

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 1/20/21**

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 1/20/21 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.**

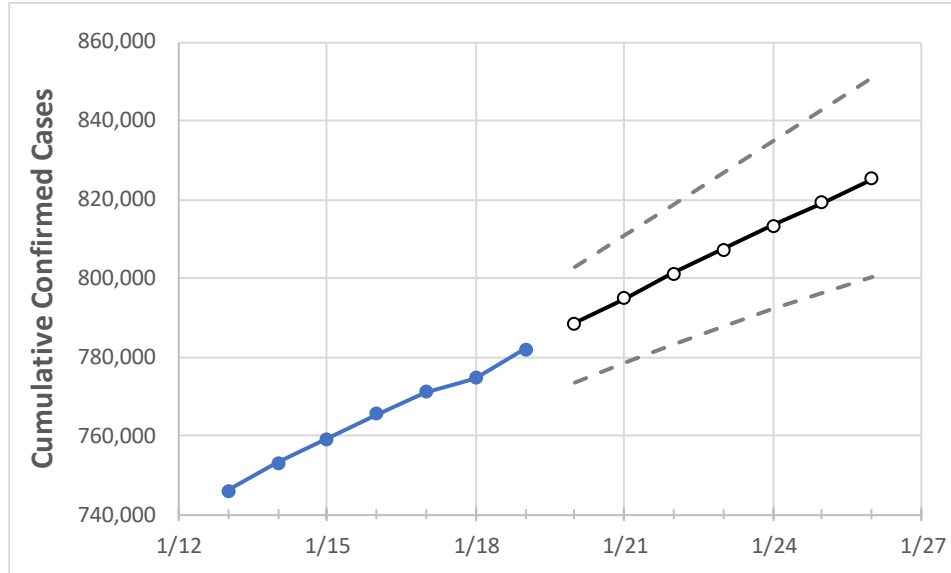
**IEM's Modeling Lead**

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Pennsylvania	765,489	770,985	774,566	781,947	788,403	794,839	801,101	807,299	813,269	819,177	825,167

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Allegheny	63,884	64,400	64,680	65,114	65,578	66,031	66,473	66,904	67,330	67,736	68,136
Berks	28,373	28,578	28,726	29,064	29,357	29,648	29,942	30,225	30,516	30,805	31,094
Bucks	36,061	36,293	36,494	36,682	36,931	37,175	37,414	37,647	37,874	38,090	38,308
Butler	11,596	11,699	11,757	11,854	11,963	12,072	12,182	12,287	12,391	12,494	12,587
Chester	23,235	23,410	23,584	23,759	23,961	24,163	24,361	24,558	24,749	24,941	25,134
Delaware	34,188	34,398	34,536	34,717	34,940	35,156	35,369	35,572	35,769	35,965	36,161
Lackawanna	10,990	11,121	11,242	11,343	11,468	11,595	11,721	11,845	11,969	12,090	12,215
Lancaster	33,686	33,978	34,211	34,468	34,800	35,125	35,457	35,770	36,097	36,414	36,732
Lehigh	25,209	25,438	25,541	25,758	26,008	26,258	26,505	26,740	26,977	27,205	27,431
Luzerne	20,438	20,696	20,763	20,879	21,059	21,227	21,397	21,564	21,730	21,898	22,061
Monroe	7,616	7,709	7,743	7,820	7,906	7,991	8,074	8,156	8,240	8,320	8,400
Montgomery	43,270	43,690	43,958	44,279	44,649	45,017	45,379	45,736	46,084	46,424	46,767
Northampton	20,432	20,611	20,716	20,952	21,157	21,355	21,549	21,745	21,928	22,116	22,304
Philadelphia	103,290	103,743	104,195	104,648	105,180	105,705	106,230	106,738	107,236	107,733	108,226
Westmoreland	23,039	23,173	23,253	23,451	23,634	23,812	23,989	24,163	24,329	24,493	24,657
York	28,125	28,488	28,686	28,930	29,221	29,511	29,797	30,069	30,350	30,627	30,899

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:											
	1/16	1/17	1/18	1/19	1/21			1/23			1/25					
Allegheny	63,884	64,400	64,680	65,114	66,031	(13,206)	[3,169]	{1,585}	66,904	(13,381)	[3,211]	{1,606}	67,736	(13,547)	[3,251]	{1,626}
Berks	28,373	28,578	28,726	29,064	29,648	(5,930)	[1,423]	{712}	30,225	(6,045)	[1,451]	{725}	30,805	(6,161)	[1,479]	{739}
Bucks	36,061	36,293	36,494	36,682	37,175	(7,435)	[1,784]	{892}	37,647	(7,529)	[1,807]	{904}	38,090	(7,618)	[1,828]	{914}
Butler	11,596	11,699	11,757	11,854	12,072	(2,414)	[579]	{290}	12,287	(2,457)	[590]	{295}	12,494	(2,499)	[600]	{300}
Chester	23,235	23,410	23,584	23,759	24,163	(4,833)	[1,160]	{580}	24,558	(4,912)	[1,179]	{589}	24,941	(4,988)	[1,197]	{599}
Delaware	34,188	34,398	34,536	34,717	35,156	(7,031)	[1,687]	{844}	35,572	(7,114)	[1,707]	{854}	35,965	(7,193)	[1,726]	{863}
Lackawanna	10,990	11,121	11,242	11,343	11,595	(2,319)	[557]	{278}	11,845	(2,369)	[569]	{284}	12,090	(2,418)	[580]	{290}
Lancaster	33,686	33,978	34,211	34,468	35,125	(7,025)	[1,686]	{843}	35,770	(7,154)	[1,717]	{858}	36,414	(7,283)	[1,748]	{874}
Lehigh	25,209	25,438	25,541	25,758	26,258	(5,252)	[1,260]	{630}	26,740	(5,348)	[1,284]	{642}	27,205	(5,441)	[1,306]	{653}
Luzerne	20,438	20,696	20,763	20,879	21,227	(4,245)	[1,019]	{509}	21,564	(4,313)	[1,035]	{518}	21,898	(4,380)	[1,051]	{526}
Monroe	7,616	7,709	7,743	7,820	7,991	(1,598)	[384]	{192}	8,156	(1,631)	[391]	{196}	8,320	(1,664)	[399]	{200}
Montgomery	43,270	43,690	43,958	44,279	45,017	(9,003)	[2,161]	{1,080}	45,736	(9,147)	[2,195]	{1,098}	46,424	(9,285)	[2,228]	{1,114}
Northampton	20,432	20,611	20,716	20,952	21,355	(4,271)	[1,025]	{513}	21,745	(4,349)	[1,044]	{522}	22,116	(4,423)	[1,062]	{531}
Philadelphia	103,290	103,743	104,195	104,648	105,705	(21,141)	[5,074]	{2,537}	106,738	(21,348)	[5,123]	{2,562}	107,733	(21,547)	[5,171]	{2,586}
Westmoreland	23,039	23,173	23,253	23,451	23,812	(4,762)	[1,143]	{571}	24,163	(4,833)	[1,160]	{580}	24,493	(4,899)	[1,176]	{588}
York	28,125	28,488	28,686	28,930	29,511	(5,902)	[1,417]	{708}	30,069	(6,014)	[1,443]	{722}	30,627	(6,125)	[1,470]	{735}

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.