

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 9/14/20**

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

The projections shown in this document are based on data pulled in as of 9/14/20 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.**

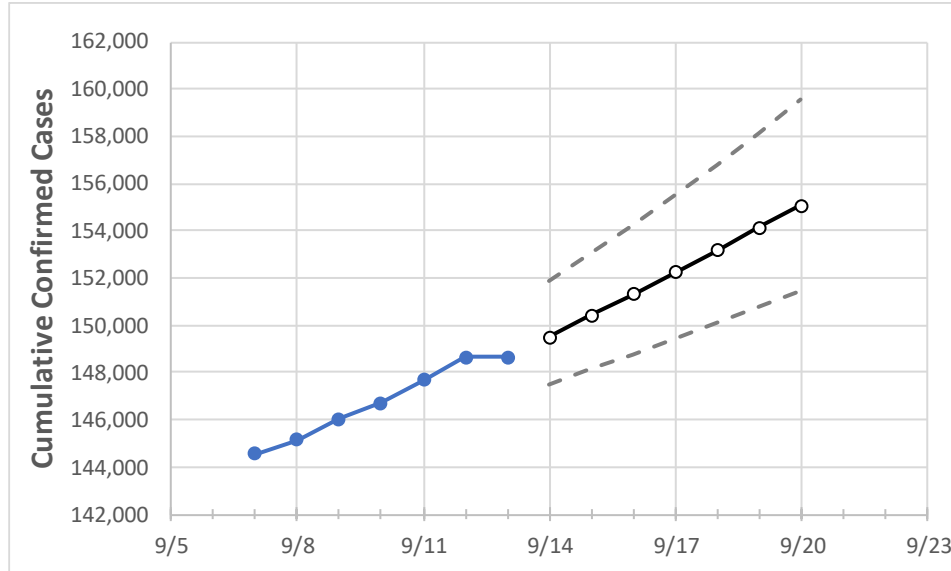
**IEM's Modeling Lead**

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:						
	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20
Pennsylvania	146,696	147,703	148,635	148,635	149,515	150,409	151,316	152,237	153,172	154,121	155,084

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:						
	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20
Allegheny	10,969	11,069	11,126	11,126	11,187	11,248	11,309	11,372	11,434	11,498	11,562
Berks	6,412	6,442	6,521	6,521	6,550	6,579	6,608	6,637	6,666	6,695	6,724
Bucks	8,148	8,198	8,229	8,229	8,258	8,287	8,317	8,346	8,377	8,407	8,438
Butler	913	923	932	932	940	949	958	967	977	987	997
Chester	6,149	6,187	6,187	6,187	6,236	6,286	6,340	6,395	6,454	6,515	6,579
Delaware	10,767	10,811	10,857	10,857	10,895	10,934	10,972	11,009	11,047	11,085	11,122
Lackawanna	2,225	2,262	2,301	2,301	2,317	2,334	2,352	2,371	2,391	2,412	2,435
Lancaster	7,185	7,238	7,273	7,273	7,319	7,365	7,412	7,460	7,508	7,556	7,606
Lehigh	5,339	5,348	5,366	5,366	5,378	5,390	5,403	5,416	5,429	5,443	5,457
Luzerne	3,913	3,926	3,941	3,941	3,949	3,956	3,964	3,971	3,979	3,986	3,993
Monroe	1,750	1,753	1,753	1,753	1,756	1,759	1,762	1,765	1,768	1,771	1,774
Montgomery	11,510	11,537	11,578	11,578	11,620	11,663	11,705	11,748	11,790	11,832	11,874
Northampton	4,196	4,210	4,224	4,224	4,233	4,242	4,251	4,261	4,271	4,281	4,292
Philadelphia	34,887	34,986	35,094	35,094	35,173	35,251	35,329	35,405	35,481	35,556	35,631
Westmoreland	1,925	1,945	1,962	1,962	1,972	1,982	1,993	2,003	2,013	2,024	2,034
York	3,929	3,995	4,124	4,124	4,175	4,227	4,281	4,336	4,392	4,450	4,509

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:							
	9/10	9/11	9/12	9/13	9/15		9/17		9/19			
Allegheny	10,969	11,069	11,126	11,126	11,248	(2,250) [540] {270}	11,372	(2,274) [546] {273}	11,498	(2,300) [552] {276}		
Berks	6,412	6,442	6,521	6,521	6,579	(1,316) [316] {158}	6,637	(1,327) [319] {159}	6,695	(1,339) [321] {161}		
Bucks	8,148	8,198	8,229	8,229	8,287	(1,657) [398] {199}	8,346	(1,669) [401] {200}	8,407	(1,681) [404] {202}		
Butler	913	923	932	932	949	(190) [46] {23}	967	(193) [46] {23}	987	(197) [47] {24}		
Chester	6,149	6,187	6,187	6,187	6,286	(1,257) [302] {151}	6,395	(1,279) [307] {153}	6,515	(1,303) [313] {156}		
Delaware	10,767	10,811	10,857	10,857	10,934	(2,187) [525] {262}	11,009	(2,202) [528] {264}	11,085	(2,217) [532] {266}		
Lackawanna	2,225	2,262	2,301	2,301	2,334	(467) [112] {56}	2,371	(474) [114] {57}	2,412	(482) [116] {58}		
Lancaster	7,185	7,238	7,273	7,273	7,365	(1,473) [354] {177}	7,460	(1,492) [358] {179}	7,556	(1,511) [363] {181}		
Lehigh	5,339	5,348	5,366	5,366	5,390	(1,078) [259] {129}	5,416	(1,083) [260] {130}	5,443	(1,089) [261] {131}		
Luzerne	3,913	3,926	3,941	3,941	3,956	(791) [190] {95}	3,971	(794) [191] {95}	3,986	(797) [191] {96}		
Monroe	1,750	1,753	1,753	1,753	1,759	(352) [84] {42}	1,765	(353) [85] {42}	1,771	(354) [85] {42}		
Montgomery	11,510	11,537	11,578	11,578	11,663	(2,333) [560] {280}	11,748	(2,350) [564] {282}	11,832	(2,366) [568] {284}		
Northampton	4,196	4,210	4,224	4,224	4,242	(848) [204] {102}	4,261	(852) [205] {102}	4,281	(856) [206] {103}		
Philadelphia	34,887	34,986	35,094	35,094	35,251	(7,050) [1,692] {846}	35,405	(7,081) [1,699] {850}	35,556	(7,111) [1,707] {853}		
Westmoreland	1,925	1,945	1,962	1,962	1,982	(396) [95] {48}	2,003	(401) [96] {48}	2,024	(405) [97] {49}		
York	3,929	3,995	4,124	4,124	4,227	(845) [203] {101}	4,336	(867) [208] {104}	4,450	(890) [214] {107}		

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.