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

Date: 12/3/20

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 12/3/20 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.

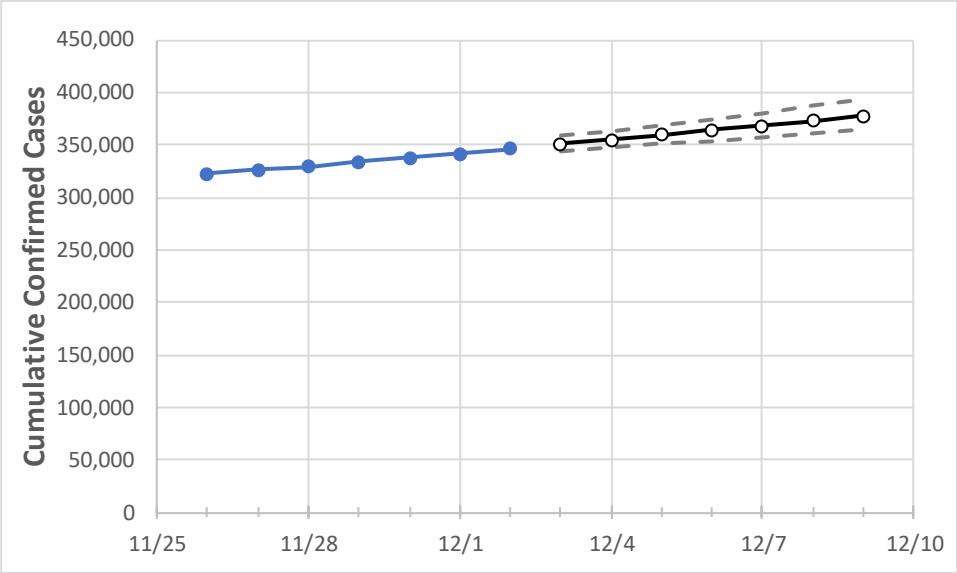
IEM's Modeling Lead

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
New Jersey	334,114	337,304	341,910	346,206	350,546	354,937	359,377	363,869	368,412	373,007	377,654

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Bergen	34,583	34,871	35,327	35,726	36,146	36,572	37,003	37,441	37,885	38,334	38,790
Burlington	13,636	13,803	14,017	14,203	14,436	14,674	14,915	15,161	15,412	15,666	15,926
Camden	18,956	19,249	19,501	19,842	20,163	20,489	20,819	21,154	21,493	21,837	22,185
Essex	35,041	35,358	35,788	36,082	36,408	36,732	37,055	37,377	37,698	38,018	38,336
Gloucester	8,932	9,053	9,190	9,331	9,464	9,597	9,731	9,865	10,000	10,136	10,273
Hudson	31,432	31,691	32,033	32,465	32,831	33,203	33,581	33,965	34,355	34,752	35,155
Hunterdon	2,469	2,510	2,535	2,577	2,615	2,654	2,693	2,734	2,775	2,816	2,859
Mercer	13,724	13,797	13,992	14,170	14,351	14,535	14,719	14,906	15,095	15,285	15,477
Middlesex	30,273	30,562	31,107	31,578	31,957	32,343	32,737	33,140	33,551	33,970	34,398
Monmouth	20,447	20,657	20,961	21,267	21,564	21,866	22,173	22,485	22,802	23,124	23,452
Morris	13,515	13,647	13,928	14,118	14,319	14,525	14,734	14,948	15,166	15,388	15,614
Ocean	21,748	21,993	22,277	22,545	22,835	23,134	23,441	23,757	24,082	24,416	24,759
Passaic	29,849	30,180	30,576	31,047	31,440	31,841	32,249	32,664	33,087	33,517	33,955
Somerset	9,032	9,104	9,231	9,360	9,466	9,573	9,681	9,791	9,902	10,014	10,127
Sussex	2,549	2,593	2,655	2,687	2,729	2,773	2,817	2,863	2,909	2,957	3,006
Union	28,255	28,437	28,756	28,969	29,231	29,491	29,752	30,011	30,270	30,529	30,786
Warren	2,495	2,512	2,526	2,570	2,600	2,630	2,661	2,691	2,722	2,752	2,783

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:		
	11/29	11/30	12/1	12/2	12/4	12/6	12/8
Bergen	34,583	34,871	35,327	35,726	36,572 (7,314) [1,755] {878}	37,441 (7,488) [1,797] {899}	38,334 (7,667) [1,840] {920}
Burlington	13,636	13,803	14,017	14,203	14,674 (2,935) [704] {352}	15,161 (3,032) [728] {364}	15,666 (3,133) [752] {376}
Camden	18,956	19,249	19,501	19,842	20,489 (4,098) [983] {492}	21,154 (4,231) [1,015] {508}	21,837 (4,367) [1,048] {524}
Essex	35,041	35,358	35,788	36,082	36,732 (7,346) [1,763] {882}	37,377 (7,475) [1,794] {897}	38,018 (7,604) [1,825] {912}
Gloucester	8,932	9,053	9,190	9,331	9,597 (1,919) [461] {230}	9,865 (1,973) [474] {237}	10,136 (2,027) [487] {243}
Hudson	31,432	31,691	32,033	32,465	33,203 (6,641) [1,594] {797}	33,965 (6,793) [1,630] {815}	34,752 (6,950) [1,668] {834}
Hunterdon	2,469	2,510	2,535	2,577	2,654 (531) [127] {64}	2,734 (547) [131] {66}	2,816 (563) [135] {68}
Mercer	13,724	13,797	13,992	14,170	14,535 (2,907) [698] {349}	14,906 (2,981) [715] {358}	15,285 (3,057) [734] {367}
Middlesex	30,273	30,562	31,107	31,578	32,343 (6,469) [1,552] {776}	33,140 (6,628) [1,591] {795}	33,970 (6,794) [1,631] {815}
Monmouth	20,447	20,657	20,961	21,267	21,866 (4,373) [1,050] {525}	22,485 (4,497) [1,079] {540}	23,124 (4,625) [1,110] {555}
Morris	13,515	13,647	13,928	14,118	14,525 (2,905) [697] {349}	14,948 (2,990) [717] {359}	15,388 (3,078) [739] {369}
Ocean	21,748	21,993	22,277	22,545	23,134 (4,627) [1,110] {555}	23,757 (4,751) [1,140] {570}	24,416 (4,883) [1,172] {586}
Passaic	29,849	30,180	30,576	31,047	31,841 (6,368) [1,528] {764}	32,664 (6,533) [1,568] {784}	33,517 (6,703) [1,609] {804}
Somerset	9,032	9,104	9,231	9,360	9,573 (1,915) [459] {230}	9,791 (1,958) [470] {235}	10,014 (2,003) [481] {240}
Sussex	2,549	2,593	2,655	2,687	2,773 (555) [133] {67}	2,863 (573) [137] {69}	2,957 (591) [142] {71}
Union	28,255	28,437	28,756	28,969	29,491 (5,898) [1,416] {708}	30,011 (6,002) [1,441] {720}	30,529 (6,106) [1,465] {733}
Warren	2,495	2,512	2,526	2,570	2,630 (526) [126] {63}	2,691 (538) [129] {65}	2,752 (550) [132] {66}

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.