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

Date: 12/9/20

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 12/9/20 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.

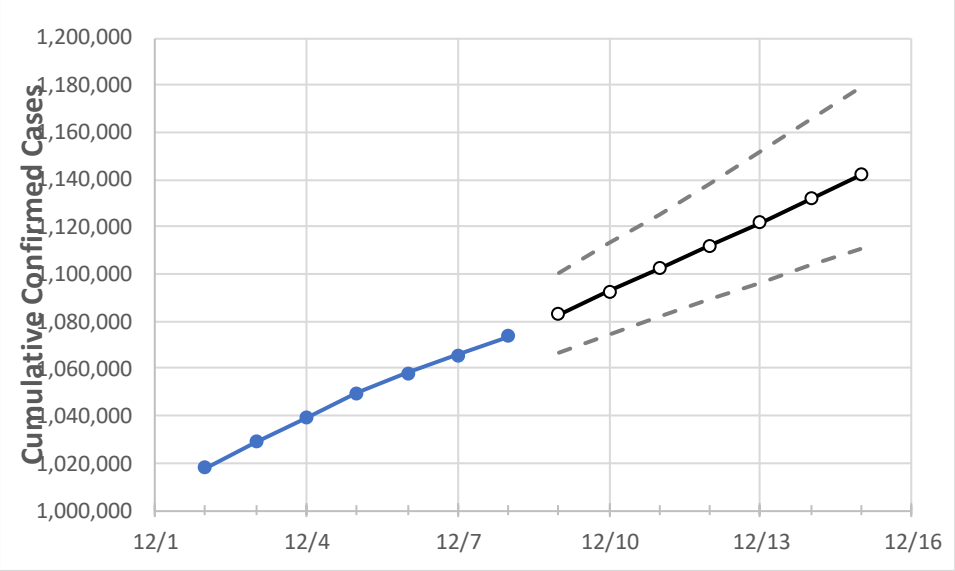
IEM's Modeling Lead

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:						
	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15
Florida	1,049,638	1,058,074	1,065,785	1,073,770	1,083,165	1,092,682	1,102,322	1,112,086	1,121,977	1,131,994	1,142,140

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:						
	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15
Alachua	13,314	13,382	13,479	13,567	13,649	13,733	13,818	13,904	13,991	14,079	14,169
Broward	112,729	113,634	114,426	115,414	116,459	117,524	118,607	119,711	120,834	121,977	123,141
Charlotte	5,437	5,527	5,593	5,652	5,723	5,795	5,868	5,944	6,021	6,099	6,180
Collier	18,751	18,926	19,026	19,133	19,277	19,422	19,570	19,721	19,873	20,028	20,185
Duval	46,606	47,036	47,418	47,818	48,310	48,810	49,318	49,833	50,356	50,886	51,425
Hillsborough	60,761	61,276	61,599	62,149	62,640	63,143	63,658	64,185	64,725	65,278	65,844
Lake	11,091	11,183	11,301	11,524	11,636	11,752	11,872	11,996	12,125	12,258	12,396
Lee	31,897	32,209	32,476	32,790	33,130	33,477	33,829	34,188	34,553	34,925	35,303
Manatee	17,606	17,713	17,800	18,008	18,150	18,293	18,437	18,583	18,729	18,877	19,025
Miami-Dade	241,051	243,050	245,064	246,915	249,147	251,407	253,695	256,013	258,359	260,734	263,139
Okaloosa	9,714	9,776	9,870	10,072	10,188	10,308	10,430	10,557	10,687	10,821	10,958
Orange	61,030	61,474	62,041	60,291	60,827	61,371	61,923	62,485	63,054	63,632	64,219
Osceola	19,487	19,625	19,809	20,277	20,514	20,758	21,012	21,274	21,545	21,825	22,115
Palm Beach	68,381	68,912	69,331	69,855	70,397	70,946	71,501	72,063	72,632	73,207	73,789
Pasco	15,948	16,153	16,338	16,543	16,760	16,983	17,212	17,447	17,688	17,936	18,191
Pinellas	34,603	34,899	35,202	35,505	35,805	36,109	36,416	36,728	37,043	37,362	37,685
Polk	28,918	29,135	29,362	29,734	30,030	30,339	30,663	31,002	31,357	31,728	32,117
Sarasota	14,575	14,753	14,862	15,024	15,174	15,324	15,473	15,622	15,770	15,919	16,067
Seminole	13,556	13,642	13,770	14,456	14,616	14,782	14,955	15,135	15,322	15,516	15,719
St. Johns	9,433	9,542	9,620	9,722	9,838	9,955	10,074	10,194	10,316	10,441	10,566
Sumter	3,701	3,716	3,745	3,802	3,846	3,892	3,942	3,994	4,049	4,108	4,169
Volusia	17,286	17,388	17,498	17,720	17,863	18,007	18,151	18,296	18,440	18,585	18,731

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:		
	12/5	12/6	12/7	12/8	12/10	12/12	12/14
Alachua	13,314	13,382	13,479	13,567	13,733 (2,747) [659] {330}	13,904 (2,781) [667] {334}	14,079 (2,816) [676] {338}
Broward	112,729	113,634	114,426	115,414	117,524 (23,505) [5,641] {2,821}	119,711 (23,942) [5,746] {2,873}	121,977 (24,395) [5,855] {2,927}
Charlotte	5,437	5,527	5,593	5,652	5,795 (1,159) [278] {139}	5,944 (1,189) [285] {143}	6,099 (1,220) [293] {146}
Collier	18,751	18,926	19,026	19,133	19,422 (3,884) [932] {466}	19,721 (3,944) [947] {473}	20,028 (4,006) [961] {481}
Duval	46,606	47,036	47,418	47,818	48,810 (9,762) [2,343] {1,171}	49,833 (9,967) [2,392] {1,196}	50,886 (10,177) [2,443] {1,221}
Hillsborough	60,761	61,276	61,599	62,149	63,143 (12,629) [3,031] {1,515}	64,185 (12,837) [3,081] {1,540}	65,278 (13,056) [3,133] {1,567}
Lake	11,091	11,183	11,301	11,524	11,752 (2,350) [564] {282}	11,996 (2,399) [576] {288}	12,258 (2,452) [588] {294}
Lee	31,897	32,209	32,476	32,790	33,477 (6,695) [1,607] {803}	34,188 (6,838) [1,641] {821}	34,925 (6,985) [1,676] {838}
Manatee	17,606	17,713	17,800	18,008	18,293 (3,659) [878] {439}	18,583 (3,717) [892] {446}	18,877 (3,775) [906] {453}
Miami-Dade	241,051	243,050	245,064	246,915	251,407 (50,281) [12,068] {6,034}	256,013 (51,203) [12,289] {6,144}	260,734 (52,147) [12,515] {6,258}
Okaloosa	9,714	9,776	9,870	10,072	10,308 (2,062) [495] {247}	10,557 (2,111) [507] {253}	10,821 (2,164) [519] {260}
Orange	61,030	61,474	62,041	60,291	61,371 (12,274) [2,946] {1,473}	62,485 (12,497) [2,999] {1,500}	63,632 (12,726) [3,054] {1,527}
Osceola	19,487	19,625	19,809	20,277	20,758 (4,152) [996] {498}	21,274 (4,255) [1,021] {511}	21,825 (4,365) [1,048] {524}
Palm Beach	68,381	68,912	69,331	69,855	70,946 (14,189) [3,405] {1,703}	72,063 (14,413) [3,459] {1,730}	73,207 (14,641) [3,514] {1,757}
Pasco	15,948	16,153	16,338	16,543	16,983 (3,397) [815] {408}	17,447 (3,489) [837] {419}	17,936 (3,587) [861] {430}
Pinellas	34,603	34,899	35,202	35,505	36,109 (7,222) [1,733] {867}	36,728 (7,346) [1,763] {881}	37,362 (7,472) [1,793] {897}
Polk	28,918	29,135	29,362	29,734	30,339 (6,068) [1,456] {728}	31,002 (6,200) [1,488] {744}	31,728 (6,346) [1,523] {761}
Sarasota	14,575	14,753	14,862	15,024	15,324 (3,065) [736] {368}	15,622 (3,124) [750] {375}	15,919 (3,184) [764] {382}
Seminole	13,556	13,642	13,770	14,456	14,782 (2,956) [710] {355}	15,135 (3,027) [726] {363}	15,516 (3,103) [745] {372}
St. Johns	9,433	9,542	9,620	9,722	9,955 (1,991) [478] {239}	10,194 (2,039) [489] {245}	10,441 (2,088) [501] {251}
Sumter	3,701	3,716	3,745	3,802	3,892 (778) [187] {93}	3,994 (799) [192] {96}	4,108 (822) [197] {99}
Volusia	17,286	17,388	17,498	17,720	18,007 (3,601) [864] {432}	18,296 (3,659) [878] {439}	18,585 (3,717) [892] {446}

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.