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

Date: 5/5/21

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 5/5/21 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.

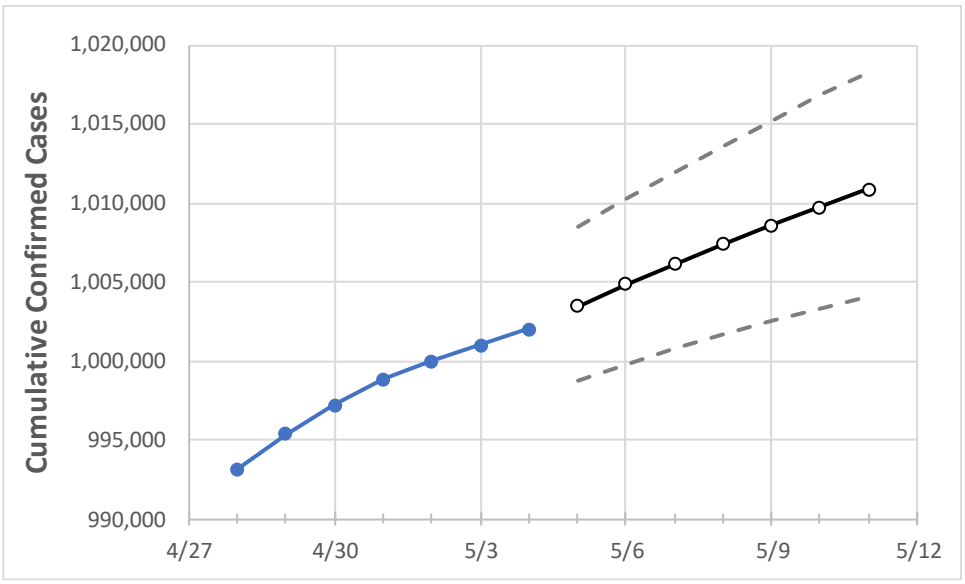
IEM's Modeling Lead

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
New Jersey	998,812	1,000,010	1,000,993	1,001,997	1,003,455	1,004,839	1,006,144	1,007,375	1,008,599	1,009,750	1,010,844

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Bergen	101,120	101,198	101,287	101,383	101,501	101,618	101,722	101,825	101,922	102,011	102,098
Burlington	43,840	43,902	43,966	43,996	44,054	44,110	44,162	44,212	44,260	44,306	44,350
Camden	54,014	54,072	54,163	54,259	54,372	54,483	54,591	54,695	54,797	54,896	54,990
Essex	93,170	93,273	93,367	93,438	93,589	93,736	93,872	94,004	94,127	94,251	94,365
Gloucester	29,697	29,770	29,801	29,877	29,937	29,996	30,054	30,111	30,165	30,217	30,269
Hudson	86,882	87,000	87,080	87,121	87,241	87,357	87,469	87,573	87,670	87,763	87,847
Hunterdon	9,519	9,523	9,528	9,556	9,568	9,579	9,589	9,598	9,608	9,616	9,625
Mercer	33,309	33,352	33,385	33,421	33,471	33,521	33,568	33,613	33,657	33,700	33,739
Middlesex	91,001	91,143	91,225	91,255	91,382	91,507	91,624	91,738	91,845	91,954	92,053
Monmouth	74,368	74,446	74,507	74,553	74,636	74,717	74,789	74,856	74,920	74,982	75,042
Morris	49,488	49,534	49,590	49,652	49,712	49,770	49,825	49,879	49,928	49,975	50,020
Ocean	74,664	74,742	74,792	74,859	74,933	75,002	75,067	75,129	75,189	75,246	75,300
Passaic	71,574	71,630	71,673	71,767	71,899	72,028	72,152	72,268	72,381	72,493	72,602
Somerset	29,442	29,489	29,515	29,557	29,600	29,642	29,680	29,717	29,752	29,785	29,817
Sussex	13,591	13,620	13,648	13,680	13,709	13,737	13,763	13,789	13,813	13,838	13,860
Union	70,328	70,399	70,453	70,513	70,626	70,733	70,837	70,939	71,036	71,128	71,220
Warren	9,671	9,684	9,694	9,708	9,727	9,744	9,760	9,777	9,792	9,806	9,820

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:		
	5/1	5/2	5/3	5/4	5/6	5/8	5/10
Bergen	101,120	101,198	101,287	101,383	101,618 (20,324) [4,878] {2,439}	101,825 (20,365) [4,888] {2,444}	102,011 (20,402) [4,897] {2,448}
Burlington	43,840	43,902	43,966	43,996	44,110 (8,822) [2,117] {1,059}	44,212 (8,842) [2,122] {1,061}	44,306 (8,861) [2,127] {1,063}
Camden	54,014	54,072	54,163	54,259	54,483 (10,897) [2,615] {1,308}	54,695 (10,939) [2,625] {1,313}	54,896 (10,979) [2,635] {1,318}
Essex	93,170	93,273	93,367	93,438	93,736 (18,747) [4,499] {2,250}	94,004 (18,801) [4,512] {2,256}	94,251 (18,850) [4,524] {2,262}
Gloucester	29,697	29,770	29,801	29,877	29,996 (5,999) [1,440] {720}	30,111 (6,022) [1,445] {723}	30,217 (6,043) [1,450] {725}
Hudson	86,882	87,000	87,080	87,121	87,357 (17,471) [4,193] {2,097}	87,573 (17,515) [4,203] {2,102}	87,763 (17,553) [4,213] {2,106}
Hunterdon	9,519	9,523	9,528	9,556	9,579 (1,916) [460] {230}	9,598 (1,920) [461] {230}	9,616 (1,923) [462] {231}
Mercer	33,309	33,352	33,385	33,421	33,521 (6,704) [1,609] {804}	33,613 (6,723) [1,613] {807}	33,700 (6,740) [1,618] {809}
Middlesex	91,001	91,143	91,225	91,255	91,507 (18,301) [4,392] {2,196}	91,738 (18,348) [4,403] {2,202}	91,954 (18,391) [4,414] {2,207}
Monmouth	74,368	74,446	74,507	74,553	74,717 (14,943) [3,586] {1,793}	74,856 (14,971) [3,593] {1,797}	74,982 (14,996) [3,599] {1,800}
Morris	49,488	49,534	49,590	49,652	49,770 (9,954) [2,389] {1,194}	49,879 (9,976) [2,394] {1,197}	49,975 (9,995) [2,399] {1,199}
Ocean	74,664	74,742	74,792	74,859	75,002 (15,000) [3,600] {1,800}	75,129 (15,026) [3,606] {1,803}	75,246 (15,049) [3,612] {1,806}
Passaic	71,574	71,630	71,673	71,767	72,028 (14,406) [3,457] {1,729}	72,268 (14,454) [3,469] {1,734}	72,493 (14,499) [3,480] {1,740}
Somerset	29,442	29,489	29,515	29,557	29,642 (5,928) [1,423] {711}	29,717 (5,943) [1,426] {713}	29,785 (5,957) [1,430] {715}
Sussex	13,591	13,620	13,648	13,680	13,737 (2,747) [659] {330}	13,789 (2,758) [662] {331}	13,838 (2,768) [664] {332}
Union	70,328	70,399	70,453	70,513	70,733 (14,147) [3,395] {1,698}	70,939 (14,188) [3,405] {1,703}	71,128 (14,226) [3,414] {1,707}
Warren	9,671	9,684	9,694	9,708	9,744 (1,949) [468] {234}	9,777 (1,955) [469] {235}	9,806 (1,961) [471] {235}

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.