

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

Date: 2/12/21

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 2/12/21 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.**

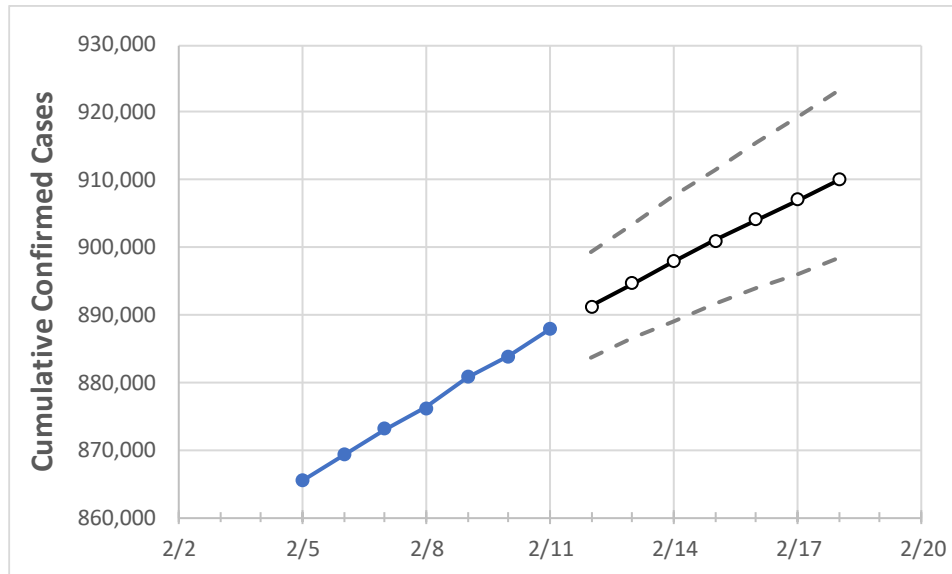
### IEM's Modeling Lead

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:						
	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18
Pennsylvania	876,165	880,838	883,928	887,863	891,316	894,681	897,906	901,039	904,088	907,097	910,072

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:						
	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18
Allegheny	71,533	71,938	72,177	72,447	72,682	72,910	73,135	73,357	73,573	73,785	73,990
Berks	33,625	33,769	33,874	34,009	34,151	34,285	34,409	34,530	34,646	34,757	34,863
Bucks	41,767	41,946	42,162	42,398	42,607	42,815	43,016	43,219	43,417	43,615	43,805
Butler	13,150	13,215	13,268	13,328	13,371	13,413	13,453	13,493	13,531	13,569	13,606
Chester	26,340	26,457	26,536	26,634	26,726	26,818	26,908	26,996	27,083	27,168	27,250
Delaware	38,461	38,616	38,751	38,901	39,032	39,160	39,283	39,403	39,519	39,631	39,743
Lackawanna	12,838	12,893	12,961	13,043	13,090	13,137	13,182	13,227	13,270	13,312	13,352
Lancaster	40,309	40,554	40,750	41,059	41,320	41,580	41,830	42,082	42,329	42,568	42,811
Lehigh	28,955	29,130	29,211	29,366	29,465	29,561	29,655	29,743	29,831	29,914	29,995
Luzerne	23,602	23,662	23,742	23,825	23,907	23,984	24,055	24,126	24,194	24,265	24,329
Monroe	8,902	8,958	8,981	9,030	9,064	9,097	9,129	9,161	9,191	9,221	9,250
Montgomery	50,413	50,615	50,815	51,044	51,273	51,494	51,709	51,914	52,121	52,319	52,510
Northampton	24,388	24,613	24,719	24,910	25,042	25,172	25,304	25,430	25,555	25,677	25,793
Philadelphia	112,652	113,224	113,519	113,878	114,205	114,528	114,845	115,163	115,474	115,780	116,080
Westmoreland	25,339	25,432	25,516	25,602	25,667	25,730	25,788	25,846	25,902	25,959	26,013
York	33,466	33,618	33,750	33,946	34,107	34,264	34,417	34,566	34,716	34,861	35,004

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:											
	2/8	2/9	2/10	2/11	2/13			2/15			2/17					
Allegheny	71,533	71,938	72,177	72,447	72,910	(14,582)	[3,500]	{1,750}	73,357	(14,671)	[3,521]	{1,761}	73,785	(14,757)	[3,542]	{1,771}
Berks	33,625	33,769	33,874	34,009	34,285	(6,857)	[1,646]	{823}	34,530	(6,906)	[1,657]	{829}	34,757	(6,951)	[1,668]	{834}
Bucks	41,767	41,946	42,162	42,398	42,815	(8,563)	[2,055]	{1,028}	43,219	(8,644)	[2,075]	{1,037}	43,615	(8,723)	[2,094]	{1,047}
Butler	13,150	13,215	13,268	13,328	13,413	(2,683)	[644]	{322}	13,493	(2,699)	[648]	{324}	13,569	(2,714)	[651]	{326}
Chester	26,340	26,457	26,536	26,634	26,818	(5,364)	[1,287]	{644}	26,996	(5,399)	[1,296]	{648}	27,168	(5,434)	[1,304]	{652}
Delaware	38,461	38,616	38,751	38,901	39,160	(7,832)	[1,880]	{940}	39,403	(7,881)	[1,891]	{946}	39,631	(7,926)	[1,902]	{951}
Lackawanna	12,838	12,893	12,961	13,043	13,137	(2,627)	[631]	{315}	13,227	(2,645)	[635]	{317}	13,312	(2,662)	[639]	{319}
Lancaster	40,309	40,554	40,750	41,059	41,580	(8,316)	[1,996]	{998}	42,082	(8,416)	[2,020]	{1,010}	42,568	(8,514)	[2,043]	{1,022}
Lehigh	28,955	29,130	29,211	29,366	29,561	(5,912)	[1,419]	{709}	29,743	(5,949)	[1,428]	{714}	29,914	(5,983)	[1,436]	{718}
Luzerne	23,602	23,662	23,742	23,825	23,984	(4,797)	[1,151]	{576}	24,126	(4,825)	[1,158]	{579}	24,265	(4,853)	[1,165]	{582}
Monroe	8,902	8,958	8,981	9,030	9,097	(1,819)	[437]	{218}	9,161	(1,832)	[440]	{220}	9,221	(1,844)	[443]	{221}
Montgomery	50,413	50,615	50,815	51,044	51,494	(10,299)	[2,472]	{1,236}	51,914	(10,383)	[2,492]	{1,246}	52,319	(10,464)	[2,511]	{1,256}
Northampton	24,388	24,613	24,719	24,910	25,172	(5,034)	[1,208]	{604}	25,430	(5,086)	[1,221]	{610}	25,677	(5,135)	[1,233]	{616}
Philadelphia	112,652	113,224	113,519	113,878	114,528	(22,906)	[5,497]	{2,749}	115,163	(23,033)	[5,528]	{2,764}	115,780	(23,156)	[5,557]	{2,779}
Westmoreland	25,339	25,432	25,516	25,602	25,730	(5,146)	[1,235]	{618}	25,846	(5,169)	[1,241]	{620}	25,959	(5,192)	[1,246]	{623}
York	33,466	33,618	33,750	33,946	34,264	(6,853)	[1,645]	{822}	34,566	(6,913)	[1,659]	{830}	34,861	(6,972)	[1,673]	{837}

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