COGNITIVE VULNERABILITY PROFILES AND SUICIDE RISK IN NEW ZEALAND ADULTS: A CLUSTER ANALYSIS

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The current study investigated the association between cognitive vulnerability (cognitive distortions and dysfunctional attitudes) and suicide risk using hierarchical cluster analysis (HCA) and multiple correspondence analysis (MCA). Ninety-two adults aged 18-35 years from the community completed measures of dysfunctional cognitive processing, psychological well-being, and suicide risk. We observed three distinct groups, a high vulnerability group, a low vulnerability group, and an ambivalent vulnerability group. More than half of the respondents (60%) were in the high and low vulnerability groups, demonstrating the expected congruent combination of dysfunctional cognitive processing and suicide risk: individuals exhibiting high numbers of cognitive errors and dysfunctional attitudes screened positive for suicide risk and vice versa. These findings underscore the importance of directly addressing these faulty or biased ways of thinking when working with individuals at risk of suicide to reduce self-harm and suicidal behaviors.

Keywords: Cognitive distortions; Dysfunctional attitudes; Hierarchical cluster analysis; Suicide/suicide risk.

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Suicide is a significant public health problem, resulting in a major social and economic burden for communities with devastating impacts on families. In Aotearoa New Zealand, in 2016, 553 people died by suicide, a rate of 11.3 per 100,000 (Ministry of Health, 2019) and rates of suicide among youth are the highest in the developed world (World Health Organization, 2017). Given the high prevalence and serious impact of suicide, research has focused on examining risk, vulnerability, and maintenance factors, with the ultimate objective of improving preventative and treatment interventions.

Suicidal behavior, including suicide and suicide attempts, is associated with a consistent and wide-ranging series of risk factors. These include any psychiatric disorder, and in particular mood disorders and substance use disorders, a history of suicide attempts, social disadvantage, and family adversity defined by neglect, family discord, and experiences of physical and/or sexual abuse (Beautrais, 2003; Beautrais et al., 1996; Cavanagh et al., 2003; Fergusson et al., 2000; Nock et al., 2008). Despite the large body of empirical research that has been devoted to identifying the risk factors associated with suicidal behavior in young people and adults, the majority of research has examined isolated risk factors, which on their own have

limited usefulness for understanding suicidal behavior. Nonetheless, several cognitive vulnerabilities, including cognitive distortions (Fazakas-DeHoog et al., 2017; Jager-Hyman et al., 2014) and dysfunctional attitudes (Ellis & Ratliff, 1986; Jekkel & Tringer, 2004) have emerged as possible mechanisms underlying the development and maintenance of suicidal behavior.

Cognitive distortions are defined as systematic errors in processing through which perceptions and interpretations of experience are distorted, in response to ambiguous or negative life events (Beck et al., 1979). Beck (1963, 1967) described several specific cognitive errors, including *catastrophizing* (anticipating that the worst possible outcome of an experience or event will be catastrophic), *overgeneralization* (assuming that a single negative outcome of an experience will apply to similar experiences in the future), *personalization* (taking excessive personal responsibility for the outcomes of negative events), and *selective abstraction* (selectively focusing on the negative aspects of an event or situation). Dysfunctional attitudes are maladaptive and rigid beliefs held about oneself, the future, and the world (negative cognitive triad) that predispose people toward negative interpretations of life events. Examples of dysfunctional attitudes include "My value as a person depends greatly on what others think of me" or "If I don't set the highest standards for myself, I am likely to end up a second-rate person." These beliefs will influence the perception of circumstances in one's life, leading to biased interpretations and exaggerated emotional responses in the face of stress (Beck, 1987).

Cognitive-behavioral models suggest suicidal behavior emerges from reciprocal relations among learned maladaptive cognitive, affective, and behavioral responses to stressors among individuals with predisposing vulnerabilities (Spirito et al., 2011). In the face of a negative stressor (such as interpersonal conflict), cognitive errors (e.g., catastrophizing, personalization) and negative views of self and the future may occur. Indeed, early research on cognition and suicide found that individuals who attempted suicide were more likely to exhibit cognitive rigidity, dichotomous thinking, overgeneralization, and selective abstraction when compared to both clinical and normal controls (e.g., Neuringer, 1961; Prezant & Neimeyer, 1988). Ellis and Ratliff (1986) found that suicidal psychiatric inpatients presented significantly more dysfunctional attitudes than nonsuicidal inpatients. Another study (Brent et al., 1990) that examined adolescents with a mood disorder in an inpatient setting, found higher catastrophizing, personalization, selective abstraction, overgeneralization, and total cognitive errors in those who were suicidal compared to nonsuicidal adolescents with a mood disorder.

More recently, Jekkel and Tringer (2004) found significant differences in nine items of the Dysfunctional Attitude Scale (DAS; Weissman & Beck, 1978) between suicidal and nonsuicidal patients with a feeling of hopelessness and a lack or loss of control predicting suicidal behavior. Jager-Hyman and colleagues (2014) found that individuals who had recently attempted suicide were more likely to engage in thinking characterized by cognitive distortions than their psychiatric controls did. The association between cognitive distortions and suicide attempt status remained significant when controlling for depression and hopelessness suggesting the unique association between cognitive distortions and suicide attempt status. Fazakas-DeHoog et al. (2017) assessed the integrity of cognitive distortions and cognitive deficits model of suicidal thinking and showed that cognitive distortions (hopelessness and negative evaluations of self and future) had a direct effect on suicidal ideation in a large sample of undergraduate students. Finally, several recent influential theories have implicated cognitive distortions in the development and maintenance of suicidal ideation and behaviors (e.g., Joiner, 2005; Rudd, 2004; Wenzel et al., 2009). In summary, the research has suggested that maladaptive cognitive processes, including cognitive distortions and dysfunctional attitudes, are related to suicidal behavior. These findings indicate that assessment of suicidal behaviors and

TPM Vol. 29, No. 2, June 2022
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subsequent treatment should target cognitive distortions, supporting cognitive-behavioral therapies as a recommended form of treatment (Nock et al., 2014).

The present study aimed to further investigate the associations between cognitive distortions, dysfunctional attitudes, and suicide risk in adults by using a different methodological approach. Previous research focusing on cognitive vulnerability to suicidal behavior has adopted a variable approach, studying the association between discrete cognitive variables and previous suicide attempts (Ellis & Ratliff, 1986; Jager-Hyman et al., 2014; Jekkel & Tringer, 2004). While these studies provide valuable information, they have not evaluated the effects of cognitive vulnerability profiles and the possible impact of multiple risks on suicidal behavior. In this study, cluster analysis was conducted to identify groups of New Zealand adults with similar cognitive vulnerability profiles and their relation to suicide risk. Specifically, hierarchical cluster analysis (HCA) was used to group respondents into homogeneous profiles based on their responses to two cognitive measures. By combining individuals with a similar profile of scores on a set of measured variables, multiple correspondence analysis (MCA) allowed for the interaction of all the variables, resulting in a more parsimonious model and a more holistic way of considering suicide risk. Although MCA is mainly used as an exploratory technique, it can be a particularly powerful one because it "uncovers" groupings of variable categories in the dimensional spaces, providing key insights on relationships between categories (i.e., multivariate treatment of the data through simultaneous consideration of multiple categorical variables), without needing to meet assumptions requirements such as those in other techniques widely used to analyze categorical data (e.g., Chi-square analysis, Fischer's exact test, G-statistics, and ratio test) (Aktürk et al., 2007). This study aimed to evaluate potential cognitive vulnerability profiles and their possible impact on suicide risk and addressed the following research questions: (1) Do identifiable clusters or cognitive vulnerability profiles exist in New Zealand adults aged 18-35 years? (2) Do the identified clusters differ on demographic, mental health, and self-esteem variables? and (3) Based on the MCA technique, what are the combined associations among all the variable categories? The understanding of these processes is crucial for prevention and specific therapeutic interventions.

METHOD

Procedure and Participants

A flyer advertising the project was posted on university online learning platforms, university notice boards, and other public areas. The study design involved an anonymous online survey, administered using the online survey software, Qualtrics. The survey included a participant consent question and participants who did not give consent were redirected to the last page of the survey and thanked for their time. The survey took approximately 30 minutes to complete. Cultural consultation was ongoing throughout the research project to ensure its cultural appropriateness taking into account the diverse ethnic characteristics among adults in New Zealand. Participation was voluntary and anonymous. Participants were given a list of community mental health support resources and were advised to seek psychological support in the event that they experienced distress due to the nature of certain questions. The study was approved by the Human Research Ethics Committee of the university.

Of 125 potential participants, eight did not consent to participate (no reason was provided) and 25 participants were excluded from the study analyses due to missing data on various measures. The final sample consisted of 92 adults, 14 men and 78 women. The age of the participants ranged from 18 to 35 years with a mean age of 26.03 years (SD = 5.43). Eighteen to 24-year-olds comprised 40% of the sample and 55% were university students. The ethnic composition was 79% New Zealand European, 5.5% Māori (the

indigenous people of New Zealand), 5.5% Asian, and 10% of other ethnicities. Ethnicity was then categorized for multivariate analyses as two binary variables, each with values 0 or 1: New Zealand European, and other. Seventy-five (82%) participants identified their sexual orientation as heterosexual, 10 (11%) as bisexual, five (5.5%) as gay/lesbian, one as questioning, and one as pansexual. Sexual orientation was also categorized for multivariate analyses as two binary variables: Heterosexual, and other.

Measures

Cognitive Distortions Scale (CDS; Covin et al., 2011). The CDS is a 20-item self-report scale developed by Covin and colleagues in 2011 to measure 10 cognitive distortions (mindreading, catastrophizing, all-or-nothing thinking, emotional reasoning, labeling, mental filter, overgeneralization, personalization, "should" statements, minimizing the positive) using a 7-point Likert scale (1 = *never*, 7 = *all the time*). Each cognitive distortion is rated in both interpersonal and achievement domains. In the original study, the CDS emerged as a one-factor (unitary) scale with good internal consistency (Chronbach's α = .85). In the present study, Cronbach's alpha for the total score was .93.

Dysfunctional Attitude Scale (DAS; Weissman & Beck, 1978). The DAS is a 40-item self-report scale in which participants rate the degree to which they agree with various value and belief statements considered to be dysfunctional (e.g., "It is difficult to be happy unless one is good-looking, intelligent, rich and creative") on a 7-point Likert scale (7 = *totally agree*, 1 = *totally disagree*). The range of possible scores is 40 to 280, with higher scores indicating a large endorsement of dysfunctional attitudes (Weissman & Beck, 1978). Internal consistency and test-retest reliability were satisfactory in different samples (e.g., Cane et al., 1986; Oliver & Baumgart, 1985). In the present study, Cronbach's alpha for the total score was .94.

Patient Health Questionnaire for Depression and Anxiety (PHQ-4; Kroenke et al., 2009). The PHQ-4 is an ultra-brief screening tool for depression and anxiety. The PHQ-4 combines two validated two-item screeners. Total score is determined by adding together the scores for the four items, which can be interpreted as normal (0-2), mild (3-5), moderate (6-8), and severe (9-12) (α = .85).

Rosenberg's Self-Esteem Scale (RSES; Rosenberg, 1965). The RSES is a 10-item self-report scale designed to measure global self-esteem. Participants rate each statement based on how they generally feel about themselves on a 4-point scale (0 to 3), ranging from *strongly agree* to *strongly disagree.* Higher scores indicate a greater degree of self-esteem. The RSES has demonstrated adequate test-retest reliability, internal consistency, and concurrent validity (Rosenberg, 1965). In the present study, Cronbach's alpha coefficient of internal consistency for the total score was .93.

Ask Suicide Screening Questions (ASQ; Horowitz et al., 2012). The ASQ instrument comprises four yes/no questions designed to identify youth at risk for suicide. It was developed in three pediatric emergency departments for implementing routine suicide screening among youth. The questions assess major facets of established risk factors for completed suicide, namely, current thoughts of being better off dead, current wish to die, current suicidal ideation, and past behavior. A positive response to any of the questions is considered a positive screen for suicide. ASQ responses were categorized for multivariate analyses as two binary variables: Positive screen for suicide risk and no suicide risk. In the current study, 38 (41.3%) adults provided a positive response to at least one of the four ASQ questions, and thus screened positive for suicide risk. This high number of participants screening positive for suicide risk may be explained by our relying on a convenience sample, which may have led to an over-representation of particular groups. On the other hand, this high number is somewhat consistent with the high rate of completed suicide among young New Zealanders

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(Ministry of Health, 2019). The ASQ has demonstrated high sensitivity and negative predictive value (Horowitz et al., 2012). In the present study, Cronbach's alpha for the total score was .65.

Data Analysis

Data analysis was based on HCA and MCA in two steps (Chadjipadelis, 2015). Cluster analysis is an exploratory, multivariate procedure that aims to classify a sample of respondents based on a set of measured variables into some distinct groups so that the respondents with a similar profile of scores are placed in the same group. This methodology has an advantage over others because it identifies groups that exist in the population without imposing a categorization based on artificial cut-off scores. Further, learning how adults may be classified based on patterns of cognitive errors and dysfunctional attitudes is of particular interest.

In the first step, HCA was used to assign respondents into distinct groups according to their response patterns on the Cognitive Distortions Scale (i.e., responding "never," "sometimes," or "all the time") and the Dysfunctional Attitude Scale (i.e., responding "disagree," "neither/nor," or "agree"). This was necessary because cluster analysis requires either dichotomous or interval-level data, thus, ordinal measures of cognitive distortions and dysfunctional attitudes were reduced to the lower level of measurement. The main output of HCA was a group or cluster membership variable, which reflects the partitioning of the respondents into groups. Furthermore, for each group, the contribution of each question (variable) to the group formation was investigated to reveal a typology of behavioral patterns. To determine the number of clusters, we used the empirical criterion of the change in the ratio of between-cluster inertia to total inertia, when moving from a partition with r clusters to a partition with r-1 clusters (Papadimitriou & Florou, 1996).

In the second step, the two group membership variables of cognitive distortions and dysfunctional attitudes, obtained from the first step and the remaining variables (i.e., gender, ethnicity, sexual orientation, self-esteem, anxiety, depression, and suicide risk) were jointly analyzed via MCA, a data analysis technique for nominal categorical data, used to detect and represent underlying structures on a Burt table derived from these variables (Greenacre, 2007). The Burt table is a symmetrical, generalized contingency table of all two-way cross-tabulations between the categorical variables and has an analogy to the covariance matrix of continuous variables. The main MCA output is a set of orthogonal axes or dimensions that summarize the associations between variable categories into a space of lower dimensionality, with the least possible loss of the original information contained in the Burt table. MCA preserves the categorical nature of the variables; the analysis is conducted at the level of the response categories themselves and not at the variable level. HCA is then applied to the coordinates of variable categories (levels) on the factorial axes. Note that this is now a clustering of variables instead of respondents. Through MCA, we get behavioral patterns (i.e., groups of variable categories), which reveal abstract discourses.

RESULTS

Analysis for the Cognitive Distortions Scale and for the Dysfunctional Attitude Scale

The HCA confirmed the expected categorization of responses in both the Cognitive Distortions Scale and the Dysfunctional Attitude Scale. The HCA for the twenty CDS statements revealed three groups of respondents, labeled CDS-A, CDS-B, and CDS-C, and their connection to each statement. According to

the loadings, the first group (i.e., CDS-A; $n = 28$) consisted of respondents choosing "never" (i.e., scoring 1 or 2 on the 7-point Likert scale) when replying to the 20 questions, the second group (i.e.., CDS-B; $n = 28$) of respondents choosing "sometimes" (scoring 3, 4, or 5), and the third group (CDS-C; $n = 36$) of respondents choosing "all the time" (scoring 6 or 7). In a similar procedure, the analysis for the Dysfunctional Attitude Scale revealed four groups, labeled DAS-A, DAS-B, DAS-C, and DAS-D. According to the loadings, group DAS-A ($n = 28$) consists of respondents choosing "disagree" (1-2) to the 40 questions, group DAS-B ($n = 31$) of respondents choosing "neutral" (3-5), and groups DAS-C and DAS-D of 25 and 8 respondents, respectively, choosing mostly "agree/neutral" and "agree" (6-7).

Cluster Selection

The two group membership variables obtained from the first step according to respondents' response patterns on the Cognitive Distortions Scale and the Dysfunctional Attitude Scale and the variables gender, ethnicity, sexual orientation, self-esteem, anxious/depressed symptoms, and suicide risk, were analyzed via HCA. HCA was applied to the matrix where the rows represent individuals and the columns are dummy variables representing categories of the variables (Greenacre, 2007). This matrix was transformed into a 0-1 matrix, where each variable was replaced by a set of 0-1 variables, one for each variable category, being ascribed value 1 if the corresponding category had been observed, and 0 otherwise. To determine the number of clusters, we used the empirical criterion of the change in the ratio of between-cluster inertia to total inertia, when moving from a partition with r clusters to a partition with r-1 clusters (Papadimitriou & Florou, 1996). Next, we calculated cluster weights, that is, the percentage of respondents that were classified within each cluster, and investigated the variables that characterized each cluster via a series of Chi-square tests with a significance level of 5%. Examination of competing cluster models indicated that a three-cluster model provided the best separation of cases into groups. Figure 1 presents an analysis of the dendrogram, indicating that the sample could be optimally divided into three groups of respondents (nodes labeled 180, 179, 181). The analysis also revealed the connection of the groups to each variable level (category). Results are presented in Table 1, columns (3), (4), (5).

Group 1: High Vulnerability

The first cluster of respondents ($n = 17$; 19% of the total sample) was characterized by higher values of cognitive distortions and dysfunctional attitudes than the other two groups and reported low self-esteem, and moderate to severe anxious/depressed symptoms. Regarding suicide risk, all respondents in this group provided a positive response to at least one suicide-related behavior and thus screened positive for suicide risk.

Group 2: Low Vulnerability

The second cluster ($n = 38$; 41%) presented relatively few cognitive distortions and adaptive functional attitudes. Ratings on the RSE and PHQ-4 revealed self-esteem in the high range and anxious/depressed symptoms in the normal range. Group 2 screened negatively for suicide risk.
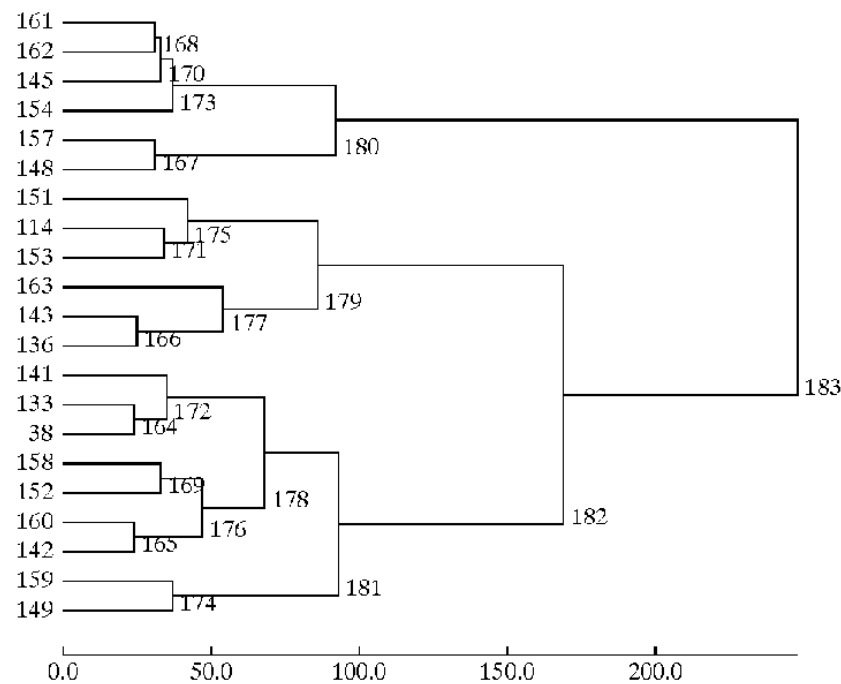
FIGURE 1
Dendrogram for individuals according to HCA revealing three groups
(nodes 180, 179, 181; the X axis shows the loss of inertia).

TABLE 1
Presentation of the results from MCA and HCA analysis [columns (3) to (6)] and frequencies distribution
[columns (7) to (9)] for the variable categories [column (1)]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	Labels	Group 1: HighV $n = 17$	Group 2: LowV $n = 38$	Group3: AmbiV $n = 37$	Clusters of variables	Suicide risk	No risk	N %
GENDER1	Male		X		B1	35.71%	64.29%	15.22%
GENDER2	Female				B2	42.31%	57.69%	84.78%
ETHNIC1	New Zealand				B2	40.85%	59.15%	77.17%
ETHNIC2	Other				A1	42.86%	57.14%	22.83%
SEXOR1	Heterosexual		X		B1	29.33%	70.67%	81.52%
SEXOR2	Other	X		X	A1	94.12%	5.88%	18.48%
ASQ1	Suicide risk	X			A1	100.00%		41.31%
ASQ2	No risk		X		B1		100.00%	58.69%
CDS-A	Never		X		B1	17.86%	82.14%	30.43%
CDS-B	Sometimes			X	B2	39.29%	60.71%	30.43%
CDS-C	All the time	X			A1	61.11%	38.89%	39.13%

(Table 1 continues)

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Table 1 (continued)

(1) Variables	(2) Labels	(3) Group 1: HighV n = 17	(4) Group 2: LowV n = 38	(5) Group3: AmbiV n = 37	(6) Clusters of variables	(7) Suicide risk	(8) No risk	(9) N %
DAS-A	Disagree		X		B1	21.43%	78.57%	30.43%
DAS-B	Neutral			X	B2	41.94%	58.06%	33.70%
DAS-C	Agree/Neutral			X	A1	48.00%	52.00%	27.17%
DAS-D	Agree	X			A2	87.50%	12.50%	8.70%
RSES-A	Low	X			A2	86.67%	13.33%	16.30%
RSES-B	Normal			X	A1	56.52%	43.48%	25.00%
RSES-C	High		X		B1	22.22%	77.78%	58.70%
PHQ4-A	Normal		X		B1	27.91%	72.09%	46.74%
PHQ4-B	Mild			X	B2	41.67%	58.33%	26.09%
PHQ4-C	Moderate	X			A1	68.75%	31.25%	17.39%
PHQ4-D	Severe	X			A2	55.56%	44.44%	9.78%

Note. HighV = high vulnerability; LowV = low vulnerability; AmbiV = ambivalent vulnerability. SEXOR = sexual orientation; ASQ = Ask Suicide Screening Questions; CDS = Cognitive Distortions Scale; DAS = Dysfunctional Attitude Scale; RSES = Rosenberg's Self-Esteem Scale; PHQ4 = Patient Health Questionnaire for Depression and Anxiety. Chi-square statistically significant associations between variables and HighV, LowV, and AmbiV groups are represented graphically with an X to ease the interpretation of the structures in the data.

Group 3: Ambivalent Vulnerability

The third cluster of respondents ($n = 37$; 40%) was distinguished by moderate numbers of cognitive distortions and mostly "neutral" and/or "agree" responses on dysfunctional attitudes. RSE scores revealed a level of self-esteem in the normal range and PHQ-4 scores identified anxious/depressed symptoms in the mild range.

Cluster Comparisons

Demographic Variables

Significant differences were found between the groups in gender and sexual orientation. Group 1: adults in the high vulnerability group were more likely to identify their sexual orientation as bisexual, gay/lesbian, and/or questioning, reported as "other" for HCA. Group 2: adults in the low vulnerability group were more likely to identify as heterosexual and were more likely to be male. No significant differences were found between the three groups for ethnicity.

Multiple Correspondence Analysis (MCA)

All existing variables were jointly analyzed via MCA on the so-called Burt table (Greenacre, 2007). The main MCA output summarizes the associations between variable categories into a space of lower dimensionality, with the least possible loss of the original information contained in the Burt table. HCA was

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then applied to the coordinates of variable categories on the factorial axes. These analyses allowed us to further examine the combined associations between all variable categories at the same time. We identified two clusters of variable categories, termed A and B, each divided into two subgroups respectively (i.e., A: A1 and A2; B: B1 and B2). Figure 2 depicts the clusters, which are indicated as nodes 41 and 42, respectively.
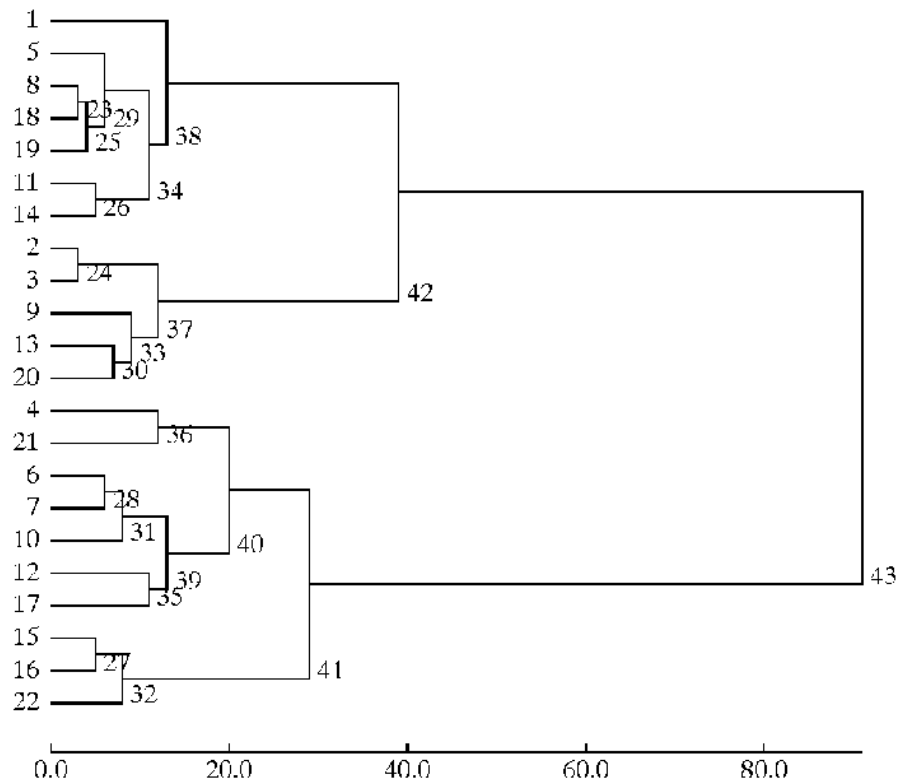
FIGURE 2
Dendrogram for clusters of variables after HCA and MCA identifying two clusters of variable categories, divided into two, respectively (nodes 42: 38, 37; and 41: 40, 32).

Cluster A was divided into two subgroups (A1 and A2). The first subgroup, A1 consisted of the following categories of variables: being of "other" ethnicity than New Zealand European, "other" sexual orientation, "all the time" responses on the Cognitive Distortions Scale, mostly "agree/neutral" responses on the Dysfunctional Attitude Scale, self-esteem scores in the normal range, anxious/depressed symptoms in the moderate range, and positive screen for suicide risk. Subgroup A2 included mostly "agree" responses on the Dysfunctional Attitude Scale, self-esteem scores in the low range, and anxious/depressed symptoms in the severe range.

On the other hand, in cluster B, subgroup B1 gathered together the following variable categories: being male, heterosexual, "never" responses on cognitive distortions, "disagree" responses on the Dysfunctional Attitude Scale, high self-esteem, anxious/depressed symptoms within the normal range, and negative screen for suicide risk. Subgroup B2 was characterized by being female, of New Zealand European ethnicity, "sometimes" responses on cognitive distortions, "neutral" responses on dysfunctional attitudes, and anxious/depressed symptoms in the mild range. Results of the clusters of variables are summarised in Table 1

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(column 6); for each variable, the corresponding row percentage for the two levels of suicide risk is given (columns 7, 8), and the relative frequency for the levels for each variable is noted (column 9).

DISCUSSION

The current study investigated the association between cognitive vulnerability (cognitive distortions and dysfunctional attitudes) and suicide risk using a different methodological approach, namely, HCA and MCA in two steps (Chadjipadelis, 2015). MCA is a technique that represents graphically the row and column categories and allows for a comparison of their "correspondences" (associations) at a category level. MCA makes a very relevant method of data analysis when an exploratory or even more in-depth analysis of categorical data is required, making it a particularly useful technique as it (i) is versatile, in part because no underlying distributional assumptions are required, thus accommodating any type of categorical variable whether binary, ordinal, or nominal; (ii) gives a graphical output (often two-dimensional) for representing the associations between the variables in a low-dimensional space, thus providing key exploratory insights on the relationships between the collected data; and (iii) can be a complement or used in pair with other methods such as HCA (strategy followed in this report). Herein, we used a combined approach of HCA and MCA for a cross-sectional analysis to, upon identifying main cognitive vulnerability profiles, explore relationships between clinical, self-esteem, and demographic variables among New Zealand adults. The combination of the two methodologies is here favorable, with neither method used in detriment of the other but rather complementarily.

First, HCA allowed grouping respondents into homogeneous profiles based on their responses to two cognitive measures (cognitive distortions and dysfunctional attitudes). Our findings identified three distinct cognitive vulnerability profiles/subgroups. Group 1–High Vulnerability was the smallest of the identified groups and clustered together adults who appeared to present the highest levels of dysfunctional cognitive processing. Specifically, these adults demonstrated high numbers of cognitive distortions and dysfunctional attitudes and screened positive for suicide risk. Further, they were more likely to self-report low self-esteem and moderate to severe anxious/depressed symptoms. Group 1 was also more likely to identify their sexual orientation as bisexual, gay/lesbian, and/or questioning. Group 2–Low Vulnerability included adults who displayed relatively no cognitive distortions, showed adaptive functional attitudes, with no suicide risk. Adults in this group were notably high in self-esteem and presented anxious/depressed symptoms in the normal range. In terms of demographics, Group 2 was more likely to be male and identify their sexual orientation as heterosexual. Group 3–Ambivalent Vulnerability consisted of adults characterized by mostly "sometimes" responses on cognitive distortions, "neutral" or "agree" responses on dysfunctional attitudes, self-esteem scores in the normal range, and anxious/depressed symptoms in the mild range.

More than half of the adults (60%) were in Group 1–High Vulnerability and Group 2–Low Vulnerability (19% and 41%, respectively). These respondents showed the expected congruent combination of dysfunctional cognitive processing and suicide risk: individuals exhibiting high numbers of cognitive errors and dysfunctional attitudes screened positive for suicide risk and vice versa (Ellis & Ratliff, 1986; Fazakas et al., 2017; Jager-Hyman et al., 2014; Jekkel & Tringer, 2004). As was anticipated, cognitive distortions and dysfunctional attitudes appear to contribute to suicide risk. The analyses revealed that 61% of the adults who displayed high levels of cognitive errors in their thinking, and 87.5% of respondents who displayed high levels of dysfunctional attitudes screened positive for suicide risk. These findings suggest that clinical work aiming to reduce suicidal thoughts and behaviors should be targeting both cognitive distortions and

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dysfunctional attitudes. Additional research is required, though, to definitively assess if and how cognitive distortions and dysfunctional attitudes interact over time to impact the development of suicidal behavior.

Comparisons of the adults in the three groups with regard to a number of external variables yielded results that were largely consistent with previous findings. Ninety-four percent of adults, who identified their sexual orientation as bisexual, gay/lesbian, and/or questioning, screened positive for suicide. This was expected as it is well documented that gay, lesbian, and bisexual people are at an increased risk for suicide (Lucassen et al., 2011, 2014; Russell & Joyner, 2001). Furthermore, 69% and 56% of the adults who reported moderate and high symptoms of anxiety and depression, respectively, screened positive for suicide risk, consistent with what has been reported elsewhere, highlighting the close association between emotional disturbance and suicidal behavior (e.g., Beautrais, 2003; Patel et al., 2007). This result also suggests that the cognitive profiles appear to show the expected specificity for internalizing problems (Kendall, 1993). Namely, comparing the PHQ-4 scores of the groups demonstrated that Group 1–High Vulnerability presented significantly higher levels of emotional symptomatology compared to the other two groups.

From MCA and its graphical representation on a Burt table (see Table 1), two main clusters of variable categories — termed A and B — were identified. Each cluster was further divided into two subgroups (A1 and A2; B1 and B2) to allow a more detailed depiction of the variable categories that clustered together. Overall, for the first cluster, a more dysfunctional cognitive processing (as indicated by mostly "all the time" responses on the Cognitive Distortions Scale, "agree/neutral" and/or "agree" responses on the Dysfunctional Attitude Scale), lower self-esteem scores, and higher anxious/depressed symptoms were associated with suicide risk, being of "other' ethnicity than New Zealand European, and "other" sexual orientation, while adaptive cognitive processing, high self-esteem, and anxious/depressed symptoms within the normal and/or mild range appeared to group with no suicide risk in the second cluster. These observations reveal behavior patterns and appear to be well aligned with the three cognitive vulnerability profiles of adults, indicating that the combined effect of multiple factors may be of greater concern than individual factors on suicide risk in adults.

This study has several strengths, including a different methodological approach that provides a more holistic analysis of the concepts under study, the simultaneous consideration of different types of cognitive biases, including self-reports of anxious/depressed symptoms, and level of self-esteem, and, last but not least, the combined examination of associations between all the variables at the same time. Meanwhile, there are also some limitations that need to be considered when interpreting the results of this study. First, this is a cross-sectional study, and thus, it is not possible to ascertain causal effects. Second, the fact that we used a community sample does not allow for the generalization of the results to clinical samples of adults. Third, a convenience sample was used, which may have led to the under-representation or over-representation of particular groups. Given that the sample is not chosen at random, the inherent bias in convenience sampling implies that any generalizations of findings must be made with caution. However, the observed high numbers of participants screening positive for suicide risk and the high levels of self-reported anxious and depressive symptoms are somewhat consistent with the high rate of completed suicide and the high rates of mental distress found among young New Zealanders (Feehan, et al., 1994; Ministry of Health, 2019). Fourth, we exclusively relied on the self-report method to evaluate cognitive and other variables among participants. It is important to note, however, that self-report measures are considered to be the optimal method for assessing these types of internal cognitive processes (Alfano et al., 2002). Further research is needed to better understand clustering patterns of thinking types, self-esteem, and mental health problems. More specifically, investigating the relationship between dysfunctional cognitive processing and suicidal behaviors in larger samples is an important next step. Given the cross-sectional nature of this study, future studies are also needed

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to confirm the temporal relationship between dysfunctional cognitive processing and suicidal thoughts and behaviors.

The present study aligns well with the empirical evidence showing that cognitive distortions and dysfunctional attitudes play a significant role in suicidal behavior for many adults (Ellis & Ratliff, 1986; Fazakas et al., 2017; Jager-Hyman et al., 2014; Jekkel & Tringer, 2004). As such, this result supports the basic assumption that underlies cognitive-behavioral interventions: these faulty or biased ways of thinking are important targets when treating individuals at risk for suicide (Joiner, 2005; Rudd, 2004; Wenzel et al., 2009). It is also significant to note that these findings are consistent with recent studies addressing the importance of changing semantic representations or "schemas" as mechanisms of action in psychotherapy, regardless of the specific approach (e.g., Messina et al., 2020, 2016).

In sum, these findings have meaningful clinical implications and underscore the importance of addressing the tendency to engage in dysfunctional cognitive patterns, ensuring that psychologists working with adults at risk of suicide be alert to their thinking, systematically identifying, evaluating, and targeting cognitive errors and dysfunctional attitudes to reduce suicidal behaviors. Furthermore, based on these findings and taking into account the high rates of completed suicide and mental distress among New Zealand adults, future priorities should emphasize prevention and intervention programs with a focus on cognitive restructuring applied early in life for youth who screen positive for suicide risk before meeting diagnostic criteria.

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