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

Date: 12/18/20

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 12/18/20 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.

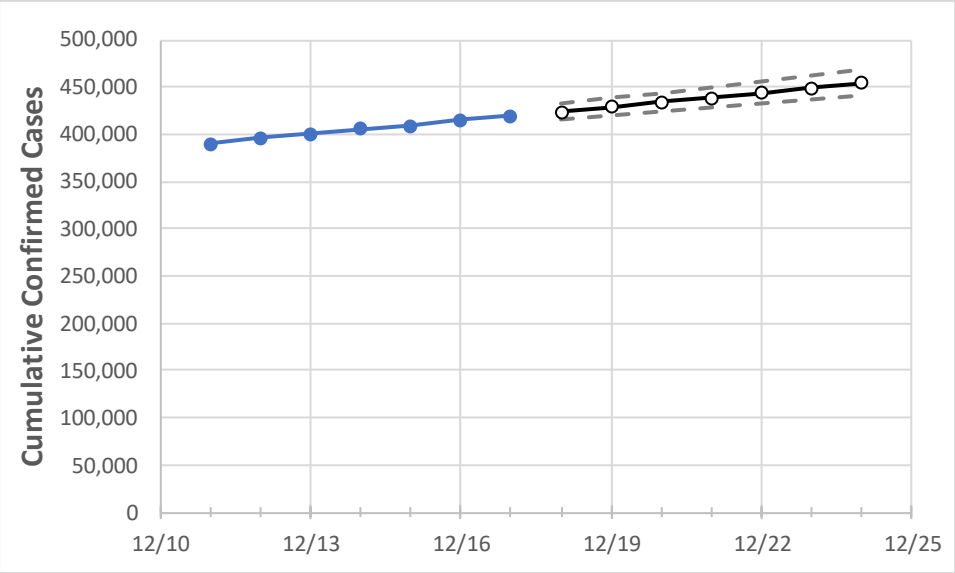
IEM's Modeling Lead

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:						
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24
New Jersey	405,448	409,414	415,075	419,330	424,233	429,146	434,071	439,008	443,957	448,916	453,886

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:						
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24
Bergen	40,879	41,216	41,641	42,008	42,393	42,774	43,153	43,529	43,902	44,272	44,640
Burlington	17,179	17,392	17,630	17,812	18,048	18,284	18,519	18,755	18,990	19,226	19,461
Camden	24,003	24,248	24,539	24,872	25,194	25,517	25,839	26,162	26,485	26,808	27,131
Essex	41,471	41,767	42,329	42,666	43,110	43,555	44,002	44,452	44,903	45,356	45,811
Gloucester	11,597	11,756	11,898	12,052	12,229	12,407	12,586	12,766	12,946	13,127	13,309
Hudson	37,521	37,925	38,429	38,675	39,092	39,509	39,928	40,347	40,768	41,189	41,611
Hunterdon	3,077	3,108	3,156	3,185	3,227	3,269	3,311	3,354	3,397	3,441	3,484
Mercer	16,312	16,515	16,725	16,897	17,077	17,257	17,438	17,620	17,801	17,984	18,167
Middlesex	37,291	37,721	38,339	38,857	39,422	39,998	40,586	41,186	41,798	42,421	43,057
Monmouth	25,681	25,981	26,465	26,824	27,230	27,641	28,058	28,480	28,908	29,342	29,782
Morris	16,934	17,092	17,339	17,547	17,798	18,052	18,308	18,567	18,830	19,095	19,363
Ocean	26,505	26,733	27,191	27,522	27,892	28,268	28,650	29,039	29,435	29,837	30,246
Passaic	35,737	35,996	36,414	36,690	37,051	37,410	37,766	38,120	38,471	38,820	39,167
Somerset	10,798	10,923	11,102	11,222	11,358	11,495	11,634	11,775	11,918	12,063	12,209
Sussex	3,403	3,455	3,511	3,555	3,621	3,689	3,758	3,829	3,901	3,974	4,049
Union	32,669	32,935	33,375	33,588	33,887	34,186	34,486	34,786	35,087	35,387	35,689
Warren	3,146	3,181	3,236	3,289	3,343	3,397	3,452	3,509	3,566	3,624	3,683

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:		
	12/14	12/15	12/16	12/17	12/19	12/21	12/23
Bergen	40,879	41,216	41,641	42,008	42,774 (8,555) [2,053] {1,027}	43,529 (8,706) [2,089] {1,045}	44,272 (8,854) [2,125] {1,063}
Burlington	17,179	17,392	17,630	17,812	18,284 (3,657) [878] {439}	18,755 (3,751) [900] {450}	19,226 (3,845) [923] {461}
Camden	24,003	24,248	24,539	24,872	25,517 (5,103) [1,225] {612}	26,162 (5,232) [1,256] {628}	26,808 (5,362) [1,287] {643}
Essex	41,471	41,767	42,329	42,666	43,555 (8,711) [2,091] {1,045}	44,452 (8,890) [2,134] {1,067}	45,356 (9,071) [2,177] {1,089}
Gloucester	11,597	11,756	11,898	12,052	12,407 (2,481) [596] {298}	12,766 (2,553) [613] {306}	13,127 (2,625) [630] {315}
Hudson	37,521	37,925	38,429	38,675	39,509 (7,902) [1,896] {948}	40,347 (8,069) [1,937] {968}	41,189 (8,238) [1,977] {989}
Hunterdon	3,077	3,108	3,156	3,185	3,269 (654) [157] {78}	3,354 (671) [161] {81}	3,441 (688) [165] {83}
Mercer	16,312	16,515	16,725	16,897	17,257 (3,451) [828] {414}	17,620 (3,524) [846] {423}	17,984 (3,597) [863] {432}
Middlesex	37,291	37,721	38,339	38,857	39,998 (8,000) [1,920] {960}	41,186 (8,237) [1,977] {988}	42,421 (8,484) [2,036] {1,018}
Monmouth	25,681	25,981	26,465	26,824	27,641 (5,528) [1,327] {663}	28,480 (5,696) [1,367] {684}	29,342 (5,868) [1,408] {704}
Morris	16,934	17,092	17,339	17,547	18,052 (3,610) [866] {433}	18,567 (3,713) [891] {446}	19,095 (3,819) [917] {458}
Ocean	26,505	26,733	27,191	27,522	28,268 (5,654) [1,357] {678}	29,039 (5,808) [1,394] {697}	29,837 (5,967) [1,432] {716}
Passaic	35,737	35,996	36,414	36,690	37,410 (7,482) [1,796] {898}	38,120 (7,624) [1,830] {915}	38,820 (7,764) [1,863] {932}
Somerset	10,798	10,923	11,102	11,222	11,495 (2,299) [552] {276}	11,775 (2,355) [565] {283}	12,063 (2,413) [579] {290}
Sussex	3,403	3,455	3,511	3,555	3,689 (738) [177] {89}	3,829 (766) [184] {92}	3,974 (795) [191] {95}
Union	32,669	32,935	33,375	33,588	34,186 (6,837) [1,641] {820}	34,786 (6,957) [1,670] {835}	35,387 (7,077) [1,699] {849}
Warren	3,146	3,181	3,236	3,289	3,397 (679) [163] {82}	3,509 (702) [168] {84}	3,624 (725) [174] {87}

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.