

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 2/11/22

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 2/11/22 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

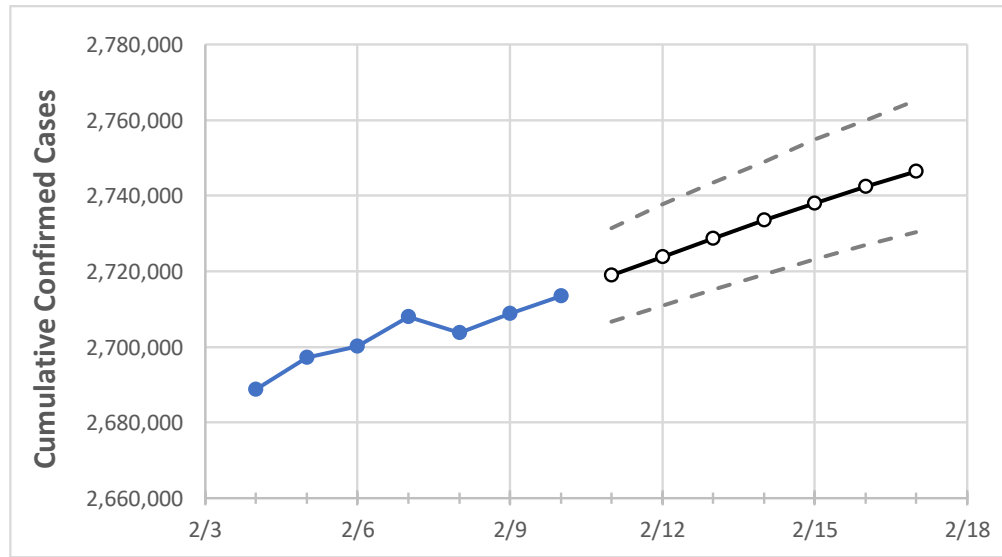
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Pennsylvania State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Pennsylvania	2,707,891	2,703,775	2,708,830	2,713,459	2,718,875	2,723,905	2,728,737	2,733,503	2,737,885	2,742,515	2,746,423

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Pennsylvania Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Allegheny	255,574	255,232	255,702	256,178	256,790	257,369	257,971	258,574	259,084	259,664	260,115
Berks	100,261	100,177	100,289	100,419	100,550	100,677	100,788	100,904	101,011	101,119	101,215
Bucks	120,700	119,990	120,177	120,296	120,506	120,718	120,905	121,097	121,288	121,467	121,652
Butler	43,243	43,219	43,310	43,387	43,481	43,570	43,655	43,742	43,820	43,900	43,973
Chester	89,034	88,661	88,764	88,909	89,072	89,220	89,383	89,521	89,663	89,802	89,933
Delaware	107,835	107,369	107,503	107,637	107,815	107,974	108,116	108,270	108,409	108,550	108,686
Lackawanna	41,571	41,568	41,683	41,787	41,897	42,002	42,107	42,207	42,305	42,397	42,488
Lancaster	118,684	118,203	118,376	118,545	118,780	119,002	119,225	119,422	119,633	119,832	120,016
Lehigh	88,015	87,805	87,898	88,000	88,115	88,224	88,324	88,423	88,523	88,610	88,705
Luzerne	71,293	71,224	71,390	71,504	71,642	71,776	71,902	72,021	72,145	72,255	72,356
Monroe	36,173	36,099	36,142	36,195	36,252	36,308	36,359	36,410	36,461	36,508	36,554
Montgomery	147,675	147,117	147,336	147,550	147,823	148,091	148,350	148,593	148,842	149,073	149,304
Northampton	77,956	77,774	77,879	77,993	78,100	78,199	78,299	78,393	78,486	78,574	78,658
Philadelphia	298,975	299,343	299,711	299,963	300,242	300,538	300,811	301,061	301,312	301,563	301,761
Westmoreland	77,121	77,129	77,266	77,462	77,665	77,844	78,027	78,204	78,379	78,546	78,701
York	115,818	115,764	115,909	116,070	116,282	116,493	116,689	116,878	117,068	117,254	117,419

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Pennsylvania Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	2/7	2/8	2/9	2/10	2/12				2/14				2/16			
Allegheny	255,574	255,232	255,702	256,178	257,369	(51,474)	[12,354]	{6,177}	258,574	(51,715)	[12,412]	{6,206}	259,664	(51,933)	[12,464]	{6,232}
Berks	100,261	100,177	100,289	100,419	100,677	(20,135)	[4,832]	{2,416}	100,904	(20,181)	[4,843]	{2,422}	101,119	(20,224)	[4,854]	{2,427}
Bucks	120,700	119,990	120,177	120,296	120,718	(24,144)	[5,794]	{2,897}	121,097	(24,219)	[5,813]	{2,906}	121,467	(24,293)	[5,830]	{2,915}
Butler	43,243	43,219	43,310	43,387	43,570	(8,714)	[2,091]	{1,046}	43,742	(8,748)	[2,100]	{1,050}	43,900	(8,780)	[2,107]	{1,054}
Chester	89,034	88,661	88,764	88,909	89,220	(17,844)	[4,283]	{2,141}	89,521	(17,904)	[4,297]	{2,149}	89,802	(17,960)	[4,311]	{2,155}
Delaware	107,835	107,369	107,503	107,637	107,974	(21,595)	[5,183]	{2,591}	108,270	(21,654)	[5,197]	{2,598}	108,550	(21,710)	[5,210]	{2,605}
Lackawanna	41,571	41,568	41,683	41,787	42,002	(8,400)	[2,016]	{1,008}	42,207	(8,441)	[2,026]	{1,013}	42,397	(8,479)	[2,035]	{1,018}
Lancaster	118,684	118,203	118,376	118,545	119,002	(23,800)	[5,712]	{2,856}	119,422	(23,884)	[5,732]	{2,866}	119,832	(23,966)	[5,752]	{2,876}
Lehigh	88,015	87,805	87,898	88,000	88,224	(17,645)	[4,235]	{2,117}	88,423	(17,685)	[4,244]	{2,122}	88,610	(17,722)	[4,253]	{2,127}
Luzerne	71,293	71,224	71,390	71,504	71,776	(14,355)	[3,445]	{1,723}	72,021	(14,404)	[3,457]	{1,729}	72,255	(14,451)	[3,468]	{1,734}
Monroe	36,173	36,099	36,142	36,195	36,308	(7,262)	[1,743]	{871}	36,410	(7,282)	[1,748]	{874}	36,508	(7,302)	[1,752]	{876}
Montgomery	147,675	147,117	147,336	147,550	148,091	(29,618)	[7,108]	{3,554}	148,593	(29,719)	[7,132]	{3,566}	149,073	(29,815)	[7,156]	{3,578}
Northampton	77,956	77,774	77,879	77,993	78,199	(15,640)	[3,754]	{1,877}	78,393	(15,679)	[3,763]	{1,881}	78,574	(15,715)	[3,772]	{1,886}
Philadelphia	298,975	299,343	299,711	299,963	300,538	(60,108)	[14,426]	{7,213}	301,061	(60,212)	[14,451]	{7,225}	301,563	(60,313)	[14,475]	{7,238}
Westmoreland	77,121	77,129	77,266	77,462	77,844	(15,569)	[3,737]	{1,868}	78,204	(15,641)	[3,754]	{1,877}	78,546	(15,709)	[3,770]	{1,885}
York	115,818	115,764	115,909	116,070	116,493	(23,299)	[5,592]	{2,796}	116,878	(23,376)	[5,610]	{2,805}	117,254	(23,451)	[5,628]	{2,814}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.