

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

**Date: 3/2/21**

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 3/2/21 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.**

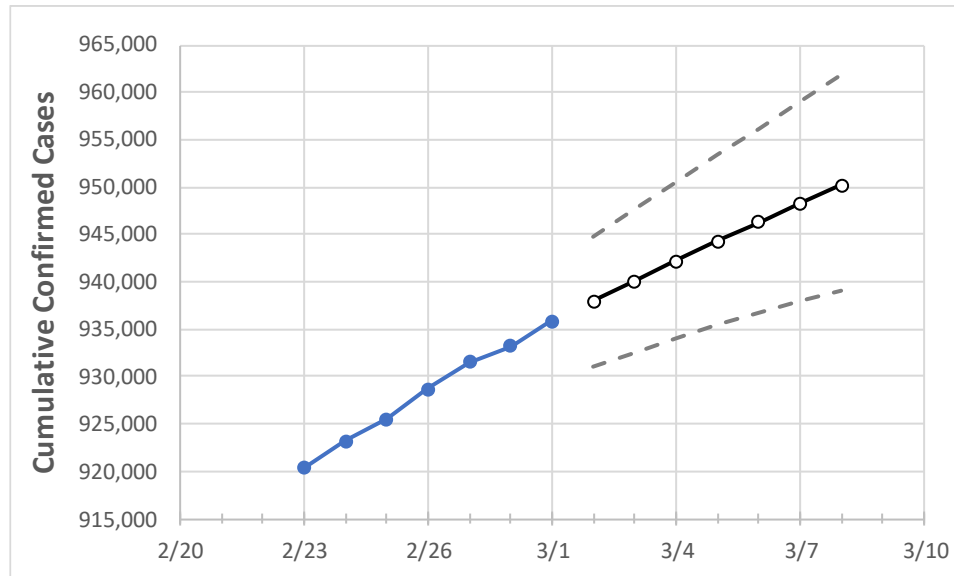
### **IEM's Modeling Lead**

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Pennsylvania	928,633	931,531	933,261	935,822	937,979	940,121	942,208	944,296	946,311	948,316	950,205

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:							
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	
Allegheny	76,136	76,449	76,669	76,853	77,079	77,309	77,536	77,757	77,978	78,202	78,418	
Berks	35,476	35,577	35,658	35,699	35,775	35,848	35,919	35,987	36,055	36,123	36,187	
Bucks	44,744	44,914	45,046	45,176	45,301	45,422	45,546	45,663	45,777	45,888	46,003	
Butler	13,851	13,893	13,916	13,939	13,968	13,998	14,026	14,053	14,081	14,108	14,134	
Chester	27,979	28,053	28,127	28,201	28,277	28,352	28,426	28,501	28,571	28,641	28,712	
Delaware	40,700	40,849	40,957	41,033	41,141	41,249	41,356	41,460	41,565	41,667	41,766	
Lackawanna	13,829	13,888	13,934	13,964	14,007	14,049	14,089	14,129	14,168	14,207	14,245	
Lancaster	43,348	43,527	43,630	43,705	43,803	43,897	43,986	44,074	44,155	44,233	44,306	
Lehigh	30,599	30,696	30,755	30,811	30,883	30,951	31,018	31,086	31,152	31,218	31,283	
Luzerne	24,804	24,849	24,905	24,928	24,974	25,018	25,061	25,104	25,145	25,185	25,225	
Monroe	9,589	9,631	9,656	9,679	9,709	9,739	9,769	9,797	9,825	9,853	9,880	
Montgomery	53,604	53,760	53,921	54,030	54,178	54,320	54,463	54,604	54,742	54,876	55,013	
Northampton	26,662	26,747	26,814	26,855	26,937	27,015	27,091	27,167	27,238	27,308	27,376	
Philadelphia	117,880	118,118	118,356	118,594	118,817	119,036	119,250	119,463	119,677	119,886	120,094	
Westmoreland	26,648	26,742	26,767	26,817	26,874	26,929	26,984	27,041	27,093	27,146	27,197	
York	35,634	35,739	35,812	35,878	35,952	36,021	36,089	36,156	36,221	36,285	36,348	

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:											
	2/26	2/27	2/28	3/1	3/3			3/5			3/7					
Allegheny	76,136	76,449	76,669	76,853	77,309	(15,462)	{3,711}	{1,855}	77,757	(15,551)	{3,732}	{1,866}	78,202	(15,640)	{3,754}	{1,877}
Berks	35,476	35,577	35,658	35,699	35,848	(7,170)	{1,721}	{860}	35,987	(7,197)	{1,727}	{864}	36,123	(7,225)	{1,734}	{867}
Bucks	44,744	44,914	45,046	45,176	45,422	(9,084)	{2,180}	{1,090}	45,663	(9,133)	{2,192}	{1,096}	45,888	(9,178)	{2,203}	{1,101}
Butler	13,851	13,893	13,916	13,939	13,998	(2,800)	{672}	{336}	14,053	(2,811)	{675}	{337}	14,108	(2,822)	{677}	{339}
Chester	27,979	28,053	28,127	28,201	28,352	(5,670)	{1,361}	{680}	28,501	(5,700)	{1,368}	{684}	28,641	(5,728)	{1,375}	{687}
Delaware	40,700	40,849	40,957	41,033	41,249	(8,250)	{1,980}	{990}	41,460	(8,292)	{1,990}	{995}	41,667	(8,333)	{2,000}	{1,000}
Lackawanna	13,829	13,888	13,934	13,964	14,049	(2,810)	{674}	{337}	14,129	(2,826)	{678}	{339}	14,207	(2,841)	{682}	{341}
Lancaster	43,348	43,527	43,630	43,705	43,897	(8,779)	{2,107}	{1,054}	44,074	(8,815)	{2,116}	{1,058}	44,233	(8,847)	{2,123}	{1,062}
Lehigh	30,599	30,696	30,755	30,811	30,951	(6,190)	{1,486}	{743}	31,086	(6,217)	{1,492}	{746}	31,218	(6,244)	{1,498}	{749}
Luzerne	24,804	24,849	24,905	24,928	25,018	(5,004)	{1,201}	{600}	25,104	(5,021)	{1,205}	{602}	25,185	(5,037)	{1,209}	{604}
Monroe	9,589	9,631	9,656	9,679	9,739	(1,948)	{467}	{234}	9,797	(1,959)	{470}	{235}	9,853	(1,971)	{473}	{236}
Montgomery	53,604	53,760	53,921	54,030	54,320	(10,864)	{2,607}	{1,304}	54,604	(10,921)	{2,621}	{1,310}	54,876	(10,975)	{2,634}	{1,317}
Northampton	26,662	26,747	26,814	26,855	27,015	(5,403)	{1,297}	{648}	27,167	(5,433)	{1,304}	{652}	27,308	(5,462)	{1,311}	{655}
Philadelphia	117,880	118,118	118,356	118,594	119,036	(23,807)	{5,714}	{2,857}	119,463	(23,893)	{5,734}	{2,867}	119,886	(23,977)	{5,755}	{2,877}
Westmoreland	26,648	26,742	26,767	26,817	26,929	(5,386)	{1,293}	{646}	27,041	(5,408)	{1,298}	{649}	27,146	(5,429)	{1,303}	{652}
York	35,634	35,739	35,812	35,878	36,021	(7,204)	{1,729}	{865}	36,156	(7,231)	{1,735}	{868}	36,285	(7,257)	{1,742}	{871}

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.