

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 11/18/20**

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 11/18/20 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.**

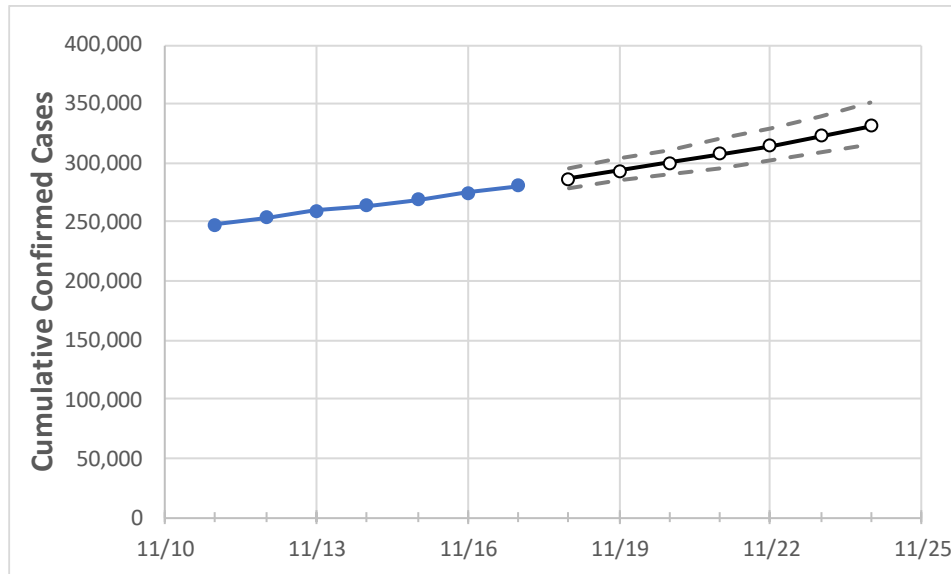
**IEM's Modeling Lead**

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:						
	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24
Pennsylvania	264,222	268,696	275,235	280,957	287,057	293,488	300,268	307,414	314,947	322,885	331,251

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 20%, and are often within 10%, of actual confirmed cases.

## Pennsylvania Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24
Allegheny	19,499	20,026	20,526	20,814	21,280	21,774	22,295	22,847	23,430	24,047	24,700
Berks	11,191	11,359	11,518	11,709	11,860	12,015	12,174	12,337	12,505	12,678	12,855
Bucks	12,748	13,050	13,285	13,518	13,847	14,200	14,581	14,990	15,430	15,904	16,413
Butler	2,829	2,901	2,983	3,108	3,218	3,335	3,460	3,592	3,732	3,881	4,040
Chester	9,576	9,724	9,873	9,999	10,160	10,331	10,511	10,701	10,902	11,114	11,339
Delaware	16,340	16,595	16,736	16,963	17,220	17,488	17,766	18,057	18,359	18,674	19,002
Lackawanna	4,321	4,360	4,369	4,415	4,443	4,471	4,498	4,526	4,553	4,580	4,606
Lancaster	11,988	12,217	12,434	12,603	12,844	13,098	13,367	13,650	13,949	14,265	14,598
Lehigh	8,466	8,637	8,725	8,831	9,012	9,202	9,403	9,614	9,837	10,071	10,318
Luzerne	6,933	7,031	7,104	7,327	7,459	7,596	7,739	7,887	8,040	8,200	8,366
Monroe	2,525	2,572	2,598	2,631	2,686	2,746	2,810	2,879	2,953	3,032	3,118
Montgomery	17,051	17,446	17,631	17,892	18,238	18,606	18,997	19,411	19,852	20,320	20,816
Northampton	6,700	6,842	6,918	7,013	7,143	7,280	7,424	7,576	7,736	7,905	8,082
Philadelphia	53,583	54,442	55,302	56,372	57,376	58,433	59,546	60,718	61,950	63,247	64,611
Westmoreland	5,912	6,099	6,266	6,421	6,569	6,722	6,882	7,049	7,222	7,402	7,590
York	7,966	8,074	8,216	8,454	8,588	8,727	8,871	9,022	9,179	9,342	9,511

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:											
	11/14	11/15	11/16	11/17	11/19				11/21				11/23			
Allegheny	19,499	20,026	20,526	20,814	21,774	(4,355)	[1,045]	{523}	22,847	(4,569)	[1,097]	{548}	24,047	(4,809)	[1,154]	{577}
Berks	11,191	11,359	11,518	11,709	12,015	(2,403)	[577]	{288}	12,337	(2,467)	[592]	{296}	12,678	(2,536)	[609]	{304}
Bucks	12,748	13,050	13,285	13,518	14,200	(2,840)	[682]	{341}	14,990	(2,998)	[720]	{360}	15,904	(3,181)	[763]	{382}
Butler	2,829	2,901	2,983	3,108	3,335	(667)	[160]	{80}	3,592	(718)	[172]	{86}	3,881	(776)	[186]	{93}
Chester	9,576	9,724	9,873	9,999	10,331	(2,066)	[496]	{248}	10,701	(2,140)	[514]	{257}	11,114	(2,223)	[533]	{267}
Delaware	16,340	16,595	16,736	16,963	17,488	(3,498)	[839]	{420}	18,057	(3,611)	[867]	{433}	18,674	(3,735)	[896]	{448}
Lackawanna	4,321	4,360	4,369	4,415	4,471	(894)	[215]	{107}	4,526	(905)	[217]	{109}	4,580	(916)	[220]	{110}
Lancaster	11,988	12,217	12,434	12,603	13,098	(2,620)	[629]	{314}	13,650	(2,730)	[655]	{328}	14,265	(2,853)	[685]	{342}
Lehigh	8,466	8,637	8,725	8,831	9,202	(1,840)	[442]	{221}	9,614	(1,923)	[461]	{231}	10,071	(2,014)	[483]	{242}
Luzerne	6,933	7,031	7,104	7,327	7,596	(1,519)	[365]	{182}	7,887	(1,577)	[379]	{189}	8,200	(1,640)	[394]	{197}
Monroe	2,525	2,572	2,598	2,631	2,746	(549)	[132]	{66}	2,879	(576)	[138]	{69}	3,032	(606)	[146]	{73}
Montgomery	17,051	17,446	17,631	17,892	18,606	(3,721)	[893]	{447}	19,411	(3,882)	[932]	{466}	20,320	(4,064)	[975]	{488}
Northampton	6,700	6,842	6,918	7,013	7,280	(1,456)	[349]	{175}	7,576	(1,515)	[364]	{182}	7,905	(1,581)	[379]	{190}
Philadelphia	53,583	54,442	55,302	56,372	58,433	(11,687)	[2,805]	{1,402}	60,718	(12,144)	[2,914]	{1,457}	63,247	(12,649)	[3,036]	{1,518}
Westmoreland	5,912	6,099	6,266	6,421	6,722	(1,344)	[323]	{161}	7,049	(1,410)	[338]	{169}	7,402	(1,480)	[355]	{178}
York	7,966	8,074	8,216	8,454	8,727	(1,745)	[419]	{209}	9,022	(1,804)	[433]	{217}	9,342	(1,868)	[448]	{224}

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.