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

Date: 2/23/22

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 2/23/22 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.

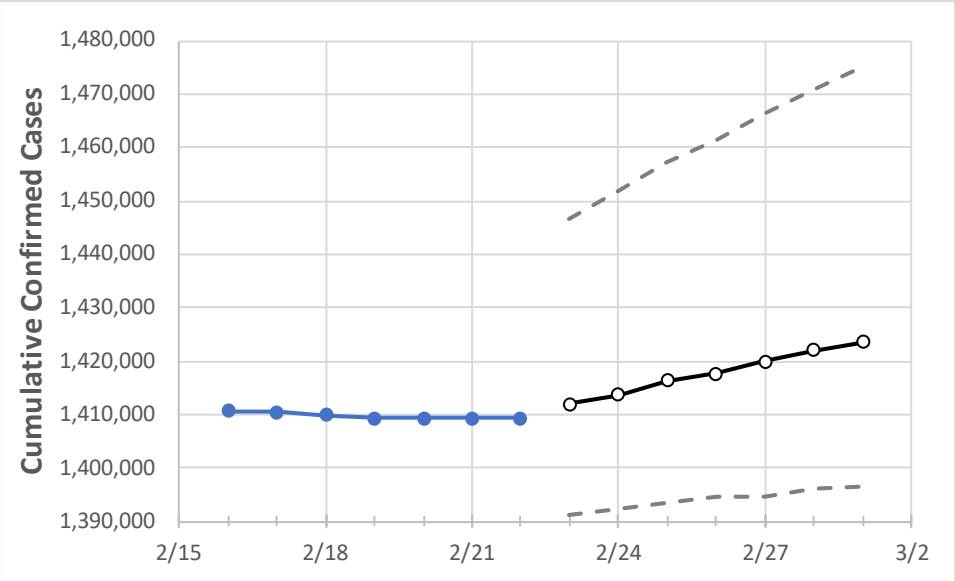
IEM's Modeling Lead

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	1,409,253	1,409,253	1,409,253	1,409,253	1,411,944	1,413,585	1,416,328	1,417,632	1,419,936	1,422,043	1,423,610

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	50,809	50,809	50,809	50,809	50,910	50,996	51,088	51,170	51,267	51,344	51,421
Clark	83,235	83,235	83,235	83,235	83,401	83,563	83,705	83,842	83,973	84,121	84,225
Grant	25,187	25,187	25,187	25,187	25,211	25,232	25,249	25,268	25,287	25,303	25,320
Island	9,649	9,649	9,649	9,649	9,669	9,685	9,700	9,717	9,733	9,746	9,760
King	361,753	361,753	361,753	361,753	362,057	362,338	362,559	362,804	363,014	363,266	363,413
Kitsap	37,938	37,938	37,938	37,938	38,000	38,060	38,109	38,158	38,215	38,268	38,307
Pierce	182,854	182,854	182,854	182,854	183,942	184,962	185,968	187,011	188,084	189,126	190,267
Skagit	21,645	21,645	21,645	21,645	21,675	21,704	21,723	21,749	21,775	21,794	21,813
Snohomish	145,695	145,695	145,695	145,695	146,802	147,922	149,064	150,210	151,365	152,534	153,700
Spokane	119,956	119,956	119,956	119,956	120,203	120,455	120,671	120,928	121,129	121,302	121,517
Thurston	45,634	45,634	45,634	45,634	45,732	45,831	45,904	46,001	46,082	46,176	46,267
Whatcom	36,176	36,176	36,176	36,176	36,283	36,393	36,488	36,572	36,679	36,758	36,865
Yakima	70,218	70,218	70,218	70,218	70,359	70,474	70,563	70,695	70,781	70,910	70,988

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	50,809	50,809	50,809	50,809	50,996 (10,199) [2,448] {1,224}	51,170 (10,234) [2,456] {1,228}	51,344 (10,269) [2,465] {1,232}
Clark	83,235	83,235	83,235	83,235	83,563 (16,713) [4,011] {2,006}	83,842 (16,768) [4,024] {2,012}	84,121 (16,824) [4,038] {2,019}
Grant	25,187	25,187	25,187	25,187	25,232 (5,046) [1,211] {606}	25,268 (5,054) [1,213] {606}	25,303 (5,061) [1,215] {607}
Island	9,649	9,649	9,649	9,649	9,685 (1,937) [465] {232}	9,717 (1,943) [466] {233}	9,746 (1,949) [468] {234}
King	361,753	361,753	361,753	361,753	362,338 (72,468) [17,392] {8,696}	362,804 (72,561) [17,415] {8,707}	363,266 (72,653) [17,437] {8,718}
Kitsap	37,938	37,938	37,938	37,938	38,060 (7,612) [1,827] {913}	38,158 (7,632) [1,832] {916}	38,268 (7,654) [1,837] {918}
Pierce	182,854	182,854	182,854	182,854	184,962 (36,992) [8,878] {4,439}	187,011 (37,402) [8,977] {4,488}	189,126 (37,825) [9,078] {4,539}
Skagit	21,645	21,645	21,645	21,645	21,704 (4,341) [1,042] {521}	21,749 (4,350) [1,044] {522}	21,794 (4,359) [1,046] {523}
Snohomish	145,695	145,695	145,695	145,695	147,922 (29,584) [7,100] {3,550}	150,210 (30,042) [7,210] {3,605}	152,534 (30,507) [7,322] {3,661}
Spokane	119,956	119,956	119,956	119,956	120,455 (24,091) [5,782] {2,891}	120,928 (24,186) [5,805] {2,902}	121,302 (24,260) [5,823] {2,911}
Thurston	45,634	45,634	45,634	45,634	45,831 (9,166) [2,200] {1,100}	46,001 (9,200) [2,208] {1,104}	46,176 (9,235) [2,216] {1,108}
Whatcom	36,176	36,176	36,176	36,176	36,393 (7,279) [1,747] {873}	36,572 (7,314) [1,755] {878}	36,758 (7,352) [1,764] {882}
Yakima	70,218	70,218	70,218	70,218	70,474 (14,095) [3,383] {1,691}	70,695 (14,139) [3,393] {1,697}	70,910 (14,182) [3,404] {1,702}

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.