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

Date: 2/11/22

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 2/11/22 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.

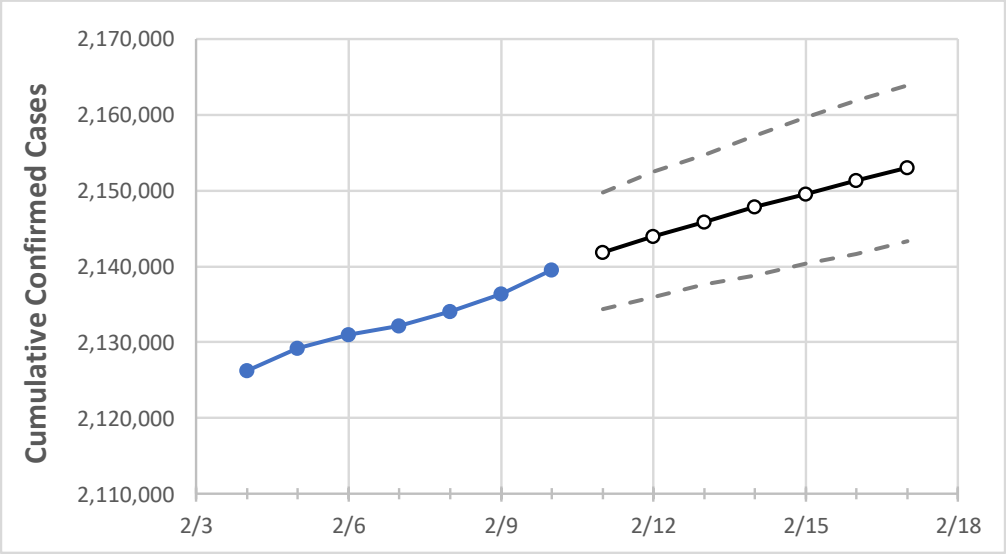
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
New Jersey	2,132,154	2,134,058	2,136,387	2,139,579	2,141,810	2,143,920	2,145,828	2,147,876	2,149,582	2,151,326	2,152,989

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Bergen	214,804	215,019	215,231	215,633	215,838	216,044	216,228	216,408	216,587	216,744	216,896
Burlington	98,763	98,878	99,041	99,292	99,447	99,588	99,727	99,860	99,988	100,113	100,228
Camden	122,277	122,370	122,570	122,783	122,927	123,062	123,193	123,316	123,431	123,542	123,648
Essex	206,450	206,534	206,682	206,962	207,075	207,194	207,301	207,400	207,497	207,599	207,671
Gloucester	67,849	67,968	68,062	68,153	68,250	68,338	68,420	68,507	68,582	68,663	68,731
Hudson	165,261	165,355	165,479	165,780	165,891	165,999	166,091	166,190	166,286	166,371	166,447
Hunterdon	23,675	23,690	23,730	23,771	23,802	23,833	23,862	23,892	23,917	23,943	23,968
Mercer	73,269	73,365	73,423	73,554	73,647	73,733	73,817	73,896	73,973	74,050	74,120
Middlesex	185,129	185,324	185,513	185,811	186,172	186,449	186,703	186,987	187,201	187,528	187,771
Monmouth	159,135	159,259	159,452	159,626	159,792	159,952	160,104	160,252	160,389	160,528	160,646
Morris	114,370	114,496	114,638	114,795	114,902	114,999	115,096	115,183	115,276	115,352	115,432
Ocean	157,636	157,770	157,918	158,118	158,286	158,445	158,594	158,741	158,880	159,010	159,127
Passaic	140,561	140,694	140,816	140,991	141,108	141,225	141,339	141,428	141,526	141,628	141,721
Somerset	65,279	65,341	65,410	65,474	65,531	65,588	65,643	65,694	65,740	65,787	65,830
Sussex	32,864	32,888	32,924	32,976	33,010	33,041	33,070	33,100	33,126	33,151	33,177
Union	138,455	138,556	138,715	138,905	139,012	139,123	139,218	139,312	139,407	139,501	139,576
Warren	23,156	23,168	23,200	23,226	23,251	23,274	23,296	23,316	23,337	23,357	23,374

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:		
	2/7	2/8	2/9	2/10	2/12	2/14	2/16
Bergen	214,804	215,019	215,231	215,633	216,044 (43,209) [10,370] {5,185}	216,408 (43,282) [10,388] {5,194}	216,744 (43,349) [10,404] {5,202}
Burlington	98,763	98,878	99,041	99,292	99,588 (19,918) [4,780] {2,390}	99,860 (19,972) [4,793] {2,397}	100,113 (20,023) [4,805] {2,403}
Camden	122,277	122,370	122,570	122,783	123,062 (24,612) [5,907] {2,953}	123,316 (24,663) [5,919] {2,960}	123,542 (24,708) [5,930] {2,965}
Essex	206,450	206,534	206,682	206,962	207,194 (41,439) [9,945] {4,973}	207,400 (41,480) [9,955] {4,978}	207,599 (41,520) [9,965] {4,982}
Gloucester	67,849	67,968	68,062	68,153	68,338 (13,668) [3,280] {1,640}	68,507 (13,701) [3,288] {1,644}	68,663 (13,733) [3,296] {1,648}
Hudson	165,261	165,355	165,479	165,780	165,999 (33,200) [7,968] {3,984}	166,190 (33,238) [7,977] {3,989}	166,371 (33,274) [7,986] {3,993}
Hunterdon	23,675	23,690	23,730	23,771	23,833 (4,767) [1,144] {572}	23,892 (4,778) [1,147] {573}	23,943 (4,789) [1,149] {575}
Mercer	73,269	73,365	73,423	73,554	73,733 (14,747) [3,539] {1,770}	73,896 (14,779) [3,547] {1,774}	74,050 (14,810) [3,554] {1,777}
Middlesex	185,129	185,324	185,513	185,811	186,449 (37,290) [8,950] {4,475}	186,987 (37,397) [8,975] {4,488}	187,528 (37,506) [9,001] {4,501}
Monmouth	159,135	159,259	159,452	159,626	159,952 (31,990) [7,678] {3,839}	160,252 (32,050) [7,692] {3,846}	160,528 (32,106) [7,705] {3,853}
Morris	114,370	114,496	114,638	114,795	114,999 (23,000) [5,520] {2,760}	115,183 (23,037) [5,529] {2,764}	115,352 (23,070) [5,537] {2,768}
Ocean	157,636	157,770	157,918	158,118	158,445 (31,689) [7,605] {3,803}	158,741 (31,748) [7,620] {3,810}	159,010 (31,802) [7,632] {3,816}
Passaic	140,561	140,694	140,816	140,991	141,225 (28,245) [6,779] {3,389}	141,428 (28,286) [6,789] {3,394}	141,628 (28,326) [6,798] {3,399}
Somerset	65,279	65,341	65,410	65,474	65,588 (13,118) [3,148] {1,574}	65,694 (13,139) [3,153] {1,577}	65,787 (13,157) [3,158] {1,579}
Sussex	32,864	32,888	32,924	32,976	33,041 (6,608) [1,586] {793}	33,100 (6,620) [1,589] {794}	33,151 (6,630) [1,591] {796}
Union	138,455	138,556	138,715	138,905	139,123 (27,825) [6,678] {3,339}	139,312 (27,862) [6,687] {3,343}	139,501 (27,900) [6,696] {3,348}
Warren	23,156	23,168	23,200	23,226	23,274 (4,655) [1,117] {559}	23,316 (4,663) [1,119] {560}	23,357 (4,671) [1,121] {561}

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.