

SOCIAL TIES AND MORTALITY IN EVANS COUNTY, GEORGIA

APPENDIX

Structure of the Berkman Social Network Index

and

Procedure for construction of an Evans County surrogate

I. PURPOSE OF EVANS COUNTY SOCIAL NETWORK INDEX

In attempting to replicate Berkman and Syme's basic finding of lower mortality risks for men and women having a higher level of social and community ties, we sought to reproduce their social network index as closely as possible given the data we had available. Our reasoning was that if one were attempting to replicate a relationship reported for a chemical substance that had not yet been fully characterized, one would repeat the methods for extraction, separation, and so forth in order to duplicate as closely as possible the procedures in the original report. Applying this analogy to the social network index, we should therefore repeat the exact method of constructing the index.

Unfortunately, the Evans County interview did not contain identical items for all of those entering the Berkman index. We therefore chose the most comparable items and derived the most comparable index. Initially, we avoided experimenting with different indexes, since we wanted to carry out our statistical test of hypothesis without adjusting the nominal significance level for multiple tests. Similarly, we carried out our attempted replication a priori rather than following examination of relationships between individual items and survival. Later, we examined individual item relationships and alternate indexes.

II. DISCUSSION OF THE BERKMAN SOCIAL NETWORK INDEX (BSNI)

The Berkman Social Network Index derives from three groups of items in the 1965 Human Population Laboratory Questionnaire. These item categories are (1) marital status, (2) close friends and relatives, and (3) membership in a church group and/or other type of social group. For the last of these categories, a distinction is drawn between membership in a church group and membership in other groups, resulting in four conceptual components. The construction of each component and the underlying concepts are described below.

(1) Marital status

Marital status is coded as a dichotomous variable: not married (includes single, separated, divorced, and widowed) versus married.

(2) Contacts with friends and relatives

Three items make up this component: the number of close friends, the number of close relatives, and the total number of close friends and relatives who are seen at least once a month. Questionnaire response choices for each of these items are: "none", "1 or 2", "3 to 5", "6 to 9", or "10 or more".

The first two items, number of close friends and number of close relatives, are combined to produce a Relatives and Friends Score. The score is obtained from a table (see Berkman, 1977, Appendix) that assigns a score value to each combination of item responses. Cutpoints were chosen to "coincide with 'breaks' in the array of ranges and to produce as even a distribution as possible" (Berkman, 1977, page 271, Appendix B).

A more compact presentation that produces equivalent scores is achieved by summing the midpoint values of the response choices for the friends and relatives variables and then employing the following table:

Categories of the
Relatives and Friends Score

<u>Relatives and Friends Score value</u>	<u>Range of midpoint sums</u>
1	0 - 4
2	5.5 - 9.0
3	10 - 15
4	16+ - 17.5+

For example, if number of close friends is 0 and number of close relatives is "3-5", then the sum of the midpoint values is 4, and the Relatives and Friends Score is 1. If number of close friends is "3-5" and number of close relatives is "6-9", then the sum of the midpoint values is $4 + 7.5 = 11.5$, and the Relatives and Friends Score is 3. (The midpoint value for the item response choice of "10 or more" has been arbitrarily set at "12+" to avoid overlap with the previous category. For example, "3-5" close friends and "10+" close relatives would yield $4 + "10+" = "14+"$.)

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The Friends and Relatives score is then combined with the third item, number of close friends and relatives seen at least once a month. The result is designated the Sociability Score, with five ordinal levels subsequently collapsed into three: low (1), medium (2), and high (3). The algorithm does not appear to have a more compact form than Berkman's table:

BSNI Sociability Score		
<u>Sociability Score value</u>	<u>Relatives and Friends Score</u>	<u>Number of Friends and Relatives Seen in a Month</u>
1. Low	1	Any response
2. Medium	2-3	Any response
	OR 4	3-5 or fewer
3. High	4	6-9 or more.

Although the absence of an algebraic formulation makes it difficult to determine weightings, the Sociability score does seem to give greater weight to number of friends and relatives than to frequency of contacts. For example, a subject with many close friends and relatives but seeing very few in a month would be placed in the medium sociability category; a subject with few close friends and relatives but seeing all of them very frequently would be placed in the low sociability category.

(3) Church group membership

Church group membership is coded as a dichotomous variable indicating whether or not the respondent reported belonging to a church group. Presumably the variable indicates church group membership rather than church membership or church attendance, per se. In Berkman (1977) and in Berkman and Syme (1979), this variable is alternately referred to as "church membership" and "church group membership". Although the questionnaire item specifically refers to membership in a church group, respondents may have responded to the question as if church membership in general were the subject, rather than specifically church group membership (personal communication from Dr. Berkman, 1983).

(4) Group membership

Group membership is coded as a dichotomous variable based on the response to the questionnaire item:

"Do you belong to any of these groups?"

"A social or recreational group?; A labor union, commercial group, professional organization?; A group concerned with children? (PTA, Boy Scout); A group concerned with community betterment, charity, or service?; Any other group?"

The variable takes on the value zero if there are no affirmative responses and the value one if the respondent indicates belonging to one or more types of groups.

Index of Intimate Contacts

The Social Network Index is formed from these four components by first constructing an Index of Intimate Contacts (low, medium, high), based on marital status and Sociability Score, and then adding points for the two membership components. For married subjects, the Intimate Contacts Index value is equal to the Sociability Score (low, medium, high). For unmarried subjects, the Intimate Contacts Index value is "medium" if the Sociability Score is "high", or "low" if the Sociability Score is "low" or "medium".

Social Networks Index

The Berkman Social Network Index is then equal to a weighted sum of the Index of Intimate Contacts and the variables indicating membership in a church group and membership in some other group or organization, with weights of 4:2:1 for intimate contacts:church group:other group. With suitable coding of each variable, the BSNI can be rendered by the formula:

$$\begin{aligned} \text{BSNI} &= 4(\text{Index of Intimate Contacts}) \\ &+ 2(\text{church group membership}) \\ &+ (\text{other group membership}) \\ &+ 1 \end{aligned}$$

where the Index of Intimate Contacts ranges from 0 (low) to 2 (high) and the two membership variables take values of 0 (not member) or 1 (member). (Note: Berkman uses codes with different numerical values; the present coding produces a slightly simpler algebraic formulation.)

The 12-value index is then collapsed into four levels: I. Low (1), II. Medium (2-5), III. Medium-high (6,7) and IV. High (8-12). Category I (low) results from a low Intimate Contacts Index and no membership in church or other groups. The other categories can each result from multiple combinations of intimate contacts and group memberships. To be classified in category IV (high), a subject must have either high Intimate Contacts (regardless of memberships) or medium Intimate Contacts together with both church and group membership.

Algebraic structure of the BSNI

The weightings involved in the construction of the overall index were based on theoretical, intuitive, and empirical considerations, including both the distribution of responses in the Alameda County dataset and the mortality rates observed at

different levels of the component variables. The resulting index is mathematically complex. In order to gain insight into the sensitivity of the BSNI to its components, we analyzed its algebraic structure. The resulting expression, however, is complicated by the unavailability of a simple algebraic formulation for the Index of Intimate Contacts. This index embodies a threshold concept so that marital status conveys no benefit when the Sociability Score is at its lowest level, and medium sociability conveys no benefit in unmarried subjects.

The derivation of the overall BSNI can be represented by the following algebraic expressions:

$$\begin{aligned} \text{BSNI} &= 4I + 2C + G + 1 \\ &= 4(M-1) + 4(S-1) + 2C + G + 1 \quad (\text{when } M + S > 1) \\ \text{OR} \\ &= 2C + G + 1 \quad (\text{when } M + S = 1) \end{aligned}$$

where:

- I (the Intimate Contacts Index) =
 $M + S - 2$ if $M + S > 1$ or 0 if $M + S = 1$;
- M (marital status) = 1 if married or 0 if not;
- S (Sociability Score) = 1 (low), 2 (medium), or 3 (high);
- C (church group membership) = 1 if a member and 0 if not;
- G (other group membership) = 1 if a member and 0 if not.

Recalling the construction of the Sociability Score, we can see that frequency of visits from friends and relatives can have the same quantitative impact as marriage, but only when the subject reports having 13 friends and relatives. Among married subjects, increasing the sociability score from its minimum value to its maximum, raises the BSNI value by a full 8 points, the largest possible impact from changing a single variable value. However, marriage is essential to reach BSNI category IV (high) unless the subject has 13 or more close friends and relatives, sees at least 6 of them monthly or more often, and belongs to both a church and other type of group. A subject in BSNI category I (low) can be married and can have numerous visits from close friends and relatives if the total number of such close friends and relatives is five or fewer. The contribution of church group membership is twice that of other group membership and half that of marriage (except for subjects with low sociability, where marriage has no effect).

III. CONSTRUCTION OF THE EVANS COUNTY SOCIAL NETWORK INDEX

Construction of the Evans County Social Network Index required:

- o identification of items comparable to those in the Alameda questionnaire;
- o combination of items in a manner similar to the BSNI;
- o identification of comparable cut-points.

One aim that guided the construction of our index was to achieve an index with a population distribution that was similar to that of the BSNI.

Items from the 1967 Evans County Sociological Questionnaire that corresponded to Alameda items used in the Berkman Social network index were evaluated for their conceptual content and response distributions in the 2170 persons who took the sociological questionnaire. We chose from among the following items:

(1) Marital status

Marital status had seven nominal levels, which we grouped in the same manner as Berkman: married (75.5%) versus not married (24.5%).

(2) Contact with friends and relatives

The Evans County questionnaire contained five items denoting contact with friends and relatives:

- a. About how many families who are relatives (kinfolk) of yours live in or around Evans County.
- b. IF "ONE" OR MORE, ASK: About how many of these families (relatives) do you see fairly often (about 5-6 times a year)?
- c. About how many neighbors around here do you know well enough to visit with?
- d. Altogether about how many people are there whom you consider to be close friends--not counting relatives or neighbors? (IF NECESSARY, ADD:) "Just give a rough estimate." (DEFINITION OF "CLOSE FRIEND": A person to whom you can tell what's on your mind.)
- e. In times of personal troubles, about how many people do you think you can depend on for help?

Response options for each item were:

[None, one, 2-3, 4-5, 6-9, 10-14, 15+, Other (specify)]
(Item d included a "Don't know" choice.)

We selected items a and d. We excluded item b because responses to item a and item b were nearly identical. We considered item c for inclusion, despite its absence from the Alameda questionnaire, because the Evans County item about close friends (item d) excluded neighbors. Nevertheless we did not include item c in the final index for two reasons: (1) comparison of the sociability scores that included relatives, friends, and neighbors with the sociability score consisting of only relatives and friends showed that the distribution of the latter sociability score better approximated the distribution of the Berkman Sociability Score; (2) the correlation between the sociability scores with and without the neighbors item was high ($r=.93$).

(3) Church group membership:

Though the Evans County Sociological Questionnaire contained no specific items on membership in church or other groups, the questionnaire did contain several related items:

- a. Quite aside from church going, how important in general would you say religion is to you: very important, somewhat important, not important at all?
- b. Are you a church-goer? (Yes, No, No Response)

IF "YES," ASK: How often do you generally attend?

	% or respondents
Daily	1
2 or more times weekly	13
Once weekly	26
A few times monthly	32
Once a month	13
A few times a year	10
Once a year	0
Less than once yearly	0
Never	4
(No response)	1

	100

There was also an item "What are the main things you usually do in your spare time?" which included "church activities--prayer meeting, church, etc." as one of sixteen choices. Responses to this choice were evenly divided between yes and no (including missing, assumed no).

We used the spare time activity item to measure church group membership because: (1) the spare time item seemed closer to the church group membership item in the Alameda questionnaire item; (2) the Alameda county questionnaire contained an item on church attendance, but Dr. Berkman had not included it in her index. We did, however, construct an alternate index based on church attendance to examine in exploratory mode. For this alternate index, we categorized church attendance as: weekly or more often (40%), twice a month (32%), and once a month or less often (28%).

50.7 percent of the Evans County subjects reported that they did church activities in spare time; 40.2 percent indicated that they did not. 9.1 percent of subjects did not respond to the church activities choice and were treated as nonparticipants in church activities. By comparison, 31.7 percent of the Alameda County sample reported belonging to a church group.

(4) Group membership

Since none of the Evans County items was similar to the Alameda items, we had to omit this component of the index.

Sociability Score

A Sociability Score was obtained from the sum of midpoint values for responses to the relatives and friends variables. This sum ranged from 0 to 35. We used cutpoints of 5 and 17 to designate Low, Medium, and High sociability. (The cutpoints for Berkman's Friends and Relatives Score were midpoint sum values of about 5 and 16.) The score distributions on Berkman's Sociability Score and the Evans County sociability score were:

	Sociability Score Percent distribution	
<u>Score</u>	<u>Alameda</u>	<u>Evans County</u>
Low	17	16
Medium	64	56
High	19	28
	-----	-----
	100	100

Index of Intimate Contacts

The Index of Intimate Contacts score (Low, Medium, High) combined Sociability Score and marital status in the same manner as the BSNI. The distributions of the Index of Intimate Contacts in the two populations were:

Index of Intimate Contacts
Percent distribution

<u>Value</u>	<u>Alameda</u>	<u>Evans County</u>
Low	27	29
Medium	55	48
High	18	23
	----	----
Total	100	100

(based on 2073 persons in Evans County with Intimate Contact scores).

Social Network Index for Evans County

The procedure for calculating Social Network Index scores from the Intimate Contacts and Church Attendance values was identical to that employed for the BSNI with the omission of a group membership component. The formula was:

$$\begin{aligned} \text{Social Network Score} = & \\ & 4 \text{ (Index of Intimate Contacts)} \\ & + 2 \text{ (Church activities - 1)} \\ & + 1 \end{aligned}$$

The social network variable scores ranged from 1 to 11, with a median of 6 and a mode of 7 (19.3 percent of the 2053 persons with available social network values fell into this category). We then collapsed the 11 values of the resulting social network index into four major categories, similar to those of Berkman. The categories and frequency distributions for the Alameda and Evans County social network variables were:

Social network index categories
Percent distribution

<u>Category</u>	<u>Alameda County</u> <u>Percent</u>	<u>Evans County</u> <u>Percent</u>
Low (1)	9.2	13.6
Medium (2-5)	31.1	39.2
Medium-high (6-7)	27.6	23.1
High (8-12)	32.1	24.1
	-----	-----
Total	100.0	100.0

Note:

For the variant in which church attendance was substituted for spare time in church activities:

Dichotomizing the church attendance variable led to a social network variable with a distribution skewed toward low scorers: the mode was 4 and the two lowest social network values contained one-third of the sample.

Categorizing church attendance so that the middle value contained both monthly attenders and twice-monthly attenders resulted in a social network variable that was also unacceptable. Some social network values had very low frequencies (only 4.8% of the sample fell into the low category), while others had disproportionately high frequencies (over 40 percent of the sample were counted as medium-high). Moreover, these distributions were very different from those of the Berkman sample.

Revising the church attendance variable so that the middle value included only persons who attended church twice a month or more resulted both in a more evenly distributed church attendance variable, and in a more normally distributed social network variable. The distribution of the social network index in which church attendance was used instead of spare time in church activities was: Low (8.8%), Medium (33.6%), Medium-high (34.6%), High (23.0%) when church attendance responses were grouped into three levels.

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