THE IMPACT OF SCHOOL CLOSURES ON
PANDEMIC INFLUENZA:
ASSESSING POTENTIAL REPERCUSSIONS USING A
SEASONAL SIR MODEL

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ABSTRACT. When a new pandemic influenza strain has been identified, mass-production of vaccines can take several months, and antiviral drugs are expensive and usually in short supply. Social distancing measures, such as school closures, thus seem an attractive means to mitigate disease spread. However, the transmission of influenza is seasonal in nature, and as has been noted in previous studies, a decrease in the average transmission rate in a seasonal disease model may result in a larger final size. In the studies presented here, we analyze a hypothetical pandemic using a SIR epidemic model with time- and age-dependent transmission rates; using this model we assess and quantify, for the first time, the effect of the timing and length of widespread school closures on influenza pandemic final size and average peak time.

We find that the effect on pandemic progression strongly depends on the timing of the start of the school closure. For instance, we determine that school closures during a late spring wave of an epidemic can cause a pandemic to become up to 20% larger, but have the advantage that the average time of the peak is shifted by up to two months, possibly allowing enough time for development of vaccines to mitigate the larger size of the epidemic. Our studies thus suggest that when heterogeneity in transmission is a significant factor, decisions of public health policy will be particularly important as to how control measures such as school closures should be implemented.

1. Introduction. Influenza, a seasonal viral disease, presents a significant morbidity and mortality burden on the population, with a typical seasonal influenza epidemic in the United States killing around 40,000 people per year\[12\]. However, during pandemic years, this number can be much larger. Influenza pandemics occur when a human influenza A virus re-assorts with an animal influenza A virus, such as one from birds or pigs. Pre-existing immunity within the population is low to these new strains, and thus pandemics are created if the strain is highly transmissible.

Because several months are needed to mass-produce vaccines once a new pandemic strain has been identified, mitigation strategies must be considered to reduce