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

Date: 11/25/20

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 11/25/20 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.

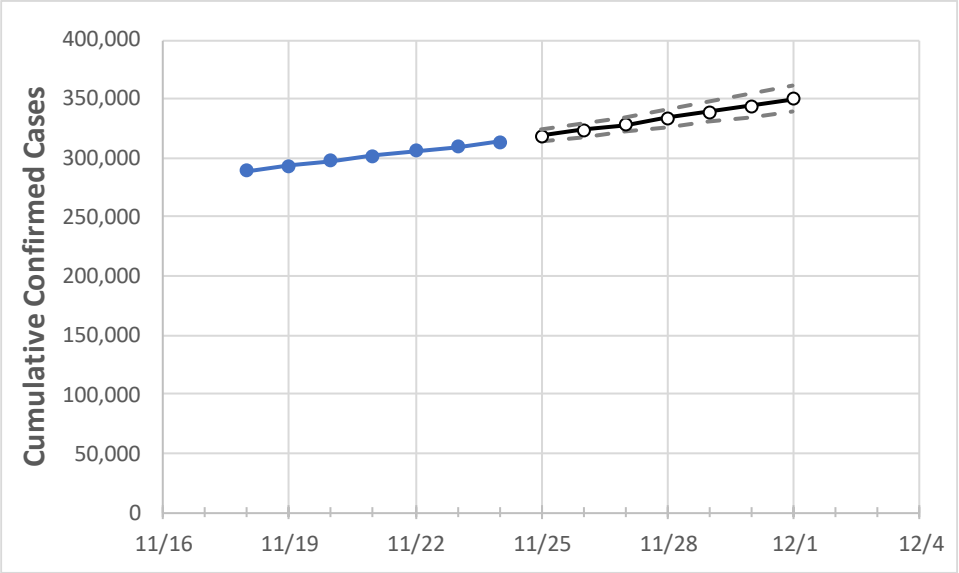
IEM's Modeling Lead

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:						
	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30	12/1
New Jersey	302,039	306,007	309,588	313,863	318,576	323,435	328,445	333,609	338,933	344,419	350,075

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:						
	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30	12/1
Bergen	31,447	31,851	32,245	32,581	33,026	33,484	33,954	34,438	34,935	35,446	35,972
Burlington	11,699	11,996	12,174	12,544	12,838	13,149	13,479	13,828	14,198	14,590	15,005
Camden	16,540	16,862	17,111	17,379	17,765	18,169	18,593	19,036	19,499	19,984	20,492
Essex	32,441	32,778	33,088	33,473	33,904	34,346	34,798	35,261	35,735	36,221	36,718
Gloucester	7,947	8,066	8,183	8,289	8,466	8,650	8,840	9,037	9,241	9,452	9,670
Hudson	28,764	29,116	29,379	29,637	29,999	30,372	30,755	31,149	31,554	31,971	32,400
Hunterdon	2,186	2,236	2,258	2,289	2,330	2,373	2,418	2,465	2,513	2,564	2,616
Mercer	12,257	12,450	12,620	12,886	13,171	13,474	13,794	14,133	14,493	14,873	15,275
Middlesex	27,671	27,987	28,263	28,719	29,115	29,526	29,952	30,395	30,854	31,331	31,825
Monmouth	18,335	18,624	18,834	19,115	19,454	19,808	20,177	20,562	20,963	21,382	21,818
Morris	12,085	12,252	12,403	12,606	12,796	12,992	13,194	13,402	13,616	13,837	14,064
Ocean	19,880	20,087	20,325	20,506	20,772	21,050	21,341	21,646	21,965	22,300	22,650
Passaic	26,806	27,065	27,438	27,797	28,217	28,651	29,102	29,568	30,052	30,552	31,071
Somerset	8,251	8,333	8,412	8,537	8,665	8,798	8,936	9,078	9,226	9,380	9,539
Sussex	2,278	2,315	2,349	2,379	2,423	2,470	2,518	2,569	2,622	2,678	2,736
Union	25,763	26,043	26,347	26,752	27,112	27,482	27,863	28,255	28,659	29,075	29,502
Warren	2,215	2,259	2,286	2,312	2,353	2,395	2,439	2,485	2,532	2,581	2,632

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:		
	11/21	11/22	11/23	11/24	11/26	11/28	11/30
Bergen	31,447	31,851	32,245	32,581	33,484 (6,697) [1,607] {804}	34,438 (6,888) [1,653] {827}	35,446 (7,089) [1,701] {851}
Burlington	11,699	11,996	12,174	12,544	13,149 (2,630) [631] {316}	13,828 (2,766) [664] {332}	14,590 (2,918) [700] {350}
Camden	16,540	16,862	17,111	17,379	18,169 (3,634) [872] {436}	19,036 (3,807) [914] {457}	19,984 (3,997) [959] {480}
Essex	32,441	32,778	33,088	33,473	34,346 (6,869) [1,649] {824}	35,261 (7,052) [1,693] {846}	36,221 (7,244) [1,739] {869}
Gloucester	7,947	8,066	8,183	8,289	8,650 (1,730) [415] {208}	9,037 (1,807) [434] {217}	9,452 (1,890) [454] {227}
Hudson	28,764	29,116	29,379	29,637	30,372 (6,074) [1,458] {729}	31,149 (6,230) [1,495] {748}	31,971 (6,394) [1,535] {767}
Hunterdon	2,186	2,236	2,258	2,289	2,373 (475) [114] {57}	2,465 (493) [118] {59}	2,564 (513) [123] {62}
Mercer	12,257	12,450	12,620	12,886	13,474 (2,695) [647] {323}	14,133 (2,827) [678] {339}	14,873 (2,975) [714] {357}
Middlesex	27,671	27,987	28,263	28,719	29,526 (5,905) [1,417] {709}	30,395 (6,079) [1,459] {729}	31,331 (6,266) [1,504] {752}
Monmouth	18,335	18,624	18,834	19,115	19,808 (3,962) [951] {475}	20,562 (4,112) [987] {493}	21,382 (4,276) [1,026] {513}
Morris	12,085	12,252	12,403	12,606	12,992 (2,598) [624] {312}	13,402 (2,680) [643] {322}	13,837 (2,767) [664] {332}
Ocean	19,880	20,087	20,325	20,506	21,050 (4,210) [1,010] {505}	21,646 (4,329) [1,039] {520}	22,300 (4,460) [1,070] {535}
Passaic	26,806	27,065	27,438	27,797	28,651 (5,730) [1,375] {688}	29,568 (5,914) [1,419] {710}	30,552 (6,110) [1,467] {733}
Somerset	8,251	8,333	8,412	8,537	8,798 (1,760) [422] {211}	9,078 (1,816) [436] {218}	9,380 (1,876) [450] {225}
Sussex	2,278	2,315	2,349	2,379	2,470 (494) [119] {59}	2,569 (514) [123] {62}	2,678 (536) [129] {64}
Union	25,763	26,043	26,347	26,752	27,482 (5,496) [1,319] {660}	28,255 (5,651) [1,356] {678}	29,075 (5,815) [1,396] {698}
Warren	2,215	2,259	2,286	2,312	2,395 (479) [115] {57}	2,485 (497) [119] {60}	2,581 (516) [124] {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.