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Association between social isolation and outpatient follow-up in older adults following emergency department discharge

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ABSTRACT

Objectives: Follow-up with outpatient clinicians after discharge from the emergency department (ED) reduces adverse outcomes among older adults, but rates are suboptimal. Social isolation, a common factor associated with poor health outcomes, may help explain these low rates. This study evaluates social isolation as a predictor of outpatient follow-up after discharge from the ED.

Materials and methods: This cohort study uses the control group from a randomized-controlled trial investigating a community paramedic-delivered Care Transitions Intervention with older patients (age≥60 years) at three EDs in mid-sized cities. Social Isolation scores were measured at baseline using the PROMIS 4-item social isolation questionnaire, grouped into tertiles for analysis. Chart abstraction was conducted to identify follow-up with outpatient primary or specialty healthcare providers and method of contact within 7 and 30 days of discharge.

Results: Of 642 patients, highly socially-isolated adults reported significantly worse overall health, as well as increased anxiety, depressive symptoms, functional limitations, and co-morbid conditions compared to those less socially-isolated ($p<0.01$). We found no effect of social isolation on 30-day follow-up. Patients with high social isolation, however, were 37% less likely to follow-up with a provider in-person within 7 days of ED discharge compared to low social isolation (OR:0.63, 95% CI:0.42–0.96).

Conclusion: This study adds to our understanding of how and when socially-isolated older adults seek outpatient care following ED discharge. Increased social isolation was not significantly associated with all-contact follow-up rates after ED discharge. However, patients reporting higher social isolation had lower rates of in-person follow-up in the week following ED discharge.

1. Introduction

Emergency department (ED) visits are common among older adults in the United States, with 45 visits per 100 older adults in 2017 (Pitts, Niska, Xu, & Burt, 2008). After discharge from the ED, approximately 20% of older adults experience adverse outcomes such as an ED revisit, hospitalization, nursing home admission, or death within 30 days at rates much higher than their younger counterparts (Aminzadeh & Dalziel, 2002; Nagurney et al., 2017). Having prompt follow-up with outpatient clinicians after ED discharge has been associated with decreases in these adverse events and improved health outcomes (Atzema & Maclagan, 2017; Atzema, Austin, & Yu, 2018; Carmel, Steel, &

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Tanouye, 2017).

Numerous healthcare, research, and policy organizations endorse timely outpatient follow-up as a key component of high-quality transitions of care and care coordination for older ED patients being discharged home (National Quality Forum, 2017; National Transitions of Care Coalition, 2010; Snow, Beck, & Budnitz, 2009). The Agency for Healthcare Research and Quality identified post-ED outpatient follow-up among older adults as one of three main characteristics of high quality ED discharge and care transitions (Boonyasai, Ijagbemi, Pham, & Wu, 2014). Geriatric ED accreditation guidelines also recommend that a follow-up plan be implemented for all older patients to optimize continuity of care (Rosenberg, Carpenter, & Bromley, 2014). Recommended practice is for emergency physicians to instruct patients to follow up with outpatient clinicians (primary or specialty), usually within a specified timeframe soon after discharge (e.g., 2–3 days) (Kyriacou, Handel, Stein, & Nelson, 2005; National Quality Forum, 2017; Rosenberg et al., 2014). Although the exact timeframe for follow-up at discharge is determined by ED providers based on factors such as case severity/characteristics and outpatient provider availability, studies have indicated that for ED patients with certain chronic diseases (e.g. heart failure), outpatient follow-up within 7-days is associated with decreased hospitalization and mortality (Atzema & Maclagan, 2017; Atzema et al., 2018). Unfortunately, ED patients, particularly older adults, have traditionally shown low rates of follow-up after discharge (Biese, LaMantia, & Shofer, 2014; Vukmir, Kremen, Dehart, & Menegazzi, 1992). Factors associated with low rates of follow-up include lack of insurance, not having a designated primary care provider (PCP), greater number of co-morbidities, cognitive impairment, transportation, and difficulty scheduling post-discharge appointments (Atzema & Maclagan, 2017; Boonyasai et al., 2014; Ouslander, Reyes, Diaz, & Engstrom, 2020).

While several studies have examined social isolation as an important influence on health care seeking behavior, its role in obtaining outpatient follow-up after ED discharge has not been explored. Social isolation is defined as a perceived or objective lack of connection to, or support from, social networks (National Academies of Sciences Engineering & Medicine, 2020). Findings of a recent national study indicate that 24% of community-dwelling older adults are socially isolated (Cudjoe et al., 2020). Over half of older adult ED patients also report feeling socially isolated (Kandasamy et al., 2018). Social Isolation is associated with a host of high-risk characteristics, including older age, lower education, poor health status, decreased cognitive function, and impaired mobility (Cacioppo & Cacioppo, 2014; Merchant, Liu, Lim, Fu, & Chan, 2020; National Academies of Sciences Engineering & Medicine, 2020; Perissinotto, Holt-Lunstad, Periyakoil, & Covinsky, 2019; Shankar, Hamer, McMunn, & Steptoe, 2013). It has also been associated with poor psychological, cognitive, and physical health outcomes, as well as negative health behaviors and all-cause mortality among older adults (Cacioppo & Cacioppo, 2014; Gerst-Emerson & Jayawardhana, 2015; Holt-Lunstad et al., 2015; National Academies of Sciences Engineering & Medicine, 2020; Steptoe, Shankar, Demakakos, & Wardle, 2013; Valtorta, Moore, Barron, Stow, & Hanratty, 2018; Veazie, Gilbert, Winchell, Paynter, & Guise, 2019; Vozikaki et al., 2017). Older adults are more likely to experience myriad factors associated with perceived and objectively-measured social isolation, such as living alone and chronic illness (Chatters, Taylor, Nicklett, & Taylor, 2018). Studies evaluating healthcare use by socially isolated older adults have yielded mixed results, suggesting that social isolation may differently impact acute care use (e.g., emergency and inpatient services) compared to primary and preventative care (Manemann, Chamberlain, & Roger, 2018; Marty, Novotny, & Benzo, 2019). Although there have been studies examining ED utilization in socially-isolated adults, no studies have evaluated follow-up after ED discharge.

Due to the growing body of evidence relating lack of social connectedness to a wide range of negative health outcomes, social isolation has gained increased attention in geriatrics, public health, and federal agencies as a factor worthy of further study and intervention. A recent consensus study report released by the National Academies of Sciences, Engineering, and Medicine (NASEM) (National Academies of Sciences Engineering & Medicine, 2020) highlighted the need to build a high-quality scientific evidence-base supporting clinical "interventions that reduce the health and medical impacts of social isolation" in older adults, specifically recommending that research be conducted in clinical settings to prevent and mitigate the effects of social isolation. In this study we aim to better understand the relationship between social isolation and post-ED outpatient follow-up for older adults. We hypothesize that older adults with higher levels of social isolation will have reduced rates of post-ED follow-up with outpatient clinicians regardless of the mode of follow-up, compared to those with lower levels of social isolation.

2. Materials and methods

2.1. Study design & setting

We conducted an analysis of consecutive control group subjects enrolled in a randomized controlled clinical trial testing an adaptation of the Care Transitions Intervention (Coleman, Parry, Chalmers, & Min, 2006) for older adults transitioning home following ED discharge (Mi et al., 2018; Shah et al., 2018). The study took place at three urban hospital EDs in the United States: one affiliated with the University of Wisconsin in Madison, WI and two affiliated with the University of Rochester in Rochester, NY. This study was approved by the University of Wisconsin Institutional Review Board and the University of Rochester Research Subjects Review Board with written informed consent. Although the overall clinical trial ran from January 2016 through July 2019, social isolation data were collected starting October 2016.

2.2. Participants

Eligible subjects were at least 60 years of age, residing in Dane County, WI or Monroe County, NY, community dwelling, had a primary care provider (PCP) affiliated with either health system, had a working telephone, and were discharged from the ED or ED observation unit to a community residence within 24 h of arrival. Subjects were excluded if they did not speak English, were previous participants, were actively enrolled in either hospice, a transitions program, or a care management program, did not have a permanent residence, presented with a primary behavioral or psychiatric health problem, were visually or hearing impaired, or had an Emergency Severity Index (ESI) category of 1. Patients were also excluded if they lived in a skilled nursing or assisted living facility. Participants were screened and consented during the index ED visit (Mi et al., 2018).

2.3. Data collection

During the index ED visit a baseline survey consisting of demographic, cognitive, functional, and health-related validated measures, including measurement of social isolation was verbally administered. Trained research associates also performed retrospective chart reviews to abstract information on all patient interactions with the healthcare system in the 30 days after their index ED visit. Best practices for chart abstraction were used to reduce potential bias (Kaji, Schriger, & Green, 2014; Mi et al., 2018).

2.4. Measures

Social Isolation: The Patient-Reported Outcomes Measurement Information System (PROMIS) Social Isolation (PSI) short form questionnaire was used to identify the extent of social isolation experienced by the patient (HealthMeasures 2018). This validated scale consists of 4 questions, each measured on a 1–5 Likert-type scale. Item scores are

summed to generate an overall score of self-reported social isolation, with possible scores ranging from 4 (lowest) to 20 (highest). Scores were only calculated for participants with complete PSI questionnaires, excluding those with incomplete data.

Consistent with other research, we grouped PSI scores into tertiles for analysis. Based on our sample distribution, scores were grouped as 4 (low), 5–7 (medium), and 8–20 (high). PSI groupings did not contain equal number of participants because the distribution of PSI scores was positively skewed, with 46.7% of the sample having the lowest possible score (4).

Covariate Measures: As previously described (Mi et al., 2018), patient sociodemographic characteristics were obtained from a combination of baseline survey responses (self-reported) and chart review. Specific demographic variables were chosen for inclusion based upon theoretical and established relationships to the primary independent and dependent variables in the literature. These included patient age, gender, race, education, and whether the individual lives alone or with others. Marital status was collected, but dropped from the list of demographic covariates due to collinearity.

Two measures of patient health status were included. Self-rated health status was assessed at baseline using the General Health item from the Short Form-12 (Ware, Kosinski, & Keller, 1996) ("In general, how would you rate your health", 5-point Likert-type scale ranging from "excellent" to "poor"). Comorbid conditions were abstracted by chart review based upon the Charlson Comorbidity Index (Chaudhry, Jin, & Meltzer, 2005).

Validated scales were also administered at baseline to measure functional limitations (deficiencies in activities of daily living) (Katz, Downs, Cash, & Grotz, 1970), health literacy (Wynia & Osborn, 2010), anxiety (Generalized Anxiety Disorder-2) (Wild, Eckl, & Herzog, 2014), depressive symptoms (Patient Health Questionairre-9) (Manea, Gilbody, & McMillan, 2012), and symptoms of cognitive impairment (Blessed Orientation Memory Concentration Test) (Katzman et al., 1983).

Clinician Follow-up: Follow-up visits with outpatient clinicians within 7 and 30 days of the original ED visit were abstracted from participants' electronic health records. Follow-up visits included in-person office visits with primary or specialty ambulatory care providers, as well as telephone calls and online patient portal messaging (excluding automated reminder messages or phone/web-portal messages that did not receive a patient response). Visits for previously-scheduled outpatient procedures or laboratory work (e.g., colonoscopy) were also excluded. Neither telemedicine nor texting were available options for provider-patient communication in either health system during the study period.

In order to differentiate between contact that occurred during face-to-face appointments and other remote means (patient-initiated phone calls or online portal messaging), we categorized the type of follow-up in two ways based on the modality of the interaction: either in-person or electronic. When combined with our timeframes of interest, this yielded a total of 6 dependent variables measuring follow-up: 7-day in-person, 7-day electronic, 7-day all-contact (total of both modalities), 30-day in-person, 30-day electronic, and 30-day all-contact. We did not differentiate between contact with PCPs and specialty providers, nor between physicians and advanced practice providers. Our primary outcome measures, driven by our aim and hypothesis, were 7-day and 30-day all-contact follow-up.

2.5. Analysis

We calculated descriptive statistics to understand the distribution of characteristics in our population. Aforementioned variables measuring basic sociodemographic characteristics and the two measures of overall health status were automatically included as covariates. Other independent variables (suggested to be associated with post-ED follow-up in prior research) having a bivariate association of $p<0.10$ for any of the six outcome variables were considered for inclusion as covariates in the multivariate models. Each of the others was added separately to the main block of covariates in a logistic regression to determine whether any resulted in ≥10% change in odds ratios for social isolation on any dependent variable. Only one of these variables (having moderate-to-high depressive symptoms) met this criterion and was therefore included in multivariate analyses.

We report multivariate logistic regression results as adjusted odds ratios (ORs) with 95% confidence intervals. In the regression models, the lowest PSI tertile was used as the referent in analyzing the separate effects of medium and high social isolation levels. Wald tests were used to evaluate the overall contribution of social isolation. For robustness checking purposes, we also conducted multivariate Quasi-Poisson regressions using continuous outcome variables, with no change in our conclusions (results not shown).

3. Results

3.1. Characteristics of study subjects

Of the participants randomized to the RCT control group, 642 had complete data for this analysis (PSI measurement starting 9 months after data collection began). As expected, subjects categorized in the different tertiles of social isolation varied in certain characteristics (Table 1). Notably, the proportion of participants who lived alone, had more than

Table 1
Study population characteristics stratified by social isolation tertile.

	Total	Low Social Isolation	Medium Social Isolation	High Social Isolation	p-value
N	642	300	166	176	
Social Isolation Score (mean (SD))	6.21 (2.95)	4.00 (0.00)	5.93 (0.76)	10.24 (2.54)	<0.001
Age (mean (SD))	71.75 (8.31)	72.53 (8.25)	71.31 (8.52)	70.84 (8.14)	0.073
Gender: Female (%)	342 (53.3)	154 (51.3)	87 (52.4)	101 (57.4)	0.428
Race: White (%)	593 (92.4)	278 (92.7)	153 (92.2)	162 (92.0)	0.910
Lives Alone (%)	188 (29.3)	60 (20.0)	57 (34.3)	71 (40.3)	<0.001
Education: Not College Graduate (%)	239 (37.2)	102 (34.0)	66 (39.8)	71 (40.3)	0.283
Chronic Conditions: Charlson Score (mean (SD))	2.70 (1.70)	2.43 (1.59)	2.73 (1.70)	3.12 (1.81)	<0.001
Self-rated Health Status: Fair or Poor (%)	334 (52.0)	124 (41.3)	91 (54.8)	119 (67.6)	<0.001
Functional Limitations: ≥1 ADL Deficiency (%)†	205 (31.9)	74 (24.7)	57 (34.3)	74 (42.0)	0.001
Health Literacy: Inadequate (%)	70 (10.9)	33 (11.0)	13 (7.8)	24 (13.6)	0.227
Anxiety: GAD-2 Score >3 (%)	111 (17.3)	25 (8.3)	33 (19.9)	53 (30.1)	<0.001
Depressive Symptoms: PHQ-9 Score ≥10 (%)	68 (10.6)	11 (3.7)	12 (7.2)	45 (25.6)	<0.001
Cognitive Impairment: BOMC Score>10 (%)	117 (18.2)	50 (16.7)	25 (15.1)	42 (23.9)	0.167
Receives Help with Healthcare Needs (%)	279 (43.5)	121 (40.3)	72 (43.4)	86 (48.9)	0.193

† ADL =Activities of Daily Living.

Table 2
Unadjusted mean number of outpatient follow-up contacts after emergency department discharge (95% CI).

	Follow-Up within 7 Days			Follow-Up within 30 Days		
	Low Social Isolation	Medium Social Isolation	High Social Isolation	Low Social Isolation	Medium Social Isolation	High Social Isolation
In-person only	0.67 (0.58, 0.75)	0.63 (0.50, 0.76)	0.58 (0.47, 0.69)	1.84 (1.65, 2.04)	1.77 (1.50, 2.04)	1.81 (1.59, 2.03)
Electronic only	1.13 (0.98, 1.28)	1.08 (0.89, 1.27)	1.25 (1.02, 1.48)	2.63 (2.30, 2.96)	2.56 (2.14, 2.98)	2.99 (2.59, 3.39)
All contacts	1.79 (1.60, 1.99)	1.70 (1.48, 1.93)	1.83 (1.55, 2.11)	4.47 (4.02, 4.93)	4.33 (3.77, 4.89)	4.80 (4.25, 5.35)

Table 3
Multivariate analysis of follow-up within 7 and 30 days of ED discharge, all contact types (adjusted odds ratio [95% CI]).

	All-Contact Follow-Up within 7 Days	All-Contact Follow-Up within 30 Days
Social Islation		
Medium Tertile	1.05 (0.66, 1.67)	1.35 (0.70, 2.60)
High Tertile	0.80 (0.50, 1.28)	0.81 (0.43, 1.53)
Age	1.00 (0.98, 1.03)	1.01 (0.98, 1.04)
Gender: Male	0.76 (0.52, 1.12)	0.77 (0.46, 1.29)
Race: Non-white	0.97 (0.48, 1.97)	0.62 (0.26, 1.48)
Lives Alone	0.85 (0.56, 1.31)	0.62 (0.35, 1.10)
Education: Not a College Graduate	0.86 (0.58, 1.26)	0.72 (0.43, 1.22)
Health Status: Fair or Poor	1.01 (0.67, 1.53)	1.11 (0.63, 1.93)
Chronic Conditions	1.08 (0.96, 1.22)	**1.31 (1.09, 1.56)****
Depressive Symptoms	**2.57 (1.15, 5.73)***	2.04 (0.67, 6.19)

*$p<0.05$, **$p<0.01$ (bold also indicates significance).

one functional limitation (ADL), reported that they were in "fair" or "poor" health, had anxiety, depressive symptoms, and more chronic conditions significantly increased as social isolation increased (all $p<0.01$).

3.2. Association between social isolation and post-ED follow-up

Overall, 76.8% of participants followed-up with their provider in the 7 days following ED discharge. Those that did follow up averaged 1.8 contacts during that period. Over 30 days, 88.9% of participants followed up with their provider, averaging 4.5 contacts during that period. Unadjusted frequencies of follow-up by social isolation tertile and modality are presented in Table 2. Average frequency of electronic follow-up was significantly greater than for in-person follow-up within each of the social isolation levels during either time window (showing no overlap between 95% confidence intervals). No differences in follow-up rates between social isolation levels were significant.

The multivariate analyses predicting all-contact follow-up rate at 7 and 30 (Table 3) indicated that social isolation was not significantly associated with follow-up after discharge from the ED (Wald test $p = 0.53$ and $p = 0.39$ respectively). Presence of moderate (or higher) depression on the PHQ-9 was the only covariate associated with significantly increased likelihood of follow-up within 7-day of the ED visit ($p<0.05$, OR: 2.57, 95% CI: 1.15–5.73). Greater number of comorbidities were significantly associated with increased likelihood of follow-up at 30 days ($p<0.01$, OR: 1.31, 95% CI: 1.09–1.56).

Multivariate analyses examining in-person and electronic follow-up are presented in Table 4. Patients with high social isolation had 37% lower odds of follow-up with a provider in-person within 7 days of ED discharge compared to those with the lowest level of social isolation ($p<0.05$, OR:0.63, 95% CI: 0.42–0.96). In addition to high social isolation, living alone also significantly predicted lower levels of 7-day in-person follow up ($p<0.05$, OR:0.67, 95% CI: 0.46–0.97). Participants identifying as a race other than white, however, had a significantly increased likelihood of following up in person ($p<0.05$, OR:1.90, 95% CI: 1.02–3.55) after taking all other model characteristics into account. As follow up rates for the moderate group were not significantly different from the low group, Wald test results for the overall model only trended towards statistical significance ($p = 0.09$).

Consistent with the 30-day all-contact results, the number of diagnosed comorbid conditions was significantly associated with increased in-person follow-up with providers ($p<0.01$, OR: 1.21, 95% CI: 1.05–1.39) and increased electronic follow-up ($p<0.01$, OR: 1.26, 95% CI: 1.10–1.44) within 30 days of discharge.

4. Discussion

In this study, the first to specifically examine the relationship between social isolation and post-ED outpatient follow-up in older adults, we found that patients reporting higher levels of social isolation had lower rates of in-person follow-up in the 7-days following ED discharge, compared with those who reported low levels of social isolation. Social isolation levels were not significantly associated with changes in all-contact follow-up rates at either 7- or 30-days after ED discharge. Our results also demonstrate that people with a greater number of comorbidities are more likely to follow up with health care providers than those with fewer, above and beyond any effects of social isolation.

Our study adds to the growing body of literature about the effects of social isolation on healthcare use, including emergency and outpatient

Table 4
Multivariate analysis of follow-up within 7 and 30 days, in-person and electronic contacts (adjusted odds ratio [95% CI]).

	In-Person Follow-Up Within 7 Days	Within 30 Days	Electronic Follow-Up Within 7 Days	Within 30 Days
Social Isolatio				
Medium Tertile	0.83 (0.56, 1.22)	1.48 (0.88, 2.50)	1.11 (0.75, 1.66)	1.07 (0.67, 1.70)
High Tertile	**0.63 (0.42, 0.96)***	0.88 (0.53, 1.47)	0.94 (0.62, 1.42)	1.13 (0.68, 1.87)
Age	1.00 (0.98, 1.02)	1.02 (0.99, 1.04)	1.00 (0.98, 1.02)	1.00 (0.97, 1.02)
Gender: Male	0.84 (0.61, 1.17)	0.78 (0.51, 1.17)	0.91 (0.65, 1.26)	0.75 (0.51, 1.11)
Race: Non-white	**1.90 (1.02, 3.55)***	0.80 (0.38, 1.68)	1.08 (0.59, 2.01)	0.77 (0.38, 1.55)
Lives Alone	**0.67 (0.46, 0.97)***	0.65 (0.41, 1.03)	1.19 (0.82, 1.73)	1.07 (0.68, 1.70)
Education: Not a College Graduate	0.95 (0.68, 1.32)	0.95 (0.62, 1.46)	0.80 (0.57, 1.12)	0.70 (0.47, 1.04)
Health Status: Fair or Poor	1.23 (0.86, 1.74)	1.08 (0.69, 1.69)	0.93 (0.66, 1.33)	1.08 (0.71, 1.64)
Chronic Conditions	1.01 (0.91,1.11)	**1.21 (1.05, 1.39)****	1.09 (0.98, 1.21)	**1.26 (1.10, 1.44)****
Depressive Symptoms	1.66 (0.95, 2.90)	1.51 (0.68, 3.33)	1.45 (0.81, 2.59)	1.84 (0.82, 4.15)

*$p<0.05$, **$p<0.01$ (bold also indicates significance).

care (Gerst-Emerson, & Jayawardhana, 2015; Manemann et al., 2018; Steptoe et al., 2013; Valtorta et al., 2018; Vozikaki et al., 2017). Specifically, this study adds additional clarity to an inconclusive pool of evidence, demonstrating the need for nuanced approaches to studying how socially-isolated older adults seek and receive care in different ways through different channels. Examining the period following ED discharge is particularly relevant, as it represents a critical time when older adults are at increased risk for negative outcomes, many of which could be mitigated by prompt outpatient follow-up.

It is understandable why individuals with varying levels of social isolation may have similar follow-up rates. It is common practice for ED providers to instruct patients at discharge to follow up with their provider(s) within a short timeframe. Also, PCPs may know if the patient was seen in an ED and reach out to them for follow up. Both of these practices can result in the overall high level of contact with outpatient providers and the similar rates of follow-up within 7 and 30 days (Table 3). How this leveled the follow-up rates is not known and is an area for further study. It is also highly likely that during any given 30-day period, older patients already have reasons for contacting a health care provider and may have already scheduled an appointment prior to their ED visit. This would explain the high level of contact (88.9%), a rate notably higher than what is found in the adult population overall (29–67% (Baren, Shofer, & Ivey, 2001; Kyriacou et al., 2005; Thomas, Burstin, O'Neil, Orav, & Brennan, 1996)). Finally, all participants had PCPs within the same health system as the ED, and both health systems were accountable care organizations (ACOs), leading to more integrated care. Given the focus on care coordination and optimizing healthcare use present in ACOs, as well as staff hours dedicated to those activities (Kaufman, Spivack, Stearns, Song, & O'Brien, 2019; Lewis, Schoenherr, Fraze, & Cunningham, 2019), any difference secondary to social isolation may have been reduced.

There are also reasonable explanations why socially-isolated older adults would have lower rates of in-person follow-up, more-so than phone or web-based communication that can be conducted from one's residence. These electronic methods may provide more accessible options for patients who are socially-isolated due to physical limitations, mental health problems, or other issues that may also prevent them from easily attending in-person medical appointments. Web-based messaging is asynchronous, allowing isolated patients to engage at the time of their choosing and take as much time as necessary to compose a message. Phone communication is conducted in real-time, but for those with physical limitations hindering or preventing computer use (e.g., arthritis, physical impairment) or travel to a clinic, it provides a lower-barrier channel for follow-up.

A number of technology-enabled interventions designed to decrease social isolation in older adults have shown potential benefit, supported by studies demonstrating older adults' positive attitudes about technologically-mediated healthcare interactions (Chen & Schulz, 2016; Chipps, Jarvis, & Ramlall, 2017). Although during our study period telemedicine was not a widely-supported option in either health system, current and developing innovative options for remote care delivery may hold promise as ways to overcome barriers leading to and caused by social-isolation, As these options become more common and accessible (particularly in light of changes in clinical care practice for older patients precipitated by the COVID-19 pandemic) (Cudjoe & Kotwal, 2020), additional research should be conducted.

Although not the primary focus of this study, our multivariate analysis also demonstrated positive significant relationships between comorbid depressive symptoms and follow-up at 7 days and between the number of comorbid conditions and outpatient follow-up at 30 days, above and beyond what is accounted for by social isolation. Potential explanations for these findings can be found in the social isolation literature, as well the healthcare utilization patterns of older adults overall. The recent NASEM report (National Academies of Sciences Engineering & Medicine, 2020) presents evidence describing the complex relationships between these factors. For instance, both depression and comorbidities have the potential to *contribute to and/or be the result of* social isolation. Looking at outpatient care use in particular, the expert NASEM committee suggests that for socially-isolated older adults, appointments with health care providers may be one of the few opportunities for social connection they have on a regular basis. Thus, familiarity with how and when to access care might make them more likely to follow up after an ED visit, regardless of social isolation level. It may also be that the need to connect (particularly in response to a stressful health event requiring ED services) could provide additional motivation for seeking timely follow-up care from providers with whom they already have a longstanding relationship. Additional research still needs to be conducted to fully understand the mechanisms through which patient-provider interactions could mitigate or protect against the negative effects of social isolation.

4.1. Limitations

We had several potential limitations in this study. First, we did not measure or control for some factors that could influence a person's ability to access in-person care (e.g., proximity to clinical locations, access to transportation). We did not determine whether the appointment had been made prior to the ED visit, or whether the appointment was made as a follow-up to the ED visit. We did, however, exclude visits for previously-scheduled outpatient procedures. This study took place in two mid-sized cities with surrounding rural areas, and therefore may not be as generalizable to other communities with differently-composed or more demographically-diverse older adult populations (e.g., mostly rural or large urban areas, larger racial/ethnic minority populations). Non-English speakers were excluded from the study, further narrowing the diversity of our sample and limiting our ability to generalize findings to different immigrant populations. Finally, all participants had PCPs within the same hospital system as the ED (both ACOs). Thus, our results may not generalize to community-dwelling older adults without PCPs, who receive primary care in practices not affiliated with the ED's health systems, or who are not part of an ACO healthcare systems, which likely already has structures in place to facilitate follow-up.

5. Conclusions

This study adds to the emerging literature on the complex relationship between social isolation and healthcare use, specifically adding to our understanding of how and when socially-isolated older adults seek outpatient care following ED discharge. We found that increased social isolation did not significantly modify the all-contact follow-up rate in either the 7-days or 30-days after ED discharge, as compared with those who reported low levels of social isolation. We did find that patients reporting higher levels of social isolation had lower rates of in-person follow-up in the 7-days following ED discharge. Further research is needed to understand the reasons for the observed follow-up patterns and whether interventions can modify follow-up and, more importantly, outcomes after ED visits.

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Author contributions

Study concept and design: NAC, GCJ, CMCJ, EHD, JTC, MNS. Acquisition of subjects and data: NAC, GCJ, CMCJ, RKG, RM, MNS. Analysis and interpretation of data: NAC, GCJ, CMCJ, EHD, ALC, RKG, RM, MNS. Preparation of manuscript: NAC, GCJ, CMCJ, EHD, ALC, RKG, RM, TVC, JTC, AJK, ML, MNS.

Sponsor's role

The sponsor had no role in the design, methods, subject recruitment, data collection, analysis, or preparation of the paper.

Declarations of Competing Interest

None.

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