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

Date: 2/9/21

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 2/9/21 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.

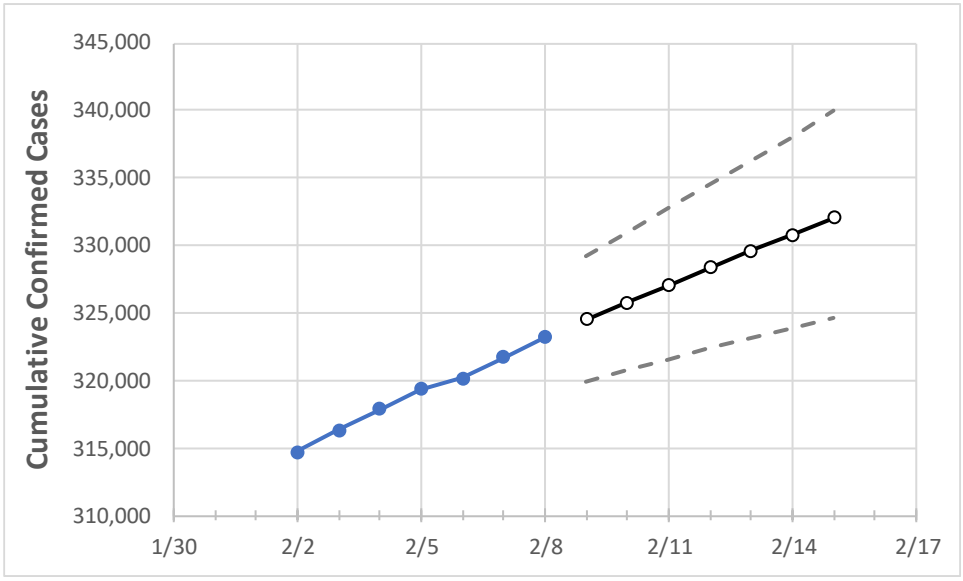
IEM's Modeling Lead

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.

Washington State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15
Washington	319,371	320,146	321,680	323,214	324,513	325,782	327,060	328,369	329,615	330,833	332,029

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.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15
Benton	14,348	14,357	14,411	14,465	14,508	14,548	14,587	14,625	14,661	14,700	14,735
Clark	17,992	18,030	18,107	18,184	18,260	18,331	18,401	18,471	18,538	18,610	18,676
Grant	7,275	7,277	7,306	7,334	7,355	7,375	7,395	7,414	7,433	7,451	7,470
Island	1,217	1,220	1,230	1,240	1,246	1,252	1,258	1,264	1,270	1,276	1,281
King	79,631	79,699	80,057	80,415	80,675	80,933	81,182	81,425	81,661	81,894	82,125
Kitsap	5,310	5,320	5,379	5,437	5,463	5,490	5,517	5,543	5,569	5,596	5,622
Pierce	35,017	35,112	35,282	35,451	35,613	35,771	35,924	36,075	36,226	36,371	36,514
Skagit	4,189	4,195	4,214	4,232	4,247	4,261	4,275	4,289	4,302	4,315	4,327
Snohomish	28,403	28,479	28,608	28,737	28,848	28,959	29,071	29,182	29,288	29,392	29,502
Spokane	34,201	34,272	34,430	34,587	34,733	34,874	35,013	35,146	35,282	35,416	35,542
Thurston	6,554	6,559	6,597	6,635	6,663	6,692	6,719	6,745	6,772	6,797	6,822
Whatcom	5,918	5,943	6,030	6,116	6,185	6,253	6,324	6,395	6,468	6,542	6,621
Yakima	25,072	25,366	25,469	25,571	25,705	25,841	25,978	26,119	26,261	26,404	26,549

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.*

Washington Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	2/5	2/6	2/7	2/8	2/10	2/12	2/14
Benton	14,348	14,357	14,411	14,465	14,548 (2,910) [698] {349}	14,625 (2,925) [702] {351}	14,700 (2,940) [706] {353}
Clark	17,992	18,030	18,107	18,184	18,331 (3,666) [880] {440}	18,471 (3,694) [887] {443}	18,610 (3,722) [893] {447}
Grant	7,275	7,277	7,306	7,334	7,375 (1,475) [354] {177}	7,414 (1,483) [356] {178}	7,451 (1,490) [358] {179}
Island	1,217	1,220	1,230	1,240	1,252 (250) [60] {30}	1,264 (253) [61] {30}	1,276 (255) [61] {31}
King	79,631	79,699	80,057	80,415	80,933 (16,187) [3,885] {1,942}	81,425 (16,285) [3,908] {1,954}	81,894 (16,379) [3,931] {1,965}
Kitsap	5,310	5,320	5,379	5,437	5,490 (1,098) [264] {132}	5,543 (1,109) [266] {133}	5,596 (1,119) [269] {134}
Pierce	35,017	35,112	35,282	35,451	35,771 (7,154) [1,717] {859}	36,075 (7,215) [1,732] {866}	36,371 (7,274) [1,746] {873}
Skagit	4,189	4,195	4,214	4,232	4,261 (852) [205] {102}	4,289 (858) [206] {103}	4,315 (863) [207] {104}
Snohomish	28,403	28,479	28,608	28,737	28,959 (5,792) [1,390] {695}	29,182 (5,836) [1,401] {700}	29,392 (5,878) [1,411] {705}
Spokane	34,201	34,272	34,430	34,587	34,874 (6,975) [1,674] {837}	35,146 (7,029) [1,687] {844}	35,416 (7,083) [1,700] {850}
Thurston	6,554	6,559	6,597	6,635	6,692 (1,338) [321] {161}	6,745 (1,349) [324] {162}	6,797 (1,359) [326] {163}
Whatcom	5,918	5,943	6,030	6,116	6,253 (1,251) [300] {150}	6,395 (1,279) [307] {153}	6,542 (1,308) [314] {157}
Yakima	25,072	25,366	25,469	25,571	25,841 (5,168) [1,240] {620}	26,119 (5,224) [1,254] {627}	26,404 (5,281) [1,267] {634}

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.