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Social Integration and Social Support Among Older Adults Following Driving Cessation

Briana Mezuk[1] and George W. Rebok[2]

[1]Department of Epidemiology, University of Michigan, Ann Arbor.
[2]Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland.

Objectives. The objective of this study was to evaluate the impact of driving cessation on social integration and perceived support from relatives and friends among older adults.

Methods. Data came from the population-based Baltimore Epidemiologic Catchment Area Study. We restricted analyses to participants aged 60+ with a history of driving ($n = 398$). Social integration (number and frequency of contact) and perceived social support from relatives/friends, driving status (continuing or ceased), and demographic and health characteristics were assessed at interviews 13 years apart. The potential mediating role of ability to use public transit was also investigated. We used repeated measures random-intercept models to evaluate the effect of driving cessation on social network characteristics over time.

Results. Former drivers were older, were more likely to be female and non-White, had lower education, had poorer self-rated health, and had lower Mini-Mental State Examination scores relative to continuing drivers. Over the follow-up period, cessation was associated with reduced network of friends (odds ratio = 0.49, $p < .05$). This association was not mediated by ability to use public transportation. Cessation had no impact on support from friends or relatives.

Discussion. Social integration is negatively affected by driving cessation even among elders who feel competent in using alternative forms of transportation, at least concerning networks of friends.

***Key Words*:** Life course—Social networks—Social support—Driving cessation—Social integration.

THE number of drivers older than age 60 is increasing as the nation's population ages, and driving is the primary mode of transportation used by older adults (Jette & Branch, 1992). Older adults are often reluctant to stop driving for fear of losing independence (Carr, 2000). A large body of literature has examined predictors and correlates of driving cessation among older adults, including older age, female gender, vision and hearing problems, poor cognitive and physical functioning, low socioeconomic status, and nursing home placement (Anstey, Windsor, Luszcz, & Andrews, 2006; Edwards et al., 2008; Freeman, Gange, Munoz, & West, 2006; Gallo, Rebok, & Lesikar, 1999).

Comparatively little research has examined the consequences of driving cessation among older adults in a longitudinal manner. Marottoli and colleagues (2000) found that driving cessation predicted a decrease in out-of-home activities, many of which involved socialization (i.e., playing cards, volunteering, going to a movie). In prospective analyses, both Marottoli and colleagues (1997) and Ragland, Satariano, and MacLeod (2005) found that former drivers had elevated depressive symptoms relative to continuing drivers.

The structure and quality of social relations change over the life course and may be affected by changes in functional status. For example, the social networks of older adults tend to be smaller and centered on close friends and family relative to those of younger groups (Adams & Blieszner, 1995; Ajrouch, Antonucci, & Janevic, 2001), and substantial, although constrained, heterogeneity exists in both the structural and support characteristics of those relationships (Antonucci & Akiyama, 1987; Consedine, Magai, & Conway, 2004). Social relations are multidimensional (i.e., they have both structural and support characteristics and consist of friends and/or relatives), and the degree and predictors of change in these relationship types may differ with age (Antonucci & Akiyama, 1987; Fiori, Smith, & Antonucci, 2007; Litwin, 2001).

Driving cessation in older age may influence social relations in differing ways. For example, former drivers generally rely on friends and relatives as their primary means transportation (Kostyniuk & Shope, 2003), which may result in increased contact with these networks. Alternatively, former drivers may be reluctant to ask for transit assistance, particularly to engage in social activities (Persson, 1993), resulting in reduced network sizes. Whether there is a relationship between driving cessation and perceived support is unclear. Former drivers may feel either increased support from those who assist them in their transportation needs, or a sense of abandonment if their needs are not met (Johnson, 1999; Kostyniuk & Shope, 2003). Finally, due to the recursive nature of the relationships between social relations, health, and functioning (Johnson, 2008; Litwin & Shiovitz-Ezra, 2006), cessation may simply be an indicator of accumulating burdens that independently lead to decreased social activities (Persson, 1993).

Older adults who stop driving must rely on alternative modes of transportation, often in an ad hoc manner (Kostyniuk & Shope, 2003). Mobility is critical to continued participation in social life in older age (Dickerson et al., 2007), and thus the availability and acceptability of alternative forms of transportation may be an important mediator of the effect of cessation on social relations. Studies have consistently shown that older adults are unsatisfied with and reluctant to use public

transportation (Dickerson et al., 2007; Kostyniuk & Shope, 2000). However, few studies have explicitly evaluated whether the ability to use such alternatives protects against potential negative effects of cessation on social life (Legh-Smith, Wade, & Hewer, 1986).

Motivated by the potential for differing effects of cessation on social life, the objective of this study was to prospectively evaluate the impact of driving cessation among older adults on social integration, as indicated by the number and frequency of contact with relatives and friends, and on perceived social support from relatives and friends. We also evaluated whether ability to use public transportation mediates these associations.

Methods

Sample

The Baltimore Epidemiologic Catchment Area (ECA) Study is a population-based probability sample of household-residing adults aged 18 and older originally interviewed in 1981 (n = 3,481). Participant characteristics and study procedures have been previously described (Eaton, Regier, Locke, & Taube, 1981). Most interviews were conducted in person unless the participant had moved more than 2 hr outside the metropolitan area. Follow-up interviews were conducted in 1982 (n = 2,768), 1993/1996 (n = 1,920), and 2004/2005 (n = 1,071), and approximately 75% of the surviving cohort was reinterviewed at each wave (Eaton, Kalaydjian, Sharfstein, Mezuk, & Ding, 2007). We restricted the analyses presented here to ECA participants aged 60 and older at the 1993/1996 (Wave 3) interview who provided data on driving status (n = 583).

The Johns Hopkins School of Public Health Institutional Review Board approved the study, and all participants provided informed consent.

Measurement of Driving Status

In the 1993/1996 and 2004/2005 interviews only, participants were asked (a) how many years they had driven an automobile and (b) if they still currently drove a vehicle at least once a week. Based on these items, we categorized 1993/1996 participants as never drivers (drove for 0 years; n = 185), former drivers (drove for ≥1 year but no longer drove at least once a week; n = 133), or continuing drivers (drove for ≥1 year and still drove at least once a week; n = 265). We excluded never drivers from the study, leaving 398 participants for analysis. Driving cessation over the follow-up period was indicated by a change in the dichotomous driving status variable from continuing driver in 1993/1996 (coded 0) to former driver in 2004/2005 (coded 1).

Measurement of Social Network Characteristics

We investigated structural and support characteristics of social networks for friends and relatives separately. We measured integration with friends and relatives over the past 6 months with two separate 3-point Likert scale items: (a) "How many family members and relatives [friends], who do not live with you, do you usually keep in touch with by telephone or by visiting?" (collapsed into three categories: 1 = none or one friend/relative, 2 = 2–5 friends/relatives, 3 = 6+ friends/relatives), and (b) "How often do you talk on the phone or get together with relatives who do not live with you [friends]—most every day, a few times a week, a few times a month, or less than once a month?" (collapsed into three categories: 1 = a few times a month or less, 2 = a few times a week, 3 = every day). Thus, higher levels of social integration were indicated by higher scores on these items, and odds ratios below unity (odds ratio = 1) indicated a decrease in social integration as indicated by these measures.

We measured perceived support from friends and relatives by summing six 4-point Likert scale items (reverse coded, when appropriate): (a) "(Not including your (husband/wife/partner)), how much do your relatives [friends] really care about you?" (b) "How much can you rely on them for help if you have a serious problem?" (c) "How much can you relax and be yourself around them?" (d) "(Not including your (husband/wife/partner)), how much do your relatives [friends] make too many demands on you?" (e) "How often do they let you down when you are counting on them?" and (f) "How often do they get on your nerves?" (1 = a lot/often, 2 = some/sometimes, 3 = a little/rarely, 4 = not at all/never). The summed scores ranged from 6 to 24, with higher values indicating greater support.

Statistical Analysis

We compared the characteristics of former and continuing drivers at each wave (1993/1996 and 2004/2005) by using chi-square tests for categorical variables and Student t tests for continuous variables. In order to estimate the influence of driving cessation on social network characteristics, we fit four regression models with driving status (former vs continuing driver) as the primary independent variable and the social network characteristic (integration with friends, integration with relatives, support from friends, and support from relatives) as the dependent variable. To assess the longitudinal effect of driving cessation on change in social network characteristics, we fit random-intercept models, which account for the repeated observations (and subsequently correlated errors) within participants across the two waves (1993/1996 to 2004/2005; Hardin & Hilbe, 2007). We chose the random-intercept model over other longitudinal modeling approaches (i.e., generalized estimating equations) in order to account for heterogeneity in baseline social affiliation (Rabe-Hesketh, Skrondal, & Pickles, 2004). This approach is more appropriate than generalized estimating equations for ordered outcomes because it relaxes the assumption that the threshold for changing response categories is the same across all individuals (Boes & Winkelmann, 2005). It is also more robust for modeling nonrandom missing data (described below; Omar, Wright, Turner, & Thompson, 1999). For the measures of social integration, indicated by ordinal scales, we used multivariate proportional odds regression to estimate the relative effect of driving cessation on categories of network size and frequency of contact. The proportional odds model calculates the probability of being in a "better" category (i.e., larger network size or more frequent contact) relative to a worse one (i.e., smaller network size or less frequent contact), presented as odds ratios and 95% confidence intervals. We tested the appropriateness of the proportional odds assumption by using an approximate likelihood ratio test of whether the beta coefficients were equal across outcome categories. For the measures of social support we used multivariate linear regression to estimate the effect of

Table 1. Characteristics of Continuing and Former Drivers by Wave, Aged 60 and Older at Wave 3

Characteristic	Wave 3 (1993/1996)			Wave 4 (2004/2005)		
	Continuing	Former	*p*	Continuing	Former	*p*
Total *N*	265	133		76	52	
Age, *M* (*SD*)	71.3 (6.8)	75.3 (7.8)	<.001	78.0 (4.8)	82.5 (6.4)	<.001
Female, *n* (%)	119 (44.9)	95 (71.4)	<.001	28 (36.8)	37 (71.2)	<.001
White, *n* (%)	217 (81.9)	88 (66.2)	<.001	66 (86.8)	37 (71.2)	.028
Education, *M* (*SD*)	10.7 (3.1)	9.5 (2.8)	<.001	11.9 (2.9)	10.5 (2.7)	.004
Lives alone, *n* (%)	79 (29.8)	52 (39.1)	.033	3 (3.9)	4 (7.7)	.360
Self-rated fair/poor health, *n* (%)	79 (29.8)	65 (48.9)	<.001	25 (36.2)	21 (47.7)	.225
Lifetime cardiovascular disease, *n* (%)[a]	91 (34.3)	54 (40.6)	.221	30 (39.5)	28 (53.8)	.109
Lifetime diabetes, *n* (%)	32 (12.1)	26 (19.5)	.046	16 (21.1)	16 (30.8)	.212
MMSE, *M* (*SD*)	27.6 (2.5)	25.8 (3.9)	<.001	27.5 (2.5)	26.2 (3.0)	.015
Can use public transit with little/no difficulty, *n* (%)	256 (97.7)	99 (78.6)	<.001	71 (93.4)	32 (61.5)	<.001
Years drove, *M* (*SD*)	45.9 (13.5)	29.5 (21.1)	<.001	55.3 (11.2)	37.9 (24.0)	<.001
Small network—relatives, *n* (%)[b]	50 (18.9)	34 (25.6)	.123	14 (18.4)	13 (25.0)	.370
Small network—friends, *n* (%)[b]	94 (35.6)	62 (46.7)	.034	24 (31.6)	22 (42.3)	.214
Infrequent contact—relatives, *n* (%)[c]	27 (10.5)	9 (7.3)	.315	9 (11.8)	12 (0.24)	.073
Infrequent contact—friends, *n* (%)[c]	37 (14.0)	27 (20.3)	.104	15 (20.8)	6 (13.4)	.304
Perceived support—relatives, *M* (*SD*)	21.0 (2.6)	20.9 (3.2)	.712	20.7 (2.6)	20.8 (3.6)	.784
Perceived support—friends, *M* (*SD*)	20.6 (2.8)	20.5 (2.8)	.679	20.1 (2.7)	20.3 (3.1)	.786

Notes: Wave 3: Total $N = 393$ for lives alone, $N = 382$ for MMSE, $N = 388$ for ability to use transportation, $N = 395$ for years drove, $N = 397$ for network size (friends), $N = 382$ for contact frequency (relatives), $N = 395$ for support (relatives), $N = 386$ for support (friends) due to missing data. Wave 4: Total $N = 113$ for self-rated health, $N = 113$ for MMSE, $N = 124$ for use transportation, $N = 126$ for contact frequency (relatives), $N = 117$ for contact frequency (friends), $N = 124$ for support (friends) due to missing data. *p* value for chi-square test for categorical variables and *t* test with unequal variances for continuous variables within wave. MMSE = Mini-Mental State Examination.

[a]Lifetime cardiovascular disease includes stroke, myocardial infarction, congestive heart failure, angina pectoris, rheumatic fever, or rheumatic heart disease.

[b]Small network refers to ≤3 relatives/friends.

[c]Infrequent contact refers to contact (in person, by phone, or by e-mail) with relatives/friends once a month or less.

driving cessation on perceived support from friends and relatives indicated on a continuous scale.

If participants were too impaired (i.e., scored <15 on the Mini-Mental State Examination [MMSE]) to complete the full interview (approximately 2.5 hr in length), a proxy was sought who completed an abbreviated version of the survey. In all, 141 (19.5%) participants aged 60 and older did not provide any data on driving status at the 1993/1996 interview, and we evaluated differences between this group and those who did provide data (including never, former, and continuing drivers) by using Student *t* tests and chi-square tests, as appropriate. Participants without driving data were older, were less educated, and had lower MMSE scores (all $ps < .01$), consistent with the notion that most of the missing data were due to reliance on proxy interviews that did not include the items on driving status.

We selected the covariates included in the models based on previous research suggesting they are related to social network characteristics or driving status. We adjusted all analyses for age, gender, race, education, household composition, MMSE score, self-rated health, and ability to use public transportation. With the exception of gender and race, we modeled these variables as time-varying covariates. We set statistical significance at $p < .05$, and all *p* values refer to two-tailed tests. We conducted analyses by using STATA (Version 9.0) statistical software.

Results

A total of 398 ECA participants aged 60 and older reported having ever driven a vehicle in 1993/1996, and 265 (66.6%) were continuing drivers (see Table 1). Former drivers were older, less educated, more likely to be female, and more likely to be non-White; had poorer self-rated health and lower MMSE scores; and reported more difficulty using public transportation than continuing drivers at both the 1993/1996 and 2004/2005 interviews ($p < .01$).

Social Integration

Driving cessation was not significantly associated with change in either measure of social integration among relatives. Significant predictors of reduced social integration (either smaller network size or less frequent contact) among relatives included inability to use public transportation, living alone, and higher levels of education (see Table 2). Driving cessation was associated with a reduction in network size of friends (odds ratio = 0.49, $p < .05$). Both higher MMSE scores and living alone were associated with increased social integration with friends, indicated by network size and frequency of contact, respectively.

Social Support

Only female gender ($\beta = 1.05$, $p < .001$) and fair/poor self-rated health ($\beta = -0.84$, $p < .003$) were significantly associated with change in perceived social support from friends in fully adjusted models; other covariates were not significant (data not shown). Driving cessation did not significantly impact change in support from friends or relatives (see Table 3).

Discussion

Over the 13-year follow-up period, driving cessation was associated with a significant decrease in social integration

Table 2. Association Between Driving Cessation and Change in Social Integration

	Relatives		Friends	
	Network Size	Contact Frequency	Network Size	Contact Frequency
Variable	Wave 3–Wave 4 OR (95% CI)	Wave 3–Wave 4 OR (95% CI)	Wave 3–Wave 4 OR (95% CI)	Wave 3–Wave 4 OR (95% CI)
Driving cessation (ref = continuing to drive)	0.80 (0.40, 1.57)	0.87 (0.53, 1.43)	0.49 (0.28, 0.86)	0.81 (0.46, 1.40)
Age (years)	1.01 (0.96, 1.04)	1.00 (0.97, 1.03)	1.02 (0.99, 1.05)	0.98 (0.95, 1.01)
Gender (ref = male)	3.96 (1.93, 8.13)	2.53 (1.58, 4.05)	1.55 (0.94, 2.55)	1.71 (1.03, 2.84)
Race (ref = White)	0.80 (0.38, 1.67)	0.99 (0.58, 1.70)	1.41 (0.77, 2.60)	1.48 (0.80, 2.75)
Education (years)	0.99 (0.89, 1.10)	0.92 (0.85, 1.00)	1.08 (0.99, 1.18)	1.00 (0.92, 1.09)
Household composition (ref = ≥1 other person)	0.41 (0.22, 0.75)	1.00 (0.64, 1.58)	1.09 (0.66, 1.80)	2.78 (1.62, 4.77)
Self-rated health (ref = good/excellent)	1.20 (0.66, 2.18)	1.36 (0.87, 2.13)	0.94 (0.58, 1.53)	1.01 (0.62, 1.65)
MMSE score (continuous)	1.08 (0.97, 1.20)	1.01 (0.93, 1.10)	1.13 (1.03, 1.24)	1.06 (0.96, 1.16)
Can use public transit (ref = little/no difficulty)	0.28 (0.10, 0.79)	0.98 (0.45, 2.11)	1.39 (0.60, 3.21)	1.15 (0.49, 2.68)
Residual intraclass correlation	0.49	0.21	0.34	0.34
Akaike information criterion	794.5	986.8	939.0	981.9
Analytic sample size	371	355	370	371

Note: Network size values are ORs (95% CIs) of higher social integration indicated by larger number of contacts with friends or relatives. Outcome categories: 1 = none or one friend/relative, 2 = 2–5 friends/relatives, 3 = 6+ friends/relatives. Contact frequency values are ORs (95% CIs) of increased interaction, indicated by more frequent contact, with relatives or friends. Outcome categories: 1 = a few times a month or less, 2 = a few times a week, 3 = every day. Values are adjusted for all variables in the table. OR = odds ratio; CI = confidence interval; MMSE = Mini-Mental State Examination.

among older adults as indicated by the number of friends. This relationship was independent of demographic characteristics, cognitive functioning, self-reported health, household composition, and ability to use public transportation. Cessation had no influence on perceived social support, a finding that supports the contention that cessation most directly affects social life through restricting opportunities for social interactions rather than by instilling a sense of abandonment in the former driver (Marottoli et al., 2000). These findings are also consistent with reports that cessation is associated with a reduction in spending on items that involve socializing, such as dining out, entertainment, and vacations, while having no effect on expenses concerning basic needs (Kim & Richardson, 2006).

Being female was consistently associated with increased social integration. This may reflect differential resiliency and survivorship between female and male drivers (never drivers, who were predominantly women, were excluded from this analysis), although future research should examine this hypothesis more directly. Several characteristics had mixed effects on integration. For example, living alone was associated with having a smaller network size of relatives, but increased contact with friends. These results emphasize that individual characteristics can affect the structure of social networks in differing ways and that few, if any, characteristics or events can invariably impact social life in a set manner.

Inability to use public transportation was strongly associated with a reduction in network size of relatives, even after we controlled for driving cessation. Although this may reflect general functional impairment, this characteristic did not mediate the association between driving cessation and reduced number of friends. This suggests that social integration is negatively affected by cessation, even among elders who feel competent in using alternative forms of transportation, at least concerning networks of friends. This is consistent with previous reports concerning the reluctance of older adults to use public transit (Dickerson et al., 2007).

Cognitive impairment, as indicated by the MMSE, was not a strong predictor of social network characteristics as previous studies (Bennett, Schneider, Tang, Arnold, & Wilson, 2006) have found. However, this is likely due to the fact that in order to complete the full interview, including the items on driving status, participants had to score at least 15 on the MMSE (discussed above). Our findings suggest that the association is relatively weak within this group of normally cognitively functioning adults.

The primary strength of this study is that it utilized a prospective study design and a probabilistic sample that is less likely to suffer from selection bias, an important limitation of studies whose sampling frames rely on elders receiving health services. We also examined multiple aspects of social life (social integration and social support) among both friends and relatives, thus providing a more multifaceted picture of the impact of cessation on social interactions.

Table 3. Association Between Driving Cessation and Change in Perceived Social Support

	Relatives	Friends
Variable	Wave 3–Wave 4 β (95% CI)	Wave 3–Wave 4 β (95% CI)
Driving cessation (ref = continuing to drive)	−0.21 (−0.85, 0.43)	−0.47 (−1.10, 0.16)
Residual intraclass correlation	0.39	0.47
Akaike information criterion	2,347.2	2,271.2
Analytic sample size	368	363

Note: Values are average expected change (95% CI) of perceived social support with relatives or friends. Values are adjusted for age, race, gender, education, household composition, self-rated health, ability to use public transportation, and Mini-Mental State Examination score. Positive beta coefficients indicate higher levels of perceived support. CI = confidence interval.

Readers should interpret these findings in light of the study limitations. The Baltimore ECA is a sample of urban-dwelling adults, and, as such, these findings may not be generalizable to rural settings or to areas where public transportation is less readily available (Johnson, 2008). For example, family and friends of elders who stop driving in a rural environment may make additional efforts to keep in contact because they are cognizant of the limited availability of alternative transportation. Also, driving cessation was measured by self-report at the same time as the social network characteristics at each wave, and although these items asked participants to focus on current social interactions, without further information we cannot determine definitively that cessation preceded changes in social network characteristics given the 13-year lag between waves. Although we accounted for the influences of many characteristics thought to influence social interactions among older adults, unmeasured confounding variables including vision and hearing problems, residential location (including assisted living), and mortality among friends and relatives may have biased our results. Finally, the categorizations of integration and support may not have been sensitive or expansive enough to capture the nuances of these constructs or to detect change in social activities due to cessation.

Driving cessation is often understood as an indicator of functional decline rather than as a life event, but these findings, and preliminary reports that cessation is associated with increased depressive symptoms (Marottoli et al., 1997), suggest that a life events framework may be a useful approach to understanding how cessation impacts psychosocial health. As with many life "events" (e.g., divorce), driving cessation is often a drawn out rather than acute change in status (Dickerson et al., 2007). Changes in social interactions may reflect difficulty coping with the mobility limitations or role changes associated with cessation (Krause, 2004). Future studies should investigate this mechanism and its potential role in psychosocial outcomes among older adults, particularly the suggestive relationship between driving cessation and depression.

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Correspondence

Address correspondence to Briana Mezuk, Department of Epidemiology, University of Michigan, 109 Observatory, 3644 SPH Tower, Ann Arbor, MI 48109. E-mail: bmezuk@umich.edu

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