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

Date: 11/9/20

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 11/9/20 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.

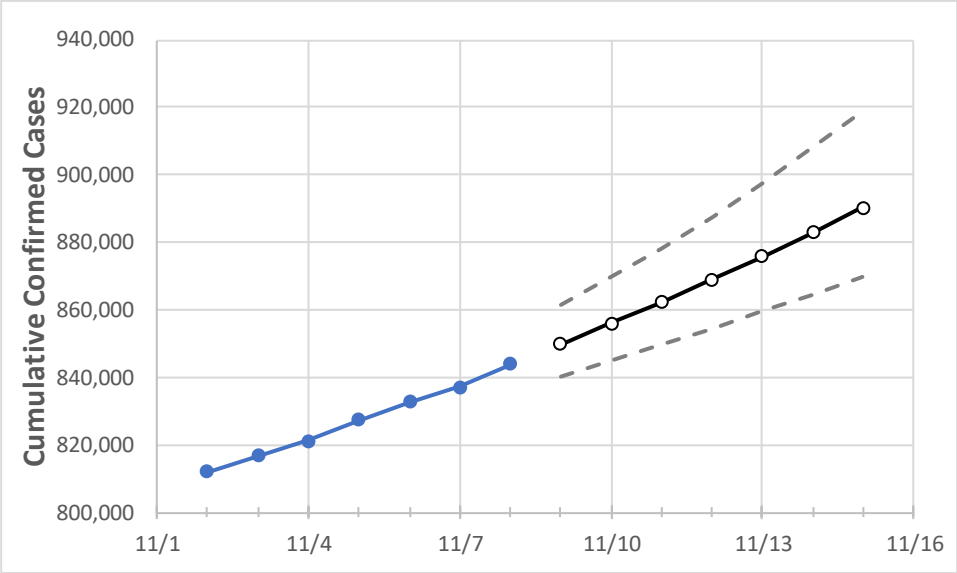
IEM's Modeling Lead

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.

Florida State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Florida	827,380	832,625	837,077	843,897	849,815	855,954	862,323	868,931	875,785	882,897	890,275

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 20%, and are often within 10%, of actual confirmed cases.

Florida Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Alachua	10,996	11,047	11,082	11,123	11,180	11,236	11,292	11,346	11,398	11,450	11,501
Broward	89,184	89,751	90,172	90,997	91,636	92,299	92,985	93,696	94,433	95,195	95,986
Charlotte	3,884	3,922	3,962	4,005	4,048	4,092	4,139	4,186	4,236	4,287	4,341
Collier	15,005	15,091	15,173	15,263	15,357	15,454	15,553	15,654	15,758	15,865	15,975
Duval	36,282	36,438	36,520	36,716	36,871	37,028	37,184	37,342	37,501	37,660	37,820
Hillsborough	49,794	50,127	50,380	50,790	51,137	51,498	51,872	52,262	52,666	53,086	53,523
Lake	9,047	9,103	9,132	9,195	9,252	9,311	9,371	9,433	9,498	9,563	9,631
Lee	24,328	24,508	24,655	24,842	25,009	25,180	25,354	25,533	25,715	25,902	26,093
Manatee	13,892	13,944	13,989	14,114	14,198	14,283	14,370	14,459	14,549	14,642	14,735
Miami-Dade	190,728	191,838	192,646	194,356	195,576	196,862	198,219	199,649	201,158	202,748	204,425
Okaloosa	6,823	6,901	6,968	7,062	7,136	7,211	7,289	7,370	7,453	7,538	7,626
Orange	48,015	48,322	48,596	48,729	48,977	49,230	49,489	49,753	50,022	50,297	50,577
Osceola	14,767	14,869	14,935	15,106	15,211	15,319	15,432	15,549	15,671	15,798	15,929
Palm Beach	54,260	54,624	55,002	55,449	55,899	56,366	56,851	57,354	57,877	58,419	58,981
Pasco	11,445	11,558	11,671	11,788	11,912	12,043	12,181	12,327	12,482	12,646	12,820
Pinellas	26,884	27,192	27,372	27,675	27,900	28,134	28,379	28,633	28,898	29,174	29,461
Polk	23,763	23,879	23,966	24,129	24,255	24,383	24,514	24,647	24,784	24,922	25,064
Sarasota	10,186	10,247	10,312	10,429	10,516	10,606	10,700	10,796	10,896	10,999	11,106
Seminole	10,725	10,801	10,860	10,938	11,017	11,099	11,185	11,273	11,364	11,459	11,558
St. Johns	6,907	6,965	6,992	7,047	7,105	7,164	7,224	7,285	7,347	7,411	7,475
Sumter	3,026	3,047	3,070	3,086	3,105	3,125	3,145	3,166	3,188	3,210	3,233
Volusia	13,360	13,439	13,557	13,653	13,756	13,862	13,971	14,083	14,198	14,317	14,440

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.*

Florida Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	11/5	11/6	11/7	11/8	11/10	11/12	11/14
Alachua	10,996	11,047	11,082	11,123	11,236 (2,247) [539] {270}	11,346 (2,269) [545] {272}	11,450 (2,290) [550] {275}
Broward	89,184	89,751	90,172	90,997	92,299 (18,460) [4,430] {2,215}	93,696 (18,739) [4,497] {2,249}	95,195 (19,039) [4,569] {2,285}
Charlotte	3,884	3,922	3,962	4,005	4,092 (818) [196] {98}	4,186 (837) [201] {100}	4,287 (857) [206] {103}
Collier	15,005	15,091	15,173	15,263	15,454 (3,091) [742] {371}	15,654 (3,131) [751] {376}	15,865 (3,173) [762] {381}
Duval	36,282	36,438	36,520	36,716	37,028 (7,406) [1,777] {889}	37,342 (7,468) [1,792] {896}	37,660 (7,532) [1,808] {904}
Hillsborough	49,794	50,127	50,380	50,790	51,498 (10,300) [2,472] {1,236}	52,262 (10,452) [2,509] {1,254}	53,086 (10,617) [2,548] {1,274}
Lake	9,047	9,103	9,132	9,195	9,311 (1,862) [447] {223}	9,433 (1,887) [453] {226}	9,563 (1,913) [459] {230}
Lee	24,328	24,508	24,655	24,842	25,180 (5,036) [1,209] {604}	25,533 (5,107) [1,226] {613}	25,902 (5,180) [1,243] {622}
Manatee	13,892	13,944	13,989	14,114	14,283 (2,857) [686] {343}	14,459 (2,892) [694] {347}	14,642 (2,928) [703] {351}
Miami-Dade	190,728	191,838	192,646	194,356	196,862 (39,372) [9,449] {4,725}	199,649 (39,930) [9,583] {4,792}	202,748 (40,550) [9,732] {4,866}
Okaloosa	6,823	6,901	6,968	7,062	7,211 (1,442) [346] {173}	7,370 (1,474) [354] {177}	7,538 (1,508) [362] {181}
Orange	48,015	48,322	48,596	48,729	49,230 (9,846) [2,363] {1,182}	49,753 (9,951) [2,388] {1,194}	50,297 (10,059) [2,414] {1,207}
Osceola	14,767	14,869	14,935	15,106	15,319 (3,064) [735] {368}	15,549 (3,110) [746] {373}	15,798 (3,160) [758] {379}
Palm Beach	54,260	54,624	55,002	55,449	56,366 (11,273) [2,706] {1,353}	57,354 (11,471) [2,753] {1,377}	58,419 (11,684) [2,804] {1,402}
Pasco	11,445	11,558	11,671	11,788	12,043 (2,409) [578] {289}	12,327 (2,465) [592] {296}	12,646 (2,529) [607] {304}
Pinellas	26,884	27,192	27,372	27,675	28,134 (5,627) [1,350] {675}	28,633 (5,727) [1,374] {687}	29,174 (5,835) [1,400] {700}
Polk	23,763	23,879	23,966	24,129	24,383 (4,877) [1,170] {585}	24,647 (4,929) [1,183] {592}	24,922 (4,984) [1,196] {598}
Sarasota	10,186	10,247	10,312	10,429	10,606 (2,121) [509] {255}	10,796 (2,159) [518] {259}	10,999 (2,200) [528] {264}
Seminole	10,725	10,801	10,860	10,938	11,099 (2,220) [533] {266}	11,273 (2,255) [541] {271}	11,459 (2,292) [550] {275}
St. Johns	6,907	6,965	6,992	7,047	7,164 (1,433) [344] {172}	7,285 (1,457) [350] {175}	7,411 (1,482) [356] {178}
Sumter	3,026	3,047	3,070	3,086	3,125 (625) [150] {75}	3,166 (633) [152] {76}	3,210 (642) [154] {77}
Volusia	13,360	13,439	13,557	13,653	13,862 (2,772) [665] {333}	14,083 (2,817) [676] {338}	14,317 (2,863) [687] {344}

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.