Acute, Post-Acute, and Primary Care Utilization in a Home-Based Primary Care Program during COVID-19

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Abstract

Background and Objectives: Older adults with multiple comorbidities experience high rates of hospitalization and poor outcomes from Coronavirus Disease 2019 (COVID-19). Changes in care utilization by persons in advanced illness management (AIM) programs during the COVID-19 pandemic are not well known. The purpose of this study was to describe changes in care utilization by homebound AIM patients in an epicenter of the COVID-19 pandemic before and during the pandemic.

Research Design and Methods: Descriptive statistics and tests of differences were used to compare care utilization rates, including emergency department (ED) and inpatient admissions, acute and sub-acute rehabilitation, and AIM program utilization during the pandemic with rates one year prior.

Results: Acute and post-acute utilization for enrollees (n=1,468) decreased March-May 2020 compared to one year prior (n=1,452), while utilization of AIM program resources remained high. Comparing 2019 and 2020, ED visits/1000 enrollees were 109 versus 44 (p<0.001), inpatient admissions 213 versus 113 (p<0.001), and rehabilitation facility admissions 56 versus 31 (p=0.014); AIM program home visits were 1935 versus 276 (p<0.001), remote visits (telehealth/telephonic) 0 versus 1079 (p<0.001), and all other phone touches 3032 versus 5062 (p<0.001). Home hospice admissions/1000 increased: 16 to 31 (p=0.011).

Discussion and Implications: Our results demonstrate decreased acute and post-acute utilization, while maintaining high levels of connectedness to the AIM program, amongst a cohort of homebound older adults during the COVID-19 pandemic compared with one year prior. While further study is needed, our results suggest that AIM programs can provide support to this population in the home setting during a pandemic.

Key Words: SARS-CoV-2, Home-based medical care, Advanced illness management, Pandemic

BACKGROUND/OBJECTIVES

Community-dwelling older adults face unique challenges due to the Coronavirus Disease 2019 (COVID-19), the illness caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)), pandemic. Age as well as underlying frailty and multi-morbidity have been shown to predispose to worse outcomes of COVID-19, including increased risk of severe infection, respiratory failure, disability, intensive care unit admission and death (Bialek et al., 2020; Nikolich-Zugich et al., 2020; Wang et al., 2020). Complicating matters, older adults with COVID-19 infection may present with signs and symptoms of illness that are different from younger adults (Annweiler et al., 2020; Struyf et al., 2020). Across one large health system in downstate New York, the epicenter of the pandemic in early 2020, a study of 5,700 hospitalized patients showed that adults over age 60 years old comprised 59% of COVID-19-positive hospitalizations and 84% of deaths. Of those discharged alive, more were likely to go to a facility (13.9% versus 2.0% for adults under 65-years-old) and to get readmitted (3.3% versus 1.6%) (Richardson et al., 2020).

Advanced illness management (AIM) programs typically serve the highest need community-dwelling individuals, most with multiple chronic conditions, advanced age, and multiple functional impairments. By providing comprehensive care in the home through multidisciplinary care teams, these programs are able to reduce unnecessary and often unwanted hospitalizations and have been shown to lower the total cost of care (Rotenberg et al, 2018).

The impact of the COVID-19 pandemic on these community-dwelling older adults has not been fully elucidated to date. While these individuals may be at lower risk of contracting COVID-19 due to the ability to self-isolate when compared with those residing in long term care facilities, they are potentially at risk of a myriad of other complications due to

the pandemic. For example, social isolation, which has shown to result in in worsening of dementia and mental health, may result from social distancing that has been enacted to prevent COVID-19 spread (Malone et al., 2020; Steinman et al., 2020). Social distancing can also decrease access to formal and informal caregivers; as a result, patients may struggle to meet their day-to-day basic needs, leading to declines in general health and function. Additionally, persons utilizing AIM program services have chronic medical conditions that continue to require follow-up during this pandemic, and may experience acute exacerbations and/or have new concerns that need to be evaluated in a prompt, patient-centered manner. While much of the COVID-19 research to date has, understandably, focused on the hospital setting, little has been documented on care models for older adults in the community, including AIM models.

This quasi-experimental study sought to describe changes in care utilization, including acute, post-acute, and AIM program services, by homebound older adults in the US epicenter of the COVID-19 pandemic in early 2020. By comparing care utilization during the pandemic with rates one year prior, we sought to characterize the impact of this public health emergency on AIM program enrollees. Additionally, as little is known about community spread of COVID-19 in homebound, chronically ill older adults, we sought to describe the rates of COVID-19 infection in this population and to compare all-cause mortality rates during the pandemic to those one year prior. The results of this investigation may inform policy and program design as we look for ways to provide care outside of the hospital for community-dwelling, older adults in the midst of an ongoing pandemic.

RESEARCH DESIGN/METHODS

This was a quasi-experimental study of AIM enrollees comparing acute (ED and inpatient admissions), post-acute (acute and sub-acute rehabilitation), and AIM program utilization (remote and in person primary care visit rates, telephonic interaction rates (incremental to primary care visits), hospice utilization, inbound after-hours calls to our nurse call center and community paramedicine dispatch rates, reasons, and transport rates) from March-May of 2020 with those of the year prior. All-cause mortality rates March-May 2020, including those due to confirmed or suspected COVID-19, were also analyzed and compared to all-cause mortality rates from the year prior.

Our AIM program, located in urban and sub-urban downstate New York, annually cares for approximately 2,000 homebound individuals with multiple chronic conditions and activities of daily living dependencies. At the time of program enrollment most individuals have had past year non-elective acute care use. Staff include ten providers (physicians and nurse practitioners), registered nurses, social workers and medical coordinators who operate in geographically-based interdisciplinary care teams. Our program, a CMS Independence at Home demonstration site, is part of an integrated delivery system that includes 23 hospitals, over 750 ambulatory practices, an emergency medical services (EMS) agency, a home health agency and a hospice agency.

Services provided to AIM program enrollees include home-based primary care services for scheduled follow-up care of chronic conditions, as well as unscheduled acute visits for evaluation and treatment of new conditions or exacerbations of chronic illnesses. Advance care planning is a cornerstone of the program, and wishes are addressed annually and when changes in condition occur. AIM enrollees are advised to call the AIM program rather than 911 to access clinical care 24/7 through a call center staffed by registered nurses.

These nurses can resolve concerns telephonically, escalate to an AIM provider, dispatch EMS services or dispatch a community paramedic for 24/7 evaluation and treatment in the home as indicated based on an individual's clinical condition as well as goals of care. The program's community paramedicine program provides in-home evaluation and treatment under the direction of an AIM physician who is certified to provide New York state online medical control (OLMC) and is able to safely evaluate and treat the majority of patients at home without transport to the ED (Abrashkin et al., 2016; Abrashkin et al., 2019).

During the pandemic, the AIM program continued to work in multidisciplinary care teams providing routine and acute care, but the majority of visits were converted from in home services to remote visits using telephonic and telehealth platforms due to risks of COVID-19 transmission. In person visits were conducted on an as needed basis when physical interventions, for example catheter management, or in person evaluations were needed. Patients and caregivers were given instructions to social distance. Suspected COVID-19 cases were referred to the appropriate public health department for testing if feasible. Testing at the beginning of the pandemic was limited for AIM enrollees, but increased considerably after the first few weeks, including the capacity to test patients at home. COVID-19 diagnoses were confirmed by a positive PCR via nasopharyngeal swab; however, a percentage of patients were unable to receive testing due to access and availability and were given a "suspected" diagnosis based on clinical signs and symptoms.

Acute and post-acute utilization data were collected from the regional health information exchange (RHIO, Healthix), our institution's internal health information exchange (HIE), and internal tracking data; the combination of these sources allowed for comprehensive data collection both in and outside of the health system. Program-specific data, including visits and telephonic interactions were extracted from the program's electronic medical record (AllScripts,TouchWorks EHR V.15.1, Chicago, Illinois, USA),

inbound calls to the nurse call center were obtained from the nurse call center's phone system (Avaya, Santa Clara, CA), and community paramedicine program data was extracted from HealthEMS (Sansio, Redmond, Washington, USA). All data were housed in REDCap. Descriptive statistics were used to summarize patient demographics and outcomes. Cross-sectional univariate and bivariate analyses were performed, chi-square tests or Fisher's exact tests were used for categorical variables and t-tests (for normally distributed data) or -Mann Whitney U tests (for non-normal data) were used for continuous variables. A p-value of 0.05 or less was considered statistically significant. Statistical analyses were performed using R statistical software, version 4.0.0 (The R Foundation for Statistical Computing, Vienna, Austria).

This investigation was approved by our institution's COVID-19 Non-Interventional Research Committee and our institution's institutional review board with a waiver of informed consent.

RESULTS

Table 1 compares patient characteristics during the study period, March-May 2020, with patient characteristics from one year earlier. Populations were clinically similar including sex, presence of Do Not Hospitalize order status, and presence of many chronic conditions including hypertension and morbid obesity which have both been associated with poor outcomes in COVID-19 infection. While several statistically significant differences between groups were detected including age (average of 83.6 in 2019 (range 23-105, standard deviation 12.4) versus 82.5 years in 2020 (range 21-106, standard deviation 12.7)), rates of several chronic conditions and ADL dependencies (5-6 ADL dependencies 65.6% in 2019 versus 67.0% in 2020), the populations were clinically very similar. Documentation of

advanced care planning discussion (97.0% in 2019 versus 98.4% in 2020), and presence of Do Not Resuscitate orders (60.9% in 2019 versus 54.8% in 2020) was high in both groups.

Patient utilization of AIM program services remained high in both 2019 and 2020, but with some notable differences reflecting substitution of the majority of in person visits with remote visits in 2020. The number of in-person visits made by physicians, nurse practitioners, and nurses decreased by 85.7% in 2020 (1935 versus 276 in-person visits/1000 patients, p < 0.001). Nurse practitioner and physician in-person visits were largely replaced by telephonic and telehealth visits in 2020 (1079 visits/1000 patients during the pandemic, p < 0.001). Of note, the program was not making any telehealth visits during the 2019 time period included in the study. Similarly, while there are always a high number of telephonic touches by nurse practitioners and physicians between in-person visits in any AIM program, we were not scheduling visits telephonically in 2019 – all scheduled visits were made in-person.

The number of inbound calls from patients and caregivers to the AIM program's nurse call center remained consistent from 2019 to 2020 (1003 versus 994 calls/1000 patients). Community paramedicine response rates did not differ significantly from 2019 to 2020, although there were a sizable number of responses dispatched for COVID-19-related calls in 2020 (Advanced Medical Priority Dispatch System (AMPDS) Card 36). Reflecting the increasing number of deaths at home during the COVID-19 pandemic, community paramedics were 220% more likely to be dispatched for death pronouncements in 2020 (13% of all CP responses in 2020 versus to 4% in 2019 (p = 0.004)). Home hospice utilization increased by 93.8% (from 16 admissions per 1000 in 2019 to 31 admissions per 1000 patients in 2020 (p = 0.011)); this was associated with an increase in all-cause mortality of 68.4% (79 versus 133, p < 0.001) during the same time period. The majority of deaths occurred at home and the percent of patients dying at home without hospice services increased, although not statistically significantly, by 26.8% (41% in 2019 and 52% in 2020 (p = 0.049).

Acute utilization during the pandemic period decreased compared to the same time period one year prior (Table 2 and Figure 1). ED visits decreased by 59.6% (from 109 visits/1000 patients in 2019 to 44 in 2020 (p < 0.001)); inpatient hospitalizations decreased by 47.0% (from 213 to 113 admissions/1000 patients in 2020 (p < 0.001)). Post-acute utilization (acute and sub-acute rehabilitation admissions) in 2020 also decreased by 44.6% compared to 2019 (56 versus 31 admissions/1000 patients, p= 0.014). Patient deaths in the hospital, rehab facility or inpatient hospice were not statistically different between 2019 and 2020.

Ten percent (n=151) of AIM patients were tested for COVID-19 during the study period, with approximately half (48%) of tests coming back positive (Figure 2). COVID-19 positive and suspected cases peaked in the first week of April 2020, coinciding with the largest number of cases in New York occurring that same week (Johns Hopkins University Coronavirus Resource Center). Seventeen percent (n=23) of COVID-19-positive patients died, presumably from complications of COVID-19. Weeks after social distancing measures had been implemented, AIM patients who were tested for COVID-19 in mid-April and May had a higher rate of negative results. Because testing capacity was limited at the beginning of the pandemic (March 2020), 29 AIM patients were given a suspected COVID-19 diagnosis; a third (34%, n=10) of those patients died during the study period. There was also an increase in deaths not associated with a diagnosis of suspected or confirmed COVID-19 during the 2020 study period (Figure 2).

DISCUSSION/IMPLICATIONS

Our study compares acute, post-acute, and primary care utilization by individuals enrolled in a program designed to meet the complex medical needs of those who are homebound, of older age, and faced with multiple chronic conditions at the epicenter of the COVID-19 pandemic with utilization one year prior. Additionally, we sought to characterize the COVID-19 infection rates and mortality patterns (all-cause and COVID-19- related) during the pandemic.

Our results demonstrate that program enrollees had lower utilization of acute and post-acute services per capita during the pandemic than in the same time period one year prior. Enrollees continued to access the AIM program's resources for routine and acute care at high rates, although service delivery necessarily changed due to pandemic conditions. Overall, comparing 2019 and 2020 there was a statistically significant increase in remote (telephonic and telehealth) visits, incremental telephonic touches, and home hospice referrals, a decrease in in-person visits, and steady levels of after-hours nurse call center and community paramedicine utilization.

Reasons for declining acute and post-acute care utilization during the pandemic were likely the result of system changes as well as attributes of the AIM model. Fear of contracting COVID-19 during a hospital encounter coupled with highly restricted visitation policies necessary for infection control likely lead to some enrollees who would otherwise have sought care in the hospital remaining home with supportive services, including hospice. Even outside of the COVID-19 pandemic, home-based medical care has been shown to prevent unnecessary and often unwanted hospital and ED utilization by providing a reliable medical response when and where it is needed, and decreasing the need to access the acute care setting for diagnostics, treatment and symptom control (Edes et al., 2014; Ornstein et al.,

2015; Rotenberg et al., 2018). Goals of care were undoubtedly shaped by the conditions faced during the pandemic. It is highly unusual to have an individual choose so starkly between seeking emergency care alone and choosing comfort care at home with family, yet this is what was faced in our region during the pandemic. The AIM program never denied or discouraged acute care use during this time period, rather AIM clinicians were able to spend the necessary time with program enrollees and caregivers to discuss options and facilitate the care desired, whether curative or palliative.

During the pandemic, much of our care model remained consistent with pre-pandemic workflows – geographically-based multidisciplinary care teams – with the necessary and substantial substitution of telehealth and telephonic visits for a majority of in person visits. Outside of pandemic conditions, telehealth in homebound older adults has shown promise for improved general health, social functioning and depression symptoms as well as for improving acute care utilization in those with COPD and CHF (Gellis et al., 2012). Studies from during the pandemic have shown promise for palliative care services provided through telehealth, as well as utilization of an electronic symptom tracking platform, although the number of older adults utilizing the platform was low (Ankuda et al., 2020; Hollander et al., 2020; Kricke, 2020; Sutherland et al., 2020). Overall, few studies of telehealth in homebound individuals have been conducted and some results, including our own pre-pandemic results, have shown low utilization of available telehealth options in this population (Dang et al., 2015; Latus-Olaifa et al., 2019). While both changes in CMS reimbursement and clinical necessity have driven tremendous uptake in the provision of telehealth nationally, further study is needed to assess the efficacy of this tool in older adult homebound populations. There are likely benefits from the standpoint of infection control (especially in areas of personal protective equipment shortages), scheduling, visit capacity, and flexibility, with

potential perils including lack of personal connection and the inability to physically intervene when needed.

COVID-19 infection, mortality, and all-cause mortality rates during the pandemic have not previously been described for community dwelling older adults enrolled in an AIM program. Our population, by nature of the ability to self-isolate, was likely relatively protected from contracting COVID-19 compared to similar individuals living in nursing homes or other long-term care facilities that experienced devastating effects of the COVID-19 pandemic in downstate New York (Arons et al., 2020; Cantor et al., 2020; Gurwitz, 2020; Lynn, 2020; Ouslander, 2020). The observed increase in non-COVID-19 related mortality during the pandemic is likely due to a shift in the desires of enrollees to seek curative care in an acute care facility alone towards a desire for more comfort oriented care at home with loved ones, as well as the recently-characterized atypical presentation of COVID-19 in older adults that may have led to symptoms being ascribed to other chronic illnesses (Annweiler et al., 2020; Struyf et al., 2020).

Limitations of this study include study design, as the separate sample pretest-posttest design may fail to control for key factors that influenced observed results. Most substantially this study design may misattribute the behavior of the AIM population during the pandemic to the influence of the AIM program when in fact it was due to something else, including fear of contracting COVID-19 in the hospital setting and a desire to remain with loved ones which was not possible in the hospital setting at the height of the pandemic. In short, using this study design it is not possible to comment on whether these older individuals would have decreased acute and post-acute utilization regardless of AIM program involvement. Additionally, our observations and results may not be generalizable to other populations enrolled in other programs, located in different geographic areas, or with different circumstances created by the COVID-19 pandemic.

While our results demonstrate a high level of outpatient support for our older adult enrollees through telehealth and telephonic care when downstate NY was at the US epicenter of the COVID-19 epidemic, additional investigation is needed in several domains. Future study should focus on comparing outcomes related to quality and total cost of care of those assigned to an AIM model of care during pandemic conditions, possibly a future wave of the COVID-19 pandemic, with those receiving traditional office-based care, ideally in a randomized setting. Additional study on the outcomes of older adults utilizing telehealth visits to replace in person care with regard to subsequent utilization of outpatient and acute care services, as well as impacts on measures of social isolation, would also be warranted. If future studies support a positive impact of the AIM model on quality and outcomes in pandemic conditions, comprehensive home-based primary care may hold promise as part of a population health strategy during additional waves of COVID-19 as well as other public health crises.

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Table 1: Differences in characteristics, ADLs, and comorbidities of enrollees before and during COVID-19 pandemic, 2019 versus 2020

Patient characteristics	March – May 2019		March – May 2020		
	Number	(%)	Number	(%)	p-value
Unique Patients	1452		1468		
Sex					
Male	445	30.7%	471	32.1%	0.426
Female	1007	69.4%	997	67.9%	
Age					
<70	157	10.8%	194	13.2%	< 0.001*
70–79	262	18.0%	309	21.1%	
80–89	499	34.4%	467	31.8%	
>90	534	36.8%	498	33.9%	
No of ADL dependencies					
0	145	10.0%	211	14.4%	0.009*
1–2	173	11.9%	146	10.0%	
3–4	133	9.2%	127	8.7%	
5–6	952	65.6%	983	67.0%	
Advance care planning [a]					
Advance care planning discussion	1409	97.0%	1445	98.4%	0.016*
Do Not Resuscitate order	884	60.9%	805	54.8%	0.006*
Do Not Hospitalize order	447	30.8%	448	30.5%	0.442
Insurance status					
Medicaid primary	26	1.8%	3	0.2%	< 0.001*
Medicare primary	818	56.3%	732	49.9%	
Private	608	41.9%	733	49.9%	
Chronic conditions [a]					
Hypertension	1054	72.6%	1083	73.8%	0.496
Alzheimer's disease & related disorders or dementia	610	42.0%	600	40.9%	0.557
Pressure and chronic ulcers	224	15.4%	214	14.6%	0.555
Hyperlipidemia	592	40.8%	577	39.3%	0.441
Depression	447	30.8%	443	30.2%	0.752
Heart failure	406	28.0%	466	31.7%	0.028*
COPD	264	18.2%	280	19.1%	0.568
Rheumatoid arthritis/osteoarthritis	531	36.6%	526	35.8%	0.706
Atrial fibrillation	318	21.9%	280	19.1%	0.065
Diabetes	518	35.7%	587	40.0%	0.018*
Chronic kidney disease	402	27.7%	461	31.4%	0.031*
Morbid obesity	79	5.4%	90	6.1%	0.472

Note. ADL=Activities of daily living; COPD= Chronic obstructive pulmonary disease.

[a] Not mutually exclusive.

Table 2: Comparison of Acute and Post-Acute Care Utilization of enrollees before and during COVID-19 pandemic, 2019 versus 2020

Metric	March – May 2019		March – May 2020		Percent Change	p-value
	Number	Per 1000 Patients	Number	Per 1000 Patients		
AIM Program Utilization						
House Calls In-Person Visits (Physician/NP/RN)	2809	1935	405	276	-85.7%	< 0.001*
House Calls Provider (Physician/NP) Telehealth & Phone Visits	0	0	1584	1079		< 0.001*
All Other House Calls Phone Touches	4403	3032	7431	5062	67.0%	< 0.001*
Inbound Calls to After-Hours RN Call Center	1457	1003	1459	994	-0.9%	
CP Responses (Excluding Death Pronouncements)	237	163	220	150	-8.0%	0.416
AMPDS Card 6 (Breathing Problems)	67	46	63	43	-6.5%	1
AMPDS Card 26 (Sick Persons)	72	50	40	27	-46.0%	0.004*
AMPDS Card 17 (Falls)	23	16	18	12	-25.0%	0.685
AMPDS Card 31 (Unconscious/Fainting)	33	23	16	11	-52.2%	0.032*
AMPDS Card 36 (Pandemic/Epidemic/Outbreak)	0	0	51	35		< 0.001*
CP Transport Rate	34	23	29	20	-13.0%	0.822
CP Responses for Death Pronouncements	10	7	28	19	171.4%	0.004*
Home Hospice Admissions[a]	23	16	45	31	93.8%	0.011*
Acute Care Utilization						
Emergency Room Visits	158	109	64	44	59.6%	< 0.001*
Inpatient Hospitalizations	310	213	166	113	-46.9%	< 0.001*
Inpatient Hospice Admissions	8	6	6	4	-33.3%	0.773
Post-Acute Utilization						
Rehabilitation Facility Admissions[b]	82	56	46	31	-44.6%	0.014*
Deaths						
All-Cause Mortality	79	54	133	91	68.5%	< 0.001*
Deaths at Home	42	29	90	61	110.3%	0.050
With Home Hospice	25	17	43	29	70.6%	1
Without Home Hospice	17	12	47	32	166.7%	0.049*
Deaths in Hospital	25	17	29	20	17.6%	0.154
Deaths in Rehabilitation Facility[b]	4	3	7	5	66.7%	1
Deaths in Inpatient Hospice	6	4	5	3	-25.0%	0.337

Note. CP=Community Paramedicine; AMPDS = Advanced Medical Priority Dispatch System

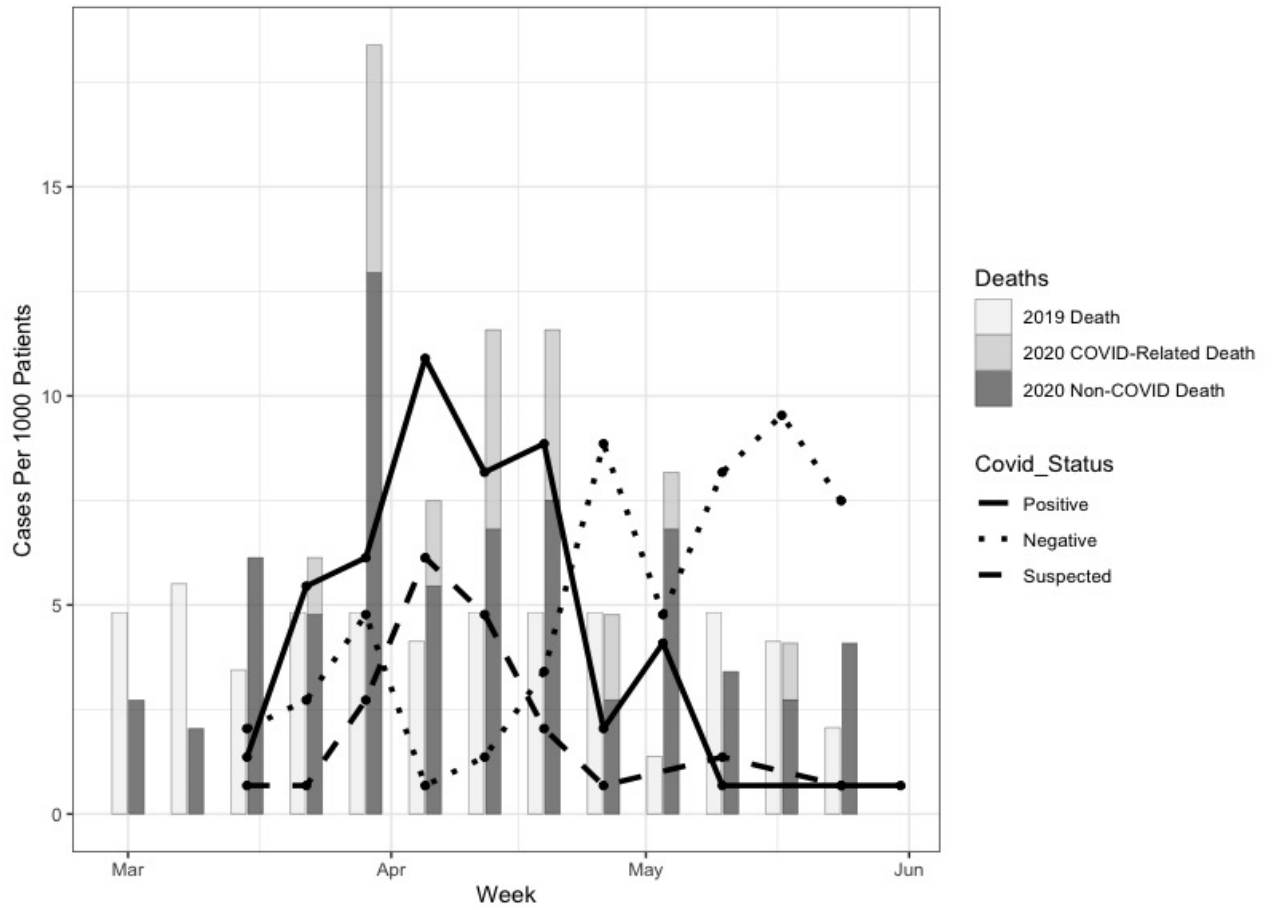[a] Referrals made by AIM program

[b] Acute and sub-acute rehabilitation

Figure 1: Comparison of Weekly Emergency Department, Hospital, and Rehab (acute and sub-acute rehabilitation) Utilization per 1000 patients in March – May 2019 versus 2020. Darker shades (gold, red, dark blue) represent 2020 utilization and lighter dotted colors (yellow, pink, light blue) represent 2019 utilization.
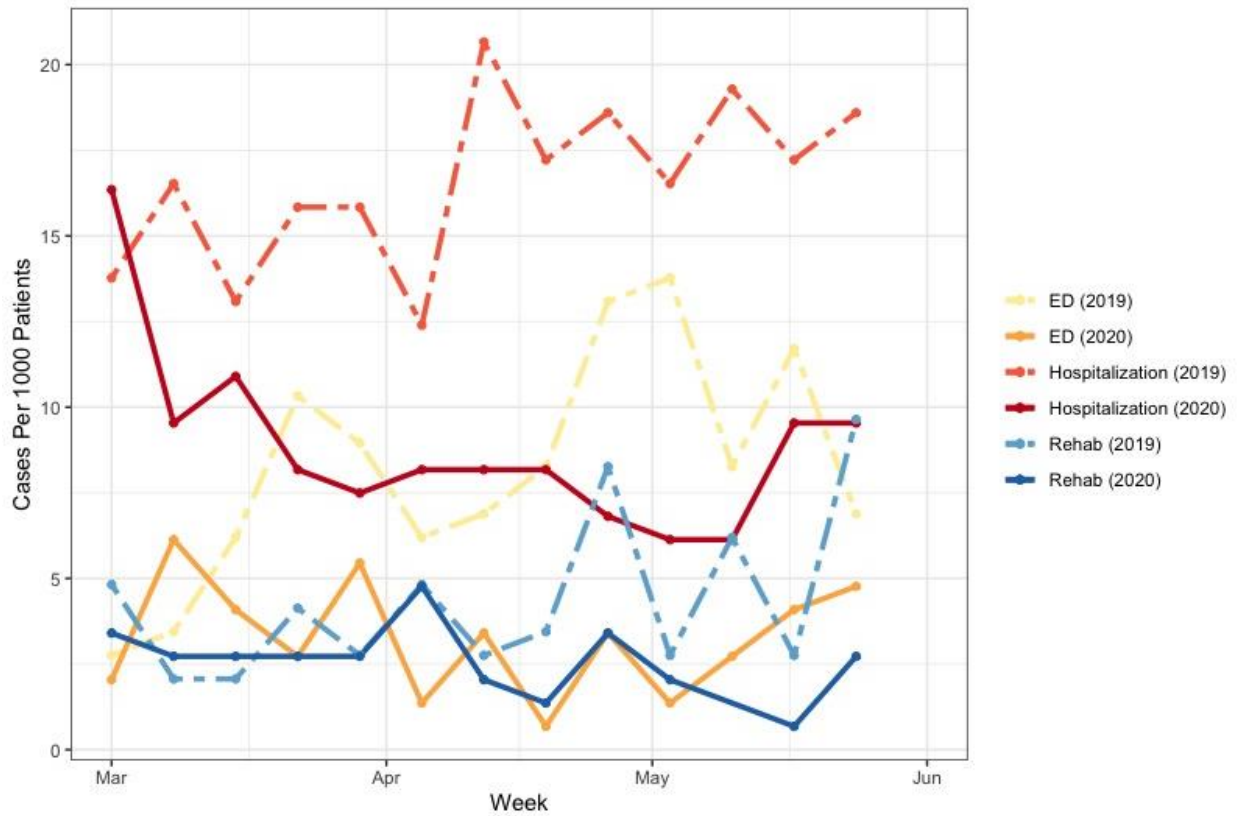
Figure 2: Weekly COVID-19 positive and Suspected Cases March – May 2020, and Comparison of COVID-19-Related and All-Cause Mortality March-May 2019 and March-May 2020