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

Date: 11/24/20

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 11/24/20 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.

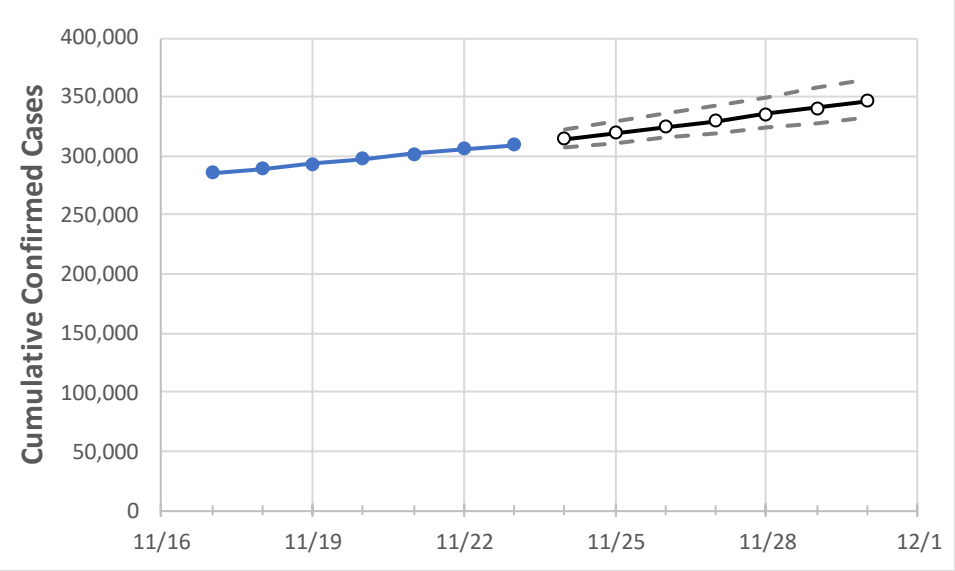
IEM's Modeling Lead

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
New Jersey	297,370	302,039	306,007	309,588	314,375	319,336	324,480	329,814	335,342	341,073	347,014

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Bergen	31,006	31,447	31,851	32,245	32,739	33,256	33,798	34,365	34,958	35,579	36,229
Burlington	11,411	11,699	11,996	12,174	12,448	12,737	13,043	13,367	13,709	14,070	14,452
Camden	16,103	16,540	16,862	17,111	17,498	17,904	18,331	18,779	19,250	19,745	20,265
Essex	31,902	32,441	32,778	33,088	33,528	33,980	34,445	34,923	35,414	35,920	36,439
Gloucester	7,718	7,947	8,066	8,183	8,365	8,553	8,749	8,954	9,166	9,386	9,616
Hudson	28,370	28,764	29,116	29,379	29,758	30,150	30,555	30,975	31,410	31,859	32,324
Hunterdon	2,155	2,186	2,236	2,258	2,300	2,344	2,390	2,438	2,488	2,541	2,596
Mercer	12,087	12,257	12,450	12,620	12,902	13,203	13,522	13,861	14,221	14,603	15,009
Middlesex	27,418	27,671	27,987	28,263	28,640	29,030	29,435	29,855	30,290	30,740	31,207
Monmouth	18,006	18,335	18,624	18,834	19,167	19,515	19,879	20,259	20,656	21,070	21,504
Morris	11,883	12,085	12,252	12,403	12,587	12,778	12,974	13,176	13,384	13,599	13,821
Ocean	19,648	19,880	20,087	20,325	20,608	20,908	21,226	21,562	21,919	22,296	22,696
Passaic	26,415	26,806	27,065	27,438	27,854	28,286	28,733	29,197	29,677	30,175	30,690
Somerset	8,146	8,251	8,333	8,412	8,547	8,688	8,835	8,988	9,147	9,312	9,484
Sussex	2,245	2,278	2,315	2,349	2,394	2,442	2,492	2,545	2,601	2,660	2,723
Union	25,437	25,763	26,043	26,347	26,692	27,047	27,412	27,786	28,170	28,565	28,970
Warren	2,181	2,215	2,259	2,286	2,328	2,373	2,419	2,467	2,517	2,569	2,624

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:		
	11/20	11/21	11/22	11/23	11/25	11/27	11/29
Bergen	31,006	31,447	31,851	32,245	33,256 (6,651) [1,596] {798}	34,365 (6,873) [1,650] {825}	35,579 (7,116) [1,708] {854}
Burlington	11,411	11,699	11,996	12,174	12,737 (2,547) [611] {306}	13,367 (2,673) [642] {321}	14,070 (2,814) [675] {338}
Camden	16,103	16,540	16,862	17,111	17,904 (3,581) [859] {430}	18,779 (3,756) [901] {451}	19,745 (3,949) [948] {474}
Essex	31,902	32,441	32,778	33,088	33,980 (6,796) [1,631] {816}	34,923 (6,985) [1,676] {838}	35,920 (7,184) [1,724] {862}
Gloucester	7,718	7,947	8,066	8,183	8,553 (1,711) [411] {205}	8,954 (1,791) [430] {215}	9,386 (1,877) [451] {225}
Hudson	28,370	28,764	29,116	29,379	30,150 (6,030) [1,447] {724}	30,975 (6,195) [1,487] {743}	31,859 (6,372) [1,529] {765}
Hunterdon	2,155	2,186	2,236	2,258	2,344 (469) [113] {56}	2,438 (488) [117] {59}	2,541 (508) [122] {61}
Mercer	12,087	12,257	12,450	12,620	13,203 (2,641) [634] {317}	13,861 (2,772) [665] {333}	14,603 (2,921) [701] {350}
Middlesex	27,418	27,671	27,987	28,263	29,030 (5,806) [1,393] {697}	29,855 (5,971) [1,433] {717}	30,740 (6,148) [1,476] {738}
Monmouth	18,006	18,335	18,624	18,834	19,515 (3,903) [937] {468}	20,259 (4,052) [972] {486}	21,070 (4,214) [1,011] {506}
Morris	11,883	12,085	12,252	12,403	12,778 (2,556) [613] {307}	13,176 (2,635) [632] {316}	13,599 (2,720) [653] {326}
Ocean	19,648	19,880	20,087	20,325	20,908 (4,182) [1,004] {502}	21,562 (4,312) [1,035] {517}	22,296 (4,459) [1,070] {535}
Passaic	26,415	26,806	27,065	27,438	28,286 (5,657) [1,358] {679}	29,197 (5,839) [1,401] {701}	30,175 (6,035) [1,448] {724}
Somerset	8,146	8,251	8,333	8,412	8,688 (1,738) [417] {209}	8,988 (1,798) [431] {216}	9,312 (1,862) [447] {223}
Sussex	2,245	2,278	2,315	2,349	2,442 (488) [117] {59}	2,545 (509) [122] {61}	2,660 (532) [128] {64}
Union	25,437	25,763	26,043	26,347	27,047 (5,409) [1,298] {649}	27,786 (5,557) [1,334] {667}	28,565 (5,713) [1,371] {686}
Warren	2,181	2,215	2,259	2,286	2,373 (475) [114] {57}	2,467 (493) [118] {59}	2,569 (514) [123] {62}

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.