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Regular Article

Beliefs about the genetics of suicide in Canadian students: Cross-language validation of the Beliefs in the Inheritance of Risk Factors for Suicide Scale (BIRFSS)

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Aim: The genetics underlying suicidal behavior is becoming increasingly recognized and investigated. Convergent evidence towards this end has emerged from numerous research strategies (adoption, family, genome-scan, geographic, immigrant, molecular genetic, surname, and twin studies of suicide). The topic-related mental-health literacy (i.e. knowledge and beliefs) of professionals and laypersons, however, may lag behind this research progress, and data on this question are scant. The aim of the present study was therefore to further validate, in a cross-language setting, the novel 22-item Beliefs in the Inheritance of Risk Factors for Suicide Scale (BIRFSS), originally developed in German, which assesses beliefs about the genetics of suicide.

Methods: Data were collected from a mixed student sample from Canada ($n = 288$; 70.5% females, 58.0% studying psychology as a major or minor).

Results: Factor analysis of BIRFSS items yielded a dominant first factor. Internal scale consistency was, however, only middling (lower than previously observed in Austrian samples). Although the structure of beliefs about the genetics of suicide seems to be complex, the Canadian sample's item-performance indicators corresponded strongly to those obtained in Austrian samples, thus indicating cross-sample and cross-language robustness of item statistics.

Conclusion: For the Canadian sample, BIRFSS scores were positively related to overall and specific knowledge about suicide and general beliefs about genetic determinism (convergent validity), whereas they were not (or only trivially) related to the Big Five personality dimensions, lay theories of suicide, locus of control, social desirability, religiosity, and political orientation (discriminant validity), and to several key demographic variables. Supplemental findings, study limitations, application possibilities, user recommendations, and avenues for further inquiry are discussed.

Key words: beliefs, Canada, cross-language validation, genetics, mental-health literacy, scale development, suicide.

SUICIDAL BEHAVIOR IS multi-determined. However, genetic contributions to the risk of suicide have only recently been recognized. Convergent evidence towards this end has flown from quantitative genetic studies (i.e. from the classic family, twin, and adoption designs used in behavioral genetics),[1–6] and, more contemporarily, from molecular genetic studies of candidate genes (mostly constituents of the serotonergic neural transmission system)[7,8] as well as from genome-wide linkage scans for genetic polymorphisms associated with suicide risk.[9,10] This literature is complemented by suggestive

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findings from several further research strategies, such as geographic,[11–16] immigrant,[17,18] and surname studies of suicide.[19,20]

Basic knowledge about suicide is a relevant component of mental-health literacy (i.e. beliefs and knowledge about mental disorders in general)[21] and accurate suicide-related knowledge is clearly salient for future healthcare professionals, such as medical and psychology students.[22,23] However, there are almost no data that address whether the current progress of research into the genetics of suicide is accurately reflected in the beliefs and knowledge of professional groups and the available narrow line of evidence is to the contrary. A recent large-scale survey of medical and psychology students in Austria[24] found that a vast majority (about 80%) of respondents negated the existence of genetic risk factors for suicide. This finding was replicated in a similarly designed study with a comparable sample from Estonia,[25] with a non-endorsement rate of about 65%. Both studies were based on a single item from the Revised Facts on Suicide Quiz[26] (Item 2: 'The tendency toward suicide is not genetically (i.e. biologically) inherited and passed on from one generation to another'; correct response: 'False'). Obviously, reliance upon a single-item measure poses problems of reliability.

Since a multi-item instrument for assessing individuals' beliefs about the genetics of suicide was hitherto unavailable, the Beliefs in the Inheritance of Risk Factors for Suicide Scale (BIRFSS) was developed by the present authors. Researchers, who have significantly contributed to the current understanding of the genetics of suicide, rated this instrument's item pool for appropriateness in an international expert validation survey. The 22-item BIRFSS taps content knowledge stemming from eight domains (details on the specific contents have been published previously[27]): family studies (five items), geographic and twin studies (four items each), adoption, immigrant, and surname studies (two items each), and molecular genetic studies (one item), along with general statements (two items). The BIRFSS item texts have been published elsewhere.[27] Table 1 displays their underlying research domains and the expert-rating results.

Item-performance indicators, internal scale consistency, dimensionality, short-term and long-term retest reliability, cross-temporal score stability, demographic correlates, and numerous facets of convergent and discriminant validity of the new instrument have previously been investigated in three validation studies,[27–29] with samples of medical and psychology undergraduates and in a more mature, general-population sample (with medical and psychology students, physicians, and psychologists excluded from participation). However, all of these samples were from a single country (Austria) and the BIRFSS was administered in its original German form, corresponding to the authors' geographic location and language. An obvious next step for extension of this research and for instrument validation is to probe the cross-language and cross-cultural applicability of the measure. This was the purpose of the present research. To further this goal, the English BIRFSS form was administered to a mixed student sample in Canada.

METHODS

Subjects and procedure

A volunteer sample of 288 students (mean age ± SD: 21.3 ± 3.6 years) from St. Mary's University (Halifax, Canada) participated for course credit in this research. Demographic sample data relevant for this research were as follows: 58.0% indicated studying psychology as a major or a minor; 28.1% stated having taken a clinical psychology or psychiatry course; 8.7% were first-year, 31.3% second-year, 32.3% third-year, 20.1% fourth-year, and 7.6% fifth-year (or higher) undergraduates. Reported nationality (83.7% Canadian) and the sample's sex ratio (70.5% females) reflected the student-body composition for psychology at this institution. The study was reviewed and approved by the Research Ethics Committee of St. Mary's University. After providing informed consent, participants completed the survey in a private setting, placed their form inside an envelope, returned this to the researcher, and were then debriefed and thanked.

Measures

Beliefs in the Inheritance of Risk Factors for Suicide Scale

Participants started their eight-part survey with the 22-item BIRFSS.[27–29] The original German form (available from the authors) had been previously translated for the international expert item-rating survey[27] by two researchers (MV and LML), using the parallel blind technique.[30] Discrepancies between individual draft translations were resolved consensually to arrive at the final version. The English form

Table 1. BIRFSS item statistics and expert validation survey results

Item	Mean item response† (Mean ± SD)	$r_{i(t\text{-}i)}$§	Mean item rating‡ ($Mean_{exp}$ ± SD_{exp})
1. (F; Adoption)	−0.30 ± 2.41	−0.03	1.83 ± 0.98
2. (F; Twin)	1.41 ± 2.36	0.06	1.50 ± 1.23
3. (Geography)	−0.29 ± 2.33	0.29	1.33 ± 0.52
4. (Molecular genetic)	0.68 ± 2.39	0.38	2.50 ± 1.23
5. (F; Surname)	1.09 ± 2.70	−0.06	2.83 ± 1.33
6. (Twin)	0.83 ± 2.61	0.44	1.17 ± 0.41
7. (F; Family)	0.94 ± 2.70	0.33	1.17 ± 0.41
8. (F; Immigrant)	0.18 ± 2.30	0.06	2.00 ± 0.89
9. (Twin)	−0.41 ± 2.39	−0.04	2.50 ± 0.84
10. (Family)	0.19 ± 2.02	0.38	2.17 ± 1.17
11. (Surname)	−0.17 ± 2.23	0.08	2.67 ± 0.52
12. (F; General)	0.95 ± 2.62	0.34	1.33 ± 0.52
13. (Family)	0.66 ± 2.40	0.44	1.50 ± 0.55
14. (F; Geography)	−0.19 ± 2.35	0.02	2.17 ± 0.75
15. (Adoption)	−0.22 ± 2.60	0.10	1.67 ± 0.82
16. (Geography)	−0.61 ± 2.18	0.01	1.67 ± 1.03
17. (F; Family)	−0.80 ± 2.38	−0.50	1.67 ± 0.82
18. (Geography)	−0.59 ± 2.24	0.30	1.67 ± 0.82
19. (Immigrant)	−0.61 ± 2.34	0.11	1.67 ± 0.82
20. (Family)	0.76 ± 2.40	0.14	2.00 ± 0.63
21. (Twin)	0.69 ± 2.51	0.42	2.00 ± 1.55
22. (General)	0.79 ± 2.49	0.30	1.17 ± 0.41

Terms in parentheses denote research domains. †range: – 4.5 to +4.5; ‡range: 1, very good to 5, inadequate; §corrected item-total correlation

BIRFSS, Beliefs in the Inheritance of Risk Factors for Suicide Scale; F, false statements (i.e. reverse-keyed items).

was reviewed once again and confirmed (by MLF and HT) prior to the present data collection. The BIRFSS instructions were: "Following is a number of statements concerning suicide, attempted suicide, and suicidal behavior. On the 10-point scale provided, please mark how *plausible* you deem these statements (1: 'very unlikely'; 10: 'very likely')". As for item examples, BIRFSS Item 1 is a statement based on adoption study findings, which is false ("Regarding suicide risk, early adopted-away individuals resemble their siblings in the adoptive family"), and Item 22 is a general statement, which is correct ("Genetically based susceptibility for suicidal behavior does exist"). The remaining seven survey parts are listed and described below.

Revised Facts on Suicide Quiz

The 36-item Revised Facts on Suicide Quiz (RFOS) assesses overall knowledge about suicide with a trichotomous response format (true/false/don't know, or appropriate choices).[26] Several items were adapted to the Canadian context. Owing to the diversity of suicide-related knowledge tapped by the instrument, internal scale consistency (Cronbach's α) is known to be only middling[24,25] (current sample α: 0.49).

Attributions of Causes to Suicide Scale

This instrument captures lay theories of suicide and consists of three subscales (beliefs in intrapsychic, interpersonal, and societal causes) with six items each, rated on 6-point scales (1: 'strongly disagree' to 6: 'strongly agree').[31,32] In above order, sample α coefficients were 0.60, 0.58, and 0.58.

Multidimensional Locus of Control Scale

This consists of three subscales (internality; powerful others, i.e. socially contingent externality; and chance

control, i.e. fatalistic externality; with seven, six, and eight items, respectively; three additional items dealt specifically with hospitalization and were thus omitted).[33] Item–response format was like above and sample α coefficients were 0.83, 0.82, and 0.76.

NEO Five-Factor Inventory

This 60-item inventory assesses the consensus model of current personality psychology; that is, the Big Five personality dimensions (agreeableness, conscientiousness, extraversion, neuroticism and openness).[34] These dimensions are tapped with 12 items each, and rated on 5-point scales (anchored as above). The α coefficients amounted to 0.72, 0.84, 0.74, 0.85 and 0.65, respectively.

Social Desirability Scale

This is a 17-item instrument assessing social desirability, with dichotomous (true/false) response format.[35] Following previous recommendations,[35] one item (capturing illicit drug use prevalence) was omitted (sample α: 0.66).

Beliefs in Genetic Determinism Scale

This 18-item instrument assesses general beliefs about the genetics of various normal and abnormal traits (but excluding suicidal behavior).[36] This is different from the BIRFSS, which captures domain-specific beliefs about the genetics of suicide. Items are rated on 7-point scales (anchored as above). This measure was additionally implemented during ongoing data collection and thus could be administered to only a partial sample ($n = 58$; α: 0.80). Respondent affiliation to this subsample versus to the remainder was not related to any variables under study.

Religiosity, political orientation and demographic information

Two single-item measures for religiosity and political orientation ('How religious are you?'; 'What is your political orientation?') completed the survey. Responses were made on 7-point scales (1: 'not at all'; 4: 'moderately'; 7: 'extremely'; and 1: 'extremely conservative', 7: 'extremely liberal', respectively). The survey concluded with basic demographic information (sex, age, nationality, major, minor, and year of study, and whether respondents had ever taken a clinical psychology or psychiatry course).

Analysis

For ease of comparison, prior to analysis all item responses were centered around zero and mean item responses were calculated for each instrument. Item-scale range for individual BIRFSS item responses and the total BIRFSS score was therefore −4.5 to +4.5. By their sign and absolute value, item responses and total scores thereby indicated more or less agreement or disagreement or indecisiveness. Significance was set to $P < 0.05$ (two-tailed).

RESULTS

Item statistics and knowledge-domain differences

BIRFSS item statistics are set out in Table 1. In decreasing order, respondents endorsed items reflecting general statements most (mean item response: 0.87), followed by those from the domains of molecular genetic, twin, surname, family, immigrant, adoption, and geographic studies (0.68, 0.63, 0.46, 0.35, −0.22, −0.26, and −0.42, respectively). One-sample *t*-tests indicated that all five domains with positive mean item responses were significantly beyond the scale midpoint (zero) and all three domains with negative mean item responses were significantly below zero ($0.001 < P\text{s} < 0.03$). BIRFSS item-total correlation coefficients obtained in the present sample were negatively, but not significantly, associated with the mean appropriateness ratings for this pool of 22 items in the expert survey ($r = -0.30$, $P = 0.17$) and also, but even more weakly, negatively associated with the degree of heterogeneity (standard deviation) of these expert ratings ($r = -0.16$, $P = 0.48$).

Internal scale consistency and dimensionality

BIRFSS internal scale consistency in this sample was only middling ($\alpha = 0.52$). Subgroup analyses (data omitted) showed that, as per expectation, α figures were higher (mostly in the 0.60 s) for Canadians (versus other nationalities), for respondents with a psychology major or minor (versus without), for those who had taken clinical psychology or psychiatry courses (versus not), and (no prior hypothesis) for females (versus males). Exploratory factor analysis of

Table 2. Intercorrelations of BIRFSS item-group scores

	Total score	Adoption	Family	General	Geography	Immigrants	Molecular	Surnames	Twins
Total score									
Adoption	0.27***								
Family	0.61***	−0.04							
General	0.60***	−0.05	0.54***						
Geography	0.48***	0.13*	−0.03	0.06					
Immigrants	0.31***	0.02	0.05	0.08	0.14*				
Molecular	0.50***	−0.02	0.29***	0.37***	0.20**	−0.01			
Surnames	0.25***	−0.01	0.06	−0.01	0.05	−0.03	−0.03		
Twins	0.61***	0.05	0.21***	0.23***	0.09	0.07	0.28***	0.07	

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$ (two-tailed).
Column and row titles denote the research domains constituting BIRFSS item groups.
BIRFSS, Beliefs in the Inheritance of Risk Factors for Suicide Scale.

the 22 BIRFSS items extracted seven factors with eigenvalues (λ) beyond unity, accounting for 55.2% of the total variance. The scree-plot criterion and λ ratios were indicative of a dominant first factor (λ = 3.73, 17.0% attributable variance), and showed a steep decline between this and the next factor extracted (for the latter, λ = 1.95, 8.9% variance explained). The intercorrelation matrix of the eight BIRFSS domains (i.e. item groups), shown in Table 2, suggested only modest communalities between these domains. However, all item-group scores were significantly positively related to total BIRFSS scores, with mean item responses on general-statement items and those based on family and twin studies of suicide the most so, and those based on immigrant, adoption, and surname studies the least.

Convergent and discriminant validity

Concerning convergent validity facets, BIRFSS scores correlated significantly positively with correct responses on RFOS Item 2 ($r = 0.40$, $P < 0.001$) as well as with total RFOS scores ($r = 0.24$, $P < 0.001$). For the subsample ($n = 58$) that responded to the Beliefs in Genetic Determinism Scale, BIRFSS scores were significantly positively associated with such beliefs ($r = 0.37$, $P = 0.005$).

As for discriminant validity facets, BIRFSS scores were unrelated to social desirability scores ($r = -0.04$), to the Big Five personality dimensions of agreeableness, conscientiousness, extraversion, neuroticism, and openness ($r = 0.01$, 0.06, 0.01, 0.05, and 0.06, respectively), religiosity ($r = -0.10$), and political orientation ($r = 0.08$). Furthermore, BIRFSS scores were modestly positively, albeit statistically significantly, related to intrapsychic and societal attributions of causes to suicide (both $r = 0.12$, $P = 0.04$), but not to interpersonal attributions ($r = 0.03$). Similarly, there were modest, albeit again statistically significant, correlations with internal ($r = 0.15$, $P = 001$) and fatalistically external ($r = -0.12$, $P = 0.04$) locus-of-control orientations, but not with socially external locus of control ($r = -0.10$).

Demographic correlates

In this sample, BIRFSS scores were related to participants' sex (females higher: $r = 0.14$, $P = 0.02$) and nationality (Canadians higher: $r = -0.12$, $P = 0.04$), but not to age ($r = -0.08$). Respondents with a psychology major or minor scored higher than those without ($r = 0.17$, $P = 0.005$), as did those with a higher year of study, but this association fell just short of significance ($r = 0.11$, $P = 0.06$). Having previously taken clinical psychology or psychiatry courses was unrelated to BIRFSS scores ($r = -0.05$).

Cross-sample comparisons of item-performance indicators

Item-total correlations of the 22 BIRFSS items in the present sample (i.e. Canada, undergraduates from a variety of study subjects, English BIRFSS form administered) corresponded strongly (all *P*s < 0.001) to those obtained in three previous validation studies[27–29] (Austria, German BIRFSS form administered): $r = 0.79$ (first study:[27] medical and psychology undergraduates), 0.87 (second study:[28] general-

population sample), 0.84 (third study:[29] new sample of psychology undergraduates, first testing), and 0.84 (third study:[29] sample retested after 2 months). Similarly, mean item responses in the Canadian sample correlated strongly to those observed previously (in above order, $r = 0.75$, 0.56, 0.78, and 0.70; all Ps < 0.007).

DISCUSSION

On the whole, the results from this first cross-language validation of BIRFSS suggest this novel instrument has potential for assessing a specific fact of mental-health literacy; namely, individual beliefs about the genetics of suicide. Among others, we envisage possibilities for application in basic research, educational settings, or for evaluation of professional training. In particular, it would be of interest to investigate not only the specific beliefs of various preprofessionals (such as medical and psychology students), but also of the professional groups who foremost deal with suicidal patients or clients (such as psychiatrists, general practitioners, clinical psychologists, psychotherapists, social workers and crisis intervention personnel). This remains an important agenda for future extension of the present research.

Item-performance indicators in the present Canadian sample were strongly correlated with those obtained in previous studies conducted in Austria, which used markedly different types of samples, thus indicating cross-sample and cross-language robustness of these item statistics. Evidence for convergent validity of BIRFSS is provided by the positive correlations with general and specific knowledge about suicide facts and general beliefs about the genetics of behavioral traits. Evidence for discriminant validity is established through a lack of association (or, in some cases, very modest correlations that were not entirely consistent directionally) with personality and locus-of-control dimensions and with beliefs about the causes to suicide. The instrument is free of social-desirability effects. Basic demographic variables, such as respondents' age, religiosity, and political orientation, are unrelated to BIRFSS scores. A small sex difference, with higher scores for females, was observed in this sample for the first time and thus needs confirmation in further samples (as does the observed score difference by Canadian versus other nationality). In contrast, meaningful differences emerged in subsample analysis for further demographic variables investigated here for the first time; as expected, beliefs about the genetics of suicide are positively related to studying psychology (major or minor) versus other subjects, and also to advanced year of study (but not to previous exposure to clinical psychology or psychiatry courses).

Concerning internal scale consistency and the dimensionality of BIRFFS, we had the following results which are recognized as limitations here. Although, similar to the previous studies,[27–29] factor analysis of BIRFSS items yielded a dominant first factor, internal scale consistency in the Canadian sample was noticeably lower (α: 0.52) than in any of the Austrian samples,[27–29] where α coefficients into the mid-to-high 0.70 s (up to 0.81) were observed. The current data cannot address the question of whether this rather low α coefficient was due to factors unique for this sample or probably applies for the English BIRFSS form in general. Further data from other study sites are necessary to achieve clarity on this point.

However, we emphasize the subsample differences in α coefficients evident from subgroup analyses; Canadians, psychology students, and respondents previously exposed to clinical psychology or psychiatry courses showed higher α coefficients than respondents of other nationalities, of other study subjects, or those who had not taken such courses. This pattern is consistent with the view that individual item responses and total BIRFSS scores of more knowledgeable respondents will reflect specific knowledge on the topic and that such groups will produce more orderly item-response patterns (leading to higher α coefficients), while those of the less knowledgeable respondents will reflect beliefs about the topic and, as a consequence, will produce less orderly response patterns (leading to lower α coefficients).

This also illustrates the well-known fact that internal scale consistency, as well as item-total correlations, should not be regarded as inherent and fixed properties of scales and items. They are, above all, sample-dependent descriptive statistics which depend on what a specific group of respondents actually does in response to the items. We have recently observed[29] that administering the BIRFSS items in reverse order (i.e. from Item 22 to Item 1) yields a higher internal scale consistency. This is very likely due to the following reason: BIRFSS Item 1 is about a specific finding from adoption studies of suicide (and a false statement), while Item 22 is a general statement about the genetics of suicide (which is true) and thus obviously a better starting item. Therefore, we recommend administration of the reversed BIRFSS item sequence

(or, alternatively, any other sequence starting with Item 22 or another item with a high item-total correlation coefficient).

All of this underscores the complexities of investigating beliefs about the genetics of suicide. We think there is no strong reason to expect that these should be strictly unidimensional in the narrow sense of classical test theory. Lay theories and beliefs about abnormal behavior and mental disorders[37] have frequently been found to be complex and multifaceted, if not inherently inconsistent and contradictory. For these reasons, we have opted not to remove the 'weaker' items (according to the perspective of classical test theory) from the scale (for background and general arguments, see Streiner[38]). BIRFSS users may however, wish to do so, but should keep in mind the trade-off between increased scale homogeneity through item removal and the accompanying decrease in item-content richness (the 22-item BIRFSS version contains more or less the currently existing totality of distinct research evidence about the genetics of suicide). Conversely, upon the emergence of novel research strategies and findings in the field, the item pool could be appropriately expanded. Calculation of subscale scores, according to the different research domains (Tables 1,2) of course is also feasible, and even mere inspection, description, and analysis of individual item responses will also be informative in itself.

Of particular note is the clearly negative item-total correlation coefficient of BIRFSS Item 17 ('Risk factors for suicidal behavior are inherited via the risk factors for psychiatric disorders'). Apparently, respondents who tend to generally endorse genetic contributions to the risk of suicide erroneously believe these traits are inherited via the risk factors for psychiatric disorders, when in fact population-based twin studies have demonstrated that the former risk factors are largely independent from the latter ones.[39] As another example, the lack of association (Table 2) between the scores of the item groups based on evidence from family versus surname studies of suicide is also striking (despite the fact that these two types of items were similarly endorsed by respondents). Theoretically, these two item-group scores should be positively associated, since surname effects are an inescapable macro-level consequence of the familial aggregation of suicide, the logic of which is as follows: in societies with a patrilineal surname system, surnames are similarly transmitted like the non-recombining part of the Y chromosome. Given that suicide runs in families (which is true), and that this is partially due to heritable risk factors (for which there is compelling evidence), macro-level effects, such as stated in BIRFSS Items 5 and 11, will be and indeed have been observed in surname studies of suicide.[19,20] Finally, researchers working specifically in the field of genetics of suicide (but also, more generally, in behavioral and psychiatric genetics) will be interested to learn that there seem to be notable differences in perceived plausibility of evidence according to research design, as demonstrated by respondents' endorsement patterns of particular item groups. For instance, it is curious and remains to be elucidated why findings from adoption studies are perceived as markedly less plausible than those derived from family or twin studies.

The current contribution is a first step towards the internationalization of BIRFSS and a prelude to cross-cultural comparisons on this topic. It would be of great interest to devise such investigations in nations with high suicide rates (such as in Japan, the Russian Federation, and the Baltic countries), in areas outside the Western industrialized sphere, in cultural settings differing from the Angloamerican and European context, and in groups with various religious backgrounds. Follow-up and extension studies in this vein are currently devised or underway and we invite fellow researchers to contribute to this endeavor.

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