IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/8/21

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 <u>not</u> 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 12/8/21 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
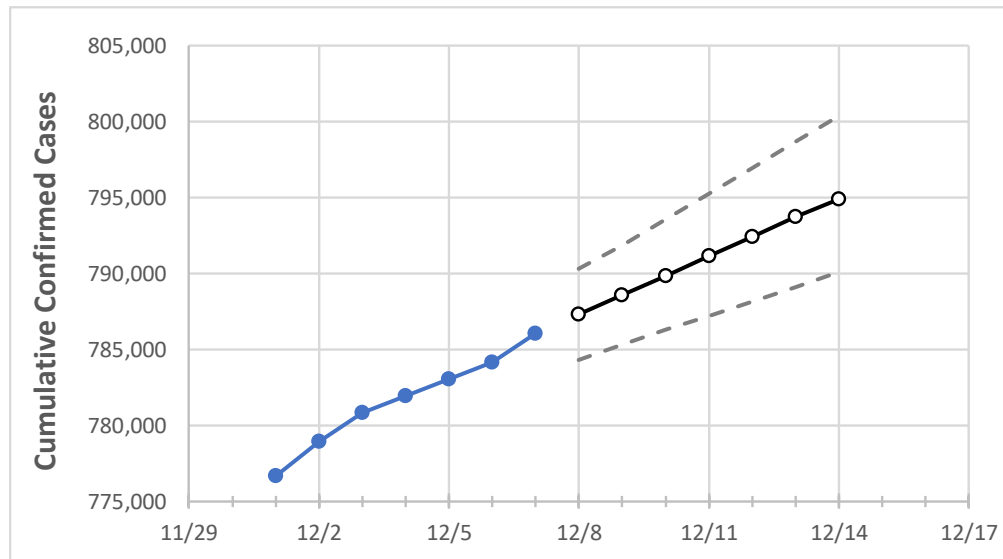
	Actual Confirmed Cases On:			Projected Cases For:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Washington	781,933	783,031	784,129	786,042	787,294	788,574	789,866	791,139	792,410	793,730	794,911

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Benton	32,442	32,471	32,501	32,537	32,566	32,595	32,624	32,654	32,682	32,713	32,742
Clark	45,642	45,703	45,763	45,936	46,035	46,132	46,229	46,332	46,436	46,534	46,636
Grant	17,073	17,094	17,116	17,141	17,160	17,179	17,197	17,214	17,234	17,253	17,271
Island	4,514	4,526	4,537	4,547	4,558	4,568	4,578	4,588	4,598	4,609	4,618
King	174,561	174,796	175,031	175,350	175,622	175,882	176,144	176,409	176,689	176,958	177,224
Kitsap	18,391	18,422	18,454	18,512	18,550	18,586	18,622	18,660	18,696	18,733	18,769
Pierce	99,918	100,082	100,245	100,566	100,750	100,942	101,128	101,309	101,512	101,709	101,887
Skagit	12,985	13,017	13,048	13,071	13,098	13,125	13,152	13,179	13,205	13,230	13,255
Snohomish	73,132	73,252	73,371	73,618	73,786	73,958	74,120	74,291	74,459	74,628	74,794
Spokane	77,919	77,998	78,078	78,216	78,308	78,401	78,489	78,581	78,668	78,759	78,844
Thurston	23,187	23,238	23,288	23,376	23,432	23,485	23,541	23,591	23,643	23,701	23,752
Whatcom	18,592	18,644	18,697	18,783	18,845	18,906	18,969	19,034	19,096	19,162	19,226
Yakima	45,495	45,530	45,564	45,617	45,660	45,704	45,748	45,791	45,834	45,881	45,924

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:		
	12/4	12/5	12/6	12/7	12/9	12/11	12/13
Benton	32,442	32,471	32,501	32,537	32,595 (6,519) [1,565] {782}	32,654 (6,531) [1,567] {784}	32,713 (6,543) [1,570] {785}
Clark	45,642	45,703	45,763	45,936	46,132 (9,226) [2,214] {1,107}	46,332 (9,266) [2,224] {1,112}	46,534 (9,307) [2,234] {1,117}
Grant	17,073	17,094	17,116	17,141	17,179 (3,436) [825] {412}	17,214 (3,443) [826] {413}	17,253 (3,451) [828] {414}
Island	4,514	4,526	4,537	4,547	4,568 (914) [219] {110}	4,588 (918) [220] {110}	4,609 (922) [221] {111}
King	174,561	174,796	175,031	175,350	175,882 (35,176) [8,442] {4,221}	176,409 (35,282) [8,468] {4,234}	176,958 (35,392) [8,494] {4,247}
Kitsap	18,391	18,422	18,454	18,512	18,586 (3,717) [892] {446}	18,660 (3,732) [896] {448}	18,733 (3,747) [899] {450}
Pierce	99,918	100,082	100,245	100,566	100,942 (20,188) [4,845] {2,423}	101,309 (20,262) [4,863] {2,431}	101,709 (20,342) [4,882] {2,441}
Skagit	12,985	13,017	13,048	13,071	13,125 (2,625) [630] {315}	13,179 (2,636) [633] {316}	13,230 (2,646) [635] {318}
Snohomish	73,132	73,252	73,371	73,618	73,958 (14,792) [3,550] {1,775}	74,291 (14,858) [3,566] {1,783}	74,628 (14,926) [3,582] {1,791}
Spokane	77,919	77,998	78,078	78,216	78,401 (15,680) [3,763] {1,882}	78,581 (15,716) [3,772] {1,886}	78,759 (15,752) [3,780] {1,890}
Thurston	23,187	23,238	23,288	23,376	23,485 (4,697) [1,127] {564}	23,591 (4,718) [1,132] {566}	23,701 (4,740) [1,138] {569}
Whatcom	18,592	18,644	18,697	18,783	18,906 (3,781) [907] {454}	19,034 (3,807) [914] {457}	19,162 (3,832) [920] {460}
Yakima	45,495	45,530	45,564	45,617	45,704 (9,141) [2,194] {1,097}	45,791 (9,158) [2,198] {1,099}	45,881 (9,176) [2,202] {1,101}

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.