IEM's AI Modeling: Short-term COVID-19 Projections

Date: 2/18/22

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 not 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 2/18/22 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.

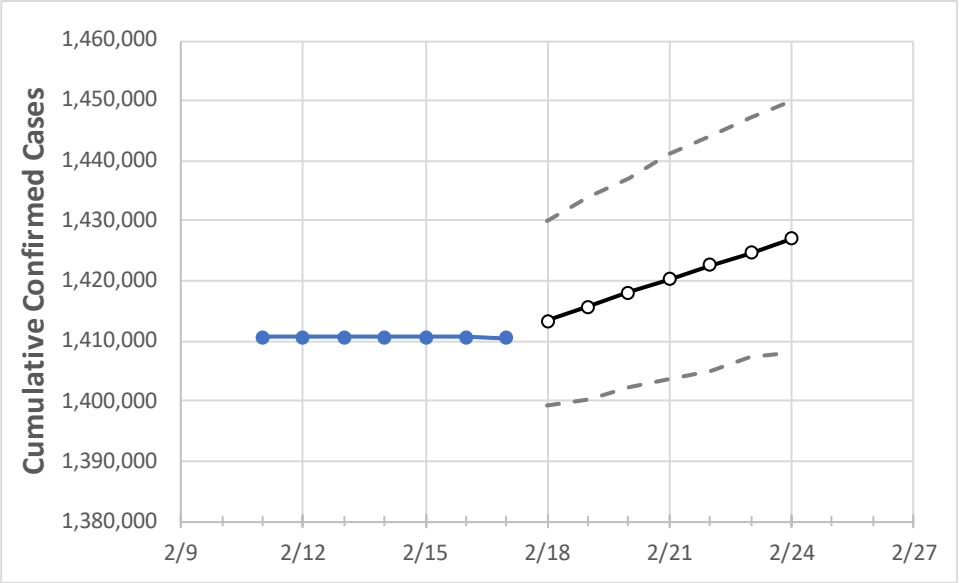
IEM's Modeling Lead

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Washington	1,410,658	1,410,635	1,410,611	1,410,499	1,413,350	1,415,784	1,418,028	1,420,367	1,422,652	1,424,710	1,426,973

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Benton	50,875	50,886	50,897	50,897	51,001	51,107	51,196	51,284	51,371	51,450	51,533
Clark	82,426	82,656	82,885	82,885	83,160	83,439	83,691	83,935	84,182	84,416	84,642
Grant	25,119	25,125	25,130	25,130	25,176	25,219	25,259	25,300	25,336	25,372	25,407
Island	9,648	9,652	9,656	9,656	9,681	9,705	9,728	9,751	9,771	9,794	9,812
King	361,584	361,610	361,635	361,635	362,223	362,746	363,249	363,704	364,180	364,658	365,018
Kitsap	37,921	37,929	37,937	37,937	38,030	38,105	38,187	38,257	38,323	38,397	38,464
Pierce	183,497	183,399	183,301	183,301	183,805	184,317	184,768	185,219	185,671	186,089	186,474
Skagit	21,610	21,624	21,637	21,637	21,689	21,742	21,788	21,837	21,882	21,923	21,965
Snohomish	146,353	146,104	145,854	145,854	146,362	146,827	147,297	147,732	148,156	148,590	148,984
Spokane	120,772	120,613	120,454	120,454	120,712	120,931	121,116	121,334	121,506	121,707	121,880
Thurston	45,638	45,658	45,678	45,678	45,805	45,908	46,025	46,136	46,244	46,333	46,424
Whatcom	36,248	36,244	36,240	36,240	36,360	36,465	36,570	36,680	36,770	36,870	36,960
Yakima	70,384	70,387	70,390	70,390	70,507	70,624	70,713	70,810	70,900	71,013	71,096

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:		
	2/14	2/15	2/16	2/17	2/19	2/21	2/23
Benton	50,875	50,886	50,897	50,897	51,107 (10,221) [2,453] {1,227}	51,284 (10,257) [2,462] {1,231}	51,450 (10,290) [2,470] {1,235}
Clark	82,426	82,656	82,885	82,885	83,439 (16,688) [4,005] {2,003}	83,935 (16,787) [4,029] {2,014}	84,416 (16,883) [4,052] {2,026}
Grant	25,119	25,125	25,130	25,130	25,219 (5,044) [1,210] {605}	25,300 (5,060) [1,214] {607}	25,372 (5,074) [1,218] {609}
Island	9,648	9,652	9,656	9,656	9,705 (1,941) [466] {233}	9,751 (1,950) [468] {234}	9,794 (1,959) [470] {235}
King	361,584	361,610	361,635	361,635	362,746 (72,549) [17,412] {8,706}	363,704 (72,741) [17,458] {8,729}	364,658 (72,932) [17,504] {8,752}
Kitsap	37,921	37,929	37,937	37,937	38,105 (7,621) [1,829] {915}	38,257 (7,651) [1,836] {918}	38,397 (7,679) [1,843] {922}
Pierce	183,497	183,399	183,301	183,301	184,317 (36,863) [8,847] {4,424}	185,219 (37,044) [8,891] {4,445}	186,089 (37,218) [8,932] {4,466}
Skagit	21,610	21,624	21,637	21,637	21,742 (4,348) [1,044] {522}	21,837 (4,367) [1,048] {524}	21,923 (4,385) [1,052] {526}
Snohomish	146,353	146,104	145,854	145,854	146,827 (29,365) [7,048] {3,524}	147,732 (29,546) [7,091] {3,546}	148,590 (29,718) [7,132] {3,566}
Spokane	120,772	120,613	120,454	120,454	120,931 (24,186) [5,805] {2,902}	121,334 (24,267) [5,824] {2,912}	121,707 (24,341) [5,842] {2,921}
Thurston	45,638	45,658	45,678	45,678	45,908 (9,182) [2,204] {1,102}	46,136 (9,227) [2,215] {1,107}	46,333 (9,267) [2,224] {1,112}
Whatcom	36,248	36,244	36,240	36,240	36,465 (7,293) [1,750] {875}	36,680 (7,336) [1,761] {880}	36,870 (7,374) [1,770] {885}
Yakima	70,384	70,387	70,390	70,390	70,624 (14,125) [3,390] {1,695}	70,810 (14,162) [3,399] {1,699}	71,013 (14,203) [3,409] {1,704}

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.