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BRIEF REPORT

Self-Reported Pain Intensity and Depressive Symptoms Among Community-Dwelling Older Adults with Schizophrenia Spectrum Disorders

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Abstract

Older adults with schizophrenia have some of the highest rates of both medical and psychiatric comorbidities. Despite this, little is known about comorbid pain and depressive symptoms in schizophrenia research. This study aimed to examine the associations between levels of pain intensity and depressive symptoms among community-dwelling adults aged 50 years and older with schizophrenia spectrum disorders. Recruited from U.S. community mental health centers, participants reported on pain and depressive symptoms at the onset of the Helping Older People Experience Success (HOPES) study. Unadjusted and adjusted regression analyses were conducted. Higher pain intensity was associated with elevated depressive symptoms in all analyses, which is consistent with other studies in the general population. Given the widespread efforts to manage pain and related mental health complications in older adults without serious mental illnesses, it is likewise important that community-based mental health professionals monitor and address intense pain and related depressive symptoms among older adults with schizophrenia.

Keywords Pain intensity · Depressive symptoms · Older adults · Schizophrenia spectrum disorders

Introduction

Community-dwelling adults aged 50 years and older with schizophrenia spectrum disorders represent only 2% of middle-aged and older age groups (Perälä et al. 2007), yet disproportionately account for higher prevalence of disabling, costly, and life-threatening psychiatric and medical comorbidities (De Hert et al. 2011). This population has some of the highest rates of psychiatric comorbidities such as subclinical and clinical depression, which affect 44% to 75% of older adults with schizophrenia (Cohen and Ryu 2015). Depressive symptoms are associated with auditory hallucinations (Cohen et al. 2014), physical illness (Diwan et al. 2007), functional impairment (Jin et al. 2001), and poor medication management (Kasckow et al. 2008). It is also well-documented that the lifespan of these individuals is shortened by 10 to 25 years due to suicide mortality related to depression (Chesney et al. 2014; Cohen et al. 2010) and death caused by medical comorbidities (Laursen et al. 2012), including diabetes (Stubbs et al. 2015), pneumonia (Seminog and Goldacre 2013), and cardiovascular disease (Crump et al. 2013). Due to the strong likelihood of

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adverse mental and physical health-related outcomes, older adults with schizophrenia are at high risks for experiencing both the mental and physical aspects of pain.

Moderate-to-severe levels of intense pain significantly affects 35% of adults with schizophrenia (Stubbs et al. 2014), which is consistent with rates in the general population (Murray et al. 2013). Remarkably though, little is known about intense pain and its impact in schizophrenia research (Brooks et al. 2018a). Given that late-life pain interferes with aging-related adjustment and is associated with depressive symptoms in U.S. older adults without serious mental illnesses (Reid et al. 2015), describing the physical and mental health characteristics of pain is critical among high-risk older adults experiencing serious mental illnesses (Almeida et al. 2014; Bartels 2004). Although a relationship between pain and depression is well established (Gatchel et al. 2007), our study is unique in that we will investigate the relationship between pain and depressive symptoms in a serious mental illness subpopulation of middle-aged and older adults with schizophrenia spectrum disorders who have been largely excluded from non-pharmacological pain management intervention studies, randomized opioid trials, and the broader pain literature (Engels and Scherder 2015).

To address a physical and mental health framework of pain-related health limitations, the purpose of the current study was to evaluate the associations between self-reported pain intensity and depressive symptoms among community-dwelling adults aged ≥ 50 years old with schizophrenia spectrum disorders. We also explored whether such an association between pain intensity and depressive symptoms is independent of sociodemographic and health characteristics. We hypothesized that there would be significant independent associations between high levels of pain intensity and elevated depressive symptoms. Findings from this study may inform recommendations for assessments and methods used in integrated mental and physical health services within community-based mental health programs. Delivering integrated health services that lessen the impact of pain-related health limitations is an example of an innovative model of care that might provide older adults with schizophrenia the opportunity to age successfully despite pain and related mental health complications.

Methods

Participants

A total of 183 participants were recruited and sampled from three community mental health centers in the New England region. Eligible participants met the following criteria: (a) aged 50 years or older; (b) diagnosed with a serious mental illness (e.g., schizophrenia, schizoaffective disorder, psychosis not otherwise specified, bipolar disorder, major depressive disorder); and (c) functional impairment. Exclusion criteria were: (a) significant cognitive impairment; (b) documentation of substance dependence; (c) diagnosed with a terminal disease; and (d) currently residing in a skilled nursing facility or inpatient institution. Out of the original participant sample size of 183, 80 participants were also excluded for the secondary data analyses based on the diagnosis of major depression or bipolar disorder due to the study's focus on pain among older adults with schizophrenia. The final analytic sample was 103 participants with schizophrenia spectrum disorders.

Measures

Outcome Variable

Depressive symptoms were assessed by the 20-item Center for Epidemiologic Studies-Depression (CES-D; Radloff 1977) scale. The CES-D is a 20-item screening tool designed to assess the frequency of perceived depressive symptoms over the past week. Items are rated on a 4-point Likert-type scale ranging from 0 (*rarely or none of the time*) to 3 (*most of the time*). Scores are calculated from responses, with a score of 16 indicating clinically significant symptoms and higher scores indicating greater distress. The CES-D has been used with a variety of populations, including individuals with schizophrenia (Herniman et al. 2017) and older adults (Hertzog et al. 1990; Radloff and Teri 1977). The instrument has strong psychometric properties among both clinical and non-clinical sample populations, with reported Cronbach's alphas ranging from .85 to .91 (Herniman et al. 2017; Radloff 1977). Research has also supported validity by demonstrating the expected relationships with similar instruments such as the Patient Health Questionnaire-9 (PHQ-9, $r = .85$; Amtmann et al. 2014; Siddaway et al. 2017). The reliability of scores from the CSE-D in the present sample was calculated to be .89.

Predictor Variable

Pain intensity was assessed using the self-report, single pain chart item from the *Dartmouth-Northern New England Primary Care Cooperative Information Project (COOP) Functional Assessment Charts* (Nelson et al. 1987). Although pain intensity is based on a self-report and single-item Likert-type scale, it is the standard pain measurement used in clinics and community-based health services (Brooks et al. 2018a). Respondents rate their pain during the past 2 weeks on a 5-point Likert-type scale ranging from 1 (*no pain*) to 5 (*severe pain*) according to illustrations depicting corresponding pain levels. The use of single item pain charts with older adults is also supported in current literature (Hawker

et al. 2011; Hoffman et al. 2010). Scores from the COOP charts have achieved test–retest reliability, with a reported 1-h test–retest average ICC of .93. Studies have supported validity by substantial shared variance between chart items and corresponding items derived from paired measures (Nelson et al. 1990).

Statistical Covariates

Sociodemographic and health characteristics, including age, gender, race, education, independent living status, and alcohol and tobacco use were collected from self-report via baseline questionnaires and/or from documentation in medical records. Disease comorbidities were assessed with the *Charlson Comorbidity Index* (CCI; Charlson et al. 1987). The CCI predicts mortality by classifying and/or weighting comorbid conditions. It has been validated for predicting mortality related to 22 conditions including stroke, intensive care, liver disease, cancer, renal disease, AIDS/HIV, and chronic pulmonary disease (Roffman et al. 2016). The CCI has good test re-test reliability ($r = .92$) and cross-validity (Davies score: $r = .80$; Robinski et al. 2016). There is also evidence to suggest that the validity of the CCI is supported due to expected relationships with CCI scores and similar instruments and criterion variables, including hospital length of stay, perceived disability, and mortality.

Data Analysis

All statistical analyses were performed using IBM SPSS Statistics version 24.0. The final sample included 103 participants. Of these participants, 2 had missing data on key variables. Given that less than 10% of the data was missing (1.9%), we used expectation–maximization imputation to replace missing data (Scheffer 2002).

The outcome, predictor, and sociodemographic and health characteristic variables were analyzed using frequencies, percentages, means, and standard deviations. For the univariable and multivariable analyses, four different linear regression models analyzed the association between pain intensity and depressive symptoms. For model adjustment, the sociodemographic and health characteristics were selected based on previous research (e.g., Sánchez et al. 2016). These statistical covariates included age, gender (1 = Female, 0 = Male), race (1 = White and 0 = Black, Asian, Native American, or Other), education (1 = Completed high school, 0 = Did not complete high school education), and independent living status (1 = independent living, 0 = Supervised/supported housing), comorbidities, and alcohol and tobacco use. The first model was unadjusted (Model 1); the second model adjusted for age and gender (Model 2); the third included Model 2 covariates, and race, education, and independent living status (Model 3); and the fourth included Model 3 covariates, comorbidities, and alcohol and tobacco use (Model 4). All statistical tests were two-sided, and *p*-values less than .05 were considered statistically significant.

Procedures

We conducted a secondary analysis of baseline data collected before the start of the Helping Older People Experience Success (HOPES) intervention study. Prior to the intervention study, the research protocol was approved by the Committee for the Protection of Human Subjects at Dartmouth College and by Institutional Review Boards specific to each site. The authors of this study certify: (a) that they accept responsibility for the conduct of the study and for the analysis and interpretation of the data; (b) that they helped write the manuscript and agree with the decisions about it; (c) that they meet the definition of an author as stated by the International Committee of Medical Journal Editors; and (d) that they have seen and approved the final manuscript. There are also no known conflicts of interest.

Results

Participant Characteristics

Our final dataset consisted of 103 participants with a mean pain intensity score of 2.58 (SD ± 1.4), indicating most participants reported levels of at least mild pain. The CES-D mean score for our sample was 19.47, indicating that the current group of participants reported moderately elevated depressive symptoms. The mean age was 58.8 years (SD ± 7.2), with a total of 47 females and 56 males. Eighty-five (82.5%) participants identified themselves as White/Caucasian, 14 (13.6%) identified as Black/African American, 2 (1.9%) identified as Asian American, and 2 (1.9%) identified with more than one race. Most of the participants had at least a high school education: 36 (35.0%) graduated high school, 27 (26.2%) completed some college, 16 (15.5%) earned college degrees, while 24 (23.3%) completed less than a high school diploma. Sixty-one (59%) participants were living in supervised/supported housing, 40 (38.8%) participants were living independently, and 2 persons (1.9%) were homeless. Regarding comorbidities, 23 participants (22.3%) had no diseases, 22 participants (21.4%) had at least 1 disease, 24 participants (23.3%) had 2 diseases, 12 participants (11.7%) had 3 diseases, 8 participants (7.8%) had 4 diseases, 6 participants (5.8%) had 5 diseases, and 4 participants had either 6 (3.9%) or 7 (3.9%) diseases. Sixty-eight (66.0%) participants reported not drinking alcohol in the past year, and 56 participants (54.4%) reported not smoking any cigarettes in the past six months.

Univariable and Multivariable Regression Analyses

Higher pain intensity was significantly associated with elevated levels of depressive symptoms in the unadjusted model ($B = 2.52 \pm 0.78$; $p < 0.01$). In the model adjusting for age and gender, higher pain intensity was still linked to elevated depressive symptoms ($B = 2.65 \pm 0.77$; $p < 0.01$), yet there were reduced depressive symptoms in older age ($B = -0.41 \pm 0.15$; $p < 0.01$). After adjusting for age, gender, race, education, and independent living status, higher pain intensity remained associated with elevated depressive symptoms ($B = 2.75 \pm 0.73$; $p < 0.001$), with lower levels of depressive symptoms in older age ($B = -0.47 \pm 0.14$; $p = 0.01$) and elevated levels of depressive symptoms in persons living independently ($B = 1.93 \pm 0.63$; $p < 0.01$). After introducing comorbidities, and alcohol and tobacco use in the fully adjusted model, higher pain intensity was also significantly associated with elevated depressive symptoms ($B = 2.67 \pm 0.84$; $p < 0.01$), with lower levels of depressive symptoms in older age ($B = -0.46 \pm 0.16$; $p < 0.01$) and elevated levels of depressive symptoms in persons living independently ($B = 1.95 \pm 0.65$; $p < 0.01$). The remaining statistical covariates were not found to be significant in any of the four models.

Discussion

Our findings provide some of the first documentation on a relationship between higher levels of pain intensity and elevated depressive symptoms among community-dwelling older adults with schizophrenia spectrum disorders, which is consistent with the large body of evidence on a pain-depression link in the general population (Gatchel et al. 2007). The intersection between pain and depression strengthened after adjusting for statistical covariates that might be independent contributors to either pain or depression, which indicates individuals with a schizophrenia spectrum disorder diagnosis alone are especially vulnerable and at risk for both increased depressive symptoms and intense pain. Due to the wide-scale neglect of pain in this subpopulation, our work underscores the need for community-based mental health professionals to start implementing integrated mental and physical health assessments and methods that monitor and address pain and related depressive symptoms (Engels and Scherder 2015).

There was a significant association between pain intensity and depressive symptoms, even after adjusting for sociodemographic and health characteristics including age, gender, race, education, independent living status, comorbidities, and alcohol and tobacco use. The mean score for pain intensity was considered ‘mild pain’, and higher levels of pain intensity were associated with greater depressive symptoms. Neither age, gender, nor other sociodemographic and health characteristics attenuated the relationship between greater depressive symptoms and higher pain levels. However, we found a negative relationship between age and depressive symptoms (i.e., the oldest of the older participants reported fewer depressive symptoms). This finding is consistent with the broad epidemiological literature on the decline in prevalence rates of depression among the oldest-old age groups (Byers et al. 2010) and with recent findings demonstrating that oldest-old age is not associated with greater depressive symptoms among persons with schizophrenia (Cohen and Ryu 2015). Also consistent with previous findings (Adams et al. 2004; Armer 1993; Kyle and Dunn 2008; La Gory et al. 1990), we found a significant, independent association between independent living status and depressive symptoms. This result suggests that, after controlling for pain intensity and statistical covariates, individuals who lived independently experienced greater depressive symptoms than individuals in supervised/supportive living facilities.

Community Mental Health Implications

Our findings have significant implications for researchers and practitioners in community-based mental health. Similar to recommendations for geriatric mental health professionals working with other older adult populations self-reporting pain and depressive symptoms (Brooks et al. 2018b), these results also suggest the importance of addressing pain and depressive symptoms as frequently co-occurring physical and mental health issues for community-dwelling older adults with schizophrenia spectrum disorders. Community-based mental health practitioners should consider using evaluations and methods targeting both pain and depressive symptoms for older adults with schizophrenia spectrum disorders through integrated mental and physical health approaches to brief screening tools, comprehensive assessments, and other health and wellness services.

The independent association between greater depressive symptoms and independent living status also suggests the potential for more targeted assessments and referral processes among persons living independently. It might be likely that these persons residing alone in independent living housing may experience reduced social support and greater levels of stress and depressive symptoms related to barriers to performing activities of daily living when compared to adults living in supportive housing. For instance, persons with similar diagnoses residing in supportive housing may receive assistance with diets and meal planning, medication adherence, household chores, and paying bills. These persons may also receive support from residential providers with attending health care appointments. It may be justified, then, to offer routine depression screening among older persons living independently with schizophrenia spectrum

disorders and target more precisely those who may need further assessment and treatment.

Limitations and Future Research directions

Several limitations should be considered when interpreting our results. First, we conducted a secondary analysis of existing data and were therefore bound to the brief measures for pain and depressive symptoms used in the original study. For example, although 1-item pain rating scales are commonly used in survey research (Herr and Garand 2001), the COOP pain chart has a limited response range. Second, self-report instruments used in the study are also susceptible to affective bias, lack of insight, and life circumstances, which could have impacted the response accuracy of study participants who had mild cognitive impairments (Atkinson et al. 1997). Third, we employed a cross-sectional study design; therefore, causality cannot be determined in the pain-depression relationship. Our findings also do not account for potential reverse or reciprocal effects between pain and depression. For instance, participants with any level of pain intensity might experience greater depressive symptoms, which in turn, might lead to increased pain intensity. Finally, our participants were principally older, non-institutionalized adults. Because individuals who are most profoundly affected by schizophrenia may be institutionalized, our findings could be skewed toward individuals with less functional impairment. Hence, findings may not generalize to the broader population of people with schizophrenia spectrum disorders.

Despite the inherent limits of this study, our findings contribute to the preliminary documentation on pain levels and its association with depressive symptoms among persons with schizophrenia spectrum disorders. Examining self-reports of physical pain among older adults with schizophrenia will contribute to the knowledge of pain- and depression-related outcomes and start to build a foundation for community-based mental health research and practice. Further research should consider using a longitudinal design to evaluate the casual, interactive, or additive effects among the current study variables and other factors relevant to severe pain such as prescription opioid use or misuse. Additional research may also inform the design and testing of pilot interventions targeting the management of pain and depressive symptoms among older adults with schizophrenia spectrum disorders.

Conclusion

Although it is established that pain is closely tied to depressive symptoms in the general population, this study's results provide initial evidence for a similar association between pain intensity and depressive symptoms in the overlooked subpopulation of community-dwelling older adults with schizophrenia spectrum disorders. Older persons with schizophrenia report varying degrees of pain intensity, with higher levels of pain associated with greater severity of depressive symptoms. These findings suggest that individuals with schizophrenia are at risk for both intense pain and elevated depressive symptoms. Routine brief screening to detect intense pain and depression in older adults with schizophrenia are indicated. Further, community-based mental health agencies that provide integrated mental and physical health approaches may need to consider offering multidimensional pain and depression inventories among older persons with schizophrenia to differentiate symptoms from other medical and psychiatric comorbidities and identify unmet need and facilitate appropriate referrals.

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References

Adams, K. B., Sanders, S., & Auth, E. A. (2004). Loneliness and depression in independent living retirement communities: Risk and resilience factors. *Aging and Mental Health, 8,* 475–485. https://doi.org/10.1080/13607860410001725054.

Almeida, O. P., Hankey, G. J., Yeap, B. B., Golledge, J., Norman, P. E., & Flicker, L. (2014). Mortality among people with severe mental disorders who reach old age: A longitudinal study of a community-representative sample of 37892 men. *PLoS ONE, 9*(10), 1–11. https://doi.org/10.1371/journal.pone.0111882.

Amtmann, D., Kim, J., Chung, H., Bamer, A. M., Askew, R. L., Wu, S., …, Johnson, K. L. (2014). Comparing CESD-10, PHQ-9, and PROMIS depression instruments in individuals with multiple sclerosis. *Rehabilitation Psychology, 59*, 220–229.

Armer, J. (1993). Elderly relocation to a congregate setting: Factors influencing adjustment. *Issues in Mental Health Nursing, 14,* 157–172.

Atkinson, M., Zibin, S., & Chuang, H. (1997). Characterizing quality of life among patients with chronic mental illness: A critical examination of the self-report methodology. *American Journal of Psychiatry, 154,* 99–105.

Bartels, S. J. (2004). Caring for the whole person: Integrated health care for older adults with severe mental illness and medical comorbidity. *Journal of the American Geriatrics Society, 52,* 249–257.

Brooks, J. M., Polenick, C. A., Bryson, W., Naslund, J. A., Renn, B. N., Orzechowski, N. M., …, Bartels, S. J. (2018a). Pain intensity, depressive symptoms, and functional limitations among older adults with serious mental illness. *Aging & Mental Health*, 1–5.

Brooks, J. M., Titus, A. J., Polenick, C. A., Orzechowski, N. M., Reid, M. C., MacKenzie, T. A., …, Batsis, J. A. (2018b). Prevalence rates of arthritis among US older adults with varying degrees of depression: Findings from the 2011 to 2014 National Health and Nutrition Examination Survey. *International Journal of Geriatric Psychiatry*. https://doi.org/10.1002/gps.4971.

Byers, A. L., Yaffe, K., Covinsky, K. E., Friedman, M. B., & Bruce, M. L. (2010). High occurrence of mood and anxiety disorders

among older adults: The National Comorbidity Survey Replication. *Archives of General Psychiatry, 67*(5), 489–496.
Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *Journal of Chronic Diseases, 40,* 373–383.
Chesney, E., Goodwin, G. M., & Fazel, S. (2014). Risks of all-cause and suicide mortality in mental disorders: A meta-review. *World Psychiatry, 13*(2), 153–160.
Cohen, C. I., Abdallah, C. G., & Diwan, S. (2010). Suicide attempts and associated factors in older adults with schizophrenia. *Schizophrenia Research*, *119*(1–3), 253–257.
Cohen, C. I., Izediuno, I., Yadack, A. M., Ghosh, B., & Garrett, M. (2014). Characteristics of auditory hallucinations and associated factors in older adultswith schizophrenia. *The American Journal of Geriatric Psychiatry*, *22*(5), 442–449.
Cohen, C. I., & Ryu, H. H. (2015). A longitudinal study of the outcome and associated factors of subsyndromal and syndromal depression in community-dwelling older adults with schizophrenia spectrum disorder. *The American Journal of Geriatric Psychiatry, 23,* 925–933. https://doi.org/10.1016/j.jagp.2014.06.011.
Crump, C., Winkleby, M. A., Sundquist, K., & Sundquist, J. (2013). Comorbidities and mortality in persons with schizophrenia: A Swedish national cohort study. *American Journal of Psychiatry, 170,* 324–333.
De Hert, M., Correll, C. U., Bobes, J., Cetkovich-Bakmas, M., Cohen, D., Asai, I., …, Leucht, S. (2011). Physical illness in patients with severe mental disorders. Prevalence, impact of medications and disparities in health care. *World Psychiatry, 10*, 52–77. https://doi.org/10.1002/j.2051-5545.2011.tb00014.x.
Diwan, S., Cohen, C. I., Bankole, A. O., Vahia, I., Kehn, M., & Ramirez, P. M. (2007). Depression in older adults with schizophrenia spectrum disorders: Prevalence and associated factors. *The American Journal of Geriatric Psychiatry*, *15*(12), 991–998.
Engels, G., & Scherder, E. (2015). Clinical pain in schizophrenia: A forgotten area. In G. Engels & E. Scherder (Eds.), *Pain, emotion and cognition: A complex nexus* (pp. 221–230). Switzerland: Springer.
Gatchel, R. J., Peng, Y. B., Peters, M. L., Fuchs, P. N., & Turk, D. C. (2007). The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychological Bulletin, 133*(4), 581–624.
Hawker, G. A., Mian, S., Kendzerska, T., & French, M. (2011). Measures of adult pain: Visual analog scale for pain (VAS pain), numeric rating scale for pain (NRS pain), McGill pain questionnaire (MPQ), short-form McGill pain questionnaire (SF-MPQ), chronic pain grade scale (CPGS), short form-36 bodily pain scale (SF-36 BPS), and measure of intermittent and constant osteoarthritis pain (ICOAP). *Arthritis Care & Research, 63,* 240–252.
Herniman, S. E., Allott, K. A., Killackey, E., Hester, R., & Cotton, S. M. (2017). The psychometric validity of the Center for Epidemiological Studies-Depression Scale (CES-D) in first episode schizophrenia spectrum. *Psychiatry Research, 252,* 16–22. https://doi.org/10.1016/j.psychres.2017.02.023.
Herr, K. A., & Garand, L. (2001). Assessment and measurement of pain in older adults. *Clinics in Geriatric Medicine*, *17*(3), 457–478.
Hertzog, C., Van Alstine, J., Usala, P. D., Hultsch, D. F., & Dixon, R. (1990). Measurement properties of the Center for Epidemiological Studies Scale (CES-D) in older populations. *Psychological Assessment, 2,* 64–72.
Hoffman, D. L., Sadosky, A., Dukes, E. M., & Alvir, J. (2010). How do changes in pain severity levels correspond to changes in health status and function in patients with painful diabetic peripheral neuropathy? *Pain, 149*(2), 194–201.
Jin, H., Zisook, S., Palmer, B. W., Patterson, T. L., Heaton, R. K., & Jeste, D. V. (2001). Association of depressive symptoms with worse functioning in schizophrenia: A study in older outpatients. *The Journal of Clinical Psychiatry*, *62*(10), 797–803.
Kasckow, J., Patterson, T., Fellows, I., Golshan, S., Solorzano, E., Mohamed, S., & Zisook, S. (2008). Functioning in middle aged and older patients with schizophrenia and depressive symptoms: Relationship to psychopathology. *The American Journal of Geriatric Psychiatry*, *16*(8), 660–663.
Kyle, T., & Dunn, J. R. (2008). Effects of housing circumstances on health, quality of life and healthcare use for people with severe mental illness: A review. *Health and Social Care, 16,* 1–15. https://doi.org/10.1111/j.1365-2524.2007.00723.x.
La Gory, M., Ritchey, F. J., & Mullis, J. (1990). Depression among the homeless. *Journal of Health and Social Behavior, 31,* 87–101.
Laursen, T. M., Munk-Olsen, T., & Vestergaard, M. (2012). Life expectancy and cardiovascular mortality in persons with schizophrenia. *Current Opinion in Psychiatry, 25*(2), 83–88.
Murray, C. J., Abraham, J., Ali, M. K., Alvarado, M., Atkinson, C., Baddour, L. M., …, & Bolliger, I. (2013). The state of US health, 1990–2010: Burden of diseases, injuries, and risk factors. *JAMA*, *310*(6), 591–606.
Nelson, E. C., Landgraf, J. M., Hays, R. D., Wasson, J. H., & Kirk, J. W. (1990). The functional status of patients: How can it be measured in physicians' offices? *Medical Care, 28,* 1111–1126.
Nelson, E., Wasson, J., Kirk, J., Keller, A., Clark, D., Dietrich, A., …, Zubkoff, M. (1987). Assessment of function in routine clinical practice: Description of the COOP Chart method and preliminary findings. *Journal of Chronic Diseases*, *40*, 55–63.
Perälä, J., Suvisaari, J., Saarni, S. I., Kuoppasalmi, K., Isometsä, E., Pirkola, S., …, & Härkänen, T. (2007). Lifetime prevalence of psychotic and bipolar I disorders in a general population. *Archives of General Psychiatry*, *64*(1), 19–28.
Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1,* 385–401.
Radloff, L. S., & Teri, L. (1977). Use of the Center for Epidemiologie Studies-Depression Scale with older adults. *Clinical Gerontologist, 5,* 119–136.
Reid, M. C., Eccleston, C., & Pillemer, K. (2015). Management of chronic pain in older adults. *BMJ, 350,* 1–43. https://doi.org/10.1136/bmj.h532.
Robinski, M., Strich, F., Mau, W., & Grindt, M. (2016). Validating a patient-reported comorbidity measure with respect to quality of life in end-stage renal disease. *PLoS ONE, 11*(6), 1–13. https://doi.org/10.1371/journal.pone.0157506.
Roffman, C. E., Buchanan, J., & Allison, G. T. (2016). Charlson comorbidities index. *Journal of Physiotherapy, 62,* 1. https://doi.org/10.1016/j.jphys.2016.05.008.
Sánchez, J., Rosenthal, D. A., Chan, F., Brooks, J., & Bezyak, J. L. (2016). Relationships between world health organization international classification of functioning, disability and health constructs and participation in adults with severe mental illness. *Rehabilitation Research, Policy, and Education, 30,* 286–304.
Scheffer, J. (2002). Dealing with missing data. *Research Letters in the Information and Mathematical Sciences, 3,* 153–160.
Seminog, O. O., & Goldacre, M. J. (2013). Risk of pneumonia and pneumococcal disease in people with severe mental illness: English record linkage studies. *Thorax, 68,* 171–176.
Siddaway, A. P., Wood, A. M., & Taylor, P. J. (2017). The Center for Epidemiologic Studies-Depression (CES-D) scale measures a continuum from well-being to depression: Testing two key predictions of positive clinical psychology. *Journal of*

Affective Disorders, 213, 180–186. https://doi.org/10.1016/j.jad.2017.02.015.

Stubbs, B., Schofield, P., & Patchay, S. (2014). Mobility limitations and fall-related factors contribute to the reduced health-related quality of life in older adults with chronic musculoskeletal pain. *Pain Practice, 16,* 80–89. https://doi.org/10.1111/papr.12264.

Stubbs, B., Vancampfort, D., De Hert, M., & Mitchell, A. J. (2015). The prevalence and predictors of type two diabetes mellitus in people with schizophrenia: A systematic review and comparative meta-analysis. *Acta Psychiatrica Scandinavica, 132,* 144–157.