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

Date: 7/19/21

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 7/19/21 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.

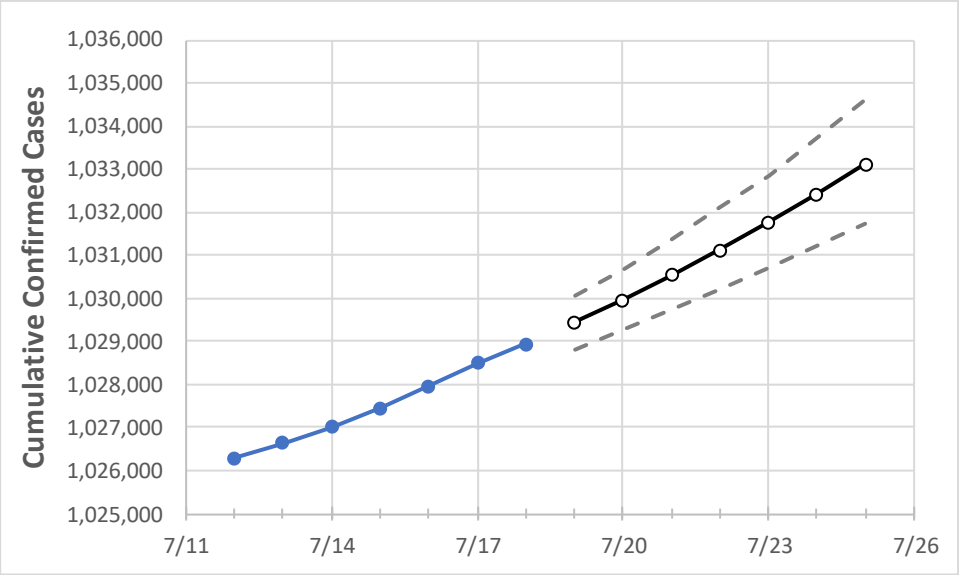
IEM's Modeling Lead

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
New Jersey	1,027,460	1,027,954	1,028,503	1,028,931	1,029,437	1,029,966	1,030,529	1,031,127	1,031,759	1,032,413	1,033,112

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
Bergen	105,384	105,434	105,485	105,517	105,563	105,612	105,662	105,716	105,774	105,835	105,898
Burlington	44,598	44,627	44,652	44,671	44,694	44,718	44,743	44,770	44,798	44,828	44,859
Camden	56,208	56,242	56,264	56,288	56,314	56,340	56,366	56,394	56,423	56,452	56,482
Essex	94,829	94,875	94,920	94,971	95,032	95,099	95,171	95,249	95,334	95,428	95,530
Gloucester	30,826	30,834	30,856	30,863	30,874	30,885	30,897	30,910	30,923	30,937	30,951
Hudson	88,604	88,636	88,678	88,715	88,743	88,772	88,802	88,835	88,869	88,904	88,941
Hunterdon	9,945	9,953	9,960	9,966	9,971	9,977	9,982	9,988	9,994	10,000	10,006
Mercer	34,270	34,286	34,303	34,314	34,325	34,336	34,349	34,362	34,376	34,391	34,407
Middlesex	92,933	92,941	92,984	93,033	93,064	93,094	93,127	93,161	93,197	93,233	93,272
Monmouth	76,687	76,744	76,808	76,861	76,914	76,965	77,020	77,077	77,135	77,195	77,257
Morris	50,596	50,628	50,645	50,665	50,692	50,721	50,751	50,782	50,816	50,850	50,887
Ocean	76,893	76,948	77,013	77,048	77,088	77,128	77,170	77,214	77,257	77,302	77,347
Passaic	73,638	73,665	73,688	73,718	73,744	73,772	73,800	73,830	73,862	73,894	73,928
Somerset	30,376	30,382	30,408	30,420	30,434	30,448	30,462	30,477	30,493	30,508	30,525
Sussex	14,165	14,171	14,183	14,184	14,188	14,192	14,197	14,201	14,206	14,210	14,214
Union	72,046	72,074	72,101	72,112	72,137	72,162	72,189	72,216	72,245	72,274	72,304
Warren	10,076	10,081	10,089	10,090	10,093	10,097	10,101	10,104	10,108	10,112	10,116

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:		
	7/15	7/16	7/17	7/18	7/20	7/22	7/24
Bergen	105,384	105,434	105,485	105,517	105,612 (21,122) [5,069] {2,535}	105,716 (21,143) [5,074] {2,537}	105,835 (21,167) [5,080] {2,540}
Burlington	44,598	44,627	44,652	44,671	44,718 (8,944) [2,146] {1,073}	44,770 (8,954) [2,149] {1,074}	44,828 (8,966) [2,152] {1,076}
Camden	56,208	56,242	56,264	56,288	56,340 (11,268) [2,704] {1,352}	56,394 (11,279) [2,707] {1,353}	56,452 (11,290) [2,710] {1,355}
Essex	94,829	94,875	94,920	94,971	95,099 (19,020) [4,565] {2,282}	95,249 (19,050) [4,572] {2,286}	95,428 (19,086) [4,581] {2,290}
Gloucester	30,826	30,834	30,856	30,863	30,885 (6,177) [1,482] {741}	30,910 (6,182) [1,484] {742}	30,937 (6,187) [1,485] {742}
Hudson	88,604	88,636	88,678	88,715	88,772 (17,754) [4,261] {2,131}	88,835 (17,767) [4,264] {2,132}	88,904 (17,781) [4,267] {2,134}
Hunterdon	9,945	9,953	9,960	9,966	9,977 (1,995) [479] {239}	9,988 (1,998) [479] {240}	10,000 (2,000) [480] {240}
Mercer	34,270	34,286	34,303	34,314	34,336 (6,867) [1,648] {824}	34,362 (6,872) [1,649] {825}	34,391 (6,878) [1,651] {825}
Middlesex	92,933	92,941	92,984	93,033	93,094 (18,619) [4,469] {2,234}	93,161 (18,632) [4,472] {2,236}	93,233 (18,647) [4,475] {2,238}
Monmouth	76,687	76,744	76,808	76,861	76,965 (15,393) [3,694] {1,847}	77,077 (15,415) [3,700] {1,850}	77,195 (15,439) [3,705] {1,853}
Morris	50,596	50,628	50,645	50,665	50,721 (10,144) [2,435] {1,217}	50,782 (10,156) [2,438] {1,219}	50,850 (10,170) [2,441] {1,220}
Ocean	76,893	76,948	77,013	77,048	77,128 (15,426) [3,702] {1,851}	77,214 (15,443) [3,706] {1,853}	77,302 (15,460) [3,710] {1,855}
Passaic	73,638	73,665	73,688	73,718	73,772 (14,754) [3,541] {1,771}	73,830 (14,766) [3,544] {1,772}	73,894 (14,779) [3,547] {1,773}
Somerset	30,376	30,382	30,408	30,420	30,448 (6,090) [1,461] {731}	30,477 (6,095) [1,463] {731}	30,508 (6,102) [1,464] {732}
Sussex	14,165	14,171	14,183	14,184	14,192 (2,838) [681] {341}	14,201 (2,840) [682] {341}	14,210 (2,842) [682] {341}
Union	72,046	72,074	72,101	72,112	72,162 (14,432) [3,464] {1,732}	72,216 (14,443) [3,466] {1,733}	72,274 (14,455) [3,469] {1,735}
Warren	10,076	10,081	10,089	10,090	10,097 (2,019) [485] {242}	10,104 (2,021) [485] {243}	10,112 (2,022) [485] {243}

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.