COVID-19 Campus Introduction Risks for Spring 2021 at the University of Texas at Austin

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[The University of Texas COVID-19 Modeling Consortium](#)
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Summary

There are more than 50,000 students enrolled at the University of Texas at Austin (UT), with an estimated 80% from Texas, 93% from the United States, and 7% from abroad. The 2021 spring semester began on January 19th. The university is taking steps to reopen safely in light of four COVID-19-related risks:

Introduction risks: UT students returning to Austin from other cities may arrive infected.

On-campus transmission risks: Transmission may occur during classes and other organized UT activities.

Off-campus transmission risks: Transmission may occur through off-campus interactions among members of the UT community.

Community amplification risks: Transmission may spill over from the UT community into the surrounding Austin community.

In order to assist the University of Texas at Austin in safely opening for the spring of 2021, this report addresses potential introduction risks. It provides estimates for the number of infected students returning to Austin in the spring semester compared to those expected to have arrived infected in the fall semester.

In brief, we assumed that 9,000 students are already in Austin and 21,000 additional students may have returned to Austin by January 19th. We note that this conservatively assumes that 20,000 of the 50,000 enrolled students at UT elected to remain in their

home regions for the spring semester. This was based on estimates provided by UT that about 30,000 students were in the Austin area during the fall semester.

Using COVID-19 confirmed case data and Texas hospitalization data through January 15th, 2021, we estimated the prevalence of COVID-19 in Austin and the home counties of returning UT students. The analysis suggests the following risks:

- The estimated prevalence of COVID-19 in Travis County as of January 15, 2021 is 1.7%.

- Based on estimates for local COVID-19 prevalence in the home counties of UT students, the expected prevalence of COVID-19 among the 30,000 returning UT students is 2.0%.

- Between 350 and 1000 students may have arrived infected during the first week of classes.

- Introduction risks may be considerably lower if infected individuals who test positive or are sufficiently symptomatic self-isolate and do not attend in-person classes and events.

Background

COVID-19 emerged in China in late 2019, and began to spread rapidly across the world in early 2020. To mitigate risks of transmission among students, faculty, and staff, colleges and universities across the country migrated classes to a strictly online format during March of 2020. The University of Texas at Austin (UT) moved all classes online on March 17, 2020, through the remainder of the 2019-2020 academic year [1]. Following a rise and subsequent fall of cases in the summer of 2020, UT partially reopened in the fall of 2020 with a combination of online and hybrid courses offered. As UT begins the spring 2021 semester, the country, state of Texas, and the Austin area are experiencing a surge in cases.

Like many universities, UT has students returning from cities across the US and globe. The risk that these students will arrive infected depends on the state of the pandemic in their home communities and the students' potential exposure to the virus. Such importations can spark outbreaks in the UT and greater Austin communities, leading to disruptions in university activities and strains on testing and healthcare resources. For UT, students returning from other cities in Texas pose a particular risk, given the winter surges in cases that have occurred across the state [2]. To mitigate these risks, UT is asking students to test upon their return to Austin [3]. Additionally, they have moved all

hybrid classes online through January to encourage students to delay or stagger their return to Austin.

Here, we estimate the prevalence of COVID-19 among UT students in January of 2021, based on estimates for the prevalence of the virus in the home counties of returning students.

Introduction risks

Using the methods described in Appendix A.1 below, we estimated the prevalence of the virus among UT students during the first week of the semester. We assume that 9,000 students were already in Austin as of January 15th and that 21,000 would move to or return to Austin around January 19th, 2021. The estimates are based on the prevalence of COVID-19 in Austin and in the home regions of students in the United States returning to Austin by January 19th. For comparison, we also retrospectively ran these estimates for the fall semester, under the same set of assumptions described here and in Appendix A.1. These estimates are slightly revised from our original analysis of introduction risks reported in August of 2020 [4], when there was more uncertainty in the number of students returning to Austin. We do not account for the possibility that social contacts among resident and returning students before January 19th could exacerbate transmission and increase prevalence.

Under the scenario of 9,000 students already in Austin and 21,000 returning before January 19th, we would expect that between 395 and 978 students would be infected during the first week of classes (Figure 1A, Table 1). This corresponds to an expected 1.3%-3.3% of the UT student body living in Austin for the spring semester infected. These estimates depend on the number of students returning from outside of Austin and the prevalence in those communities. Assuming 30,000 students were present in Austin during the fall semester, we retrospectively estimated that between 185 and 250 students arrived infected. The number of introduced infections during the spring semester is therefore expected to be around 2.9 times greater than the number arriving in the fall semester, based on hospitalization data in Texas and case data throughout the country. Of note, these estimates are strictly based on community-level prevalence, and do not take into account the potential that a higher number of UT students were already infected in the fall semester, and potentially have a higher level of immunity than is reflected in their communities.

Table 1. Expected introductions of COVID-19 among UT students in Austin during the week of January 19th. Estimates are provided both as the number of students and percentage of the student body infected. In estimating the prevalence of COVID-19 in the home regions of Texas students, we analyzed Texas Trauma Service Area COVID-19 hospitalization data using models calibrated to each region to estimate the lower bound (2.5th percentile), median, and upper bound (97.5th percentile) of prevalence in each area [6, 7]. To estimate the prevalence of students coming from outside of Texas, we used the county-level reported cases [10,11] and adjusted them by case reporting rates. The lower bounds, medians, and upper bounds reflect case reporting rates that are either 1 in 3, 1 in 5, or 1 in 10, respectively. The expected introductions and prevalence are reported from students that reside in Travis County, all those expected to be imported from other regions in Texas and the US, and the total numbers expected at UT. The importation estimates were combined to get the total number of expected introductions.

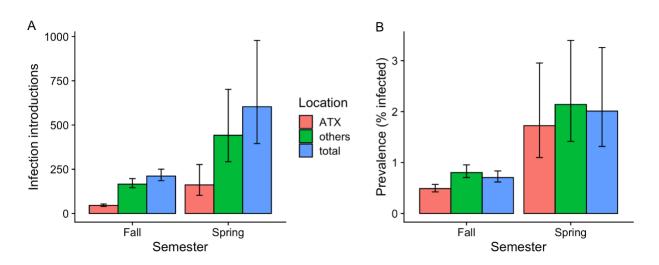|	Austin		Other regions		Total	
	Infections	Prevalence	Infections	Prevalence	Infections	Prevalence
Fall	45 (39-53)	0.49% (0.42%-0.57%)	165 (145- 197)	0.80% (0.71%- 0.95%)	211 (185-250)	0.62% (0.70%-0.84%)
Spring	161 (103- 276)	1.72% (1.10%- 2.95%)	442 (292- 701)	2.14% (1.41%- 3.40%)	603 (395-978)	2.01% (1.32%-3.26%)

Figure 1. Expected prevalence of COVID-19 among returning UT students at the start of the fall 2020 semester vs. the start of the spring 2021 semester. The estimates assume that 9,000 students have home residences in Austin and that an additional 21,000 returned to Austin from other areas in both the fall and spring semesters (x-axis). (A) The expected number of students initially infected is stratified by those expected to live in Austin (pink), those coming from other regions (green) and the total (blue). Based on data through January 15th, we project that about 211 students arrived infected in the fall semester, while 603 are expected to arrive infected during the spring semester. (B) The expected infected percentages of the UT student body in Austin at the beginning of the spring 2021 semester. The error

bars in both graphs reflect uncertainty in the prevalence of COVID-19 in the home regions of the students from two sources: (1) uncertainty in SARS-CoV-2 prevalence from our TSA projection models for students returning from Texas, and (2) uncertainty in case reporting rates for students returning from outside of Texas, where the lower and upper bounds assume 1 in 3 and 1 in 10 case reporting rates, respectively.

Final considerations

Roughly 9,000 UT students live in Austin and up to 21,000 additional students were expected to move to or return to Austin around January 19th, 2021. Based on mid-January and mid-August estimates for the prevalence of SARS-CoV-2 in Austin as well as the home counties of the returning students, we project that the introductions of SARS-CoV-2 among UT students at the start of the spring semester may be 2.9 times greater than they were at the start of the fall semester. This is largely due to alarming surges in COVID-19 hospitalizations in the Austin area, as well as throughout the state of Texas and the country. Our analysis suggests that around six hundred UT students will likely be infected at the outset. Contacts between resident and returning students may exacerbate risks, fuel transmission and deplete public health resources even further. Thus, wearing of face masks, social distancing, frequent testing, self-isolation when symptomatic and other risk-reduction measures will be key to ensuring a safe reopening of UT [5].

We emphasize that these estimates should be interpreted merely as **rough guideposts** to inform effective risk communication and mitigation planning. They are based on the following key assumption: the chance that a student will be infected with COVID-19 at the start of the spring semester is equal to the overall prevalence of the virus in their home community. In fact, the prevalence of COVID-19 often varies across age groups, through time, geographically and socioeconomically. Therefore, the risk that a returning student arrives infected may be overestimated or underestimated by the overall prevalence of the virus on January 19th in their home community. As noted above, the introduction risks may be considerably lower if individuals test upon returning to campus and self-isolate to prevent spread of the virus and if there is extensive and rapid testing coupled with voluntary precautionary behavior to make reopening safer and more feasible.

Appendix: Estimation Methods

Appendix A.1. Estimating introduction risks

To estimate the number of UT students who will return to Austin infected, we consider the prevalence of the virus in the US county or non-US country of residence for each student. For each home region, *r*, we define the following:

n_r: the number of UT students originating from region r

p_r: the probability that a student from region *r* is infected with COVID-19

The expected number of students that will arrive infected from that region is then the product of these two quantities:

$$i_r = n_r \cdot p_r.$$

While n_r is known, p_r must be approximated. We assume that p_r is equal to the background prevalence of COVID-19 in the region. For example, if there are 100 students from a given region with a COVID-19 prevalence of 5%, we assume that 5 students are currently infected. In order to calculate the expected total number of infected UT students *i*, we simply add up the expected number of infected students from each region that UT students come from:

$$i = \sum_r i_r.$$

To determine the number of students originating from various US counties and countries, we obtained county and country-level data for the more than 51,000 students enrolled at the University of Texas at Austin as of July 2, 2020.

Estimating the prevalence of COVID-19 for returning students

COVID-19 prevalence of a region was estimated by those living in Texas by the Trauma Service Area (TSA) models developed by the UT Modeling Consortium [6]. Full details of the methods of this model can be found here [7]. In brief, the TSA models use daily hospitalization data combined with infection-hospitalization ratios to estimate the total number infected and exposed in the region. For a given home region r of a returning student, the prevalence of SARS-CoV-2 p_r is the fraction of the population that are

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currently infected plus the fraction of the population that have already been exposed and will become infected.

$$p_r = \frac{I_r + E_r}{N_r}.$$

For students living outside of Texas, the prevalence was estimated using reported case counts from a region. Because of uncertainty in whether international students would return and because of differences in reporting rates, prevalence was only estimated for regions in the U.S. For a given home region r of a returning student, the prevalence of SARS-CoV-2 p_r is the fraction of the population that are currently infected and capable of infecting others. To approximate prevalence, we consider the following four quantities:

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1. **Incidence in reported cases in region r, t days ago** $(C_{r,t})$**.** We obtained confirmed case count data from the New York Times and Our World in Data [8,9].

2. **Reporting rate in region r** (k_r)**.** Many infections are never reported because they are asymptomatic, mild or not tested for other reasons [10]. In Austin, we estimate that one in three cases is reported [11]. Elsewhere in Texas, we estimate that the reporting rate may be as low as one in ten cases reported [11]. In the analysis below, we assume a 1 in 3 reporting rate for Austin and consider three possible scenarios for reporting rates outside of Austin: 1 in 10, 1 in 5, and 1 in 3.

3. **Duration of the infectious period** (τ)**.** We make the simplifying assumption that newly detected infections are infectious for 7 days after detection [12].

4. **The population size of the region** (N_r)**.**

First, we estimate the number of current infections in a region as

$$I_r = \frac{1}{k_r} \sum_{t=1}^{\tau} C_{r,t}.$$

We then estimate the prevalence in region r as

$$p_r = \frac{I_r}{N_r}.$$

Accounting for uncertainty

To account for uncertainty in the number of UT students returning infected in the fall and spring semester, we vary the following:

1. For those students outside of Texas, the COVID-19 case reporting rate outside of Austin: 1 in 10, 1 in 5, or 1 in 3.

2. For students residing in Texas, uncertainty comes from the stochastic estimates of the number infected that give rise to the observed hospitalizations (see [7] for full uncertainty details).

We combine the lower and upper 95% confidence intervals from the TSA models with the lower and upper bounds of the case reporting rate for students outside of Texas to get the joint uncertainty estimates.

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