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

Date: 6/16/21

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 6/16/21 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.

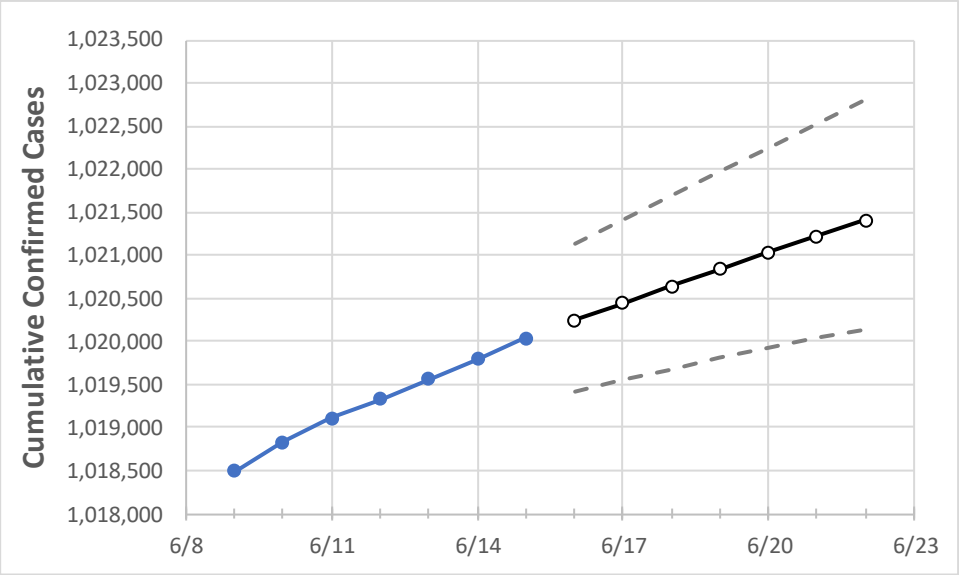
IEM's Modeling Lead

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:						
	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22
New Jersey	1,019,335	1,019,563	1,019,794	1,020,043	1,020,249	1,020,448	1,020,645	1,020,840	1,021,034	1,021,222	1,021,408

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:						
	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22
Bergen	104,531	104,553	104,574	104,610	104,632	104,654	104,675	104,697	104,718	104,740	104,761
Burlington	44,262	44,271	44,278	44,283	44,290	44,298	44,305	44,311	44,318	44,324	44,330
Camden	55,724	55,734	55,747	55,763	55,772	55,781	55,789	55,796	55,804	55,811	55,818
Essex	94,253	94,257	94,279	94,317	94,333	94,348	94,364	94,378	94,392	94,406	94,420
Gloucester	30,594	30,600	30,604	30,606	30,611	30,615	30,619	30,623	30,627	30,630	30,634
Hudson	88,139	88,161	88,197	88,230	88,252	88,275	88,298	88,322	88,346	88,370	88,393
Hunterdon	9,824	9,828	9,825	9,826	9,829	9,832	9,835	9,838	9,841	9,843	9,846
Mercer	34,085	34,090	34,099	34,107	34,114	34,121	34,126	34,133	34,138	34,143	34,149
Middlesex	92,408	92,423	92,439	92,481	92,501	92,521	92,541	92,561	92,580	92,600	92,619
Monmouth	75,688	75,715	75,737	75,660	75,677	75,695	75,713	75,730	75,747	75,764	75,781
Morris	50,220	50,230	50,237	50,250	50,260	50,270	50,280	50,289	50,299	50,308	50,317
Ocean	76,007	76,030	76,051	76,095	76,119	76,144	76,169	76,194	76,219	76,244	76,270
Passaic	73,085	73,107	73,129	73,165	73,185	73,204	73,224	73,243	73,261	73,281	73,300
Somerset	30,091	30,103	30,118	30,127	30,134	30,140	30,147	30,153	30,160	30,167	30,173
Sussex	14,035	14,039	14,036	14,041	14,045	14,048	14,052	14,055	14,059	14,062	14,065
Union	71,554	71,574	71,587	71,607	71,623	71,640	71,656	71,673	71,689	71,705	71,721
Warren	9,993	9,995	9,996	9,998	10,000	10,002	10,003	10,005	10,006	10,008	10,009

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:		
	6/12	6/13	6/14	6/15	6/17	6/19	6/21
Bergen	104,531	104,553	104,574	104,610	104,654 (20,931) [5,023] {2,512}	104,697 (20,939) [5,025] {2,513}	104,740 (20,948) [5,028] {2,514}
Burlington	44,262	44,271	44,278	44,283	44,298 (8,860) [2,126] {1,063}	44,311 (8,862) [2,127] {1,063}	44,324 (8,865) [2,128] {1,064}
Camden	55,724	55,734	55,747	55,763	55,781 (11,156) [2,677] {1,339}	55,796 (11,159) [2,678] {1,339}	55,811 (11,162) [2,679] {1,339}
Essex	94,253	94,257	94,279	94,317	94,348 (18,870) [4,529] {2,264}	94,378 (18,876) [4,530] {2,265}	94,406 (18,881) [4,532] {2,266}
Gloucester	30,594	30,600	30,604	30,606	30,615 (6,123) [1,470] {735}	30,623 (6,125) [1,470] {735}	30,630 (6,126) [1,470] {735}
Hudson	88,139	88,161	88,197	88,230	88,275 (17,655) [4,237] {2,119}	88,322 (17,664) [4,239] {2,120}	88,370 (17,674) [4,242] {2,121}
Hunterdon	9,824	9,828	9,825	9,826	9,832 (1,966) [472] {236}	9,838 (1,968) [472] {236}	9,843 (1,969) [472] {236}
Mercer	34,085	34,090	34,099	34,107	34,121 (6,824) [1,638] {819}	34,133 (6,827) [1,638] {819}	34,143 (6,829) [1,639] {819}
Middlesex	92,408	92,423	92,439	92,481	92,521 (18,504) [4,441] {2,221}	92,561 (18,512) [4,443] {2,221}	92,600 (18,520) [4,445] {2,222}
Monmouth	75,688	75,715	75,737	75,660	75,695 (15,139) [3,633] {1,817}	75,730 (15,146) [3,635] {1,818}	75,764 (15,153) [3,637] {1,818}
Morris	50,220	50,230	50,237	50,250	50,270 (10,054) [2,413] {1,206}	50,289 (10,058) [2,414] {1,207}	50,308 (10,062) [2,415] {1,207}
Ocean	76,007	76,030	76,051	76,095	76,144 (15,229) [3,655] {1,827}	76,194 (15,239) [3,657] {1,829}	76,244 (15,249) [3,660] {1,830}
Passaic	73,085	73,107	73,129	73,165	73,204 (14,641) [3,514] {1,757}	73,243 (14,649) [3,516] {1,758}	73,281 (14,656) [3,517] {1,759}
Somerset	30,091	30,103	30,118	30,127	30,140 (6,028) [1,447] {723}	30,153 (6,031) [1,447] {724}	30,167 (6,033) [1,448] {724}
Sussex	14,035	14,039	14,036	14,041	14,048 (2,810) [674] {337}	14,055 (2,811) [675] {337}	14,062 (2,812) [675] {337}
Union	71,554	71,574	71,587	71,607	71,640 (14,328) [3,439] {1,719}	71,673 (14,335) [3,440] {1,720}	71,705 (14,341) [3,442] {1,721}
Warren	9,993	9,995	9,996	9,998	10,002 (2,000) [480] {240}	10,005 (2,001) [480] {240}	10,008 (2,002) [480] {240}

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.