Changing Role of Comorbidities in Risk of Mortality Among Elderly Patients Diagnosed with COVID-19 in the United States: Examining Pre- and Post-Vaccine Clinical Risk Factors

Background

- Greater than 80% of the COVID-19 deaths worldwide were among individuals aged 60 years and older, across all income groups¹
- According to a recent CDC study, of 357,133 death certificates that listed COVID-19 as cause of death, 97% had a co-occurring diagnosis of chain-of-event (CoE) or significant contributing condition (SCC) or both²

Objective

• The primary objective of this study was to examine the clinical conditions associated with COVID-19 mortality before and after the first availability of vaccine.

Study Design

Study design

• This retrospective cohort study utilized linked data from IQVIA's Professional fee claims (Dx), Longitudinal prescription claims (LRx) between 01 April 1 2020 and 30 April 2022 (pre-vaccine period: 01 April 2020 - 31 December 2020; post-vaccine period: 01 January 2021 and 30 April 2022)

Data source

- Dx includes approximately 1 billion professional fee claims per year, representing over 870,000 practitioners per month. Records are available from September 1999, with approximately 95% of claims available for analyses within 3 weeks of the service date
- •LRx includes more than 1.6B retail or mail-order prescription claims, representing dispensed prescriptions for approximately 85% of all pharmacies (94% of retail, 74% of mail, and 74% of long-term care)

Measures

- The presence of COE (+/- 7 days of the last COVID diagnosis date) and SCC (over the study period) were assessed²
- Separate multivariable logistic regression models were developed to assess factors associated with deaths among elderly patients with COVID-19 diagnosis during pre- and post-vaccine periods
- Age, sex, payer type and Charlson comorbidity index (CCI) score (continuous) were included as covariates in the regression models

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	Results
y population	Table 1. CoE and
ong over 277 million patients in the Dx database, 6.4% d an ICD-10 diagnosis code for COVID-19 during the ection window. We identified a cohort of 4,199,378 ients aged ≥65 years among these patients with a 0VID-19 diagnosis	Cardiaraapirata
ure 1 illustrates the patient selection for this study	Cardiorespirato
re 1. Patient selection	
Patients with \geq 1 claim in Dx with a COVID-19 gnosis during the selection window (April 1, 2020 oril 30, 2022). Date of the first claim with COVID-	
19 diagnosis during the selection window was termed the 'index date'	Cardiovascu
ients with ≥1 claim in Dx >180 days prior to N = 17,682,111 the index date	
	CNS, Cerebrovasc
ents with no missing data regarding region of residence	Renal
Final Sample Patients aged ≥65 years	Metabolic
	Pulmonary

Table 2. Factors associated with COVID-19 deaths among elderly patients during the pre-vaccine and post-vaccine periods

	Pre-vaccine period			Post-vaccine period			
/ariables	Odds Ratio	Lower CI	Upper CI	Odds Ratio	Lower CI	Upper CI	
Chain of event conditions (ref: No)							
Pneumonia, unspecified	1.082	1.067	1.096	1.217	1.201	1.233	
Acute respiratory failure	1.527	1.508	1.546	2.184	2.160	2.208	
Respiratory failure, unspecified	1.424	1.394	1.455	1.637	1.607	1.668	
Cardiac arrest, unspecified	2.023	1.948	2.101	3.105	3.009	3.205	
Adult respiratory distress syndrome	1.792	1.746	1.840	2.478	2.420	2.537	
Sepsis, unspecified	1.233	1.212	1.254	1.493	1.471	1.516	
Viral pneumonia, unspecified	0.883	0.852	0.914	0.996	0.952	1.043	
Asphyxia	1.207	1.190	1.224	1.395	1.378	1.413	
Respiratory arrest	1.445	1.290	1.620	1.635	1.476	1.810	
Significant contributing conditions (ref: No)							
Essential (primary) hypertension	0.835	0.824	0.845	0.900	0.890	0.911	
Unspecified diabetes mellitus without complications	0.889	0.837	0.945	0.923	0.874	0.975	
Unspecified dementia	1.476	1.458	1.494	1.568	1.548	1.589	
Chronic obstructive pulmonary disease, unspecified	1.101	1.088	1.114	1.154	1.141	1.166	
Atherosclerotic heart disease*	0.997	0.985	1.008	1.019	1.009	1.030	
Type 2 diabetes mellitus without complications	0.891	0.881	0.901	0.966	0.957	0.976	
Atrial fibrillation and flutter	1.274	1.260	1.288	1.338	1.324	1.352	
Congestive heart failure	1.302	1.287	1.317	1.362	1.347	1.377	
Tobacco use**	0.958	0.933	0.983	1.006	0.987	1.025	
Chronic kidney disease, unspecified	1.122	1.108	1.137	1.246	1.231	1.261	
Alzheimer disease, unspecified	1.388	1.367	1.409	1.413	1.388	1.438	
Hypertensive heart disease without (congestive) heart failure	0.722	0.706	0.738	0.737	0.723	0.752	
Hyperlipidemia, unspecified	0.681	0.674	0.688	0.698	0.691	0.705	
Other specified disorders of kidney and ureter	0.885	0.872	0.899	0.924	0.911	0.936	
Obesity, unspecified	0.716	0.705	0.727	0.744	0.734	0.753	
Stroke, not specified as hemorrhage or infarction (I64) *P value not statistically significant during the pre-vaccine period **P value not statistically significant during the post-vaccine period	1.107	1.090	1.125	1.173	1.156	1.191	

	Chain of event conditions	Ν	%
	Acute respiratory failure	751,125	17.89%
	Adult respiratory distress syndrome	78,435	1.87%
	Asphyxia	468,645	11.16%
	Cardiac arrest, unspecified	35,091	0.84%
ory	Pneumonia, unspecified	483,043	11.50%
	Respiratory arrest	3,838	0.09%
	Respiratory failure, unspecified	142,482	3.39%
	Viral pneumonia, unspecified	42,614	1.01%
	Sepsis, unspecified	236,665	5.64%
	Significant contributing conditions		
lar	Essential (primary) hypertension	3,142,806	74.84%
	Atherosclerotic heart disease	1,220,115	29.05%
	Atrial fibrillation and flutter	899,546	21.42%
	Congestive heart failure	973,104	23.17%
	Hypertensive heart disease without CHF	243,721	5.80%
	Hyperlipidemia, unspecified	1,974,606	47.02%
	Alzheimer disease, unspecified	256,708	6.11%
	Unspecified dementia	573,315	13.65%
ular	Stroke, not specified as hemorrhage or infarction (I64)	326,983	7.79%
	Other specified disorders of kidney and ureter	501,914	11.95%
	Chronic kidney disease, unspecified	594,231	14.15%
	Unspecified diabetes mellitus without complications	26,345	0.63%
	Type 2 diabetes mellitus without complications	1.694.823	40.36%
	Obesity, unspecified	835,153	19.89%
	Chronic obstructive pulmonary disease, unspecified	866,643	20.64%
	Tobacco use	247 709	5 90%

• While certain CoE and SCC are fairly common among elderly patients with COVID-19 diagnosis, factors associated with death among these patients vary during pre- and post-vaccine periods



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Key findings

Of over 22 million patients with a COVID-19 diagnosis in Dx, 4,199,378 were elderly (aged \geq 65 years) (Fig. 1) with ,441,278 diagnosed during pre-vaccine (215,094 [14.92%] deaths) and 2,758,100 diagnosed during post-/accine (237,793 [8.62%] deaths)

A large proportion had CoE like acute respiratory failure, asphyxia and pneumonia

Essential hypertension, hyperlipidemia, atherosclerosis and type 2 diabetes were the most common significant comorbid conditions

After controlling for age, sex, payer type and CCI, COE ncluding cardiac arrest and acute respiratory distress syndrome had higher odds of mortality during the postaccine period

Neurological SCC including **Alzheimer's disease** and dementia that have not been previously considered as significant risk factors associated with deaths among patients with COVID-19 had higher odds during postaccine period

Cardiac SCC including atrial fibrillation and congestive neart failure had higher odds during post-vaccine period; on the contrary conditions like atherosclerotic heart disease was not significantly associated with deaths during pre-vaccine period

Conclusions

•Alzheimer's disease and dementia were strongly with deaths among elderly patients with COVID-19 during preand post-vaccine periods

References

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2. Gundlapalli AV, Lavery AM, Boehmer TK, Beach MJ, Walke HT, Sutton PD, Anderson RN. Death Certificate-Based ICD-10 Diagnosis Codes for COVID-19 Mortality Surveillance - United States, January-December 2020. MMWR Morb Mortal Wkly Rep. 2021 Apr 9;70(14):523-527. doi: 10.15585/mmwr.mm7014e2. PMID: 33830982; PMCID: PMC8030983.