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

Date: 12/16/20

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 12/16/20 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.

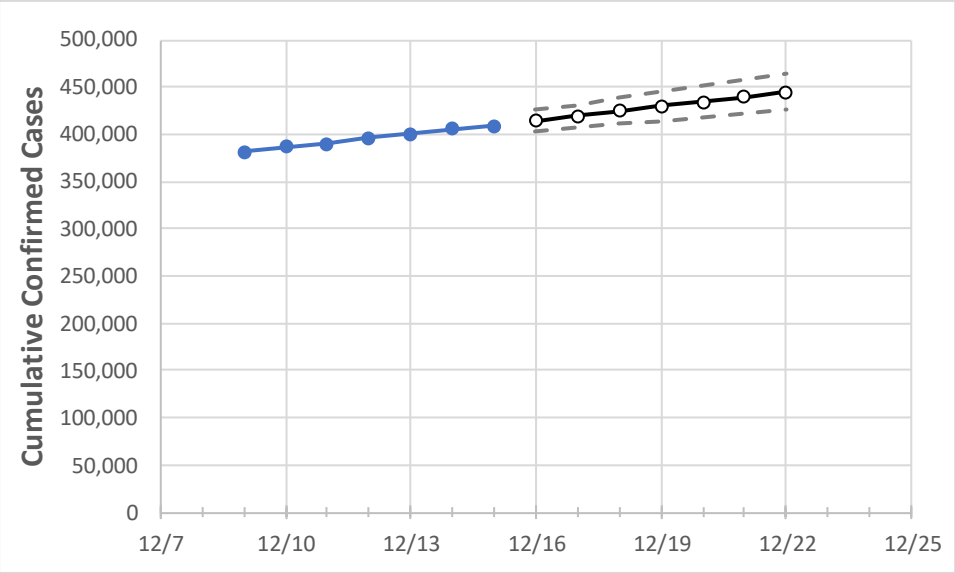
IEM's Modeling Lead

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.

New Jersey State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
New Jersey	396,496	400,650	405,448	409,414	414,426	419,470	424,546	429,653	434,792	439,962	445,163

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.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
Bergen	40,115	40,483	40,879	41,216	41,624	42,032	42,440	42,846	43,253	43,658	44,063
Burlington	16,736	16,874	17,179	17,392	17,638	17,885	18,135	18,385	18,638	18,892	19,148
Camden	23,486	23,633	24,003	24,248	24,579	24,911	25,245	25,580	25,916	26,253	26,591
Essex	40,650	41,089	41,471	41,767	42,202	42,639	43,079	43,521	43,966	44,413	44,862
Gloucester	11,375	11,472	11,597	11,756	11,948	12,142	12,339	12,538	12,740	12,944	13,150
Hudson	36,850	37,187	37,521	37,925	38,359	38,795	39,235	39,678	40,123	40,571	41,022
Hunterdon	3,015	3,040	3,077	3,108	3,152	3,196	3,240	3,285	3,331	3,377	3,423
Mercer	15,985	16,134	16,312	16,515	16,689	16,863	17,036	17,209	17,383	17,556	17,728
Middlesex	36,246	36,739	37,291	37,721	38,250	38,788	39,335	39,892	40,458	41,034	41,619
Monmouth	25,001	25,288	25,681	25,981	26,368	26,760	27,156	27,558	27,964	28,376	28,793
Morris	16,486	16,692	16,934	17,092	17,341	17,593	17,849	18,108	18,371	18,638	18,908
Ocean	25,927	26,145	26,505	26,733	27,086	27,444	27,807	28,175	28,549	28,928	29,312
Passaic	34,930	35,368	35,737	35,996	36,371	36,746	37,119	37,492	37,864	38,235	38,606
Somerset	10,571	10,671	10,798	10,923	11,052	11,183	11,316	11,450	11,586	11,723	11,862
Sussex	3,294	3,349	3,403	3,455	3,523	3,593	3,665	3,739	3,816	3,894	3,975
Union	32,101	32,383	32,669	32,935	33,229	33,525	33,820	34,116	34,413	34,710	35,008
Warren	3,041	3,079	3,146	3,181	3,232	3,285	3,338	3,392	3,447	3,503	3,560

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.*

New Jersey Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	12/12	12/13	12/14	12/15	12/17	12/19	12/21
Bergen	40,115	40,483	40,879	41,216	42,032 (8,406) [2,018] {1,009}	42,846 (8,569) [2,057] {1,028}	43,658 (8,732) [2,096] {1,048}
Burlington	16,736	16,874	17,179	17,392	17,885 (3,577) [858] {429}	18,385 (3,677) [882] {441}	18,892 (3,778) [907] {453}
Camden	23,486	23,633	24,003	24,248	24,911 (4,982) [1,196] {598}	25,580 (5,116) [1,228] {614}	26,253 (5,251) [1,260] {630}
Essex	40,650	41,089	41,471	41,767	42,639 (8,528) [2,047] {1,023}	43,521 (8,704) [2,089] {1,045}	44,413 (8,883) [2,132] {1,066}
Gloucester	11,375	11,472	11,597	11,756	12,142 (2,428) [583] {291}	12,538 (2,508) [602] {301}	12,944 (2,589) [621] {311}
Hudson	36,850	37,187	37,521	37,925	38,795 (7,759) [1,862] {931}	39,678 (7,936) [1,905] {952}	40,571 (8,114) [1,947] {974}
Hunterdon	3,015	3,040	3,077	3,108	3,196 (639) [153] {77}	3,285 (657) [158] {79}	3,377 (675) [162] {81}
Mercer	15,985	16,134	16,312	16,515	16,863 (3,373) [809] {405}	17,209 (3,442) [826] {413}	17,556 (3,511) [843] {421}
Middlesex	36,246	36,739	37,291	37,721	38,788 (7,758) [1,862] {931}	39,892 (7,978) [1,915] {957}	41,034 (8,207) [1,970] {985}
Monmouth	25,001	25,288	25,681	25,981	26,760 (5,352) [1,284] {642}	27,558 (5,512) [1,323] {661}	28,376 (5,675) [1,362] {681}
Morris	16,486	16,692	16,934	17,092	17,593 (3,519) [844] {422}	18,108 (3,622) [869] {435}	18,638 (3,728) [895] {447}
Ocean	25,927	26,145	26,505	26,733	27,444 (5,489) [1,317] {659}	28,175 (5,635) [1,352] {676}	28,928 (5,786) [1,389] {694}
Passaic	34,930	35,368	35,737	35,996	36,746 (7,349) [1,764] {882}	37,492 (7,498) [1,800] {900}	38,235 (7,647) [1,835] {918}
Somerset	10,571	10,671	10,798	10,923	11,183 (2,237) [537] {268}	11,450 (2,290) [550] {275}	11,723 (2,345) [563] {281}
Sussex	3,294	3,349	3,403	3,455	3,593 (719) [172] {86}	3,739 (748) [179] {90}	3,894 (779) [187] {93}
Union	32,101	32,383	32,669	32,935	33,525 (6,705) [1,609] {805}	34,116 (6,823) [1,638] {819}	34,710 (6,942) [1,666] {833}
Warren	3,041	3,079	3,146	3,181	3,285 (657) [158] {79}	3,392 (678) [163] {81}	3,503 (701) [168] {84}

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.