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

Date: 10/27/21

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 10/27/21 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.

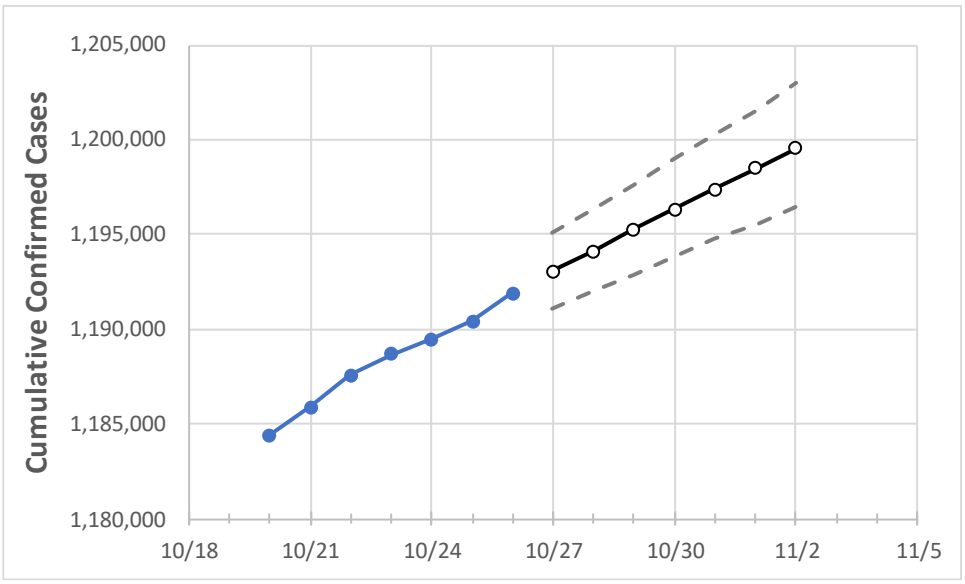
IEM's Modeling Lead

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.

New Jersey State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
New Jersey	1,188,709	1,189,496	1,190,439	1,191,912	1,193,057	1,194,143	1,195,256	1,196,336	1,197,404	1,198,479	1,199,530

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.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Bergen	119,208	119,267	119,375	119,509	119,601	119,690	119,782	119,867	119,958	120,043	120,126
Burlington	54,279	54,339	54,402	54,498	54,577	54,655	54,732	54,808	54,886	54,961	55,037
Camden	67,590	67,650	67,719	67,815	67,896	67,974	68,050	68,127	68,204	68,280	68,353
Essex	105,856	105,879	105,931	106,049	106,086	106,123	106,157	106,192	106,225	106,262	106,290
Gloucester	38,037	38,079	38,115	38,192	38,249	38,303	38,359	38,408	38,462	38,517	38,568
Hudson	97,140	97,187	97,219	97,277	97,327	97,379	97,429	97,479	97,529	97,580	97,629
Hunterdon	11,948	11,960	11,969	11,991	12,012	12,031	12,052	12,072	12,092	12,112	12,131
Mercer	39,289	39,314	39,350	39,397	39,448	39,499	39,550	39,603	39,654	39,708	39,759
Middlesex	105,834	105,880	105,950	106,076	106,167	106,258	106,346	106,437	106,525	106,615	106,701
Monmouth	91,778	91,855	91,939	92,040	92,149	92,257	92,364	92,471	92,577	92,682	92,787
Morris	57,710	57,753	57,787	57,849	57,902	57,954	58,005	58,056	58,107	58,158	58,205
Ocean	94,419	94,533	94,661	94,834	94,988	95,140	95,288	95,436	95,581	95,723	95,867
Passaic	81,320	81,360	81,405	81,496	81,549	81,602	81,652	81,704	81,754	81,806	81,852
Somerset	34,740	34,762	34,783	34,814	34,840	34,867	34,893	34,919	34,945	34,971	34,995
Sussex	17,121	17,152	17,167	17,201	17,235	17,268	17,302	17,335	17,368	17,399	17,432
Union	79,371	79,380	79,420	79,476	79,504	79,535	79,560	79,587	79,614	79,642	79,667
Warren	12,061	12,076	12,094	12,118	12,143	12,167	12,191	12,216	12,240	12,265	12,289

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:		
	10/23	10/24	10/25	10/26	10/28	10/30	11/1
Bergen	119,208	119,267	119,375	119,509	119,690 (23,938) [5,745] {2,873}	119,867 (23,973) [5,754] {2,877}	120,043 (24,009) [5,762] {2,881}
Burlington	54,279	54,339	54,402	54,498	54,655 (10,931) [2,623] {1,312}	54,808 (10,962) [2,631] {1,315}	54,961 (10,992) [2,638] {1,319}
Camden	67,590	67,650	67,719	67,815	67,974 (13,595) [3,263] {1,631}	68,127 (13,625) [3,270] {1,635}	68,280 (13,656) [3,277] {1,639}
Essex	105,856	105,879	105,931	106,049	106,123 (21,225) [5,094] {2,547}	106,192 (21,238) [5,097] {2,549}	106,262 (21,252) [5,101] {2,550}
Gloucester	38,037	38,079	38,115	38,192	38,303 (7,661) [1,839] {919}	38,408 (7,682) [1,844] {922}	38,517 (7,703) [1,849] {924}
Hudson	97,140	97,187	97,219	97,277	97,379 (19,476) [4,674] {2,337}	97,479 (19,496) [4,679] {2,339}	97,580 (19,516) [4,684] {2,342}
Hunterdon	11,948	11,960	11,969	11,991	12,031 (2,406) [578] {289}	12,072 (2,414) [579] {290}	12,112 (2,422) [581] {291}
Mercer	39,289	39,314	39,350	39,397	39,499 (7,900) [1,896] {948}	39,603 (7,921) [1,901] {950}	39,708 (7,942) [1,906] {953}
Middlesex	105,834	105,880	105,950	106,076	106,258 (21,252) [5,100] {2,550}	106,437 (21,287) [5,109] {2,554}	106,615 (21,323) [5,118] {2,559}
Monmouth	91,778	91,855	91,939	92,040	92,257 (18,451) [4,428] {2,214}	92,471 (18,494) [4,439] {2,219}	92,682 (18,536) [4,449] {2,224}
Morris	57,710	57,753	57,787	57,849	57,954 (11,591) [2,782] {1,391}	58,056 (11,611) [2,787] {1,393}	58,158 (11,632) [2,792] {1,396}
Ocean	94,419	94,533	94,661	94,834	95,140 (19,028) [4,567] {2,283}	95,436 (19,087) [4,581] {2,290}	95,723 (19,145) [4,595] {2,297}
Passaic	81,320	81,360	81,405	81,496	81,602 (16,320) [3,917] {1,958}	81,704 (16,341) [3,922] {1,961}	81,806 (16,361) [3,927] {1,963}
Somerset	34,740	34,762	34,783	34,814	34,867 (6,973) [1,674] {837}	34,919 (6,984) [1,676] {838}	34,971 (6,994) [1,679] {839}
Sussex	17,121	17,152	17,167	17,201	17,268 (3,454) [829] {414}	17,335 (3,467) [832] {416}	17,399 (3,480) [835] {418}
Union	79,371	79,380	79,420	79,476	79,535 (15,907) [3,818] {1,909}	79,587 (15,917) [3,820] {1,910}	79,642 (15,928) [3,823] {1,911}
Warren	12,061	12,076	12,094	12,118	12,167 (2,433) [584] {292}	12,216 (2,443) [586] {293}	12,265 (2,453) [589] {294}

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.