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

Date: 11/2/20

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 11/2/20 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.

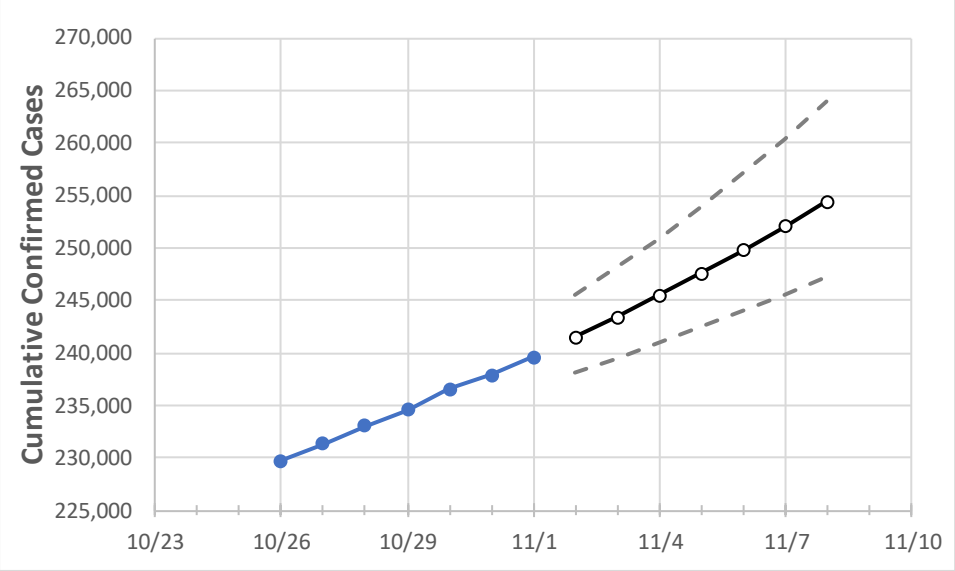
IEM's Modeling Lead

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:						
	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8
New Jersey	234,547	236,523	237,886	239,629	241,491	243,429	245,447	247,548	249,735	252,012	254,383

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:						
	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8
Bergen	25,027	25,235	25,366	25,526	25,691	25,862	26,040	26,226	26,419	26,620	26,829
Burlington	8,486	8,587	8,623	8,721	8,803	8,889	8,978	9,071	9,168	9,269	9,375
Camden	11,617	11,729	11,799	11,988	12,087	12,191	12,300	12,413	12,531	12,655	12,784
Essex	24,709	24,970	25,117	25,292	25,572	25,867	26,177	26,503	26,847	27,209	27,589
Gloucester	5,559	5,550	5,591	5,679	5,725	5,772	5,821	5,872	5,925	5,979	6,036
Hudson	23,132	23,357	23,486	23,633	23,832	24,042	24,266	24,502	24,753	25,019	25,301
Hunterdon	1,586	1,603	1,615	1,626	1,637	1,648	1,660	1,673	1,686	1,700	1,714
Mercer	9,297	9,340	9,379	9,438	9,488	9,542	9,599	9,659	9,723	9,791	9,863
Middlesex	22,274	22,444	22,553	22,676	22,834	22,998	23,168	23,345	23,528	23,717	23,913
Monmouth	14,111	14,242	14,309	14,415	14,497	14,581	14,667	14,753	14,842	14,931	15,022
Morris	9,145	9,243	9,293	9,357	9,446	9,539	9,637	9,738	9,845	9,956	10,072
Ocean	16,715	16,804	16,938	16,990	17,042	17,092	17,141	17,189	17,235	17,280	17,324
Passaic	20,898	21,060	21,155	21,282	21,415	21,555	21,703	21,860	22,026	22,201	22,386
Somerset	6,485	6,527	6,549	6,575	6,616	6,659	6,704	6,751	6,800	6,852	6,906
Sussex	1,720	1,739	1,754	1,761	1,775	1,791	1,807	1,824	1,842	1,861	1,882
Union	20,195	20,413	20,552	20,674	20,877	21,091	21,319	21,559	21,814	22,084	22,370
Warren	1,595	1,607	1,620	1,632	1,644	1,656	1,670	1,684	1,700	1,717	1,736

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:		
	10/29	10/30	10/31	11/1	11/3	11/5	11/7
Bergen	25,027	25,235	25,366	25,526	25,862 (5,172) [1,241] {621}	26,226 (5,245) [1,259] {629}	26,620 (5,324) [1,278] {639}
Burlington	8,486	8,587	8,623	8,721	8,889 (1,778) [427] {213}	9,071 (1,814) [435] {218}	9,269 (1,854) [445] {222}
Camden	11,617	11,729	11,799	11,988	12,191 (2,438) [585] {293}	12,413 (2,483) [596] {298}	12,655 (2,531) [607] {304}
Essex	24,709	24,970	25,117	25,292	25,867 (5,173) [1,242] {621}	26,503 (5,301) [1,272] {636}	27,209 (5,442) [1,306] {653}
Gloucester	5,559	5,550	5,591	5,679	5,772 (1,154) [277] {139}	5,872 (1,174) [282] {141}	5,979 (1,196) [287] {144}
Hudson	23,132	23,357	23,486	23,633	24,042 (4,808) [1,154] {577}	24,502 (4,900) [1,176] {588}	25,019 (5,004) [1,201] {600}
Hunterdon	1,586	1,603	1,615	1,626	1,648 (330) [79] {40}	1,673 (335) [80] {40}	1,700 (340) [82] {41}
Mercer	9,297	9,340	9,379	9,438	9,542 (1,908) [458] {229}	9,659 (1,932) [464] {232}	9,791 (1,958) [470] {235}
Middlesex	22,274	22,444	22,553	22,676	22,998 (4,600) [1,104] {552}	23,345 (4,669) [1,121] {560}	23,717 (4,743) [1,138] {569}
Monmouth	14,111	14,242	14,309	14,415	14,581 (2,916) [700] {350}	14,753 (2,951) [708] {354}	14,931 (2,986) [717] {358}
Morris	9,145	9,243	9,293	9,357	9,539 (1,908) [458] {229}	9,738 (1,948) [467] {234}	9,956 (1,991) [478] {239}
Ocean	16,715	16,804	16,938	16,990	17,092 (3,418) [820] {410}	17,189 (3,438) [825] {413}	17,280 (3,456) [829] {415}
Passaic	20,898	21,060	21,155	21,282	21,555 (4,311) [1,035] {517}	21,860 (4,372) [1,049] {525}	22,201 (4,440) [1,066] {533}
Somerset	6,485	6,527	6,549	6,575	6,659 (1,332) [320] {160}	6,751 (1,350) [324] {162}	6,852 (1,370) [329] {164}
Sussex	1,720	1,739	1,754	1,761	1,791 (358) [86] {43}	1,824 (365) [88] {44}	1,861 (372) [89] {45}
Union	20,195	20,413	20,552	20,674	21,091 (4,218) [1,012] {506}	21,559 (4,312) [1,035] {517}	22,084 (4,417) [1,060] {530}
Warren	1,595	1,607	1,620	1,632	1,656 (331) [79] {40}	1,684 (337) [81] {40}	1,717 (343) [82] {41}

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.