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

Date: 3/9/21

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 3/9/21 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.

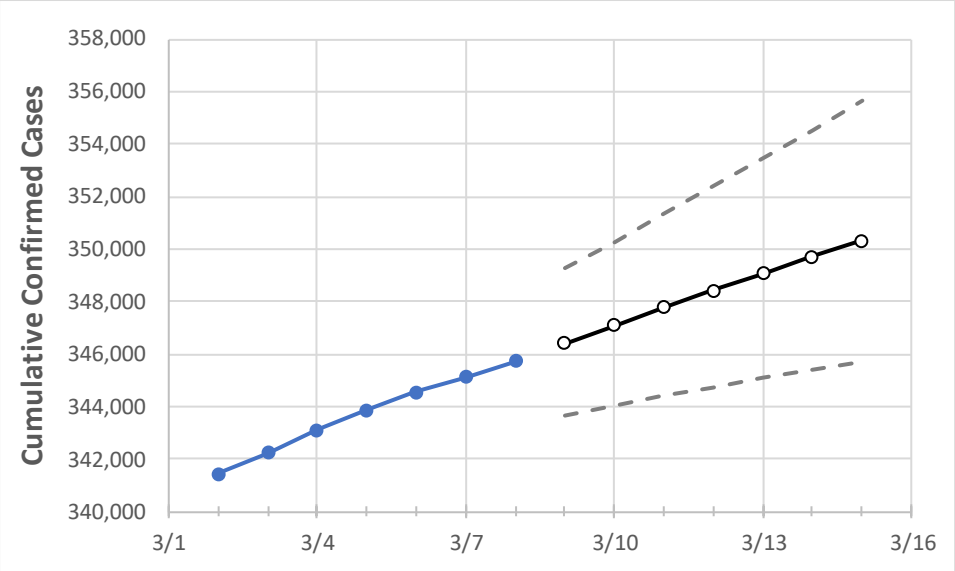
IEM's Modeling Lead

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
Washington	343,868	344,532	345,132	345,731	346,401	347,088	347,771	348,413	349,078	349,709	350,333

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
Benton	15,145	15,169	15,189	15,208	15,229	15,249	15,268	15,288	15,308	15,327	15,345
Clark	19,103	19,142	19,159	19,175	19,205	19,234	19,263	19,291	19,318	19,345	19,372
Grant	7,744	7,751	7,758	7,764	7,772	7,780	7,788	7,795	7,803	7,810	7,817
Island	1,347	1,363	1,370	1,377	1,387	1,398	1,409	1,422	1,435	1,449	1,463
King	84,855	85,015	85,149	85,282	85,423	85,555	85,693	85,828	85,961	86,090	86,215
Kitsap	5,839	5,863	5,880	5,897	5,910	5,924	5,938	5,951	5,965	5,978	5,990
Pierce	38,909	39,031	39,152	39,272	39,399	39,526	39,652	39,780	39,908	40,039	40,165
Skagit	4,519	4,531	4,543	4,555	4,570	4,586	4,602	4,619	4,635	4,652	4,670
Snohomish	30,535	30,566	30,609	30,651	30,699	30,745	30,790	30,835	30,879	30,921	30,961
Spokane	36,765	36,816	36,854	36,892	36,939	36,984	37,028	37,071	37,112	37,151	37,188
Thurston	7,311	7,336	7,345	7,353	7,368	7,383	7,397	7,411	7,424	7,436	7,449
Whatcom	6,925	6,953	6,973	6,992	7,017	7,041	7,064	7,088	7,110	7,133	7,154
Yakima	26,832	26,869	26,965	27,060	27,126	27,193	27,261	27,329	27,402	27,475	27,548

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:		
	3/5	3/6	3/7	3/8	3/10	3/12	3/14
Benton	15,145	15,169	15,189	15,208	15,249 (3,050) [732] {366}	15,288 (3,058) [734] {367}	15,327 (3,065) [736] {368}
Clark	19,103	19,142	19,159	19,175	19,234 (3,847) [923] {462}	19,291 (3,858) [926] {463}	19,345 (3,869) [929] {464}
Grant	7,744	7,751	7,758	7,764	7,780 (1,556) [373] {187}	7,795 (1,559) [374] {187}	7,810 (1,562) [375] {187}
Island	1,347	1,363	1,370	1,377	1,398 (280) [67] {34}	1,422 (284) [68] {34}	1,449 (290) [70] {35}
King	84,855	85,015	85,149	85,282	85,555 (17,111) [4,107] {2,053}	85,828 (17,166) [4,120] {2,060}	86,090 (17,218) [4,132] {2,066}
Kitsap	5,839	5,863	5,880	5,897	5,924 (1,185) [284] {142}	5,951 (1,190) [286] {143}	5,978 (1,196) [287] {143}
Pierce	38,909	39,031	39,152	39,272	39,526 (7,905) [1,897] {949}	39,780 (7,956) [1,909] {955}	40,039 (8,008) [1,922] {961}
Skagit	4,519	4,531	4,543	4,555	4,586 (917) [220] {110}	4,619 (924) [222] {111}	4,652 (930) [223] {112}
Snohomish	30,535	30,566	30,609	30,651	30,745 (6,149) [1,476] {738}	30,835 (6,167) [1,480] {740}	30,921 (6,184) [1,484] {742}
Spokane	36,765	36,816	36,854	36,892	36,984 (7,397) [1,775] {888}	37,071 (7,414) [1,779] {890}	37,151 (7,430) [1,783] {892}
Thurston	7,311	7,336	7,345	7,353	7,383 (1,477) [354] {177}	7,411 (1,482) [356] {178}	7,436 (1,487) [357] {178}
Whatcom	6,925	6,953	6,973	6,992	7,041 (1,408) [338] {169}	7,088 (1,418) [340] {170}	7,133 (1,427) [342] {171}
Yakima	26,832	26,869	26,965	27,060	27,193 (5,439) [1,305] {653}	27,329 (5,466) [1,312] {656}	27,475 (5,495) [1,319] {659}

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.