

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

**Date: 3/4/21**

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 3/4/21 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.**

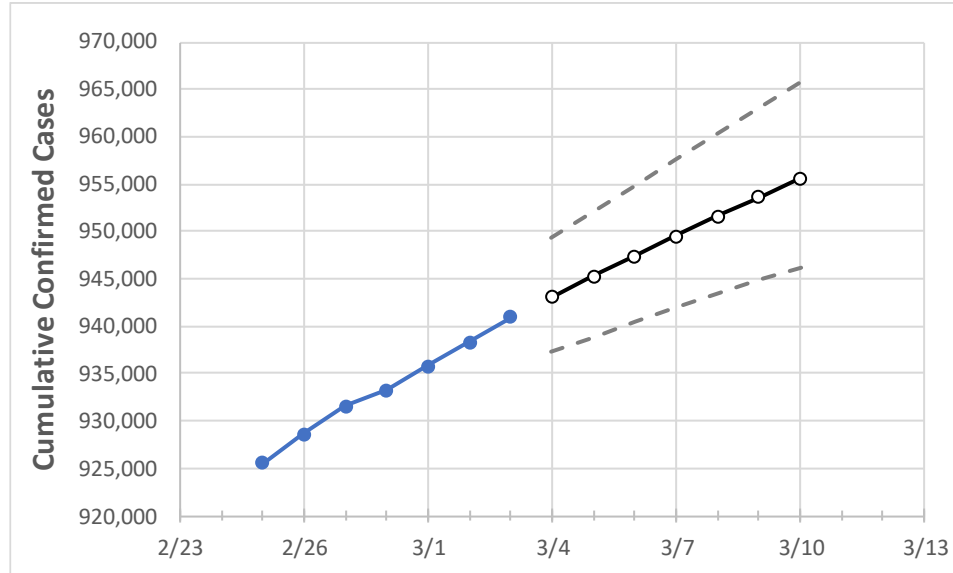
### **IEM's Modeling Lead**

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Pennsylvania	933,261	935,822	938,296	940,923	943,117	945,296	947,426	949,548	951,620	953,588	955,639

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Allegheny	76,669	76,853	77,053	77,239	77,471	77,694	77,919	78,133	78,351	78,566	78,775
Berks	35,658	35,699	35,791	35,888	35,962	36,034	36,103	36,171	36,238	36,303	36,366
Bucks	45,046	45,176	45,320	45,456	45,580	45,702	45,823	45,944	46,059	46,175	46,285
Butler	13,916	13,939	13,978	14,013	14,043	14,072	14,102	14,131	14,160	14,188	14,216
Chester	28,127	28,201	28,261	28,353	28,427	28,500	28,574	28,646	28,718	28,788	28,860
Delaware	40,957	41,033	41,132	41,224	41,322	41,422	41,518	41,611	41,707	41,801	41,896
Lackawanna	13,934	13,964	14,009	14,072	14,117	14,162	14,206	14,250	14,291	14,335	14,377
Lancaster	43,630	43,705	43,809	43,951	44,043	44,133	44,217	44,303	44,384	44,465	44,541
Lehigh	30,755	30,811	30,897	30,975	31,048	31,121	31,194	31,266	31,337	31,408	31,478
Luzerne	24,905	24,928	24,973	25,033	25,079	25,123	25,167	25,209	25,250	25,291	25,331
Monroe	9,656	9,679	9,732	9,783	9,818	9,854	9,889	9,925	9,960	9,995	10,030
Montgomery	53,921	54,030	54,217	54,364	54,511	54,658	54,806	54,947	55,087	55,226	55,360
Northampton	26,814	26,855	26,969	27,090	27,172	27,253	27,332	27,410	27,485	27,559	27,632
Philadelphia	118,356	118,594	118,906	119,245	119,485	119,721	119,961	120,192	120,420	120,651	120,874
Westmoreland	26,767	26,817	26,864	26,938	26,995	27,049	27,103	27,156	27,208	27,260	27,310
York	35,812	35,878	35,938	36,033	36,105	36,172	36,237	36,300	36,362	36,420	36,478

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:											
	2/28	3/1	3/2	3/3	3/5			3/7			3/9					
Allegheny	76,669	76,853	77,053	77,239	77,694	(15,539)	[3,729]	{1,865}	78,133	(15,627)	[3,750]	{1,875}	78,566	(15,713)	[3,771]	{1,886}
Berks	35,658	35,699	35,791	35,888	36,034	(7,207)	[1,730]	{865}	36,171	(7,234)	[1,736]	{868}	36,303	(7,261)	[1,743]	{871}
Bucks	45,046	45,176	45,320	45,456	45,702	(9,140)	[2,194]	{1,097}	45,944	(9,189)	[2,205]	{1,103}	46,175	(9,235)	[2,216]	{1,108}
Butler	13,916	13,939	13,978	14,013	14,072	(2,814)	[675]	{338}	14,131	(2,826)	[678]	{339}	14,188	(2,838)	[681]	{341}
Chester	28,127	28,201	28,261	28,353	28,500	(5,700)	[1,368]	{684}	28,646	(5,729)	[1,375]	{688}	28,788	(5,758)	[1,382]	{691}
Delaware	40,957	41,033	41,132	41,224	41,422	(8,284)	[1,988]	{994}	41,611	(8,322)	[1,997]	{999}	41,801	(8,360)	[2,006]	{1,003}
Lackawanna	13,934	13,964	14,009	14,072	14,162	(2,832)	[680]	{340}	14,250	(2,850)	[684]	{342}	14,335	(2,867)	[688]	{344}
Lancaster	43,630	43,705	43,809	43,951	44,133	(8,827)	[2,118]	{1,059}	44,303	(8,861)	[2,127]	{1,063}	44,465	(8,893)	[2,134]	{1,067}
Lehigh	30,755	30,811	30,897	30,975	31,121	(6,224)	[1,494]	{747}	31,266	(6,253)	[1,501]	{750}	31,408	(6,282)	[1,508]	{754}
Luzerne	24,905	24,928	24,973	25,033	25,123	(5,025)	[1,206]	{603}	25,209	(5,042)	[1,210]	{605}	25,291	(5,058)	[1,214]	{607}
Monroe	9,656	9,679	9,732	9,783	9,854	(1,971)	[473]	{236}	9,925	(1,985)	[476]	{238}	9,995	(1,999)	[480]	{240}
Montgomery	53,921	54,030	54,217	54,364	54,658	(10,932)	[2,624]	{1,312}	54,947	(10,989)	[2,637]	{1,319}	55,226	(11,045)	[2,651]	{1,325}
Northampton	26,814	26,855	26,969	27,090	27,253	(5,451)	[1,308]	{654}	27,410	(5,482)	[1,316]	{658}	27,559	(5,512)	[1,323]	{661}
Philadelphia	118,356	118,594	118,906	119,245	119,721	(23,944)	[5,747]	{2,873}	120,192	(24,038)	[5,769]	{2,885}	120,651	(24,130)	[5,791]	{2,896}
Westmoreland	26,767	26,817	26,864	26,938	27,049	(5,410)	[1,298]	{649}	27,156	(5,431)	[1,303]	{652}	27,260	(5,452)	[1,308]	{654}
York	35,812	35,878	35,938	36,033	36,172	(7,234)	[1,736]	{868}	36,300	(7,260)	[1,742]	{871}	36,420	(7,284)	[1,748]	{874}

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.