IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/14/21

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 5/14/21 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
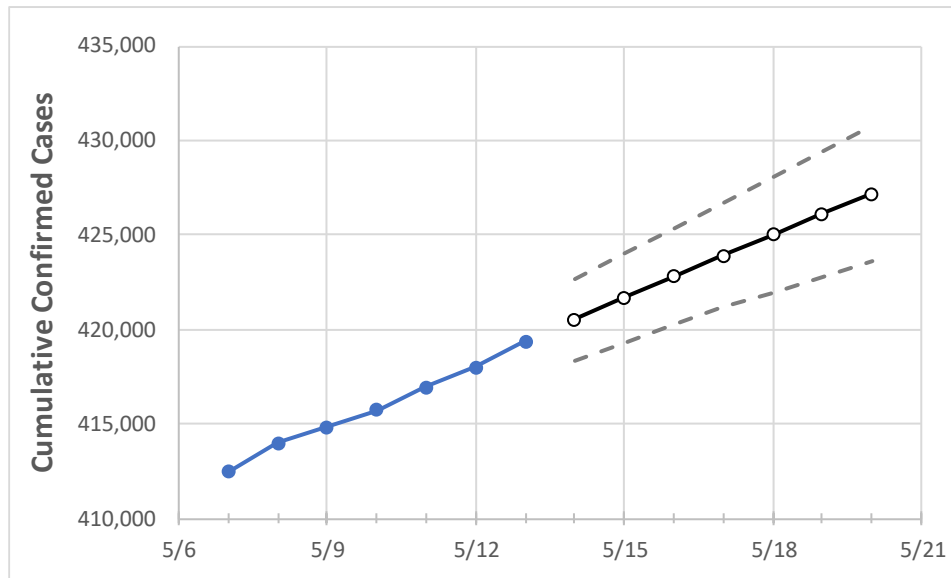
	Actual Confirmed Cases On:				Projected Cases For:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Washington	415,705	416,930	418,020	419,382	420,548	421,691	422,798	423,905	425,018	426,119	427,203

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Benton	16,879	16,905	16,934	16,959	16,981	17,003	17,025	17,045	17,066	17,087	17,107
Clark	23,418	23,536	23,546	23,646	23,741	23,833	23,928	24,021	24,114	24,210	24,306
Grant	8,819	8,823	8,845	8,862	8,880	8,899	8,917	8,934	8,951	8,968	8,986
Island	1,714	1,725	1,723	1,727	1,733	1,739	1,745	1,751	1,757	1,762	1,768
King	105,423	105,690	105,967	106,275	106,575	106,875	107,166	107,449	107,735	108,016	108,298
Kitsap	7,957	7,998	8,015	8,061	8,096	8,131	8,166	8,200	8,235	8,269	8,304
Pierce	51,305	51,556	51,827	52,061	52,276	52,495	52,711	52,929	53,149	53,365	53,580
Skagit	5,578	5,589	5,612	5,635	5,652	5,669	5,685	5,701	5,717	5,733	5,747
Snohomish	37,164	37,277	37,374	37,478	37,591	37,702	37,813	37,924	38,033	38,143	38,250
Spokane	42,391	42,493	42,587	42,731	42,838	42,943	43,047	43,150	43,255	43,362	43,467
Thurston	9,364	9,396	9,445	9,491	9,533	9,576	9,618	9,661	9,702	9,744	9,786
Whatcom	8,808	8,855	8,882	8,915	8,954	8,993	9,032	9,072	9,112	9,152	9,192
Yakima	29,706	29,728	29,734	29,770	29,788	29,806	29,823	29,840	29,856	29,872	29,886

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: | | |
	5/10	5/11	5/12	5/13	5/15	5/17	5/19
Benton	16,879	16,905	16,934	16,959	17,003 (3,401) [816] {408}	17,045 (3,409) [818] {409}	17,087 (3,417) [820] {410}
Clark	23,418	23,536	23,546	23,646	23,833 (4,767) [1,144] {572}	24,021 (4,804) [1,153] {577}	24,210 (4,842) [1,162] {581}
Grant	8,819	8,823	8,845	8,862	8,899 (1,780) [427] {214}	8,934 (1,787) [429] {214}	8,968 (1,794) [430] {215}
Island	1,714	1,725	1,723	1,727	1,739 (348) [83] {42}	1,751 (350) [84] {42}	1,762 (352) [85] {42}
King	105,423	105,690	105,967	106,275	106,875 (21,375) [5,130] {2,565}	107,449 (21,490) [5,158] {2,579}	108,016 (21,603) [5,185] {2,592}
Kitsap	7,957	7,998	8,015	8,061	8,131 (1,626) [390] {195}	8,200 (1,640) [394] {197}	8,269 (1,654) [397] {198}
Pierce	51,305	51,556	51,827	52,061	52,495 (10,499) [2,520] {1,260}	52,929 (10,586) [2,541] {1,270}	53,365 (10,673) [2,562] {1,281}
Skagit	5,578	5,589	5,612	5,635	5,669 (1,134) [272] {136}	5,701 (1,140) [274] {137}	5,733 (1,147) [275] {138}
Snohomish	37,164	37,277	37,374	37,478	37,702 (7,540) [1,810] {905}	37,924 (7,585) [1,820] {910}	38,143 (7,629) [1,831] {915}
Spokane	42,391	42,493	42,587	42,731	42,943 (8,589) [2,061] {1,031}	43,150 (8,630) [2,071] {1,036}	43,362 (8,672) [2,081] {1,041}
Thurston	9,364	9,396	9,445	9,491	9,576 (1,915) [460] {230}	9,661 (1,932) [464] {232}	9,744 (1,949) [468] {234}
Whatcom	8,808	8,855	8,882	8,915	8,993 (1,799) [432] {216}	9,072 (1,814) [435] {218}	9,152 (1,830) [439] {220}
Yakima	29,706	29,728	29,734	29,770	29,806 (5,961) [1,431] {715}	29,840 (5,968) [1,432] {716}	29,872 (5,974) [1,434] {717}

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.