IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/3/20

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 <u>not</u> 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 11/3/20 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
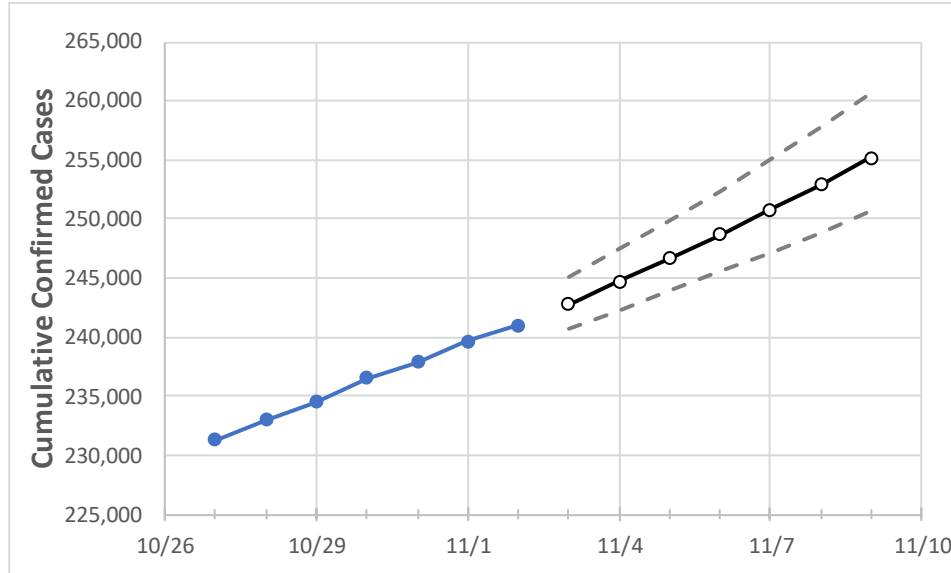
	Actual Confirmed Cases On:				Projected Cases For:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
New Jersey	236,523	237,886	239,629	240,997	242,815	244,699	246,651	248,674	250,769	252,941	255,192

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Bergen	25,235	25,366	25,526	25,677	25,844	26,018	26,199	26,387	26,582	26,785	26,996
Burlington	8,587	8,623	8,721	8,794	8,878	8,965	9,056	9,150	9,249	9,352	9,459
Camden	11,729	11,799	11,988	12,060	12,165	12,274	12,389	12,509	12,634	12,765	12,902
Essex	24,970	25,117	25,292	25,437	25,708	25,992	26,289	26,599	26,925	27,265	27,621
Gloucester	5,550	5,591	5,679	5,713	5,758	5,805	5,853	5,903	5,954	6,007	6,061
Hudson	23,357	23,486	23,633	23,730	23,916	24,112	24,317	24,532	24,757	24,994	25,243
Hunterdon	1,603	1,615	1,626	1,643	1,657	1,673	1,689	1,707	1,725	1,745	1,766
Mercer	9,340	9,379	9,438	9,479	9,531	9,586	9,644	9,705	9,770	9,839	9,912
Middlesex	22,444	22,553	22,676	22,804	22,962	23,126	23,295	23,470	23,652	23,839	24,034
Monmouth	14,242	14,309	14,415	14,499	14,582	14,667	14,753	14,840	14,929	15,020	15,112
Morris	9,243	9,293	9,357	9,448	9,540	9,636	9,737	9,842	9,952	10,066	10,186
Ocean	16,804	16,938	16,990	17,034	17,086	17,138	17,188	17,237	17,284	17,331	17,377
Passaic	21,060	21,155	21,282	21,383	21,520	21,664	21,815	21,976	22,145	22,323	22,510
Somerset	6,527	6,549	6,575	6,614	6,656	6,700	6,747	6,796	6,847	6,901	6,957
Sussex	1,739	1,754	1,761	1,773	1,788	1,803	1,819	1,837	1,855	1,874	1,895
Union	20,413	20,552	20,674	20,820	21,028	21,247	21,479	21,723	21,981	22,254	22,541
Warren	1,607	1,620	1,632	1,650	1,663	1,678	1,693	1,710	1,729	1,749	1,770

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:		
	10/30	10/31	11/1	11/2	11/4	11/6	11/8
Bergen	25,235	25,366	25,526	25,677	26,018 (5,204) [1,249] {624}	26,387 (5,277) [1,267] {633}	26,785 (5,357) [1,286] {643}
Burlington	8,587	8,623	8,721	8,794	8,965 (1,793) [430] {215}	9,150 (1,830) [439] {220}	9,352 (1,870) [449] {224}
Camden	11,729	11,799	11,988	12,060	12,274 (2,455) [589] {295}	12,509 (2,502) [600] {300}	12,765 (2,553) [613] {306}
Essex	24,970	25,117	25,292	25,437	25,992 (5,198) [1,248] {624}	26,599 (5,320) [1,277] {638}	27,265 (5,453) [1,309] {654}
Gloucester	5,550	5,591	5,679	5,713	5,805 (1,161) [279] {139}	5,903 (1,181) [283] {142}	6,007 (1,201) [288] {144}
Hudson	23,357	23,486	23,633	23,730	24,112 (4,822) [1,157] {579}	24,532 (4,906) [1,178] {589}	24,994 (4,999) [1,200] {600}
Hunterdon	1,603	1,615	1,626	1,643	1,673 (335) [80] {40}	1,707 (341) [82] {41}	1,745 (349) [84] {42}
Mercer	9,340	9,379	9,438	9,479	9,586 (1,917) [460] {230}	9,705 (1,941) [466] {233}	9,839 (1,968) [472] {236}
Middlesex	22,444	22,553	22,676	22,804	23,126 (4,625) [1,110] {555}	23,470 (4,694) [1,127] {563}	23,839 (4,768) [1,144] {572}
Monmouth	14,242	14,309	14,415	14,499	14,667 (2,933) [704] {352}	14,840 (2,968) [712] {356}	15,020 (3,004) [721] {360}
Morris	9,243	9,293	9,357	9,448	9,636 (1,927) [463] {231}	9,842 (1,968) [472] {236}	10,066 (2,013) [483] {242}
Ocean	16,804	16,938	16,990	17,034	17,138 (3,428) [823] {411}	17,237 (3,447) [827] {414}	17,331 (3,466) [832] {416}
Passaic	21,060	21,155	21,282	21,383	21,664 (4,333) [1,040] {520}	21,976 (4,395) [1,055] {527}	22,323 (4,465) [1,071] {536}
Somerset	6,527	6,549	6,575	6,614	6,700 (1,340) [322] {161}	6,796 (1,359) [326] {163}	6,901 (1,380) [331] {166}
Sussex	1,739	1,754	1,761	1,773	1,803 (361) [87] {43}	1,837 (367) [88] {44}	1,874 (375) [90] {45}
Union	20,413	20,552	20,674	20,820	21,247 (4,249) [1,020] {510}	21,723 (4,345) [1,043] {521}	22,254 (4,451) [1,068] {534}
Warren	1,607	1,620	1,632	1,650	1,678 (336) [81] {40}	1,710 (342) [82] {41}	1,749 (350) [84] {42}

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.