For example, poor

psychological health associated with social isolation may occur through perceived

burdensomeness (Baams et al., 2015), decreased societal acceptance and parental support

(Bauer, Scheim et al., 2015), decreased peer support (Bockting et al., 2013), ostracization

(Johnson & Amella, 2014), or family rejection (Yadegarfard et al., 2013). The practical

limitations of this study that may have affected this assumption are discussed in the next

section.

The final assumption reflected the analytic requirement of normality. The

analytic plan for this study was based on regression (which is also the foundation of

SEM), which required a reasonable assumption of normality. The statistical distributions

of the composite variables that were created for this study approximated normality since

they were created with at least five categories (see Byrne, 1998; Rhemtulla et al., 2012).

Scope and Delimitations

The focus of this study was chosen in response to reports of discrimination

(including violent victimization) directed at transgender persons, high rates of suicide in

this group, and the possible involvement of healthcare in promoting psychological

distress (see Baams et al., 2015; Bauer et al., 2014; Grant et al., 2011; One-Colorado,

2014; Poteat et al., 2013). The research problem (negative perceptions of healthcare, higher incidence of psychological distress, and the uncertain role of social isolation) was largely within the analytic potential afforded by the data used in this study, but this potential was delimited by several constraints. First, the cross-sectional nature of the study could not provide a sense of how this problem had changed over time nor whether cause-effect relationships existed. Second, as a convenience sample of self-identified transgender persons who were likely to have been more socially connected than nonrespondent transgender persons, the ability to identify social isolation was limited since it was possible that few truly socially isolated persons participated in the survey. Finally, the use of data collected under earlier definitions and rubrics may not have been adequate for this research problem.

Exploration of this research problem within the framework of MST contributed to a fuller understanding of the dynamics of social isolation, supportive medical care and psychological distress in the real-life social milieu of the respondents. The value of MST in this context was in the process orientation of this theory. Plausible antecedent-outcome pathways were suggested by this theory, so that a social component (healthcare) and a subjective component (psychological distress) were conceptually linked by the bridging influence of social isolation, which was both a social and a subjective construct. Also, by using SEM, some multidimensional pathways between the primary constructs were exposed within an analytic space bounded by the demographic, medical, and behavioral control variables. This study identified characteristics of social isolation within a constellation of socioeconomic and network indicators which provided a useful,

if not definitive, key to understanding unappreciated influences on the relationship between psychological distress and the negative perceptions of healthcare.

Finally, the scope of the survey, and thus the scope and generalizability of this study, was limited to adult Coloradoans. There are few, if any, datasets that would have been appropriate for triangulation to assess the generalizability of these data. And, since this study drew on survey data that specifically sought the perceptions of the respondents, the research problems and the ability to investigate them are likely to have been subtly delimited by the social climate of Colorado in 2014. At that time, Colorado was undergoing profound social changes: Same-sex marriage was legalized in Colorado in 2014, as was the recreational use of marijuana. By the time of data collection, Colorado also had a relatively long history of statutory protections for LGBT persons in employment, schooling, and adoption, dating to 2007 and 2008 (One-Colorado, 2017).

Limitations

While the major strength of the quasi-experimental research design used for this dataset was that it allowed the most flexible use of the available data, cause-and-effect could not be determined from this dataset, even though causation could have possibly been inferred from a nonrandomized design following Schwartz and Meyer's (2010) approach, which was based on between-groups analyses that satisfy at least two of O'Sullivan, Rassel, and Berner's (2012, p. 57) causality criteria (statistical association and theoretical link). Other threats to internal and external validity may have arisen from measurement error (discussed in the Assumptions section) and selection biases. While an internet survey was perhaps the most advantageous way to reach a hidden population

(Bockting et al., 2013), selection bias was a problem with this method (Koch & Emrey, 2001). The sample in the 2014 One-Colorado survey was predominantly urban, and probably overrepresented transgender persons with greater social connectivity, internet access, and income. Non-White persons were underrepresented (One-Colorado, 2014). Therefore, identification of social isolation may have been relatively more difficult to assess, since persons who are truly socially isolated may have been excluded.

To an extent, the quasi-experimental design of this study allowed for the statistical mitigation of selection-related threats to validity since testable hypotheses used dataset-derived groups that were all subject to the same selection biases. Despite the lack of rigorous external validity there was informal external validity, since the cross-sectional method of the One-Colorado survey described phenomena in a natural setting, and may be relevant to other similar settings. Cross-sectional studies are advantageous when a research question could not be ethically or realistically studied using a randomized experimental design (Frankfort-Nachmias et al., 2015, p. 117).

Two potential confounders (unobserved influences) were identified. First, the quality of social relationships (apart from the number or type) has been shown to be important to the study of social isolation (Zavaleta et al., 2014). Though this information was not specifically collected in this dataset, several items (relationship status, especially) captured aspects of this concept. Second, information on victimization, a potent factor in the psychological well-being of a marginalized population, was absent in this dataset. The importance of victimization information was particularly acute for transgender

persons who are victimized at higher rates than cisgender persons (Grant et al., 2011; Johnson & Amella, 2014; Richmond et al., 2012; Shipherd et al., 2011).

Significance

The significance of this study was that it addressed a gap in knowledge regarding the interrelated effects of social isolation, psychological distress, and supportive medical care in transgender persons in Colorado in 2014. Even though this specificity limited external validity, it also provided a detailed view of the experiences and perceptions of these persons that could not be gleaned from studies with a broader focus. Discrimination against transgender persons and provider ignorance in healthcare settings may have induced some transgender persons to avoid seeking needed healthcare (Bauer et al., 2014; Grant et al., 2011) even though serious psychological consequences, including suicide, were associated in transgender persons with stigma (Poteat et al., 2013) and social isolation (Yadegarfard et al., 2013). While the potentially lethal combination of psychological distress and lack of supportive medical care has been investigated in other settings, even a partial clarification of the role of social isolation may have laid a foundation for social change by advancing the knowledge regarding the dynamics of minority stress in transgender Coloradoans.

The goal of this study to inform and facilitate social change was guided by two theories of public policy formation that specifically addressed the social effects of stigma and discrimination: Social constructionism (Schneider, Ingram, & deLeon, 2014) and the advocacy coalition framework (Jenkins-Smith, Nohrstedt, Weible, & Sabatier, 2014). Each of these theories emphasized the importance of belief systems and stereotypes in the

origination, continuation, and mitigation of social problems. Informed by these perspectives and the knowledge gained from this study, there were avenues by which social change could occur.

Social constructionism and the advocacy coalition framework focus on the attitudes of individuals in a society. Changes in personal attitudes can evolve into political will, which then can become social change. Individual attitudes can change through the realization that transgender and nontransgender persons are similar in many respects, such as in the health-related benefits derived from of income, steady employment, and regular medical care, and in the interrelated effects of psychological distress and social involvement. Attitude changes among institutional actors such as healthcare personnel can occur by demonstrating that ignorance and lack of competence regarding transgender health issues are not effect-neutral; such behaviors are active contributors to psychological harm. Specific areas for policy change include employment, housing, insurance, social services (such as birth certificate or driver license modification), and in the improvement of data systems, especially those involving victimization and hate crime awareness. These policy or administrative changes may lessen the impact of stigma, and thus produce effective social change.

In addition to those transgender persons who are directly at risk, there are many other people who may wish to understand and promote the well-being of transgender persons, including their families, healthcare providers, those who design and implement public and private programs, and others who are concerned with just and equitable social policies. Investigating how the social environment affected a marginalized group of

people helped to deepen the scientific understanding of the social forces to which all persons are subjected, and it was likely that other marginalized or stigmatized groups may benefit from the information gained through this study. Thus, social change may be accomplished.

Summary

This chapter introduced a study that focused on the interactions between social isolation, psychological distress, and supportive medical care as identified through an anonymous survey of transgender persons in Colorado. The chapter explored the research that developed as the health needs of this marginalized and hidden group of persons had become more known. It presented MST as the theoretical framework and showed the connections of this theory to the three primary constructs pursued in this research. The methodological challenges of research regarding the experiences of hidden groups were explored, particularly with respect to social isolation, for which a gap in the literature existed with respect to its interaction with the other two primary constructs.

The potential significance of this research was presented considering the known problems found by other researchers on this group of persons regarding suicide, depression, and inadequate healthcare. This was the foundation of the purpose and the research question the study addressed, and this chapter presented hypotheses that were investigated using a unique, previously-collected, cross-sectional dataset. The variables and the analysis plan were then outlined, followed by specific definitions and assumptions. Finally, the scope and limitations of the study were explored.

This chapter introduced topics that bridged concepts drawn from psychology, sociology, and epidemiology, the interactions of which were only partially understood or conceptualized. The theoretical framework of this study rested on knowledge derived from biological principles regarding stress response evident at the cellular level and at the societal level. The use of methodologies by which vague or latent statistical constructs may be identified formed a key element of this study. A deeper exploration of these interrelated ideas, approaches, and research findings will be undertaken in Chapter 2.

Chapter 2: Literature Review

Introduction

In Colorado, suicidal ideation or suicide attempts may occur 10 times more frequently in the transgender population than the general population (One-Colorado, 2014). Investigation of the dynamics of social isolation, psychological distress, and lack of supportive medical care (all of which known risk factors for suicide) may open avenues to reduce the burden of psychological distress that these persons report. Each of the three risk factors has been addressed to some degree in the literature, but their interactions in transgender persons was unclear.

While the interaction between psychological distress and lack of supportive medical care has been investigated in other datasets, the gap in the literature that this study addressed was how these three factors, especially social isolation, interacted among transgender Coloradoans using the MST framework. Since social isolation was seldom explicitly defined in the literature, analysis of elements of a broader conception of social isolation (e.g., partnership status, household composition, employment, education, income, insurance status, and physical limitations) may help to close the literature gap regarding the dynamics of minority stress in transgender Coloradoans.

The purpose of this quantitative study was to assess the interactions that may exist between social isolation, supportive medical care, and psychological distress among transgender Coloradoans. Since any of these three concepts may influence the others in complex ways, the statistical relationships between these concepts may provide information about their underlying dynamics. Such dynamics may be manifest in many

ways, since the literature concerning the effect of MST on psychological health cross-cuts social, biological, and epidemiological domains.

Social stress, though defined in several ways (i.e., biochemically, medically, epidemiologically, or psychologically), has measurable influences on health, but these influences are often obscure, confounded by other factors, or prone to multiple interpretations (Baams et al., 2015; Goldstein & Kopin, 2007). Operationalization of stress-related research questions is difficult and reaching the people who may be most affected by social stress is also challenging (Bauer et al., 2014). However, epidemiologic studies have shown clear population-level disparities in health outcomes of minority groups, which may have been influenced by the dehumanizing effects of prejudice (Blosnich et al., 2014; Kteily et al., 2015). Gender- and sexuality-based discrimination is well-documented; social discrimination has been found in healthcare settings also (Bauer, Zong et al., 2015; Snelgrove et al., 2012). The effects of discrimination directed at transgender persons may be reflected in mental and physical conditions, including (but not limited to) substance abuse, cancer, and cardiovascular disease (IOM, 2011).

Several approaches to understanding these and other observations invoke the biophysical concept of homeostasis, with psychological as well as medical applications (Bibbey, Carroll, Roseboom, Phillips, & de Rooij, 2013). Some of the effects of environmental and psychological stress on neuroendocrine systems have been established by epidemiological, laboratory, and imaging studies; and reliable biochemical tests have measured physiologic responses and adaptation to stress at the cellular and population levels (Koolhaas et al., 2011). Manifestations of stress may be found in rates of disease

or symptoms in biological systems that share theoretical relationships to the known stress-response pathways (Goldstein & Kopin, 2007). Evidence reviewed in Marin et al. (2011) supported the concept that stress, in general and specific ways, can influence psychological and physiological stability in humans.

For psychological conditions such as post-traumatic stress disorder (PTSD), the stress-pathology link has been clearly shown; many obviously stressful life events have the traumatic severity to trigger PTSD (Dohrenwend, 1998; 2000). However, while some symptoms and behaviors common to depression, anxiety, and suicidal ideation have shown similarities to PTSD, the general relationships of life stressors with these conditions is less clear, despite the documented link of victimization to psychological distress (Richmond et al., 2012; Shipherd et al., 2011). Some resilience strategies are beneficial (i.e., facilitative coping and strong familial and social support); others are maladaptive and have been associated with more serious psychological and behavioral conditions, such as substance abuse or suicide (Bariola et al., 2015; Budge, Adelson et al., 2013).

The gap in the literature that this study addressed was how psychological distress, supportive medical care, and especially social isolation (often ambiguously defined in the literature) interacted among transgender Coloradoans within a framework of MST. A broader conception of social isolation involving socioeconomic and lifestyle factors may help provide information about the dynamics of minority stress in transgender Coloradoans.

This chapter will review literature that reflects the increasing scientific understanding of how stress from any source affects human biology and psychology. First, the foundations and applications of MST regarding gender-related stress are reviewed, especially with regards to self-esteem, human dignity, and resilience. Then, the psychological and social effects of gender-related stress are discussed with an emphasis on the role of the American healthcare system in mitigating and perpetuating discrimination. Following that, the theory and epidemiology of the effects of social and minority stress on physical health are presented and some approaches to policy development are addressed. Finally, measurement issues are reviewed.

Literature Search Strategy

The ScienceDirect, ProQuest Central, Academic Search Complete, and Thoreau research databases were searched for a period between 2011 and 2017 (with some focused searches for earlier seminal works) for the following keywords: *transgender* (or the equivalent *transsexual*), *stigma*, *social isolation*, *social exclusion*, *social support*, *social networks*, *minority stress*, *suicide*, *victimization*, *hate crime*, *gender dysphoria*, *gender identity*, *health services*, *health access*, and *BRFSS* (Behavioral Risk Factor Surveillance System). Seminal works were identified through citations within the articles identified as being published between 2011 and the present, and additional literature was identified by reviewing authors who had cited a relevant article from this period. Recent textbooks and collections on relevant topics were also used.

Theoretical Foundation

The theoretical foundation of this dissertation was MST. The premise of MST, as applied in this study, was that social stress from discrimination decreases psychological well-being in persons who belong to a gender minority group (IOM, 2011; Meyer, 2003a). For gender-variant persons, MST predicts expectations of rejection, concealment of one's identity as a minority person, and internalized homophobia (the acquisition of self-directed homophobia). The simplicity of MST allowed adaptation for situations beyond its initial scope, such as with stigma-related psychological distress in transgender persons.

The principal modern theorist of this perspective was Meyer (1995; 2003a) and others such Dohrenwend (1998; 2000) who conceptualized a wide range of medical and psychological effects of prejudice and adversity. However, attempts to determine the effects of a negative social environment can raise important methodological issues. Factors such as the rarity of natural situations of adversity, the frequency of psychiatric morbidity, and the differential social impact of both psychiatric morbidity and social adversity were elaborated by Dohrenwend (2000).

In situations of social adversity such as divorce, job loss, illness, injury, or victimization, the effects on the individual person have been shown to be largely like the effects that large-scale events (such as natural disasters) have. Dohrenwend (2000) categorized stressors by the type of event, the intensity of the individual's reaction, the ability to cope, and the degree to which the event threatens the individual's core self-

esteem. From this work, concepts such as controllability, predictability, and duration of exposure have emerged as measurable characteristics of health-stress relationships.

Meyer (2003a) focused on the individual's response to the social stigma of discrimination and prejudice and the overt and subtle behaviors associated with it. Using a specific population of lesbian, gay, and bisexual individuals (LGB), Meyer (2003a) formulated the minority stress model, by which the stressor, potentially mediated by numerous factors, leads to mental health outcomes. Most of the factors in Meyer's (2003a) model were measurable (to varying degrees of validity and reliability) even though measurement validity was a key challenge (Meyer, 2003b).

Building and expanding on Meyer (2003a), Thoits (2010) theoretically identified five aspects of stress. First, stressors were cumulative, highlighting the importance of early life experiences. Second, wide differences in the impact of stress-related illness disparities and variability were observed. Third, there were many sources and pathways for the measurably harmful effects associated with stress and its disproportionate effect on minority groups. Fourth, stress exhibited contagion-like endemicity that could lead to partner, family, or social symptomatology. Fifth, confidence (mastery and self-esteem), controllability, predictability, and social support were protective.

The Stress Response

The pathway by which social stress can affect psychological health can be made clearer by consideration of the biology of stress and how it is likely to be manifest in humans. The psychological distress predicted by MST as a response to stress may be mediated or caused by biological stress-response mechanisms. Distress may invoke an

individual's appraisal and coping responses and may entail varying degrees of anxiety, consistent with a diathesis-stress (stress-response) model of behavior (Butcher et al., 2014). Consideration of individual vulnerability and response is necessary to understanding the range of effects that stress can engender.

Variation in the reported contribution of stress to poor health (mental or physical) outcomes has been suggested to indicate adaptation, the presence of protective factors (i.e., support), individual variation, or methodologic flaws such as measurement error (Thoits, 2010). In a framework of mastery, self-esteem, and social support, the foundation for resilience is established (Marin et al., 2011; Thoits, 2010). Severe threats can be damaging at any age, but the earlier in one's life these threats occur, the worse (Turner et al., 2016).

The behaviors observed in response to perceived social or personal stress have a neuroendocrine component that may interact (from animal and human models) with almost every body system or function. Physiologic arousal (i.e., flight-or-fight or alarm reactions) is characterized by adrenaline release, resulting in measurable rises in heart rate, respiratory rate, and blood pressure that are characteristic of the early stress response; a disseminated hormonal response follows, which can be measured biochemically. Exhaustion of these physiologic processes may occur if the stress is prolonged (Kassin, Fein, & Markus, 2011). Two interrelated brain-body systems activated during the stress response are the sympathetic-adrenomedullary (SAM) system acting primarily on the cardiovascular system and the hypothalamus-pituitary-adrenal (HPA) system acting primarily in the neuroendocrine system (to produce glucocorticoids,

especially cortisol) and the immune system (Butcher et al., 2014). Part of this system is implicated in memory and learning. Oxytocin may be an important mediator/moderator of the stress response (Poulin & Holman, 2013).

An individual's physiological responses to stressful stimuli may provide not only a sense of the severity of the stressor, but also clues regarding the individual's vulnerability to stress (i.e. stress reactivity) (Lovallo, 2011). For example, epidemiologic evidence of chronic deleterious SAM activation may be seen in rates of cardiovascular diseases such as hypertension. Epidemiologic evidence of HPA damage may be seen in rates of immune-related diseases, such as diabetes and asthma.

Blunted stress reactivity is maladaptive (Bibbey et al., 2013; Hatzenbuehler & McLaughlin, 2014; Thoits, 2011). However, there is also evidence that either blunted *or* exaggerated stress reactivity is harmful (Knack, Jensen-Campbell, & Baum, 2011; Lovallo, 2011; Marin et al., 2011). Personality traits (such as neuroticism, agreeableness, openness to experience, extraversion, and conscientiousness) have been shown to be related to stress reactivity (Bibbey et al., 2013; Livingston, Christianson, & Cochran; 2016). Ambiguity in stress reactivity (i.e., divergent or ambiguous results) across multiple studies may be secondary to underlying variations in individuals or to methodological issues such as measuring stressor intensity or failing to model factors such as controllability. The concepts of homeostasis and allostasis have been used to conceptualize psychological and physical stress reactivity.

Goldstein and Kopin (2007) noted that the concept of homeostasis more appropriately represented a flexible internal physiologic state that may have distinct

levels of sensitivity to disruption. *Allostasis* is the biological effort to maintain the

current homeostatic equilibrium, and may partially explain individual variations in stress

reactivity (Goldstein & Kopin, 2007). Allostatic load (a quantification of an individual's

potential for physiological dysregulation as a response to a stressor) has been variably

defined and measured, making cross-study comparisons difficult. Nevertheless, the

concept of allostatic load has emerged as a useful way to assess the impact of stress at the

individual level and at the group level (Deuster, Su Jong, Remaley, & Poth, 2011;

Doamekpor & Dinwiddie, 2015; Goldstein & Kopin, 2007; Koolhaas et al., 2011; Le

Moal, 2007; Tiedt & Brown, 2014; Turner et al., 2016). A common set of HPA and

SAM measurements that assess allostatic load (i.e., the deviation from homeostatic

normality) is fasting glucose, total cholesterol, high-density lipoprotein cholesterol,

dehydroepiandrosterone sulfate, cortisol, systolic and diastolic blood pressure, and waist-

to-hip ratio (Bahreinian et al., 2013).

Controllability, predictability, and anticipation of the stressor are crucial aspects

of a potentially pathological stressor, as is the magnitude of the stress response (Koolhaas

et al., 2011). There is no empirical evidence that the biological stress response

mechanism is different according to the stress source, although some stressors (such as

violent victimization) are demonstrated clinically and epidemiologically to have more

serious ramifications for an individual's psychological and physical well-being. Also, a

history of childhood stress has been shown to raise the likelihood of adult stress-related

physical or psychological disease (Thoits, 2010; Turner et al., 2016)

Stress-Related Psychological Harm

The fundamental proposition of the MST is that social stress (i.e., discrimination) leads to negative psychological outcomes (i.e., depression or suicide) in persons who belong to a minority group (i.e., LGB persons). According to MST, three mediating/moderating factors should occur in this pathway, especially for gender-variant minorities: Expectations of rejection, concealment of one's identity as a minority person, and internalized homophobia (the acquisition of self-directed homophobia). In identifying the importance of concealment, Meyer (2003a) provided a theoretic rationale for a protective effect of disclosure, as an antagonist to the deleterious physical and psychological effects of repression.

In differentiating between the objective (social, distal) sources of stress and the subjective (psychological, proximal) sources, Meyer (2003a) formed a more unified and consistent view of how stress was mediated by cognitive and appraisal processes as a response to general stressors and minority-specific stressors. Intersectionality (the occurrence of multiple stigma-based stressors such as gender and race) was inferred in Meyer's (2003a) model, but not explicitly addressed.

An assumption of the MST was that, in addition to the effects of intersectionality, the cumulative effects of all stressors are differentially distributed within minority groups, principally as a function of age, race, or gender (Meyer, 2003a). Place (possibly a surrogate for local or regional cultural influences) may have also accounted for disparities in the effects of stigma (Hatzenbuehler, Bellatorre et al., 2014; Hatzenbuehler & McLaughlin, 2014; McCarthy et al., 2014; Swank et al., 2012).

The conceptual models of Meyer (2003a) and Hatzenbuehler (2009) provided a broad approach to the statistical modeling and analysis of multifactorial psychological stress-related outcomes. In a complementary way, Pachankis (2007) explored a more cyclic, bi-directional process of the effects of stress on psychological well-being, involving situational factors, cognitive-affective-behavioral factors, and self-evaluative (appraisal) influences. The importance of feedback (regulatory) processes in this model was consistent with the observed maladaptive effects of homeostatic over- or under-reactivity, especially with respect to factors (such as social support) that may have modulated this feedback mechanism. Social support may be eroded though avoidance and exclusion, fears of rejection, and interpersonal tension in relationships.

Hatzenbuehler (2009) focused also Meyer's (2003a) depiction of the mediation effect of individual responses, and formulated the Psychological Mediation Framework (PMF), which further specified how mental health effects occurred as a response to stress. The use of a mediation (as opposed to moderation) approach was intentional, but the practical difference is obscure, possibly due to lack of specificity (and probably measurement variation) in the factors that were purported to distinguish from mediation and moderation.

Meyer (2010) shed some light on the appropriate uses of MST and social stress theory also. MST was developed to explain the aggregate burden of mental illness on minority groups, originally lesbian, gay, and bisexual (LGB) persons. Meyer's (2010) more narrow view was that MST was not applicable to individual disorders, because social stress was a "generic" not a "specific" pathogen (Meyer, 2010, p. 1218) and that

MST was developed to assess societal sexuality-based stigma, and not specifically, to multiple and intersectional sources of stigma. This narrow view has been challenged and most results have been supportive (though inconclusive) of an expanded application of MST.

Schwartz and Meyer (2010) addressed a fundamental, not-fully-resolved question in the study of stress: Does social stress promote mental illness? The lack of unambiguous conclusions in many studies that have attempted to isolate the stress effect makes this question appropriate (Bauer et al., 2016; Budge, Adelson et al., 2013; Budge et al., 2014; Conron et al., 2012; Frost & Meyer, 2012; Hoffman, 2014; Shipherd et al., 2011).

Also, Schwartz and Meyer (2010) offered a looser conception of causality based on the use of between-group and within-group analysis. Schwartz and Meyer (2010) maintained that between-group analyses of cross-sectional data can establish etiology based on "convergence of findings" from robust between-group studies (p. 1116).

Transgender Stress

Overt expressions of discrimination, such as violence - especially violence targeting one's person - contribute to the individual's perceived stress (Baams et al., 2015). For victimized transgender persons, much of the deleterious symptomatology from violent victimization is shared by other forms of PTSD pathogenesis (Richmond et al., 2012; Shipherd et al., 2011).

In addition to adult victimization, transgender persons may be the victims of child abuse as well, and in the presence of stigma and inadequate healthcare, this combination

may lead to depression and suicide attempts (Reisner et al., 2014). Gender-related abuse is likely to be detrimental as well.

Nuttbrock et al., (2014), in a 36-month longitudinal study, identified gender abuse in association with depression, with psychological abuse reported (in the preceding six months) in over 50% of respondents and physical abuse reported from about 10%. They found some evidence for adaptation: Perceived psychological abuse decreased to a 12-month incidence of 41%, but the percentage of physical abuse remained the same. Nuttbrock et al., (2014) also noted that while discrimination may have led to depression, as depression worsened it may have become an independent source of discrimination, an observation that was consistent with the well-documented association of stigma with mental illness.

Transgender persons encounter stressful events frequently, but not all the stressful events are related to discrimination or bias. Shipherd et al. (2011) reported that 98% of transgender participants in a cross-sectional study had experienced a potentially traumatic event, a rate higher than that reported for LGB persons. However, death of a loved one was the most common type of traumatic event reported (78% of respondents) while 43% of the respondents reported a bias-related event. There was no difference in depressive symptoms in the respondents who had experienced a bias event than those who had not, in contrast to MST prediction. In this study, stress-related psychological effects may have been resisted by support- or coping-mediated resilience.

The degree of resilience from a stressful event is difficult to measure. While social support is clearly protective, resilience may be underappreciated in MST and PMF,

even though the PMF model offers more detailed conceptualizations of the intersection of physical and psychological health by encompassing broad individual, familial, and social influences. However, the tradeoff of simplicity with complexity in this model (compared to MST) presents more opportunity for definitional and measurement variability.

The importance (and the challenges) of the measurement of the psychological and sociological concepts related to the deleterious effects of minority stress has been acknowledged (Meyer, 2003a; IOM, 2014). The practical difficulties of psychometric quantification of this phenomenon were examined by Holden, Lee, Hockey, Ware, and Dobson (2014) and by Jiang and Zack (2011).

Model Uncertainty

Hatzenbuehler's (2009) PMF model presupposed an effect from stigma that, through hyper-reactivity to this stressor, led to psychopathology. In this relationship, mediators were coping skills, socialization, and cognitive behaviors. By identifying observable (and potentially measurable) mediators, the lack of such a feature (though implied) in MST was resolved. In the MST, stress was a mediator affecting society and the individual. The PMF placed individual factors between stress and psychopathology, indicating a more explanatory role for mediating concepts regarding the antecedent (stress), in conjunction with the moderating processes that added to or diminished the psychopathology.

Meyer (2003a) proposed that minority stress is unique in its effects on the individual (compared to other forms of stress), but could not identify what makes it unique. Possibly any stressor powerful enough to provoke a response in an individual

was, for all practical purposes, unique to that individual. Minority stress, though

proposed by Meyer (2003a) to be unique, may have depended more on the totality

(additivity) of a series of stressors than on a specific component (such as social stigma)

related to minority discrimination. The PMF attempted to provide a research-oriented

model of the totality of stressors on a minority group. The social orientation of the MST

would naturally lead to social remedies, whereas the PMF, with a more individual

orientation lends itself to individual remedies for stigma-related stressors.

The effects of stigma may involve several intersecting sources or moderators of

stigma-related stress (Hatzenbuehler, Keyes, & Hasin, 2009), such as race/ethnicity, age,

or gender. Location may also be such a moderator, since local or regional culture may

determine or reflect the types and distribution of social stressors (Frost, Lehavot, &

Meyer, 2015; Hatzenbuehler, Bellatorre et al., 2014; Jauk, 2013; Swank et al., 2012).

Individual factors (i.e., genetic, developmental, or experiential) add variability. These

may also lead to analytic problems such as reporting bias (Simons, Schrager, Clark,

Belzer, & Olson, 2013). Also, as individuals adapt to minority status, the perception of

minority stress may diminish. Behavioral responses to stress may also follow

internalizing paths (i.e., leading to psychological distress) or externalizing paths (i.e.,

alcohol abuse) (Hatzenbuehler, Keyes et al., 2009).

Partially due to its wide acceptance, the interdisciplinary approach of MST is

relevant in understanding a wide variety of social and individual experiences of

transgender persons. The elevated reporting of serious psychological distress in the

presence of overt societal discrimination (Grant et al., 2011; One-Colorado, 2014) is

consistent with the MST and is important in understanding suicidal behavior (Baams et al., 2015; Hendricks & Testa, 2012; IOM, 2011). Social stress (especially the everyday discrimination that transgender persons perceive) has been shown to contribute to depression and suicidal behavior (Poteat et al., 2013; White Hughto, Reisner, & Pachankis, 2015). Stigma and discrimination against transgender persons were a source of much of the perceived inequities and difficulties with healthcare that have been reported (One-Colorado, 2014; Poteat et al., 2013).

By representing a plausible and testable schematic connection between social stress and psychological health, the conceptual framework of MST can accommodate factors such as social support, self-esteem and human dignity, and resilience. This study delved more deeply into the statistical dynamics of the MST schema of psychological health by examining a research question that involved the interactions of social isolation, psychological distress, and supportive medical care in a cohort of transgender Coloradoans.

Self-esteem

Key aspects of the MST address deficits in self-esteem that may arise through the effects of expected rejection, concealment of minority status, and self-stigma. Threats to self-esteem may trigger a stress response, and the perception of discrimination may be such a threat (Butcher et al., 2014). Self-esteem is an important mediator of social interaction and mental health (Thoits, 2011) and social processes may blunt threats to self-esteem (Brown & Pantalone, 2011; Dargie, Blair, Pukall, & Coyle, 2014; Hatzenbuehler, 2009). Self-esteem has been shown to be related to social support and

well-being in transgender persons (Barr, Budge, & Adelson, 2016). Also, Bouman, Davey, Meyer, Witcomb, and Arcelus (2016) noted the relationship of self-esteem to poor psychological health in a transgender group, and even for the cisgender controls, decreased self-esteem and other interpersonal factors were significant predictors of mental health disorders, including depression. The importance of self-esteem may be ambiguous since the clinical implications of self-esteem deficits may not be apparent. However, more direct person-to-person interactions can improve self-esteem. For example, Greene and Britton (2013) studied the impact of forgiveness in relation to self-esteem, in the context of shame. The promotion of self-forgiveness had a significant mediating effect on the relationship of shame and self-esteem.

In lesbians, the combined effects of discrimination (especially physical victimization from hate crime) in a setting of low self-esteem were predictive of PTSD symptoms (Szymanski & Balsam, 2011). In this study, these factors accounted for a third of the variance in PTSD symptomatology, despite the diagnostic ambivalence surrounding whether heterosexist victimization should be classified as a traumatic event.

Serious threats to self-esteem may be dehumanizing. Discrimination, as a particular form of social stress that attacks human dignity, may be more damaging due its personal nature (Butcher et al., 2014). This may exacerbate feelings of social isolation and depression, which are compounded by other stressors that arise from social structures, such as law and governance. Even members of a stigmatized group can themselves dehumanize other minorities (MacInnis & Hodson, 2012). Dehumanization can occur through a variety of harmful social interactions, such as denial of someone's

ability to have complex emotions (Kassin et al., 2011). Dehumanizing behaviors often convey disgust, an emotion which may be especially injurious to others (Buckels & Trapnell, 2013). Use of dehumanizing social tactics has been shown to be a precursor to aggressive actions such as torture (Kteily et al., 2015).

Dehumanizing behavior may be ameliorated. For example, Martinez (2014), using a series of three experiments, demonstrated that by increasing subjects' perceptions of humanity toward the mentally ill, compassion improved and the subjects' own potential to seek treatment for a mental health issue was improved. This may be a key component of a more compassionate approach to clinical care (Zulueta, 2013).

Resilience

Resilience is a "buffer against stress" (Kassin et al., 2011, p. 584). It is a restorative process to heal the effects of trauma (Butcher et al., 2014). Resilience across groups has been linked to some of the inability to demonstrate stress-related disparities in mental health outcomes (Schwartz & Meyer, 2010). Coping mechanisms may also account for some variation. Avoidant coping (i.e., using behavior that avoids a stressor rather than seeking treatment) was been shown to be psychologically harmful, while social support was beneficial (Budge, Adelson et al., 2013). However, denial of a stigmatizing condition (such as mental illness) may be a protective form of resilience, when anticipation of rejection is a more dominant stressor, in accordance with labeling theory (Thoits, 2016). The efficacy of resilience to mitigate psychological distress is diminished by youth, lack of parental or familial support, and victimization, and strengthened by higher income and peer association (Bariola et al., 2015). The theme of

support (from institutions, peers, or family) was found in Singh, Meng, and Hansen, (2014) who also identified protective factors (self-awareness and cognitive appraisal) and risks (isolation).

The conceptual models of Meyer (2003a) and Hatzenbuehler (2009) provided a broad approach to the statistical modeling and analysis of complex, multiple-domain research questions and hypotheses. The one-way and/or cyclic interactions thus formed may be quantified statistically. Understanding the underlying biological and psychological mechanisms that are represented by this schema can help to identify subtle, potentially overlooked relationships.

The Psychological and Biological Literature of Stress

Many transgender persons are invisible, isolated, and alone. Psychological distress (especially suicide and depression) is more common in this group than in the general population. In addition to the daily reality of overt discrimination that is all-too-often accompanied by lethal violence, these persons often do not receive appropriate care from a healthcare system that many perceive as so uncaring that they actively avoid it even in times of need. The MST-hypothesized relationships between social stress and psychological health involve many psychological and biological sub-systems that leave their marks epidemiologically and statistically. This section explores the literature through a holistic lens that often blends psychological and physical wellness and disease.

Psychological Distress

Mental health issues are not rare. These conditions, comprising psychological distress (anxiety, depression, and suicidal ideation), substance abuse, and a wide variety

of behavioral, emotional, or mental disorders, have been the largest sources of disability

in developed countries (Reeves et al., 2011). In the United States in 2014, these

conditions were found in approximately 18% of adults (over 18 years of age); about 4%

of U.S. adults had a mental health issue that affected their usual daily activities. In

persons 12 to 17 years of age in 2014, approximately 11% reported a major depressive

episode (depression that persisted for 2 or more weeks and affected self-worth and daily

activities such as sleeping, eating, and ability to concentrate) within the last 12 months.

Suicide has been a major health problem (David-Ferdon et al., 2016; WHO,

2014). It may be 20 times higher in transgender persons or those with gender identity

disorder, based on Veterans Administration (VA) data (Blosnich et al., 2013). The

number of completed suicides among transgender persons is not known (Marshall, Claes,

Bouman, Witcomb, & Arcelus, 2016).

Suicide has been linked to stigma (Perez-Brumer et al., 2015) and violent (or hate

crime) victimization (Duncan & Hatzenbuehler, 2014; Goldblum et al., 2012; Hendricks

& Testa, 2012; House et al., 2011; Ioerger et al., 2015; Lehavot & Simoni, 2011; Testa et

al., 2012). The perception of victimization may also occur because of intimate partner

violence (Edwards & Sylaska, 2013; Lewis, Milletich, Kelley, & Woody, 2012) and

bullying (Hatzenbuehler, Duncan, & Johnson, 2015; Reisner, Greytak et al., 2015;

Vaillancourt et al., 2011). The effects of childhood bullying (such as depression,

isolation, low self-esteem) may extend into adulthood (Tariq & Tayyab, 2011).

The interpersonal theory of suicide (IPTS) identified two characteristics of

suicidal ideation that are directly related to social interactions. The IPTS asserted that

"stressful social experiences are associated with two psychological states, thwarted belongingness and perceived burdensomeness, which when simultaneously held long enough lead to suicide desire (i.e., suicidal ideation)" (Grossman et al., 2016, p. 333). Thwarted belongingness led to social isolation, and may have been accompanied by peer or family rejection. The perception of burdensomeness was often accompanied by feelings of self-hatred, akin to internalized homophobia or internalized transphobia as predicted by MST (Meyer, 2003a). The longer these beliefs were held the more likely the person was to harm themselves, which was often pre-suicidal behavior (Arcelus, Claes, Witcomb, Marshall, & Bouman, 2016). Suicidal ideation and attempts and less severe forms of self-harm were found in transgender persons (Dickey et al., 2015; Reisner, Vetters et al., 2015), in other sexual minorities (Muehlenkamp et al., 2015), and in those experiencing social exclusion from homelessness (Moskowitz et al., 2013).

In a community-based study of LGBTQ (lesbian, gay, bisexual, transgender, queer) persons, Grossman et al. (2016), examined thwarted belongingness, perceived burdensomeness, painful events, and the capability for self-harm against two outcome measures: Suicidal ideation and suicidal attempts. The authors noted that the role of belongingness and burdensomeness may have been obscured by measurement issues. In the IPTS model, painful events influenced one's capability for self-harm; as the pain from stressful life events increased, so did the will to remove the pain through self-harm.

In Grossman et al. (2016), persons born as female who transitioned to male or genderqueer had significantly more suicidal ideation than persons born as male who transitioned to female. Also, perceived burdensomeness was a stronger predictor of

suicidal ideation than thwarted belongingness. However, for those who reported suicidal

attempts, painful events and thwarted belongingness (and their interaction) significantly

predicted attempts.

In a clinic-based, case-control study of transgender persons and cisgender

controls, Reisner et al. (2014) found higher incidence in transgender persons of suicide

ideation or attempts, violent victimization, social discrimination, and history of abuse as a

child. Transmen may be more likely to be victimized (Bockting et al., 2013).

The social environment and local culture may contribute to suicidal ideation

(Irwin, Coleman, Fisher, & Marasco, 2014). Even though social support has been shown

to be protective (Bockting et al., 2013), a problem relationship can be a suicide risk

(Kazan, Calear, & Batterham, 2016). A key predictor of suicide, depression, is

measurable (Jia et al., 2015) and multifactorial, especially in sexual minorities

(Mustanski & Liu, 2013), and often intersectional, as when obesity occurs in a minority

person (Peterson et al., 2016).

Baams et al. (2015), like Hatzenbuehler (2009), theorized psychological

mechanisms to complement the social focus of MST using the IPTS (interpersonal theory

of suicide) and its twin emphasis on burdensomeness and belongingness. They measured

these two characteristics in addition to depression, suicidal ideation, and concealment

(perceived knowledge of identity) in LGB adolescents. Their results indicated that

burdensomeness mediates the relationship between victimization and suicidal ideation.

Birth sex may have been a moderator in this relationship, as predicted by Hatzenbuehler's

(2009) PMF. This result was supported by others (Barboza et al., 2016; Rood et al.,

2015; Seelman, 2016). Bauer, Scheim et al. (2015) showed the importance of social (especially parental) support.

To evaluate a potential gender effect on depression in the context of minority stress (subject to intersectionality, moderation, or bias), Hoffman (2014) reviewed studies of depression in transgender women. While transgender women had higher rates of clinical and symptomatic depression compared to cisgender women, the intersectional effect of sex work as a factor may have obscured other key aspects of transgender women's group-level experiences with depression. The studies reviewed in Hoffman (2014) did not show differences in depression as a function of race.

However, in Reisner, Katz-Wise, Gordon, Corliss, and Austin (2016), current symptomatic depression and anxiety in young sexual minority adults was found to be significantly higher compared to cisgender persons. Interestingly, in that study (mostly LGB – few T), cisgender respondents showed some gender differences with respect to these two conditions. The occurrence of anxiety was more common in females, while the occurrence of depression was nearly equal in males and females.

Age may be another possible moderator for depression, subject to the same potential bias from intersectionality. Older age may be a separate source of bias, and younger age may be a risk factor. Livingston, Christianson, and Cochran (2016) found adolescent sexual minority youth to be at elevated risk for alcohol abuse, and identified Five Factor personality components (neuroticism, extraversion, conscientiousness, agreeableness, and openness to experience) associated with this risk. They identified two personality groups, an at-risk group and an adaptive group, based on the Five Factor

scores. While the at-risk and the adaptive groups were similar regarding sexual orientation, the adaptive group endorsed less concealment of their identity, as predicted by MST. For the adaptive group, the personality components were not predictive of alcohol misuse as a result of stress, but in the at-risk group personality components (especially neuroticism and lower conscientiousness), were significantly associated to the stress-alcohol misuse.

Bauer et al. (2016) found syndemic (i.e., multiple, interrelated) relationships between substance abuse and discrimination. Their results also suggested independent bias against mental illness and against substance abuse. However, in a case-control study (Reisner, Vetters et al., 2015), even though transgender persons faced increased risk for psychological distress and self-harm, there were no differences in these outcomes between female-to-male (FTM) and male-to-female (MTF) respondents, which refuted MST predictions.

Substance abuse (including alcohol) has been frequently associated with maladaptive responses to stress in transgender and other gender minority persons (Reisner, Greytak et al., 2015) and with multiple co-existing sources of stress (Flentje et al., 2014; Keuroghlian et al., 2015). Possible evidence of positive adaptation to stress was reported in an online survey conducted by Wilson, Gilmore, Rhew, Hodge, and Kaysen (2016). Early adult lesbian and bisexual women showed higher rates of alcohol use which subsequently diminished at later waves of this three-year longitudinal study. Also, in this study, alcohol use was associated with stressful events in general.

Social Isolation

Consistent with predictions of expectation of rejection, concealment, and self-stigma in MST (Meyer, 2003a), social isolation has been found to exacerbate the deleterious effects of stigma in gender-variant persons (Baams et al., 2015; Yadegarfard et al., 2013). The association of social isolation and lack of social support with depression in the general population also has been well-documented (Butcher et al., 2014).

However, the concepts of social isolation (and social support) lack reliable definition (IOM, 2014; Zavaleta et al., 2014), which has led to ambiguous results. For example, social support, broadly defined, was found to be protective against suicide in transgender persons (Yadegarfard et al., 2013), but while peer support was influential (though not unequivocally less so than parental support) in Bockting et al. (2013), this effect was not found in Bauer, Scheim et al. (2015). Johnson and Amella (2014), in a literature review, identified two components of the psychological experience of social isolation: A feeling of detachment from others or alienation (Baams et al., 2015) and actual detachment. These are important distinctions, since social isolation has been generally assessed only by measuring social support, which reflects the second concept.

Social support, especially from parents, has been shown to be protective against suicide (Bauer, Scheim et al., 2015; Yadegarfard et al., 2013). Yadegarfard et al. (2013) found that family rejection, loneliness, and social isolation were significant predictors of suicide even in a relatively tolerant society. This was supported by Klein & Golub (2016). In this study, family rejection was associated with suicide attempts and substance

abuse, after statistical control for factors such as age, race/ethnicity, and economic factors such as income, education, and employment. Budge et al. (2014) demonstrated that social support was significantly negatively associated with depression and anxiety.

For other gender-variant persons, Rothman, Sullivan, Keyes, and Boehmer (2012), with data from the 2002 Massachusetts Behavioral Risk Factor Surveillance System (BRFSS), also showed that in LGB persons (transgender persons were not included), parental support after revealing their orientation decreased the likelihood of risk-taking behaviors, while lack of parental support was associated with increased risk-taking.

The beneficial effects of social support may involve different psychological processes than coping, especially with respect to less-effective strategies such as avoidant coping (i.e., ignoring or withdrawing from a problem rather than addressing it). In a study of anxiety, depression, and coping in transgender persons, Budge, Adelson et al. (2013) identified increases in depression and anxiety associated with the use of avoidance coping. Timing may have been a factor. For transgender persons, the stage in the transition process may be significant: As the transition progressed, avoidance coping was used less. Social support may be, to an extent, a substitute for avoidance coping, especially in transgender men where family help was sought more often than in transgender women; a transgender man's prior socialization as a female may have partially explained a willingness to seek support.

Overall, avoidance coping is used more when less support is available; with avoidance coping, depression and anxiety increases. Facilitative (treatment-seeking)

coping was not a significant mediator in Budge, Adelson et al. (2013); the benefit of facilitative coping may have been in its use in place of avoidance coping. However, transgender women more often turned to facilitative coping mechanisms after using avoidance. A sense of loss also was found as transition progressed, particularly in transgender women, which may have been related to failure to achieve transition expectations. Higher income was also related to fewer symptoms of depression in transgender men, but not in transgender women.

Budge et al. (2014) also measured facilitative and avoidant coping; avoidant coping was significantly associated with anxiety and depression. Facilitative coping was not associated with either anxiety or depression, in contrast to Budge, Adelson et al. (2013). Neither of the coping strategies was significantly associated with social support, but even after controlling for coping strategy, the negative association between social support and depression or anxiety remained; 47% (transgender women) and 53% (transgender men) of the variance in anxiety was explained by four measurable factors: Support, coping, age and income.

Frost and Meyer (2012) measured community connectedness, a cognitive attribute of individuals (differentiated from community participation, a behavioral attribute) among LGB individuals in New York City. They found an inconsistent relationship of connectedness with psychological well-being, and notably, no correlation with depression. The authors acknowledged that measurement bias (from the instrument used to measure connectedness) may have been present. Also, there were no differences in

connectedness by race/ethnicity or gender; however, bisexuals reported significantly less connectedness than gay or lesbian respondents.

Barr et al. (2016) investigated another aspect of community involvement in transgender persons, belongingness, which was a component of the IPTS. The concept of belongingness addressed the subjective sense of being a member of a community. In this study, belongingness significantly mediated a relationship between strength of identity and well-being. This relationship was also significantly mediated by age; well-being was also significantly moderated by the stage of transition and by income. Despite the relatively high levels of education in the sample, the level of income was low.

The availability and perception of social support can be modified to ameliorate psychological distress. For example, in an evaluation of a group-oriented intervention aimed at LGBTQ youth (Hatch Youth), Wilkerson, Schick, Romijnders, Bauldry, and Butame (2016) reported that improvements in depressive symptoms were achieved in as short as six months, primarily through an increase in respondents' perceived social support, coupled with an increase in self-esteem.

The benefits of social support may accrue from other than direct, face-to-face sources. The use of online support may be particularly important to LGBT (lesbian, gay, bisexual, transgender) persons, especially youth. However, the online environment may be also more likely to present negative situations such as bullying and other forms of victimization. Ybarra, Mitchell, Palmer, and Reisner (2015), reporting data from the Teen Health and Technology (THT) study (CIPHR, 2016) noted that in-person social

support was more beneficial than online sources, yet youth perceived the online environment as an important source of support.

Simons, Schrager, Clark, Belzer, and Olson (2013) studied parental support in the context of youth who attended a transgender health clinic for hormone therapy. In this setting, parental support was significantly associated with positive psychological well-being, which was indicated by increased life satisfaction and decreased symptoms of depression. Potential selection or reporting biases may have existed in that persons who attended such a clinic may have been those who had more familial support and therefore were not representative of the larger groups of transgender adolescents.

A personal or romantic relationship may be a key component in the beneficial effect of social support. Baams, Bos, and Jonas (2014) evaluated three aspects of MST (internalized homophobia, expected rejection, and stereotyping) in a Dutch LGB sample (no transgender participants). Stereotyping, in this study, had two forms: Expecting that most heterosexuals are prejudiced and harboring negative feelings about other members of one's own in-group. The authors found that only the association of expectation of rejection with poor psychological health was mediated by a romantic relationship. However, since the participants were from a country with relatively liberal attitudes to same-sex relationships, the results may not be generalizable to the United States.

A romantic relationship can bring risks as well as benefits. In a sample of transgender women characterized by racial/ethnic diversity, depression, and economic hardship, Gamarel, Reisner, Laurenceau, Nemoto, and Operario (2014) investigated the relationship quality of transgender women and their male partners. Partners in the

relationships, as well as the transgender women, had elevated levels of depression, but this was not related to the degree of stigma experienced by the transgender women. These elevated levels of depression also were associated with decreased relationship quality.

The mechanism for these beneficial and negative effects may be through interpersonal communication between partners, or through coping processes. Using case studies, Giammattei (2015), explored the implications of transgender relationships for couple and family therapists. Several of the concepts advanced by MST, especially that discrimination may be associated with clinically apparent mental health issues and that a transgender person may harbor internalized transphobia, were important considerations in such therapy.

Healthcare Access and Support

Transgender persons have frequently reported discrimination or lack of support in healthcare encounters (Bauer et al., 2014; Bradford, Reisner, Honnold, & Xavier, 2013; Cruz, 2014; Grant et al., 2011; One-Colorado, 2014; Poteat et al., 2013). Even in states perceived to be more open to gender diversity, such as Hawai'i (where less transgender people report problems with healthcare access), healthcare discrimination is reported (Stotzer et al., 2014). In an analysis of healthcare access problems across the United States, White Hughto, Murchison et al. (2016) identified several individual and societal associations with healthcare avoidance or inability to obtain treatments. As independent factors, being older, transwoman, or having low income were barriers to access; racial characteristics (Native American, multiracial, or non-White) were also barriers.

Geographic disparities were also identified. Inability to access healthcare was more likely in the American South and West, and more likely in states with larger Republican populations.

For transgender persons, medical care that is perceived as being nonsupportive will not be used. Using anonymous online survey methodologies, Bauer et al. (2014), Grant et al. (2011), and One-Colorado (2014) have reported that stigma and fear of discrimination may prevent transgender persons from seeking healthcare. Disparities in healthcare access may be confounded by symptom severity. Dhingra, Zack, Strine, Druss, Berry, and Balluz (2011) examined BRFSS data to determine whether persons who reported psychological distress received treatment for it. They found that those who reported the most severe symptoms did obtain treatment, but those who reported milder symptoms did not obtain treatment as often. Transgender patients are likely to have multiple physical, psychological, or wellness issues some of which may be overlooked if not specifically addressed (Brennan et al., 2012; Zucker et al., 2016). This may include substance abuse (Cole et al., 2011).

Studies of providers have corroborated the perceptions of bias and disparity. As McIntyre et al. (2011) found, mental health professionals acknowledged that problems such as ignorance and discrimination were barriers to providing care to transgender patients. Lack of supportive medical care could lead to delays in care and the failure to treat life-threatening conditions appropriately (Bauer, Scheim et al., 2015; Huot et al., 2013; Xavier et al., 2013). A qualitative study of physicians in Ontario, Canada also revealed multifactorial provider-side barriers to optimal transgender healthcare. These

barriers included lack of (or inadequate) knowledge, the provider's perception of

transgender as a pathology, and lack of interest in the unique health needs of transgender

persons (Snelgrove et al., 2012).

There may be discomfort in discussing transgender (especially transition) issues

with family physicians, especially if there were previous negative experiences; improving

physician knowledge may reduce discomfort. Overtly discriminatory behaviors (such as

insults or termination of an examination) were particularly discomforting (Bauer, Zong et

al., 2015). Affirmative language (i.e., correct pronouns) was especially important (Hagen

& Galupo, 2014).

The diagnosis and treatment of gender identity disorder (GID) has been poorly

understood but is evolving (Byne et al., 2012; Davy, 2015). The classification of GID

can be controversial (Meier et al., 2013), as are the research data elements to be collected

(Nieder et al., 2016). Best practices research has been lacking and necessary (Feldman et

al., 2016). Clinician professional groups such as the American Psychological Association

(APA, 2015) and the American College of Emergency Physicians (Brown & Fu, 2014)

have addressed practice issues through the standardization and publication of practice

guidelines in those areas (mental health and emergency services) where there is great

need and potential for benefit. Lim et al. (2013) focused on attempts to improve clinician

knowledge and sensitivity through nursing education that included topics relevant to

LGBT patients.

Building an evidence-base to guide clinical practice for a stigmatized group is

difficult, but for youth, legal and ethical issues involving parental consent may hamper

investigations (Mustanski, 2011). As transgender issues often arise prior to adolescence, pediatricians have also been recognizing the need for provider education (Gridley et al., 2016; Radix & Silva, 2014; Steever & Cooper-Serber, 2013). In a prospective study of youth and young adults seeking treatment for gender dysphoria, the reported average age at onset of the gender dysphoria was 8.3 years. However, the average age at disclosure was over 17 years, indicating almost 9 years (on average) from onset (awareness) until disclosure (Olson et al., 2015).

The need for appropriate attention to transgender health issues and provider discrimination has been shown to be important at all points in the life course. The psychophysical responses to stress persisted as persons aged (Purcell et al., 2012; Zelle & Arms, 2015); an aging gender variant population affected Medicare usage and benefits (Kattari & Hasche, 2016) and end-of-life decisions (Cartwright et al., 2012). Also, transgender persons, especially transgender women, presented with a variety of transition-associated medical or psychological issues during the life course, such as gender-specific cancers (Bauer & Hammond, 2015; Quinn et al., 2015).

Whitehead, Shaver, and Stephenson, (2016) provided baseline data for healthcare utilization and stigma in rural areas, following the HealthyPeople 2020 guidelines (ODPHP, 2016). The overall goal of HealthyPeople 2020 was to provide targets for improvements in a variety of issues. A key focus was the identification and reliable measurement of sources of disparities in health outcomes. The overall goal for the LGBT community was improvement in "health, safety, and well-being" (ODPHP, 2016). The two LGBT-specific objectives (LGBT-1 and LGBT-2) were focused on improvements in

data systems. One area of improvement was in the recognition of LGB and T

(transgender) differences, also noted in Shipherd et al. (2011) and Worthen (2013).

The collection of more realistic gender information in the BRFSS and other

population-based research was a goal consistent with IOM (2012); LGBT health also was

potentially impacted by other objectives of HealthyPeople 2020. These objectives were

in the areas of cancer, HIV, nutrition, education, health insurance coverage, healthcare

access, substance abuse, suicide, depression, and bullying. More complete data

collection is feasible since, if respectful and protective of privacy, it is likely to be well-

received among LGBT persons (Cahill et al., 2014; Cahill et al., 2016).

Transition-Related Care

Many persons seek treatment and help in transitioning from one gender to

another. As in civilian healthcare, this has been recognized in the VA also (Kauth et al.,

2014). The main forms of current reassignment therapy involve administration of cross-

sex hormones (i.e., testosterone in FtM [natal female to transgender male] transition and

estrogen in MtF [natal male to transgender female] transition) or surgery. Transitioning

is complex, stressful, and requires attention to psychological and physical health. From a

qualitative study of transgender persons, Budge, Katz-Wise et al. (2013) identified

resilience changes during the transition process. With support, coping that may have

been maladaptive early in the process can become more facilitative. Transition is

preferably managed in a multidisciplinary setting, and should be done in accordance with

World Professional Association for Transgender Health (WPATH) guidelines (WPATH,

2011). Registries may be the best way to accumulate detailed longitudinal outcome data (Fisher et al., 2016).

Hormonal treatment is more common than surgery, and requires regular monitoring by a medical provider. For some, though, use of these drugs is unsupervised (de Haan, Santos, Arayasirikul, & Raymond, 2015; Rotondi et al., 2013). Even with proper medical supervision, hormone therapy carries risk. Kranz et al. (2015) showed that exogenous testosterone therapy affected the serotonin system, and may implicate anatomic and physiologic mechanisms known to be involved in depression and anxiety. While improvement in psychological well-being following hormone therapy is partially supported by research, ethically-sound controlled trials have yet to be conducted to evaluate this question (Heylens, Verroken, De Cock, T'Sjoen, & De Cuypere, 2014; White Hughto & Reisner, 2016).

Transition surgery is often performed to remove or rebuild anatomic structures. Some outcomes from major reassignment surgeries have been followed over decades, especially using the Swedish national all-diagnosis treatment registry. Using this source, a controversial result reported by Dhejne et al. (2011) was an increase in rates of suicide approximately 10 years following surgery. Due to the long follow-up afforded by the Swedish registry, this result may have been affected by treatment advances that had occurred since the inception of the registry. As applications for sex reassignment increased over the time span (1960-2010), regrets had likewise diminished over time (Dhejne et al., 2014).

The care of transgender persons may hinge on recognition of the psychological

factors that may influence the success or failure of transition therapy. In settings where

the WPATH Standards of Care (WPATH, 2011) are followed, transition therapy should

not begin without psychological evaluation, making the need for informed providers

more critical (Coolhart, Baker, Farmer, Malaney, & Shipman, 2013).

Katz-Wise and Budge (2015) noted in a study of transwomen and counseling

efficacy, that psychological needs may change during the transition process, making

consistent care from a qualified provider even more important. For some persons, sexual

orientation may also change after transition (Katz-Wise, Reisner, Hughto, & Keo-Meier,

2016). Fluidity in sexual orientation following transition may be more frequent than

previously appreciated, especially in persons who were heterosexual prior to transition

(Auer, Fuss, Höhne, Stalla, & Sievers, 2014). Also, during transition or after completion,

the patient may re-evaluate the treatment goals or the criteria for a successful outcome

(Yerke & Mitchell, 2011).

Physical Health

Investigations into the health of minority persons have often sought to further

understand the relationships between stress (especially social stress), physical illness, and

psychological distress (Frost et al., 2015; Hatzenbuehler, Bellatorre et al., 2014). There

are several physical diseases with well-documented associations between stress,

psychological manifestations, and clinical characteristics. When such diseases occur in

the presence of psychological illness, it may be difficult to disentangle the stress

originating from social causes and the stress originating from disease.

For example, in diabetes, the anatomic and physiologic structures and processes affected in diabetes have been shown to be susceptible to stress-related effects. Epidemiologic associations of disease and stress were reported in Type II diabetes (Carvalho et al., 2015; Faulenbach et al., 2012), older people (DiPietro, Yeckel, & Gribok, 2012; Poulsen & Pachana, 2012), and laboratory models (Li, Li, Zhou, & Messina, 2013). Depression and measurable physical or psychological stress may be a precursor and/or a result of diabetes (Semenkovich, Brown, Svrakic, & Lustman, 2011), as well as other endocrine/metabolic, cardiovascular, or psychological disorders.

Characteristics associated with endocrine/metabolic conditions such as obesity may be intersectional stressors (Robins, McCain, & Elswick, 2012), as is socioeconomic stress and race in the context of diabetes (LeBron et al., 2014; Weiss et al., 2011). PTSD may be comorbid in new-onset diabetic women, but may be ameliorated by education regarding coping skills (Ciocca et al., 2015). Biological markers, such as C-reactive protein (CRP), may be associated with many diseases and conditions, including diabetes, cardiovascular disease, and stress reactions (Das, 2013; Nygren, Ludvigsson, Carstensen, & Sepa, 2013; Powers et al., 2016). Prenatal stress may also be a risk for diabetes (Vargas et al., 2016). The deleterious role of stress, even if not causative for disease occurrence, may play a significant role in successful management of diabetes (Cline, Schwartz, Axelrad, & Anderson, 2011; Karlsen, Oftedal, & Bru, 2012; Walker, Gebregziabher, Martin-Harris, & Egede, 2014; Yi-Frazier et al., 2015).

Asthma is also clearly linked to adult stress, and may also be affected by prenatal stress exposure (Chen et al., 2011; Guxens et al., 2014; Lange et al., 2011; Lee et al.,

2016; Rosenberg, Miller, Brehm, & Celedón, 2014). The stress response in persons with asthma may be altered (Rosenkranz et al., 2016; Trueba & Ritz, 2013; Trueba, Mizrachi, Auchus, Vogel, & Ritz, 2012). Asthma attacks may be severe enough to trigger PTSD symptoms (Chung, Rudd, & Wall, 2012).

Experiencing dental anxiety (even though this stressor is often controllable and predictable to an extent) may also be severe enough in some persons to trigger PTSD symptoms. Age and socioeconomic factors may moderate the severity of dental stress reactions (Boyce et al., 2010; Ohura et al., 2012). Music, not surprisingly, may be palliative for dental-associated stress reactions (Thoma et al., 2015).

The association of stress to certain types of cardiovascular disease has been well-established (Butcher et al., 2014; Kassin et al., 2011). Certain cardiovascular diseases, such as hypertension (high blood pressure) or coronary artery disease, have been linked theoretically to the neuroendocrine stress response (Lovallo, 2011) and epidemiologically to social stressors, such as racism, or to individual stressors such as PTSD (Browning, Cagney, & Iveniuk, 2012; Gebreab et al., 2012; Lukachko, Hatzenbuehler, & Keyes, 2014). The cardiovascular burden of social stigma has been measured by allostatic load (Deuster et al., 2011; Doamekpor & Dinwiddie, 2015).

Socioeconomic Status

Socioeconomic disparities in health have been associated with education, employment and income, and insurance, each of which may have independently (or in concert with other factors), influenced the well-being of gender and other minorities. Sexuality- or gender-based discrimination in education can impact instructional quality as

well as educational opportunities (Asada, Whipp, Kindig, Billard, & Rudolph, 2014). A

component of discrimination (i.e., lack of knowledge on the part of teachers and school

systems) has been recognized in many situations. Sexuality education has been lacking

in school systems (Ghajarieh & Kow, 2011; Gowen & Winges-Yanez, 2014) and in

corporate training (Schmidt, Githens, Rocco, & Kormanik, 2012). With suitable

programs, teacher awareness has been improved (Mahdi, Jevertson, Schrader, Nelson, &

Ramos, 2014; Nowakowski, Sumerau, & Mathers, 2016; Schmidt et al., 2012). Music

and theater programs have been instrumental in raising awareness (Ahessy, 2011; Hughes

et al., 2016).

 Increasing emphasis has been placed on providing healthcare professionals with

knowledge of the unique needs of transgender and other gender diverse patients

(Coleman et al., 2013; Dowshen, Nguyen, Gilbert, Feiler, & Margo, 2014; Fredriksen-

Goldsen, Woodford, Luke, & Gutiérrez, 2011; Jaffee, Shires, & Stroumsa, 2016; Lim et

al., 2013; Moll et al., 2014; Safer, 2013). For social workers, clinical competence in

helping transgender clients may also require advocacy skills (Collazo, Austin, & Craig,

2013). As in other settings, LGBT students may face barriers at medical schools

(Lapinski & Sexton, 2014).

 Widespread social and structural discrimination has been identified in

employment (Bradford et al., 2013; Sangganjanavanich & Headley, 2013). The

healthcare workplace may also reflect social discrimination (Eliason, Dibble, &

Robertson, 2011; MacDonnell & Grigorovich, 2012). Discrimination in this area is likely

reflected by the common finding of low incomes in transgender persons relative to

educational attainment (Bariola et al., 2015; Barr et al., 2016; Budge, Adelson et al., 2013; Budge et al., 2014; Conron et al., 2012; Grant et al., 2011; Klein & Golub, 2016; One-Colorado, 2014; White Hughto, Murchison et al., 2016). Employment may be risky for gender minority persons; for some, honesty in the workplace is not the best policy (Connell, 2012). Workplace challenges have also occurred for transgender people during the transition process (Phoenix & Ghul, 2016).

Since most insurance is obtained from employers, employment discrimination may be doubly harmful by denying minority persons the ability to obtain insurance (Wheeler & Dodd, 2011; Wong, 2013). Problems with insurance may have accounted for some of the negative aspects of transgender persons' perception of healthcare. In Massachusetts, where healthcare was nearly universally available, Conron et al. (2012) reported that in medical (nonpsychological) measures of health, transgender persons were comparable to the general population, a partial refutation of the MST prediction of negative health effects due to discrimination; poor outcomes could also be related to the availability of insurance. This is a *partial* refutation since Meyer (2003a; 2003b; 2010) was cautious about the application of MST to nonpsychological outcomes. However, even when health insurance was available, coverage may be inadequate (Deutsch, 2016; Padula, Heru, & Campbell, 2016; Underhill, 2012).

In addition to the impact of economic factors on psychological well-being noted in Klein and Golub (2016), economic disadvantage may also have exacerbated social isolation. Housing discrimination may also be present in the lives of sexual minority persons (Reisner, Hughto et al., 2015).

The effects of policy decisions on mental and physical health can be measured (Gleason et al., 2016; Hatzenbuehler et al., 2009; Kreiger, 2012; Pachankis, Hatzenbuehler, & Starks, 2014). Addressing complex situations involving gender and sexuality is challenging (Kaiser, Seitz, & Walters, 2014; Lutwak, Dill, & Saliba, 2013; Schilt & Westbrook, 2015; Westbrook & Schilt, 2014), but social change can be achieved through coalition-building (Flores, Herman, & Mallory, 2015; Miller, Reed, Francisco, & Ellen, 2012). Marginalized people are often disadvantaged relative to the benefits of public policy (Knauer, 2012).

The public policy implications of MST may be guided by certain theories of policy action which have addressed external (structural or institutional) stress (Wyatt-Nichol & Naylor, 2013). Two such theories were social constructionism and the advocacy coalition framework (ACF), each of which gave guidance for devising policy approaches to social problems related to belief systems.

Social construction theory provided a plausible mechanism by which stigma produced societal effects (Merry & Coutin, 2014; Nagoshi et al., 2012). The social construction framework (i.e., democratic policy design), described in Schneider, Ingram, and deLeon (2014), focused on the policy effects of social constructs (i.e., stereotypes). The ACF was predicated on the identification of core and subsidiary beliefs, the role of the individual in articulating beliefs, and the importance of groups that were formed around common goals and shared beliefs. Addressing stereotypes and social constructs in policy discussions may be necessary for bias-related discrimination. For example, shared ideology and group identification has been nearly always found in hate crimes

(Ardley, 2005), as well perceived threats to the beliefs of the perpetrator (Jenkins-Smith, Nohrstedt, Weible, & Sabatier, 2014).

Measurement

Transgender persons are not identifiable in most epidemiologic databases. An invisible (or hidden) population, from a statistical perspective, is a group of persons who cannot be identified by usual case-finding methods. There are certain characteristics that pertain to a hidden population (Heckathorn, 1997). First, it is unknown how many people constitute the population; other demographic characteristics (such as age, location, etc.) may also be unknown. Second, (consistent with MST) these persons are likely to have substantial self-imposed privacy considerations; anonymity may be desirable and necessary. Third, a hidden population usually comprises persons with a rare condition. These characteristics are consistent with Daniel (2012), who also discussed the uncertainty regarding the degree of statistical heterogeneity or homogeneity in a hidden population.

Web and paper survey instruments have been the preferred means to collect data for large-scale research on invisible populations (Ahern, 2005; Bauer & Scheim, 2013; Bauer et al., 2014; IOM, 2014; One-Colorado, 2014). Anonymous surveys are a common way to gather national health status data, as is done by the BRFSS (CDC, 2013) on which many health measures have been based (Bockting et al., 2013; Bossarte, He, Claassen, Knox, & Tu, 2011). The anonymity of an internet survey allows persons to freely reveal sensitive information, such as health status, without fear of recrimination.

There are several biases that have been reported to occur in internet surveys (Yeager et al., 2011), notably selection bias that may impair (or eliminate) external validity (Koch & Emrey, 2001). Respondent-driven sampling (Heckathorn, 1997; 2002) may reach more participants since it places the recruitment effort on the participant, not on the researcher. Enlisting participants in finding other participants may be necessary (McCreesh et al., 2012). Heckathorn (2002) described key potential biases of these sampling methods: 1) the dependence on the initial respondents; 2) over-representation of those who are prone to volunteer; 3) nonrandomness of referrals; and, 4) over-representation of socially well-connected persons.

Schwartz and Meyer (2010) identified measurement variability and lack of attention to between-group and within-group differences as sources of observed variations in the amount of stress attributed to mental health outcomes, and as major hurdles to the application of social stress theory (and MST). Schwartz and Meyer (2010) was preceded by Meyer's (2003a) identification of three interrelated measurement problems: 1) isolating individual versus structural factors, 2) measuring the subjective perceptions of stress, and, 3) separating the various sources of stress (i.e., major versus more common). Turner (2010), reflected on this problem and placed misclassification as a major potential threat to validity; potential sources of divergence may be due to other measurement issues, reporting bias, and underestimated exposure variation (or lack of variation).

Summary and Conclusions

In Colorado, transgender persons reported suicidal ideation or suicide attempts approximately 10 times more frequently than in the general Colorado population (One-Colorado, 2014). MST, the theoretical foundation of this study, identified prejudice as a subjective and as a societal stressor that independently, and though interaction with other stressors, affected minorities in multiple ways. MST directly addressed depression and suicide in minority groups by predicting adverse psychological experiences involving rejection, concealment, and self-stigma (Meyer, 2003a).

The literature of MST supported the biological and psychological effects of stress, but it was difficult to isolate a consistent specific effect of discrimination on psychological and physical health in the body of research. However, disparities in psychological and physical health across social strata pointed to a role for social adversity in the etiology of psychological illness and suicidal ideation, but results were often inconclusive or inconsistent (Frost & Meyer, 2012). Nevertheless, elevated rates of psychological distress (especially suicidal ideation and attempts) and victimization were consistently apparent in transgender Coloradoans and nationally (Grant et al., 2011; One-Colorado, 2014).

That social stress should have a measurable influence of health seemed intuitive, but operationalization of research questions was difficult, and reaching the people who may be most affected by social stress was also challenging for many researchers. Analysis and interpretation of data from minority groups exposed to social stress was enhanced by knowledge of the likely theoretical, biological, and epidemiological

manifestations of the human responses to stress. Some of the biological effects of environmental and psychological stress have been established. The anatomical structures and physiological processes activated during an experimentally-induced stress response are the same structures activated in a variety of human emotional and physical states, so it was reasonable to hold that stress, in a broad sense, influenced psychological and physiological stability in humans (Baams et al., 2015; Marin et al., 2011).

A gap in the literature existed with respect to social isolation and its interdependent relationships to psychological distress and medical care. This study addressed this gap through secondary analysis of survey data gathered in Colorado in 2014 (One-Colorado, 2014). Through the literature, it was shown that social isolation, despite precise definition, was a risk factor for suicide and other forms of psychological distress in gender-variant persons (Zavaleta et al., 2014). Though indicating a positive value for social support (Bauer, Scheim et al., 2015; Klein & Golub, 2016; Yadegarfard et al., 2013), the literature was largely silent on a consistent role for social isolation (a concept distinct from social support), even though the negative effects of avoidance as a coping strategy were demonstrated (Budge, Adelson et al., 2013). Further, transgender persons reported discrimination or lack of support in healthcare encounters, and subsequent avoidance of healthcare (Bauer et al., 2014; One-Colorado, 2014). Healthcare providers also recognized this lack of support for transgender persons from the healthcare system (McIntyre et al., 2011).

Minority stress theory connected discrimination to psychological distress, and the psychological harm associated with lack of adequate mental health treatment was

supported (Dhingra et al., 2011; Bauer, Scheim et al., 2015). Thus, each leg of this three-pronged study had documented relationships to a common outcome: Suicide or suicidal ideation. However, the interrelationships of these three constructs had not been jointly addressed in a transgender population.

Chapter 3 describes the research methods used to explore these relationships in a dataset that was specific to the health of transgender Coloradoans. This dataset contained broad measures of social stress, healthcare, individual characteristics, and physical and psychological health. However, as with many studies of rare, ambiguously-defined phenomena, measurement and analytic issues demanded extra attention; exploration found more questions than answers.

Chapter 3: Research Method

Introduction

The purpose of this quantitative study was to assess the interactions that existed between social isolation, supportive medical care, and psychological distress among transgender and gender-variant Coloradoans who participated in an anonymous survey in 2014. Previous descriptive analyses of this survey identified health status differences between persons who had regular medical care and those who did not (One-Colorado, 2014). Since any of these three concepts may have influenced the others in complex ways, the statistical relationships between these concepts provided information about some of their underlying dynamics.

This purpose of this chapter is to explain the research design and methodology of this project. It begins by restating the study purpose, and then introduces the three primary study variables. After this, the research questions are presented, and the research design is introduced. The population and the sampling strategies used in the datasets are described. Following that, several of the various indices or measures are described, along with assessments of their validity and reliability. Next, the variables to be analyzed are operationalized. The data analysis plan in four parts is then described, including the statistical procedures. Threats to validity and methods of mitigation are examined. Finally, ethical issues are discussed.

Research Design and Rationale

Research Question and Hypotheses

The research question of this project addressed the interactions of social isolation, supportive medical care, and psychological distress in transgender Coloradoans. This question was evaluated with three core hypotheses that evaluated composite variables for social isolation (SI), supportive medical care (SMC), and psychological distress (PSY). These hypotheses were examined by analyzing the relationship of one variable (such as PSY) to the other two (such as SMC and/or SI), after identifying and mitigating the influence of control variables (covariates and confounders such as respondents' demographic, medical, and behavioral characteristics). With this strategy, one null hypothesis and three alternative hypotheses formed the foundation of the research plan.

RQ: What were the relationships between SI, PSY, and SMC in transgender Coloradoans?

H0: There was no relationship between SI, PSY, and SMC in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

H1a: A positive association existed between PSY and SI in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

H1b: A positive association existed between PSY and SMC in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

H1c: A positive association existed between SI and SMC in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

Study Variables

There were three interdependent concepts of primary interest in this study. They were psychological distress, social isolation, and supportive medical care. Since these broad concepts were not completely captured by the survey data, they were operationalized as composite variables built from the available data: PSY represented the indicators of psychological distress, SI represented the indicators of social isolation, and SMC represented the indicators of supportive medical care. PSY and SMC were the most straightforward of the variables, while SI was a latent variable (Blunch, 2013, p. 9) discerned through indicators of social integration. Since causal relationships could not be determined in this secondary analysis, each variable was at times independent, dependent, covariate, mediating, and/or moderating with respect to the others. For most analyses, PSY was hypothesized to be a dependent variable.

Psychological Distress (PSY)

Self-reported anxiety, depression, suicidal ideation, or suicidal behavior (i.e., suicide attempts) captured in the survey dataset constituted PSY. Suicide has been found to be more common in transgender persons than in the general population (Blosnich et al., 2013) and has been influenced by stigma (Perez-Brumer et al., 2015), social support (Bockting et al., 2013), and depression (Jia et al., 2015).

Social Isolation (SI)

Social isolation has been variably defined in the literature. Zavaleta et al. (2014) reviewed such variations, and drew distinctions based on whether the concept of social isolation involved supporting concepts such as the quantity, quality, and adequacy of

social contacts, as well as the levels at which the contact or lack of contact occurred (i.e., individual, group, community, or societal), whether physical or geographical separation was present, or whether stigma or ostracization was present. Social isolation has also been investigated as a distinct component of more societal-level phenomena such as social capital, social cohesion, or social exclusion.

Loneliness, a marker of social isolation, has been linked to psychological distress (Zavaleta et al., 2014, p. 18). Zavaleta et al. (2014) suggested several potentially measurable dimensions of social isolation such as quantity, quality, and adequacy (i.e., the ability to produce satisfaction) of personal, family, friend, and community relationships and noted the relevance of socioeconomic indicators such as poverty as suggested by Conron et al. (2012) and Klein and Golub (2016). Johnson and Amella (2014) expanded the definition of social isolation to reflect cognitive and emotional aspects as well as the social aspects of this concept; they also included victimization as a component of social isolation.

Supportive Medical Care (SMC)

Medical care that was affirmative and did not convey the perception of prejudice to the recipient of the care characterized supportive medical care and operationalized as SMC. The perception of nonsupport from healthcare providers has occurred from overt acts of discrimination such as failure of providers to use proper pronouns (Hagen & Galupo, 2014), and has been reported to occur in response to more subtle barriers such as failure to find knowledgeable practitioners or insurance coverage (Bauer, Zong et al., 2015; Snelgrove et al., 2012) and lack of gender specificity in medical research and

classification systems (Byne et al., 2012; Davy, 2015). The perception of supportive medical care may be affected by age, since lack of awareness of life-course issues in transgender health has been found in pediatrics as well as geriatrics (Cartwright et al., 2012; Kattari & Hasche, 2016; Mustanski, 2011) and in specialty areas such oncology (Bauer & Hammond, 2015; Quinn et al., 2015).

Control Variables

There were many possible control constructs (covariates or confounders) that could have affected social isolation, psychological distress, and supportive medical care. Some of these constructs (such as Race or Gender) also represented intersectional sources of discrimination (Hoffman, 2014; Meyer, 2003a). Other control constructs were indicators of time since routine medical checkups, cardiovascular or respiratory history, alcohol abuse, drug abuse, metabolic disease history, presence of financial barriers to access, tobacco use, transition-related medical care, age group, body mass index (as a marker for obesity), general health, Hispanic ethnicity, mental health, physical health, poor health, sex, and sexual orientation.

Research Design

A quasi-experimental research design for this secondary analysis of cross-sectional survey data was appropriate. It was not possible to derive temporal order from this dataset, so causal relationships were not established. But by simulating independent and dependent relationships and comparison groups, hypotheses were quantitatively evaluated using bivariate and multivariate regression-based methods, factor analysis, and SEM.

The availability of a dataset with which to investigate the health status of transgender persons was fortuitous. The time and resource requirements to design and apply an original survey of the magnitude of the One-Colorado survey would have been redundant, coming closely after the 2014 One-Colorado survey and the 2015 BRFSS survey in Colorado which incorporated a sexual orientation module, and the 2015 NTDS.

To assess the health status of transgender Coloradoans, given the lack of existing data in this area, the One Colorado Educational Fund, with support from the Colorado Department of Public Health and Environment, the University of Colorado (Denver and Anschutz Medical Campus) and other advocacy organizations, designed and implemented and anonymous survey of self-described transgender persons in 2014. The resulting One-Colorado dataset represented one of only two quantitative sources of health status information about transgender and gender-variant Coloradans. However, because of the nonprobabilistic, nonrandom nature of the One-Colorado dataset (and the lack of temporal sequence information) analyses performed in this study were not experimental and external validity was weak.

Due to the specificity of the One-Colorado dataset, rigorous triangulation with other data sources was not planned. The two most nearly appropriate sources for comparable data were the BRFSS, a source of Colorado-specific general health information, (CDC, 2013) and the 2009 National Transgender Discrimination Survey (NTDS) dataset (the only other source of national quantitative transgender or gender-variant health information) (Grant et al., 2011). However, even though the BRFSS and One-Colorado were largely similar to the structure of One-Colorado survey items,

important coding variations existed. The 2009 NTDS lacked detailed health information and the operational definitions of items were generally quite different from that of One-Colorado.

Methodology

For this study, the sample was 417 self-identified transgender persons residing in Colorado who participated in the One-Colorado survey. The population from which this sample was drawn was hidden due to stigma (Heckathorn, 1997). At the outset of this study, the degree of statistical heterogeneity or homogeneity of this group was unknown. Thus, this hidden (or *invisible*) population would not have been identifiable by usual probabilistic sampling methods.

Part of the uncertainty surrounding the hidden transgender population was due to ambiguity in the term *transgender*. For example, in the One-Colorado dataset, the sexual orientation survey item that focused on gender characterization offered seven different options, three of which were specifically transgender (transgender man, transgender woman, transgender) and four of which indicated gender-variance without the term *transgender* (man, woman, agender/no gender, gender queer/gender fluid). Ambiguity of terminology has been found in national studies also. The 2009 NTDS (Grant et al., 2011) was solely comprised of persons who self-identified as transgender, but it was not known precisely how the respondents considered themselves; 13% identified as a gender that was neither male nor female and only 65% of the respondents identified with the word *transgender*. The 2015 NTDS (James et al., 2016) adopted the term *transgender* as the overall most inclusive and appropriate term for large-scale research involving transgender

or other forms of gender variance that was not more appropriately described as lesbian, gay, or bisexual (LGB).

Conron et al. (2012) estimated the prevalence (the number of transgender persons) at 0.5% of the adult Massachusetts population in 2009 using Massachusetts BRFSS data. This calculation was reliable (within the limits of the definition of *transgender*) since the BRFSS uses probability-based sampling (CDC, 2013). In Colorado, using 2009 census data (Census Bureau, 2009) and the Massachusetts percentage, an estimate of 18,985 transgender persons was derived. The 417 respondents to One-Colorado may have represented about 2.2% of the estimated Colorado transgender population.

Alternatively, the National Center for Transgender Equality (NCTE) gave an un-cited estimate of the number of transgender persons at 0.25% to 1% of the U.S. population (NCTE, 2009). In Colorado (in 2009) the population was 5,024,748 (Census Bureau, 2009). Using the low-range estimate of 0.25% (0.0025) gives the number of transgender persons in Colorado in 2009 as approximately 12,561. However, the 2009 NTDS (Grant et al., 2011) showed a response map in which the Colorado respondents were concentrated in four Front Range metropolitan and micropolitan statistical areas (MMSAs). The combined population for these MMSAs in 2009 was 3,780,286, giving a low-range estimate of the Front Range transgender population as 9,450 persons. Using this percentage, the 417 respondents to the One-Colorado survey may have represented about 4.4% of the estimated Front Range transgender population. Therefore, the 417 respondents may have represented about between 2.2% to 4.4% of the estimated Colorado transgender population.

The One-Colorado dataset (n = 417) was collected cross-sectionally from Colorado residents during February to August 2014. This was a one-time, anonymous, internet-based survey of self-described transgender persons. A nonprobability, nonrandom sampling plan was used since a rare condition like transgender was unlikely to be identified in a probability sample, unless the sample would have been very large. While the One-Colorado sampling was largely purposeful (i.e., the survey was limited to self-reported transgender persons), it was not clear if the sampling was based on a quota or simply by availability, and it was not clear if sample size targets were evaluated prior to data collection.

Using dual (paper/web) instruments addressed a potential bias due to lack of computer access (Ahern, 2005; Rhodes et al., 2002). Web and paper survey instruments were employed by One-Colorado, as well as the 2009 NTDS (Grant et al., 2011) and by Bauer et al. (2014). Peers or other trusted persons may have successfully enlisted potential respondents; which would have been an informal application of *respondent-driven* sampling (Bauer et al., 2014; Daniel, 2012); Heckathorn, 1997). Heckathorn (2002) described key potential biases of respondent-driven sampling methods: 1) the dependence on the initial respondents; 2) over-representation of those who are prone to volunteer; 3) nonrandomness of referrals; and, 4) over-representation of socially well-connected persons. The One-Colorado process effectively eliminated younger (age < 18) transgender persons, non-Colorado participants, and persons who did not frequent any of the collaborating organizations.

Performing secondary analyses of a convenience-derived dataset did not eliminate the need for population, sample size, and power considerations. For One-Colorado, it was unknown if sample size and power estimates were conducted *a priori*. Kline (2011), in estimating sample size requirements for structural equation models, noted that sample size requirements increased as the number of parameters increased, and as the data deviate from normality, the sample size requirement also increased. Kline (2011) offered a rule-of-thumb that there should be 20 cases for each parameter in the model, but the sample size should not be below 100. Lei's (2007) rule of thumb was five to 20 cases per parameter, not less than 200. Similarly, for factor analysis, Field (2013) de-emphasized the number of cases per parameter and recommended a total sample size greater than 300.

To examine whether Kline's (2011, p. 12) rule-of-thumb of 20 cases per parameter was supported by the sample size and power calculation software G*Power v. 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007), a G*Power calculation was made (specifications: F test family, fixed linear multiple regression model, testing the R^2 deviation from zero, effect size = 0.15, α = .05, 1-β = .80, and number of predictors = 20). The total sample size calculated by G*Power was 157, and Kline's estimate was 400. The One-Colorado sample of 417 was therefore adequate for most analyses, since it exceeded Kline's, G*Power's, and Field's guidelines.

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Secondary Dataset: One-Colorado

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Recruitment

Details of the One-Colorado survey methodology were described in One-Colorado (2014). To summarize, the survey was promoted state-wide and undertaken

with the collaboration and input of several organizations: One Colorado (a transgender advocacy organization), GLBT Community Center of Colorado, the Colorado LGBT Health Coalition, and the Colorado Department of Public Health and Environment. Contacts were also made with LGBT organizations across the state and with "LGBT-friendly healthcare providers, mental health providers, support organizations, homeless shelters, religious organizations, colleges, and universities" (One-Colorado, 2014, p. 3). The survey was also promoted via Facebook, Twitter, transgender forums, and at transgender-specific educational or social events. One-Colorado offered no incentives for participation.

Accessing the Data Set

In contemplating a dissertation topic involving transgender health, an exploratory internet search was conducted for Colorado transgender advocacy organizations involved in this work. The One Colorado Educational Fund (OCEF) was identified and contacted. After explaining the then-vague goals of the dissertation project to OCEF, an in-person meeting was held to further pursue the dissertation project, and the availability of the One-Colorado dataset was discovered, and a specific dissertation topic was formulated. Following this, formal permission was given and the data were transferred. The data sharing agreement for One Colorado is presented in Appendix A.

Operational Definitions

The One-Colorado dataset comprised 115 variables (derived from 73 survey items – one item allowed more than one response). Items in One-Colorado represented 18 conceptual groups (Demographics, Health Status, Health-Related Quality of Life,

Hormone Replacement Therapy, Transition Related Surgery, Health Care Access, Hypertension Awareness, Cholesterol Awareness, Chronic Health Conditions, Anxiety and Depression, Suicidal Ideation and Behavior, Oral Health, Tobacco Use, Physical Activity, Disability, Alcohol Consumption, Marijuana Use, and Illicit Drug Use). The data dictionary for the One-Colorado survey dataset is given in Appendix B. The variety of constructs in this dataset supported the creation of multifactorial composite variables, with the potential for capturing key concepts in more than one way. The operational constructs (including composite variables) are presented in Table C1.

Psychological Distress (PSY)

Psychological distress was operationalized as a composite of eight measures of current mental health, four measures of current physical and mental health status, a measure of activity limitation, a measure of self-reported history of anxiety, a measure of self-reported history of depression, and three measures reflecting self-reported suicidal ideation behavior. This variable (PSY) was formed so that lower values of indicated increased psychological distress (i.e., higher values reflected a more beneficial condition). The eight measures of current mental health are eight components of the Patient Health Questionnaire-8 (PHQ-8) scale (Kroenke, 2001), and the four measures of current health status comprise the Healthy Days construct (CDC, 2000; Holden, Lee, Hockey, Ware, & Dobson, 2014; Horner-Johnson et al., 2009; Zullig, 2010).

Social Isolation (SI)

Social isolation was operationalized as a "deprivation of social connectedness" (Zavaleta et al., 2014, p. 1) that was reflected by a measure of the type of interpersonal

relationships reported, a measure of the amount of physical activity, and three socioeconomic measures, forming the variable SI. It was not possible to directly assess social support, and social support may not adequately capture several important nuances that characterize social isolation (Johnson & Amella, 2014). For example, economic disadvantage may exacerbate social isolation (Conron et al., 2012); as may any social stressor (Hatzenbuehler, 2009).

Regardless of etiology, social isolation was an independent risk factor for suicide and other forms of psychological distress in gender-variant persons (Baams et al., 2015). Items in One-Colorado that captured the depth of the respondent's social network were the number of persons in the household and relationship status; but, the number of persons was not contributory, so it was not included in the analyses. Items related to the formation of external social networks were education, income, and employment. In this formulation, lower scores for social isolation indicate greater purported social isolation, higher scores convey greater social integration. Neither social isolation nor integration was specifically addressed by a survey item.

Supportive Medical Care (SMC)

In One-Colorado several survey items captured supportive medical care explicitly. Supportive medical care was represented by a direct indication that care was inclusive, a direct indication that the respondent did not delay seeking care due to fear of discrimination, the respondent's positive perceptions of inclusiveness, and the respondent's negative perceptions of inclusiveness. These components constituted the variable SMC. Measures of health insurance were not significant contributors to this

construct and were not included in the analyses, despite reported associations of lack of insurance with discriminatory practices (Deutsch, 2016; Padula et al., 2016; Underhill, 2012).

Control Variables

The various roles that control variables can assume are depicted in Table C2. These variables represented the respondents' age group, gender, ethnicity, race, potentially unhealthy behavioral characteristics, disease-related experiences, and transition-related experiences. Potentially, any of the control variables could be a covariate, a mediator, or a moderator. A potential unmeasured confounder was victimization (i.e., whether the respondent was a victim of a hate crime or other overt discriminatory behavior); victimization has been linked to at least two of the primary variables, psychological distress (Richmond et al., 2012; Shipherd et al., 2011) and social isolation (Johnson & Amella, 2014).

Data Analysis Plan

There were four parts to the analysis plan: Data quality evaluation, index construction and validity testing, hypothesis testing, and supplemental analyses. The statistical analyses were conducted in IBM Statistical Package for the Social Sciences v. 21 (SPSS) and IBM SPSS AMOS (IBM, 2012). Data management and manipulation (sorting, creation of custom datasets, field creation, etc.) was done in ResearchBase v. 9.33 (Clinical Data Management, Inc., 2014). Technical documentation, schema, and other supporting technical documents existed for the One-Colorado dataset. The

methodologies for SEM in AMOS were outlined in Blunch (2013), Byrne (2016), and Kline (2011).

Data Quality Evaluation

Assessing data quality was the first part of the data analysis plan. Data validation had been documented for One-Colorado (One-Colorado, 2014). Using the data management features of ResearchBase, the One-Colorado dataset was examined for outliers, skewness, kurtosis, and missing data frequency. Recoding and restructuring in ResearchBase was done to impute missing data and to resolve data quality issues, and to export cleaned data into the analytic databases in SPSS. It was not possible to identify duplicate response entries based on similarity of responses, so a meaningful duplicate response rate could not be calculated.

Index Construction and Validity Testing

Indices that summarized the three primary concepts (social isolation, psychological distress, and supportive medical care), covariate constructs, and control constructs were created in ResearchBase and then imported into SPSS. The main guidelines followed in the creation of these indices are outlined in Table C3. The index creation processes principally involved summation due to data constraints, although factor analysis was used to form the social isolation variable. Factor analysis was also used to examine component relationships.

Since many of the items in the One-Colorado survey were binary responses to sets of related questions, the summation method of index construction was appropriate and, by the central limit theorem, the summation was normally distributed (Blunch, 2013).

Byrne (1998, p. 165) suggested that categorical variables may be thought of as a "crude measurement" of a latent continuous variable. As respondents could not weigh the importance of responses, each component of a summated index was assumed *a priori* to contribute equally to the composite result; thus, weighting of the components was not done initially (Blunch, 2013), although custom formulations were required due scale differences or lack of centrality, a key characteristic of normality (Blunch, 2013). Through examination of bivariate correlations, reliability analyses, and data quality, some variables were shown to flawed or noncontributory and were eliminated. All the study variables except Behavior, were monotonic (Field, 2013, p. 710) with respect to benefit. That is, larger values of the variable conveyed greater health benefit. The summated indices were designed to yield at least five categories to avoid bias in SEM or regression (Blunch, 2013, p. 102; Kline, 2011). The continuity of ordinal/categorical variables with at least five values was assumed (Byrne, 1998; Rhemtulla et al., 2012). The statistical methods for validation of the custom indices that were used for this study are described in Table C4.

Hypothesis Testing

The third step in the data analysis plan was to evaluate the hypotheses. The tests used in this study were based on regression-based procedures, the assumptions of which are given in Table C5. Each of the alternate hypotheses was evaluated for two-way significance from several statistical perspectives, and are reported in Chapter 4. The use of multiple perspectives was done to triangulate the results and to expose relationships that may have been obscure from one perspective.

Supplemental Analyses

While the testing of the alternate hypotheses was adequate to answer the basic research question, ambiguities and subtleties of the relationships were explored in the fourth phase of the analysis. In this phase, mediation and moderation analyses were conducted, and a structural equation model was constructed and a second-order factor analysis was performed.

Threats to Validity

The general limitations of the One-Colorado dataset and methodology were discussed in an initial report (One-Colorado, 2014). In that document, the authors explained that despite attempts to attract as broad a participant pool as possible, some potential external threats to validity, especially related to selection, remained. The authors also described item creation procedures that indicated potential threats to internal validity.

External Validity

The selection biases acknowledged in One-Colorado (2014) were lack of random selection, a predominantly urban sample, likely over-representation of transgender persons with greater social connectivity (i.e., via community networks, academia, healthcare institutions, or social justice groups), over-representation of people with internet access, and underparticipation from nonwhite persons. These selection biases made identification of social isolation more difficult since persons who were truly socially isolated would probably not have been aware of the survey due to lack of social contact, a characteristic of a hidden population.

Internal Validity

Internal threats to validity in this study arose from potential lack of validity for the custom indices (i.e., SI, SMC, and PSY) and lack of generalizability.

Construct or Statistical Validity

The BRFSS items that were found in One Colorado had demonstrated validity and reliability from the long and widespread usage of those items across populations. The One-Colorado items that were not found in the BRFSS had some content and construct validity due to their approval by expert consensus (i.e., involvement by researchers from the Colorado Department of Public Health and Environment and the University of Colorado Medical School, and Institutional Review Board approval from the University of Colorado) during the design of the survey. It was not clear if there was a pilot testing of non-BRFSS survey items with subsequent evaluation.

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Ethical Issues

</div>

Even though the survey data were gathered anonymously and confidentially, the transgender community was not nameless or faceless. Despite the lack of personal identifiers, ethical dilemmas could have arisen from the analysis and interpretation of the data. Analytic mismanagement of these data could do as much harm as a breach of confidentiality.

While there were acknowledged selection biases of these datasets, there were no apparent ethical issues related to recruitment or data collection. However, ethical considerations could have arisen from reliability concerns in other ways. For example, if indicators did not accurately measure the intended concepts, then unreliable

interpretations could have resulted. Also, if indicators measured the intended concept accurately, but incompletely, a false picture of the status of this group could have resulted, also leading to poor decisions that could perpetuate inequity.

The definitional ambiguity of the term *transgender* could have led to an ethical dilemma if gender-variant people who did not use that term felt that their perspective was ignored. This was addressed in James et al. (2016), who suggested that the use of the term *transgender* was an appropriate aggregate description of this group for research purposes.

The researcher's duty to these persons was to objectively provide as true a picture of their experiences as possible (Creswell, 2009). Rigorous attention to correct analytics and interpretational accuracy (especially avoidance of over-generalization) constituted the best likelihood of producing research of the highest quality and usefulness. The One-Colorado data were the most detailed quantitative window into the experiences of self-identified transgender Coloradans, a stigmatized group who were at elevated risk for suicide. While presenting some analytic challenges, the failure to apply the utmost rigor to this unique dataset would have been unethical.

There were no ethical issues related to work environment, conflicts of interest, power differentials, or incentives. Access to the public use One-Colorado dataset was granted by the One Colorado Educational Fund (the chief sponsor of the survey), and since this was an anonymous survey, there was no need or ability to interact with any of the participants. Institutional Review Board (IRB) approval for the survey was granted by the University of Colorado (Personal Communication from the One Colorado

Educational Fund, 2016). Approval from the IRB of Walden University was obtained

(IRB approval number 06-16-17-0071664) before any analysis was begun. The data

were stored on a password protected local computer (not cloud-based) and protected by

proprietary security programs, in addition to Windows 7 Professional firewall services.

The datasets used in this dissertation will be retained for five years following the

publication of the dissertation and then destroyed.

Summary

This chapter outlined the methods and procedures used to perform secondary

analyses of a dataset collected from an anonymous, internet-based survey that focused on

the health of transgender Coloradoans (One-Colorado, 2014). This study used quasi-

experimental statistical methods to analyze this dataset. Because of the nonprobabilistic,

nonrandom nature of the One-Colorado dataset (and the lack of temporal sequence

information) analyses were not be experimental and external validity was weak, but as

this dataset was the only Colorado-specific source of health status information about this

marginalized and hidden population, the dataset was uniquely valuable.

Three main theoretically-interrelated constructs were being assessed: Social

isolation, psychological distress, and supportive medical care. Social isolation was

conceptualized as a latent variable expressed through indicators of socioeconomic

integration. Each of these primary constructs was operationalized as a composite,

ordinal, multi-level variable based on item from the One-Colorado dataset. Control

variables (either directly found in the dataset or constructed as composite variables) are

described. The control variables encompassed demographic, behavioral, and medical information.

The research question and the main hypotheses are described, and the composition of the survey population and the methodological challenges of investigating a hidden population are presented. The analysis plan is then described. The four parts of this plan (data evaluation, scale construction, hypothesis testing, and supplemental analysis) are explained. In that discussion, attention is given to the continuity and normality assumptions of regression and SEM. Internal and external validity is then considered, and finally, ethical issues are discussed. In the next chapter, descriptive statistics concerning data quality are presented and the results of the statistical analyses used to evaluate the research questions and probe the primary constructs' relationships are reported.

Chapter 4: Results

Introduction

This study sought to examine certain problems found in the transgender community: Negative perceptions of their healthcare, higher incidence of psychological distress, and the uncertain role that social isolation may play in these problems. Since aspects of these problems were measurable, this research explored the three 2-way interactions of these conditions in a cohort of 417 transgender Coloradoans who responded to a 2014 survey. Specifically, diminished social isolation, more supportive medical care, and less psychological distress were hypothesized to coexist in this cohort; this goal motivated a secondary analysis of the 2014 survey data through quasi-experimental statistical methods, which included multivariate regression-based methods, factor analysis, and SEM.

This chapter presents the methods used to evaluate the research question and hypotheses in this secondary analysis, and the results obtained from the four-phase analysis plan described in Chapter 3. First, the evaluation of the data (Phase 1) is detailed, with attention to database management and statistical transformation. This step played a key role in this study, and is described in detail since the data were collected to explore general healthcare experiences, without focusing on social isolation. This purpose and the purpose of this study were closely aligned. Next, the construction of several indices (composite variables) is described (Phase 2). The process by which the indices were constructed primarily involved summation of dichotomous and ordinal data. In this phase, a latent variable was developed to numerically express social isolation. Following

this, the results of hypothesis testing (Phase 3) are presented. Hypotheses were tested and

probed from several related statistical perspectives; two analytic models that differed in

the treatment of covariates are presented. In Phase 4, moderation/mediation relationships

between the covariates were investigated using the PROCESS procedure in SPSS (Hayes,

2013) and SEM. Phase 4 concluded with a second-order factor analysis that evaluated

the overall model. The results of these analyses are presented and the chapter concludes

with a summary of the analysis that leads to the discussion presented in Chapter 5.

Through the auspices of the One Colorado Educational Fund (OCEF), a survey

dataset was identified that could potentially address the research topic. The survey was

conducted from February to August in 2014; 417 Colorado residents responded (One-

Colorado, 2014). A data sharing agreement was implemented in February 2015 and

renewed in June 2017 (see Appendix A). The data were collected in accordance with

Walden University standards (IRB approval number 06-16-17-0071664). The final

dataset was comprised of 417 self-identified transgender Coloradoans.

Data Analysis

The data analysis proceeded in four phases. The statistical analyses were

performed in IBM SPSS v. 21 and IBM SPSS AMOS v. 21. Data management and

manipulation (sorting, creation of custom datasets, field creation, etc.) was done in

ResearchBase v. 9.33 (Clinical Data Management, Inc., 2014) and Microsoft Excel 2010.

Data Quality Evaluation (Phase 1)

The mechanics of data preparation involved several iterative and overlapping

steps. First, the data file was obtained and opened successfully. Integrity (correct number

of records and columns, and the ability to copy at the record level) was verified. On

import into ResearchBase (RB), a tracking number was assigned to uniquely identify

each record to allow precise record linking. Each item was examined descriptively and

grouped to map the survey constructs to the study constructs. Outliers and missing data

were identified (see Table D1). The data types (dichotomous, scale, etc.) were tabulated.

A thorough, multi-perspective examination of this dataset was essential to identify any

potential data-related barriers that could have affected the subsequent results and

findings.

The original dataset consisted of 417 records and 115 variables, of which 77 were

dichotomous. These 115 variables were reduced to the final dataset of 57 variables used

in these analyses (i.e., the analysis dataset); these were ultimately transformed, primarily

through summation, into eight study variables that were used in hypothesis testing (see

Table C1 and Appendix B). Once the transformations were completed, the dataset was

exported into SPSS.

Data issues.

Several resolvable data issues were discovered during the data evaluation phase.

These issues involved the survey items Race, Gender, the four alcohol use survey items,

and a nested survey item. For the Race survey item, the White response accounted for

86% of the cases in the dataset, and since ambiguity and low frequency were found in

some of the non-White categories, the Race item was restructured to be dichotomous:

White or non-White. The Gender survey item had ambiguity due to undocumented

responses and low frequency in several categories: 51.8% of respondents identified as

transgender male or transgender female. The original eight categories in this item were collapsed into six which resolved the low frequency and data ambiguity issues. Ambiguous or contradictory data were found in three of the four alcohol use survey items. Two of these four items were excluded, so that only one survey item involving binge drinking was retained. The fourth item was excluded due to lack of significance in the analysis.

To achieve more tractable data formats for this study, many survey items were recoded or restructured. Most of these transformations involved recoding 2- or 3-level categorical survey items; the goal was to associate a numerically larger value to a better health outcome or condition (monotonicity). This goal was achieved for all but one composite variable: Behavior. Higher values of this variable indicated less healthy behavior. A more complex process was the restructuring of certain survey items. The restructuring process reassigned data categories to compress low frequency cells or to achieve monotonicity in certain ordinal demographic or socioeconomic items (see Table D2). An example of this process was the restructuring of the seven marital/relationship survey items into the ordinal variable Marital based on partnership status, using the premise that close interpersonal relatedness was beneficial to well-being, as self-determination theory purports (Zavaleta et al., 2014).

Finally, a minor data issue related to missing data occurred in the nested survey items that captured satisfaction with healthcare. This situation was resolved by imputation based on responses to other fields. However, to assure the validity of the other

nested groups, all were checked and found to be problem-free. The nine groups of nested survey items (43 survey items in all) are displayed in Table D3.

Completeness.

Record completeness was assessed as a percent of survey items that have any data, divided by the number of survey items that would be expected to have data. Even though the number of total survey items in the dataset was 115, the conditional nature of some of these survey items allowed the maximum number of survey items (those that a respondent would be able to complete) to vary. A respondent could potentially have answered from 78 survey items to 108 survey items; the potential number (determined by an RB algorithm) was the denominator for the completeness percentage. Overall, the completeness of the dataset was 94.6%.

The importance of accounting for nested responses was seen in the three survey items regarding suicidality. These items were particularly important for this study; heightened risk for suicide was consistently found among transgender persons. The field Suicide-Injury (suicide attempt resulting in injury in the past year) had the lowest raw completeness of all 115 survey items (91% missing, 9% Yes), since it was dependent on the presence of suicidal thought and attempt. A listwise exclusion of the records with missing data for this item would have eliminated valuable information. Of the respondents with self-reported suicidal thought (142/417=34.1%), all completed the Suicide-Attempt item (142/142=100%). All those who responded Yes to an attempt (39/142=27.5%) completed the Suicide-Injury item (100% Yes). Thus, the true

completeness of the Suicide-Injury field was 100%, not the 9% that might have been superficially apparent.

From the information in Table D4, it was observed that 139 records (33.3%) were 100% complete; listwise elimination of 278 records that were incomplete would have been excessively damaging to the analyses. A better course than listwise elimination, as noted by Byrne (2016), was to make reasonable imputations based on a logical process. In most cases, missing data were inferred by using similar response pattern-matching (SRP-M) methods (Byrne, 2016, p. 398), such as basing the imputation on the response frequency of cases with similar characteristics. Mean-imputation was used for missing bounded continuous data in the PSY construct. In this construct, several survey items collected the number of days of well-being; missing data in these survey items were imputed by an algorithm that averaged the numeric responses of the other same-scaled survey items in the group, and imputed that value.

In the Disease construct, for the 10 disease-specific dichotomous or trichotomous survey items, the assumption was made that if the disease was not acknowledged it was not known to exist. This reasoning was plausible since almost all respondents (n=413) answered the General-Health item (self-reported general health assessment) which indicated a willingness to share health information (the publicized intent of the survey). It was reasonable to assume that one would answer a disease question if one knew one had the disease; therefore, it was reasonable to assume that if the disease was not acknowledged it was not known to be present.

While it was possible to impute missing data for almost all records, 26 records remained in the original dataset with missing psychological distress items that could not be imputed. These 26 records were excluded from the final dataset (i.e., the analysis dataset), leaving 391 records (417-26=391) for hypothesis testing.

Descriptive and demographic characteristics.

The information reported in One-Colorado (2014) described the survey respondents (N=417) by many characteristics, some of which were compared with all Coloradoans. The convenience sampling of this hidden group of persons made it impossible to determine the representativeness of the respondents to transgender persons in general, and thus external validity cannot be assumed to exist. The summary of selected characteristics (Table D5) highlights certain disparities of transgender persons relative to all Coloradoans such as higher prevalence of suicidal ideation and attempts in the presence of relative poverty, underemployment, and greater educational achievement. The general health of the transgender respondents compared to all Coloradoans was generally similar. In addition to the comparative data, other noncomparative demographic characteristics of the dataset are also given in Table D5. Table D6 gives further information on the dataset. In this table, strata of Race, Ethnicity, Gender-ID, and Age-Group are compared for suicidal ideation and health status (as measured by a composite measure of the Healthy Days construct). Suicidal ideation was significantly more common in the non-White respondents, and among the younger and middle-age respondents. However, their self-reported health status was relatively homogeneous; the

mean Health-Days score was statistically comparable in all race, ethnicity, gender, and age groups.

Index Construction (Phase 2)

The purpose of Phase 2 was to construct composite variables for use in the quasi-experimental analyses used to test the hypotheses (conducted in Phase 3). The primary variables (i.e., scale-level constructs used in the analyses) were PSY, SI, and SMC, and were operationally termed the ***dependent*** variables. The scale-level variables that modeled the other four important constructs (Access, Disease, Behavior, and Transition) and the scale-level demographic variable Age-Group were the ***covariates***. These eight scale-level variables were termed the ***study*** variables. Two other nominal demographic variables (Race and Gender-ID) were the ***control*** variables. Hypothesis testing was done with these eight variables and the analysis dataset (N=391). Although the control variables (Race and Gender-ID) were used to stratify some analyses, they were excluded from regression-based analyses due to lack of significance, possibly due to homogeneity in the Race data (86% White) and low-frequency categories in Gender-ID.

Most index construction was done by assumption-free summation with equal and nonequal/proportional weighting of dichotomous categorical variables. The scale-level variables created by this method mitigated concerns that arose from noninterval data constraints regarding factor analysis and SEM. For appropriate data, factor analysis was the preferred method for index construction over categorical principal components analysis (SPSS CATPCA) since the principal axis extraction (PAF) and oblimin rotation that were available in FACTOR (and not in CATPCA) were more suitable to highly

correlated datasets. The PAF with oblimin technique was relatively free of the assumption of covariate independence, thus it represented a truer of picture of a dataset that was inter-correlated (Thompson, 2004).

As Thompson (2004) points out, there are many ways to summarize the factor matrix. Each of the factor matrices (i.e., the Pattern, Structure, and Factor Score Coefficient matrices) were examined (when available), and were all congruent with respect to the number of factors and the relative weights of the components, though the factor-specific values varied. This was expected since these matrices represent different statistical perspectives: The Pattern matrix reflects regression and the Structure matrix reflects correlation (Thompson, 2014, p.16-18). The factor score coefficient matrix was chosen for the weighting algorithms since it could be calculated with only one factor. To construct a score for a record in the dataset, the factor score coefficient for each component variable and each factor was multiplied by the value of the variable then summed to create the per-record score.

Psychological Distress (PSY).

This variable synthesized currently-experienced psychological symptoms and comprised 18 survey items that were related to self-reported psychological states. Lower values indicated a greater level of psychological distress, and higher values indicated greater psychological health, as measured by the components. These components represented psychiatric history (two variables), the Healthy Days construct (five variables), eight variables representing the eight components of the Patient Health Questionnaire-8 (PHQ-8) scale (Kroenke, 2001), an activity measure conceptually related

to the PHQ-8 (one variable), and suicidality (three variables). For these measures, Cronbach's alpha (standardized) = .918. Because the data types were dichotomous, ordinal, and continuous, the scales were varied; and due to the number of dichotomous fields, factor analysis was not appropriate for the construction of this composite variable. Therefore, to balance the various scale differences in the algorithm for PSY, each nondichotomous variable was computed as the percentage of a perfect score. For example, for the analysis dataset, the survey item General-Health, an ordinal 0-4 measure, was divided by 4 so that the maximum score (4 out of possible 4) would be 1. Due to the diversity of data in this construct, there were three denominators (4, 14, and 30) for variables in this measure, so each variable was standardized on a 0-1 scale, and then summed for a possible equal-weighted maximum of 18.

To assess how factor analysis would respond to mixed data types, the 18 component items were subjected to factor analysis (SPSS FACTOR, PAF extraction, Oblimin rotation) and the resulting variable was termed PSYF. The results of this analysis are in Table D10 and in Table D11. Even though PSYF was not used in hypothesis testing, PSYF was analytically comparable to PSY, as seen in the bivariate adjusted R^2 found in Table D11. This result indicated that the two variables were correlated. The conclusion from this analysis was that the use of dichotomous data probably would not have greatly distorted factor analysis. The results presented in Table D11 also suggested that the factor analysis version may have been more predictive than the summed version. Nevertheless, the PSYF variable was not used in hypothesis testing.

Social Isolation (SI).

Social isolation was operationalized as the combination of interpersonal involvement (one ordinal variable), socioeconomic markers (three ordinal variables), and a measure of exercise (one dichotomous variable). Since these concepts reflected how a person interacts with society, the absence of these interactions operationally constituted a form of social isolation. Low scores indicated evidence of social isolation and higher scores reflect greater social interaction. For this construct, Cronbach's alpha (standardized) = .518. Factor analysis (SPSS FACTOR, PAF extraction, Oblimin rotation) was used to specify this latent variable, even though one of the components was a dichotomous variable. The results of the factor analysis for SI are given in Table D12 (KMO = .619, 56% of variance explained by the two factors, correlation matrix determinant = .696); there was no summed-variable comparison for this variable. Noteworthy observations in Table D12 are the predominant influences of income and activity (Exercise-Any), and the weak effect of the relationship variable Marital (a small negative impact on Exercise-Any).

The theoretical importance of relationship (Zavaleta et al., 2014) relative to the other influences measured in this dataset could not be verified, since other relationship information was also benign. In addition to the seven multiple-response relationship items Marital_A to Marital_F (which were restructured into the Marital variable), the other variables in the dataset that most directly captured social relationships were Number-Adult and Number-Child. However, Number-Adult and Number-Child proved insignificant in exploratory factor analyses and were excluded.

Supportive Medical Care (SMC).

Due to concerns about the validity of factor analysis with two ordinal variables and two dichotomous variables, weighted summation was used to create the SMC variable used in hypothesis testing. A bimodal distribution resulted, which required algebraic weighting to minimize kurtosis and skew. Larger values represented more perceived support from the medical care system. For this construct, Cronbach's alpha (standardized) = .784, which was between the values derived for the SI and PSY variables. To determine if a factor analysis version of this construct would be more appropriate (despite concerns about the use of dichotomous data), a version of the SMC construct was built with factor analysis for comparison. Tables D13 and D14 show these results. The factor score coefficient matrix (for the one factor identified) is shown in Table D13 (KMO = .683, 63% variance explained, correlation matrix determinant = .142). Each of the four variables was a self-reported indicator of the degree of inclusion experienced by the respondent. The ordinal field for the negative reasons for the perceptions of inclusion exerted a greater influence than the perceptions of positive care, but these paled against the influence of the dichotomous self-reported indicator of inclusiveness (Care-Inclusive). Self-reported perceptions of care delayed due to discrimination (Delay-A) exerted the least influence. The comparison of the SMC and the factor analysis version (SMCF) is depicted in Table D14. In this table, neither of the two variations of SMC was predictive of SI; the summed variable (SMC), free of data type concerns, was used for hypothesis testing.

Assumptions.

The study variables' suitability for regression-based hypothesis testing (i.e., using SPSS REGRESSION and GLM) was assessed according to the general guidelines presented in Table C5. In Table D7, descriptive statistics for the eight scale-level study variables are presented. A measure is presented, k/se (kurtosis divided by its standard error), that gives a z-value for kurtosis deviations (Byrne, 2016, p. 122). In Byrne's estimation, if this value was < 7 (or possibly as high as 9) the data were adequate with respect to normality for SEM, one of the planned analyses in this study. The outlier in the table was the covariate variable Behavior. Even though K-S tests (SPSS EXAMINE) were all significant (indicating significant deviation from normality), the lack of agreement between the two assessments (k/se and K-S) allowed the assumption of reasonable normality to be accepted.

Linearity of residuals was seen graphically (SPSS REGRESSION), indicating the linearity and residual normality assumptions were reasonably upheld. Regression-based assessments of error independence (the Durbin-Watson statistic) and multicollinearity (VIF) are given in Table D8. Regarding these two assumptions, the eight scale-level study variables were adequate as the Durbin-Watson statistic was between 1 and 3 (Field, 2013, p. 337) and VIF < 10 (Field, 2013, p. 325). The Durbin-Watson conclusion of error independence, however, was challenged by the SEM results, described below, which suggested *lack* of error independence.

Heterogeneity of variances was expected given the convenience sampling and the level of correlation in the data. As the information in Table D6 showed, Levene's test was significant in some analyses comparing the means of self-reported suicidal thought

and self-reported health status stratified by Gender-ID (nominal) and Age-Group (ordinal). Levene's was significant for Gender-ID and for Age-Group with respect to suicidal thought and self-reported health status, while the Levene's for Race was only significant for suicidal thought. The results presented in Table D9 showed that heterogeneity of variance was found for two of the three dependent variables with respect to Gender-ID and Age-Group. The variable PSY was the least affected since the variances of this variable across Age-Group and Gender-ID were statistically equal. Thus, the heterogeneity of variance that was seen in some analyses was not uniform. Based on the results of assumption testing, the variables largely met the normality, linearity, error independence, nonmulticollinearity, and homoscedasticity criteria for regression.

Reliability.

Cronbach's alpha (standardized) was measured for the seven multi-component scale variables (PSY, SI, SMC, Access, Behavior, Disease, and Transition), and the results are presented in Table D15. Between the three dependent variables, alpha for SI was the lowest at .518, indicating a large degree of random error (Kline, 2011, p. 69). PSY was the highest at .918, indicating either relatively low random error or the effect of the number (18) of components (Field, 2013, p. 709). Cronbach's alpha for the covariates ranged from .576 to .778, and indicated low to moderate reliability.

Preparation.

To prepare for hypothesis testing, the eight scale-level study variables were normalized, to minimize covariance due to scale differences, which could have biased

some analyses. Numerically, using normalized or nonnormalized variables made no difference in the interpretation of regression results, and, when normalized, covariances equaled correlations.

Since the research question identified the importance of interdependent relationships, two analytic models were formed that guided the hypothesis testing and supplemental analyses. Even though the three primary variables (PSY, SI, and SMC) were termed *dependent* variables, a covariate role in any analysis could also have been conceptualized for any of them. Assigning a covariate role to a dependent variable helped to identify the interacting effects of one dependent variable and another. This model was Model 1; analyses that used this model had a dependent variable (an outcome) and seven covariates (predictors): The five scale-level variables Access, Age-Group, Behavior, Disease, and Transition plus the other two dependent variables. In addition to Model 1, a different analytic model was formed to be more SEM-compatible. This model, Model 2, kept the number of covariates fixed at the five scale-level covariates. In Model 2, when one of the dependent variables was the outcome, the other dependent variables were *not* assigned as covariates.

The nominal control variables Gender-ID and Race were not included in the regression analyses, since they failed to contribute significantly to any of the three dependent variable models and thus were excluded. Also, SEM would have been invalid with nominal (though numeric) data.

Results (Phase 3)

The research question of this study was: What were the relationships between SI, PSY, and SMC in transgender Coloradoans? Therefore, the null hypothesis (H0) was: There was no relationship between SI, PSY, and SMC in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

Each of the three 2-way interactions between the dependent variables was addressed by an alternate hypothesis. Rejection of any of the alternate hypotheses constituted an acceptance of the null hypothesis. The summary of hypothesis testing is presented in Table D16. The hypotheses were tested primarily by multiple linear regression (SPSS REGRESSION, forced entry method). Multivariate analysis of variance (GLM) was used to triangulate the regression results, as was bivariate correlation (CORRELATIONS) and partial correlation (PARTIAL CORR). The SPSS procedure HETCOR (heterogeneous correlation) was used for calculations involving the nominal variables. GLM was chosen instead of SPSS MANOVA since it was reportedly more flexible in handling assumption violations than the SPSS MANOVA procedure (IBM, 2012). For GLM, Pillai's Trace (a test of model adequacy) was reported as a measure of effect since it was relatively impervious to violations of normality (Field, 2013, p. 644).

Was the PSY - SI association positive?

H1a: A positive association existed between PSY and SI in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

This alternative was accepted. In a regression of the outcome PSY in which SI was a covariate (presented in Table D8), the standardized coefficient for SI, .269, was

significant, t = 6.090, $p < .001$; SI had the second strongest effect in this regression. Acceptance was also supported by the other methods. Thus, in the whole cohort, social integration and psychological health were positively related; as social integration increased so did psychological health. However, as the information in Table D19 showed, this relationship was not uniformly significant across the strata of Gender-ID. The PSY-SI relationship was found in the two largest groups (53% of respondents), but not in the others. The interaction of Transgender Males and Transgender Females with the PSY-SI relationship was also found in the information presented in Table D18. In that table, Gender-ID was further stratified by Race: The positive Transgender Male and Transgender Female correlation with the PSY-SI relationship was only found in the White respondents. The PSY-SI relationship was also identified by second-order factor analysis (Table D27). This analysis placed PSY and SI as the two dominant components of Factor 1, with PSY the stronger. In general, analyses involving PSY as an outcome produced the greatest Adjusted R^2, as seen in Table D23, which possibly reflected the relatively high Cronbach's value, $\alpha = .918$, (Table D15). The PSY variable also displayed the best variance homogeneity (Table D9).

Was the SMC-PSY association positive?

H1b: A positive association existed between SMC and PSY in the cohort of transgender Coloradoans who participated in the One-Colorado survey.

This alternative was accepted. In a regression of the outcome SMC in which PSY was a covariate (presented in Table D8), the standardized coefficient for PSY, .171, was significant, t = 3.073, $p = .002$; PSY was the weakest influence in this regression. From

the information presented in Table D16, this conclusion was also supported by the other

methods, but the strength of the relationship (as seen by *p* values) differed. Thus,

supportive medical care and psychological health were also positively related; as

supportive medical care increased so did psychological health. However, this relationship

was not consistent across Gender-ID strata either (Table D19), although, in contrast to the

PSY-SI relationship above, positive SMC-PSY significance was found in the two smaller

groups (28% of the respondents). From the information in Table D18, it was observed

that the SMC-PSY relationship was significantly positive for two Gender-ID groups

(Transgender, Agender, No Gender, Other and Gender Queer/Gender Fluid), and

significantly negative for non-White Transgender Female respondents. Nevertheless,

SMC variances were homogeneous with respect to Gender-ID (Table D9), though not

with respect to Age-Group, which was not a significant covariate in that regression.

Was the SI-SMC association positive?

H1c: A positive association existed between SI and SMC in the cohort of

transgender Coloradoans who participated in the One-Colorado survey.

This alternative was rejected; therefore, the null hypothesis was accepted. From

the results in Table D16, the SI-SMC relationship was nonsignificant; and, it was

negative. The SI-SMC relationship presented the most ambiguity in the Table D16 data,

since the relationship was positive and significant by GLM, and by the bivariate

correlation also (Table D17). This ambiguity was reflected in the lowest Adjusted R^2 for

the SI regression (Table D23) and the lowest Cronbach's (Table D15). SI was relatively

uninfluenced by the other covariates, except Access (Table D19). From the information

presented in Table D19 it was observed that for two Gender-ID groups, SI had no

significant covariates, even though it was strongly aligned with PSY, as seen in the

second-order factor analysis (Table D27). Also, no Gender-ID or Race group exerted a

significant influence on the SI-SMC relationship (Table D18) although variance

heterogeneity was found with respect to Gender-ID and Age-Group (Table D9).

Therefore, supportive medical care and social integration are not associated in the cohort

of transgender Coloradoans who participated in the One-Colorado survey.

The three concepts identified in the research question were operationalized in

positive terms so that higher values of PSY reflected less psychological distress (a better

condition), higher values of SI less social isolation, and higher values of SMC reflected

greater perception of supportive medical care. Two of the relationships were positive; one

was ambiguous. Thus, the null hypothesis was accepted.

Supplemental Analyses (Phase 4)

Each of alternative hypotheses presented some ambiguity in the results, possibly

due to strong influences from sub-populations or covariates, or both. The goal of Phase 4

was to explore the differential effects of mediating or moderating covariates on the study

variables. This was done in three ways: 1) through a systematic evaluation of the

moderating/mediating effects of the covariates, 2) through a SEM model of the study

variables, and, 3) through a second-order factor analysis to identify the remaining latent

sources of variation. To establish an accurate baseline from which to compare the

covariates, three regressions were performed with each dependent variable as an

outcome, and the five scale-level covariates as the predictors. These analyses used the

normalized study variables in the analysis dataset (N=391), and the results are presented in Table D20. This was the Model 2 format described earlier, and, to refresh, it was different from the other covariate model (Model 1) that was used in hypothesis testing (presented in Table D8).

To see the effect of the dependent variables as covariates, the information in Table D20 can be compared to that in Table D8. Table D8 presented the results of three regressions using the Model 1 format (a dependent variable and seven covariates), and a slightly different picture emerged from the Model 2 regressions than that seen with the Model 1 regressions. While all the Adjusted R^2 values decreased, the predictor Standardized Beta values uniformly increased in the results presented in Table D20, as expected due to the absence of powerful dependent variable effects on the covariates. While the magnitudes of the covariate influences changed, the directions or relative ranks of the covariates in the regressions did not. The PSY and SMC regression models remained relatively stable (similar R^2 and the same significant covariates with the comparable weights). However, the SI relationship changed the most of the three. Without the effect of PSY found in the data presented in Table D8, the information in Table D20 showed that Age-Group and Disease emerged as significant covariates (in addition to Access). The effect size (Adj. R^2) decreased by 27%, from .256 to .188, the largest reduction of the three Model 2 regressions. However, while the regressions could isolate significant predictors, a more appropriate tool for exploring moderation/mediation analyses was the SPSS add-in procedure PROCESS (Hayes, 2013).

Moderation/mediation.

Moderation is a process in which a predictor-covariate interaction alters the predictor's effect (size and/or direction) on the outcome (Field, 2013, p. 395). Mediation is a change in the relationship (magnitude or direction) of two variables by a third variable that is statistically related to each of the other two variables (p. 879). As Field (2013) noted, it was controversial as to whether the direction of the mediation effect was important; Field allowed that the direction of effect was not as relevant as the significance of the effect. In this dataset, moderation and mediation occurred in two relationships. The moderated relationships are presented in Table D21 and the mediated relationships are shown in Table D22. From these analyses, Access was an unambiguous moderator/mediator for the SMC (outcome) and PSY (predictor) relationship, since significant interactions were seen in PROCESS and in regression analyses (Table D8). However, the role of Disease was less clear-cut for the PSY-SI relationship, since it showed a significant relationship with PSY and SI in PROCESS but did not show a significant relationship with SI in regression (Table D8). The moderating role of Transition in the SI-PSY relationship was also ambiguous; while Transition had a significant interaction with PSY in the PROCESS analysis, it was not a significant predictor of either SI or PSY in the regression analysis shown in Table D8.

In the information found in Table D22, the mediation effect was strongest for the PSY (outcome) relationships. Hayes (2013, p. 430) offered caution in interpreting the Sobel test, so the bootstrapped standard error and 95% confidence intervals are also reported. The Total Indirect Effect was divided by the standard error (TIE/SE) to give a normal-theory z-score. This z-score was > 3 for each scenario; it was largest for PSY-SI

and PSY-SMC. This table also revealed that the greatest interrelatedness was in the PSY

(outcome) and SI (predictor) relationship, which corroborates the acceptance of the H1a

hypothesis.

SEM.

To more fully account for the sources of variation among the study variables, and

to validate and triangulate the regression analyses, SEM (SPSS AMOS) was used. While

the regression analyses identified the relationships of the covariates to the dependent

variables, SEM added additional information regarding the interactions between the

covariates. Since SEM may be invalid for nominal or dichotomous variables, Race and

Gender-ID were not included in these analyses.

Covariate-dependent regression weights from AMOS were equal to those

produced by regression and GLM, as seen by comparing the information found in Table

D25 to that of Table D20 (the Model 2 covariate format was also used in the SEM

analyses). However, the R^2 (effect size) differed between regression/GLM and SEM, as

seen in Table D23. Regression (using the forced entry method) and GLM produced the

same R^2 for the PSY and the SMC outcomes; AMOS produced a higher R^2 for the SI and

SMC outcomes.

The SEM analysis is depicted in Figure E1. To accompany Figure E1, all the

covariances computed by AMOS are given in Table D24, and Table D25 gives the

covariate-dependent correlation estimates. The critical ratio was the normal-theory

measure of effect for this analysis and was computed from the correlation estimate

divided by its standard error (in an analysis of normalized variables, covariance equals correlation). Three latent variables (error terms) were included in the model.

The error terms (ePSY, eSI, and eSMC) represented the unexplained variance in the Model 2. Even though regression analysis of the three dependent variables showed (in Table D20) adequate error independence as measured by Durbin-Watson (i.e., between 1 and 3), the AMOS SEM model (Table D24) identified two significant error correlations: ePSY – eSI (CR = 6.441, $p < .001$) and ePSY – eSMC (CR = 3.147, $p = .002$). This challenged the Durbin-Watson conclusion of error independence that was indicated by the data in Table D20. The significant error terms could not be explained by differences in the number of covariates, as both regression and the SEM analyses used Model 2 (dependent variable and five covariates).

The covariate relationships derived from the SEM analyses supplement the moderation/mediation analyses and the regressions. Since AMOS reports bivariate correlations between the covariates, the data in Table D24 mimics that of Table D17. In the regression reported in Table D20, one significant negative covariate-dependent was found: With PSY as an outcome, Behavior had a negative impact (std. beta = -.233, $p < .001$). Since Behavior was coded negatively (a larger value represented less-healthy behavior) this result was expected. However, SEM demonstrated (Table D24 and Figure E1) that other significant negative relationships existed between the covariates, results that are also found in the bivariate correlations presented in Table D17. In the data presented in Table D24, the strongest of these significant negative covariate correlations was between Disease and Age-Group (AMOS estimate of the correlation = -.347, $p <$

.001). Even though the Age-Group and Disease relationship was negative (Table D24),

in the PSY and SI regressions (Table D20), they both exerted significantly positive

effects on the dependent variable, which was also shown in the data depicted in Table

D25. From the data found in Table D25, both the Age-Group and Disease interaction

was nonsignificantly negative in the SMC regression. Disease was also negatively related

to Transition (estimate = -.122, p = .017) in the data depicted in Table D24. The

ambiguous role of Transition was partially clarified by the SEM analysis presented in

Table D25, since the Transition-SI relationship was observed to be close to significance

(p = .065), which may partially explain how PROCESS may have arrived at its

significant result.

The adequacy of the SEM model was assessed by several measures, reported in

Table D26. The AMOS reference model (Independence) represented complete lack of

correlation, and the null hypothesis was that there was no difference from the current data

and a fully uncorrelated version. Since the original dataset was known to be bivariate

collinear, it was expected that the measures of fit would indicate the same condition. For

the CMIN/DF ratio, Arbuckle (2012) suggested that values of < 5 indicate that a model

was reasonably adequate. The value reported was > 18, indicating a large deviation from

independence. RMSEA (root mean square error of approximation), is a variant of the

chi-square statistic; Byrne (2016, p. 98) has suggested that values of RMSEA > .10

indicate poor fit. The poor fit of the data to a fully independent (uncorrelated) model

shown by the AMOS analyses was consistent with the R^2 values observed earlier, in that

a large amount of unexplained variance existed in this correlated dataset. Poor fit was

also indicated by the relatively large error-dependent correlations seen in Figure E1 and Table D25.

The low degree of multicollinearity of the study variables (as assessed by the VIF) was less than what may have been expected, given the high degree of bivariate collinearity found between the survey items. Since the VIFs of variables known to be correlated were presented in Tables D11 and D14, it was possible to observe the degree to which VIF reflected collinearity. The VIF of the summed and factor analysis variables (PSY and PSYF) showed a VIF of 7.866 for these two highly correlated variables (Table D11); similarly, the VIF for SMC and SMCF (two variables also correlated) was 4.040 (Table D14). Both VIFs were below the criterion for multicollinearity (Field, 2013, p. 325). The VIF for the regression of the three dependent variables did not exceed 1.271 for any significant covariate (Table D20), a value numerically far from that of variables with a high degree of collinearity. Therefore, despite bivariate collinearity, multicollinearity was not strongly found in the dataset.

Second-Order FA.

As the last step in resolving ambiguity in interpreting the hypothesis testing results, a second-order factor analysis was conducted on the eight study variables (principal axis extraction; oblimin rotation; KMO = .698; Bartlett's test, $p < .001$). These eight study variables had synthesized 57 distinct but correlated component variables, and reliability, regression, and SEM analyses indicated a large amount of unexplained variation. Second-order factor analysis presented a different view of the intra-variable

relationships, which generally corroborated the hypothesis testing and the SEM analysis (Table D27).

In the first-order analyses, six component variables (Suicide-Attempt, AD-Anxiety, Physical-Health, Income, and Care-Inclusive) exerted a dominant influence with factor coefficients (loadings) > .5, as seen in Tables D10, D12 and D13. The .5 criterion was used in this study and was more conservative than the .4 criterion suggested in Field (2013, p. 682). The second-order factor analysis identified three factors represented (conceptually) as the latent variables that accounted for the 68.5% (at least) potentially explainable variance, based on the highest AMOS R^2, .325, in Table D23.

These three factors do not correspond to the three dependent-specific latent error variables in the SEM analyses, although the strong connection between PSY and SI seen in Factor 1 may have also been reflected in the significant error correlation (ePSY - eSI) seen in Figure E1, and in the Model 1 regressions presented in Table D8. The results of Table D27 confirmed the PSY-SI axis seen in the regressions, and showed a more distributed influence (relative to PSY) in the effects of Access, Behavior, and Transition (which was shared by Factor 2). Factor 2 included Age-Group and Disease, in addition to Transition. In Factor 2, Age-Group and Disease opposed each other, consistent with SEM (Table D24) and bivariate correlations (Table D17). SMC was the only element in Factor 3, an isolating effect not reflected in the regressions or in SEM. In Factor 3, Transition exerted a small effect, almost identical in magnitude to its effect on the other two study variables, yet opposite in sign. The weakness of this effect was not seen in the SEM analysis. In comparing the data presented in Table D27 to that of Table D20, it was

observed that Factor 2, representing an Age-Group and Disease interaction, also was found in the regressions for PSY and SI, which were the key influences in Factor 1. Transition, a weak component of Factor 2, was not a significant predictor of PSY or SI (for which it was a moderator [Table D21]), and did not align strongly with SMC in Factor 3, even though regression had identified Transition as a significant predictor (Figure E1) for SMC.

Summary

The research question of this study was to identify and quantify relationships between three theoretically-related constructs (or constructs) present in this dataset. To accomplish this, the dataset (with a high rate of respondent completion) was transformed through recoding and restructuring so that each of the three essential constructs of the research question was modeled by a continuous variable. In addition to these, the study variables included five other scale-level composite covariates and two nominal control variables. The indices were created by the summation of categorical data or standardized continuous data, or by factor analysis. Regression-based methods were used to evaluate the hypotheses. Certain analyses were conducted by stratifying the dataset by one or both nominal control variables.

The null hypothesis of this study was that there were no statistically significant relations among all the dependent variables. This hypothesis was accepted since there were durable relationships between two of the three dependent variables, but an ambiguous relationship in the third. The three alternate hypotheses focused on pair-wise relationships between the three dependent study variables: Two of the alternate

hypotheses were accepted. It was shown that the dataset was not multicollinear despite

bivariate collinearity. Two analytic models were formulated during the study, and the

differential effect of Gender-ID and Race was shown descriptively (with Age-Group) and

by stratification. Significant differences in suicidal thought by Race and Age-Group

were also shown. It was also shown that the PSY and SI (PSY-SI) interaction was

dominant and that all three relationships were moderated or mediated by one or more

covariates, especially Access.

The original dataset represented a unique window into the health status of a group

of hidden persons. The results reported here offer some insights and suggest many

questions. These will be examined in greater detail in Chapter 5.

Chapter 5: Results

Introduction

Transgender persons have consistently reported negative perceptions of the healthcare they receive (Grant et al., 2011; James et al., 2016; One-Colorado, 2014). These perceptions, to the extent that they reflect gender-based discrimination, may contribute to psychological distress (including suicidal thoughts or actions) and social isolation; these deleterious effects would be predicted by the MST (Meyer, 2003a). The purpose of this study was to assess how psychological distress, social isolation, and supportive medical care interacted in a cohort of transgender Coloradoans who participated in an anonymous survey in 2014.

By formulating the research question in terms of the two-way interactions between these three constructs, quasi-experimental methods (including regression and SEM) were used in secondary analyses of this survey dataset. Since the survey dataset comprised dichotomous, ordinal, and interval-level items, the survey items were first transformed into study and control variables with which hypotheses could be tested. Even though the cross-sectional nature of the dataset precluded the identification of cause-effect relationships, the basic features of a model based on the MST could be assessed. Since social isolation was not directly measurable in this dataset, socioeconomic and interpersonal characteristics formed a proxy measure. The analyses were then conducted from several statistical perspectives that involved bivariate and multivariate methods, and ultimately, SEM. In models emanating from MST, measurement can be problematic and potentially obfuscating, so triangulating methods

were used in the supplemental analyses to obtain as much clarity as possible in the findings.

Several durable relationships emerged, but, since one of the two-way relationships was insignificant, the null hypothesis could not be rejected. While psychological health was found to be positively related to diminished SI (or increased social integration) and to SMC, SMC and SI were not significantly associated. Further, the relationships between the three study variables were moderated and mediated by the covariates in varied ways as a function of gender identity.

In this chapter, findings are interpreted against the predictions of the MST and the existing literature on the health and healthcare of transgender persons. The limitations of this study are discussed and measurement issues are presented. Recommendations are offered for community-level social change and for change at the level of the individual healthcare provider.

Interpretation of Findings

This study sought to uncover relationships between psychological distress, social isolation, and supportive medical care by studying the survey responses of transgender Coloradoans. It is plausible that the survey responses from any given person do not represent a single consistent point-of-view, but may reflect varied thoughts and beliefs, which may explain some counter-intuitive or contradictory findings.

The key findings that emerged from this study were:

Psychological health, as measured by the variable PSY, and social integration, as measured by SI, were positively related. Using this study's nomenclature, higher SI

values (which reflected less social isolation) were associated with higher PSY values (representing less psychological distress). This finding resulted in the acceptance of alternate hypothesis H1a.

Supportive medical care, as measured by SMC, and psychological health (the PSY variable) were positively related. As SMC was measured to reflect a more beneficial condition, higher values of SMC reflected more supportive medical care. This finding resulted in the acceptance of alternate hypothesis H1b.

Social integration (measured by SI) and SMC were not associated, necessitating the rejection of alternate hypothesis H1c. With this rejection, the null hypothesis was therefore accepted. The SI-SMC relationship was nonsignificant and negative, and statistically ambiguous.

These three findings arose in a milieu of other statistical influences. Each of the main findings was accompanied by some ambiguity, possibly due to strong influences from subpopulations or covariates, or both. Also, each of the three dependent variables was affected by at least one dominant statistical influence. In this section, each of the three dependent variables are discussed individually. Then, the important covariates are discussed.

Psychological Distress

PSY was the strongest construct in this survey, significant in both its two-way interactions and homogeneity in variance across gender and age. PSY was measured so that higher values represented increased psychological health. Psychological health was significantly and positively associated with social integration (i.e. high values of the SI

variable) and SMC, although the strongest regression-based association was with the

absence of physical disease (high values of the Disease variable), a finding which

underscored the importance for transgender persons to obtain appropriate medical as well

as psychological care (Bauer, Scheim et al., 2015; Huot et al., 2013; Xavier et al., 2013).

For the PSY variable, there were three dominant statistical influences in the 18

items from which this variable was formed: Suicide-Attempt, AD-Anxiety, and Physical-

Health. These items each anchored three of the four distinct groups identified by factor

analysis. The factor analysis revealed several unexpected characteristics of the PSY

construct. First, the strongest item in the PSY measure was whether the respondent had

attempted suicide. In this analysis, the statistical weight of an attempt was approximately

10 times stronger compared to suicidal ideation (Table D10). The strength of a suicide

attempt relative to ideation as a determinant of current psychological distress is consistent

with Mustanski and Liu (2013) who found that a suicide attempt predicted ongoing

psychological distress, as shown by a 10-fold increase in the likelihood of a subsequent

attempt with 1 year.

The second strongest item in the PSY factor analysis was the transformed AD-

Anxiety (history of anxiety) item; greater psychological health was associated with the

absence of a history of anxiety. A history of anxiety outweighed the history of

depression by 2.5 times. This finding was unanticipated, and it may reflect one or more

processes: A desire to avoid acknowledging depression, the coexistence or similarity of

these two concepts in the respondents, or a real conceptual distinction. Since depression

itself is a source of social stigma (see Nuttbrock et al., 2014), it is plausible that a desire

to avoid acknowledging depression may have existed. Also, anxiety and depression may be largely synonymous, comorbid, or undifferentiated in many respondents; the history of anxiety clustered with the history of depression as a separate factor distinct from the measures of current psychological distress. Depression is the more common focus of studies of psychological distress in transgender persons (see Blosnich et al., 2013; Jia et al., 2015), and the finding that the history of anxiety may be a stronger predictor of psychological distress in some circumstances may alert providers to the importance of obtaining history of anxiety as well as history of depression.

The third dominant influence in the PSY measure was the transformed Healthy Days physical health assessment (the number of days in the last month when physical health was good). In concert with other findings reported in this study, it was shown that transgender persons are not inherently less healthy than other relatively youthful Coloradoans, despite greater poverty and unemployment, and membership in a stigmatized community. This finding was also consistent with the regression finding that less reported disease (i.e., high values of the Disease variable) are likewise associated with psychological health.

In the factor analysis of PSY, the physical health measure outweighed the simpler assessment of health status (General-Health) and clustered with other two measures of impairment. It was unanticipated that the verbatim survey items that comprise the PHQ-8 and the Healthy Days measures did not cluster together. These two measures are well-validated and commonly used in the epidemiological analysis of BRFSS datasets. In this study, these measures were deconstructed and their individual items stood alone; the

failure of these items to coalesce does not cast doubt on the PHQ-8 or Healthy Days constructs as much as it shows the value of seeing these items as valuable measures of distinct aspects of psychological health.

Social Isolation/Integration

In this study, social integration (high values of the SI variable) and psychological health (high values of PSY) are closely related. Even so, SI was the weakest measurement (as measured by Cronbach's alpha), and was relatively uninfluenced by other covariates. An ambiguous moderating role of Transition in the SI-PSY relationship was also found. This may be a statistical aberration; while Transition had a significant interaction with PSY in the moderation analysis, it was not a significant predictor of either SI or PSY in the regression analysis. The dominant influence in SI was Income, and the second strongest influence was Exercise-Any. The other items that comprised SI (education, employment, and marital/relationship status) were weak influences. The importance of physical activity may be consistent with the relative youth and general health of the respondents, and the strong influence of income occurs in a group characterized by relative poverty.

The beneficial effect of income has been reported elsewhere (Barr et al., 2016), and the poverty of the group may have intensified the importance of income to psychological health, perhaps indicating a palliative effect consistent with other research (Bariola et al., 2015; Budge, Adelson et al., 2013). An unexpected and counter-intuitive finding in this dataset was the nonsignificance of the measures of peer relationships (as proxies for support), contrary to the results of other research. For example, Budge,

Adelson et al. (2013) found that measures of support *and* income were beneficial; in this study, only income was a significant contributor.

The items in the dataset that most directly captured social relationships were two items that characterized living arrangements (Number-Adult and Number-Child) and the multiple response items Marital_A to Marital_F. Number-Adult and Number-Child proved insignificant in exploratory factor analyses and were excluded. The relationship information in the multiple-response items was transformed into the ordinal variable Marital, but the Marital variable ultimately exerted a small impact roughly equivalent to that of employment. Even without information regarding the quality and duration of interpersonal relationships, the interpretation of these findings was that the mere number of persons in a household may not reflect the quality of the relationships. Other research has emphasized the quality of relationships as a key element of the beneficial effect (Kazan, Calear, & Batterham, 2016). Plausibly, the weak role for living arrangements and relationship status could reflect a tendency to form communities without structured relationships. Nevertheless, the importance of relationship relative to the other influences measured in this dataset could not be verified.

Supportive Medical Care

The dominant influence in SMC was the dichotomous self-reported indicator of inclusiveness (Care-Inclusive); other components of this variable were a dichotomous indicator of whether the respondent had ever experienced delays in obtaining care due to discrimination, the reasons for determining that care had been inclusive, and the reasons for determining that care had not been inclusive. Even though the lack of relationship of

this variable to social integration was unexpected, there were three interesting aspects to SMC. First, the reasons given for noninclusive care had a stronger effect than the reasons for given for inclusive care. This may have reflected more persistent or intense effects of bad experiences in relation to good experiences. Second, the perception of care delayed due to discrimination exerted the least influence on SMC, despite the 39% (overall) of respondents who indicated a lack of supportive care (One-Colorado, 2014). Third, psychological health had the weakest regression-based effect on SMC. The strongest of the three predictors of SMC was the use of transition-related services; in the middle was the covariate Access, indicating use of relatively barrier-free routine medical care. While Access was a common predictor in all the regressions, SMC was the only dependent variable associated with Transition; as respondents used more transition services the perception of supportive care increased. An unexpected nonfinding was that having a personal physician did not influence the perception of supportive care. Other unexpected nonfindings were the lack of significance of insurance information and Age-Group. The absence of a relationship between Disease and SMC was also unexpected since other research has suggested that lack of supportive care may lead to lack of necessary treatments, which would reduce overall health (i.e., decrease the Disease value).

Covariates

Overall, the most important covariate or control influence was gender identity (Gender-ID), which was an important determinant of each of the PSY-SI-SMC relationships. The control variable Race, which was a less powerful force due to sample size constraints, is discussed with Gender-Id. Also, strong effects from the covariates

Access and Disease were found. The covariate Access was significantly found in each of the main dependent variable analyses, and in the each of covariate analyses. However, this effect was not uniformly distributed in the gender identity groups. Lesser effects from the covariates Age-Group, Behavior, and Transition are discussed in relation to specific circumstances.

Gender-Id and Race

Even though the survey was nominally intended for self-reported transgender persons, only 52% of the respondents identified as either transgender male or transgender female. This definitional diversity has been found in other studies (James et al., 2016) and represents a key aspect to the interpretation of this study. The transgender community is not homogeneous. There are fundamental differences between gender identity groups, which amplify the measurement difficulties of an amorphous, fluid, and hidden group of marginalized persons (Heckathorn, 1997; Schwartz & Meyer, 2010). In this study, gender identity created statistical heterogeneity (as represented by Levene's test) with respect to suicidal ideation and self-reported health status, even though rate differences were insignificant. The most striking gender-related differences were in the influences found between the dependent variable and covariate relationships. In this area, persons reporting their gender identity as Man or Woman had no significant associations between any of the dependent variables. For them, psychological distress, social isolation, and supportive medical care were wholly unrelated; and, in these two groups, there were no significant predictors for social isolation and psychological distress. The lowest average percentage of suicidal ideation was reported by Man group and the highest was reported

by the Woman group. These groups may represent persons who are feeling unable to identify or assimilate their gender identity, and those who identify as Woman (n=53) may represent a group hidden within a hidden population.

Differences as a function of Race were more difficult to assess due to the relative homogeneity of the group as White. Interpretable racial diversity was found in four groups: Transgender males, transgender females, gender queer/gender fluid, and the nonspecific transgender group (persons who identified as transgender, agender, no gender, or other). For most of the non-White respondents in these groups, their perceptions of the three dependent variable relationships were opposite (i.e., opposite in sign) and insignificant compared to those found in their White counterparts, which indicated the importance of racial differences within these respondents. For example, the clearest division was in transgender females. For the non-White respondents, the SMC-PSY relationship (which was alternate hypothesis H1b and shown to be significantly positive in the cohort) was significantly negative, indicating that greater psychological distress was associated with increased level of supportive care. This condition may also be reflected in the significantly increased level of suicidal ideation found among the non-White respondents. While this finding supports the harmful intersectional relationship of social stress and race inferred by MST (see Meyer, 2003a), Hoffman (2014) failed to support this link.

Access

The variable Access was a composite of five survey items, but was dominated by two: CheckUp and MedCost. The ordinal CheckUp item captured the length of time since

the last visit to a doctor for a routine visit; higher values indicated a more recent visit. In a factor analysis of the Access components (Table D28), CheckUp was the solitary component of one of the two factors identified. The other dominant variable, MedCost, was a dichotomous item defined as the inability to see a doctor because of cost; the higher value represented the absence of a cost constraint and grouped with weaker measures of service usage. Interestingly, insurance and personal physician information were insignificant contributors and were excluded; these may have been subordinated by the stronger influence of cost. Thus, the higher values of the variable Access reflected use of health services for routine care for which cost was not a barrier. This variable exerted the most widespread influence among the covariates; it was a mediator for all the two-way interactions of the dependent variables and was a moderator for the SMC (outcome) – PSY (predictor) relationship. The ubiquity of the Access relationships strengthened the importance of relatively barrier-free usage of supportive medical care in this cohort; the availability of health services is a significant component of psychological health, social integration, and the perception of supportive care.

The importance of Access also was affected by gender identity; for four of the six gender identity groups, Access was intertwined with SMC (i.e., the perception of support), but for the nonspecific transgender group and for gender queer/gender fluid group it was not. Interestingly, those two groups reported the highest average self-reported health scores, and even though the health scores of all the gender identity groups were not significantly different, there may have been less perceived need in those groups which led to less use of services. The significant contributions of Access to the

perceptions of supportive care were linked to the covariate Transition (use of transition-related interventions) in most gender groups, which could have indicated that the perception of supportive medical care increased as one began to use transition-related health services. This could be an encouraging sign that the use of transition-related services was associated with supportive medical care, consistent with guidelines which recommend that transition interventions be done in conjunction with medical evaluation (WPATH, 2011) and with the availability of informed providers (Coolhart, Baker, Farmer, Malaney, & Shipman, 2013).

A more ambiguous Transition picture was found for those who reported the gender identities Man and Woman. In the Man group, Transition and Behavior were negatively correlated; this might have been expected since higher values of the Behavior variable indicted greater use of potentially harmful behaviors. So, while the use of Transition services was beneficially related to less harmful behaviors, Transition was not associated with supportive care in this group. This group also reported the least suicidal ideation, so it is plausible that this group is relatively resilient. The lack of significant SMC and Transition associations in the Woman group was more concerning; with the highest percentage of suicidal ideation, the lack of transition usage in this group may represent a harmful form of avoidance coping, as avoidance coping can be associated with higher levels of anxiety and depression in transgender persons (Budge et al., 2014).

Disease

The covariate Disease was formed by items that indicated either the history or the current occurrence of hypertension, obesity, diabetes, arthritis, asthma, dental disease,

lung disease, and mobility impairments. Many of these conditions are known to be susceptible to the effects of stress (Koolhaas et al., 2011; Lovallo, 2011) and may be intersectional sources of social stress, as in the case of obesity (Peterson et al., 2016; Robins, McCain, & Elswick, 2012). Higher values of this variable reflected less reported disease. The dominant influence in this variable (Table D29) was the historical or current occurrence of asthma, which offset the beneficial absence of other conditions. In other words, health benefits due to absence of other diseases (such as high blood pressure, high cholesterol, and diabetes) were negated by the deleterious effects of asthma.

The covariate Disease was not associated with supportive medical care or the covariate Access, a possible reflection of the generally homogenous good health found in the survey respondents. Also, Disease was significantly negatively related to Transition in the SEM cohort-wide analyses, but this possibly aberrant effect did not appear in the gender-stratified analyses. Disease was negatively associated with Age-Group in four of the gender groups, and positively associated with psychological health in three of the gender groups.

The relative dearth of age effects may reflect the relative youth of the cohort, in which 71% of the respondents were less than 45 years of age, although age-induced heterogeneity was found with respect to suicidal ideation and health status. Age-related rates of suicidal ideation were also significantly different, with the youngest reporting the highest percentage (52%), a finding consistent with Bariola et al., (2015) who found diminished resilience to psychological distress in transgender youth. The next highest rate of suicidal ideation was found in the 35-44 age group, who also reported the lowest

average health status, even though the health status scores were not significantly different in the age groups. Nevertheless, for Transgender Females, less reported disease was a significant predictor of psychological health and social integration. Interestingly, in that group, older age was also a significant predictor of psychological health, possibly in contrast to the reported persistence of stress-induced psychological harm throughout the life course (Purcell et al., 2012; Zelle & Arms, 2015) and the intersectional stress due to age (Hatzenbuehler, Keyes, & Hasin, 2009).

Theoretical Interpretation

This study was undertaken within the framework of the MST, which asserts that discriminatory stress is a progenitor of psychological distress or other manifestations of psychological ill health. The preponderance of evidence supports the concept that stress, in a broad (though sometimes specific) sense, can influence psychological health in humans (Marin et al., 2011), but the measurement of societal stress and its effects is difficult and often ambiguous, which prompted Schwartz and Meyer (2010) to provocatively assess the etiologic relationship of social disadvantage and mental disorders. Gender-focused studies that use probability sampling to improve external validity are few; and may not include transgender persons or control groups. Most of the probability-based studies involve the BRFSS, which does not collect the level of detail found in the One-Colorado dataset even though One-Colorado is based on BRFSS items. Thus, the ability to rigorously support or refute other research must be gauged against these realities.

Supportive Medical Care and Access

Other aspects of the relationships between psychological distress, social isolation, and supportive medical care were clarified, especially when gender identity was considered. For example, it was shown in this study that even though social isolation was not related to supportive medical care in the overall cohort, it was related to access to medical care (Access) in three of six gender identity groups, and to psychological distress in two of the six gender identity groups. Further, supportive medical care was related to Access in five of the six gender identity groups, and to psychological distress in only two of the groups. This granularity has not been previously reported. These findings underscore the profound, and largely unreported, intra-group differences that derive from gender identity. There are important implications to this finding for policymakers and providers, who may see transgender persons as a homogeneous group with generally similar needs.

Even the role of discrimination may be ambiguous. In this study, while supportive medical care was significantly related to Access, which supported the avoidance of medical care due to discrimination reported by Bauer et al. (2014) and Grant et al. (2011), the self-reported occurrence of delay caused by discrimination was relatively weak in its relationship to SMC (Table D13). The respondents to this survey clearly regarded their care as overwhelmingly nonsupportive, as have other studies of the perceptions of transgender persons regarding their healthcare (Bauer et al., 2014; Bradford, Reisner, Honnold, & Xavier, 2013; Cruz, 2014; Grant et al., 2011; One-Colorado, 2014; Poteat et al., 2013). However, in this dataset, the relationship of delays in care to discrimination

was less certain. Interestingly, the significant association of Access to supportive care found in most gender identity groups was not found in the Man group, although this was probably related to low sample size.

Other researchers have explored the relationship of gender identity to access. White Hughto, Murchison et al. (2016) found healthcare avoidance, inability to obtain treatments, or barriers to care in Transgender Females (which could plausibly be thought to be deleterious). This conclusion could only be partially supported in this study, since access to medical care was not related to psychological distress in this group (Table D19). In other studies, the role of gender identity with respect to psychological problems has been investigated. Transgender Males or Genderqueer persons were found to have more suicidal ideation than Transgender Females in Grossman et al. (2016), which was not supported in this study (Table D6). Conversely, no difference in risk for psychological distress was found between Transgender Males and Transgender Females in Reisner, Vetters et al. (2015), a finding which was supported in this study (Table D6).

Studies of the general health of transgender persons have also yielded conflicting results. Transgender patients were found to have multiple physical, psychological, or wellness issues in White Hughto, Murchison et al. (2016), but in Conron et al. (2012), a BRFSS-based study, transgender persons were comparable in health measures to the general population. The One-Colorado study supported the Conron position (Table D6), but the respondents to the One-Colorado survey also reported greater suicidal ideation in the presence of comparable health status.

Psychological Distress

Differences in suicidal ideation by race were found in this study (Table D6), in partial contrast to Hoffman (2014), who reported no difference in depression in relation to race; admittedly, depression and suicidal ideation are not always synonymous. This study identified a significant increase in suicidal ideation in the younger respondents, a finding also reported by Bariola et al. (2015). This study also corroborated the well-documented finding that transgender persons have high-levels of education but lower levels of income (see Bariola et al., 2015; Barr et al., 2016; Budge, Adelson et al., 2013; Budge et al., 2014; Conron et al., 2012; Grant et al., 2011; Klein & Golub, 2016; One-Colorado, 2014; White Hughto, Murchison et al., 2016).

Social Isolation and Support

The role of social support and social isolation has been widely investigated, but as noted earlier, results have been ambiguous. The broad relationship of social isolation to psychological distress (see Yadegarfard et al., 2013) was supported in this study (Table D8), but Frost and Meyer (2012) also reported that the relationship of connectedness (a concept approximated by the SI variable in this study) to psychological well-being was inconsistent. This conclusion is also supported in this study since the SI-PSY relationship was inconsistent across gender identity (Table D19). Social isolation, despite measurement challenges, has been found to be related to suicide (see Zavaleta et al., 2014); this was partially supported in this study, to the extent that psychological distress, measured in this study to include suicidal thought or action, is a true precursor of suicide (Table D8).

The greatest ambiguity in this study arose in the role of direct social support via interpersonal relationships. Many studies have reported strong positive and protective effects from peer or parental support (Bauer, Scheim et al., 2015; Klein & Golub, 2016; Yadegarfard et al., 2013); the ability to differentiate peer and parental support was not available in this dataset and the relationship variables in this dataset proved to be weak (Table D12). Nevertheless, the strong relationship of SI and PSY in this study (Table D8) supports a negative association of social support with depression and anxiety (see Budge et al., 2014) and harmful effects due to social isolation in gender-variant persons as reported in Baams et al. (2015) and Yadegarfard et al. (2013).

In this study, the measurement of social isolation was strongly influenced by income; higher income signaled greater social integration, which in turn, was related to psychological health (Table D12, Table D8). This finding is consistent with other research in two ways. First, economic disadvantage has been linked to social isolation (Klein & Golub, 2016), so, conversely, higher income is related to social integration. Second, income confers controllability over some aspects of one's life, and lack of controllability is a crucial aspect of a pathological stress response (Koolhaas et al., 2011). The deleterious effects of employment disadvantage that were found in Wheeler and Dodd (2011) and Wong (2013) were not found in this study, as employment was a weak-to-moderate influence on SI (Table D12) and the availability of insurance was largely insignificant in these analyses. However, the effect of employment on SI was subordinated by the stronger effect of income, which may mask measurement error in the employment data.

Disease

The expected effects of social stigma on physical health were ambiguous in this study. For example, theoretically-plausible age-associated effects of stress on psychological distress (Purcell et al., 2012; Zelle & Arms, 2015) were not found; suicidal ideation was stronger in the young and health status was not different by age (Table D6). Also, the association of diabetes with socioeconomic stress and race (Carvalho et al., 2015; Faulenbach et al., 2012; LeBron et al., 2014; Semenkovich, Brown, Svrakic, & Lustman, 2011; Weiss et al., 2011) was not found. However, the research-supported susceptibility of asthma to stress (Chen et al., 2011; Guxens et al., 2014; Lange et al., 2011; Lee et al., 2016; Rosenberg, Miller, Brehm, & Celedón, 2014) was found (the two Asthma-related variables exerted a strong effect in the Disease variable) and the association of cardiovascular disease to stress (Butcher et al., 2014; Kassin et al., 2011; Lovallo, 2011) may have been reflected by a moderate effect for cardiovascular items in the Disease variable.

Transition

Meyer (2003a) had suggested a protective effect arising from disclosure of one's sexual orientation. Even though that research did not include transgender persons, medical and surgical transition interventions would be expected to provide amelioration to most forms of gender dysphoria (WPATH, 2010). While not directly comparable, this study supports a protective effect for transition therapies. The use of transition therapies is associated with supportive care and psychological health: The Transition - SMC relationship was positive in four of the six gender identity groups (excepting the Man and

Woman groups) and the Transition-PSY relationship was positive in the nonspecific

Transgender group (Table D19). These findings are also supportive of the WPATH

(2010) guidelines for psychological stability as a precursor to transition (Coolhart, Baker,

Farmer, Malaney, & Shipman, 2013).

Limitations

This study was limited by several structural and methodological constraints that

were mostly apparent during the design of the study. In this secondary analysis of a

previously collected dataset, methodological constraints were mitigated and possibly

could have been eliminated by adopting a different research perspective. Structural

constraints are inherent in the dataset and were mitigated as much as possible. In this

study, these constraints prevented rigorous external validity, although other researchers in

similar demographic and cultural settings may find useful insights from this study.

Despite the relative loosening of cause-effect criteria suggested by Schwartz and Meyer

(2010), such interpretations were avoided.

Structural

Structural limitations involved the sample composition and size, and the survey

design. The survey design constraints form part of the recommendations for future

research discussed in the next section.

Sample.

Any assessment of a hidden population is unavoidably constrained by sampling

issues. The lack of information on the size, extent, and demographic characteristics of the

population from which the sample is drawn creates substantial uncertainty about

representativeness (external validity), as pointed out by Heckathorn (1997) and Daniel (2012). This dataset was formed from an anonymous, convenience sample characterized by racial homogeneity, and possible age bias toward younger, more healthy participants. The unavoidable lack of probability sampling may have also created distributional bias (seen in elevated skewness, kurtosis, heteroscedasticity), ambiguous measures of multicollinearity, and low statistical power. These conditions almost certainly resulted in some degree of bias, an effect found in other studies of transgender persons (Simons, Schrager, Clark, Belzer, & Olson, 2013).

  The internet is often the only way to reach groups who may be reluctant to participate in face-to-face surveys; yet, this method is not free of potential selection bias (Koch & Emrey, 2001; Yeager et al., 2011). Other forms of selection bias may arise in studies of hidden populations. One such bias results from the characteristics of persons who respond to an internet survey. For example, these persons may be more computer-literate than others or more socially connected than others. Since one aspect of this study involved the assessment of social isolation, persons who were truly socially isolated may not have been able (psychologically or practically) to participate. While no financial or other inducements were offered to respondents, convenience sampling may often be dependent on the initial responders who then enlist others (further increasing the nonrandomness) or they may be persons who are prone to volunteer (Heckathorn, 2002). Further, convenience sampling of a hidden population generally precluded the formation of suitable control groups, although in this study, comparative analyses were done on groups stratified by gender identity.

Survey Design.

The design of the survey instrument was done for compatibility with the

Behavioral Risk Factor Survey System. While this approach offered many advantages,

several items relevant to the research question were unfortunately not collected. These

are discussed more fully in the Recommendations section, but, briefly, these involved

current and historical victimization and other stressful life events, quality and duration of

interpersonal relationships, the occurrence of self-harm, and housing information. Also,

ambiguity regarding the quality of the information related to alcohol consumption may

have masked a sub-population prone to abuse.

Methodological

Potential methodological limitations were related to analytic decisions, and if

present, would have potentially resulted in invalid results and interpretations. This

potential was anticipated; the use of more than one statistical perspective was an attempt

to mitigate this possibility.

Misclassification.

The primary methodological concern involved the adequacy of analytic model

itself and may have been indicated by a large amount of unexplained variance which was

seen in measures of regression effects (R^2) and SEM fit. Model adequacy may have been

influenced by several situations.

First, the R^2 (effect size) was sensitive to the statistical test. Regression and GLM

produced the same R^2 for each dependent variable; AMOS produced a higher R^2 for the

SI and SMC outcomes and lower for PSY. Second, the Durbin-Watson conclusion of

error independence was challenged by the SEM results, which suggested lack of error independence. The Durbin-Watson rule-of-thumb (1-3) to indicate error independence (Field, 2013, p. 337) may have been too wide for these data. Third, a slightly different picture emerged from the Model 2 regressions than that seen with the Model 1 regressions. The covariates used and the regression method had important consequences for the results obtained and interpretations. Fourth, the variance inflation factor (VIF) for variables known to be collinear in this dataset was well below the guideline (10) that is suggested for multicollinearity (Field, 2013, p. 325). False hope could be given by over-reliance on this guideline.

There are several points where faulty analytic choices could have been made. First, the process of creating the study variables may have been flawed, which would have created a large misclassification error. As Turner (2010) and Schwartz and Meyer (2010) have pointed out, misclassification as a major potential threat to the validity of MST studies. This could have occurred in study variables with many components such Disease or psychological health (PSY). Further, the transformation of certain variables, such as Marital, and the collapsing of survey items into variables such as Race, Education, or Gender-ID could have introduced measurement error.

Standardization.

Also, the use of standardization (used in the hypothesis testing and supplemental analyses) is controversial. Hayes (2013) maintains that standardization obscures the relationships among data and thus could diminish a study's external validity (which was already compromised). Even though a predictive statistical model was not a desired

endpoint of this study, accurate scale measurement was crucial to interpretation of the results. I determined that external validity (though inherently weak) would be enhanced by standardization so that comparability (i.e., freedom from scale concerns) might be achieved that would simplify any future studies of this dataset.

Factor Analysis.

A further methodological limitation may have arisen from the choice of statistical methods for index construction. A concern arose early in the study that too many survey items did not meet the scale-level data constraints for factor analysis, which was the preferred method for index construction. While other researchers (Byrne, 2016; Thompson, 2004) were somewhat ambivalent about this topic, they presented theoretical reasons for the necessity of scale-level data. I decided to evaluate the practical implications of violations of this criterion. These results showed no serious (in my opinion) deficiency arising from the use of dichotomous or low-level categorical data, since the results from factor analytic variable constructions compared to simple summed constructions were similar. The use of dichotomous component-discrimination methods such as CATPCA as an alternative to factor analysis were possible, but those methods did not allow certain advantageous processes available in factor analysis (i.e., principal axis extraction and oblimin rotation) which were more tolerant (theoretically) of normality violations. This tolerance may extend to dichotomous data.

Nevertheless, for most indices summation with variants of equal or proportional weighting, was used to build the variables. But, factor analysis offered a better statistical picture of the composite relationships, and since one of the primary goals of this study

was the construction of a latent variable for social isolation, it was decided to use (with reservations) factor analysis to construct this variable. In addition to a concern over the use of factor analysis in general, another potential source of measurement error may have been in the use of the factor score coefficient matrix in the SI algorithm as opposed to the pattern or structure matrix. Thompson (2004) offered no clear guidelines on this topic, and suggested that, in fact, there was no preference.

<div align="center">**Recommendations for Further Research**</div>

The 2014 One-Colorado survey was the first attempt to obtain more detailed information on the healthcare needs of transgender Coloradoans. Since the composition and needs of this group of largely hidden and stigmatized persons are likely to be in flux in response to individual changes (such as aging) and societal effects (such as increased acceptance and in- or out-migration), regular assessments of their health status are warranted. The Colorado BRFSS, in 2015, added a sexual orientation module that can potentially offer comparable, probability-sampled data, and the National Transgender Discrimination Survey (NTDS) periodically creates nationally comparable data on the experiences of transgender persons. However, the BRFSS dataset may not be detailed enough for local health planning for this group, and its probability-sampled information may not uncover sufficient respondents for this rare condition. Also, the NTDS may not capture sufficiently detailed health information, and may not capture local cultural and legislative characteristics relevant to Colorado. Therefore, future research like the One-Colorado survey may be necessary. In this section, some improvements to the process

begun by One-Colorado, as well as other approaches to information-gathering are suggested.

As pointed out by Meyer (2003a), studies relating to the MST should mitigate three measurement problems: Isolating individual versus structural factors, measuring the subjective perceptions of stress, and isolating the various sources of stress (i.e., major versus more common). As demonstrated by One-Colorado, transgender persons are willing to participate in detailed research, as are other gender minorities (Cahill et al., 2014; Cahill et al., 2016). Information from several areas, therefore, could probably be sought and reliably provided.

Social Isolation

A limitation of this study was the inability to fully assess social isolation, possibly partially due to the dearth of respondents who, by their own social isolation, did not participate. Ideally, the respondent networking that was probably at work in the One-Colorado could be more proactively geared to finding and including those persons who may have withdrawn from regular social contact.

Racial Mix

A future study of transgender health should attempt to expand the racial mix of respondents. In this study, the non-White respondents showed higher risk in suicidal ideation, but deeper analysis of this finding was hampered by low sample size.

Stressful Events and Support

The link between victimization and psychological distress has been documented in transgender persons (Richmond et al., 2012; Shipherd et al., 2011), but stressful events

such as death of a loved one and other events not necessarily related to discrimination, also can be potentially traumatic (Shipherd et al., 2011). Therefore, information on stressful events should be sought in a future study. Improvement in collection of hate crime data related to gender should also be sought (Duncan and Hatzenbuehler, 2014). In addition to the harm from external violence, self-inflicted harm is also found in transgender and sexual minority persons (Dickey et al., 2015; Moskowitz et al., 2013; Muehlenkamp et al., 2015; Reisner, Vetters et al., 2015) and may be an antecedent of suicidal behavior (Arcelus, Claes, Witcomb, Marshall, & Bouman, 2016). Therefore, this information should be collected.

As shown in other research, deleterious psychological effects can be mitigated by support or coping strategies (Shipherd et al., 2011). The failure of this study to verify this effect suggests that stronger measures to assess support, such as the quality and duration of relationships, adequacy of housing, and involvement in community activities should be solicited.

Anxiety

The strength of the history of anxiety in relation to psychological distress suggests that further study into the role that the past occurrence of anxiety (and probably depression also) is warranted. An aspect of this research might be to ascertain whether this information is routinely obtained by the providers of transgender healthcare.

Comparative Analyses

Future research could also use the Colorado BRFSS and the NTDS data to provide triangulating validation to the One-Colorado dataset or to other compatible

transgender-specific datasets. Areas of compatibility might include rates of supportive

medical care, disease information, and Healthy Days or PHQ-8 constructs.

Improvement of Data Systems

Future studies of transgender health should include information that could be used

to support or refute guidelines promulgated in HealthyPeople 2020 (ODPHP, 2016).

While many of the goals put forth in that document reflect desirable improvements in the

health of all persons, two transgender-specific goals focus on data collection, especially

in the differentiation of transgender persons from other gender minorities. In this study,

significant differences were found according to self-reported gender identity, with some

ambiguity in responses. Therefore, future studies should attempt to obtain more clarity

regarding gender identity. Improved gender information (even simply including

nonbinary responses) would improve the BRFSS and other data systems also (IOM,

2012).

One of the most widely-used methods to gather longitudinal data with sufficient

quality and reliability to support treatment and planning decisions, is to implement a

transgender-specific treatment and epidemiologic database, either as a stand-alone data

system or as a consolidation of information from other sources. The justification for this

approach arises from the complexity, risk, and long-term outcomes associated with the

medical, surgical, and psychiatric interventions associated with transgender care. This

method has been developed in Sweden (Dhejne et al., 2011; Dhejne et al., 2014), where it

is part of a national disease registry. In the US, successful disease registries are in place

for conditions such as cancer, trauma, cardiac disease, and stroke, and are invaluable sources of consistently high-quality medical data (Fisher et al., 2016).

Qualitative Investigations

This study identified at least two groups that were potentially underrepresented in this dataset: Non-White self-identified transgender persons, and socially isolated transgender persons of any race. Future research could actively seek these persons and qualitatively explore the transgender phenomenon through their feelings and experiences, with the encouragement and direction of a sensitive interviewer. For example, one or more in-person qualitative studies involving these persons could specifically examine the interactions of the three concepts that were quantitatively examined in this study (social isolation, psychological distress, and medical care) and follow the broad outline of the One-Colorado survey without the constraints imposed by structured options. Many themes could be effectively developed qualitatively, such as social stigma, victimization, resilience, social networks, power relationships, economic interactions, health needs, coping behaviors, and access to healthcare.

<div align="center">

Implications for Social Change

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This study was undertaken to develop information that could lead to attitudinal and practical changes in the way transgender Coloradoans are viewed by the community, by their healthcare providers, and by themselves. The underlying motive of this study was to contribute to the understanding of the ways by which certain social influences (specifically, isolation and medical care) contribute to individual psychological well-being in transgender persons. As scientific information about these relationships

(combined with other sources of personal experience and knowledge) reach individuals and policy-makers, discriminatory behaviors can change; transgender persons can gain a better chance to live full and productive lives.

The Literature Gap

The literature gap that this study sought to address concerned social isolation and its interdependent relationships with psychological distress and medical care in transgender persons. Social isolation was imperfectly measured in this study (with the lowest Cronbach of any variable) which reflected a documented challenge (IOM, 2014; Zavaleta et al., 2014). Yet, it was significantly related to psychological distress, also a finding previously reported (Yadegarfard et al., 2013). Supportive medical care was related to psychological distress, a finding also previously reported (Bauer, Scheim et al., 2015; Huot et al., 2013; Xavier et al., 2013), but social isolation was not related to supportive medical care as hypothesized. Thus, the gap in literature remains.

This study contributed to the on-going conversation on the social origins of mental disorders by identifying a group of Coloradoans that, in some ways, defied expectations, even though their high rate of suicidal ideation is consistent with other research. In the One-Colorado respondents, income was a stronger influence than interpersonal relationship on psychological distress and supportive medical care; this finding may indicate that socioeconomic sources of discrimination that inhibit a person's ability to earn a living may be particularly harmful in this group. Also, other research had not identified the importance of self-reported gender identity in the areas addressed in this study; transgender persons did not constitute a homogeneous group in this dataset

and studies that consolidate persons of various gender identities may obscure other important distinctions.

This study also added to research that explores the social identities of transgender persons. The transgender respondents in this dataset were relatively similar in health status to Coloradoans in general (One-Colorado, 2014), and they placed emphasis on exercise and activity. Knowledge of the humanity and similarity of these persons may help to dispel the perception that transgender persons constitute 'semi-acceptable targets of public venom' (SPLC, 2017, p. 1).

Policy and Advocacy

This study demonstrated a link between socioeconomic forces, especially income, and individual psychological well-being. By removing policies that prevent persons from earning a living commensurate with their abilities, social change can occur, sometimes with unanticipated speed. Evidence-based advocacy for transgender persons can benefit other persons or groups at the margins of society, since intersectional stigma can be present from sources such as race, physical disease, substance abuse, or psychological distress as well as from gender.

Improvements in health insurance can benefit everyone, but marginalized persons can be especially aided. Adequate insurance, especially within the Medicaid framework, is essential since transgender persons may be underemployed and lower-income relative to their education. Insurance coverage should offer preventive and therapeutic services to transgender persons. Insurance and employment are related. Employment discrimination,

which may even occur in healthcare settings, can be mitigated through policy advocacy and action.

Advocacy should also include efforts to improve gender-related data, which are at the core of an evidenced-based approach to policy development and evaluation. This study identified ambiguity in gender identity within the cohort of self-identified transgender persons; periodic local assessments of the transgender community can promote social change by helping to resolve confusion on the part of the community regarding the degree of diversity felt by gender-variant persons. Likewise, advocacy to improve gender information in large databases such as the BRFSS can also promote social change, by modifications of binary gender data collection.

Even though data on victimization was not available in this study, the available data on hate crimes may underestimate the problem, partially due to the voluntary and often incomplete nature of data collection; a more complete picture of the role of victimization (which would also include bullying and other overt forms of gender-based bias) in the genesis of psychological distress is necessary to social change.

Social Change

Social change that leads to improvement in the lives of transgender persons may be accomplished not only by identifying and mitigating the modifiable external influences that provoke bias, but also by strengthening individuals to be more resilient and resistant to the harmful effects of social stigma. This twin focus was guided by the policy theories of social constructionism (Schneider, Ingram, & deLeon, 2014) and the advocacy coalition framework (Jenkins-Smith, Nohrstedt, Weible, & Sabatier, 2014);

both of which are based upon the importance of belief systems and stereotypes in the origination, continuation, and mitigation of social problems. While it may be easier to change policies than beliefs, the two are complementary. There are two specific areas – interpersonal relationships and health-related interactions - in which the results of this study may fruitfully promote social change.

Interpersonal.

At the interpersonal level, individuals, family members, and organizations can benefit from a better understanding of the transgender community and better appreciation of the similarities and differences between oneself and other persons who identify themselves as transgender. Such understanding can be gained intellectually or experientially. This study provides an intellectual basis for allowing experiential change to occur by showing that transgender and nontransgender persons share many responses and characteristics, such as the importance of income and regular medical care, and the effects of psychological distress on social involvement.

Healthcare.

Health systems and providers already recognize that societal influences may play important roles in individual well-being (Heiman & Artiga, 2015; ODPHP, 2017). Thus, the linkage between gender-based discrimination and psychological distress is largely intuitive, even though it is often ambiguous (Schwartz & Meyer, 2010). The results of this study may help providers understand that ignorance and lack of competence in transgender health issues are not effect-neutral; they are active contributors to psychological harm. Since providers are often influenced by their professional

organizations, the adoption of community-wide practice standards derived though a locally relevant evidence-base would be a major impetus to improving individual competence.

Providers should acquire the ability to differentiate the various transgender conditions and understand the treatment options that are available across the life course (i.e., from the pre-adolescence to old age). Providers also should be able to recognize the common symptoms of depression in gender-variant persons. As was noted in this study, providers should recognize the importance of obtaining an adequate psychiatric/psychological history (especially with respect to anxiety and substance abuse) in a caring manner that includes the use of appropriate pronouns.

Some counseling services may already be at the forefront of social change that benefits transgender persons. Service organizations that are not as progressive can foster social change by being responsive to gender-related cultural and political changes, respectful of the person's privacy and gender identity, and cognizant of the transgender person's stage of transition. Assistance with employment, housing, insurance, or other social services (such as birth certificate or driver license modification) may lessen the impact of stigma, and frequent program evaluation and revision is necessary.

Conclusion

This study sought to clarify the role of social isolation in relation to psychological distress and supportive medical in transgender Coloradoans. While this goal was not completely achieved, the exploration of the perceptions of over 400 stigmatized Coloradoans has opened a window into a hidden community that otherwise would have

remained closed. Through these secondary analyses, several insights have been gained: The Colorado transgender community is, in many ways, at least four distinct groups, each with characteristics which have health and policy importance; economic self-sufficiency is perhaps the dominant armor with which this community can withstand the often-brutal stigma of society; healthcare can be a source of resilience as well as healing; and, efforts must continue to reach out to those transgender and gender-variant persons who, for whatever reason, remain isolated.

It took great courage for these 417 persons to share some of their perceptions in this anonymous survey. Many of these persons admitted to deeply disturbing thoughts of suicide; most of those who did were the youngest respondents. They also confided information concerning drug use and disease, and expressed hope for the future through embarking on risky and uncertain transition therapies. They were, as a group, highly educated, yet mired in poverty and underemployment. They often do not receive healthcare for problems for which cisgender persons are easily treated; and despite these disadvantages most express positive expressions of their own well-being while at the same time revealing long-term bouts with depression and anxiety. While no survey item directly measured this, they are persons that, as a group, are largely optimistic in the face of adversity.

There are several ways that the information obtained in this study can turn into positive social action. One way is to turn the healthcare community from a source of dread into a source of hope. This can be partially accomplished by pragmatic improvements in data systems and insurance coverage; another complementary way is to

confront ignorance and prejudice with scientifically solid evidence that can educate

providers on the ways that help and harm can result from their encounters with

transgender persons. But healthcare is not the only avenue toward social change.

Another way is to channel the knowledge and resilience of these persons into

economically productive areas. It has been shown that hidden populations often have

substantial privacy concerns; while this is a barrier to assessment, it is also plausibly

indicative of a desire to simply live a normal life, removed from public scrutiny.

Employers might see this as a sign of stability, if given the opportunity.

This study has unexpectedly extended the knowledge of the role of gender

identity in healthcare, and it has also demonstrated the fragility of conceptions of social

support. At the same time, it has strengthened understanding of the importance of social

integration. Making room in our communities for capable and resilient persons who

would otherwise be excluded creates benefits for all.

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Appendix A: One-Colorado Data Sharing Agreement

DATA SHARING AGREEMENT

THIS DATA SHARING AGREEMENT (the "Agreement") is made and entered into on February 2 , 2015 by and between the One Colorado Education Fund (One Colorado) Denver nonprofit corporation and Charles Tinnell ("Researcher") (together, "the Parties")..

WHEREAS, in 2014 One Colorado conducted the Colorado Transgender Health Survey ("Survey"); and

WHEREAS, Researcher has asked One Colorado for access to the data set collected for the Survey; and

WHEREAS, the requested data consists of trade secrets, proprietary, and highly confidential information; and

WHEREAS, One Colorado is willing to disclose the Survey data set to Researcher, but only if the Parties hereto enter into this Agreement as a condition of disclosure.

NOW, THEREFORE, in consideration of the mutual agreements contained herein, are hereby acknowledged, the parties hereto, intending to be legally bound, hereby agree as follows:

The Confidential Data: For purposes of this Agreement, the "Confidential Data" shall mean the data set of responses collected from individuals who responded to the Survey or any part of that data set. The Confidential Data will be provided to Researcher as an electronic file. The Confidential Data includes the entire data set and any individual portions of the set.

Confidential Data is Proprietary:

The Researcher hereby agrees and acknowledges that all Confidential Data supplied hereunder is highly confidential, proprietary, personal, and of the highest value to One Colorado, and that none of such information shall be used by the Researcher in any manner other than as expressly approved in this Agreement.

As used herein, Researcher means the Researcher receiving the Confidential Data and any employees, officers, directors, agents or other individuals affiliated with the Researcher.

Use and Disclosure of Confidential Data:

The Researcher may use the Confidential Data only for the agreed upon purpose.

The Researcher shall not, directly or indirectly, disclose, share or use the Confidential Data for any purpose whatsoever, whether for its own benefit or use or for that of another person or entity, other than as set forth in paragraph 4(a) above.

The Researcher shall keep the Confidential Data in strictest confidence and shall not disclose the Confidential Data or any part of it to any other person or entity without the prior written consent of One Colorado. In keeping the Confidential Data in strictest confidence, Researcher shall take appropriate steps to inform and bind any of those given access to the Confidential Data pursuant to this Agreement (e.g., directors, officers, employees, agents, students) of their obligations of confidentiality and nondisclosure pursuant to this Agreement.

Notwithstanding any other provision of this Agreement, the Researcher may disclose the Confidential Data to the extent required by applicable law. If the Researcher is required in any civil or criminal legal proceeding, regulatory proceeding or any similar process to disclose any part of the Confidential Data, the Researcher shall give prompt notice of such request to the One Colorado so that One Colorado may seek appropriate legal relief, including injunctive relief, prior to disclosure, or waive the Researcher's compliance with the provisions of this Agreement.

Ownership and Approval of Publication

One Colorado asks to be informed of any publication, dissemination, or distribution of any reports, articles, books, studies or other products created in any part with the Confidential Data.

Nothing in this Agreement shall in any way grant Researcher any intellectual property rights in the Confidential Data or in any edits, updates, modifications, adaptations, additions, supplementations, and/or derivative works to or based on the Confidential Data.

Researcher shall not, without the prior written consent of the One Colorado, seek to obtain any protection of intellectual property derived from the Confidential Data. Any Confidential Data disclosed pursuant to this Agreement, and any copies thereof, shall remain the sole and exclusive property of One Colorado.

The Researcher agrees that it will not use the Confidential Data as a basis upon which to develop, or have a third party develop, any further intellectual property rights, except to the extent expressly provided herein.

Upon request, Researcher agrees to share with One Colorado the results of any calculations or other manipulations made with the Confidential Data.

Institutional Review Board.

If the Researcher is based at a research institution that has an Institutional Review Board ("IRB"), any use of the Confidential Data must be approved by the Researcher's IRB.

Attribution

Any approved study, report, analysis, article, book or other publication making any use of the Confidential Data shall credit One Colorado as follows**:**
For academic publications One Colorado should receive attribution as the source of the data in a manner consistent with the citation style then in use.

For non-academic publications, the attribution should include language to the following effect:

One Colorado Education Fund conducted the Colorado Transgender Health Survey which generated the data this work is based on. To find out more about the original report, visit http://www.one-colorado.org

No Warranty. One Colorado does not make any warranty to Researcher about the scope, correctness, or completeness of the Confidential Data disclosed to Researcher.

Indemnification: The Researcher agrees to indemnify and hold One Colorado and their officers, directors, employees, agents and other representatives harmless from and against any and all losses, liabilities, costs or expenses based upon, arising out of or otherwise in respect of any breach or violation of this Agreement.

The parties hereto have executed this Confidentiality Agreement as of the date first above written.

For

By: Charles Tinnell (signed)   Date: June 14, 2017

For One Colorado Education Fund

By: Daniel Ramos (signed)   Date: June 14, 2017
Daniel Ramos
Executive Director

Appendix B: One-Colorado Data Dictionary

Variable	Number	Text	Response Options
ADANXEV	10.9	Has a doctor or other healthcare provider EVER told you that you have an anxiety disorder?	1=Yes 2=No
ADDEPEV	9.1b	Has a doctor, nurse or other health professional EVER told you that you had a depressive disorder?	1=Yes 2=No 3=Not sure
ADDEPNOW	10.1-10.8	Calculated current depression	1=Yes 2=No
ADDOWN	10.2	Over the last 2 weeks, how many days have you felt down, depressed or hopeless?	_ _ Number of days (0 to 14)
ADEAT1	10.5	Over the last 2 weeks, how many days have you had a poor appetite or eaten too much?	_ _ Number of days (0 to 14)
ADENERGY	10.4	Over the last 2 weeks, how many days have you felt tired or had little energy?	_ _ Number of days (0 to 14)
ADFAIL	10.6	Over the last 2 weeks, how many days have you felt bad about yourself – or that you were a failure or had let yourself or your family down?	_ _ Number of days (0 to 14)
ADMOVE	10.8	Over the last 2 weeks, how many days have you moved or spoken so	_ _ Number of days (0 to 14)

		slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you were moving around a lot more than usual?	
ADPLEASR	10.1	Over the last 2 weeks, how many days have you had little interest or pleasure in doing things?	_ _ Number of days (0 to 14)
ADSLEEP	10.3	Over the last 2 weeks, how many days have you had trouble falling asleep or staying asleep or sleeping too much?	_ _ Number of days (0 to 14)
ADTHINK	10.7	Over the last 2 weeks, how many days have you had trouble concentrating on things, such as reading the newspaper or watching TV?	_ _ Number of days (0 to 14)
AGEGRP	1.4	What is your age?	1=Under 18 2=18 to 24 3=25 to 34 4=35 to 44 5=45 to 54 6=55 to 64 7=65 to 74 8=75 or older
ASTHMA	9.3	Have you EVER been told by a doctor, nurse or other health professional that you had asthma?	1=Yes 2=No
ASTHNOW	9.4	Do you still have asthma	1=Yes 2=No

BINGE4	16.3	Considering all types of alcoholic beverages, how many times during the past 30 days did you have 4 or more drinks on an occasion?	_ _ Number of times
BINGE5	16.4	On how many of these occasions did you drink 5 or more drinks?	_ _ Number of times
BMICAT	1.13-1.14	Calculated BMI status	1=Underweight (BMI <18.5) 2=Healthy weight (18.5 ≤ BMI <25.0) 3=Overweight (25.0 ≤ BMI <30.0) 4=Obese (BMI ≥30.0)
BPHIGH	7.1	Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure?	1=Yes 2=No
CARE	6.4	Do you feel your primary health care provider (or the provider you see most regularly) provides you transgender inclusive health care?	1=Yes 2=No
CHCCOPD	9.1a	Has a doctor, nurse or other health professional EVER told you that you had COPD, emphysema, or chronic bronchitis?	1=Yes 2=No 3=Not sure
CHECKUP	6.9	About how long has it been since you last visited a doctor for a routine checkup? A	1=Within past year (anytime less than 12 months ago) 2=Within past 2 years (1 year but less than 2 years ago)

		routine checkup is a general physical exam, not an exam for a specific injury, illness, or condition.	3=Within past 5 years (2 years but less than 5 years ago) 4=5 or more years ago 5=Never
CHOLCHK	8.1	About how long has it been since you last had your blood cholesterol checked?	1=Within past year (anytime less than 12 months ago) 2=Within past 2 years (1 year but less than 2 years ago) 3=Within past 5 years (2 years but less than 5 years ago) 4=5 or more years ago 5=Never 6=Don't know/Not sure
DELAY_a	6.8	Other than cost, have you delayed getting needed medical care for any of the following reasons in the past 12 months? I fear discrimination	1=Yes 2=No
DELAY_b	6.8	Other than cost, have you delayed getting needed medical care for any of the following reasons in the past 12 months? I do not have health insurance	1=Yes 2=No
DELAY_c	6.8	Other than cost, have you delayed getting needed medical care for any of the following reasons in the past 12 months? I had an issue with my health insurance/services not covered by my insurance	1=Yes 2=No
DELAY_d	6.8	Other than cost, have you delayed getting needed medical care for any of the	1=Yes 2=No

		following reasons in the past 12 months? I cannot find a doctor who accepts my insurance	
DELAY_e	6.8	Other than cost, have you delayed getting needed medical care for any of the following reasons in the past 12 months? Clinic is too far away	1=Yes 2=No
DELAY_f	6.8	Other than cost, have you delayed getting needed medical care for any of the following reasons in the past 12 months? I had transportation issues	1=Yes 2=No
DELAY_g	6.8	Other than cost, have you delayed getting needed medical care for any of the following reasons in the past 12 months? There were no convenient times to go or I could not get an appointment	1=Yes 2=No
DELAY_j	6.8	Other than cost, have you delayed getting needed medical care for any of the following reasons in the past 12 months? I did not need medical care or I did not delay medical care	1=Yes 2=No
DELAY_k	6.8	Other than cost, have you delayed getting needed medical care	1=Yes 2=No

		for any of the following reasons in the past 12 months? Other reason	
DIABETES	9.2	Has a doctor, nurse or other health professional EVER told you that you have diabetes?	1=Yes 2=No 3=No, pre-diabetes or borderline diabetes
DRNKANY	16.1	During the past 30 days, did you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?	1=Yes 2=No
DRNKAVG	16.2	One drink is equivalent to a 12-ounce beer, a 5ounce glass of wine, or a drink with one shot of liquor. During the past 30 days, on the days when you drank, about how many drinks did you drink on the average? A 40 ounce beer would count as 3 drinks, or a cocktail drink with 2 shots would count as 2 drinks.	_ _ Number of drinks
EDUCA	1.8	What is the highest degree or level of school you have completed?	1=Less than high school, no diploma 2=High school graduate, diploma, or equivalent (e.g., GED) 3=Some college credit, no degree 4=Trade/technical school/vocational training 5=Associate degree 6=Bachelor's degree

			7=Master's degree
			8=Professional degree
			9=Doctorate degree
EMPLOY	1.11	Employment status: Are you currently…?	1=Employed for wages
			2=Self-employed
			3=Out of work and looking for work
			4=Out of work and not currently looking for work
			5=A homemaker
			6=A student
			7=Military
			8=Retired
			9=Unable to work
EXERANY	14.1	During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?	1=Yes
			2=No
GENDER	1.2	What is your gender? (Choose the most appropriate)	1=Transgender Man
			2=Transgender Woman
			3=Transgender
			4=Man
			5=Woman
			6=Agender (or no gender)
			7=Gender Queer/Gender Fluid
			8=Not listed above
GENHLTH	2.1	In general, how would you rate your overall health?	1=Excellent
			2=Very good
			3=Good
			4=Fair
			5=Poor
HALLUDRUG	18.2	During the past 12 months have you used any hallucinogens (such as LSD, mushrooms, PCP), cocaine,	1=Yes
			2=No

		heroin, meth or any other drugs not intended for medical use?	
HAVARTH	9.1c	Has a doctor, nurse or other health professional EVER told you that you had arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?	1=Yes 2=No 3=Not sure
HISPANIC	1.5	Are you Hispanic or Latino	1=Yes 2=No
HLTHPLN	6.1	Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, Medicaid, or Indian Health Service?	1=Yes 2=No
HRTEVER	4.1	Have you EVER used hormone replacement therapy or cross-sex hormones?	1=Yes 2=No
HRTFUTR	4.3	Are you planning to take hormone replacement therapy?	1=Yes 2=No 3=Don't know/Not sure
HRTNOW	4.2	Are you currently taking hormone replacement therapy?	1=Yes 2=No
INCOME	1.12	Pleae mark your annual household income from all sources:	1=Less than $10,000 2=$10,000 to less than $15,000 3=$15,000 to less than $20,000 4=$20,000 to less than $25,000 5=$25,000 to less than $35,000 6=$35,000 to less than $50,000 7=$50,000 to less than $75,000

			8=$75,000 or more
			9=Don't know/Not sure
LASTDEN	12.1	How long has it been since you last visited a dentist or dental clinic for any reason? Include visits to a dental specialist, such as an orthodontist.	1=Within past year (anytime less than 12 months ago) 2=Within past 2 years (1 year but less than 2 years ago) 3=Within past 5 years (2 years but less than 5 years ago) 4=5 or more years ago 5=Never
MARITAL_a	1.7	What is your current partnership status? Single, never married	1=Yes 2=No
MARITAL_b	1.7	What is your current partnership status? Divorced	1=Yes 2=No
MARITAL_c	1.7	What is your current partnership status? Married/domestic partnership/living with a partner	1=Yes 2=No
MARITAL_d	1.7	What is your current partnership status? Partnered, not living together	1=Yes 2=No
MARITAL_e	1.7	What is your current partnership status? Polyamorous/non-monogamous	1=Yes 2=No
MARITAL_f	1.7	What is your current partnership status? Widowed/grieving the loss of a partner	1=Yes 2=No
MARITAL_g	1.7	What is your current partnership status? Other	1=Yes 2=No
MEDCOST	6.7	Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?	1=Yes 2=No

MENTHLTH	3.2	Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?	_ _ Number of days (0 to 30)
MJEVER	17.1	Have you ever used marijuana or hashish?	1=Yes 2=No
MJNOW	17.2	During the past 30 days, on how many days did you use marijuana?	_ _ Number of days (0 to 30)
NOCARE_a	6.6	Why do you feel that your primary health care provider does NOT provide transgender inclusive health care? Not enough knowledge on transgender related health care needs	1=Yes 2=No
NOCARE_b	6.6	Why do you feel that your primary health care provider does NOT provide transgender inclusive health care? Not comfortable with patients who identify as transgender	1=Yes 2=No
NOCARE_c	6.6	Why do you feel that your primary health care provider does NOT provide transgender inclusive health care? Does not address my	1=Yes 2=No

		transgender specific health care needs, only other medical needs	
NOCARE_d	6.6	Why do you feel that your primary health care provider does NOT provide transgender inclusive health care? Office policies and forms are not transgender inclusive	1=Yes 2=No
NOCARE_e	6.6	Why do you feel that your primary health care provider does NOT provide transgender inclusive health care? Office does not provide a welcoming environment for transgender patients	1=Yes 2=No
NOCARE_f	6.6	Why do you feel that your primary health care provider does NOT provide transgender inclusive health care? Other reason	1=Yes 2=No
NUMADULT	1.9	How many adults including yourself live in your household?	_ _ Number of adults
NUMCHILD	1.1	How many children leas than 18 years of age live in your household?	_ _ Number of children
OTCDRUG	18.3	During the past 12 months have you used any over-the-counter drugs (non-prescription) to get high?	1=Yes 2=No

PERSDOC	6.3	Do you have one person you think of as your personal doctor or health care provider?	1=Yes - only one person 2=Yes - more than one person 3=No - no particular person or persons
PHYSHLTH	3.1	Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?	_ _ Number of days (0 to 30)
PLAN_a	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Health insurance through your work	1=Yes 2=No
PLAN_b	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Health insurance through someone else's work	1=Yes 2=No
PLAN_c	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Medicare	1=Yes 2=No
PLAN_d	6.2	Are you currently covered by any of the following types of insurance or health coverage plans?	1=Yes 2=No

		Railroad retirement plan	
PLAN_e	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Veteran's Affairs, Military Health, TRICARE, or CHAMPUS	1=Yes 2=No
PLAN_f	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Indian Health Service	1=Yes 2=No
PLAN_g	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Medicaid	1=Yes 2=No
PLAN_h	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? A student insurance plan	1=Yes 2=No
PLAN_i	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Health insurance bought directly by you	1=Yes 2=No

PLAN_j	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Health insurance bouth directly by someone else	1=Yes 2=No
PLAN_k	6.2	Are you currently covered by any of the following types of insurance or health coverage plans? Any other type of health insurance	1=Yes 2=No
POORHLTH	3.3	During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?	_ _ Number of days (0 to 30)
QLACTLM	15.1	Are you limited in any way in any activities because of physical, mental, or emotional problems?	1=Yes 2=No
RACE	1.6	Which one of these groups would you say best represents your race?	1=White 2=Black or African American 3=Asian 4=Native Hawaiian or Other Pacific Islander 5=American Indian or Alaska Native 6=Multiracial 7=Other
RMVTETH	12.2	How many of your permanent teeth have been removed because of tooth	1=1 to 5 2=6 or more but not all 3=All 4=None

		decy or because of gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.	
RXDRUG	18.1	During the past 12 months have you used any prescription drugs (drugs prescribed to you or someone else by a doctor) for recreation or non-medical use?	1=Yes 2=No
SCDATMPT	11.2	In the past year, have you ever actually tried to hurt yourself in a way that might have resulted in your death?	1=Yes 2=No
SCDINJ	11.3	If you attempted suicide in the past year, did this (any) attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?	1=I did not attempt suicide in the past year 2=Yes 3=No
SCDTHNK	11.1	In the past year, have you ever seriously thought about trying to hurt yourself in a way that might have resulted in your death?	1=Yes 2=No
SEX	1.1	What was your assigned sex at birth (meaning on your original birth certificate)?	1=Male 2=Female

SEXOR	1.3	Do you think of yourself as: (Choose one	1=Lesbian, gay, or same-gender loving 2=Straight or heterosexual, that is, not gay or lesbian 3=Queer 4=Bisexual or pansexual 5=Not sure, questioning 6=Not listed above
SMOKDAY	13.2	Do you now smoke cigarettes every day, some days, or not at all?	1=Every day 2=Some days 3=Not at all
SMOKE100	13.1	Have you smoked at least 100 cigarettes in your entire life? (5 packs=100 cigarettes)	1=Yes 2=No
STOPSMK	13.3	During the past 12 months, have you stopped smoking for one day or longer because you were trying to quit smoking?	1=Yes 2=No
SURGERY	5.1	Have you had any transition related surgery?	1=Yes 2=No
SURGERY_a	5.2	What transition related surgeries have you had? Vaginoplasty	1=Yes 2=No
SURGERY_b	5.2	What transition related surgeries have you had? Orchiectomy	1=Yes 2=No
SURGERY_c	5.2	What transition related surgeries have you had? Scrotoplasty	1=Yes 2=No
SURGERY_d	5.2	What transition related surgeries have you had? Scrotectomy	1=Yes 2=No

SURGERY_e	5.2	What transition related surgeries have you had? Phalloplasty	1=Yes 2=No
SURGERY_f	5.2	What transition related surgeries have you had? Metoidioplasty	1=Yes 2=No
SURGERY_g	5.2	What transition related surgeries have you had? Ring Metoidioplasty	1=Yes 2=No
SURGERY_h	5.2	What transition related surgeries have you had? Bilateral Salpingo-oophorectomy	1=Yes 2=No
SURGERY_i	5.2	What transition related surgeries have you had? Hysterectomy	1=Yes 2=No
SURGERY_j	5.2	What transition related surgeries have you had? Bilateral Mastectomy	1=Yes 2=No
SURGERY_k	5.2	What transition related surgeries have you had? Breast reconstruction/Breast Augmentation	1=Yes 2=No
TOLDHI	8.2	Have you EVER been told by a doctor, nurse, or other health professional that your blood cholesterol is high?	1=Yes 2=No
USEEQUIP	15.2	Do you now have any health problem that requires you to use special equipment, such as a	1=Yes 2=No

		cane, a wheelchair, a special bed, or a special telephone? Please also include occasional use or use in certain circumstances.	
USENOW	13.4	Do you currently use chewing tobacco, snuff, or snus every day, some days, or not at all?	1=Every day 2=Some days 3=Not at all
YESCARE_a	6.5	Why do you feel that your primary health care provider does provide transgender inclusive health care? Has knowledge on transgender related health care needs	1=Yes 2=No
YESCARE_b	6.5	Why do you feel that your primary health care provider does provide transgender inclusive health care? Comfortable with patients who identify as transgender	1=Yes 2=No
YESCARE_c	6.5	Why do you feel that your primary health care provider does provide transgender inclusive health care? Addresses my transgender specific health care needs, not only other medical needs	1=Yes 2=No
YESCARE_d	6.5	Why do you feel that your primary health care provider does	1=Yes 2=No

		provide transgender inclusive health care? Office policies and forms are transgender inclusive	
YESCARE_e	6.5	Why do you feel that your primary health care provider does provide transgender inclusive health care? Office is a welcoming environment for transgender patients	1=Yes 2=No
YESCARE_f	6.5	Why do you feel that your primary health care provider does provide transgender inclusive health care? Other reason	1=Yes 2=No

Appendix C: Evaluation Tables

Table C1

Dataset Constructs

Construct	Item	Strategy	Description	Impute	I/N
Demographic					
	Age-Group	Restructure (n=156)	Restructured age groups combining lowest two categories into 'Age <=24' and highest two categories into 'Age >= 55'	'Age 18-24' based on EDUCA = 'Some College' and EMPLOY = 'Student'	1/0
	Gender-ID	Restructure (n=47)	Restructured GENDER into 6 levels by combining categories 6 and 8 with category 3.	'Not Listed Above'	1/0
	Hispanic	Not used in analysis			
	Race	Restructure (n=65)	Restructured into 'White' or 'Not White'	'Not White'	6/0
	Sex	Not used in analysis		'Male' if Gender = 'Transgender Female', otherwise 'Female' based on frequency	3/0
	SexOr	Not used in analysis			
Access	Access	Covariate	Sums binary variables and divides ordinal		

			variables by maximum value to standardize to 1		
	CheckUp	Recode		'Within Past Year' based on frequency	13/0
	CholChk	Recode		'Within Past Year' based on frequency	53/0
	Delay_J	Recode		'Did Not Need Care' if GENHLTH = 'Excellent Health', otherwise 'Needed Care'	47/0
	LastDen	Recode		'Care Within Last Year' based on overall frequency	24/0
	MedCost	Recode		'Unable to Obtain Health Care Due to Cost' based on overall frequency	14/0
Disease	Disease	Covariate	Sums binary variables and divides ordinal variables by maximum value to standardize to 1		
	Asthma	Recode		'No History'.	16/0
	Asthma-Now	Recode		'Not Current'	311/0
	BmiCat	Recode		'Healthy Weight'	9/0

	BpHigh	Recode		'No History'	15/0
	ChcCopd	Recode		'No History'	24/0
	Diabetes	Restructure (n=53)	Compresses history of diabetes and pre-diabetes/borderline diabetes	'No History'	15/0
	HavArth	Recode		'No History'	31/0
	RmvTeth	Recode		'No Removed Teeth'	27/0
	ToldHi	Recode		'No History'	15/0
	UseEquip	Recode		'No History'	28/0
Psychological Distress	PSY	Dependent Variable	Sums binary variables and divides ordinal variables by maximum value to standardize to 1		
	AD-Anxiety	Recode		'Not Told'	22/0
	AdDepEv	Recode		'Not Told'	29/0
	AdDown	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	2/22
	AdEat1	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	9/22

AdEnergy	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	3/22
AdFail	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	8/22
AdMove	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	2/22
AdPleasr	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	0/22
AdSleep	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	9/22
AdThink	Recode	Recode number of good days (14 minus number of bad days)	Average of other ADnnnn day measures	8/22
General-Health	Recode		None	0/4
Mental-Health	Recode	Recode number of good days (30 minus number of bad days)	Average of other HLTH day measures	0/10
Physical-Health	Recode	Recode number of good days (30 minus number of bad days)	Average of other HLTH day measures	0/10

	Poor-Health	Recode	Recode number of good days (30 minus number of bad days)	Average of other HLTH day measures	4/10
	QLActLm	Recode		If GENHLTH was 'Good', 'Fair', or 'Poor' impute 'Limitation' otherwise 'No Limitation', based on frequency	30/0
	Suicide-Attempt	Recode		'No Attempt' if SCDTHNK = 'No Suicidal Thought'	275/0
	Suicide-Injury	Recode		'No Injury' if SCDTHNK = 'No Suicidal Thought'	378/0
	Suicide-Think	Recode		'No Suicidal Thought'	23/0
Social Isolation	SI	Dependent Variable	Weighted by Factor Analysis		
	Educa	Restructure (n=358)	Combined HS grad and non-HS grad, combined trade/vocational training with Associate degree, and combined professional degree and doctorate degree	Based on frequency, if INCOME >= $20,000 then impute 'Bachelor's degree' otherwise 'Some College Credit, No Degree'	5/0
	Employ	Restructure (n=339)	Nominal employment transformed to ordinal based on the concept of	'No Work'	1/0

		employment stability. Wage or military employment was 4, self-employment or homemaking was 3, student status was 2, retired was 1, and out-of-work was 0.		
Exercise-Any	Recode		'No Exercise'	26/0
Income	Restructure (n=292)	5 categories: 1 = 0-15k , 2 = 15-25k, 3 = 25-50k, 4 = 50-75k, 5 = >75k.	$25-50k based on frequency	23/0
Marital	Composite	Recodes binary, multiple-response relationship data to a weighted ordinal variable. Assigns a weight to theoretically exclusive relationship categories: married or widowed (4), separated (3), divorced (2), and single/other (1). Then, a point was added for a polyamorous relationship.	None	
Number-Adult	Not used in analysis			
Number-Child	Not used in analysis			

Supportive Medical Care	SMC	Dependent Variable	Sums binary variables and divides ordinal variables by maximum value to standardize to 1		
	Care-Inclusive	Recode		'Not Inclusive' if NOCARE was not null or DELAY_A was 'Discrimination' otherwise 'Care Inclusive' if YESCARE was not null or DELAY_A was 'No Discrimination' or GENHLTH was answered	19/0
	Delay_A	Recode		'No Discrimination'	47/0
	NoCare	Composite	Sum NOCARE_x then subtract from 6	Maximum score (6) if GENHLTH was answered	259/4
	YesCare	Composite	Sum YESCARE_x	Minimum score (0)	168/4
Behavior	Behavior	Covariate	Unweighted sum of percent components		
	Drnk	Composite	Based on BINGE5 only		
	DrnkAny	Not used in analysis			
	DrnkAvg	Not used in analysis			

	Binge4	Not used in analysis			
	Binge5		Decimal percent of binge alcohol use in 30 days	'No Binge' based on frequency.	82/0
	Drug	Composite	Sums binary variables and divides MJNOW by maximum value to standardize to 1		
	MJEver	No Change		None	26/26
	MJNow	No Change		None	134/134
	RXDrug	No Change		None	30/30
	HalluDrug	No Change		None	28/28
	OTCDrug	No Change		None	28/28
	Smoke	Composite	Sums ordinal variables then divides by maximum value (6) for scale consistency	Minimum (0) score	
	Smoke100	No Change		'Has Not Smoked 100 Cigarettes'	23/0
	SmokDay	No Change		'Does Not Smoke'.	232/0
	StopSmk	No Change		'Stopped Smoking'	348/0
	UseNow	No Change		None	28/0
Transition	Transition	Covariate	Sums binary past and current therapy variables and divides by maximum (4) then adds half-point for future therapy		
	HrtEver	No Change		'Not Used'	11/0
	HrtFutr	No Change		'Not Planning'	12/0

HrtNow	No Change	'Not Currently'	8/0
Surgery	No Change	'No Surgery'	9/0

Table C2

Types of Control (Interaction) Variables

Type	Definition	Measured?	Effect on Independent variable (predictor)?	Effect on dependent variable (outcome)?	How Assessed
Confounder	Variable other than predictor that affects outcome (Field, 2013)	No	Possibly	Yes	Hypothesized, not directly assessed
Covariate	Not part of experimental manipulation but affects outcome (Field, 2013)	Yes	No	Yes	Plots; Correlation; Interaction; Independence from predictor
Moderator	Influences direction or strength of other variables (Field, 2013)	Yes	Possibly	Yes	Predictor - moderator interaction is significant
Mediator	Reduces the size or direction of predictor-outcome relationship (Field, 2013)	Yes	Yes	Yes	Correlation; Interaction

Table C3

Main Guidelines for Index Construction

Guideline	Explanation	Source
Construct and content (face) validity	The index is created from components that are theoretically appropriate and academically supported. Items have face validity even if exhaustive content validity is absent.	Frankfort-Nachmias et al. (2015, p. 133-135); Kline (2011, p. 71-72)
Comparability	If possible, the index is constructed from variables that exist in the BRFSS.	Frankfort-Nachmias et al. (2015, p. 133-135)
Reliability	The index displays acceptable values of reliability tests such as Cronbach's alpha and factor analysis.	Kline (2011, p. 69)
Balance	The components of the scale do not disproportionately influence the numerical value of the index.	Blunch (2013, p. 36)
Monotonic	All component scales should be monotonic (in the same direction).	Field (2013, p. 710)
>= 5 categories	The index should have at least five ordinal result categories to allow the assumption of continuity.	Byrne (1998, p. 100); Rhemtulla et al. (2012, p. 370)
Unidimensionality of components	Each component of the index should have Cronbach's alpha > 0.7.	Frankfort-Nachmias et al. (2015, p. 394)
Central tendency	Minimal skewness and kurtosis; expected values cluster toward the middle of the distribution.	Blunch (2013, p. 38, 84)

Table C4

Statistical Validation of Indices

Test	Rationale	Criterion	Source
Cronbach's alpha	Evaluate relatedness, reliability (consistency), and unidimensionality	> .7	Blunch (2013, p. 40); Frankfort-Nachmias et al. (2015, p. 394); Kline (2011, p. 69). Note: .5 criterion in Field (2013, p. 709)
Collinearity	Identify redundant variables	Variance Inflation Factor (VIF) < 10	Kline (2011, p. 51); Field (2013, p. 325)
Skewness	Assess normality.	Not differentiated; Skew Index < 3.0	Blunch (2013, p.84); Kline (2011, p. 63)
Kurtosis	Assess normality.	Near 0; Kurtosis Index < 8.0	Blunch (2013, p.84); Kline (2011, p. 63)
Kolmogorov-Smirnov	Assess normality.	Nonsignificant	Field (2013, p. 187)
Factor analysis	Assess dimensionality.	Minimal multidimensionality	Blunch (2013, p. 59); Frankfort-Nachmias et al. (2015, p. 397)

Note: Statistical adjustment of p-value levels for significance will be adjusted for multiple tests, and particular attention will be given to power and sample size estimation based on conservative effect sizes. Type I significance will be at p-values $<= 0.05$ and trending toward significance will be reported at p-values from 0.05 to 0.1. Type II power-to-detect levels will be set at 0.80.

Table C5

General Linear Model Assumptions and Remedies

Assumption	Meaning	Test	Remedy	Comments
Additivity and Linearity	Predictor effects are additive; Predictor and outcome relationship is linear.	SPSS: zpred vs. zresid; linear fit; curve fitting.	Transformation; remove outliers	
Independent errors	Uncorrelated residuals; no autocorrelation	Durbin-Watson 1-3; SPSS: zpred vs. zresid; multilevel model		
Normality	Distribution of means, predictor levels, and residuals is normal.	SPSS: k-s; p-p, q-q plots; z-score; skewness; kurtosis	Larger sample size; transformation; bootstrap CI	Central limit theorem implies normality when categories > 5
Homoscedasticity	Samples drawn from the same population with same variance.	SPSS: Zpred vs. zresid; Levene's test	Equal group size; larger sample; weighted LS regression	Irrelevant when groups equal or sample large
No unknown confounders	The model specifies the dependent effects.	R^2: if low then poor fit of model.	Seek possible confounders.	Affect significance and Confidence intervals, not coefficients
Lack of multicollinearity	Predictors are not perfectly correlated.	Pearson $r <= 0.9$; tolerance > 0.2; VIF < 10.	Remove covariate from analysis; use hierarchical method.	
Nonzero variance	Predictors must have variance.	Descriptive statistics; plots	Study design.	

From Field (2013, p. 165, p. 311)

Appendix D: Result Tables

Table D1

Missing Data

Item	N		Minimum	Maximum	Median	Mode
	Valid	Missing				
ADDEPEV	388	29	1	2	1.00	1
ADDEPNOW	359	58	1	2	2.00	2
ADDOWN	393	24	0	14	3.00	0
ADEAT1	386	31	0	14	3.00	0
ADENERGY	392	25	0	14	5.00	14
ADFAIL	387	30	0	14	3.00	0
ADMOVE	393	24	0	14	0.00	0
ADPLEASR	395	22	0	14	3.00	0
ADSLEEP	386	31	0	14	6.00	14
ADTHINK	387	30	0	14	2.00	0
AGEGRP	416	1	1	7	3.00	3
ASTHMA	401	16	1	2	2.00	2
ASTHNOW	106	311	1	2	1.00	1
BINGE4	280	137	0	30	0.00	0
BINGE5	280	137	0	30	0.00	0
BMICAT	408	9	1	4	3.00	2
BPHIGH	402	15	1	2	2.00	2
CARE	398	19	1	2	1.00	1
CHCCOPD	393	24	1	2	2.00	2
CHECKUP	404	13	1	5	1.00	1
CHOLCHK	364	53	1	5	1.00	1
DELAY_A	370	47	1	2	2.00	2
DELAY_B	370	47	1	2	2.00	2
DELAY_C	370	47	1	2	2.00	2
DELAY_D	370	47	1	2	2.00	2
DELAY_E	370	47	1	2	2.00	2
DELAY_F	370	47	1	2	2.00	2
DELAY_G	370	47	1	2	2.00	2
DELAY_J	370	47	1	2	2.00	2
DELAY_K	370	47	1	2	2.00	2
DIABETES	402	15	1	3	2.00	2
DRNKANY	391	26	1	2	1.00	1
DRNKAVG	281	136	1	300	2.00	2
EDUCA	412	5	1	9	5.00	6
EMPLOY	416	1	1	9	2.00	1
EXERANY	391	26	1	2	1.00	1
GENDER	416	1	1	99	2.00	2
GENHLTH	413	4	1	5	3.00	3
HALLUDRUG	389	28	1	2	2.00	2
HAVARTH	386	31	1	2	2.00	2

HISPANIC	410	7	1	2	2.00	2
HLTHPLN	407	10	1	2	1.00	1
HRTEVER	406	11	1	2	1.00	1
HRTFUTR	405	12	1	3	1.00	1
HRTNOW	409	8	1	2	1.00	1
INCOME	394	23	1	8	5.00	8
LASTDEN	393	24	1	5	2.00	1
MARITAL_A	416	1	1	2	2.00	2
MARITAL_B	416	1	1	2	2.00	2
MARITAL_C	416	1	1	2	2.00	2
MARITAL_D	416	1	1	2	2.00	2
MARITAL_E	416	1	1	2	2.00	2
MARITAL_F	416	1	1	2	2.00	2
MARITAL_G	416	1	1	2	2.00	2
MEDCOST	403	14	1	2	2.00	2
MENTHLTH	407	10	0	30	7.00	0
MJEVER	391	26	1	2	1.00	1
MJNOW	283	134	0	30	0.00	0
NOCARE_A	155	262	1	2	1.00	1
NOCARE_B	155	262	1	2	2.00	2
NOCARE_C	155	262	1	2	1.00	1
NOCARE_D	155	262	1	2	2.00	2
NOCARE_E	155	262	1	2	2.00	2
NOCARE_F	155	262	1	2	2.00	2
NUMADULT	415	2	0	7	2.00	2
NUMCHILD	397	20	0	7	0.00	0
OTCDRUG	389	28	1	2	2.00	2
PERSDOC	407	10	1	3	2.00	1
PHYSHLTH	407	10	0	30	2.00	0
PLAN_A	347	70	1	2	2.00	2
PLAN_B	347	70	1	2	2.00	2
PLAN_C	347	70	1	2	2.00	2
PLAN_D	347	70	2	2	2.00	2
PLAN_E	347	70	1	2	2.00	2
PLAN_F	347	70	2	2	2.00	2
PLAN_G	347	70	1	2	2.00	2
PLAN_H	347	70	1	2	2.00	2
PLAN_I	347	70	1	2	2.00	2
PLAN_J	347	70	1	2	2.00	2
PLAN_K	347	70	1	2	2.00	2
POORHLTH	403	14	0	30	3.00	0
QLACTLM	387	30	1	2	2.00	2
RACE	411	6	0	6	1.00	1
RMVTETH	390	27	1	4	4.00	4
RXDRUG	387	30	1	2	2.00	2
SCDATMPT	142	275	1	2	2.00	2
SCDINJ	39	378	1	3	3.00	3
SCDTHNK	394	23	1	2	2.00	2

SEX	414	3	1	2	1.00	1
SEXOR	415	2	1	99	3.00	4
SMOKDAY	185	232	1	3	3.00	3
SMOKE100	394	23	1	2	2.00	2
STOPSMK	69	348	1	2	1.00	1
SURGERY	408	9	1	2	2.00	2
SURGERY_A	102	315	1	2	2.00	2
SURGERY_B	102	315	1	2	2.00	2
SURGERY_C	102	315	1	2	2.00	2
SURGERY_D	102	315	1	2	2.00	2
SURGERY_E	102	315	1	2	2.00	2
SURGERY_F	102	315	1	2	2.00	2
SURGERY_G	102	315	2	2	2.00	2
SURGERY_H	102	315	1	2	2.00	2
SURGERY_I	102	315	1	2	2.00	2
SURGERY_J	102	315	1	2	1.00	1
SURGERY_K	102	315	1	2	2.00	2
TOLDHI	402	15	1	2	2.00	2
USEEQUIP	389	28	1	2	2.00	2
USENOW	389	28	1	3	3.00	3
YESCARE_A	245	172	1	2	1.00	1
YESCARE_B	245	172	1	2	1.00	1
YESCARE_C	245	172	1	2	1.00	1
YESCARE_D	245	172	1	2	1.00	1
YESCARE_E	245	172	1	2	1.00	1
YESCARE_F	245	172	1	2	2.00	2

Table D2

Restructured Survey Items

Item	Description	Records Affected
AGEGRP	Restructured age groups combining lowest two categories into 'Age <=24' and highest two categories into 'Age >= 55'	156
GENDER_ID	Restructured GENDER into six levels by combining categories 6 and 8 with category 3	47
DIABETES	Compresses history of diabetes and pre-diabetes/borderline diabetes	53
EDUCA	Combined HS grad and non-HS grad, combined trade/vocational training with Associate degree, and combined professional degree and doctorate degree	358
EMPLOY	Nominal employment transformed to ordinal based on the concept of employment stability. Wage or military employment was 4, self-employment or homemaking was 3, student status was 2, retired was 1, and out-of-work was 0	339
INCOME	Created five categories by collapsing adjacent categories so that 1 = $0-15k, 2 = $15-25k, 3 = $25-50k, 4 = $50-75k, 5 = >$75k	292
MARITAL	Recodes binary, multiple-response relationship data to a weighted ordinal variable. Assigns a weight to relationship categories: married or widowed (4), separated (3), divorced (2), and single/other (1). Then, a point was added for a polyamorous relationship.	417

Table D3

Nested (Conditional) Survey Items

Nested Item	Lead Item	Number of Records Affected	Records Missing the Lead Item	Records Missing the Nested Item	Remedy
SCDATMPT	SCDTHNK=1	0	23	275	If SCDTHNK=2, impute 2; recode and sum the values
SCDINJ	SCDATMPT=1	0	275	378	If SCDATMPT=2, impute 2; recode and sum the values
PLAN_A to PLAN_K (11 survey items)	HLTHPLN=1	2	10	70	Do not analyze – not relevant to RQ
DRNKAVG,	DRNKANY=1	1	26	136	DQ problems; removed from analysis
BINGE4 BINGE5	DRNKANY=1	1	26	137	DQ problems; removed from analysis
YESCARE_x (6 survey items)	CARE=1	2	19	172	Recode to 0/1 and sum the values
NOCARE_x (6 survey items)	CARE=2	2	19	262	Recode to 0/1 and sum the values
ASTHNOW	ASTHMA=1	0	16	311	Analysis problems with 0 variance; remove from analysis

SURGERY_x (11 survey items)	SURGERY=1	0	9	315	Recode and sum the values
SMOKDAY	SMOKE100=1	1	23	232	Analysis problems due to 0 variance; remove from analysis
STOPSMK	SMOKE100=1	1	23	348	Analysis problems due to 0 variance; remove from analysis
MJNOW	MJEVER=1	1	26	134	Remain

Table D4

Distribution of Item Completeness

Complete Percent	Number of Records	Percent of N	Cumulative Percent
100	139	33.3	33%
90-100	218	51.9	86%
< 90	60	13.2	100%

Table D5

Demographic Characteristics, Compared to Colorado

Survey Area	Dataset	All Colorado
Psychological Health[a]		
Contemplated Suicide in Last Year	36%	4%
Attempted Suicide in Last Year	10%	1%
History of Anxiety	53%	13%
General Health[a]		
Excellent	13%	21%
Very Good	34%	37%
Good	34%	29%
Fair	13%	10%
Poor	5%	3%
Income[a]		
< $25k	42%	24%
$25 - $50k	26%	24%
> $50k	32%	51%
Employment[b]		
Wage Earner	48%	51%
Self Employed	14%	17%
Student	13%	6%
Retired	5%	15%
Not Working	19%	11%
Education[b]		
Less than high school or graduate	12%	34%
Some college, tech, or associate degree	27%	33%
College degree	61%	33%
Race[c]		
Not White	16%	NA
White	84%	NA
Gender Identity[c]		
Transgender Male	24%	NA
Transgender Female	29%	NA
Transgender, Agender, No Gender, Other	11%	NA

Man	5%	NA
Woman	14%	NA
Gender Queer/Gender Fluid	17%	NA
Age Group[c]		
Age <= 24	23%	NA
Age 25 to 34	29%	NA
Age 35 to 44	20%	NA
Age 45 to 54	14%	NA
Age >= 55	15%	NA

Note. N=417.

[a] Source: OCEF, 2014.

[b] Source: OCEF, 2014. Re-computed for the analysis dataset categories.

[c] Source: Restructured item, calculated from the original dataset, comparison not available.

Table D6

Percent Suicidal Thought and Health Days

Survey Item		N	%	% Suicidal Thought	Avg. Health Days Score
	Overall	417		34.05	20.02
Race					
	Not White	65	15.6	50.77	19.96
	White	352	84.4	30.97	20.03
	ANOVA			$F(1)=9.76, p=\mathbf{.002}$	$F(1) = .005, p = .943$
	Power[a]			.876	.051
	Levene			$F(1,415) = 10.924, p = \mathbf{.001}$	$F(1,403) = .012, p = .912$
Hispanic Ethnicity					
	Hispanic	28	6.8	42.86	19.53
	Non-Hispanic	382	93.2	33.25	20.03
	ANOVA			$F(1) = 1.073, p = .301$	$F(1) =.139, p = .709$
	Power[a]			.176	.066
	Levene			$F(1,408) = 2.325, p = .128$	$F(1,397) = .006, p = .940$
Gender					
	Transgender Male	98	23.5	31.63	20.36
	Transgender Female	119	28.5	32.77	19.47
	Transgender, Agender, No Gender, Other	47	11.3	36.17	20.64
	Man	22	5.3	18.18	19.30
	Woman	59	14.1	47.46	19.39
	Gender Queer/Gender Fluid	72	17.3	31.94	20.79
	ANOVA			$F(5) = 1.560, p = .170$	$F(5) =.631, p = .676$
	Power[a]			.546	.230
	Levene			$F(5,411) = 5.471, p < \mathbf{.001}$	$F(5,399) = 3.095, p = \mathbf{.009}$
Age Group					

			Health Days Score	
Age <= 24	94	22.5	52.13	19.55
Age 25 to 34	121	29.0	23.97	20.20
Age 35 to 44	83	19.9	40.96	18.95
Age 45 to 54	57	13.7	28.07	21.51
Age >= 55	62	14.9	22.58	20.44
ANOVA			$F(4) = 6.699, p < .001$	$F(4) = 1.418, p = .227$
Power[a]			.993	.441
Levene			$F(4,412) = 13.722, p < .001$	$F(4,400) = 3.838, p = .004$

Note. Suicidal thought was a 'Yes' response to SCDTHNK. The Health Days Score was a weighted measure of the number of healthy days in the last month. Differences in group means were tested by SPSS GLM on the THS dataset, N=417.

[a] Observed Power for Corrected Model from GLM. GLM power values are comparable to G*Power (F Tests, ANOVA Fixed Effects, omnibus, one-way; Post hoc: compute achieved power; effect size was eta, not eta^2).

256

Table D7

THS Descriptives

	Min	Max	Mean	Variance	Skew	Std. Error	Kurtosis	Std. Error	k/se	K-S
PSY	.607	18	12.04	16.90	-.473	.123	-.700	.246	-2.846	.089[a]
SI	.818	6.652	3.87	1.95	-.008	.123	-.789	.246	-3.207	.051[b]
SMC	0	4	2.08	1.05	-.875	.123	.011	.246	0.045	.149[a]
Access	.25	5	3.30	1.33	-.207	.123	-.787	.246	-3.199	.092[a]
Age-Group	1	5	2.70	1.86	.378	.123	-1.065	.246	-4.329	.211[a]
Behavior	0	2.601	.40	.14	1.675	.123	5.031	.246	20.451	.174[a]
Disease	1	10	7.78	3.48	-.926	.123	.685	.246	2.785	.128[a]
Transition	.25	1.5	1.04	.19	-.801	.123	-.743	.246	-3.020	.316[a]

Note. N = 391, nonnormalized variables. Source: DESCRIPTIVES and EXAMINE. K-S=Kolmogorov-Smirnoff.
[a] df=391, *p* < .001
[b] df=391, *p* = .018

Table D8

Summary Regression Results and Significant Predictors, Model 1

Outcome	Adj. R^2	ANOVA	Durbin-Watson	Predictors	Std. Beta	*p* value	VIF	Observed Power[a]
PSY	.388	$F(7,383)=36.370$ $p < .001$	2.010					1.000
				SI	.269	**<.001**	1.297	1.000
				SMC	.140	**.002**	1.331	.865
				Access	.124	**.010**	1.457	.737
				Age-Group	.185	**<.001**	1.297	.983
				Behavior	-.219	**<.001**	1.093	1.000
				Disease	.299	**<.001**	1.206	1.000
SI	.256	$F(7,383)=20.202$ $p < .001$	1.896					1.000
				PSY	.328	**<.001**	1.518	1.000
				Access	.252	**<.001**	1.393	.999
SMC	.253	$F(7,383)=19.899$ $p < .001$	1.862					1.000
				PSY	.171	**.002**	1.625	.865
				Access	.255	**<.001**	1.352	1.000
				Transition	.346	**<.000**	1.037	1.000

Note. N = 391, normalized variables. Source: SPSS REGRESSION, Forced Entry. Model 1 was a dependent variable and seven covariates, which include the other dependent variables. Race and Gender-ID were excluded. VIF = variance inflation factor.
[a] From SPSS Procedure GLM Tests of Between-Subjects Effects.

Table D9

Levene's Test of Dependent Variables

	Gender-ID		Age-Group	
	Levene	*p*	Levene	*p*
PSY	.915	.477	1.627	.167
SI	2.571	**.026**	2.392	**.050**
SMC	1.580	.165[a]	7.131	**.000**

Note. Source: EXAMINE (EXPLORE). Levene's Test based on the median. N=391. Gender-ID: df1=5, df2=385. Age-Group: df1=4, df2=386
[a] The Levene test based on the mean was significant: $F(5,385) = 2.954$, $p = .012$.

Table D10

Factor Analysis for PSY

Factor	Variable	Communalities Extraction	MSA	Factor 1 Coefficient	Factor 2 Coefficient	Factor 3 Coefficient	Factor 4 Coefficient
1	ADDOWN	0.772	0.922	.220	0.074	0.036	-0.017
	ADFAIL	0.694	0.962	.183	0.075	0.036	-0.075
	ADPLEASR	0.702	0.94	.131	-0.026	-0.022	0.043
	MENTHLTH	0.665	0.954	.120	-0.012	-0.061	0.041
	ADEAT1	0.569	0.969	.107	-0.049	0.036	0.012
	ADSLEEP	0.519	0.966	.082	-0.031	0.06	0.004
	ADTHINK	0.546	0.972	.097	0.041	0.066	0.003
2	SCDATMPT	0.743	0.822	0.018	.702	0.003	-0.033
	SCDINJ	0.309	0.712	-0.002	.144	0.016	-0.018
	SCDTHNK	0.353	0.911	0.03	.078	0.055	-0.014
	ADMOVE	0.285	0.917	0.045	.069	0.036	-0.033
3	ADANXEV	0.621	0.86	0.01	0.015	.575	-0.015
	ADDEPEV	0.366	0.878	0.014	0.023	.224	-0.021
4	PHYSHLTH	0.727	0.851	-0.034	-0.074	-0.05	.523
	GENHLTH	0.602	0.919	0.027	0.018	0.065	.250
	POORHLTH	0.612	0.941	0.061	0.057	-0.029	.164
	ADENERGY	0.623	0.964	0.103	-0.044	0.037	.106
	QLACTLM	0.338	0.955	0.015	0.009	0.058	.082

Note. N = 391. MSA = Measures of Sampling Adequacy.

Table D11

Comparison of Factor Analysis and Summed PSY Variables

Dependent	Predictor	Adj. R^2	Bivariate Adj. R^2	Durbin-Watson	VIF	Coefficient *p* value
SI	Model	.207		1.835		
	PSY		.873		7.866	.092
	PSYF		.873		7.866	**.045**

Note. N = 391. PSY: summed variable, PSYF: factor analysis version.

Table D12

Factor Analysis for SI

Factor	Variable	Communalities Extraction	MSA	Factor 1 Coefficient	Factor 2 Coefficient
1	INCOME	.692	.598	.718	.017
	EDUCA	.177	.647	.128	.089
	EMPLOY	.158	.612	.105	.069
	MARITAL	.116	.646	.107	-.024
2	EXERANY	.541	.620	.074	.707

Note. N = 417. MSA = Measures of Sampling Adequacy.

Table D13

Factor Analysis for SMC

Variable	Communalities Extraction	MSA	Factor 1 Coefficient
CARE	.933	.629	.803
NOCARE	.660	.715	.144
YESCARE	.600	.727	.055
DELAY_A	.064	.678	.045

Note. N = 413, 1 Factor. MSA = Measures of Sampling Adequacy.

Table D14

Comparison of Factor Analysis and Summed SMC Variables

Dependent	Predictor	Adj. R²	Bivariate Adj. R²	Durbin-Watson	VIF	Coefficient p value
PSY	Model	.049		1.880		
	SMC		.752		4.040	.101
	SMCF		.752		4.040	.450

Note. N = 391. SMC: summed variable, SMCF = factor analysis.

Table D15

Cronbach's Standardized Alpha for Multi-Component Study Variables

	Components	Alpha Std.
PSY	18	.918
SI	5	.518
SMC	4	.784
ACCESS	5	.576
BEHAVIOR	3	.598
DISEASE	10	.663
TRANSITION	4	.778

Note. N = 391. Prior to normalization.

Table D16

Evaluation of Hypotheses

Hypothesis	Regression Std. Beta	GLM Pillai's Trace[a]	Bivariate Pearson Correlation[b]	Partial Pearson Correlation[c]	Conclusion
H1a: PSY - SI was positive	.269 $p < .001$[d]	1.977 $p = .038$	.451 $p < .001$	.297 $p < .001$	Accept: all relationships are significantly positive.
H1b: SMC – PSY was positive	.171 $p = .016$[e]	1.978 $p = .025$	.228 $p < .001$	.157 $p = .002$	Accept: all relationships are significantly positive.
H1c: SI - SMC was positive	-.022 $p = .662$[f]	1.988 $p = .001$	.119 $p = .018$	.024 $p = .643$	Reject; the relationship was negative and nonsignificant.

Note. For all tests, N = 391, normalized variables. For Regression, the standardized beta is reported. For GLM, Pillai's Trace is reported.

[a] Source: GLM Model 2 (three dependent variables and five covariates). Pillai's Trace reported for dependent pairs.

[b] Source: Table D17.

[c] df = 383, with five covariates and two control variables (Gender_ID and Race).

[d] Source: REGRESSION Forced Entry, Model 1 with PSY outcome, SI coefficient reported from Table D8.

[e] Source: REGRESSION Forced Entry, Model 1 with SMC outcome, PSY coefficient reported from Table D8.

[f] Source: REGRESSION Forced Entry, Model 1 with SI outcome, excluded SMC coefficient reported.

Table D17

Bivariate Correlations

		1	2	3	4	5	6	7	8	9	10
PSY[a]		1									
SI[a]		.451	1								
	Sig.	**<.001**									
SMC[a]		.228	.119	1							
	Sig.	**<.001**	**.018**								
ACCESS[a]		.388	.389	.351	1						
	Sig.	**<.001**	**<.001**	**<.001**							
AGEGRP[a]		.207	.174	.146	.284	1					
	Sig.	**<.001**	**.001**	**.004**	**<.001**						
BEHAVIOR[a]		-.348	-.185	-.056	-.266	-.119	1				
	Sig.	**<.001**	**<.001**	.273	**<.001**	**.019**					
DISEASE[a]		.278	.140	-.065	.001	-.348	-.056	1			
	Sig.	**<.001**	**.006**	.202	.989	**<.001**	.271				
TRANSITION[a]		.000	-.075	.365	.038	.137	.017	-.122	1		
	Sig.	.997	.139	**<.001**	.458	**.007**	.731	**.016**			
GENDER_ID[b]		.040	.059	-.128	-.020	.020	-.068	.085	-.510	1	
	Se	.053	.053	.053	.054	.053	.053	.053	.036		
	z	0.755	1.113	**-2.415**	-0.370	0.377	-1.283	1.604	**-14.167**		
RACE[b,c]		.056	.058	.128	.155	.023	.017	.078	-.049	-.017[c]	1
	Se	.075	.076	.073	.074	.078	.078	.074	.079	.081	
	z	0.747	0.763	1.753	**2.095**	0.295	0.218	1.054	-0.620	-0.210	

Note. N = 391. Pearson correlations for normalized variables (except GENDER_ID and RACE), df = 389. Polyserial/polychoric correlations (SPSS HETCOR) used for GENDER_ID and RACE;
[a] Pearson correlations from SPSS procedure CORRELATIONS.
[b] Polyserial correlations (except GENDER_ID and RACE) from SPSS procedure HETCOR, which does not report significance. Standard error (se) from HETCOR and the calculated z value (correlation/se) are reported instead. Significance occurs when z > |1.96|.
[c] The RACE – GENDER_ID correlation was polychoric from HETCOR.

Table D18

Dependent Variable Correlations by GENDER_ID and RACE, Model 1

GENDER_ID	RACE	N (df)	PSY - SI	SMC-PSY	SI-SMC
Transgender Male	Not White	13 (6)	-.578	-.296	-.002
	White	79 (72)	**.357***	.217	.040
Transgender Female	Not White	17 (10)	.563	**-.724***	-.257
	White	95 (88)	**.300***	.185	.121
Transgender, Agender, No Gender, Other	Not White	10 (3)	.701	.800	.276
	White	35 (28)	.154	**.384***	-.198
Man	Not White	2 (na)	Na	Na	Na
	White	18 (11)	.196	-.135	.203
Woman	Not White	9 (2)	.862	.151	.506
	White	44 (37)	.140	-.255	-.052
Gender Queer/Gender Fluid	Not White	10 (3)	-.541	.831	-.069
	White	59 (52)	.047	**.299***	-.054

Note. N = 391, normalized variables. Source: PARTIAL CORR with five covariates stratified by Gender_ID and Race (GR).

* $p < .05$

Table D19

Significant Covariates of Study Variables by GENDER_ID, Model 1

Dependent	Transgender Male (n=92)	Transgender Female (n=112)	Transgender, Agender, No Gender, Other (n=45)	Man (n=20)	Woman (n=53)	Gender Queer Gender Fluid (n=69)
PSY	SI ACCESS DISEASE	SI AGEGRP BEHAVIOR[a] DISEASE	SMC TRANSITION[a]	ACCESS	BEHAVIOR[a]	SMC AGEGRP BEHAVIOR[a] DISEASE
SI	PSY	PSY ACCESS DISEASE	ACCESS	None	None	ACCESS AGEGRP
SMC	ACCESS TRANSITION	ACCESS BEHAVIOR[a] TRANSITION	PSY ACCESS TRANSITION	None	ACCESS	PSY ACCESS TRANSITION
ACCESS	BEHAVIOR[a] PSY SMC	SI SMC	AGEGRP SI SMC	PSY	SMC	SI
BEHAVIOR	ACCESS[a]	PSY[a] SMC	None	TRANSITION[a]	PSY[a]	PSY[a]
DISEASE	PSY	AGEGRP[a] PSY SI	None	AGEGRP[a]	AGEGRP[a]	AGEGRP[a] PSY
TRANSITION	SMC	SMC	PSY[a] SMC	BEHAVIOR[a]	None	SMC

Note. N = 391, normalized variables. Significance level = .05. Source: GLM, stratified by GENDER_ID.
[a] negative.

Table D20

Summary Regression Results with Significant Predictors, Model 2

Outcome	Adj. R^2	ANOVA	Durbin-Watson	Predictors	Std. Beta	*p* value	VIF	Observed. Power[a]
PSY	.316	$F(5,385)=37.040$ $p < .001$	2.001					
				ACCESS	.263	$< .001$	1.166	1.000
				AGEGRP	.224	$< .001$	1.271	.997
				BEHAVIOR	-.233	$< .001$	1.086	1.000
				DISEASE	.343	$< .001$	1.166	1.000
SI	.188	$F(5,385)=19.062$ $p < .001$	1.904					1.000
				ACCESS	.333	$< .001$	1.166	1.000
				AGEGRP	.144	**.005**	1.271	.799
				DISEASE	.176	$< .001$	1.166	.945
SMC	.238	$F(5,385)=25.413$ $p < .001$	1.845					
				ACCESS	.347	$< .001$	1.166	1.000
				TRANSITION	.349	$< .001$	1.027	1.000

Note. N = 391, normalized variables. Source: SPSS REGRESSION, Forced Entry. Model 2 was a dependent variable and five covariates. VIF = variance inflation factor.
[a] From SPSS Procedure GLM Tests of Between-Subjects Effects.

Table D21

Significant Moderators, Model 1

Outcome	Predictor	Moderator	Predictor x Moderator Interaction[a]		Outcome-Moderator Coefficient[b]	
			Coefficient	*p* Value	Coefficient	*p* Value
PSY	SI	DISEASE	-.082	**.008**	.278	**< .001**
SMC	PSY	ACCESS	-.113	**.020**	.309	**< .001**
SI	PSY	TRANSITION	.088	**.042**	-.097	**.036**

Note. N = 391. Normalized variables. Source: Hayes' PROCESS Model Number 1 with covariates that include one dependent variable.
[a] Coefficient of interaction term (predictor x moderator).
[b] Coefficient of moderator in the regression.

Table D22

Significant Mediators, Model 1

Outcome	Predictor	Total Indirect Effect	SE	Confidence Intervals[a]	TIE/SE	Mediator	Sobel's Test Of Indirect Effect	*p* value
PSY	SI	0.1555	.0283	[.1042, .2151]	5.49	ACCESS	.0430	**.016**
						AGEGRP	.0321	**.009**
						BEHAVIOR	.0390	**.006**
						DISEASE	.0414	**.020**
PSY	SMC	.1234	.0229	[.0834, .1744]	5.39	ACCESS	.0399	**.018**
SMC	PSY	.0638	.0208	[.0300, .1134]	3.07	ACCESS	.0638	**.002**
SMC[b]	SI	.0776	.0202	[.0431, .1257]	3.84	ACCESS	.0776	**< .001**
SI	PSY	.0588	.0180	[.0290, .1005]	3.27	ACCESS	.0588	**.001**
SI[b]	SMC	.0757	.0196	[.0408, .1183]	3.86	ACCESS	.0757	**< .001**

Note. N = 391. Normalized variables. Source: Hayes' PROCESS Model Number 4 with covariates that include one dependent variable. X = Predictor, Y = Outcome. SE = standard error. TIE/SE = Total Indirect Effect / SE.
[a] Confidence intervals are from BootLLCI and BootULCI. All confidence intervals exclude 0.
[b] The SMC – SI relationship was not significant.

Table D23

Effect (R^2) Comparison for the Dependent Variables, Model 2

Outcome	Regression[a] Adj. R^2	GLM Adj. R^2	AMOS SMC[b]
PSY	0.316	0.316	0.198
SI	0.188	0.188	0.248
SMC	0.238	0.238	0.325

Note. N = 391, normalized variables. The beta weights for each test and the predictors are the same as the Regression results in Table D20.
[a] Source: SPSS REGRESSION, Forced Entry.
[b] SMC = Squared Multiple Correlation, which is equivalent to the Adjusted R^2.

Table D24

Model 2 AMOS Covariate Correlations, Model 2

Covariate Pair		Estimate	SE	CR	*p* value
ePSY[a]	eSI[a]	0.297	0.046	6.441	**< .001**
ePSY[a]	eSMC[a]	0.156	0.049	3.147	**0.002**
eSI[a]	eSMC[a]	0.025	0.051	0.497	0.619
ACCESS	TRANSITION	0.038	0.051	0.743	0.458
ACCESS	AGEGRP	0.283	0.053	5.39	**< .001**
BEHAVIOR	TRANSITION	0.017	0.051	0.345	0.73
BEHAVIOR	ACCESS	-0.265	0.052	-5.076	**< .001**
BEHAVIOR	AGEGRP	-0.119	0.051	-2.332	**0.02**
DISEASE	BEHAVIOR	-0.056	0.051	-1.101	0.271
DISEASE	ACCESS	0.001	0.051	0.014	0.989
DISEASE	AGEGRP	-0.347	0.053	-6.485	**< .001**
DISEASE	TRANSITION	-0.122	0.051	-2.39	**0.017**
TRANSITION	AGEGRP	0.137	0.051	2.68	**0.007**

Note. N = 391, normalized variables. Estimate = covariance or correlation (covariance = correlation in normalized variables). SE = standard error. CR = critical ratio (correlation/se).
[a] AMOS error term for any unmodeled variance.

Table D25

Model 2 AMOS Dependent Variable Correlations, Model 2

Dependent Variables		Estimate	SE	CR	*p*
From	To				
ePSY[a]	PSY	0.821	0.029	27.928	**< .001**
eSI[a]	SI	0.894	0.032	27.928	**< .001**
eSMC[a]	SMC	0.866	0.031	27.928	**< .001**
ACCESS	PSY	0.263	0.045	5.85	**< .001**
AGEGRP	PSY	0.223	0.047	4.758	**< .001**
BEHAVIOR	PSY	-0.233	0.043	-5.367	**< .001**
DISEASE	PSY	0.343	0.045	7.64	**< .001**
TRANSITION	PSY	0.005	0.042	0.125	.900
ACCESS	SI	0.333	0.049	6.812	**< .001**
AGEGRP	SI	0.144	0.051	2.822	**.005**
BEHAVIOR	SI	-0.068	0.047	-1.434	.151
DISEASE	SI	0.176	0.049	3.593	**< .001**
TRANSITION	SI	-0.085	0.046	-1.842	.065
ACCESS	SMC	0.347	0.047	7.311	**< .001**
AGEGRP	SMC	-0.004	0.049	-0.085	.932
BEHAVIOR	SMC	0.029	0.046	0.628	.53
DISEASE	SMC	-0.022	0.047	-0.467	.64
TRANSITION	SMC	0.349	0.044	7.847	**< .001**

Note. N = 391, normalized variables. Estimate = covariance or correlation (covariance = correlation in normalized variables). SE = standard error. CR = critical ratio (correlation/se).
[a] AMOS error term for any unmodeled variance.

Table D26

Model 2 AMOS Fit statistics, Model 2

AMOS Model	CMIN/DF	RMSEA
Independence	18.803	0.214 [.198, .23]

Note. N = 391, normalized variables. The independence model assumes no correlation.

Table D27

Second Order Factor Analysis

Variable	Factor	Communalities Extraction	MSA	Factor 1 Coefficient	Factor 2 Coefficient	Factor 3 Coefficient
PSY	1	.550	.636	.451	.058	-.066
SI	1	.386	.684	.286	-.014	-.036
ACCESS	1	.270	.720	.157	-.061	.002
BEHAVIOR	1	.158	.712	-.133	.019	-.002
TRANSITION	1-2	.178	.558	-.046	-.046	.040
DISEASE	2	.607	.487	.128	.535	-.085
AGEGRP	2	.537	.540	.179	-.423	.050
SMC	3	.934	.584	.057	.004	.939

Note. N = 391, normalized variables. KMO = .698. Bartlett's *p* < .001.

Table D28

Factor Analysis for ACCESS

Factor	Variable	Communalities Extraction	MSA	Factor 1 Coefficient	Factor 2 Coefficient
1	CHECKUP	.997	.525	.980	.087
	MEDCOST	.643	.569	.115	.641
2	DELAY_J	.352	.589	.033	.261
	LASTDEN	.088	.625	-.017	.071
	CHOLCHK	.221	.539	-.007	.054

Note. N = 417. MSA = Measures of Sampling Adequacy.

Table D29

Factor Analysis for DISEASE

Factor	Variable	Communalities Extraction	MSA	Factor 1 Coefficient	Factor 2 Coefficient	Factor 3 Coefficient
	BPHIGH	.410	.733	.373	.009	.115
	TOLDHI	.334	.739	.286	.013	.116
1	BMICAT	.200	.762	.208	-.017	-.013
	DIABETES	.193	.778	.190	-.005	.047
	HAVARTH	.185	.745	.083	-.012	.188
2	ASTHMA	.735	.533	.033	-.495	-.030
	ASTHNOW	.736	.545	.024	-.486	.151
	RMVTETH	.282	.713	.051	.015	.317
3	CHCCOPD	.237	.700	-.006	-.013	.266
	USEEQUIP	.177	.743	.081	-.019	.191

Note. N = 417. MSA = Measures of Sampling Adequacy.

Appendix E: Figures

Figure E1. Significant Dependent and Covariate Relationships, AMOS Model 2
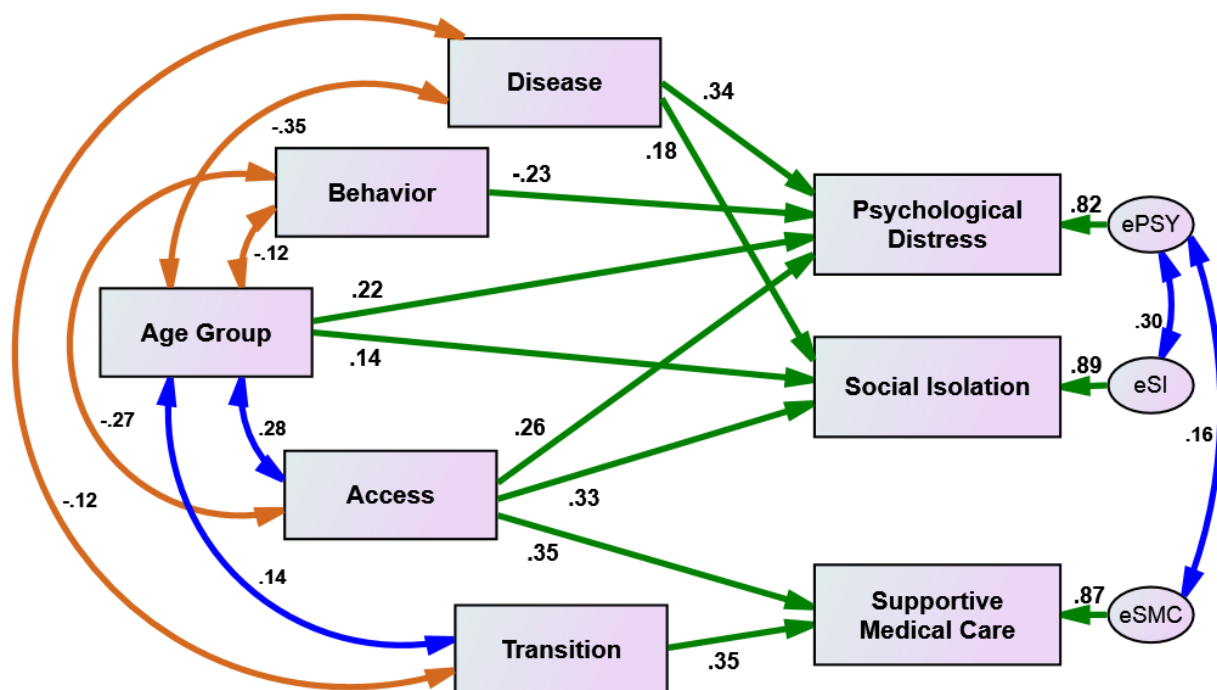

Figure E1. SEM of Model 2. The dark green lines are the significant correlations of the covariates to the dependent variables. The blue lines represent the significant positive correlations among the covariates and the brown lines represent the significant negative correlations among the covariates. Psychological Distress and Social Isolation are reverse scored: higher values represent diminished of psychological distress and diminished social isolation. See Tables D24 and D25 for the coefficient tabulations.