

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/16/20**

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 10/16/20 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.

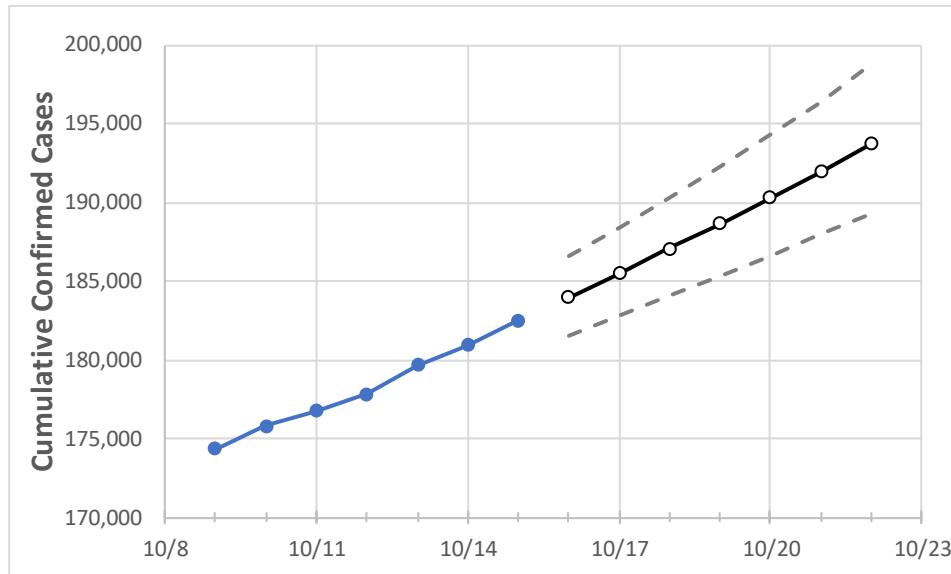
IEM's Modeling Lead

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:						
	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22
Pennsylvania	177,819	179,651	180,935	182,486	183,964	185,482	187,039	188,638	190,278	191,962	193,690

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:						
	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22
Allegheny	13,362	13,436	13,533	13,672	13,765	13,859	13,956	14,054	14,154	14,256	14,360
Berks	7,819	7,901	7,961	8,035	8,108	8,184	8,262	8,344	8,428	8,516	8,607
Bucks	9,366	9,392	9,423	9,485	9,523	9,562	9,600	9,640	9,679	9,719	9,759
Butler	1,273	1,298	1,319	1,346	1,371	1,398	1,426	1,455	1,487	1,520	1,555
Chester	7,402	7,456	7,491	7,534	7,572	7,611	7,650	7,689	7,728	7,768	7,808
Delaware	12,159	12,234	12,285	12,349	12,411	12,475	12,540	12,608	12,677	12,748	12,821
Lackawanna	2,974	3,022	3,065	3,125	3,174	3,225	3,280	3,337	3,398	3,461	3,529
Lancaster	8,607	8,669	8,718	8,751	8,804	8,857	8,911	8,965	9,020	9,076	9,133
Lehigh	5,981	5,999	6,023	6,053	6,077	6,102	6,127	6,153	6,179	6,205	6,232
Luzerne	4,426	4,458	4,496	4,550	4,597	4,647	4,701	4,760	4,824	4,893	4,967
Monroe	1,875	1,884	1,893	1,898	1,906	1,914	1,923	1,932	1,941	1,952	1,962
Montgomery	12,841	12,897	12,945	12,999	13,047	13,096	13,146	13,197	13,248	13,300	13,353
Northampton	4,864	4,883	4,905	4,929	4,957	4,985	5,015	5,046	5,077	5,110	5,144
Philadelphia	39,252	39,413	39,691	39,870	40,093	40,325	40,566	40,815	41,073	41,342	41,620
Westmoreland	2,904	2,993	3,053	3,201	3,303	3,415	3,535	3,666	3,808	3,963	4,130
York	5,487	5,553	5,615	5,649	5,696	5,743	5,791	5,840	5,888	5,938	5,988

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:											
	10/12	10/13	10/14	10/15	10/17				10/19				10/21			
Allegheny	13,362	13,436	13,533	13,672	13,859	(2,772)	[665]	{333}	14,054	(2,811)	[675]	{337}	14,256	(2,851)	[684]	{342}
Berks	7,819	7,901	7,961	8,035	8,184	(1,637)	[393]	{196}	8,344	(1,669)	[401]	{200}	8,516	(1,703)	[409]	{204}
Bucks	9,366	9,392	9,423	9,485	9,562	(1,912)	[459]	{229}	9,640	(1,928)	[463]	{231}	9,719	(1,944)	[467]	{233}
Butler	1,273	1,298	1,319	1,346	1,398	(280)	[67]	{34}	1,455	(291)	[70]	{35}	1,520	(304)	[73]	{36}
Chester	7,402	7,456	7,491	7,534	7,611	(1,522)	[365]	{183}	7,689	(1,538)	[369]	{185}	7,768	(1,554)	[373]	{186}
Delaware	12,159	12,234	12,285	12,349	12,475	(2,495)	[599]	{299}	12,608	(2,522)	[605]	{303}	12,748	(2,550)	[612]	{306}
Lackawanna	2,974	3,022	3,065	3,125	3,225	(645)	[155]	{77}	3,337	(667)	[160]	{80}	3,461	(692)	[166]	{83}
Lancaster	8,607	8,669	8,718	8,751	8,857	(1,771)	[425]	{213}	8,965	(1,793)	[430]	{215}	9,076	(1,815)	[436]	{218}
Lehigh	5,981	5,999	6,023	6,053	6,102	(1,220)	[293]	{146}	6,153	(1,231)	[295]	{148}	6,205	(1,241)	[298]	{149}
Luzerne	4,426	4,458	4,496	4,550	4,647	(929)	[223]	{112}	4,760	(952)	[228]	{114}	4,893	(979)	[235]	{117}
Monroe	1,875	1,884	1,893	1,898	1,914	(383)	[92]	{46}	1,932	(386)	[93]	{46}	1,952	(390)	[94]	{47}
Montgomery	12,841	12,897	12,945	12,999	13,096	(2,619)	[629]	{314}	13,197	(2,639)	[633]	{317}	13,300	(2,660)	[638]	{319}
Northampton	4,864	4,883	4,905	4,929	4,985	(997)	[239]	{120}	5,046	(1,009)	[242]	{121}	5,110	(1,022)	[245]	{123}
Philadelphia	39,252	39,413	39,691	39,870	40,325	(8,065)	[1,936]	{968}	40,815	(8,163)	[1,959]	{980}	41,342	(8,268)	[1,984]	{992}
Westmoreland	2,904	2,993	3,053	3,201	3,415	(683)	[164]	{82}	3,666	(733)	[176]	{88}	3,963	(793)	[190]	{95}
York	5,487	5,553	5,615	5,649	5,743	(1,149)	[276]	{138}	5,840	(1,168)	[280]	{140}	5,938	(1,188)	[285]	{143}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.