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

Date: 6/3/21

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 6/3/21 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.

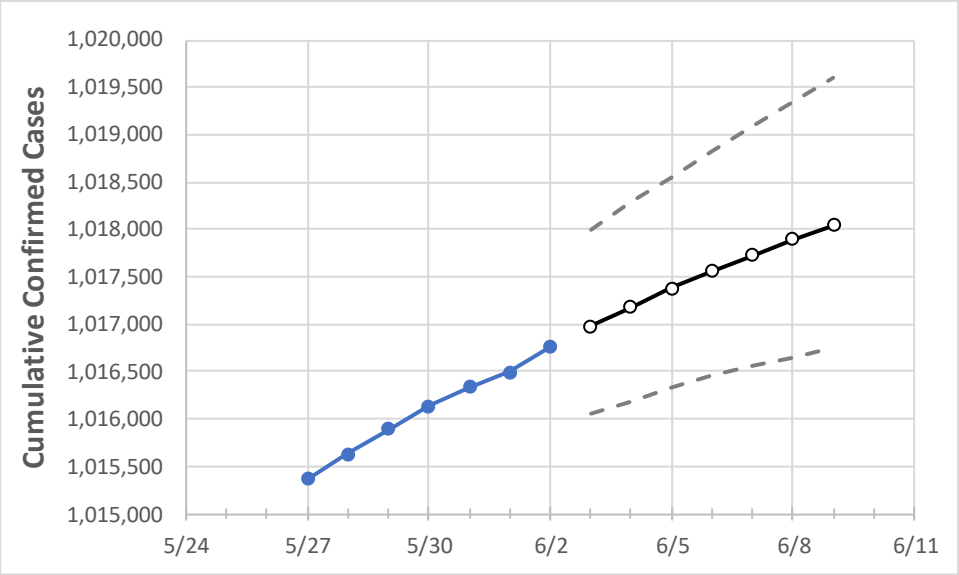
IEM's Modeling Lead

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
New Jersey	1,016,135	1,016,332	1,016,490	1,016,763	1,016,976	1,017,180	1,017,376	1,017,555	1,017,733	1,017,897	1,018,050

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Bergen	104,237	104,255	104,270	104,287	104,304	104,320	104,335	104,349	104,361	104,373	104,384
Burlington	44,159	44,169	44,176	44,159	44,171	44,182	44,193	44,204	44,213	44,222	44,231
Camden	55,559	55,569	55,578	55,604	55,625	55,645	55,663	55,681	55,698	55,714	55,729
Essex	93,970	93,990	94,005	94,065	94,092	94,119	94,144	94,171	94,194	94,219	94,241
Gloucester	30,487	30,494	30,499	30,516	30,524	30,531	30,537	30,543	30,549	30,554	30,559
Hudson	87,881	87,886	87,893	87,905	87,914	87,922	87,930	87,937	87,944	87,950	87,956
Hunterdon	9,781	9,784	9,785	9,782	9,785	9,788	9,791	9,793	9,796	9,798	9,800
Mercer	33,964	33,981	33,987	33,990	34,003	34,016	34,028	34,040	34,051	34,063	34,074
Middlesex	92,110	92,138	92,154	92,181	92,204	92,225	92,246	92,266	92,286	92,305	92,323
Monmouth	75,451	75,464	75,473	75,485	75,499	75,512	75,524	75,536	75,547	75,557	75,566
Morris	50,064	50,071	50,078	50,093	50,105	50,116	50,127	50,137	50,147	50,157	50,166
Ocean	75,722	75,743	75,754	75,776	75,791	75,805	75,818	75,831	75,843	75,855	75,866
Passaic	72,818	72,827	72,844	72,873	72,893	72,913	72,932	72,951	72,968	72,985	73,001
Somerset	30,024	30,023	30,027	30,032	30,038	30,043	30,048	30,053	30,058	30,062	30,066
Sussex	13,973	13,980	13,982	13,987	13,991	13,995	14,000	14,003	14,007	14,010	14,013
Union	71,313	71,325	71,336	71,348	71,359	71,369	71,379	71,389	71,397	71,405	71,413
Warren	9,961	9,962	9,963	9,967	9,971	9,974	9,977	9,980	9,983	9,986	9,989

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:		
	5/30	5/31	6/1	6/2	6/4	6/6	6/8
Bergen	104,237	104,255	104,270	104,287	104,320 (20,864) [5,007] {2,504}	104,349 (20,870) [5,009] {2,504}	104,373 (20,875) [5,010] {2,505}
Burlington	44,159	44,169	44,176	44,159	44,182 (8,836) [2,121] {1,060}	44,204 (8,841) [2,122] {1,061}	44,222 (8,844) [2,123] {1,061}
Camden	55,559	55,569	55,578	55,604	55,645 (11,129) [2,671] {1,335}	55,681 (11,136) [2,673] {1,336}	55,714 (11,143) [2,674] {1,337}
Essex	93,970	93,990	94,005	94,065	94,119 (18,824) [4,518] {2,259}	94,171 (18,834) [4,520] {2,260}	94,219 (18,844) [4,522] {2,261}
Gloucester	30,487	30,494	30,499	30,516	30,531 (6,106) [1,465] {733}	30,543 (6,109) [1,466] {733}	30,554 (6,111) [1,467] {733}
Hudson	87,881	87,886	87,893	87,905	87,922 (17,584) [4,220] {2,110}	87,937 (17,587) [4,221] {2,110}	87,950 (17,590) [4,222] {2,111}
Hunterdon	9,781	9,784	9,785	9,782	9,788 (1,958) [470] {235}	9,793 (1,959) [470] {235}	9,798 (1,960) [470] {235}
Mercer	33,964	33,981	33,987	33,990	34,016 (6,803) [1,633] {816}	34,040 (6,808) [1,634] {817}	34,063 (6,813) [1,635] {818}
Middlesex	92,110	92,138	92,154	92,181	92,225 (18,445) [4,427] {2,213}	92,266 (18,453) [4,429] {2,214}	92,305 (18,461) [4,431] {2,215}
Monmouth	75,451	75,464	75,473	75,485	75,512 (15,102) [3,625] {1,812}	75,536 (15,107) [3,626] {1,813}	75,557 (15,111) [3,627] {1,813}
Morris	50,064	50,071	50,078	50,093	50,116 (10,023) [2,406] {1,203}	50,137 (10,027) [2,407] {1,203}	50,157 (10,031) [2,408] {1,204}
Ocean	75,722	75,743	75,754	75,776	75,805 (15,161) [3,639] {1,819}	75,831 (15,166) [3,640] {1,820}	75,855 (15,171) [3,641] {1,821}
Passaic	72,818	72,827	72,844	72,873	72,913 (14,583) [3,500] {1,750}	72,951 (14,590) [3,502] {1,751}	72,985 (14,597) [3,503] {1,752}
Somerset	30,024	30,023	30,027	30,032	30,043 (6,009) [1,442] {721}	30,053 (6,011) [1,443] {721}	30,062 (6,012) [1,443] {721}
Sussex	13,973	13,980	13,982	13,987	13,995 (2,799) [672] {336}	14,003 (2,801) [672] {336}	14,010 (2,802) [672] {336}
Union	71,313	71,325	71,336	71,348	71,369 (14,274) [3,426] {1,713}	71,389 (14,278) [3,427] {1,713}	71,405 (14,281) [3,427] {1,714}
Warren	9,961	9,962	9,963	9,967	9,974 (1,995) [479] {239}	9,980 (1,996) [479] {240}	9,986 (1,997) [479] {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.