Comparing VA and DoD Health Services Cost Data: An example using COVID-19 inpatient admissions
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Clara E. “Libby” Dismuke-Greer, PhD, HERC, VA Palo Alto Health Care System

Patrick Richard, PhD, Uniformed Services University of the Health Sciences

HERC Health Economics Resource Center

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VA U.S. Department of Veterans Affairs
Veterans Health Administration
Health Services Research & Development Service

Introduction/Background

- The American Hospital Association[1] found that US hospital systems lost over $50.7 billion per month over the course of the four-month period from March 1, 2020, to June 30, 2020 due to:
  - COVID-19 hospitalizations
  - Cancelled and forgone services due to COVID-19
    - Since many surgical costs are fixed (operating rooms, equipment etc), cancelling surgeries had no measurable impact on reducing hospitals' operating costs[2]
  - Additional costs associated with purchasing personal protective equipment
  - The costs of the additional support required for hospital staff (additional labor costs)

Introduction/Background

- Medical Spending in the DoD

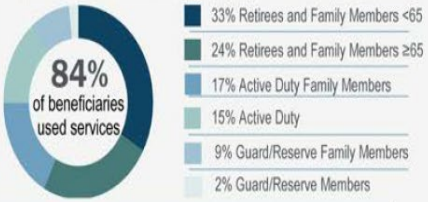
EXECUTIVE SUMMARY: KEY FINDINGS FOR FY 2021 *(CONT.)*

Budget (page 43)

FY 2020 Expenditures → FY 2021 Budget

$51.0 B → $50.5 B

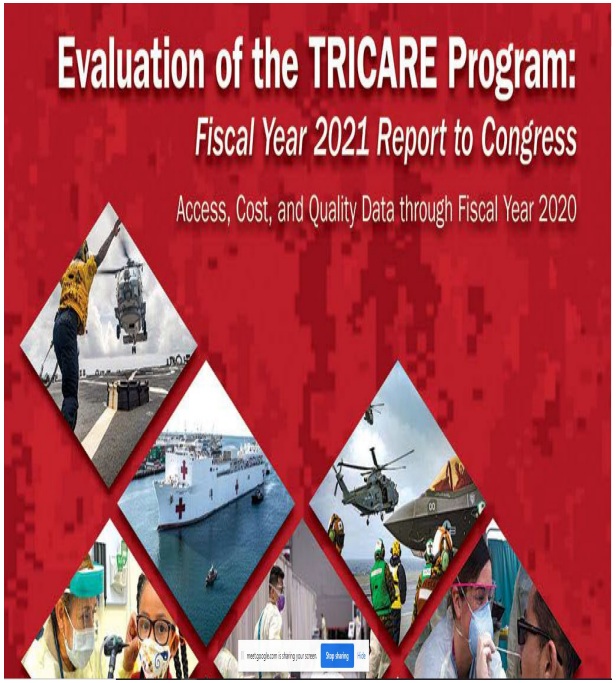
Beneficiary Categories (pages 33, 41)



- 33% Retirees and Family Members <65
- 24% Retirees and Family Members ≥65
- 17% Active Duty Family Members
- 15% Active Duty
- 9% Guard/Reserve Family Members
- 2% Guard/Reserve Members

Utilization & Expenditures (pages 46–47, 51, 57)

PURCHASED CARE			DIRECT CARE	
Utilization	Expenditures		Expenditures	Utilization
344,700 7% decrease	$3,802 M <1% decrease	Inpatient Dispositions	$1,925 M 9% decrease	166,800 14% decrease
35.1 million 5% decrease	$8,684 M <1% increase	Outpatient Encounters	$6,794 M 15% decrease	33.5 million 14% decrease
23.8 million 4% increase	$2,075 M 6% increase	Pharmacy Scripts	$1,240 M 16% decrease	37.6 million 14% decrease
	$14,651 M 1% decrease	Expenditures Total	$9,959 M 14% decrease	



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Introduction/Background

Medical Spending - National Center for Veterans Analysis and Statistics, FY20[2]

FY20 Summary of Expenditures by State

Expenditures in $000s

State	Veteran Population*	Total Expenditure	Compensation & Pension	Construction	Education & Vocational Rehabilitation / Employment	Loan Guaranty#	General Operating Expenses	Insurance & Indemnities	Medical Care	Unique Patients **
Totals	19,465,698	$ 217,953,742	$ 104,566,125	$ 1,530,522	$ 12,688,057	$ 288,554	$ 10,798,214	$ 1,274,361	$ 86,807,908	6,108,277

Motivation

- Hence, it is important to understand the impact of COVID 19 on hospitalization costs in the DoD/VA
- Help clinicians and policy makers alike in arriving at better decisions related to the delivery of care and optimal allocation of resources in DoD and VA healthcare facilities
- Gain insight into the costs of COVID-19-related hospitalizations in DoD and VA facilities
- To our knowledge, no studies examining hospitalizations cost of COVID 19 in the DoD and the VA

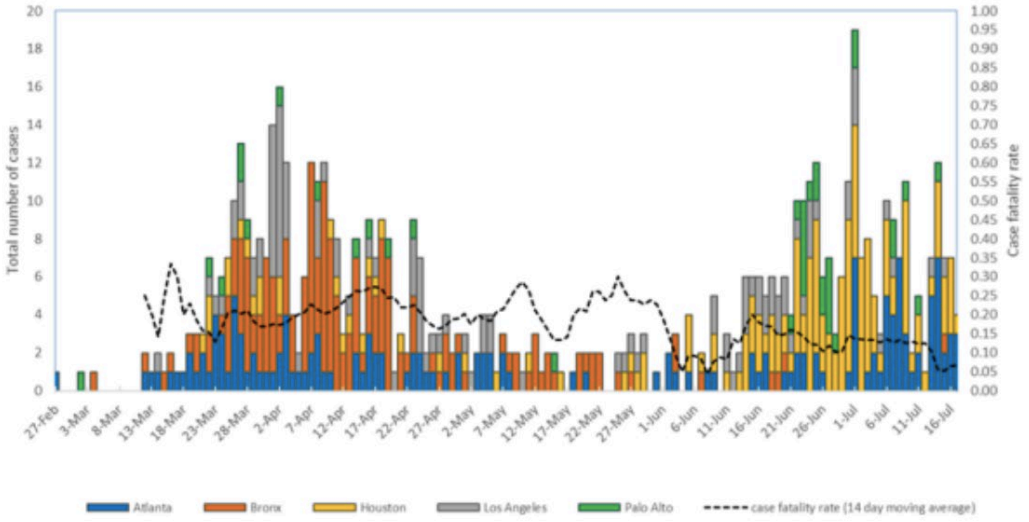
Motivation

- However, we found one study on the rate of COVID-19 hospitalizations in VA facilities
- COVID-19 surveillance at 5 VA centers across the United States demonstrated higher hospitalization rates and severe outcomes among older veterans, as well as higher hospitalization rates among Hispanic or Latino and non-Hispanic Black veterans than among non-Hispanic White veterans[3]

Motivation

COVID-19–Related Hospitalization Rates and Severe Outcomes Among Veterans From 5 Veterans Affairs Medical Centers: Hospital-Based Surveillance Study

Figure 1. Epidemic curve of hospitalized COVID-19 cases and case fatality rate for US veterans at 5 Veterans Affairs Medical Centers by hospital admission date, from February 27 to July 17, 2020. Case fatality rate represents a 14-day moving average. Rate suppressed prior to March 12, 2020, due to low case counts (n≤3).



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Motivation

COVID-19–Related Hospitalization Rates and Severe Outcomes Among Veterans From 5 Veterans Affairs Medical Centers: Hospital-Based Surveillance Study

Table 1. Distribution characteristics, incidence rates, and adjusted incidence rate ratios of US veterans hospitalized with COVID-19—overall, by age, and by race and ethnicity, at 5 Veterans Affairs Medical Centers from February 27 to July 17, 2020.

Variable	Overall distribution of characteristics, n (%)	Hospitalization incidence rates, per 100,000	Adjusted incidence rate ratios of hospitalization (95% CI)[a]
Overall	621 (100)	205.7	N/A[b]
Age range (years)			
18-29	5 (0.8)	48.4	ref[c]
30-39	21 (3.4)	61.7	1.31 (0.50-3.48)
40-49	37 (6)	121.2	2.25 (0.88-5.74)
50-64	150 (24.2)	190.9	3.68 (1.51-9.00)
65-74	218 (35.1)	238.6	5.89 (2.42-14.32)
75-84	107 (17.2)	282.7	8.16 (3.32-20.06)
≥85	83 (13.4)	429.7	14.00 (5.66-34.63)
Age group (years)			
<65	213 (34.3)	138.8	ref
≥65	408 (65.7)	274.7	2.65 (2.23-3.15)
Race and ethnicity			
Non-Hispanic White	153 (24.6)	96.1	ref
Hispanic or Latino	112 (18)	317.3	4.57 (3.58-5.85)
Non-Hispanic Black	325 (52.3)	297.9	4.18 (3.43-5.10)

Motivation

- When it comes to hospitalization costs of COVID 19, we found a couple of studies in the gray and scientific literatures that may inform our analysis
  - Total hospitalization costs for unvaccinated patients in August 2021 was $3.7 billion[4]
  - The average cost of hospitalization for an uninsured, or out-of-network patient was $73,330[5]
  - Delta Air Lines CEO Ed Bastian estimates hospitalized COVID-19 patients cost the company on average $40,000 per person[6]
  - Costs vary depending on many individual factors in including, insurance status, age, vaccination status, and severity of illness—Rep. Jayapal estimates an average cost of $17,064 for a typical COVID-19 hospital stay[7]

Motivation

- Costs per hospitalized patient vary depending on age
  - A single hospitalized case cost a median of $14,366 when only costs during the course of the infection are included[5]

Median direct medical cost of a COVID-19 case in the US, by type

Type of case	Median cost ($)	95% uncertainty interval ($)
INCLUDING ONLY COSTS DURING THE COURSE OF THE INFECTION		
A person with symptomatic infection	3,045	2,873, 3,205
A person with only mild symptoms by age group, years		
0–17	91	60, 124
18–64	57	54, 67
65 or older	96	89, 103
A person with symptomatic infection requiring hospitalization		
Any patient	14,366	13,545, 15,129
A patient by age group, years		
0–17	11,367	9,070, 13,840
18–44	13,132	11,510, 14,741
45–64	15,943	14,419, 17,557
65–84	14,859	14,179, 15,538
85 or older	11,900	11,089, 12,835
INCLUDING COSTS DURING THE COURSE OF THE INFECTION AND ONE YEAR AFTER HOSPITAL DISCHARGE		
A person with symptomatic infection	3,994	3,799, 4,200
A person with symptomatic infection requiring hospitalization	18,579	17,524, 19,609

Methods

Operations Data for DoD and VA

- We used operations databases from DaVINCI for inpatient MTF (SIDR).
- We used operations databases from VA containing hospital costs (hdisch20)
- We identified hospitalizations with a primary diagnosis of U071-COVID-19 which was approved for use by CDC in FY2020 DoD and VA databases.
- We tried to match cost between DoD and VA as closely as possible.
- We used totcost from hdisch20 from VINCI.

Operations Data for DOD and VA

- We created a DoD MTF total cost variable for the hospitalization from SIDR, total cost=FCANCLAB+FCANCRAD+FCCLNSAL+FCICU+FCOTHANC+FCOTHSAL+FCSUPPRT+FCSURG.
- We also obtained common variables for diagnosis related group (MSDRG) fiscal month, age and sex,and length of stay common in both DoD and VA databases.
- We also created a variable for both DoD and VA databases, cost per day per hospitalization =total cost of hospitalization/length of stay of hospitalization

Analyses in Separate databases

- MSDRG is a classification system to classify hospitalizations into similar casemix categories. It is used for civilian hospital billing by Medicare/Medicaid and many private insurers.
- We first examined hospitalizations in FY 2020 for DoD and VA by mean and median age, percentage age <50 vs age≥50, percentage male vs female, and percentage for the most frequent DRG, DRG177 vs other DRGs.
- DRG 177 is RESPIRATORY INFECTIONS AND INFLAMMATIONS WITH MCC

Analyses in Separate Databases

- We tested for differences in medians , due to non-normal distribution of the data of total cost per hospitalization, length of stay and cost per day per hospitalization by age group and gender for the entire database and then for DRG 177 only in the separate databases.
- We used Generalized Linear Models with Gamma distribution to estimate total cost per hospitalization, all hospitalizations and DRG 177 only. We adjusted for age group, sex , length of stay and fiscal month in all models. We adjusted for DRG 177 in the all-hospitalizations sample.

Analyses in Separate Databases

- We used Generalized Linear Models with Poisson distribution to estimate length of stay models. We adjusted for age, sex, fiscal month and DRG 177 in the all-hospitalizations sample.
- We used Generalized Linear Models with Gamma distribution to estimate the cost per day models. We adjusted for age, sex, fiscal month and DRG 177 in the all-hospitalizations sample.
- We report all cost information for the fiscal month and year incurred.

Analyses in Merged databases

- After conducting the analyses in the separate DoD and VA databases, we merged the data based on creating the same variable names for the common variables in both databases.
- We plotted the frequency of hospitalizations by fiscal month for FY2020 by DoD and VA.
- We then estimated models for total cost, length of stay and cost per day.
- We adjusted for being a DoD hospitalization relative to VA in all models to test for differences in costs and length of stay.

Results

Primary ICD U071 FY2020 MTF and VA Hospitalizations

FY 2020 ICD10 U071- COVID-19 as Primary Diagnosis	DOD N=773	VA N=7,818
MSDRG 177- RESPIRATORY INFECTIONS AND INFLAMMATIONS WITH MCC	69.34%	75.17%
Age	Mean 54.12 Median 56.0	Mean 68.51 Median 71.0
Age>=50	60.54%	90.21%
Female	14.75%	6.69%
MSDRG 177 Only	N=536	N=5,877
Age	Mean=55.58 Median=57	Mean=68.52 Median=70
Age>=50	63.06%	90.32%
Female	13.62%	7.03%

Primary ICD U071 FY2020 MTF and VA Hospitalizations

FY 2020 ICD10 U071- COVID-19 as Primary Diagnosis	DOD N=773	VA N=7,818
Total Cost of the Hospitalization	Mean=$28,396 Median=$13,640	Mean=$61,268 Median=$31,587
Length of Stay	Mean=6.53 Median=4	Mean=12.99 Median=7
Cost Per Day	Mean=$4,633 Median=$4,276	Mean=$5,155 Median=$4,474
DRG 177	N=536	N=5,877
Total Cost of the Hospitalization	Mean=$21,846 Median=$13,688	Mean=$61,858 Median=$32,850
Length of Stay	Mean=5.87 Median=4	Mean=13.36 Median=7
Cost Per Day	Mean=$4,523 Median=$4,219	Mean=$5,150 Median=$4,523

Total Cost, LOS, Cost Per Day by Age

FY 2020 ICD10 U071- COVID-19 as Primary Diagnosis	DOD N=773	VA N=7,818
Total Cost Hospitalization Age<50	Mean=$20,266 Median=$11,664*	Mean=$40,333 Median=$19,163*
Total Cost Hospitalization Age>=50	Mean=$33,694 Median=$15,157*	Mean=$63,539 Median=$33,653*
Length of Stay Age<50	Mean=4.57 Median=4*	Mean=6.77 Median=5*
Length of Stay Age>=50	Mean=7.81 Median=5*	Mean=13.66 Median=8*
Cost Per Day Age<50	Mean=$4,720 Median=$4,449	Mean=$5,124 Median=$4,454
Cost Per Day Age>=50	Mean=$4,576 Median=$4,223	Mean=$5,158 Median=$4,477
* P<0.05 on Median Test		

Total Cost, LOS, Cost Per Day by Sex

FY 2020 ICD10 U071- COVID-19 as Primary Diagnosis	DOD N=773	VA N=7,818
Total Cost Hospitalization Male	Mean=$29,058 Median=$13,917*	Mean=$61,819 Median=$32,147*
Total Cost Hospitalization Female	Mean=$24,565 Median=$11,836*	Mean=$53,587 Median=$24,582*
Length of Stay Male	Mean=6.74 Median=4*	Mean=13.25 Median=7*
Length of Stay Female	Mean=5.36 Median=4*	Mean=9.36 Median=6*
Cost Per Day Male	Mean=$4,636 Median=$4,270	Mean=$5,155 Median=$4,471
Cost Per Day Female	Mean=$4,618 Median=$4,306	Mean=$5,149 Median=$4,529
* P<0.05 on Median Test		

Gamma Generalized Linear Model for Total Costs

FY 2020 ICD10 U071- COVID-19 as Primary Diagnosis	DOD N=773	VA N=7,818
Age>=50	-$83	$331
Female relative to Male	-$180	-$270
Length of Stay (Each Additional Day)	$3,822*	$5,178*
DRG 177 relative to other DRGs	$879*	-$342
Total Cost for DRG 177 Hospitalizations	N=536	N=5,877
Age>=50	$449	$969*
Female	-$106	$76
Length of Stay (Each Additional Day)	$3,155*	$5,198*
* P<0.05		
Note: Both Models Adjusted for Fiscal Month		

Poisson Generalized Linear Model for Length of Stay

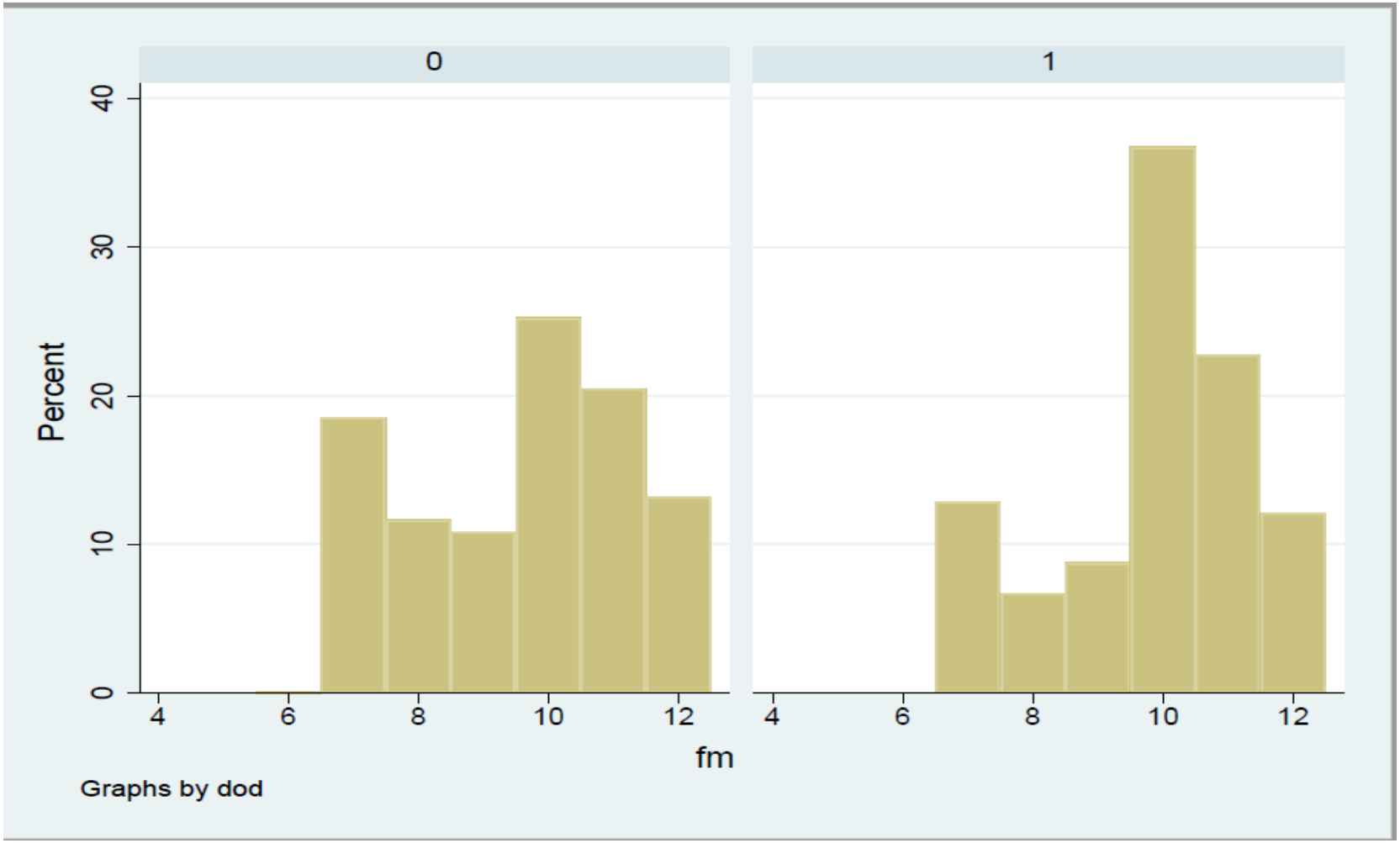
FY 2020 ICD10 U071- COVID-19 as Primary Diagnosis	DOD N=773	VA N=7,818
Age>=50	2.99*	5.09*
Female relative to Male	-1*	-2.06*
DRG 177 relative to other DRGs	-1.9*	1.40
LOS for DRG 177 Hospitalizations	N=536	N=5,877
Age>=50	2.16*	5.06*
Female	-0.55*	-2.14*
* P<0.05		
Note: Both Models Adjusted for Fiscal Month		

Gamma Generalized Linear Model Cost Per Day

FY 2020 ICD10 U071- COVID-19 as Primary Diagnosis	DOD N=773	VA N=7,818
Age>=50	-$171	$33
Female relative to Male	$10	$0
DRG 177 relative to other DRGs	-$329	-$21
Total Cost for DRG 177 Hospitalizations	N=536	N=5,877
Age>=50	-$213	$288*
Female	$234	-$24
* P<0.05		
Note: Both Models Adjusted for Fiscal Month		

Results – Merged VA/DOD Data

Frequency of Fiscal Month by DOD/VA Status (0=VA, 1=DoD)



Combined DOD and VA Total Cost and LOS Models

Total Cost	Total Cohort N=8,951	DRG 177 N=6,143
Age>=50	$240	$807*
Female relative to Male	-$267	$73
Length of Stay	$5,078*	$5,082*
DRG 177 relative to other DRGs	-$157	N/A
DOD	$329	$736*
Length of Stay		
Age>=50	4.53*	4.22*
Female relative to Male	-1.75*	-1.70*
DRG 177 relative to other DRGs	0.80	N/A
DOD	-2.83*	-3.70*
* P<0.05		
Note: Both Models Adjusted for Fiscal Month		

Combined DOD and VA Databases GLM Cost Per Day

Cost Per Day	Total Cohort N=8,951	DRG 177 N=6,413
Age>=50	-$11	$172
Female relative to Male	-$10	-$1
DRG 177 relative to other DRGs	-$64	N/A
DOD	-$520*	-$572*
*P<0.05		
Note: Both Models Adjusted for Fiscal Month		

Conclusions

- Lower costs associated with treating COVID 19 patients in DoD hospitals compared to VA hospitals
- DoD Patients spent 2.83 fewer days in hospitals compared to VA patients diagnosed with COVId-19 ($p<0.005$)
- Similar results were found for DRG 177 (3.70 fewer days $p<0.05$)
- Likewise, DoD spent $520 less per day to treat patients with COVID-19 compared to similar patients in VA facilities ($p<0.05$)
- Plausible explanation: labor costs of treating patients in DoD are cheaper compared to the VA

Discussions and Implications

- Hospitalized patients with COVID 19 are older and sicker in VA compared to DoD facilities

Table 3. Prevalence of underlying medical conditions among US veterans hospitalized with COVID-19—overall, by age, and by race and ethnicity, at 5 Veterans Affairs Medical Centers from February 27 to July 17, 2020.

Underlying medical conditions	Overall (n=621), n (%)	Age group			Race and ethnicity			
		<65 years (n=213), n (%)	≥65 years (n=408), n (%)	*P* value	Hispanic or Latino (n=112), n (%)	Non-Hispanic Black (n=325), n (%)	Non-Hispanic White (n=153), n (%)	*P* value[a]
Any underlying medical condition[b]	547 (88.1)	166 (77.9)	381 (93.4)	<.001	91 (81.3)	287 (88.3)	140 (91.5)	.04
Chronic kidney disease[c]	134 (21.6)	30 (14.1)	104 (25.5)	.001	20 (17.9)	78 (24)	29 (19)	.26
COPD[d]/emphysema	90 (14.5)	14 (6.6)	76 (18.6)	<.001	15 (13.4)	32 (9.8)	40 (26.1)	<.001
Coronary artery disease	120 (19.3)	17 (8)	103 (25.2)	<.001	27 (24.1)	50 (15.4)	34 (22.2)	.06
Heart failure	89 (14.3)	11 (5.2)	78 (19.1)	<.001	17 (15.2)	44 (13.5)	25 (16.3)	.71
Hypertension[e]	442 (71.2)	120 (56.3)	322 (78.9)	<.001	74 (66.1)	233 (71.7)	110 (71.9)	.49
Diabetes	306 (49.3)	88 (41.3)	218 (53.4)	.004	56 (50)	166 (51.1)	71 (46.4)	.63
Obesity[e]	177 (28.5)	93 (43.7)	84 (20.6)	<.001	32 (28.6)	97 (29.8)	40 (26.1)	.70

[a]Due to the small number of cases in the other race and ethnicity groups (non-Hispanic Asian, non-Hispanic American Indian or Alaskan Native, and non-Hispanic Native Hawaiian or Pacific Islander), comparisons were limited to the 3 race and ethnicity groups listed in this table.

[b]Any of the 7 underlying medical conditions listed in this table.

[c]Chronic kidney disease or chronic renal insufficiency.

Discussions and Implications

- Hospitalized patients ages 65 and older in VA healthcare facilities are more than two times as likely to report an underlying medical condition including chronic kidney disease, COPD/emphysema, coronary artery disease, heart failure, hypertension, and/or diabetes than those under the age of 65

Next Steps

- Obtain IRB approval to have access to richer data sets
- Additional variables including comorbidity indices (Elixhauser or Charlson)

- We have shown that DoD and VA cost data can be merged on matching variables to compare the cost of a condition in hospital databases.

- Future work should include examining outpatient and pharmacy costs in DoD and VA military treatment facilities as well as community care private provider costs paid for by DoD via Tricare and VA via the Mission Act.

- This will require understanding the cost variables available in these databases and how they can be appropriately compared between DoD and VA.
- We acknowledge the support of Mitali Shah, MA at USU and Samantha Illarmo, MPH at HERC, VA Palo Alto.

Thank You!

Any questions?

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Thank You!

Any questions?

Contact Information

For more information visit the HERC website at www.herc.research.va.gov.

Email us at clara.dismuke@va.gov or patrick.richard@usuhs.edu.

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- Tables, charts, and images must have a text description or be described orally by the speaker. Do not use “visual references”
  - Bad: “The yellow box contains data from…”
  - Bad: “The arrows indicate…”
  - Good: “Data flows in real time from the client CPRS computer to…”
  - Good: “The chart show that women Veterans are just as likely to use VA primary care…”
- All info conveyed with color should be available without color
  - For graphs, add text labels (e.g. male vs. female), use grayscale (e.g. black vs. grey), or use non-text indicators (e.g. a solid versus dotted line)
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