Projecting the COVID-19 Weekly Deaths, Infections, and Hospitalizations for Jefferson County, Kentucky

April 23, 2020

Last date with actual data: **April 20**
Predicted for: **Every week from April 23 to August 20**

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Executive Summary

Objective

We projected the trends in the numbers of actively circulating infections, active hospitalizations, and fatalities caused by the COVID-19 in Jefferson County, KY, over the period April 20 to August 20, 2020.

Background

Jefferson County includes the city of Louisville which has an estimated population of 767,000 people and 310,000 households in July 2019.[1] The county may be more vulnerable to the COVID-19 impact than a typical US county because of its lower-than-average health and economic status. The median household income in the county was about 10% lower than the national average in the past five years, and the poverty rate was 30% higher than the national rate in 2019.[1] Jefferson County also ranks in the lowest tertile of life expectancy and the highest tertile of deaths associated with respiratory diseases, compared to other counties in the US.[2] Among the 120 Kentucky counties, Jefferson County ranks 47 and 37 in terms of health risk factors and health outcomes, respectively.[3]

Methods

Epidemic Modeling: We used a classic deterministic model of epidemic dynamics called the **s**usceptible-**e**xposed-**i**nfectious-**r**ecovered (SEIR) model.[4] The model classifies a population into four connected compartments: the **s**usceptible, the **e**xposed, the **i**nfectious, and the **r**ecovered. The susceptible population includes individuals who could be infected by the virus. In this model, those who live in Jefferson County are the susceptible population. The exposed or latently infected population includes those who have acquired the virus but are not transmitting it. The infectious population is a subset of the exposed who are actively transmitting the virus. The recovered population is a subset of the infectious population who recovered and are no longer infectious. We regulated the transmission through these four compartments using the most up to date COVID-19 transmission dynamics parameters (namely, the basic reproduction factor and the periods of incubation and infectiousness) reported in the COVID-19 rapidly growing literature. We also fed the model with globally and locally acceptable clinical dynamics parameters, for example, case fatality rate (CFR), incubation to death period, and length of stay in hospital.

Scenario Building: The model allows for measuring the effect of a public health policy intervention to contain an infection. The policy is characterized by an intervention day and a degree of the strength of the intervention. The intervention day can be set closer to or further from the emergence of the first reported infection and death in the susceptible population. The strength of the infection is determined by the decrease in the number of transmissions by one person.

We used the intervention tool to calibrate the model for the Jefferson County deaths. Specifically, we considered two potential intervention scenarios that would have approximately led to the current number of deaths in the county. In one, we set the intervention day on April 7, 2020 (two weeks after the governor's stay-home order issued on

March 25)[5] and assumed that the intervention (representing all containment measures taken by the public authority, businesses and people) led to a 70% decrease in the transmission of COVID-19. In another intervention scenario, we set the intervention day a week earlier on March 31, 2020, but assumed that the intervention led to a 65% decrease in transmission of the virus. We call these two scenarios *status quo* scenarios. Both scenarios allow for a period of adjustment (compliance) after the governor's March 25 stay-home order.

Under each of the two *status quo* scenarios, we considered four potential alternatives that reflect containment methods that would have been weaker or stronger. Therefore, we discussed where the Jefferson County COVID-19 status in terms of the numbers of infections, hospitalizations, and fatalities would have been if we had practiced weaker or stronger containment (social distancing) strategies.

Results

Observed Data: By April 16, 2020, there were 774 cases and 61 COVID-19 deaths in Jefferson County. On average, there was an estimated 9-day delay from the start date of symptoms to the reporting date in the data. The CFR was 7.9%, which is perceived as an overestimation of the actual case fatality rate because of the lack of widespread testing. The average age of deceased individuals was 75 years. About 91% of them had a history of cardiovascular disease, 55% had a neurological condition, 50% had diabetes, and 46% had a history of chronic lung disease. About 54% and 25% of COVID-19 cases were among white and black residents, respectively; about 56% and 30% of deaths were among the white and black residents, respectively. Among the hospitalized, 35% were admitted to the ICU, and 27% used a ventilator.

Projections: Projections based on the presumed *status quo* (which will be reevaluated as Jefferson County COVID-19 data is updated) showed 518−912 actively circulating infections, 198−399 active hospitalizations, 49−86 total fatalities, on average, on May 7. Also, the average numbers of active infections, active hospitalizations, and total fatalities were projected to decrease to 456−530, 185−269, 79−148, respectively, by June 4. By the end of this first wave of the epidemic (presumably, late August), the average numbers of active infections, active hospitalizations, and total fatalities were projected to decrease to 113−306, 65−130, 230−317, respectively.

Interpretation: Under any of the two *status quo* scenarios, **if stronger containment methods** (including personal precautions, population management i.e., social distancing, workplace personnel management, and patient placement) would have been used from the presumed intervention days (March 31 and April 7) and **they would have decreased the transmission of the virus by an additional 10%,** the average numbers of active infections, active hospitalizations, and total fatalities may decrease to 74−94, 51−90, 64−127, respectively, by June 4. On the other hand, if weaker containment methods were used from the presumed intervention days and virus transmission would have increased by an additional 10%, the projected average numbers of active infections, active hospitalizations, and total fatalities, may increase to 2175−2278, 637−785, 178−272, respectively, by June 4.

Conclusion

- Maintaining the *status quo* assumes that we decreased transmission by 65% or 70% (which may or may not be true and needs to be reevaluated as Jefferson County data is updated). Nonetheless, we will likely have hundreds of active infections in early June.
- If we **practice stronger social distancing strategies, we could safely open in early June.** Therefore, taking new and more effective measures can make a manageable early-June opening more likely.
- Stronger containment efforts in the future to reduce transmission of the virus could include more extensive testing together with consistent tracing (quarantine as appropriate) of all contacts of recognized cases.
- These efforts should allow for much more effective containment of spread than is currently present and could allow for an earlier date of gradual relaxation of current restrictions.
- If we had practiced **weaker social distancing than the current status, we would have been in an unstable path with increased hospitalization and infection trends.** Decreasing the current social distancing measures without efforts in regard to testing, isolating, and contact tracing can move us to an unstable status which can be catastrophic.
- The **rapid implementation and effectiveness** of social distancing measures, personal protection measures, testing, and systems to quickly contact trace to decrease transmission after a contact has been made are **crucial to limit the transmission of the virus.** The rates of hospitalization suggest that only 400 beds are needed to handle the "surge" under good social distancing compliance. Point of care (POC) rapid testing should be used before any hospitalization. This provides better medical care to the community and brings hospital beds back online that will likely not be needed under a surge if we prudently practice social distancing.

Key Takeaways

1. Social distancing measures taken in Jefferson County were justified.
2. We have hospital capacity to reopen carefully and slowly.
3. The modeling numbers help the Louisville Metro Department of Health & Wellness (LMPHW) predict the number of staff they will need to expand to do proper investigations and contact tracing (currently between 250 and 500 staff are expected to be needed).

The COVID-19 in Jefferson County, KY

Table 1: Characteristics of COVID-19 positive cases and deaths from COVID-19 in Jefferson County (KY) as of April 16th, 2020		
	Cases (n=774)	Deaths (n=61)
Time from symptoms to report form in days, mean (SD) n=600 (174 missing symptom onset date)	9.2 (5.9)	
Input Statistics from the data:		
Case Fatality Rate (%)	7.9%	
Time from symptoms to death in days, mean (IQR) n=56		10 (6, 17)
-# of deaths with missing onset date		5
Hospitalization proportion, n (%)*	326 (46.8%)	
-% of cases with unknown hospitalization status, n (%)	77 (9.9%)	
Length of hospital stay in days, median (IQR),	5 (3, 8)	
- % of hospitalized patients (n=326) with unknown	113 (34.7%)	
Time from symptoms to hospitalizations in days, median (IQR), n=294	4 (1, 7)	
- % of hospitalized patients (n=326) with unknown admission or onset date, n (%)	32 (9.8%)	
Case Characteristics (n=774)		
Age in years, mean (IQR; min:max)	56.9 (43, 71; 0:102)	75.3 (66, 85; 42:93)
Race, n (%)		
-White	420 (54.3)	34 (55.7)
-Black	192 (24.8)	18 (29.5)
-Asian	47 (6.1)	1 (1.6)
-Other	115 (14.9)	8 (13.1)
Sex, n (%)*		
Male	340 (45.8)	28 (47.5)
Female	403 (54.2)	31 (52.5)
-Missing	31	2
With COVID-19 symptom, n (%)	627 (81.0)	56 (91.8)
-Missing	80 (10.3)	4 (6.6)
Among those hospitalized COVID-19 cases (n=326):		Among hospitalized deaths (n=50)
Admitted to ICU, n (%)	107 (35.1)	31 (62.0)

		Cases (n=774)	Deaths (n=61)
	-Missing	21	
	*Mechanical Ventilator, n (%)**	77 (26.6)	25 (50.0)
	-Missing	37	--

Table 1: Characteristics of COVID-19 positive cases and deaths from COVID-19 in Jefferson County (KY) as of April 16th, 2020

Characteristics of COVID-19 deaths (n=61)

		Cases	Deaths
Diabetic, n (%)*		--	26 (50)
	-Missing	--	9
Immunocompromised, n (%)*		--	6 (13.6)
	-Missing	--	17
History of CVD, n (%)*		--	51 (91.1)
	-Missing	--	5
History of Chronic Liver Disease, n (%)*		--	1 (2.3)
	-Missing	--	17
History of Chronic Lung Disease, n (%)*		--	22 (45.8)
	-Missing	--	13
Neurological Condition, n (%)*		--	24 (54.6)
	-Missing	--	17
Pneumonia, n (%)*		--	50 (89.3)
	-Missing	--	5
Renal Disease, n (%)*		--	15 (31.9)
	-Missing	--	14
Abnormal Chest X-Ray, n (%)*		--	49 (84.5)
	-Missing	--	3
Acute Respiratory Distress, n (%)*		--	21 (38.9)
	-Missing	--	7
ICU, n (%)*		--	32 (54.2)
	-Missing	--	2
Intubated, n (%)*		--	26 (44.1)
	-Missing	--	2

#Results are presented as sample sizes, n, with percentages within parentheses, n (%); and means or medians with standard deviations (SD) or interquartile ranges (IQR) within parentheses.

The Model

A traditional infectious disease model — SEIR (Susceptible → Exposed → Infected → Removed).[6]

Table 2: Assumptions

Inputs	Assigned Numbers
Transmission Dynamics:	
Jefferson County population[1]	767k
Basic reproduction number (R_0)	2.75
Length of Incubation Period[7,8]	5.2 days
Duration patient is infectious[9]	5 days
Clinical Dynamics:	
Case Fatality Rate (CFR)[10-14]	2%
Time from end of incubation to death	32 days
Length of hospital stay	7 days
Recovery time for mild cases	11 days
Hospitalization rate	20%
Time to hospitalization	5 days
Intervention Day	Scenarios on effective intervention day:
The date of stay-stay home executive order: March 25[5]	(1) One week later, on March 31
	(2) Two weeks later, on April 7
Decrease in transmission after the intervention	Scenarios:
(a correlate of R_t, with lower R_t for higher decreases in transmission)	(1) Low: 55% and 60%
	(2) Middle: 65% and 70%
	(3) High: 75% and 80%

Calibration:
The model is calibrated for the observed Jefferson County deaths for two pairs of benchmark or status quo scenarios:

    Intervention day: April 7   &   Decrease in transmission: 70%
    Intervention day: March 31   &   Decrease in transmission: 65%

Interpretation of the results under each scenario:

Section 1:

- Figure 1.1 shows the patterns of exposure, infections, hospitalizations, and deaths under a calibrated scenario that assumes the stay-home order became effective on April 7 and resulted in a 70% decrease in transmission. This scenario, which we call the first status quo scenario, approximately fits the trend of deaths in Jefferson County under the model assumptions.
- Figures 1.2 and 1.3 show the potential patterns had the measures taken to decrease the transmission of the virus from April 7 were more effective (or had we practiced stronger social distancing).
- Figures 1.4 and 1.5 show the potential patterns had the measures taken to decrease the transmission of the virus from April 7 were less effective (or had we practiced weaker social distancing).

- Table 3 present the projected numbers under our modeling assumptions.
- Figures 1.6−1.8, respectively, show the trends in infections, hospitalizations, and deaths under social distancing scenarios that are weaker or stronger than the status quo scenario.

Section 2:
- Figure 2.1 shows the patterns of exposure, infections, hospitalizations, and deaths under a calibrated scenario that assumes the stay-home order became effective in March 31 and resulted in a 65% decrease in transmission. This scenario, which we call the second status quo scenario, approximately fits the trend of deaths in Jefferson County.
- Figures 2.2 and 2.3 show the potential patterns had the measures taken to decrease the transmission of the virus from March 31 were more effective (or had we practiced stronger social distancing).
- Figures 2.4 and 2.5 show the potential patterns had the measures taken to decrease the transmission of the virus from March 31 were less effective (or had we practiced weaker social distancing).
- Table 4 present the projected numbers under our modeling assumptions.
- Figures 2.6−2.8, respectively, show the trends in infections, hospitalizations, and deaths under social distancing scenarios that are weaker or stronger than the status quo scenario.

Caveats:
- The projections are highly dependent on the assumptions of basic reproduction number R_0 (no control over), the true intervention day in the sense of when it became an effective intervention, and the presumed percentage decrease in transmission after the intervention.
- The scenarios will be narrowed further as more Jefferson County data is fed into the model.

All considered scenarios

		% Decrease in Transmission or Degree of Social Distancing		
		Low	Middle	High
Effective Intervention Day	March 31	55% and 60%	65% and 70%	75% and 80%
	April 7	55% and 60%	65% and 70%	75% and 80%

1. Projections with April 7 as the Effective Intervention Day

The Benchmark Scenario, resembling the current status in Jefferson County

Figure 1.1: The pattern of the exposed, the infectious, the hospitalized, and fatalities
(Assumption: the intervention on April 7 decreased transmission by 70% and others in Table 2)

The status if we had practiced a **stronger** social distancing

Figure 1.2: The pattern of the exposed, the infectious, the hospitalized, and fatalities (Assumption: the intervention on April 7 decreased transmission by 75% and others in Table 2)

Presumed Intervention Day
April 7

Exposed
Infectious
Hospitalized
Fatalities

June 4:
Fatalities: 148
Active Hospitalizations: 156
Active Infections: 232

July 2:
Fatalities: 189
Active Hospitalizations: 67
Active Infections: 88

August 20 (end of wave 1):
Fatalities: 218
Active Hospitalizations: 14
Active Infections: 16

Figure 1.3: The pattern of the exposed, the infectious, the hospitalized, and fatalities (Assumption: the intervention on April 7 decreased transmission by 80% and others in Table 2)

Presumed Intervention Day
April 7

Exposed
Infectious
Hospitalized
Fatalities

June 4:
Fatalities: 127
Active Hospitalizations: 90
Active Infections: 94

July 2:
Fatalities: 153
Active Hospitalizations: 29
Active Infections: 22

August 20 (end of wave 1):
Fatalities: 167
Active Hospitalizations: 4
Active Infections: 2

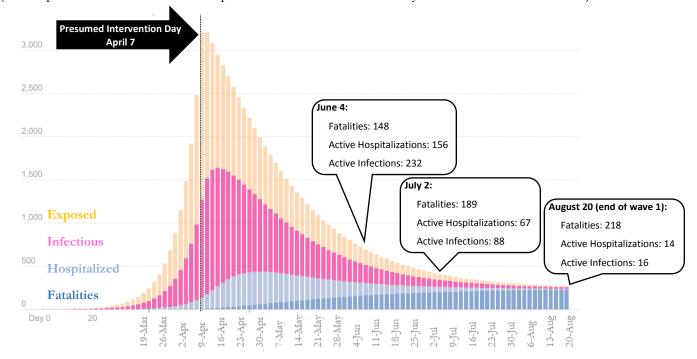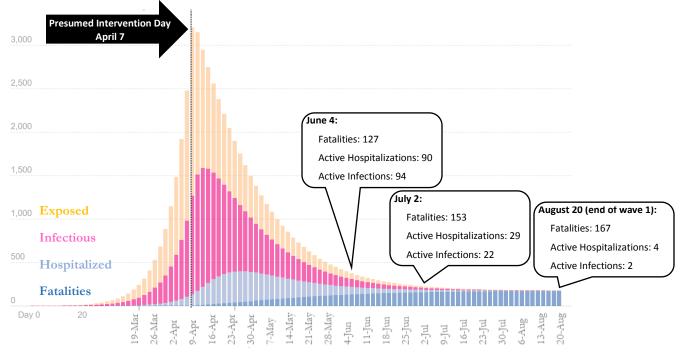**The status if we had practiced a weaker social distancing**

Figure 1.4: The pattern of the exposed, the infectious, the hospitalized, and fatalities (Assumption: the intervention on April 7 decreased transmission by 65% and others in Table 2)

Presumed Intervention Day April 7

June 4:
Fatalities: 217
Active Hospitalizations: 463
Active Infections: 1131

July 2:
Fatalities: 341
Active Hospitalizations: 401
Active Infections: 944

August 20 (end of wave 1):
Fatalities: 528
Active Hospitalizations: 288
Active Infections: 656

Exposed
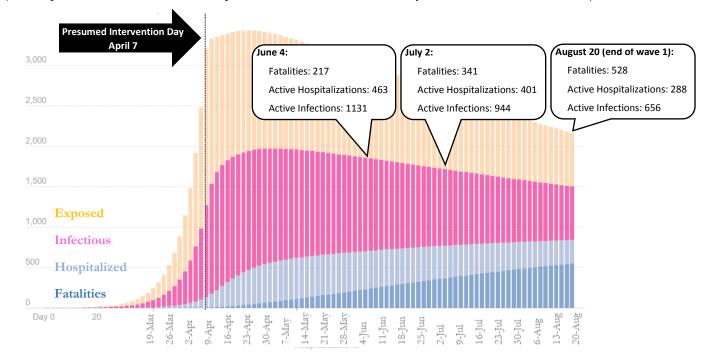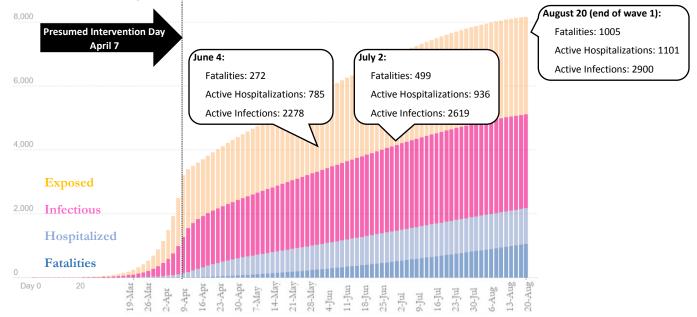Infectious
Hospitalized
Fatalities

Figure 1.5: The pattern of the exposed, the infectious, the hospitalized, and fatalities (Assumption: the intervention on April 7 decreased transmission by 60% and others in Table 2)

Presumed Intervention Day April 7

June 4:
Fatalities: 272
Active Hospitalizations: 785
Active Infections: 2278

July 2:
Fatalities: 499
Active Hospitalizations: 936
Active Infections: 2619

August 20 (end of wave 1):
Fatalities: 1005
Active Hospitalizations: 1101
Active Infections: 2900

Exposed
Infectious
Hospitalized
Fatalities

Table 3: Projected fatalities, infections and hospitalizations under different scenarios of decrease in transmission after the presumed intervention (Assumption: April 7 was the effective intervention day and others listed on page 4 of the report)
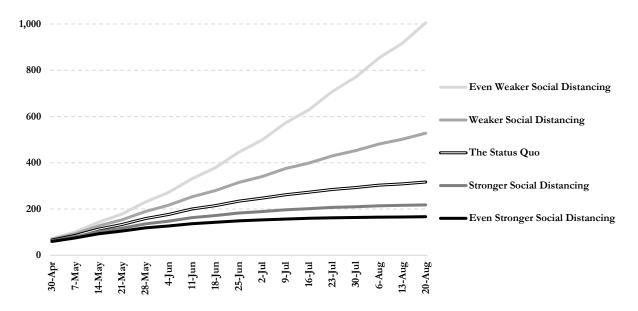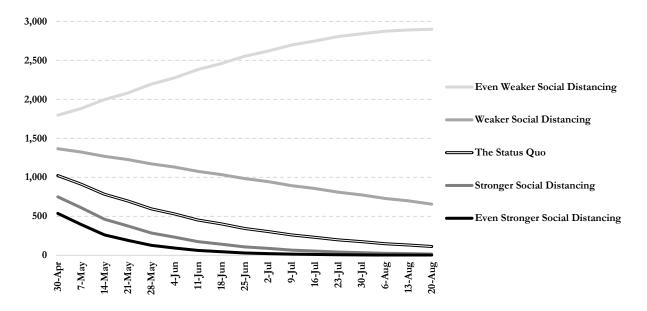
Dates in 2020	Total Projected Numbers of **Infections Actively Circulating** % Decrease in Transmission						Total Projected Numbers of **Active Hospitalizations** % Decrease in Transmission						Total Projected Numbers of **Fatalities** % Decrease in Transmission				
	60	65	70	75	80		60	65	70	75	80		60	65	70	75	80
30-Apr	1,797	1,367	**1,023**	750	537		547	475	**413**	359	312		73	69	**66**	63	60
7-May	1,883	1,325	**912**	610	395		600	490	**399**	325	265		101	93	**86**	80	75
14-May	1,997	1,270	**782**	463	262		659	491	**365**	270	200		143	127	**113**	102	93
21-May	2,083	1,228	**696**	377	192		699	486	**336**	231	159		178	153	**133**	117	105
28-May	2,195	1,172	**596**	286	127		749	474	**297**	185	116		230	189	**159**	136	119
4-Jun	2,278	1,131	**530**	232	94		785	463	**269**	156	90		272	217	**177**	148	127
11-Jun	2,384	1,076	**453**	176	62		831	447	**235**	123	65		331	253	**200**	163	137
18-Jun	2,459	1,036	**403**	143	46		864	433	**212**	103	51		379	280	**215**	172	143
25-Jun	2,554	983	**344**	108	30		906	415	**184**	81	37		446	315	**234**	183	149
2-Jul	2,619	944	**305**	88	22		936	401	**165**	67	29		499	341	**247**	189	153
9-Jul	2,697	894	**261**	67	15		974	383	**143**	53	21		572	375	**262**	197	157
16-Jul	2,749	857	**231**	54	11		999	369	**128**	44	16		629	399	**273**	202	160
23-Jul	2,807	809	**197**	41	7		1,030	350	**110**	34	12		708	430	**285**	207	162
30-Jul	2,841	775	**175**	33	5		1,050	336	**98**	28	9		770	453	**293**	210	164
6-Aug	2,875	730	**149**	25	3		1,073	318	**85**	22	7		853	481	**303**	214	165
13-Aug	2,891	698	**132**	21	3		1,087	305	**75**	18	5		917	502	**309**	216	166
20-Aug	2,900	656	**113**	16	2		1,101	288	**65**	14	4		1,005	528	**317**	218	167

Figure 1.6: Projected numbers of **total fatalities** by week under different social distancing scenarios (The status quo: the intervention on April 7 decreased transmission by 70%)

Figure 1.7: Projected weekly numbers of **infections actively circulating** under different social distancing scenarios (The status quo: the intervention on April 7 decreased transmission by 70%)
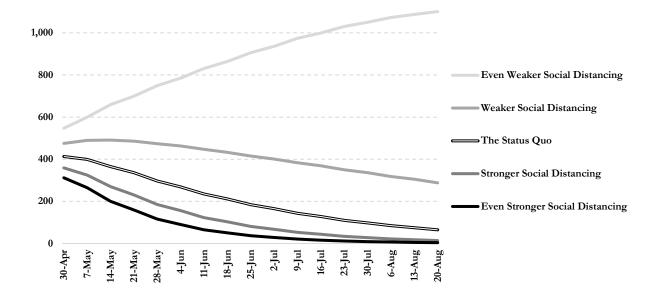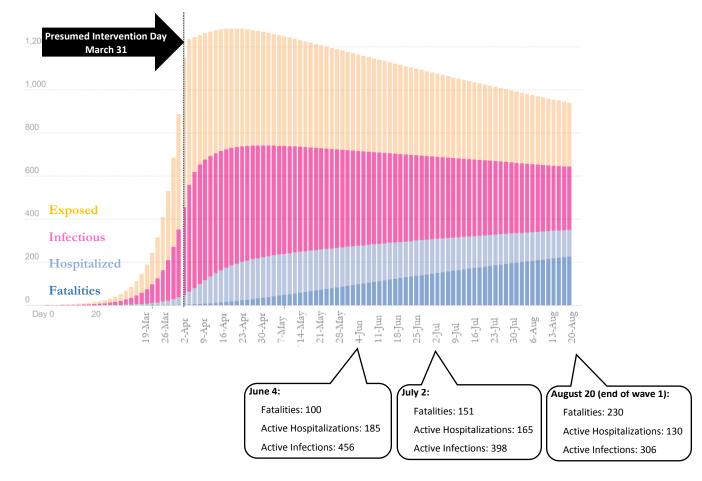
Figure 1.8: Projected weekly numbers of **active hospitalizations** under different social distancing scenarios (The status quo: the intervention on April 7 decreased transmission by 70%)

2. Projections with March 31 as the Effective Intervention Day

The Benchmark Scenario, resembling the current status in Jefferson County

Figure 2.1: The pattern of the exposed, the infectious, the hospitalized, and fatalities
(Assumption: the intervention on March 31 decreased transmission by 65% and others in Table 2)

June 4:
Fatalities: 100
Active Hospitalizations: 185
Active Infections: 456

July 2:
Fatalities: 151
Active Hospitalizations: 165
Active Infections: 398

August 20 (end of wave 1):
Fatalities: 230
Active Hospitalizations: 130
Active Infections: 306

The status if we had practiced a stronger social distancing
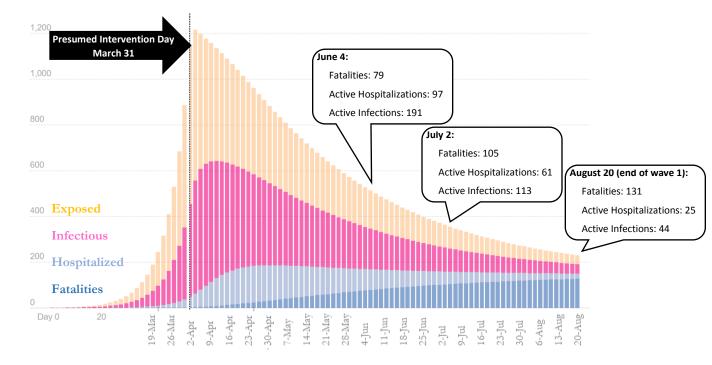
Figure 2.2: The pattern of the exposed, the infectious, the hospitalized, and fatalities
(Assumption: the intervention on March 31 decreased transmission by 70% and others in Table 2)
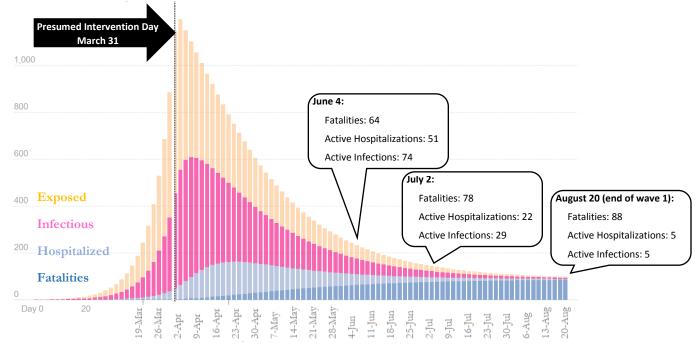

Figure 2.3: The pattern of the exposed, the infectious, the hospitalized, and fatalities
(Assumption: the intervention on March 31 decreased transmission by 75% and others in Table 2)

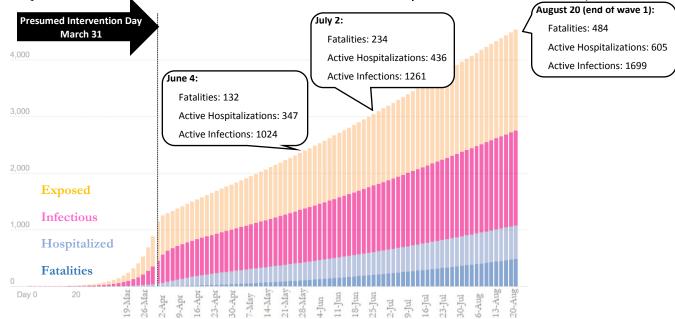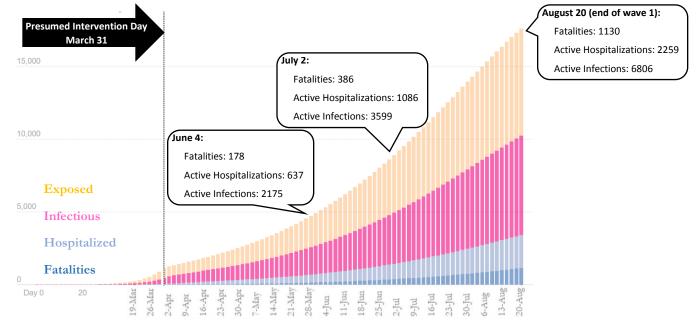# The status if we had practiced a weaker social distancing

Figure 2.4: The pattern of the exposed, the infectious, the hospitalized, and fatalities (Assumption: the intervention on March 31 decreased transmission by 60% and others in Table 2)

Presumed Intervention Day March 31

June 4:
Fatalities: 132
Active Hospitalizations: 347
Active Infections: 1024

July 2:
Fatalities: 234
Active Hospitalizations: 436
Active Infections: 1261

August 20 (end of wave 1):
Fatalities: 484
Active Hospitalizations: 605
Active Infections: 1699

Exposed
Infectious
Hospitalized
Fatalities

Figure 2.5: The pattern of the exposed, the infectious, the hospitalized, and fatalities (Assumption: the intervention on March 31 decreased transmission by 55% and others in Table 2)

Presumed Intervention Day March 31

June 4:
Fatalities: 178
Active Hospitalizations: 637
Active Infections: 2175

July 2:
Fatalities: 386
Active Hospitalizations: 1086
Active Infections: 3599

August 20 (end of wave 1):
Fatalities: 1130
Active Hospitalizations: 2259
Active Infections: 6806

Exposed
Infectious
Hospitalized
Fatalities

Table 4: Projected fatalities, infections and hospitalizations under different scenarios of decrease in transmission after the presumed intervention
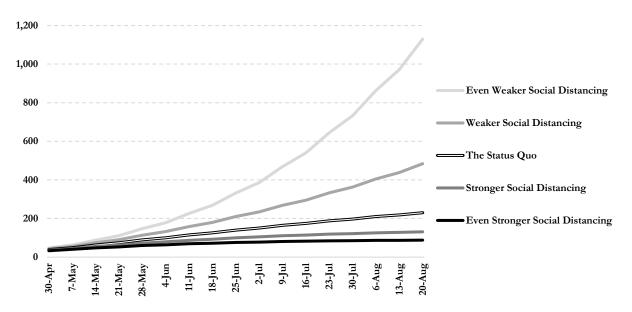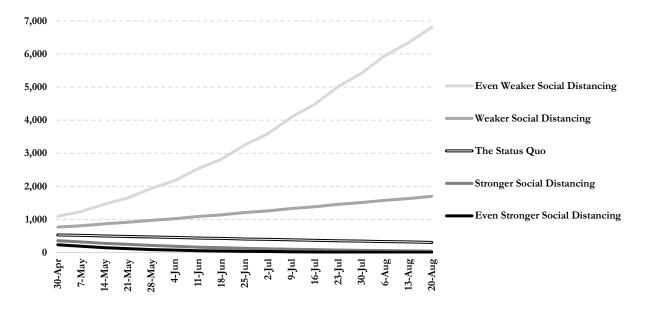(Assumption: March 31 was the intervention day)

Dates in 2020	Total Projected Numbers of **Infections Actively Circulating** % Decrease in Transmission					Total Projected Numbers of **Active Hospitalizations** % Decrease in Transmission					Total Projected Numbers of **Fatalities** % Decrease in Transmission				
	55	**60**	**65**	**70**	**75**	**55**	**60**	**65**	**70**	**75**	**55**	**60**	**65**	**70**	**75**
30-Apr	1,094	771	**532**	359	235	304	245	**197**	158	126	47	43	**39**	36	33
7-May	1,240	812	**518**	321	192	351	264	**198**	148	110	63	55	**49**	44	40
14-May	1,462	869	**500**	277	146	419	288	**196**	133	90	88	74	**63**	55	48
21-May	1,651	914	**487**	248	119	477	305	**193**	122	76	111	90	**74**	62	53
28-May	1,936	976	**469**	214	91	563	329	**189**	107	61	147	113	**89**	72	60
4-Jun	2,175	1,024	**456**	191	74	637	347	**185**	97	51	178	132	**100**	79	64
11-Jun	2,530	1,089	**439**	164	57	746	372	**180**	85	40	226	158	**115**	87	69
18-Jun	2,823	1,140	**426**	147	46	838	390	**176**	77	34	268	180	**126**	93	72
25-Jun	3,252	1,209	**410**	127	35	974	416	**170**	67	27	332	210	**140**	100	76
2-Jul	3,599	1,261	**398**	113	29	1,086	436	**165**	61	22	386	234	**151**	105	78
9-Jul	4,093	1,332	**382**	97	22	1,249	462	**160**	53	17	469	268	**165**	111	81
16-Jul	4,482	1,385	**370**	87	18	1,380	483	**155**	47	15	540	295	**175**	114	83
23-Jul	5,017	1,457	**355**	75	14	1,566	510	**149**	41	11	645	333	**188**	119	84
30-Jul	5,422	1,510	**344**	67	11	1,712	531	**145**	37	9	733	363	**197**	122	85
6-Aug	5,955	1,580	**330**	58	8	1,911	558	**139**	32	7	864	405	**210**	126	87
13-Aug	6,337	1,632	**319**	51	7	2,062	578	**135**	29	6	972	438	**219**	128	87
20-Aug	6,806	1,699	**306**	44	5	2,259	605	**130**	25	5	1,130	484	**230**	131	88

Figure 2.6: Projected numbers of **total fatalities** by week under different social distancing scenarios (The status quo: the intervention on March 31 decreased transmission by 65%)

Figure 2.7: Projected weekly numbers of **infections actively circulating** under different social distancing scenarios (The status quo: the intervention on March 31 decreased transmission by 65%)
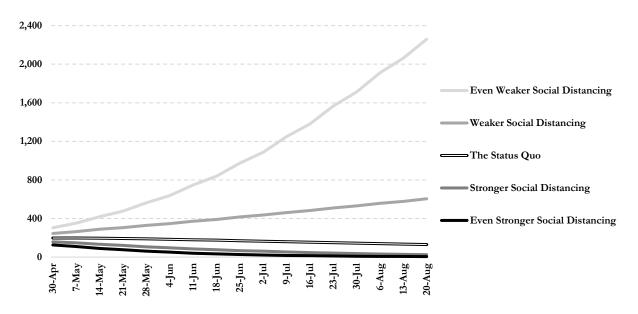
Figure 2.8: Projected weekly numbers of **active hospitalizations** under different social distancing scenarios (The status quo: the intervention on March 31 decreased transmission by 65%)

Conclusion

(1)   Maintaining the status quo assumes that we decreased transmission by 65% or 70% (which may or may not be true and needs to be reevaluated as Jefferson County data gets updated) and will likely result in hundreds of active infections in early June.

(2)   If we had practiced stronger containment strategies, we could safely open in early June. Therefore, taking new and more effective measures can make a manageable early-June opening more likely.

(3)   Stronger efforts in the future to reduce transmission of the virus could include more extensive testing together with consistent tracing (with quarantine as appropriate) of all contacts of recognized cases. These efforts should allow for much more effective containment of spread than is available at present and could allow for an earlier date of gradual relaxation of current restrictions.

(4)   If we had practiced weaker social distancing than the current status, we would have been in an unstable path with increasing hospitalization and infection trends.

(5)   Decreasing the current social distancing measures without efforts in regard to testing, isolating, and contact tracing can move us to an unstable status.

(6)   The rapid implementation and effectiveness of any social distancing measures, personal protection measures, and systems to quickly contact trace to decrease transmission after a contact has been made are crucial to limit the transmission of the virus.

(7)   ***Of more than 3600 hospital beds in Louisville, <u>an estimated 3200 hospital beds could be brought back into clinical use and used as Non-COVID</u>.*** Point of care (POC) rapid COVID testing should be used before any hospital admission. ***This would improve medical care in the community and help begin to return the economy to normal.***

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