IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/15/20

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 12/15/20 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
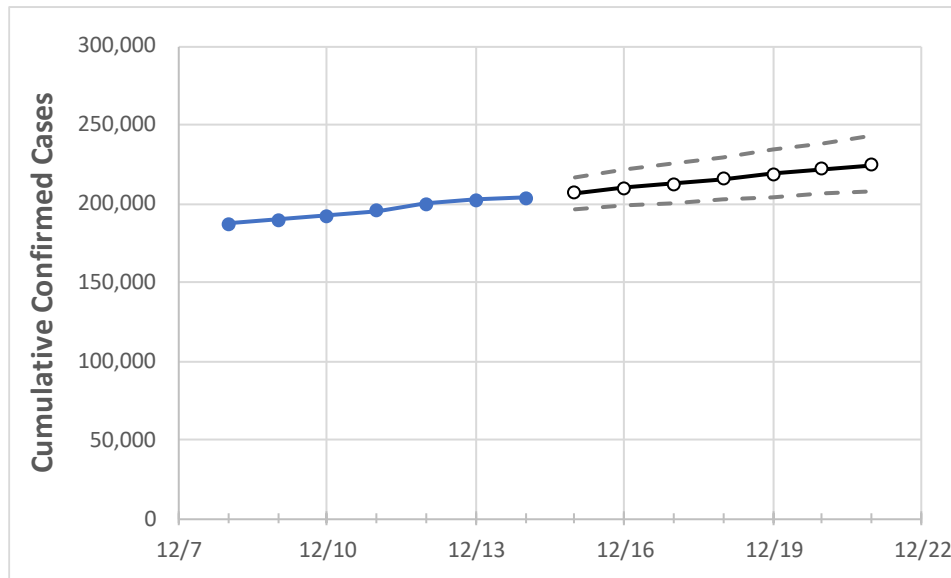
	Actual Confirmed Cases On:				Projected Cases For:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Washington	195,554	199,735	202,063	203,797	206,711	209,653	212,623	215,622	218,650	221,707	224,792

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 20%, and are often within 10%, of actual confirmed cases.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Benton	9,562	9,760	9,863	9,946	10,081	10,217	10,355	10,494	10,635	10,778	10,923
Clark	10,773	10,974	11,109	11,204	11,376	11,548	11,721	11,893	12,066	12,239	12,412
Grant	4,562	4,593	4,611	4,665	4,704	4,744	4,784	4,826	4,867	4,910	4,953
Island	767	782	784	785	796	807	817	828	839	850	861
King	52,398	53,282	53,927	54,535	55,283	56,037	56,797	57,562	58,332	59,107	59,889
Kitsap	3,029	3,087	3,121	3,126	3,173	3,221	3,270	3,319	3,368	3,418	3,468
Pierce	20,280	21,134	21,460	21,661	22,024	22,394	22,773	23,160	23,555	23,959	24,371
Skagit	2,462	2,519	2,558	2,564	2,605	2,648	2,691	2,735	2,780	2,825	2,872
Snohomish	17,587	17,942	18,202	18,370	18,653	18,940	19,230	19,523	19,820	20,120	20,424
Spokane	20,544	21,033	21,361	21,543	21,918	22,297	22,681	23,070	23,464	23,862	24,265
Thurston	3,580	3,633	3,686	3,724	3,776	3,828	3,880	3,933	3,986	4,039	4,093
Whatcom	2,834	2,879	2,906	2,924	2,957	2,990	3,023	3,056	3,089	3,122	3,155
Yakima	15,271	15,548	15,679	15,795	15,984	16,180	16,385	16,598	16,819	17,049	17,289

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:		
	12/11	12/12	12/13	12/14	12/16	12/18	12/20
Benton	9,562	9,760	9,863	9,946	10,217 (2,043) [490] {245}	10,494 (2,099) [504] {252}	10,778 (2,156) [517] {259}
Clark	10,773	10,974	11,109	11,204	11,548 (2,310) [554] {277}	11,893 (2,379) [571] {285}	12,239 (2,448) [587] {294}
Grant	4,562	4,593	4,611	4,665	4,744 (949) [228] {114}	4,826 (965) [232] {116}	4,910 (982) [236] {118}
Island	767	782	784	785	807 (161) [39] {19}	828 (166) [40] {20}	850 (170) [41] {20}
King	52,398	53,282	53,927	54,535	56,037 (11,207) [2,690] {1,345}	57,562 (11,512) [2,763] {1,381}	59,107 (11,821) [2,837] {1,419}
Kitsap	3,029	3,087	3,121	3,126	3,221 (644) [155] {77}	3,319 (664) [159] {80}	3,418 (684) [164] {82}
Pierce	20,280	21,134	21,460	21,661	22,394 (4,479) [1,075] {537}	23,160 (4,632) [1,112] {556}	23,959 (4,792) [1,150] {575}
Skagit	2,462	2,519	2,558	2,564	2,648 (530) [127] {64}	2,735 (547) [131] {66}	2,825 (565) [136] {68}
Snohomish	17,587	17,942	18,202	18,370	18,940 (3,788) [909] {455}	19,523 (3,905) [937] {469}	20,120 (4,024) [966] {483}
Spokane	20,544	21,033	21,361	21,543	22,297 (4,459) [1,070] {535}	23,070 (4,614) [1,107] {554}	23,862 (4,772) [1,145] {573}
Thurston	3,580	3,633	3,686	3,724	3,828 (766) [184] {92}	3,933 (787) [189] {94}	4,039 (808) [194] {97}
Whatcom	2,834	2,879	2,906	2,924	2,990 (598) [144] {72}	3,056 (611) [147] {73}	3,122 (624) [150] {75}
Yakima	15,271	15,548	15,679	15,795	16,180 (3,236) [777] {388}	16,598 (3,320) [797] {398}	17,049 (3,410) [818] {409}

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.