IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/7/21

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 4/7/21 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
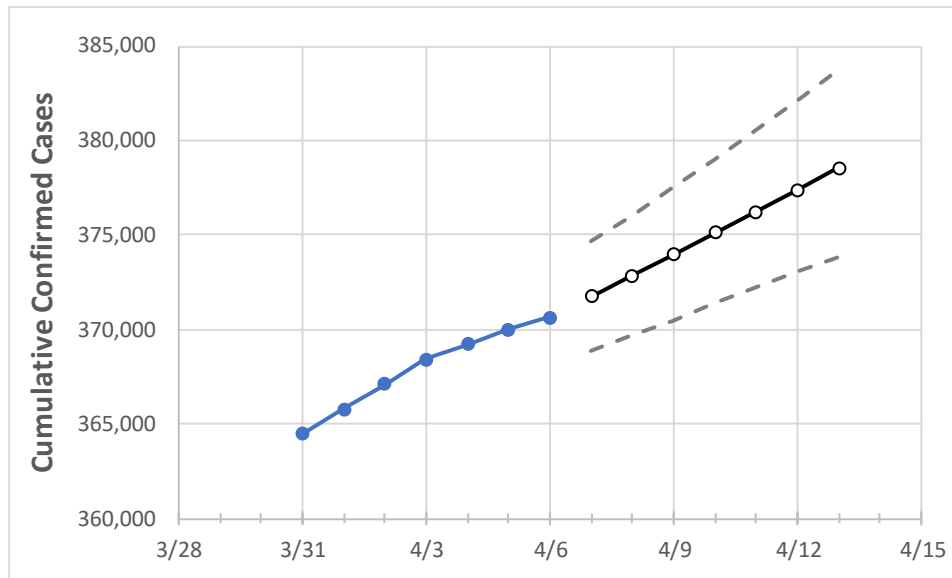
	Actual Confirmed Cases On:				Projected Cases For:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Washington	368,403	369,210	370,017	370,652	371,757	372,863	373,979	375,107	376,240	377,401	378,562

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:						
	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
Benton	15,767	15,784	15,801	15,827	15,850	15,873	15,896	15,920	15,943	15,967	15,991
Clark	20,385	20,415	20,445	20,506	20,558	20,610	20,666	20,721	20,775	20,829	20,886
Grant	8,076	8,081	8,086	8,095	8,104	8,112	8,121	8,129	8,137	8,145	8,154
Island	1,487	1,488	1,489	1,493	1,495	1,498	1,500	1,502	1,504	1,506	1,508
King	91,855	92,166	92,476	92,570	92,924	93,279	93,644	94,016	94,397	94,776	95,165
Kitsap	6,525	6,555	6,584	6,604	6,640	6,676	6,713	6,750	6,787	6,827	6,868
Pierce	43,239	43,387	43,535	43,647	43,837	44,027	44,220	44,420	44,622	44,825	45,028
Skagit	4,772	4,783	4,794	4,809	4,820	4,831	4,842	4,854	4,866	4,878	4,890
Snohomish	32,485	32,562	32,638	32,687	32,796	32,906	33,020	33,135	33,257	33,378	33,503
Spokane	38,671	38,729	38,787	38,847	38,922	39,001	39,078	39,156	39,233	39,311	39,391
Thurston	7,915	7,940	7,965	7,979	8,005	8,031	8,057	8,086	8,113	8,142	8,170
Whatcom	7,619	7,637	7,655	7,665	7,687	7,708	7,730	7,751	7,772	7,793	7,814
Yakima	28,195	28,237	28,278	28,334	28,383	28,434	28,484	28,537	28,589	28,640	28,692

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:		
	4/3	4/4	4/5	4/6	4/8	4/10	4/12
Benton	15,767	15,784	15,801	15,827	15,873 (3,175) [762] {381}	15,920 (3,184) [764] {382}	15,967 (3,193) [766] {383}
Clark	20,385	20,415	20,445	20,506	20,610 (4,122) [989] {495}	20,721 (4,144) [995] {497}	20,829 (4,166) [1,000] {500}
Grant	8,076	8,081	8,086	8,095	8,112 (1,622) [389] {195}	8,129 (1,626) [390] {195}	8,145 (1,629) [391] {195}
Island	1,487	1,488	1,489	1,493	1,498 (300) [72] {36}	1,502 (300) [72] {36}	1,506 (301) [72] {36}
King	91,855	92,166	92,476	92,570	93,279 (18,656) [4,477] {2,239}	94,016 (18,803) [4,513] {2,256}	94,776 (18,955) [4,549] {2,275}
Kitsap	6,525	6,555	6,584	6,604	6,676 (1,335) [320] {160}	6,750 (1,350) [324] {162}	6,827 (1,365) [328] {164}
Pierce	43,239	43,387	43,535	43,647	44,027 (8,805) [2,113] {1,057}	44,420 (8,884) [2,132] {1,066}	44,825 (8,965) [2,152] {1,076}
Skagit	4,772	4,783	4,794	4,809	4,831 (966) [232] {116}	4,854 (971) [233] {116}	4,878 (976) [234] {117}
Snohomish	32,485	32,562	32,638	32,687	32,906 (6,581) [1,579] {790}	33,135 (6,627) [1,590] {795}	33,378 (6,676) [1,602] {801}
Spokane	38,671	38,729	38,787	38,847	39,001 (7,800) [1,872] {936}	39,156 (7,831) [1,879] {940}	39,311 (7,862) [1,887] {943}
Thurston	7,915	7,940	7,965	7,979	8,031 (1,606) [385] {193}	8,086 (1,617) [388] {194}	8,142 (1,628) [391] {195}
Whatcom	7,619	7,637	7,655	7,665	7,708 (1,542) [370] {185}	7,751 (1,550) [372] {186}	7,793 (1,559) [374] {187}
Yakima	28,195	28,237	28,278	28,334	28,434 (5,687) [1,365] {682}	28,537 (5,707) [1,370] {685}	28,640 (5,728) [1,375] {687}

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.