Measurement issues in research on social support and health

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Abstract

Study objective – The aims were: (1) to identify methodological problems that may explain the inconsistencies and contradictions in the research evidence on social support and health, and (2) to validate a frequently used measure of social support in order to determine whether or not it could be used in multivariate analyses of population data in research on social support and health.

Design and methods – Secondary analysis of data collected in a cross sectional survey of a multistage cluster sample of the population of the United States, designed to study relationships in behavioural, social support and health variables. Statistical models based on item response theory and graph theory were used to validate the measure of social support to be used in subsequent analyses.

Participants – Data on 1755 men and women aged 20 to 64 years were available for the scale validation.

Results – Massive evidence of item bias was found for all items of a group membership subscale. The most serious problems were found in relationship to an item measuring membership in work related groups. Using that item in the social network scale in multivariate analyses would distort findings on the statistical effects of education, employment status, and household income. Evidence of item bias was also found for a sociability subscale. When marital status was included to create what is called an intimate contacts subscale, the confounding grew worse.

Conclusions – The composite measure of social network is not valid and would seriously distort the findings of analyses attempting to study relationships between the index and other variables. The findings show that valid measurement is a methodological issue that must be addressed in scientific research on population health.

to use rather standard approaches to investigating the topic. In such instances, the research goal needs to shift to clarifying the inconsistencies and contradictions in the evidence. The subject of social support influences on health is this type of substantive area in population health research. The purpose of this paper is to consider methodological problems that may explain the contradictory evidence surrounding this important subject.

A large number of studies have identified statistical relationships between measures of social support and health status variables. In spite of much evidence suggesting that social relationships influence health, the research findings contain fundamental unresolved issues and contradictions.

The serious inconsistencies in the research evidence revolve around questions that are extremely relevant for policy and programme development. The confusion on basic issues may be a reason for the tendency to focus away from the social environment, traditionally considered as a "soft" research area, and concentrate on what seems to be harder evidence, such as individual behavioural or biological risk factors. A main thesis of this paper is that sound research must uncover the complex forces that shape health and deal with the methodological problems encountered in doing so. Research that elaborates complex causal processes provides "harder" evidence (taken to mean more scientifically sound) than research which predicts statistical effects from a postulated influence.

Issues in the research evidence on social support and health

It has long been recognised that the social environment is important for people's wellbeing. Studies of the influence of the social situation and social relationships have deep roots in research on mental health.¹⁻³ Over the past two decades, epidemiological research has produced findings which suggest that support from or interaction in social networks also influence physical health. A wide array of types of research, including prospective studies documenting relationships between social network variables and mortality, have contributed to this body of knowledge.⁴⁻⁷

There is no longer any doubt that social support or social network variables predict health outcomes. There is, however, disagreement about the meaning of the statistical associations between social network and health variables, and about possible underlying processes of influence shaping the global correlations. While most of the multitude of invest-

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It sometimes occurs in research on health that considerable evidence accumulates with regard to a particular type of variable believed to exert a causal influence, but that the research findings are inconsistent and contradictory. Numerous explanations may be put forth for the contradictions, while researchers continue

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igations conducted during the past 10–15 years have found statistical associations in the expected direction, the nature and strength of the relationships vary widely from study to study with major inconsistencies pervading the findings.

Three basic issues remain unsolved. Firstly, it remains unclear how the components of the social environment provide health protective or health damaging effects. The relative importance of the size of the social network, participation in the network, and the functioning of the network is unknown. The second issue relates to the nature of the health protective or health damaging effects of social support. Numerous studies provide evidence that social support reduces the impact of stress. In addition to stress buffering effects, many studies find evidence that social support itself is health protective, irrespective of stress. Other studies, however, do not find any direct effects of social support variables on health variables. The third area of major disagreement centres on the extent to which personal functioning, depression, or psychological distress may account for relationships between measures of social support and health variables, especially mental health.

The direction of the causal influence along with questions about intervening influences or the possibility that spurious statistical correlations account for the findings remain fundamental issues in assessing the body of evidence.

Cohen and Syme,⁶ interpreting the findings in their edited overview of the subject, conclude that enough evidence is available to support both direct and buffering effects of social support on health. They point out that direct effects generally occur when the support measure assesses the degree to which people are integrated in networks, while buffering effects are found when the measure focuses on the availability of resources for help in responding to stressful events.

The concerns about directionality in the relationships are considered by House *et al*⁸ to have been sufficiently addressed by a series of prospective mortality studies. They support this conclusion with a discussion of the findings from five mortality studies. In summarising findings derived from calculations of relative risk values on data from these studies, they conclude, "... patterns of prospective association between social integration (that is, the number and frequency of social relationships and contacts) and mortality are remarkably similar, with some variations by race, sex, and geographic locale." (p 542). This interpretation of the findings, leading the authors to the conclusion that the evidence is strong enough to approximate the evidence available on smoking at the time of the US Surgeon General's 1964 report on smoking and health, ignores the serious implications of inconsistencies on such fundamental variables as sex, race, and population density.

Berkman,^{9–10} who conducted the prototype study on relationships between social network and mortality, recognised that the inconsisten-

cies present problems. She pointed out that the evidence is remarkably unspecific with regard to the range of disease states, and that the most confusing and contradictory evidence stems from the research on cardiovascular disease. In a discussion of the findings from the prospective mortality studies, Berkman noted that while these studies generally support the hypothesis that social ties are related to mortality risk, subgroup differences, especially with regard to sex and race, are serious research issues confronting investigators.

Explaining the inconsistencies

Various explanations have been put forth for the subgroup differences in the findings. One explanation, which holds that blacks and women may be integrated more deeply in rural communities,^{8,11} led Berkman to conclude that the critical dimensions of social networks and support have not been adequately measured in those people for whom support is especially important. Other explanations suggested that pre-existing disease may influence the ability to maintain social ties, or that in socially cohesive groups and well integrated populations (for example, women and Japanese-Americans), differences in risks between isolated and unisolated people may not be great. It has also been suggested that in cohesive groups, social contacts may be so much a part of everyday life that they are not reported.

These explanations all build on the assumption that the statistical correlations between social network variables and mortality variables are valid. When methodological issues are raised, they generally have been concerned with the possibility that dimensions of social network relevant for specific subgroups have not been measured. This assumption prompted investigators to seek solutions for clarifying the inconsistencies in demographic variables by developing social network measures specific to groups.

House *et al* suggested that the sex and urban-rural variations may have methodological rather than substantive explanations, but then arrived at similar conclusions regarding the content of measures for particular subgroups (that is, that measures of social relationships may be less valid in rural and small town environments and for women, and thus reduce accordingly the statistical effects on mortality).

It is possible, however, that rather than failing to tap some dimensions of the social network that are relevant for certain subgroups, a substantive issue, technical problems in measurement may account for the contradictory findings. It may be that the social network measures and the way they are used in the analysis of population data result in distortions in the findings.

For example, in the mortality studies generally cited as providing the conclusive evidence of the causal influence of social support on health, the Berkman Social Network Scale, or variables modelled on it, have been used as measures of social ties. The Berkman

scale, developed for secondary analyses of data collected in Alameda County, California, was the first measure with which statistical correlations between social network and mortality were found in a community survey study. The epidemiological analyses of the data concentrated on obtaining relative risk values and the control of confounding factors. The validity of the scale and possible statistical effects of using it in multivariate analysis of population data have not been investigated.

Before searching for substantive explanations, a check for methodological problems that may affect the validity of an analysis, including the effects of constructing and using specific measures of a concept, need to be considered. This paper reports the results of a validation of the Berkman index undertaken in the first phase of a methodological study of the relationships between social network, social support, and health variables.

Validity of measures

The manner in which a scale is constructed and its effects on the analysis of complex inter-relationships among variables (the validity of the construction and use of the scale) determine its acceptability as a measure of a concept for use in population research. Not all procedures for assigning numbers to concepts can achieve valid measurement. The researcher works within the context of a theoretical domain transformed into a system of empirical relations to which a numerical system is assigned. The numerical system is manipulated to understand better the empirical system. Only with valid transformation of the theoretical domain into the empirical system of relationships and the use of appropriate techniques for assigning numerical values can we achieve measurement. If we move immediately from a perceived need to measure a concept to some technique for making the scale, there is a serious risk of misrepresenting the empirical domain under study.¹² For these reasons, scale validations must consider both theoretical and technical aspects of constructing an index.

Methodological project

The need for research on national populations to investigate the replicability of findings on social support and health, and to investigate the inconsistencies which characterise the results of the prospective studies of mortality was recognised in the decision of the US National Center of Health Statistics (NCHS) to include research on social support in the Study of Personal Health Practices and Consequences.¹³ This investigation was designed to replicate the study conducted by the Human Population Laboratory of the California State Department of Health in 1965, the study which produced the data on which the Berkman Social Network Scale was used in the first prospective analyses of social support and mortality.¹⁴⁻¹⁵

Data collected in the NCHS national study

of the US population are being used in a cross national methodological project to study research issues identified in the published reports on social network and health. The purpose of the study is to elaborate the inter-relationships among social network and psychosocial and behavioural variables which may contribute to or account for the statistical relationships between social network and morbidity/mortality.

The NCHS national study was conducted in two waves on a stratified cluster sample of the uninstitutionalised civilian population aged between 20 and 64 years, and living in households with telephones in 1979. A second interview was conducted, using a slightly modified version of the questionnaire, in the second wave of the study one year after the initial interview. The wave two data are being used in the methodological study. While the fact that these empirical data were collected 14 years ago might be a problem if we were interested in estimating frequencies on specific variables in the population, for our purposes of understanding relationships between psychosocial, behavioural, and health variables, and identifying methodological problems that distort findings in population investigations, these data are well suited. Extensive knowledge is locked up in neglected data sets, while excessive resources are used to collect data that are often less useful and, in turn, become only superficially analysed.¹⁶⁻¹⁷

The major research issue addressed in the study is concerned with the extent to which behavioural variables may remove or modify statistical effects of social support on health. The first step in our project to study the methodological issues had to focus on the validity of the social network variable. It is essential for the purposes of the investigation both that any social network variables used in the analysis are valid measures of the social support construct, and that they should not distort the findings on interactions between other variables included in the study. The central social support variable in the US data is the Berkman Social Network Scale.

CONSTRUCTION OF THE SCALE

The Berkman scale is an ad hoc construction that is built from subscales and individual items. The final scale is a hierarchical composition of different types of social situation variables. The description of the procedures used are seen in the publication on the USNSPHPC data tape specifications. In the validation procedures the measure has been used unchanged. The scale is constructed from combining individual items and subscales which themselves are composed of both individual items and scaled items:

Group membership (G) = four items about membership in various groups

Sociability score (S) = number of friends and relatives combined with frequency of social contact

Intimate contacts (I) = S plus marital status
Berkman scale = I plus G plus church membership.

The validity of the scale had to be assessed, as suggested above, both in relation to the theoretical domain of social support and to the effects of using the scale in the analysis of the inter-relationships among the health and social situation variables used in the study. This means checking for problems of item bias that would distort the findings in the definitive analyses in the investigation.

CONCEPT VALIDITY

The theoretical basis for social network research rests on the notion that support from the social network affects health through some direct and/or indirect processes of influence. As discussed in the introduction, there are differences of opinion about whether or not it is the structure of the social network, its functioning, or the amount of social contact that is important for health.

The Berkman scale, and measures similar to it, are generally considered measures of the structure of the network, of being embedded in a network of social relationships. From the point of view of conceptual validity, the measurement issue is whether or not the index measures the structure dimension of the social network and nothing else. As shown above the scale is an ad hoc construct of subscales and items. An examination of the components of the scale raises questions about concept validity. The variables and subscales combined in the scale mix measures of network structure, size, and contact so that these different aspects of the network cannot be differentiated and assessed.

The meaning of correlations between the scale and other social support variables would be impossible to understand. Problems arising from the conceptual overlap interfere with the validity of the scale as a measure of any of the social support concepts that need to be tested.

CONSTRUCT VALIDITY

What then about the construct validity? Do the items of the scale represent an empirical domain of social support that could be used with other variables to study health outcomes? Are the items (scale components) free of bias? In sociological research, a key aspect of assessing construct validity needs to be testing whether or not findings about other influences would be distorted by using the scale. That is, the goal of using a scale in population research means that in addition to psychometric measurement demands for unidimensionality and independence of items, a measurement must meet the demand that all essential information is obtained (or at the very least, that essential findings are not hidden) by using the scale in place of the items that compose it. This means that in addition to tests for scalability, tests for item bias with regard to variables of key relevance to the study must also be conducted.

SCALE VALIDATION PROCEDURES

The analytic methods generally used to validate scales come from the field of psychometrics. Validity and reliability are the two major concerns of classic psychometric validation procedures based in a paradigm of true scores and error terms. A number of serious limitations have been associated with the classic procedures.¹⁸ Among the more serious limitations is a circular problem involving the dependency of scales constructed in this tradition on the persons used in the initial data collection process (group dependency), and in turn the dependency of the scale scores on the particular items used in the scale construction. That is, the scores obtained depend on the respondents' values on the specific items, while the item values are determined by the characteristics of the group used in the construction of the index. Because of the limitations of classic methods, we use an alternative approach combining methods based in item response theory with graphical models.¹⁹⁻²⁰

Remembering the purpose of our research, a sociological rather than psychometric research problem, the adequacy of the scale must be assessed in the study data to assure that information on health and demographic variables is not lost or distorted by using the scale in this particular population. Usually we would also have to test for unidimensionality and objectivity in a scale validation. In the case of the Berkman index, however, our consideration of concept validity showed that we are not dealing with a well defined and unidimensional social support variable.

The index is in reality a classification system rather than a scale. Therefore, psychometric demands which must be met for construct validity (under both classic and item response theory) make no sense in this instance. It is clear that no latent dimension of social support is measured when from the start multiple dimensions that may include some components of social support, but also include other phenomena are mixed together. For example, the index could not be objective, because it is organically tied to the variables that compose it. Our assessment must focus on the acceptability or consequences of using the index as a data reduction that might be useful for analysing health outcomes in population research.

A technical explanation of the validation methods is provided in the appendix. The exogenous variables used for tests of item bias were: measures of health – bed days, difficulty walking, and perceived health status; psychological distress – a measure of emotional problems; and, situational/demographic variables – gender, education, occupational status, and income. Since all variables are either ordinal measures or bivariate categorical (marital status = married or not married, employment status = employed or unemployed/pensioned and gender), gamma tests were used in the analysis. If the scale was found free of item bias when tested against these variables, then we might use it as some type of ad hoc measure representing the social network in our multivariate analyses.

Table 1 Gamma partial rank correlations between specific items of the group membership subscale and the validation variables given the subscale "G" and the Berkman scale "B"

		Community		Work related		Children		Social	
		gamma	p	gamma	p	gamma	p	gamma	p
Bed days	G	—	—	—	—	—	—	—	—
	B	—	—	—	—	0.21	0.016	0.10	0.016
Difficulty walking	G	—	—	—	—	—	—	—	—
	B	—	—	0.30	0.001	—	—	—	—
Perceived health status	G	0.13	0.005	0.15	0.002	0.09	0.053	0.11	0.018
	B	0.22	0.000	0.27	0.000	0.18	0.000	0.22	0.000
Psychological distress	G	—	—	—	—	—	—	—	—
	B	0.13	0.0006	—	—	—	—	—	—
Employment status	G	—	—	0.67	0.000	—	—	—	—
	B	0.13	0.010	0.70	0.000	0.11	0.028	—	—
Education	G	0.30	0.000	0.37	0.000	—	—	0.14	0.001
	B	0.43	0.000	0.49	0.000	0.25	0.000	0.34	0.000
Income	G	—	—	0.22	0.000	0.09	0.033	0.16	0.000
	B	0.14	0.001	0.30	0.000	0.16	0.001	0.22	0.000
Gender	G	—	—	—	—	—	—	—	—
	B	—	—	—	—	—	—	—	—

Table 2 Gamma partial rank correlations between specific items of the sociability subscale and the validation variables given the subscale "S" and the Berkman scale "B"

		No of close friends		No of close relations		Frequency visits from friends/relatives	
		gamma	p	gamma	p	gamma	p
Bed days	S	—	—	0.07	0.007	—	—
	B	—	—	0.06	0.018	—	—
Difficulty walking	S	—	—	0.13	0.024	—	—
	B	—	—	0.10	0.044	—	—
Perceived health status	S	—	—	—	—	—	—
	B	—	—	—	—	—	—
Psychological distress	S	—	—	0.07	0.020	—	—
	B	—	—	0.08	0.004	—	—
Employment status	S	—	—	—	—	—	—
	B	0.06	0.041	—	—	0.08	0.009
Education	S	0.08	0.000	—	—	—	—
	B	—	—	—	—	—	—
Income	S	—	—	—	—	—	—
	B	0.05	0.025	—	—	0.06	0.012
Gender	S	0.18	0.000	0.13	0.000	—	—
	B	—	—	—	—	—	—

Table 3 Gamma partial rank correlations between specific items of the intimate contacts subscale and the validation variables given the subscale "I" and the Berkman scale "B"

		Marital status		No of close friends		No of close relations		Frequency of visits from friends/relatives	
		gamma	p	gamma	p	gamma	p	gamma	p
Bed days	I	—	—	—	—	—	—	—	—
	B	0.12	0.008	—	—	0.06	0.018	—	—
Difficulty walking	I	—	—	—	—	0.13	0.009	—	—
	B	—	—	—	—	0.10	0.044	—	—
Perceived health status	I	—	—	—	—	—	—	—	—
	B	—	—	—	—	—	—	—	—
Psychological distress	I	0.13	0.020	—	—	0.05	0.039	—	—
	B	0.21	0.000	—	—	0.08	0.004	—	—
Employment status	I	0.18	0.003	0.07	0.019	—	—	0.08	0.007
	B	0.26	0.000	0.06	0.041	—	—	0.08	0.009
Education	I	—	—	—	—	—	—	—	—
	B	—	—	—	—	—	—	—	—
Income	I	0.46	0.000	—	—	—	—	0.05	0.038
	B	0.37	0.000	0.05	0.025	—	—	0.06	0.012
Gender	I	—	—	0.12	0.000	0.11	0.000	—	—
	B	—	—	—	—	—	—	—	—

Findings

Table 1 shows massive evidence of item bias for all items of the group membership subscale in relation to both the Berkman index and the group membership subscale itself. Serious item bias was found in relation to perceived health status, education, employment status, and household income, especially for the item on membership in work related groups. Sporadic signs of bias are also seen for various items in relation to disability, illness measured as bed days, and psychological distress. It is clear that the measure of group membership cannot be validly used as either a scale in its own right or a subscale of a global measure of social network/support.

In table 2, the findings for the sociability subscale are seen. While the item bias is less massive for the components of this subscale, the consistent significant relationships between the number of close relatives and the illness variables suggests that this subscale also has problems which cannot be ignored. Signs of item bias are seen for both the number of close friends and the frequency of social interaction in relation to the social situational variables and gender.

Table 3 shows that the item bias seen for the sociability subscale grows stronger when marital status is added to make the intimate contacts subscale. Evidence against using marital status as an item is found in relation to bed days, psychological distress, employment status, and especially income.

Discussion

The massive evidence of item bias found in this study means that the Berkman scale cannot be used as a valid and useful measure of social network in our definitive analyses. It is likely that the summary scale would predict morbidity and mortality in our study, just as it has in other investigations, but the findings could not provide valid and useful evidence about the influence of social support on health. Both issues of valid measurement and of drawing causal conclusions from statistical predictions are fundamental scientific problems in population research on complex health questions such as those involved in social support research.¹⁷

Even if we could validly use the measure to see if previous findings were replicated, all of the issues and research questions in need of clarification for the development of health policy and professional services would remain. The basic questions of what aspects of the social environment provide health protective or health damaging effects and how health protective mechanisms operate could not be answered.

The problems are both theoretical and methodological. Since the purpose of scaling is to transform a theoretical domain into an empirical measure of a concept, it is precisely that concept and not others that must be the subject of measurement. The Berkman index includes quite diverse components: marital status, size of the network, contact with the

network, and membership of formal organisations. Marital status represents many things besides the possibility of a supportive relationship. It also affects family income, social status, and opportunities for social interaction. Likewise, membership in formal organisations arises from many different types of influences which have little or nothing to do with support from the social network – for example education, social status, personal social functioning, etc. The extensive signs of item bias illustrate these problems.

It is clear from the findings that the group membership subscale is meaningless for the purposes of our work, and should not be included in our analyses of the research questions in the project. While the problems of item bias are not as extensive with regard to the sociability subscale and the intimate contacts subscale (which is an expansion of the sociability subscale with marital status added), it is clear that there are problems, in addition to the theoretical ones already mentioned, with construct validity as well. The consistent findings with regard to employment status, income, and gender indicate problems of confounding in the scale and its subscales. The effects of these variables would be confused or hidden in any multivariate analyses conducted with the measures.

For the purposes of our research, to investigate the inconsistencies and contradictions in the published reports on social support and health research and to elaborate the interrelationships among social support, psychosocial functioning, and behavioural variables, the separate measures of network composition and social contact must be included in the multivariate analyses to study the indirect and direct relationships with the health variables.

In subsequent studies, it is important to use or construct measures of social support that tap the theoretical domains of network composition, how the network functions to provide support, and of psychosocial functioning. When measures of these domains are validated, then population studies of their relative influence on health can be conducted. The measures must be validated in each population studied to ensure that scaled variables do not hide the effects of other influences in different populations.

While the focus of our investigation is social support research, the consequences arising from reducing complex data into scaled variables that are used as measures of some concept without considering the theoretical and methodological problems of doing so can be generalised to many substantive areas of population health research.

Appendix

The statistical problem may be formulated as follows:

$I = (I(1), \dots, I(m))$ is the vector of items
 $B =$ Berkman scale
 $X = (X(1), \dots, X(n))$ is the vector of exogenous variables

In order for us to maintain that no information is lost

by using the scale it is necessary that items and exogenous variables are conditionally independent:

$$I \perp X \mid B,$$

To ensure that this statistical demand is met it is necessary that: it holds for individual items and the individual exogenous variables

$$(1) \quad I(i) \perp X(j) \mid B$$

and, that in cases where there is not a relationship between the scale and the individual exogenous variables, that this also holds for the separate items of the scale

$$(2) \quad X(j) \perp B = > X(j) \perp I(i)$$

The first condition is the demand discussed in the psychometric literature that a scale should not have "item-bias", while the second condition is a demand that a given scale should not hide any relationship with an exogenous variable. This is an obvious, but still often overlooked, prerequisite for the valid use of a scale.

Conditions (1) and (2) constitute a set of simple demands for the validation of a scale. For more sophisticated scale construction it is necessary to consider other demands, but these two are fundamental conditions which must always be met. When the scale is an ad hoc classification system like the Beckman scale, no other reasonable statistical conditions can be demanded of the scale. Other validity questions are theoretical and conceptual.

For the testing of conditions (1) and (2) Goodman and Kruskal's gamma have been used both for calculating marginal rank correlations and for partial rank correlations. In every case where the analysis of two way tables suggests possible item bias, the evaluation has proceeded to analyse relevant three way tables.

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