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

Date: 2/16/22

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 2/16/22 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.

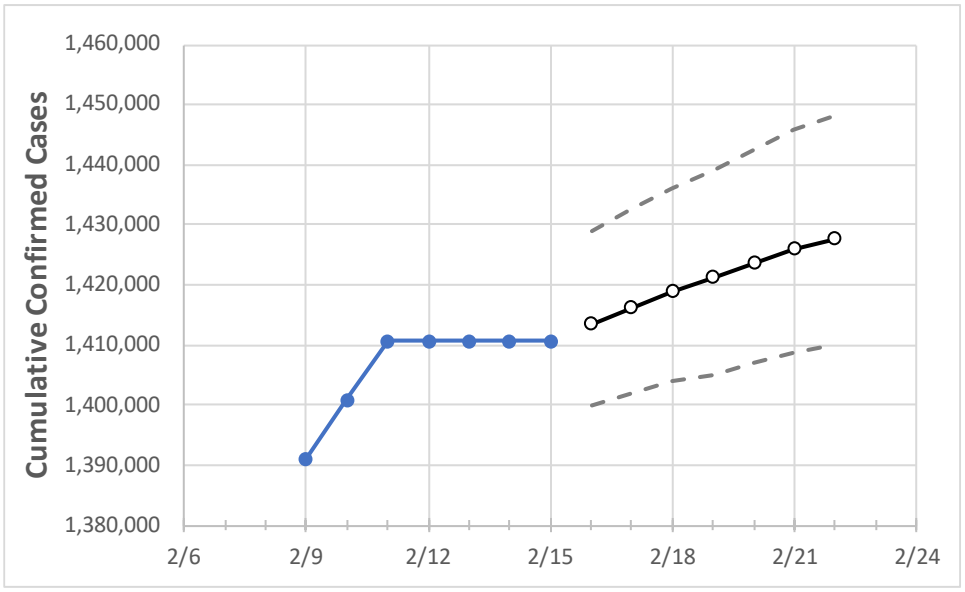
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Washington	1,410,617	1,410,637	1,410,658	1,410,658	1,413,571	1,416,302	1,418,887	1,421,350	1,423,661	1,425,948	1,427,717

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Benton	51,013	50,944	50,875	50,875	51,019	51,148	51,272	51,386	51,493	51,617	51,718
Clark	82,100	82,263	82,426	82,426	82,750	83,067	83,352	83,643	83,919	84,196	84,450
Grant	25,076	25,098	25,119	25,119	25,177	25,229	25,280	25,328	25,373	25,418	25,459
Island	9,617	9,632	9,648	9,648	9,680	9,710	9,740	9,765	9,794	9,819	9,846
King	361,165	361,375	361,584	361,584	362,294	362,920	363,504	364,070	364,616	365,156	365,605
Kitsap	37,858	37,890	37,921	37,921	38,021	38,119	38,197	38,296	38,381	38,463	38,549
Pierce	183,637	183,567	183,497	183,497	183,981	184,424	184,856	185,291	185,678	186,073	186,422
Skagit	21,544	21,577	21,610	21,610	21,675	21,735	21,790	21,849	21,901	21,957	22,003
Snohomish	147,600	146,976	146,353	146,353	146,837	147,289	147,736	148,161	148,578	148,966	149,349
Spokane	120,641	120,707	120,772	120,772	121,019	121,262	121,498	121,686	121,892	122,074	122,286
Thurston	45,509	45,574	45,638	45,638	45,774	45,915	46,034	46,159	46,272	46,392	46,518
Whatcom	36,185	36,217	36,248	36,248	36,374	36,488	36,601	36,714	36,815	36,926	37,018
Yakima	70,515	70,450	70,384	70,384	70,533	70,669	70,805	70,921	71,037	71,153	71,257

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:		
	2/12	2/13	2/14	2/15	2/17	2/19	2/21
Benton	51,013	50,944	50,875	50,875	51,148 (10,230) [2,455] {1,228}	51,386 (10,277) [2,467] {1,233}	51,617 (10,323) [2,478] {1,239}
Clark	82,100	82,263	82,426	82,426	83,067 (16,613) [3,987] {1,994}	83,643 (16,729) [4,015] {2,007}	84,196 (16,839) [4,041] {2,021}
Grant	25,076	25,098	25,119	25,119	25,229 (5,046) [1,211] {606}	25,328 (5,066) [1,216] {608}	25,418 (5,084) [1,220] {610}
Island	9,617	9,632	9,648	9,648	9,710 (1,942) [466] {233}	9,765 (1,953) [469] {234}	9,819 (1,964) [471] {236}
King	361,165	361,375	361,584	361,584	362,920 (72,584) [17,420] {8,710}	364,070 (72,814) [17,475] {8,738}	365,156 (73,031) [17,527] {8,764}
Kitsap	37,858	37,890	37,921	37,921	38,119 (7,624) [1,830] {915}	38,296 (7,659) [1,838] {919}	38,463 (7,693) [1,846] {923}
Pierce	183,637	183,567	183,497	183,497	184,424 (36,885) [8,852] {4,426}	185,291 (37,058) [8,894] {4,447}	186,073 (37,215) [8,932] {4,466}
Skagit	21,544	21,577	21,610	21,610	21,735 (4,347) [1,043] {522}	21,849 (4,370) [1,049] {524}	21,957 (4,391) [1,054] {527}
Snohomish	147,600	146,976	146,353	146,353	147,289 (29,458) [7,070] {3,535}	148,161 (29,632) [7,112] {3,556}	148,966 (29,793) [7,150] {3,575}
Spokane	120,641	120,707	120,772	120,772	121,262 (24,252) [5,821] {2,910}	121,686 (24,337) [5,841] {2,920}	122,074 (24,415) [5,860] {2,930}
Thurston	45,509	45,574	45,638	45,638	45,915 (9,183) [2,204] {1,102}	46,159 (9,232) [2,216] {1,108}	46,392 (9,278) [2,227] {1,113}
Whatcom	36,185	36,217	36,248	36,248	36,488 (7,298) [1,751] {876}	36,714 (7,343) [1,762] {881}	36,926 (7,385) [1,772] {886}
Yakima	70,515	70,450	70,384	70,384	70,669 (14,134) [3,392] {1,696}	70,921 (14,184) [3,404] {1,702}	71,153 (14,231) [3,415] {1,708}

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.