


SHORT REPORT

COVID-19 associated disruptions in routine health care of people with mild cognitive impairment or dementia

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Abstract

Introduction: We report the COVID-19 pandemic's impact on health-care use disruption among people with mild cognitive impairment or Alzheimer's disease and related dementia (MCI/ADRD).

Methods: We compared the pandemic-period health-care use between MCI/ADRD and matched non-MCI/ADRD patients. Using 4-year pre-pandemic data, we modeled three health-care use types (inpatient, outpatient, emergency encounters) to predict pandemic-period use, disaggregated for lockdown and post-lockdown periods. Observed health-care use was compared to the predicted. Proportional differences (confidence intervals) are reported.

Results: Both MCI/ADRD and non-MCI/ADRD patients ($n = 5479$ each) experienced pandemic-related health-care use disruptions, which were significantly larger for the MCI/ADRD group for outpatient, -13.2% (-16.2% , -10.2%), and inpatient encounters, -12.8% (-18.4% , -7.3%). Large health-care disruptions during lockdown were similar for both groups. However, post-lockdown outpatient, -14.4% (-17.3% , -11.5%), and inpatient, -15.2% (-21.0% , -9.5%), disruptions were significantly greater for MCI/ADRD patients.

Conclusion: MCI/ADRD patients experienced greater and sustained pandemic-related health-care use disruptions, highlighting the need for robust strategies to sustain their essential health care during pandemic-like catastrophes.

1 | INTRODUCTION

Older individuals with mild cognitive impairment (MCI) or various forms of dementia, including Alzheimer's disease and related dementias (ADRD), are particularly susceptible to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, have higher rates of coronavirus disease 2019 (COVID-19) hospitalizations, and experience

poor outcomes.^{1,2} This vulnerability may be due to a higher burden of comorbidities among people living with MCI/ADRD compared to their non-MCI/ADRD peers.³ This also implies that MCI/ADRD individuals have complex health-care needs that require ongoing management of chronic medical conditions and risk factors. However, beyond the risk of infection, the COVID-19 pandemic resulted in unprecedented health-care disruptions due to local lockdowns,

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RESEARCH IN CONTEXT

- 1. Systematic review:** Using traditional (e.g., PubMed) sources, we found evidence highlighting higher COVID-19 susceptibility, severity, and mortality among the elderly and those with cognitive dysfunction. However, the indirect impact of the pandemic by causing disruptions in regular health-care use (HCU) among people with mild cognitive impairment or Alzheimer's disease and related dementias (MCI/ADRD) has not been systematically evaluated. The relevant work is appropriately cited.
- 2. Interpretation:** Our findings highlight the critical vulnerability of the MCI/ADRD population to greater and sustained HCU disruptions compared to their peers. These disruptions particularly impacted outpatient care for MCI/ADRD patients.
- 3. Future directions:** The article emphasizes the need to examine long-term effects of HCU disruptions on health and quality of life outcomes among MCI/ADRD patients. Furthermore, we underscore the importance of investigating the mechanisms of HCU discontinuance in the MCI/ADRD population, specifically pertaining to caregiver burden, disruption of essential services, and shortages in home-health personnel and solutions.

strained health-care systems, and critical shortages of health-care workers and caregivers.⁴ As optimal management of comorbidities among people with MCI/ADRD is directly linked to improved clinical and quality of life outcomes,⁵ such health disruptions may have had a disproportionately higher impact on long-term health of MCI/ADRD patients. While the direct pandemic-related clinical burden (infection, hospitalization, and mortality) among individuals with MCI/ADRD has been described, the indirect impact of the pandemic on disruptions in regular health-care use among people with MCI/ADRD has not been systematically evaluated.

2 | METHODS

We conducted a retrospective matched case-control analysis of MCI/ADRD and non-MCI/ADRD patients and evaluated health-care use during the COVID-19 pandemic among established patients of a tertiary health-care system. Houston Methodist (HM) is an eight-hospital health-care system with an extensive primary and emergency care network across the greater Houston area, representing one of the most diverse US populations of around 7 million. All outpatient, inpatient, and emergency care services across HM remained fully operational during the pandemic.⁶ We used the HM COVID-19 Surveillance and Outcomes Registry (CURATOR) to identify adult (>18 years) MCI/ADRD patients via validated International Classification

of Disease version 10 (ICD-10) diagnoses for MCI, various dementia subtypes (including vascular dementia) and Alzheimer's disease. CURATOR is an HM Institutional Review Board–approved electronic medical record–based COVID-19 informatics pipeline that captures longitudinal demographic, social determinant, clinical, laboratory, serological, imaging, and outcomes data on all tested and/or vaccinated SARS-CoV-2 phenotypes. More than 90% of CURATOR patients have information available on prior health-care encounters. Detailed design and rationale of CURATOR has been reported previously.⁷

Between April 2016 and February 2020 (pre-pandemic phase), patients with ≥ 2 hospitalizations, one hospitalization and ≥ 2 outpatient and/or emergency visits, or ≥ 4 outpatient and/or emergency visits were considered “established patients.” A propensity score–based non-MCI/ADRD established patient group was matched for age, sex, race, ethnicity, insurance type, Area Deprivation Index, Charlson Comorbidity Index, SARS-CoV-2 infection based on a positive polymerase chain reaction test, and COVID-19 severity as defined per World Health Organization criteria.^{8,9} The match adequacy was evaluated by comparing pre- and post-match standardized mean differences (SMD). Using pre-pandemic data, autoregressive integrated moving average (ARIMA) models for three health-care types (inpatient, outpatient, emergency encounters) were fit to predict health-care use during the pandemic (March 2020–October 2021). The pandemic period was further disaggregated for lockdown (March 2020–May 2020) and post-lockdown (June 2020–October 2021) periods. The overall and the lockdown period disaggregated model based expected use was compared to the observed use for both MCI/ADRD and matched non-MCI/ADRD groups for all encounter types. The proportional difference (PD) with 95% confidence interval (CI) between expected and observed use during the pandemic period is reported. All analyses were conducted using statistical software R version 4.1.0.

3 | RESULTS

We identified 12,350 MCI/ADRD patients, of whom 5767 were flagged as established patients. Socio-demographic or clinical data were missing for 270 (4.7%), resulting in a total of 5497 adult MCI/ADRD established patients (mean age: 77.6 years, 60.9% females) who were propensity score matched to 5497 non-MCI/ADRD patients. The match resulted in 99.5% overall SMD reduction between the MCI/ADRD and non-MCI/ADRD groups. Table 1 reports the socio-demographic and clinical differences between the MCI/ADRD and pre- and post-match non-MCI/ADRD groups. Figures S1–S2 in supporting information demonstrate SMD reduction for individual variables and the distribution of propensity scores in the pre- and post-match groups.

A steady increase in pre-pandemic (April 2016–February 2020) use for outpatient, inpatient, and emergency care was observed for both MCI/ADRD and non-MCI/ADRD patients. During the pandemic, the overall observed use (vs. expected) significantly declined for both MCI/ADRD and non-MICD groups for all three encounter types. Figure 1 demonstrates pre-pandemic trends, and expected and observed use for non-MCI/ADRD and MCI/ADRD patients.

TABLE 1 Demographic, social, comorbidity, and clinical characteristics of MCI/ADRD, and pre- and post-match non-MCI/ADRD established patients of the health-care system

	MCI/ADRD (N = 5497)	Non-MCI/ADRD pre match (N = 77,027)	Non-MCI/ADRD matched (N = 5497)	% SMD ^a change
Age (years): mean (SD)	77.7 (10.9)	57.1 (18.0)	77.7 (10.5)	99.9
Females: n (%)	3348 (60.9)	53,461 (69.4)	3306 (60.1)	90.8
Non-Hispanic-race and ethnicity: n (%)				
Hispanic/Latino	576 (10.5)	11,978 (15.6)	458 (8.8)	67.4
White	4113 (74.8)	54,613 (70.9)	4167 (75.8)	74.9
Black	1090 (19.8)	17,125 (22.2)	1060 (19.3)	77.3
Asian	245 (4.5)	4475 (5.8)	229 (4.2)	78.5
Native American/other	49 (0.9)	794 (1.0)	49 (0.9)	-4.4
Area deprivation index: mean (SD)	3.6 (2.5)	3.6 (2.6)	3.5 (2.5)	-19.2
Medicare insured: n (%)	4896 (89.1)	33,493 (43.5)	4924 (89.6)	98.9
Charlson Comorbidity Index: mean (SD)	6.2 (3.7)	3.1 (1.2)	6.3 (3.9)	98.0
COVID-19 severity: mean (SD)	0.33 (1.8)	0.21 (1.7)	0.25 (1.9)	30.3

Abbreviations: MCI/ADRD, mild cognitive impairment/Alzheimer's disease and related dementias; SD, standard deviation; SMD, standardized mean difference.

^aReported for pre- vs. post-match non-MCI/ADRD patients as a percent change with overall SMD reduction of 99.5%.

3.1 | Healthcare use disruption among MCI/ADRD patients

For MCI/ADRD patients, the largest overall health-care use decline during the pandemic was observed for outpatient care, percent PD (CI): -33.6% (-39.6%, -27.7%), followed by emergency care encounters: -32.3% (-35.7%, -28.9%), and inpatient encounters: -25.7% (-31.6%, -19.9%).

3.2 | Healthcare use disruption among non-MCI/ADRD patients

Among non-MCI/ADRD patients, the largest decline during the pandemic was observed for the emergency care encounters, percent PD (CI): -30.4% (-34.6%, -26.1%), followed by outpatient: -20.4% (-28.0%, -12.8%), and inpatient encounters: -12.9% (-18.2%, -7.7%).

3.3 | Healthcare use disruption among MCI/ADRD versus non-MCI/ADRD patients

The overall pandemic period health-care use disruptions were significantly greater for the MCI/ADRD patients (vs. non-MCI/ADRD patients) for outpatient, -13.2% (-16.2%, -10.2%), and inpatient encounters, -12.8% (-18.4%, -7.3%) encounters. However, MCI/ADRD versus non-MCI/ADRD disruptions were not significantly different for emergency care, with both groups experiencing ≈30% declines in emergency encounters.

In the disaggregated analyses, a sharp decline in observed (vs. expected) was noted for both the MCI/ADRD and non-MCI/ADRD

patients during lockdown (Figure 1). These lockdown disruptions were not significantly different between the MCI/ADRD and non-MCI/ADRD patients for any of the encounter types. However, post-lockdown, among non-MCI/ADRD patients, outpatient and inpatient encounters rebounded to non-significantly different levels (vs. expected use). Such rebounds were not observed for the MCI/ADRD patients. Therefore, post-lockdown outpatient and inpatient disruptions were significantly larger for MCI/ADRD (vs. non-MCI/ADRD) patients. Post lockdown period PD (CI) between MCI/ADRD and non-MICD patients for outpatient, emergency, and inpatient care encounters were -14.4% (-17.3%, -11.5%); -3.2% (-8.0%, 1.5%); and -15.2% (-21.0%, -9.5%), respectively, again demonstrating significant differences in health-care disruptions for outpatient and inpatient care among MCI/ADRD patients.

4 | DISCUSSION

Our study found large health-care disruptions during the pandemic in outpatient, emergency, and inpatient encounters in both MCI/ADRD and non-MCI/ADRD populations. We demonstrate, however, that people with MCI/ADRD have had significantly higher disruptions in inpatient and outpatient encounters. Additionally, our findings highlight that MCI/ADRD individuals continue to have a sustained longer term health-care disruption and perhaps have not been able to recover from early lockdown-related disruptions to the extent of their age and comorbidity-matched peers.

Senescence, comorbidity burden, and residence in congregate care settings predisposes older adults to poor COVID-19 outcomes. Older individuals with cognitive dysfunction are also more vulnerable to infection—perhaps driven by a multitude of clinical and social

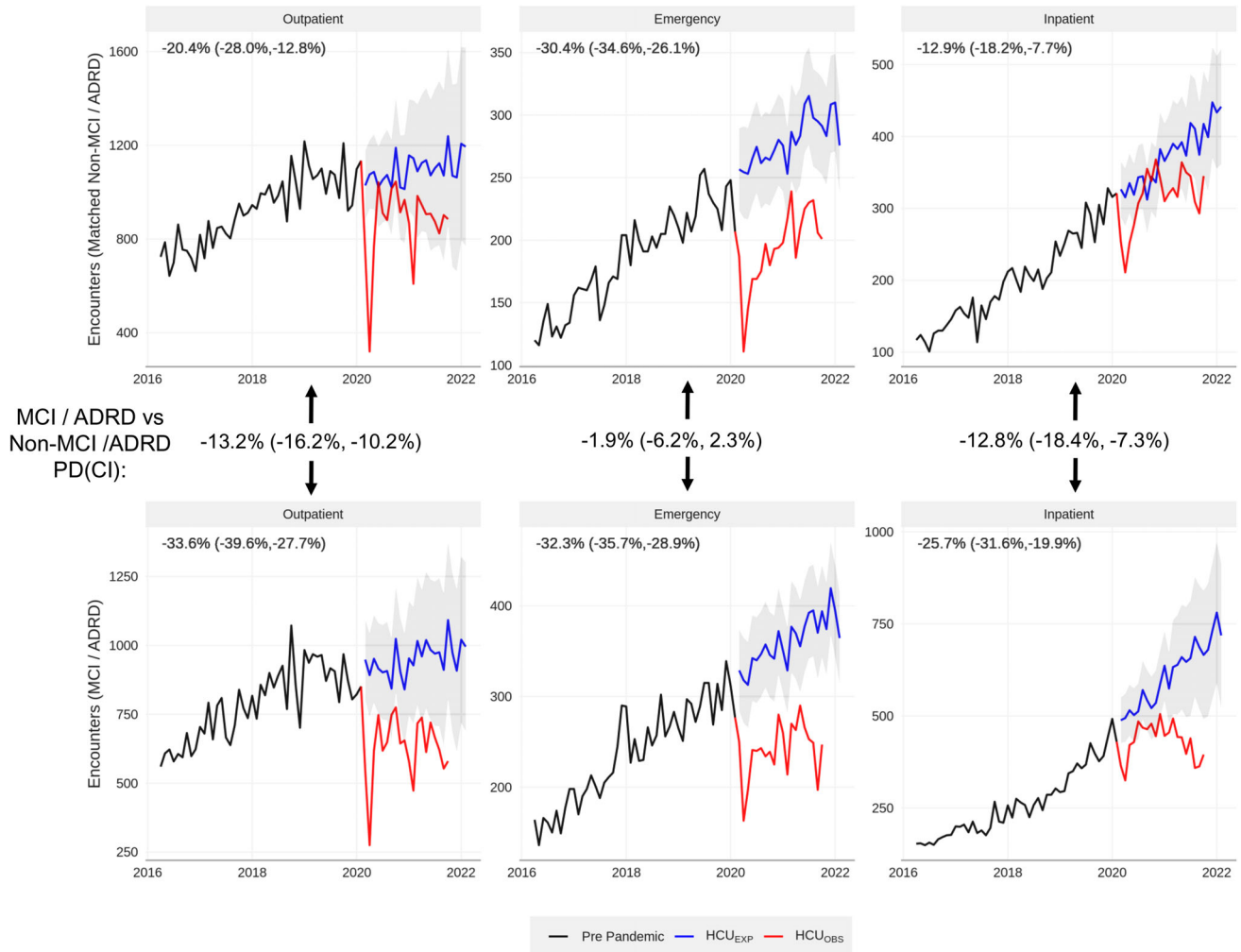


FIGURE 1 Pre-pandemic and pandemic period health-care use trends for inpatient, outpatient, and emergency care encounters among people with and without mild cognitive impairment or Alzheimer's disease and related dementias (MCI/ADRD). Pre-pandemic health-care use trends (black) were modeled to predict pandemic period health-care use (blue) and compared to observed health-care use (red) for three health-care use types for patients with MCI/ADRD and propensity score matched non-MCI/ADRD patients. Proportional differences (95% confidence intervals) for healthcare use across various healthcare use types and between MCI/ADRD and non-MCI/ADRD groups reported. Abbreviations: CI, confidence interval; HCU, health-care use; PD, proportional difference

factors.^{10,11} Though these direct effects of the COVID-19 pandemic among individuals with MCI/ADRD have been characterized, to our knowledge, we uniquely report the indirect effects of the pandemic on people living with MCI/ADRD.

The reasons for higher disruptions among MCI/ADRD patients can be complex and may be in part driven by greater caregiver dependency than their non-MCI/ADRD peers.¹² Hence, MCI/ADRD health-care disruptions are influenced by the direct (clinical) or indirect (socio-economical) impacts of the COVID-19 pandemic on caregivers. Though not specific to MCI/ADRD populations, broad pandemic-related stressors on formal and informal caregivers have been avidly reported.^{13,14} There is a need to systematically assess specific aspects of pandemic-associated burden that may be uniquely relevant to MCI/ADRD caregivers. Other sets of factors that may lead to higher health-care use disruptions among MCI/ADRD patients may be intrinsic to the cognitive deficit itself. Although research on MCI/ADRD

health-care use is limited, pre-pandemic trends indicated that cognitive impairment was associated with less outpatient/preventative care, more emergency department encounters, and increased health-care spending.^{15,16} Lapses in memory, compromised executive functioning, disruption in essential services such as transportation, closure of primary care practices, unavailability of home-health personnel and solutions, and added challenges in interfacing with technology coupled with pandemic-depleted caregiver support may constitute a "perfect storm" for this population that is vulnerable to gaps in care. A multi-modal approach is therefore needed to develop and test targeted mitigation strategies and interventions for patients, caregivers, and health systems, such that pandemic-like health-care disruptions can be minimized.

The long-term health-related consequences of health-care disruptions for MCI/ADRD patients need to be further studied. It is expected that primary care disruptions would lead to suboptimal management of

chronic diseases and risk factors. Due to the high burden of comorbidity in MCI/ADRD populations,³ disruptions may have a greater impact on the long-term health and well-being of MCI/ADRD patients than non-MCI/ADRD individuals. Incident disease and worsening chronic conditions would likely compromise cardiovascular, cerebrovascular, renal, and other body systems commonly affected by comorbid illnesses^{3,17} thus, directly contributing to poor outcomes, including hospitalizations, enhanced disabilities, and higher mortality among MCI/ADRD patients. Reports of pandemic-related poor outcomes in other vulnerable populations are emerging, for example, population level increased stroke mortality and worsening maternal-fetal outcomes.^{18,19} It would therefore be critical to track health outcomes among MCI/ADRD populations.

The strengths of our study include a large sample size, modeling longitudinal 4-year pre-pandemic data to derive expected health-care use, and meticulous use of methods of causal inference. However, our work is limited by factors inherent to the use of secondary electronic medical record data. Our predictions are based on time-series modeling of retrospective data, which may be influenced by seasonal variations and outliers. In addition, our analysis relies on ICD-driven identification of MCI/ADRD patients. MCI/ADRD may be undocumented in some patients, and hence, there is potential for missed MCI/ADRD diagnoses and a bias toward null. Also, our data are limited to one health-care system and because health-care use is in part driven by health system factors, our findings may not be broadly generalizable. Despite these limitations, we provide evidence of sustained pandemic-related health-care disruptions among MCI/ADRD patients throughout the care continuum, with major impacts on primary care. Our findings therefore underscore the urgent and critical need for developing multi-modal mitigation strategies to sustain essential health care for populations with chronic health conditions during pandemic-like catastrophes.

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CONFLICTS OF INTEREST

All authors have no conflicts of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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