IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/24/21

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 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 5/24/21 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.

Colorado State Projections
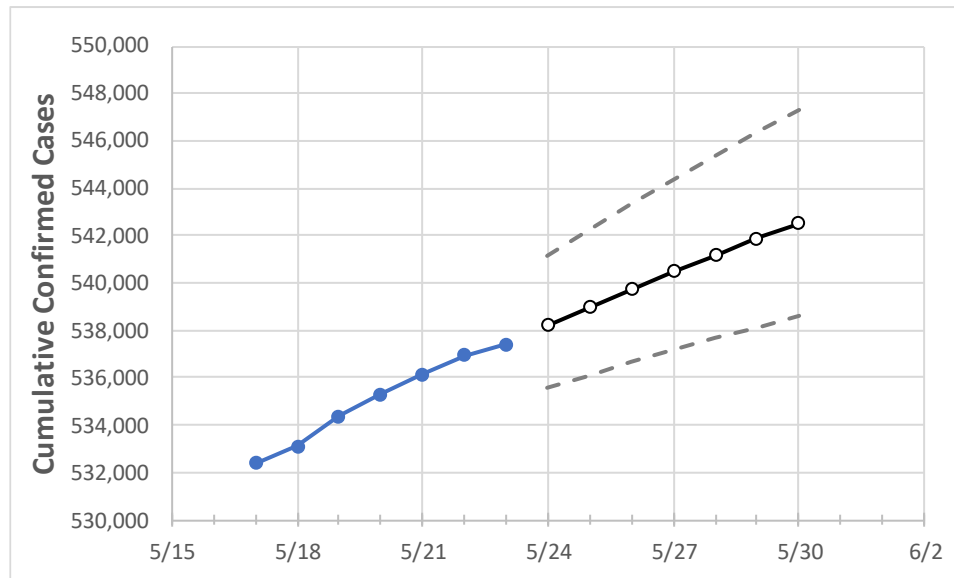
	Actual Confirmed Cases On:				Projected Cases For:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Colorado	535,316	536,128	536,969	537,401	538,205	538,983	539,742	540,478	541,185	541,869	542,531

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.

Colorado Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Adams	59,080	59,162	59,264	59,317	59,419	59,524	59,623	59,720	59,816	59,907	59,999
Arapahoe	60,624	60,750	60,848	60,886	60,995	61,102	61,209	61,315	61,413	61,513	61,608
Boulder	23,466	23,480	23,496	23,500	23,513	23,524	23,536	23,547	23,557	23,566	23,575
Denver	72,566	72,622	72,655	72,688	72,743	72,794	72,844	72,894	72,940	72,983	73,024
Douglas	29,140	29,164	29,210	29,231	29,265	29,298	29,330	29,360	29,391	29,419	29,446
Eagle	6,307	6,311	6,315	6,314	6,316	6,319	6,321	6,323	6,325	6,327	6,328
El Paso	68,497	68,653	68,836	68,937	69,108	69,276	69,441	69,605	69,766	69,924	70,077
Gunnison	1,347	1,348	1,349	1,349	1,350	1,351	1,353	1,354	1,355	1,356	1,358
Jefferson	47,427	47,504	47,571	47,614	47,687	47,760	47,832	47,900	47,968	48,033	48,097
Larimer	26,680	26,705	26,740	26,757	26,793	26,828	26,863	26,895	26,926	26,956	26,984
Pueblo	18,855	18,870	18,884	18,894	18,912	18,928	18,944	18,958	18,972	18,984	18,997
Weld	32,073	32,112	32,174	32,215	32,270	32,324	32,377	32,427	32,478	32,527	32,574

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.*

Colorado Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	5/20	5/21	5/22	5/23	5/25	5/27	5/29
Adams	59,080	59,162	59,264	59,317	59,524 (11,905) [2,857] {1,429}	59,720 (11,944) [2,867] {1,433}	59,907 (11,981) [2,876] {1,438}
Arapahoe	60,624	60,750	60,848	60,886	61,102 (12,220) [2,933] {1,466}	61,315 (12,263) [2,943] {1,472}	61,513 (12,303) [2,953] {1,476}
Boulder	23,466	23,480	23,496	23,500	23,524 (4,705) [1,129] {565}	23,547 (4,709) [1,130] {565}	23,566 (4,713) [1,131] {566}
Denver	72,566	72,622	72,655	72,688	72,794 (14,559) [3,494] {1,747}	72,894 (14,579) [3,499] {1,749}	72,983 (14,597) [3,503] {1,752}
Douglas	29,140	29,164	29,210	29,231	29,298 (5,860) [1,406] {703}	29,360 (5,872) [1,409] {705}	29,419 (5,884) [1,412] {706}
Eagle	6,307	6,311	6,315	6,314	6,319 (1,264) [303] {152}	6,323 (1,265) [303] {152}	6,327 (1,265) [304] {152}
El Paso	68,497	68,653	68,836	68,937	69,276 (13,855) [3,325] {1,663}	69,605 (13,921) [3,341] {1,671}	69,924 (13,985) [3,356] {1,678}
Gunnison	1,347	1,348	1,349	1,349	1,351 (270) [65] {32}	1,354 (271) [65] {32}	1,356 (271) [65] {33}
Jefferson	47,427	47,504	47,571	47,614	47,760 (9,552) [2,292] {1,146}	47,900 (9,580) [2,299] {1,150}	48,033 (9,607) [2,306] {1,153}
Larimer	26,680	26,705	26,740	26,757	26,828 (5,366) [1,288] {644}	26,895 (5,379) [1,291] {645}	26,956 (5,391) [1,294] {647}
Pueblo	18,855	18,870	18,884	18,894	18,928 (3,786) [909] {454}	18,958 (3,792) [910] {455}	18,984 (3,797) [911] {456}
Weld	32,073	32,112	32,174	32,215	32,324 (6,465) [1,552] {776}	32,427 (6,485) [1,557] {778}	32,527 (6,505) [1,561] {781}

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.