IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/12/21

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 <u>not</u> 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 11/12/21 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
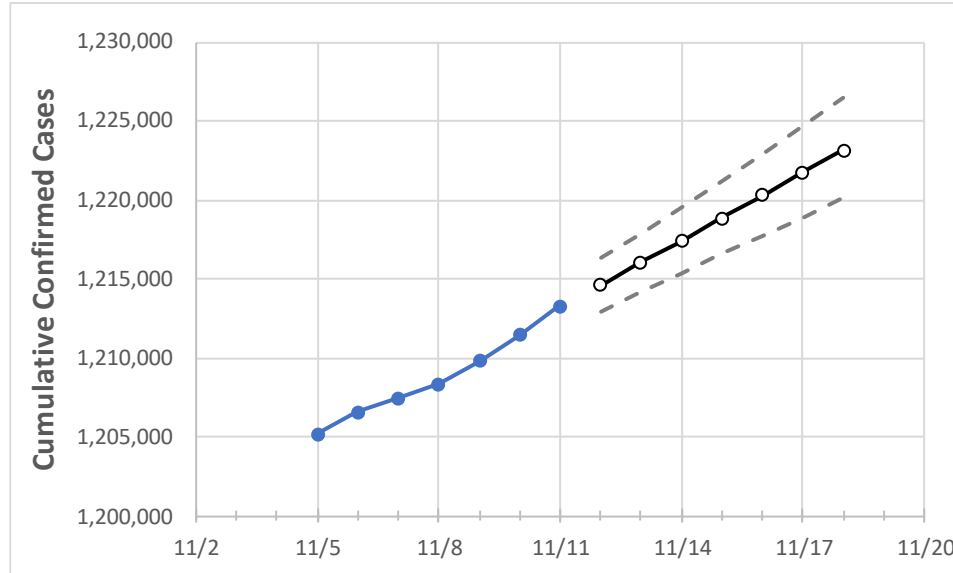
	Actual Confirmed Cases On:				Projected Cases For:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
New Jersey	1,208,321	1,209,785	1,211,423	1,213,246	1,214,628	1,216,032	1,217,416	1,218,840	1,220,295	1,221,749	1,223,169

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:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Bergen	120,802	120,902	121,000	121,137	121,236	121,334	121,431	121,529	121,630	121,729	121,826
Burlington	55,552	55,651	55,770	55,911	56,002	56,091	56,181	56,273	56,366	56,462	56,552
Camden	69,011	69,110	69,210	69,360	69,453	69,548	69,643	69,738	69,835	69,933	70,030
Essex	106,948	107,054	107,154	107,281	107,373	107,470	107,566	107,664	107,765	107,871	107,976
Gloucester	39,032	39,098	39,177	39,262	39,330	39,394	39,460	39,528	39,595	39,662	39,730
Hudson	98,017	98,055	98,142	98,193	98,250	98,308	98,364	98,423	98,480	98,539	98,597
Hunterdon	12,191	12,211	12,238	12,282	12,300	12,317	12,335	12,352	12,370	12,388	12,405
Mercer	40,007	40,066	40,124	40,175	40,224	40,274	40,323	40,372	40,422	40,471	40,520
Middlesex	107,193	107,308	107,414	107,549	107,647	107,750	107,847	107,949	108,052	108,158	108,258
Monmouth	93,703	93,850	94,056	94,227	94,376	94,524	94,680	94,832	94,990	95,148	95,306
Morris	58,705	58,801	58,875	58,974	59,052	59,130	59,208	59,288	59,368	59,450	59,532
Ocean	96,891	97,056	97,268	97,475	97,632	97,788	97,944	98,105	98,257	98,414	98,573
Passaic	82,304	82,359	82,423	82,528	82,588	82,647	82,706	82,769	82,830	82,892	82,952
Somerset	35,195	35,230	35,275	35,315	35,351	35,386	35,422	35,459	35,496	35,535	35,572
Sussex	17,720	17,771	17,828	17,873	17,913	17,953	17,993	18,033	18,074	18,114	18,156
Union	80,134	80,206	80,260	80,355	80,420	80,485	80,551	80,620	80,689	80,761	80,832
Warren	12,373	12,401	12,431	12,457	12,480	12,503	12,527	12,552	12,576	12,601	12,625

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:		
	11/8	11/9	11/10	11/11	11/13	11/15	11/17
Bergen	120,802	120,902	121,000	121,137	121,334 (24,267) [5,824] {2,912}	121,529 (24,306) [5,833] {2,917}	121,729 (24,346) [5,843] {2,921}
Burlington	55,552	55,651	55,770	55,911	56,091 (11,218) [2,692] {1,346}	56,273 (11,255) [2,701] {1,351}	56,462 (11,292) [2,710] {1,355}
Camden	69,011	69,110	69,210	69,360	69,548 (13,910) [3,338] {1,669}	69,738 (13,948) [3,347] {1,674}	69,933 (13,987) [3,357] {1,678}
Essex	106,948	107,054	107,154	107,281	107,470 (21,494) [5,159] {2,579}	107,664 (21,533) [5,168] {2,584}	107,871 (21,574) [5,178] {2,589}
Gloucester	39,032	39,098	39,177	39,262	39,394 (7,879) [1,891] {945}	39,528 (7,906) [1,897] {949}	39,662 (7,932) [1,904] {952}
Hudson	98,017	98,055	98,142	98,193	98,308 (19,662) [4,719] {2,359}	98,423 (19,685) [4,724] {2,362}	98,539 (19,708) [4,730] {2,365}
Hunterdon	12,191	12,211	12,238	12,282	12,317 (2,463) [591] {296}	12,352 (2,470) [593] {296}	12,388 (2,478) [595] {297}
Mercer	40,007	40,066	40,124	40,175	40,274 (8,055) [1,933] {967}	40,372 (8,074) [1,938] {969}	40,471 (8,094) [1,943] {971}
Middlesex	107,193	107,308	107,414	107,549	107,750 (21,550) [5,172] {2,586}	107,949 (21,590) [5,182] {2,591}	108,158 (21,632) [5,192] {2,596}
Monmouth	93,703	93,850	94,056	94,227	94,524 (18,905) [4,537] {2,269}	94,832 (18,966) [4,552] {2,276}	95,148 (19,030) [4,567] {2,284}
Morris	58,705	58,801	58,875	58,974	59,130 (11,826) [2,838] {1,419}	59,288 (11,858) [2,846] {1,423}	59,450 (11,890) [2,854] {1,427}
Ocean	96,891	97,056	97,268	97,475	97,788 (19,558) [4,694] {2,347}	98,105 (19,621) [4,709] {2,355}	98,414 (19,683) [4,724] {2,362}
Passaic	82,304	82,359	82,423	82,528	82,647 (16,529) [3,967] {1,984}	82,769 (16,554) [3,973] {1,986}	82,892 (16,578) [3,979] {1,989}
Somerset	35,195	35,230	35,275	35,315	35,386 (7,077) [1,699] {849}	35,459 (7,092) [1,702] {851}	35,535 (7,107) [1,706] {853}
Sussex	17,720	17,771	17,828	17,873	17,953 (3,591) [862] {431}	18,033 (3,607) [866] {433}	18,114 (3,623) [869] {435}
Union	80,134	80,206	80,260	80,355	80,485 (16,097) [3,863] {1,932}	80,620 (16,124) [3,870] {1,935}	80,761 (16,152) [3,877] {1,938}
Warren	12,373	12,401	12,431	12,457	12,503 (2,501) [600] {300}	12,552 (2,510) [602] {301}	12,601 (2,520) [605] {302}

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.