

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 3/30/21**

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 3/30/21 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.**

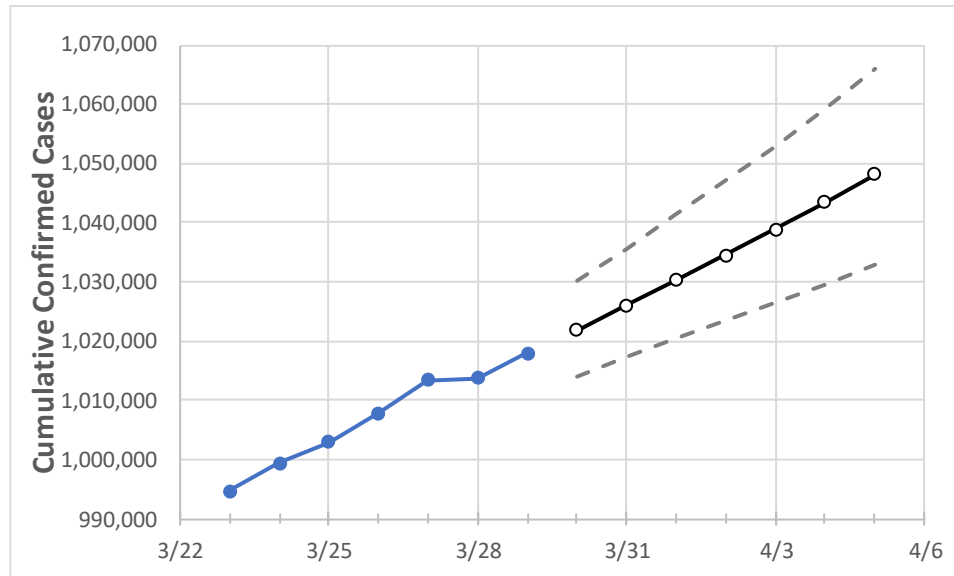
**IEM's Modeling Lead**

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Pennsylvania	1,007,892	1,013,488	1,013,731	1,017,881	1,021,872	1,025,986	1,030,217	1,034,525	1,038,954	1,043,487	1,048,148

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Allegheny	83,811	84,210	84,522	84,850	85,283	85,717	86,179	86,650	87,129	87,625	88,131
Berks	39,062	39,204	39,328	39,419	39,589	39,768	39,948	40,133	40,325	40,523	40,711
Bucks	49,685	49,929	50,185	50,345	50,596	50,862	51,140	51,416	51,703	51,989	52,288
Butler	14,976	15,138	15,067	15,108	15,185	15,265	15,348	15,434	15,525	15,623	15,722
Chester	30,649	30,781	30,913	31,045	31,184	31,325	31,469	31,616	31,765	31,920	32,077
Delaware	43,859	44,040	44,208	44,363	44,524	44,695	44,870	45,050	45,231	45,415	45,608
Lackawanna	15,224	15,316	15,336	15,365	15,425	15,485	15,545	15,608	15,672	15,738	15,803
Lancaster	46,948	47,113	47,271	47,420	47,583	47,747	47,916	48,087	48,263	48,442	48,626
Lehigh	33,320	33,498	33,614	33,695	33,846	34,005	34,169	34,338	34,514	34,700	34,887
Luzerne	26,614	26,705	26,788	26,869	26,971	27,076	27,186	27,297	27,412	27,532	27,659
Monroe	11,057	11,144	11,192	11,244	11,314	11,386	11,459	11,532	11,606	11,679	11,758
Montgomery	58,534	58,804	59,046	59,243	59,487	59,735	59,987	60,250	60,515	60,792	61,065
Northampton	29,725	29,985	29,974	30,082	30,260	30,451	30,652	30,859	31,064	31,278	31,506
Philadelphia	127,770	128,206	128,641	129,077	129,636	130,218	130,825	131,443	132,092	132,743	133,420
Westmoreland	28,660	29,017	28,816	28,930	29,111	29,304	29,506	29,726	29,955	30,203	30,463
York	38,767	39,355	39,027	39,111	39,365	39,632	39,923	40,212	40,536	40,871	41,209

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:											
	3/26	3/27	3/28	3/29	3/31			4/2			4/4					
Allegheny	83,811	84,210	84,522	84,850	85,717	(17,143)	[4,114]	{2,057}	86,650	(17,330)	[4,159]	{2,080}	87,625	(17,525)	[4,206]	{2,103}
Berks	39,062	39,204	39,328	39,419	39,768	(7,954)	[1,909]	{954}	40,133	(8,027)	[1,926]	{963}	40,523	(8,105)	[1,945]	{973}
Bucks	49,685	49,929	50,185	50,345	50,862	(10,172)	[2,441]	{1,221}	51,416	(10,283)	[2,468]	{1,234}	51,989	(10,398)	[2,495]	{1,248}
Butler	14,976	15,138	15,067	15,108	15,265	(3,053)	[733]	{366}	15,434	(3,087)	[741]	{370}	15,623	(3,125)	[750]	{375}
Chester	30,649	30,781	30,913	31,045	31,325	(6,265)	[1,504]	{752}	31,616	(6,323)	[1,518]	{759}	31,920	(6,384)	[1,532]	{766}
Delaware	43,859	44,040	44,208	44,363	44,695	(8,939)	[2,145]	{1,073}	45,050	(9,010)	[2,162]	{1,081}	45,415	(9,083)	[2,180]	{1,090}
Lackawanna	15,224	15,316	15,336	15,365	15,485	(3,097)	[743]	{372}	15,608	(3,122)	[749]	{375}	15,738	(3,148)	[755]	{378}
Lancaster	46,948	47,113	47,271	47,420	47,747	(9,549)	[2,292]	{1,146}	48,087	(9,617)	[2,308]	{1,154}	48,442	(9,688)	[2,325]	{1,163}
Lehigh	33,320	33,498	33,614	33,695	34,005	(6,801)	[1,632]	{816}	34,338	(6,868)	[1,648]	{824}	34,700	(6,940)	[1,666]	{833}
Luzerne	26,614	26,705	26,788	26,869	27,076	(5,415)	[1,300]	{650}	27,297	(5,459)	[1,310]	{655}	27,532	(5,506)	[1,322]	{661}
Monroe	11,057	11,144	11,192	11,244	11,386	(2,277)	[547]	{273}	11,532	(2,306)	[554]	{277}	11,679	(2,336)	[561]	{280}
Montgomery	58,534	58,804	59,046	59,243	59,735	(11,947)	[2,867]	{1,434}	60,250	(12,050)	[2,892]	{1,446}	60,792	(12,158)	[2,918]	{1,459}
Northampton	29,725	29,985	29,974	30,082	30,451	(6,090)	[1,462]	{731}	30,859	(6,172)	[1,481]	{741}	31,278	(6,256)	[1,501]	{751}
Philadelphia	127,770	128,206	128,641	129,077	130,218	(26,044)	[6,250]	{3,125}	131,443	(26,289)	[6,309]	{3,155}	132,743	(26,549)	[6,372]	{3,186}
Westmoreland	28,660	29,017	28,816	28,930	29,304	(5,861)	[1,407]	{703}	29,726	(5,945)	[1,427]	{713}	30,203	(6,041)	[1,450]	{725}
York	38,767	39,355	39,027	39,111	39,632	(7,926)	[1,902]	{951}	40,212	(8,042)	[1,930]	{965}	40,871	(8,174)	[1,962]	{981}

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.