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

Date: 3/11/21

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 3/11/21 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.

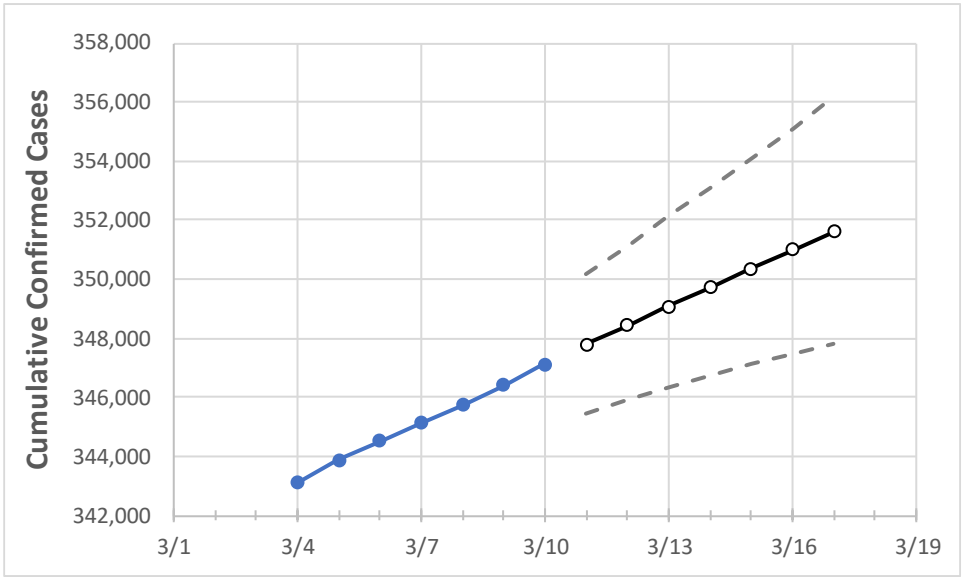
IEM's Modeling Lead

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Washington	345,132	345,731	346,403	347,131	347,792	348,451	349,086	349,723	350,368	350,989	351,606

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Benton	15,189	15,208	15,226	15,248	15,267	15,285	15,305	15,324	15,342	15,360	15,378
Clark	19,159	19,175	19,228	19,285	19,320	19,354	19,389	19,424	19,458	19,492	19,525
Grant	7,758	7,764	7,788	7,805	7,815	7,825	7,836	7,845	7,854	7,863	7,872
Island	1,370	1,377	1,387	1,405	1,419	1,435	1,452	1,470	1,490	1,511	1,534
King	85,149	85,282	85,417	85,596	85,739	85,883	86,023	86,162	86,299	86,436	86,572
Kitsap	5,880	5,897	5,918	5,932	5,945	5,959	5,972	5,985	5,999	6,012	6,025
Pierce	39,152	39,272	39,367	39,485	39,606	39,726	39,846	39,968	40,089	40,208	40,328
Skagit	4,543	4,555	4,562	4,567	4,579	4,590	4,602	4,614	4,626	4,638	4,649
Snohomish	30,609	30,651	30,712	30,759	30,808	30,853	30,899	30,943	30,987	31,028	31,070
Spokane	36,854	36,892	36,933	37,008	37,054	37,099	37,144	37,185	37,227	37,267	37,307
Thurston	7,345	7,353	7,369	7,381	7,395	7,410	7,423	7,435	7,447	7,459	7,471
Whatcom	6,973	6,992	7,017	7,044	7,067	7,090	7,113	7,134	7,156	7,177	7,198
Yakima	26,965	27,060	27,099	27,134	27,188	27,242	27,298	27,355	27,409	27,465	27,522

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:		
	3/7	3/8	3/9	3/10	3/12	3/14	3/16
Benton	15,189	15,208	15,226	15,248	15,285 (3,057) [734] {367}	15,324 (3,065) [736] {368}	15,360 (3,072) [737] {369}
Clark	19,159	19,175	19,228	19,285	19,354 (3,871) [929] {465}	19,424 (3,885) [932] {466}	19,492 (3,898) [936] {468}
Grant	7,758	7,764	7,788	7,805	7,825 (1,565) [376] {188}	7,845 (1,569) [377] {188}	7,863 (1,573) [377] {189}
Island	1,370	1,377	1,387	1,405	1,435 (287) [69] {34}	1,470 (294) [71] {35}	1,511 (302) [73] {36}
King	85,149	85,282	85,417	85,596	85,883 (17,177) [4,122] {2,061}	86,162 (17,232) [4,136] {2,068}	86,436 (17,287) [4,149] {2,074}
Kitsap	5,880	5,897	5,918	5,932	5,959 (1,192) [286] {143}	5,985 (1,197) [287] {144}	6,012 (1,202) [289] {144}
Pierce	39,152	39,272	39,367	39,485	39,726 (7,945) [1,907] {953}	39,968 (7,994) [1,918] {959}	40,208 (8,042) [1,930] {965}
Skagit	4,543	4,555	4,562	4,567	4,590 (918) [220] {110}	4,614 (923) [221] {111}	4,638 (928) [223] {111}
Snohomish	30,609	30,651	30,712	30,759	30,853 (6,171) [1,481] {740}	30,943 (6,189) [1,485] {743}	31,028 (6,206) [1,489] {745}
Spokane	36,854	36,892	36,933	37,008	37,099 (7,420) [1,781] {890}	37,185 (7,437) [1,785] {892}	37,267 (7,453) [1,789] {894}
Thurston	7,345	7,353	7,369	7,381	7,410 (1,482) [356] {178}	7,435 (1,487) [357] {178}	7,459 (1,492) [358] {179}
Whatcom	6,973	6,992	7,017	7,044	7,090 (1,418) [340] {170}	7,134 (1,427) [342] {171}	7,177 (1,435) [345] {172}
Yakima	26,965	27,060	27,099	27,134	27,242 (5,448) [1,308] {654}	27,355 (5,471) [1,313] {657}	27,465 (5,493) [1,318] {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.