IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/9/21

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 4/9/21 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
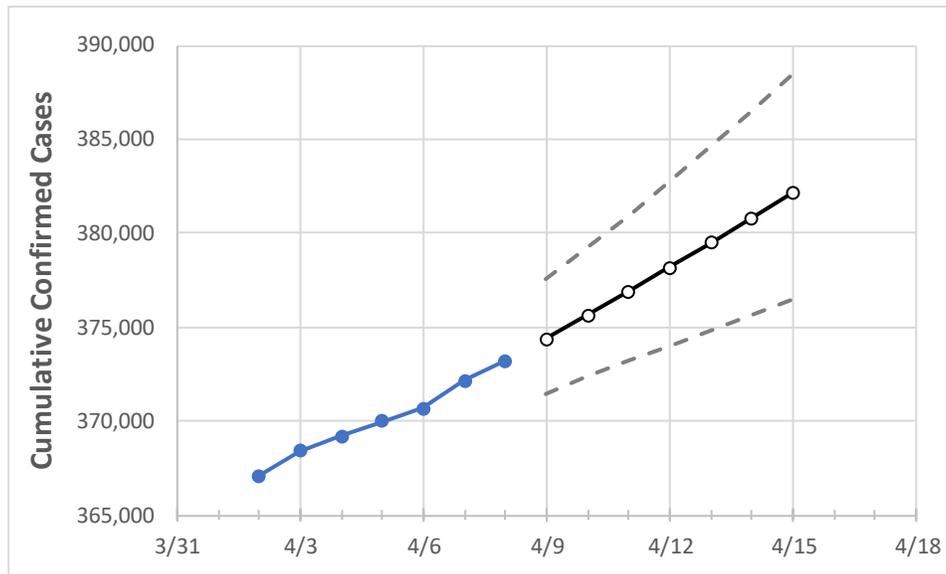
	Actual Confirmed Cases On:				Projected Cases For:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Washington	370,017	370,652	372,170	373,212	374,388	375,615	376,900	378,176	379,479	380,808	382,164

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Benton	15,801	15,827	15,868	15,895	15,922	15,950	15,978	16,005	16,035	16,065	16,096
Clark	20,445	20,506	20,554	20,613	20,666	20,720	20,773	20,826	20,880	20,934	20,991
Grant	8,086	8,095	8,106	8,117	8,125	8,133	8,141	8,149	8,157	8,164	8,171
Island	1,489	1,493	1,495	1,496	1,498	1,500	1,502	1,504	1,505	1,507	1,509
King	92,476	92,570	93,002	93,324	93,662	94,010	94,357	94,710	95,067	95,422	95,784
Kitsap	6,584	6,604	6,626	6,647	6,682	6,716	6,751	6,788	6,825	6,863	6,901
Pierce	43,535	43,647	43,842	44,007	44,196	44,385	44,576	44,767	44,973	45,176	45,379
Skagit	4,794	4,809	4,838	4,864	4,885	4,907	4,931	4,956	4,982	5,011	5,042
Snohomish	32,638	32,687	32,858	32,958	33,082	33,208	33,341	33,477	33,619	33,765	33,918
Spokane	38,787	38,847	38,968	39,046	39,129	39,213	39,299	39,390	39,478	39,570	39,661
Thurston	7,965	7,979	8,004	8,023	8,047	8,070	8,092	8,116	8,138	8,162	8,184
Whatcom	7,655	7,665	7,705	7,729	7,753	7,778	7,803	7,828	7,853	7,878	7,904
Yakima	28,278	28,334	28,367	28,423	28,477	28,532	28,588	28,644	28,700	28,759	28,815

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:		
	4/5	4/6	4/7	4/8	4/10	4/12	4/14
Benton	15,801	15,827	15,868	15,895	15,950 (3,190) [766] {383}	16,005 (3,201) [768] {384}	16,065 (3,213) [771] {386}
Clark	20,445	20,506	20,554	20,613	20,720 (4,144) [995] {497}	20,826 (4,165) [1,000] {500}	20,934 (4,187) [1,005] {502}
Grant	8,086	8,095	8,106	8,117	8,133 (1,627) [390] {195}	8,149 (1,630) [391] {196}	8,164 (1,633) [392] {196}
Island	1,489	1,493	1,495	1,496	1,500 (300) [72] {36}	1,504 (301) [72] {36}	1,507 (301) [72] {36}
King	92,476	92,570	93,002	93,324	94,010 (18,802) [4,512] {2,256}	94,710 (18,942) [4,546] {2,273}	95,422 (19,084) [4,580] {2,290}
Kitsap	6,584	6,604	6,626	6,647	6,716 (1,343) [322] {161}	6,788 (1,358) [326] {163}	6,863 (1,373) [329] {165}
Pierce	43,535	43,647	43,842	44,007	44,385 (8,877) [2,130] {1,065}	44,767 (8,953) [2,149] {1,074}	45,176 (9,035) [2,168] {1,084}
Skagit	4,794	4,809	4,838	4,864	4,907 (981) [236] {118}	4,956 (991) [238] {119}	5,011 (1,002) [241] {120}
Snohomish	32,638	32,687	32,858	32,958	33,208 (6,642) [1,594] {797}	33,477 (6,695) [1,607] {803}	33,765 (6,753) [1,621] {810}
Spokane	38,787	38,847	38,968	39,046	39,213 (7,843) [1,882] {941}	39,390 (7,878) [1,891] {945}	39,570 (7,914) [1,899] {950}
Thurston	7,965	7,979	8,004	8,023	8,070 (1,614) [387] {194}	8,116 (1,623) [390] {195}	8,162 (1,632) [392] {196}
Whatcom	7,655	7,665	7,705	7,729	7,778 (1,556) [373] {187}	7,828 (1,566) [376] {188}	7,878 (1,576) [378] {189}
Yakima	28,278	28,334	28,367	28,423	28,532 (5,706) [1,370] {685}	28,644 (5,729) [1,375] {687}	28,759 (5,752) [1,380] {690}

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.