

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 3/11/21**

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 3/11/21 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.**

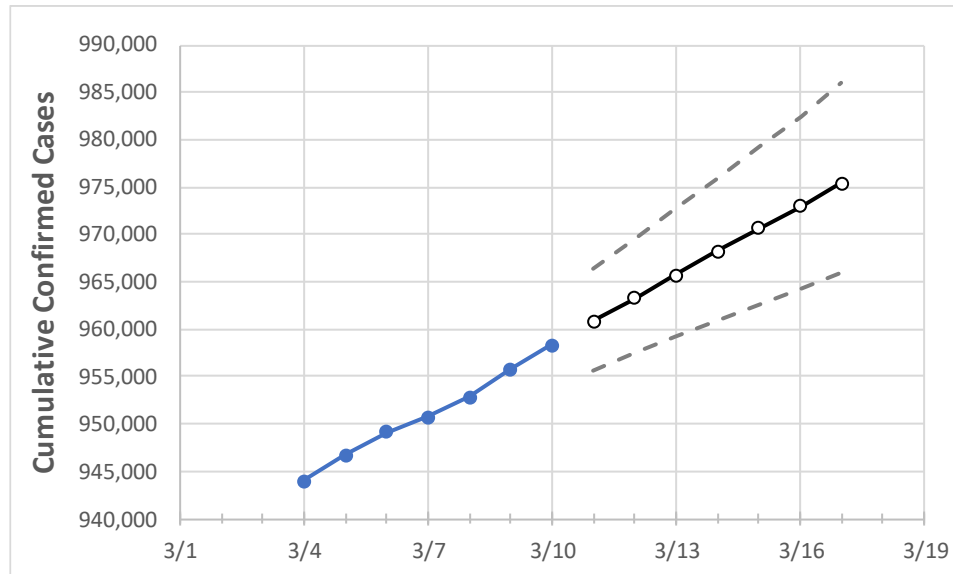
**IEM's Modeling Lead**

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Pennsylvania	950,773	952,818	955,743	958,349	960,809	963,273	965,758	968,196	970,647	973,019	975,436

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Allegheny	78,220	78,357	78,705	78,914	79,141	79,370	79,600	79,831	80,055	80,280	80,502
Berks	36,378	36,444	36,529	36,611	36,704	36,795	36,888	36,980	37,071	37,163	37,257
Bucks	46,156	46,264	46,408	46,559	46,713	46,865	47,015	47,165	47,318	47,472	47,621
Butler	14,121	14,141	14,192	14,240	14,273	14,306	14,339	14,372	14,404	14,438	14,471
Chester	28,707	28,772	28,849	28,932	29,010	29,090	29,168	29,245	29,322	29,397	29,473
Delaware	41,765	41,841	41,923	42,015	42,124	42,233	42,341	42,452	42,558	42,662	42,766
Lackawanna	14,228	14,265	14,325	14,374	14,416	14,460	14,502	14,543	14,584	14,626	14,668
Lancaster	44,480	44,556	44,684	44,833	44,948	45,061	45,175	45,286	45,398	45,507	45,616
Lehigh	31,262	31,304	31,382	31,470	31,539	31,608	31,675	31,741	31,809	31,878	31,947
Luzerne	25,248	25,268	25,335	25,390	25,435	25,478	25,522	25,565	25,608	25,649	25,687
Monroe	9,955	9,981	10,044	10,100	10,148	10,196	10,245	10,295	10,346	10,398	10,452
Montgomery	55,218	55,332	55,442	55,594	55,761	55,925	56,092	56,257	56,426	56,591	56,757
Northampton	27,446	27,483	27,564	27,650	27,721	27,792	27,863	27,932	28,000	28,063	28,126
Philadelphia	120,317	120,539	120,966	121,242	121,543	121,846	122,152	122,456	122,764	123,078	123,392
Westmoreland	27,172	27,203	27,303	27,369	27,422	27,474	27,527	27,581	27,633	27,688	27,739
York	36,413	36,466	36,540	36,669	36,752	36,835	36,916	36,997	37,077	37,157	37,234

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:											
	3/7	3/8	3/9	3/10	3/12			3/14			3/16					
Allegheny	78,220	78,357	78,705	78,914	79,370	(15,874)	{3,810}	{1,905}	79,831	(15,966)	{3,832}	{1,916}	80,280	(16,056)	{3,853}	{1,927}
Berks	36,378	36,444	36,529	36,611	36,795	(7,359)	{1,766}	{883}	36,980	(7,396)	{1,775}	{888}	37,163	(7,433)	{1,784}	{892}
Bucks	46,156	46,264	46,408	46,559	46,865	(9,373)	{2,250}	{1,125}	47,165	(9,433)	{2,264}	{1,132}	47,472	(9,494)	{2,279}	{1,139}
Butler	14,121	14,141	14,192	14,240	14,306	(2,861)	{687}	{343}	14,372	(2,874)	{690}	{345}	14,438	(2,888)	{693}	{347}
Chester	28,707	28,772	28,849	28,932	29,090	(5,818)	{1,396}	{698}	29,245	(5,849)	{1,404}	{702}	29,397	(5,879)	{1,411}	{706}
Delaware	41,765	41,841	41,923	42,015	42,233	(8,447)	{2,027}	{1,014}	42,452	(8,490)	{2,038}	{1,019}	42,662	(8,532)	{2,048}	{1,024}
Lackawanna	14,228	14,265	14,325	14,374	14,460	(2,892)	{694}	{347}	14,543	(2,909)	{698}	{349}	14,626	(2,925)	{702}	{351}
Lancaster	44,480	44,556	44,684	44,833	45,061	(9,012)	{2,163}	{1,081}	45,286	(9,057)	{2,174}	{1,087}	45,507	(9,101)	{2,184}	{1,092}
Lehigh	31,262	31,304	31,382	31,470	31,608	(6,322)	{1,517}	{759}	31,741	(6,348)	{1,524}	{762}	31,878	(6,376)	{1,530}	{765}
Luzerne	25,248	25,268	25,335	25,390	25,478	(5,096)	{1,223}	{611}	25,565	(5,113)	{1,227}	{614}	25,649	(5,130)	{1,231}	{616}
Monroe	9,955	9,981	10,044	10,100	10,196	(2,039)	{489}	{245}	10,295	(2,059)	{494}	{247}	10,398	(2,080)	{499}	{250}
Montgomery	55,218	55,332	55,442	55,594	55,925	(11,185)	{2,684}	{1,342}	56,257	(11,251)	{2,700}	{1,350}	56,591	(11,318)	{2,716}	{1,358}
Northampton	27,446	27,483	27,564	27,650	27,792	(5,558)	{1,334}	{667}	27,932	(5,586)	{1,341}	{670}	28,063	(5,613)	{1,347}	{674}
Philadelphia	120,317	120,539	120,966	121,242	121,846	(24,369)	{5,849}	{2,924}	122,456	(24,491)	{5,878}	{2,939}	123,078	(24,616)	{5,908}	{2,954}
Westmoreland	27,172	27,203	27,303	27,369	27,474	(5,495)	{1,319}	{659}	27,581	(5,516)	{1,324}	{662}	27,688	(5,538)	{1,329}	{665}
York	36,413	36,466	36,540	36,669	36,835	(7,367)	{1,768}	{884}	36,997	(7,399)	{1,776}	{888}	37,157	(7,431)	{1,784}	{892}

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.