

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

**Date: 4/2/21**

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 4/2/21 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.**

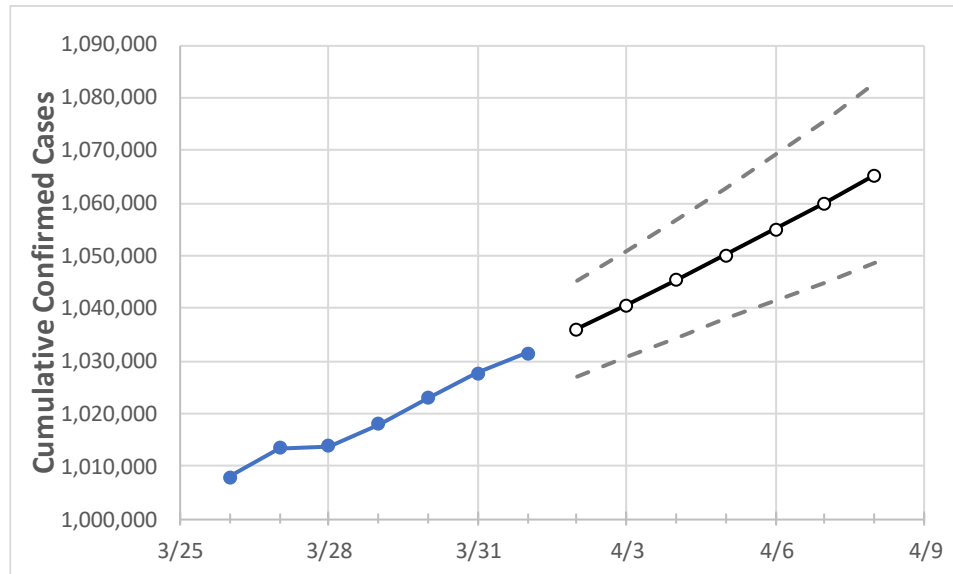
### **IEM's Modeling Lead**

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:							
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	
Pennsylvania	1,017,881	1,022,992	1,027,678	1,031,542	1,035,956	1,040,604	1,045,272	1,050,029	1,054,928	1,059,990	1,065,200	

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:							
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	
Allegheny	84,850	85,262	85,680	86,007	86,444	86,891	87,350	87,809	88,284	88,793	89,301	
Berks	39,419	39,706	39,895	40,054	40,254	40,456	40,669	40,888	41,108	41,334	41,577	
Bucks	50,345	50,726	51,005	51,283	51,577	51,879	52,191	52,510	52,833	53,175	53,516	
Butler	15,108	15,183	15,262	15,303	15,378	15,455	15,534	15,616	15,701	15,789	15,880	
Chester	31,045	31,247	31,448	31,606	31,781	31,963	32,152	32,346	32,550	32,760	32,978	
Delaware	44,363	44,618	44,791	44,969	45,163	45,368	45,570	45,787	46,006	46,240	46,472	
Lackawanna	15,365	15,491	15,567	15,656	15,732	15,810	15,891	15,974	16,059	16,149	16,241	
Lancaster	47,420	47,656	47,817	48,010	48,192	48,381	48,574	48,775	48,982	49,190	49,405	
Lehigh	33,695	33,915	34,045	34,208	34,383	34,562	34,748	34,939	35,142	35,346	35,559	
Luzerne	26,869	26,975	27,080	27,185	27,295	27,406	27,522	27,642	27,763	27,890	28,020	
Monroe	11,244	11,366	11,446	11,537	11,623	11,709	11,800	11,894	11,990	12,088	12,189	
Montgomery	59,243	59,562	59,801	60,008	60,268	60,532	60,801	61,083	61,371	61,666	61,961	
Northampton	30,082	30,312	30,460	30,602	30,809	31,019	31,241	31,468	31,700	31,938	32,184	
Philadelphia	129,077	129,790	130,405	130,974	131,611	132,265	132,948	133,663	134,392	135,146	135,943	
Westmoreland	28,930	29,052	29,178	29,265	29,424	29,591	29,768	29,948	30,139	30,336	30,544	
York	39,111	39,298	39,481	39,646	39,883	40,128	40,391	40,659	40,938	41,230	41,536	

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:											
	3/29	3/30	3/31	4/1	4/3			4/5			4/7					
Allegheny	84,850	85,262	85,680	86,007	86,891	(17,378)	[4,171]	{2,085}	87,809	(17,562)	[4,215]	{2,107}	88,793	(17,759)	[4,262]	{2,131}
Berks	39,419	39,706	39,895	40,054	40,456	(8,091)	[1,942]	{971}	40,888	(8,178)	[1,963]	{981}	41,334	(8,267)	[1,984]	{992}
Bucks	50,345	50,726	51,005	51,283	51,879	(10,376)	[2,490]	{1,245}	52,510	(10,502)	[2,520]	{1,260}	53,175	(10,635)	[2,552]	{1,276}
Butler	15,108	15,183	15,262	15,303	15,455	(3,091)	[742]	{371}	15,616	(3,123)	[750]	{375}	15,789	(3,158)	[758]	{379}
Chester	31,045	31,247	31,448	31,606	31,963	(6,393)	[1,534]	{767}	32,346	(6,469)	[1,553]	{776}	32,760	(6,552)	[1,572]	{786}
Delaware	44,363	44,618	44,791	44,969	45,368	(9,074)	[2,178]	{1,089}	45,787	(9,157)	[2,198]	{1,099}	46,240	(9,248)	[2,219]	{1,110}
Lackawanna	15,365	15,491	15,567	15,656	15,810	(3,162)	[759]	{379}	15,974	(3,195)	[767]	{383}	16,149	(3,230)	[775]	{388}
Lancaster	47,420	47,656	47,817	48,010	48,381	(9,676)	[2,322]	{1,161}	48,775	(9,755)	[2,341]	{1,171}	49,190	(9,838)	[2,361]	{1,181}
Lehigh	33,695	33,915	34,045	34,208	34,562	(6,912)	[1,659]	{829}	34,939	(6,988)	[1,677]	{839}	35,346	(7,069)	[1,697]	{848}
Luzerne	26,869	26,975	27,080	27,185	27,406	(5,481)	[1,316]	{658}	27,642	(5,528)	[1,327]	{663}	27,890	(5,578)	[1,339]	{669}
Monroe	11,244	11,366	11,446	11,537	11,709	(2,342)	[562]	{281}	11,894	(2,379)	[571]	{285}	12,088	(2,418)	[580]	{290}
Montgomery	59,243	59,562	59,801	60,008	60,532	(12,106)	[2,906]	{1,453}	61,083	(12,217)	[2,932]	{1,466}	61,666	(12,333)	[2,960]	{1,480}
Northampton	30,082	30,312	30,460	30,602	31,019	(6,204)	[1,489]	{744}	31,468	(6,294)	[1,510]	{755}	31,938	(6,388)	[1,533]	{767}
Philadelphia	129,077	129,790	130,405	130,974	132,265	(26,453)	[6,349]	{3,174}	133,663	(26,733)	[6,416]	{3,208}	135,146	(27,029)	[6,487]	{3,243}
Westmoreland	28,930	29,052	29,178	29,265	29,591	(5,918)	[1,420]	{710}	29,948	(5,990)	[1,438]	{719}	30,336	(6,067)	[1,456]	{728}
York	39,111	39,298	39,481	39,646	40,128	(8,026)	[1,926]	{963}	40,659	(8,132)	[1,952]	{976}	41,230	(8,246)	[1,979]	{990}

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.