

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 6/14/21

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 6/14/21 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.

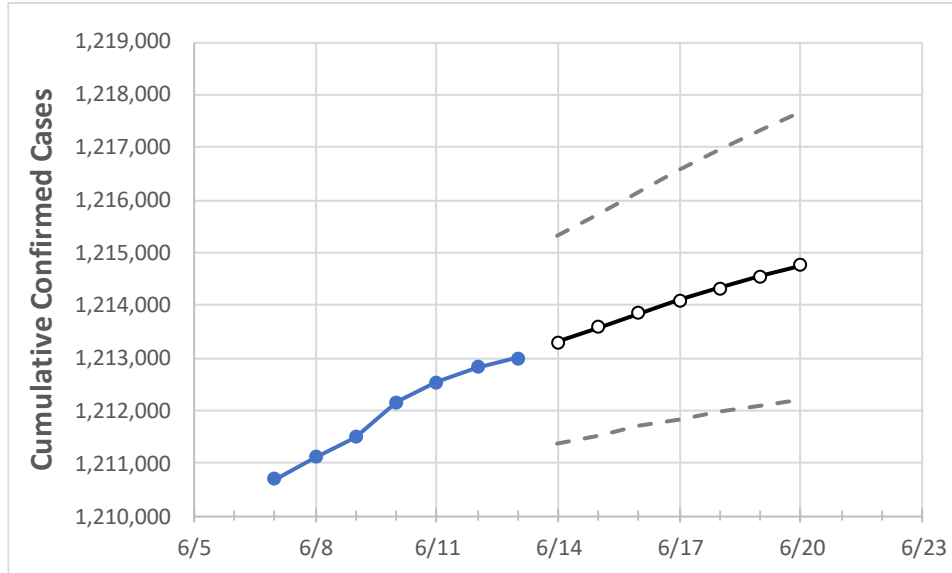
IEM's Modeling Lead

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20

Pennsylvania 1,212,155 1,212,529 1,212,831 1,212,999 1,213,290 1,213,573 1,213,844 1,214,092 1,214,328 1,214,560 1,214,767

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Allegheny	101,605	101,624	101,639	101,646	101,662	101,677	101,691	101,704	101,716	101,726	101,737
Berks	48,232	48,254	48,273	48,293	48,308	48,323	48,337	48,350	48,363	48,375	48,386
Bucks	60,709	60,714	60,725	60,736	60,743	60,750	60,756	60,761	60,767	60,772	60,776
Butler	17,553	17,555	17,558	17,564	17,569	17,574	17,579	17,583	17,587	17,591	17,595
Chester	40,691	40,704	40,704	40,704	40,708	40,711	40,714	40,717	40,720	40,722	40,724
Delaware	52,327	52,350	52,350	52,350	52,363	52,375	52,387	52,399	52,410	52,421	52,430
Lackawanna	18,485	18,491	18,498	18,499	18,502	18,505	18,507	18,510	18,512	18,514	18,516
Lancaster	55,280	55,292	55,305	55,311	55,319	55,327	55,334	55,341	55,348	55,354	55,359
Lehigh	39,743	39,759	39,769	39,774	39,782	39,791	39,799	39,806	39,813	39,820	39,826
Luzerne	31,964	31,977	31,996	32,008	32,019	32,029	32,040	32,049	32,058	32,067	32,074
Monroe	14,753	14,767	14,771	14,775	14,779	14,782	14,786	14,789	14,792	14,795	14,798
Montgomery	70,246	70,255	70,279	70,289	70,301	70,311	70,321	70,331	70,339	70,348	70,356
Northampton	35,773	35,787	35,792	35,797	35,802	35,806	35,810	35,814	35,818	35,821	35,824
Philadelphia	153,888	153,888	153,888	153,888	153,929	153,965	154,000	154,034	154,065	154,093	154,122
Westmoreland	34,258	34,280	34,287	34,290	34,299	34,307	34,315	34,322	34,329	34,336	34,342
York	46,810	46,819	46,848	46,859	46,886	46,912	46,937	46,963	46,987	47,011	47,033

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:											
	6/10	6/11	6/12	6/13	6/15			6/17			6/19					
Allegheny	101,605	101,624	101,639	101,646	101,677	(20,335)	[4,881]	{2,440}	101,704	(20,341)	[4,882]	{2,441}	101,726	(20,345)	[4,883]	{2,441}
Berks	48,232	48,254	48,273	48,293	48,323	(9,665)	[2,320]	{1,160}	48,350	(9,670)	[2,321]	{1,160}	48,375	(9,675)	[2,322]	{1,161}
Bucks	60,709	60,714	60,725	60,736	60,750	(12,150)	[2,916]	{1,458}	60,761	(12,152)	[2,917]	{1,458}	60,772	(12,154)	[2,917]	{1,459}
Butler	17,553	17,555	17,558	17,564	17,574	(3,515)	[844]	{422}	17,583	(3,517)	[844]	{422}	17,591	(3,518)	[844]	{422}
Chester	40,691	40,704	40,704	40,704	40,711	(8,142)	[1,954]	{977}	40,717	(8,143)	[1,954]	{977}	40,722	(8,144)	[1,955]	{977}
Delaware	52,327	52,350	52,350	52,350	52,375	(10,475)	[2,514]	{1,257}	52,399	(10,480)	[2,515]	{1,258}	52,421	(10,484)	[2,516]	{1,258}
Lackawanna	18,485	18,491	18,498	18,499	18,505	(3,701)	[888]	{444}	18,510	(3,702)	[888]	{444}	18,514	(3,703)	[889]	{444}
Lancaster	55,280	55,292	55,305	55,311	55,327	(11,065)	[2,656]	{1,328}	55,341	(11,068)	[2,656]	{1,328}	55,354	(11,071)	[2,657]	{1,328}
Lehigh	39,743	39,759	39,769	39,774	39,791	(7,958)	[1,910]	{955}	39,806	(7,961)	[1,911]	{955}	39,820	(7,964)	[1,911]	{956}
Luzerne	31,964	31,977	31,996	32,008	32,029	(6,406)	[1,537]	{769}	32,049	(6,410)	[1,538]	{769}	32,067	(6,413)	[1,539]	{770}
Monroe	14,753	14,767	14,771	14,775	14,782	(2,956)	[710]	{355}	14,789	(2,958)	[710]	{355}	14,795	(2,959)	[710]	{355}
Montgomery	70,246	70,255	70,279	70,289	70,311	(14,062)	[3,375]	{1,687}	70,331	(14,066)	[3,376]	{1,688}	70,348	(14,070)	[3,377]	{1,688}
Northampton	35,773	35,787	35,792	35,797	35,806	(7,161)	[1,719]	{859}	35,814	(7,163)	[1,719]	{860}	35,821	(7,164)	[1,719]	{860}
Philadelphia	153,888	153,888	153,888	153,888	153,965	(30,793)	[7,390]	{3,695}	154,034	(30,807)	[7,394]	{3,697}	154,093	(30,819)	[7,396]	{3,698}
Westmoreland	34,258	34,280	34,287	34,290	34,307	(6,861)	[1,647]	{823}	34,322	(6,864)	[1,647]	{824}	34,336	(6,867)	[1,648]	{824}
York	46,810	46,819	46,848	46,859	46,912	(9,382)	[2,252]	{1,126}	46,963	(9,393)	[2,254]	{1,127}	47,011	(9,402)	[2,257]	{1,128}

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.