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

Date: 3/15/22

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 3/15/22 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.

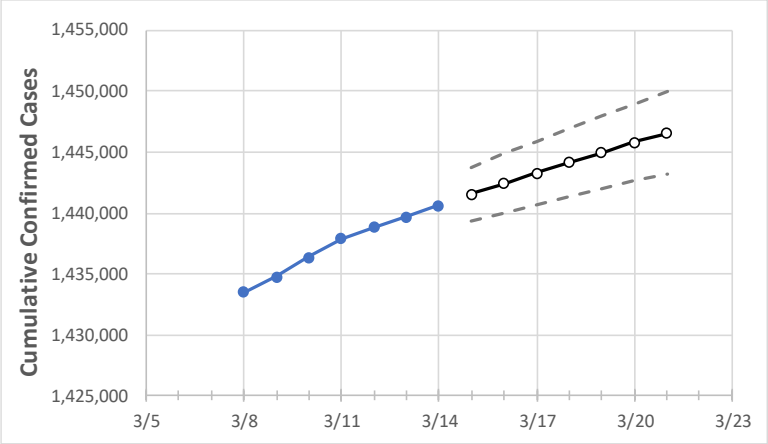
IEM's Modeling Lead

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Washington	1,437,914	1,438,820	1,439,726	1,440,632	1,441,566	1,442,454	1,443,317	1,444,163	1,444,992	1,445,823	1,446,576

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Benton	51,898	51,912	51,927	51,941	51,974	52,005	52,033	52,065	52,093	52,121	52,148
Clark	86,324	86,387	86,451	86,514	86,727	86,931	87,115	87,341	87,546	87,785	88,004
Grant	25,465	25,472	25,479	25,486	25,495	25,503	25,510	25,518	25,525	25,534	25,540
Island	9,843	9,853	9,862	9,872	9,878	9,884	9,890	9,896	9,902	9,907	9,913
King	368,827	369,074	369,322	369,569	369,774	369,982	370,178	370,367	370,557	370,746	370,917
Kitsap	38,783	38,812	38,842	38,871	38,900	38,927	38,954	38,979	39,005	39,031	39,055
Pierce	189,137	189,301	189,464	189,628	189,726	189,821	189,907	189,996	190,075	190,158	190,237
Skagit	21,834	21,844	21,853	21,863	21,873	21,883	21,893	21,902	21,912	21,921	21,930
Snohomish	147,773	147,847	147,920	147,994	148,061	148,125	148,188	148,248	148,311	148,369	148,426
Spokane	121,817	121,944	122,070	122,197	122,345	122,492	122,649	122,804	122,962	123,122	123,285
Thurston	46,026	46,046	46,067	46,087	46,112	46,137	46,161	46,185	46,208	46,231	46,253
Whatcom	36,747	36,764	36,782	36,799	36,827	36,856	36,884	36,911	36,938	36,965	36,992
Yakima	70,906	70,927	70,947	70,968	71,004	71,037	71,072	71,104	71,136	71,169	71,201

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:		
	3/11	3/12	3/13	3/14	3/16	3/18	3/20
Benton	51,898	51,912	51,927	51,941	52,005 (10,401) [2,496] {1,248}	52,065 (10,413) [2,499] {1,250}	52,121 (10,424) [2,502] {1,251}
Clark	86,324	86,387	86,451	86,514	86,931 (17,386) [4,173] {2,086}	87,341 (17,468) [4,192] {2,096}	87,785 (17,557) [4,214] {2,107}
Grant	25,465	25,472	25,479	25,486	25,503 (5,101) [1,224] {612}	25,518 (5,104) [1,225] {612}	25,534 (5,107) [1,226] {613}
Island	9,843	9,853	9,862	9,872	9,884 (1,977) [474] {237}	9,896 (1,979) [475] {238}	9,907 (1,981) [476] {238}
King	368,827	369,074	369,322	369,569	369,982 (73,996) [17,759] {8,880}	370,367 (74,073) [17,778] {8,889}	370,746 (74,149) [17,796] {8,898}
Kitsap	38,783	38,812	38,842	38,871	38,927 (7,785) [1,869] {934}	38,979 (7,796) [1,871] {936}	39,031 (7,806) [1,873] {937}
Pierce	189,137	189,301	189,464	189,628	189,821 (37,964) [9,111] {4,556}	189,996 (37,999) [9,120] {4,560}	190,158 (38,032) [9,128] {4,564}
Skagit	21,834	21,844	21,853	21,863	21,883 (4,377) [1,050] {525}	21,902 (4,380) [1,051] {526}	21,921 (4,384) [1,052] {526}
Snohomish	147,773	147,847	147,920	147,994	148,125 (29,625) [7,110] {3,555}	148,248 (29,650) [7,116] {3,558}	148,369 (29,674) [7,122] {3,561}
Spokane	121,817	121,944	122,070	122,197	122,492 (24,498) [5,880] {2,940}	122,804 (24,561) [5,895] {2,947}	123,122 (24,624) [5,910] {2,955}
Thurston	46,026	46,046	46,067	46,087	46,137 (9,227) [2,215] {1,107}	46,185 (9,237) [2,217] {1,108}	46,231 (9,246) [2,219] {1,110}
Whatcom	36,747	36,764	36,782	36,799	36,856 (7,371) [1,769] {885}	36,911 (7,382) [1,772] {886}	36,965 (7,393) [1,774] {887}
Yakima	70,906	70,927	70,947	70,968	71,037 (14,207) [3,410] {1,705}	71,104 (14,221) [3,413] {1,706}	71,169 (14,234) [3,416] {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.