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

Date: 2/23/21

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 2/23/21 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.

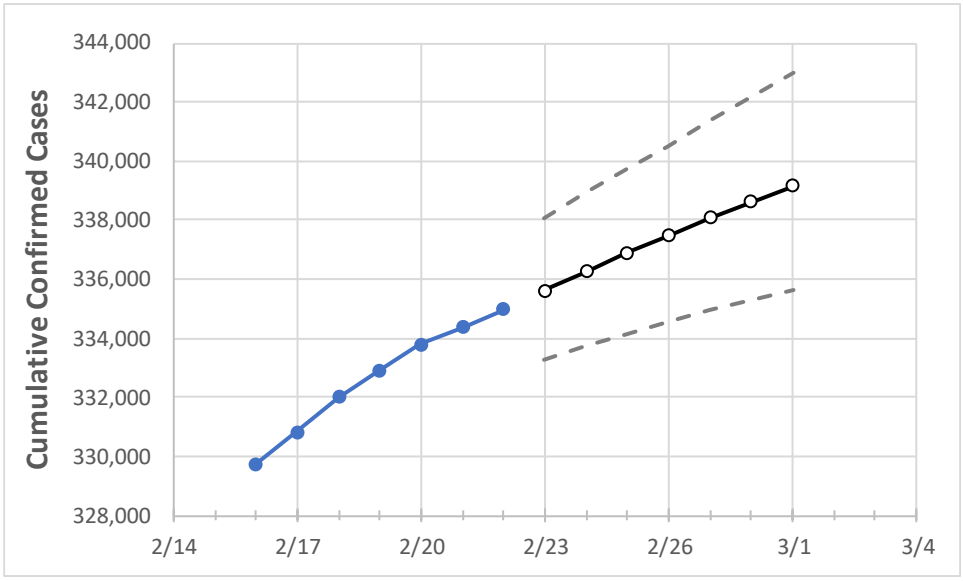
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Washington	332,904	333,794	334,378	334,962	335,625	336,259	336,895	337,482	338,074	338,622	339,164

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Benton	14,793	14,830	14,848	14,865	14,886	14,905	14,925	14,943	14,960	14,977	14,993
Clark	18,551	18,612	18,643	18,674	18,702	18,729	18,754	18,780	18,805	18,828	18,849
Grant	7,540	7,556	7,563	7,569	7,582	7,594	7,606	7,618	7,629	7,640	7,651
Island	1,272	1,274	1,276	1,277	1,279	1,281	1,282	1,284	1,285	1,287	1,288
King	82,615	82,835	82,953	83,071	83,221	83,368	83,514	83,651	83,782	83,916	84,041
Kitsap	5,632	5,647	5,664	5,680	5,693	5,705	5,717	5,728	5,739	5,749	5,759
Pierce	37,152	37,243	37,349	37,454	37,568	37,677	37,783	37,885	37,991	38,091	38,187
Skagit	4,323	4,341	4,350	4,359	4,366	4,373	4,379	4,386	4,392	4,398	4,404
Snohomish	29,595	29,705	29,740	29,775	29,845	29,913	29,981	30,046	30,111	30,174	30,237
Spokane	35,677	35,780	35,855	35,930	36,002	36,076	36,142	36,209	36,273	36,332	36,392
Thurston	6,980	7,024	7,035	7,046	7,072	7,097	7,123	7,147	7,171	7,195	7,218
Whatcom	6,439	6,456	6,508	6,560	6,592	6,625	6,660	6,691	6,725	6,756	6,788
Yakima	26,150	26,198	26,226	26,254	26,284	26,314	26,341	26,368	26,391	26,414	26,436

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Benton	14,793	14,830	14,848	14,865	14,905 (2,981) [715] {358}	14,943 (2,989) [717] {359}	14,977 (2,995) [719] {359}
Clark	18,551	18,612	18,643	18,674	18,729 (3,746) [899] {449}	18,780 (3,756) [901] {451}	18,828 (3,766) [904] {452}
Grant	7,540	7,556	7,563	7,569	7,594 (1,519) [365] {182}	7,618 (1,524) [366] {183}	7,640 (1,528) [367] {183}
Island	1,272	1,274	1,276	1,277	1,281 (256) [61] {31}	1,284 (257) [62] {31}	1,287 (257) [62] {31}
King	82,615	82,835	82,953	83,071	83,368 (16,674) [4,002] {2,001}	83,651 (16,730) [4,015] {2,008}	83,916 (16,783) [4,028] {2,014}
Kitsap	5,632	5,647	5,664	5,680	5,705 (1,141) [274] {137}	5,728 (1,146) [275] {137}	5,749 (1,150) [276] {138}
Pierce	37,152	37,243	37,349	37,454	37,677 (7,535) [1,809] {904}	37,885 (7,577) [1,819] {909}	38,091 (7,618) [1,828] {914}
Skagit	4,323	4,341	4,350	4,359	4,373 (875) [210] {105}	4,386 (877) [211] {105}	4,398 (880) [211] {106}
Snohomish	29,595	29,705	29,740	29,775	29,913 (5,983) [1,436] {718}	30,046 (6,009) [1,442] {721}	30,174 (6,035) [1,448] {724}
Spokane	35,677	35,780	35,855	35,930	36,076 (7,215) [1,732] {866}	36,209 (7,242) [1,738] {869}	36,332 (7,266) [1,744] {872}
Thurston	6,980	7,024	7,035	7,046	7,097 (1,419) [341] {170}	7,147 (1,429) [343] {172}	7,195 (1,439) [345] {173}
Whatcom	6,439	6,456	6,508	6,560	6,625 (1,325) [318] {159}	6,691 (1,338) [321] {161}	6,756 (1,351) [324] {162}
Yakima	26,150	26,198	26,226	26,254	26,314 (5,263) [1,263] {632}	26,368 (5,274) [1,266] {633}	26,414 (5,283) [1,268] {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.