

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 3/18/22**

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 3/18/22 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.**

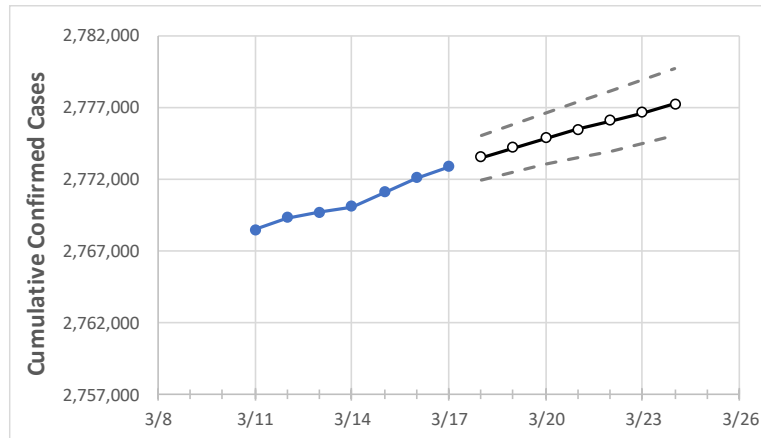
**IEM's Modeling Lead**

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Pennsylvania	2,770,077	2,771,090	2,772,116	2,772,886	2,773,555	2,774,218	2,774,874	2,775,492	2,776,101	2,776,696	2,777,266

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Allegheny	262,042	262,125	262,172	262,233	262,293	262,351	262,406	262,460	262,511	262,562	262,610
Berks	101,871	101,887	101,904	101,922	101,937	101,952	101,965	101,979	101,992	102,004	102,016
Bucks	122,326	122,383	122,427	122,457	122,484	122,512	122,539	122,566	122,593	122,620	122,645
Butler	44,234	44,255	44,257	44,268	44,278	44,288	44,297	44,307	44,315	44,325	44,332
Chester	91,002	91,034	91,061	91,078	91,102	91,126	91,149	91,171	91,194	91,215	91,236
Delaware	109,184	109,240	109,281	109,307	109,329	109,351	109,372	109,394	109,414	109,436	109,455
Lackawanna	43,109	43,129	43,137	43,160	43,175	43,190	43,203	43,216	43,229	43,242	43,254
Lancaster	120,466	120,483	120,499	120,523	120,540	120,555	120,572	120,585	120,600	120,614	120,628
Lehigh	89,009	89,016	89,030	89,049	89,062	89,073	89,084	89,096	89,107	89,117	89,128
Luzerne	73,158	73,169	73,183	73,198	73,213	73,228	73,242	73,255	73,268	73,280	73,292
Monroe	36,746	36,759	36,766	36,775	36,781	36,786	36,791	36,796	36,801	36,806	36,811
Montgomery	150,637	150,858	151,015	151,146	151,222	151,304	151,381	151,461	151,543	151,623	151,703
Northampton	79,052	79,066	79,078	79,092	79,105	79,117	79,128	79,140	79,150	79,161	79,171
Philadelphia	306,134	306,251	306,606	306,682	306,788	306,892	306,978	307,088	307,174	307,275	307,377
Westmoreland	79,326	79,351	79,361	79,379	79,392	79,405	79,417	79,428	79,440	79,450	79,461
York	118,162	118,172	118,199	118,217	118,232	118,247	118,261	118,275	118,289	118,301	118,314

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:											
	3/14	3/15	3/16	3/17	3/19				3/21				3/23			
Allegheny	262,042	262,125	262,172	262,233	262,351	(52,470)	[12,593]	{6,296}	262,460	(52,492)	[12,598]	{6,299}	262,562	(52,512)	[12,603]	{6,301}
Berks	101,871	101,887	101,904	101,922	101,952	(20,390)	[4,894]	{2,447}	101,979	(20,396)	[4,895]	{2,447}	102,004	(20,401)	[4,896]	{2,448}
Bucks	122,326	122,383	122,427	122,457	122,512	(24,502)	[5,881]	{2,940}	122,566	(24,513)	[5,883]	{2,942}	122,620	(24,524)	[5,886]	{2,943}
Butler	44,234	44,255	44,257	44,268	44,288	(8,858)	[2,126]	{1,063}	44,307	(8,861)	[2,127]	{1,063}	44,325	(8,865)	[2,128]	{1,064}
Chester	91,002	91,034	91,061	91,078	91,126	(18,225)	[4,374]	{2,187}	91,171	(18,234)	[4,376]	{2,188}	91,215	(18,243)	[4,378]	{2,189}
Delaware	109,184	109,240	109,281	109,307	109,351	(21,870)	[5,249]	{2,624}	109,394	(21,879)	[5,251]	{2,625}	109,436	(21,887)	[5,253]	{2,626}
Lackawanna	43,109	43,129	43,137	43,160	43,190	(8,638)	[2,073]	{1,037}	43,216	(8,643)	[2,074]	{1,037}	43,242	(8,648)	[2,076]	{1,038}
Lancaster	120,466	120,483	120,499	120,523	120,555	(24,111)	[5,787]	{2,893}	120,585	(24,117)	[5,788]	{2,894}	120,614	(24,123)	[5,789]	{2,895}
Lehigh	89,009	89,016	89,030	89,049	89,073	(17,815)	[4,276]	{2,138}	89,096	(17,819)	[4,277]	{2,138}	89,117	(17,823)	[4,278]	{2,139}
Luzerne	73,158	73,169	73,183	73,198	73,228	(14,646)	[3,515]	{1,757}	73,255	(14,651)	[3,516]	{1,758}	73,280	(14,656)	[3,517]	{1,759}
Monroe	36,746	36,759	36,766	36,775	36,786	(7,357)	[1,766]	{883}	36,796	(7,359)	[1,766]	{883}	36,806	(7,361)	[1,767]	{883}
Montgomery	150,637	150,858	151,015	151,146	151,304	(30,261)	[7,263]	{3,631}	151,461	(30,292)	[7,270]	{3,635}	151,623	(30,325)	[7,278]	{3,639}
Northampton	79,052	79,066	79,078	79,092	79,117	(15,823)	[3,798]	{1,899}	79,140	(15,828)	[3,799]	{1,899}	79,161	(15,832)	[3,800]	{1,900}
Philadelphia	306,134	306,251	306,606	306,682	306,892	(61,378)	[14,731]	{7,365}	307,088	(61,418)	[14,740]	{7,370}	307,275	(61,455)	[14,749]	{7,375}
Westmoreland	79,326	79,351	79,361	79,379	79,405	(15,881)	[3,811]	{1,906}	79,428	(15,886)	[3,813]	{1,906}	79,450	(15,890)	[3,814]	{1,907}
York	118,162	118,172	118,199	118,217	118,247	(23,649)	[5,676]	{2,838}	118,275	(23,655)	[5,677]	{2,839}	118,301	(23,660)	[5,678]	{2,839}

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.