

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 3/25/22**

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 3/25/22 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.

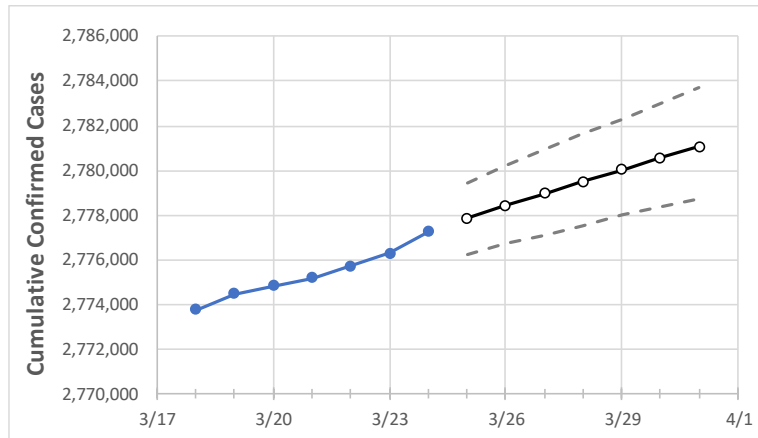
IEM's Modeling Lead

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Pennsylvania	2,775,183	2,775,728	2,776,302	2,777,260	2,777,844	2,778,405	2,778,968	2,779,504	2,780,042	2,780,573	2,781,075

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Allegheny	262,514	262,556	262,636	262,741	262,796	262,852	262,908	262,962	263,012	263,065	263,115
Berks	101,976	101,990	102,006	102,032	102,044	102,056	102,066	102,077	102,088	102,099	102,109
Bucks	122,574	122,597	122,628	122,690	122,725	122,759	122,794	122,828	122,862	122,897	122,930
Butler	44,296	44,306	44,316	44,327	44,334	44,342	44,349	44,355	44,362	44,370	44,375
Chester	91,172	91,193	91,216	91,263	91,284	91,305	91,325	91,345	91,364	91,384	91,403
Delaware	109,393	109,424	109,443	109,494	109,520	109,547	109,572	109,599	109,625	109,651	109,677
Lackawanna	43,212	43,220	43,237	43,250	43,261	43,272	43,283	43,293	43,302	43,312	43,322
Lancaster	120,575	120,588	120,605	120,628	120,641	120,653	120,665	120,677	120,689	120,700	120,711
Lehigh	89,090	89,095	89,107	89,138	89,148	89,159	89,169	89,178	89,188	89,199	89,208
Luzerne	73,246	73,262	73,277	73,293	73,303	73,312	73,322	73,331	73,340	73,348	73,355
Monroe	36,799	36,807	36,824	36,835	36,843	36,851	36,859	36,867	36,876	36,884	36,892
Montgomery	151,349	151,385	151,450	151,561	151,644	151,727	151,818	151,905	151,995	152,083	152,175
Northampton	79,166	79,169	79,182	79,224	79,239	79,253	79,266	79,280	79,293	79,307	79,319
Philadelphia	307,095	307,142	307,160	307,297	307,390	307,490	307,572	307,663	307,746	307,840	307,929
Westmoreland	79,450	79,465	79,480	79,498	79,511	79,525	79,537	79,549	79,562	79,574	79,586
York	118,264	118,277	118,295	118,310	118,322	118,333	118,344	118,354	118,365	118,375	118,384

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:											
	3/21	3/22	3/23	3/24	3/26				3/28				3/30			
Allegheny	262,514	262,556	262,636	262,741	262,852	(52,570)	[12,617]	{6,308}	262,962	(52,592)	[12,622]	{6,311}	263,065	(52,613)	[12,627]	{6,314}
Berks	101,976	101,990	102,006	102,032	102,056	(20,411)	[4,899]	{2,449}	102,077	(20,415)	[4,900]	{2,450}	102,099	(20,420)	[4,901]	{2,450}
Bucks	122,574	122,597	122,628	122,690	122,759	(24,552)	[5,892]	{2,946}	122,828	(24,566)	[5,896]	{2,948}	122,897	(24,579)	[5,899]	{2,950}
Butler	44,296	44,306	44,316	44,327	44,342	(8,868)	[2,128]	{1,064}	44,355	(8,871)	[2,129]	{1,065}	44,370	(8,874)	[2,130]	{1,065}
Chester	91,172	91,193	91,216	91,263	91,305	(18,261)	[4,383]	{2,191}	91,345	(18,269)	[4,385]	{2,192}	91,384	(18,277)	[4,386]	{2,193}
Delaware	109,393	109,424	109,443	109,494	109,547	(21,909)	[5,258]	{2,629}	109,599	(21,920)	[5,261]	{2,630}	109,651	(21,930)	[5,263]	{2,632}
Lackawanna	43,212	43,220	43,237	43,250	43,272	(8,654)	[2,077]	{1,039}	43,293	(8,659)	[2,078]	{1,039}	43,312	(8,662)	[2,079]	{1,039}
Lancaster	120,575	120,588	120,605	120,628	120,653	(24,131)	[5,791]	{2,896}	120,677	(24,135)	[5,792]	{2,896}	120,700	(24,140)	[5,794]	{2,897}
Lehigh	89,090	89,095	89,107	89,138	89,159	(17,832)	[4,280]	{2,140}	89,178	(17,836)	[4,281]	{2,140}	89,199	(17,840)	[4,282]	{2,141}
Luzerne	73,246	73,262	73,277	73,293	73,312	(14,662)	[3,519]	{1,759}	73,331	(14,666)	[3,520]	{1,760}	73,348	(14,670)	[3,521]	{1,760}
Monroe	36,799	36,807	36,824	36,835	36,851	(7,370)	[1,769]	{884}	36,867	(7,373)	[1,770]	{885}	36,884	(7,377)	[1,770]	{885}
Montgomery	151,349	151,385	151,450	151,561	151,727	(30,345)	[7,283]	{3,641}	151,905	(30,381)	[7,291]	{3,646}	152,083	(30,417)	[7,300]	{3,650}
Northampton	79,166	79,169	79,182	79,224	79,253	(15,851)	[3,804]	{1,902}	79,280	(15,856)	[3,805]	{1,903}	79,307	(15,861)	[3,807]	{1,903}
Philadelphia	307,095	307,142	307,160	307,297	307,490	(61,498)	[14,760]	{7,380}	307,663	(61,533)	[14,768]	{7,384}	307,840	(61,568)	[14,776]	{7,388}
Westmoreland	79,450	79,465	79,480	79,498	79,525	(15,905)	[3,817]	{1,909}	79,549	(15,910)	[3,818]	{1,909}	79,574	(15,915)	[3,820]	{1,910}
York	118,264	118,277	118,295	118,310	118,333	(23,667)	[5,680]	{2,840}	118,354	(23,671)	[5,681]	{2,841}	118,375	(23,675)	[5,682]	{2,841}

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.