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

Date: 5/10/21

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 5/10/21 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.

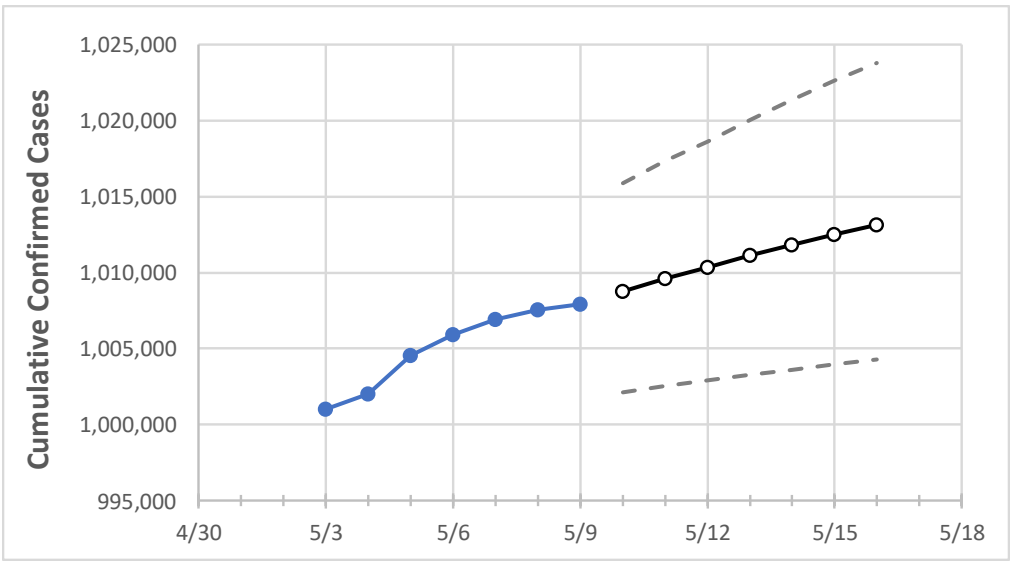
IEM's Modeling Lead

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:						
	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16
New Jersey	1,005,938	1,006,905	1,007,555	1,007,894	1,008,769	1,009,617	1,010,358	1,011,113	1,011,839	1,012,512	1,013,158

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:						
	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16
Bergen	103,082	103,164	103,253	103,314	103,529	103,730	103,938	104,146	104,340	104,533	104,730
Burlington	44,032	44,005	44,061	44,099	44,137	44,174	44,209	44,243	44,274	44,303	44,331
Camden	54,449	54,550	54,608	54,646	54,720	54,791	54,857	54,921	54,982	55,039	55,095
Essex	93,534	93,597	93,562	93,474	93,528	93,579	93,625	93,666	93,702	93,735	93,764
Gloucester	30,008	30,061	30,086	30,112	30,158	30,203	30,247	30,289	30,331	30,369	30,406
Hudson	87,363	87,492	87,559	87,598	87,672	87,741	87,806	87,866	87,923	87,980	88,029
Hunterdon	9,605	9,628	9,636	9,644	9,654	9,664	9,674	9,683	9,691	9,700	9,709
Mercer	33,495	33,526	33,553	33,569	33,596	33,621	33,645	33,667	33,687	33,708	33,728
Middlesex	91,301	91,386	91,406	91,417	91,465	91,508	91,547	91,582	91,614	91,645	91,676
Monmouth	74,731	74,794	74,839	74,857	74,901	74,940	74,978	75,014	75,047	75,078	75,109
Morris	49,641	49,612	49,635	49,653	49,686	49,719	49,748	49,776	49,803	49,828	49,852
Ocean	75,036	75,106	75,173	75,208	75,263	75,316	75,366	75,414	75,458	75,500	75,540
Passaic	72,060	72,106	72,152	72,171	72,234	72,292	72,350	72,399	72,445	72,489	72,530
Somerset	29,710	29,736	29,741	29,754	29,782	29,808	29,833	29,857	29,881	29,903	29,923
Sussex	13,741	13,762	13,774	13,786	13,807	13,827	13,845	13,863	13,880	13,896	13,911
Union	70,738	70,773	70,807	70,832	70,888	70,940	70,990	71,037	71,079	71,120	71,158
Warren	9,749	8,878	9,794	9,799	9,810	9,822	9,832	9,842	9,851	9,860	9,868

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:		
	5/6	5/7	5/8	5/9	5/11	5/13	5/15
Bergen	103,082	103,164	103,253	103,314	103,730 (20,746) [4,979] {2,490}	104,146 (20,829) [4,999] {2,500}	104,533 (20,907) [5,018] {2,509}
Burlington	44,032	44,005	44,061	44,099	44,174 (8,835) [2,120] {1,060}	44,243 (8,849) [2,124] {1,062}	44,303 (8,861) [2,127] {1,063}
Camden	54,449	54,550	54,608	54,646	54,791 (10,958) [2,630] {1,315}	54,921 (10,984) [2,636] {1,318}	55,039 (11,008) [2,642] {1,321}
Essex	93,534	93,597	93,562	93,474	93,579 (18,716) [4,492] {2,246}	93,666 (18,733) [4,496] {2,248}	93,735 (18,747) [4,499] {2,250}
Gloucester	30,008	30,061	30,086	30,112	30,203 (6,041) [1,450] {725}	30,289 (6,058) [1,454] {727}	30,369 (6,074) [1,458] {729}
Hudson	87,363	87,492	87,559	87,598	87,741 (17,548) [4,212] {2,106}	87,866 (17,573) [4,218] {2,109}	87,980 (17,596) [4,223] {2,112}
Hunterdon	9,605	9,628	9,636	9,644	9,664 (1,933) [464] {232}	9,683 (1,937) [465] {232}	9,700 (1,940) [466] {233}
Mercer	33,495	33,526	33,553	33,569	33,621 (6,724) [1,614] {807}	33,667 (6,733) [1,616] {808}	33,708 (6,742) [1,618] {809}
Middlesex	91,301	91,386	91,406	91,417	91,508 (18,302) [4,392] {2,196}	91,582 (18,316) [4,396] {2,198}	91,645 (18,329) [4,399] {2,199}
Monmouth	74,731	74,794	74,839	74,857	74,940 (14,988) [3,597] {1,799}	75,014 (15,003) [3,601] {1,800}	75,078 (15,016) [3,604] {1,802}
Morris	49,641	49,612	49,635	49,653	49,719 (9,944) [2,386] {1,193}	49,776 (9,955) [2,389] {1,195}	49,828 (9,966) [2,392] {1,196}
Ocean	75,036	75,106	75,173	75,208	75,316 (15,063) [3,615] {1,808}	75,414 (15,083) [3,620] {1,810}	75,500 (15,100) [3,624] {1,812}
Passaic	72,060	72,106	72,152	72,171	72,292 (14,458) [3,470] {1,735}	72,399 (14,480) [3,475] {1,738}	72,489 (14,498) [3,479] {1,740}
Somerset	29,710	29,736	29,741	29,754	29,808 (5,962) [1,431] {715}	29,857 (5,971) [1,433] {717}	29,903 (5,981) [1,435] {718}
Sussex	13,741	13,762	13,774	13,786	13,827 (2,765) [664] {332}	13,863 (2,773) [665] {333}	13,896 (2,779) [667] {333}
Union	70,738	70,773	70,807	70,832	70,940 (14,188) [3,405] {1,703}	71,037 (14,207) [3,410] {1,705}	71,120 (14,224) [3,414] {1,707}
Warren	9,749	8,878	9,794	9,799	9,822 (1,964) [471] {236}	9,842 (1,968) [472] {236}	9,860 (1,972) [473] {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.