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

Date: 5/14/21

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 5/14/21 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.

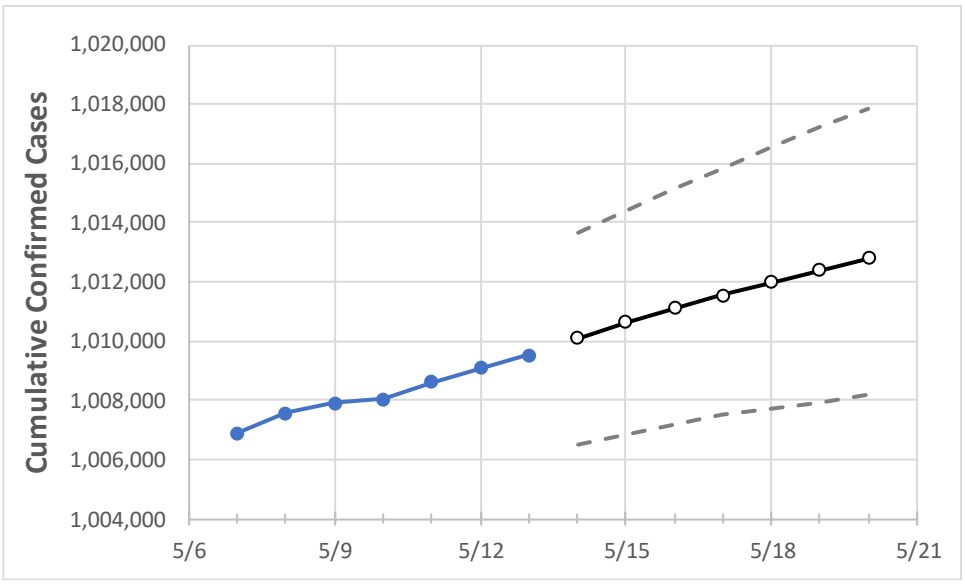
IEM's Modeling Lead

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
New Jersey	1,008,046	1,008,607	1,009,093	1,009,521	1,010,112	1,010,624	1,011,114	1,011,563	1,012,005	1,012,408	1,012,786

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Bergen	103,352	103,408	103,494	103,542	103,691	103,837	103,980	104,120	104,250	104,378	104,496
Burlington	44,118	44,081	43,990	44,001	44,028	44,054	44,080	44,103	44,125	44,146	44,166
Camden	54,665	54,724	54,799	54,859	54,914	54,966	55,016	55,063	55,108	55,150	55,192
Essex	93,440	93,453	93,504	93,525	93,550	93,575	93,597	93,616	93,632	93,648	93,662
Gloucester	30,118	30,158	30,189	30,216	30,250	30,281	30,312	30,340	30,368	30,395	30,421
Hudson	87,596	87,632	87,630	87,608	87,662	87,714	87,761	87,805	87,845	87,885	87,920
Hunterdon	9,650	9,661	9,675	9,682	9,691	9,700	9,708	9,716	9,724	9,731	9,739
Mercer	33,574	33,600	33,632	33,661	33,681	33,701	33,718	33,735	33,751	33,766	33,781
Middlesex	91,416	91,462	91,505	91,552	91,580	91,605	91,628	91,649	91,669	91,686	91,703
Monmouth	74,890	74,943	74,959	74,950	74,981	75,011	75,040	75,065	75,089	75,111	75,133
Morris	49,669	49,711	49,714	49,728	49,749	49,769	49,787	49,804	49,820	49,835	49,848
Ocean	75,236	75,264	75,298	75,335	75,371	75,406	75,438	75,468	75,495	75,522	75,547
Passaic	72,184	72,212	72,240	72,261	72,299	72,331	72,361	72,391	72,419	72,446	72,470
Somerset	29,756	29,782	29,797	29,815	29,835	29,855	29,873	29,889	29,906	29,921	29,935
Sussex	13,788	13,798	13,811	13,825	13,837	13,849	13,861	13,871	13,880	13,890	13,898
Union	70,845	70,874	70,917	70,950	70,983	71,016	71,049	71,077	71,103	71,128	71,151
Warren	9,805	9,820	9,839	9,847	9,855	9,863	9,871	9,877	9,884	9,890	9,896

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:		
	5/10	5/11	5/12	5/13	5/15	5/17	5/19
Bergen	103,352	103,408	103,494	103,542	103,837 (20,767) [4,984] {2,492}	104,120 (20,824) [4,998] {2,499}	104,378 (20,876) [5,010] {2,505}
Burlington	44,118	44,081	43,990	44,001	44,054 (8,811) [2,115] {1,057}	44,103 (8,821) [2,117] {1,058}	44,146 (8,829) [2,119] {1,060}
Camden	54,665	54,724	54,799	54,859	54,966 (10,993) [2,638] {1,319}	55,063 (11,013) [2,643] {1,322}	55,150 (11,030) [2,647] {1,324}
Essex	93,440	93,453	93,504	93,525	93,575 (18,715) [4,492] {2,246}	93,616 (18,723) [4,494] {2,247}	93,648 (18,730) [4,495] {2,248}
Gloucester	30,118	30,158	30,189	30,216	30,281 (6,056) [1,454] {727}	30,340 (6,068) [1,456] {728}	30,395 (6,079) [1,459] {729}
Hudson	87,596	87,632	87,630	87,608	87,714 (17,543) [4,210] {2,105}	87,805 (17,561) [4,215] {2,107}	87,885 (17,577) [4,218] {2,109}
Hunterdon	9,650	9,661	9,675	9,682	9,700 (1,940) [466] {233}	9,716 (1,943) [466] {233}	9,731 (1,946) [467] {234}
Mercer	33,574	33,600	33,632	33,661	33,701 (6,740) [1,618] {809}	33,735 (6,747) [1,619] {810}	33,766 (6,753) [1,621] {810}
Middlesex	91,416	91,462	91,505	91,552	91,605 (18,321) [4,397] {2,199}	91,649 (18,330) [4,399] {2,200}	91,686 (18,337) [4,401] {2,200}
Monmouth	74,890	74,943	74,959	74,950	75,011 (15,002) [3,601] {1,800}	75,065 (15,013) [3,603] {1,802}	75,111 (15,022) [3,605] {1,803}
Morris	49,669	49,711	49,714	49,728	49,769 (9,954) [2,389] {1,194}	49,804 (9,961) [2,391] {1,195}	49,835 (9,967) [2,392] {1,196}
Ocean	75,236	75,264	75,298	75,335	75,406 (15,081) [3,619] {1,810}	75,468 (15,094) [3,622] {1,811}	75,522 (15,104) [3,625] {1,813}
Passaic	72,184	72,212	72,240	72,261	72,331 (14,466) [3,472] {1,736}	72,391 (14,478) [3,475] {1,737}	72,446 (14,489) [3,477] {1,739}
Somerset	29,756	29,782	29,797	29,815	29,855 (5,971) [1,433] {717}	29,889 (5,978) [1,435] {717}	29,921 (5,984) [1,436] {718}
Sussex	13,788	13,798	13,811	13,825	13,849 (2,770) [665] {332}	13,871 (2,774) [666] {333}	13,890 (2,778) [667] {333}
Union	70,845	70,874	70,917	70,950	71,016 (14,203) [3,409] {1,704}	71,077 (14,215) [3,412] {1,706}	71,128 (14,226) [3,414] {1,707}
Warren	9,805	9,820	9,839	9,847	9,863 (1,973) [473] {237}	9,877 (1,975) [474] {237}	9,890 (1,978) [475] {237}

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.