School practices to promote social distancing in K-12 schools: review of influenza pandemic policies and practices

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Abstract

Background: During an evolving influenza pandemic, community mitigation strategies, such as social distancing, can slow down virus transmission in schools and surrounding communities. To date, research on school practices to promote social distancing in primary and secondary schools has focused on prolonged school closure, with little attention paid to the identification and feasibility of other more sustainable interventions. To develop a list and typology of school practices that have been proposed and/or implemented in an influenza pandemic and to uncover any barriers identified, lessons learned from their use, and documented impacts.

Methods: We conducted a review of the peer-reviewed and grey literature on social distancing interventions in schools other than school closure. We also collected state government guidance documents directed to local education agencies or schools to assess state policies regarding social distancing. We collected standardized information from each document using an abstraction form and generated descriptive statistics on common plan elements.

Results: The document review revealed limited literature on school practices to promote social distancing, as well as limited incorporation of school practices to promote social distancing into state government guidance documents. Among the 38 states that had guidance documents that met inclusion criteria, fewer than half (42%) mentioned a single school practice to promote social distancing, and none provided any substantive detail about the policies or practices needed to enact them. The most frequently identified school practices were cancelling or postponing after-school activities, canceling classes or activities with a high rate of mixing/contact that occur within the school day, and reducing mixing during transport.

Conclusion: Little information is available to schools to develop policies and procedures on social distancing. Additional research and guidance are needed to assess the feasibility and effectiveness of school practices to promote social distancing.

Keywords: Pandemic influenza, School planning, Social distancing

Background

During communicable disease outbreaks such as pandemic influenza, social distancing interventions that increase the space between people and decrease the frequency of contacts can play an important role in emergency response [1, 2]. Influenza pandemics typically have multiple waves and can last for months [3, 4]. The most recent pandemic in the United States was the 2009–2010 H1N1 influenza pandemic, which disproportionately impacted children and young adults [5, 6].

During an evolving influenza pandemic, community mitigation strategies, such as social distancing, can slow down virus transmission in schools and surrounding communities, helping to relieve pressure on overburdened healthcare and public health systems and buy time for pandemic vaccine production and distribution [7]. Because schools are socially dense environments where students congregate for many hours of the day, schools can fuel community-wide disease transmission [8, 9]. It follows that school practices that promote social
distancing could potentially protect large numbers of vulnerable children, as well as limit secondary transmis-
sion to adults within their households and communities.

Despite the potential impact of school practices on disease transmission, research on school practices to promote social distancing in primary and secondary schools has focused on prolonged school closure [10–
12], with little attention paid to the identification and feasibility of other more sustainable interventions that are less costly for society. Although many states and grant programs require school districts and individual schools to plan for infectious disease outbreaks, such as pandemic influenza, there is a paucity of published research on the content of these planning documents. Thus, pandemic influenza guidance documents and plans produced by state governments are a potential source of information on school practices to promote social distancing, as well as practical and policy barriers to the adoption of those practices.

To fully characterize and identify gaps in the literature on school practices to promote social distancing in a communicable disease outbreak, we reviewed both peer-reviewed and grey literature on social distancing interventions in schools other than school closure. We also collected and catalogued state government planning documents to assess state policies regarding social distancing interventions. Our aims were to develop a list and typology of school practices that have been proposed and/or implemented, summarize any barriers identified and lessons learned from their use, and summarize documented impacts. Such a typology can be of use to state and local education agencies as they consider their options for emergency planning.

Methods

Literature review

From September–October 2016, the lead author and re-
search assistant independently conducted searches of 10 education, public health, and general library catalogue da-
tabases. Multiple databases (e.g., EBSCO Information Ser-
"vices, WorldCat, New York Academy of Medicine) cover both peer-reviewed and grey literature sources, including reports, newspaper, newsletter, and magazine articles. We restricted our search to articles published after 2000.

Within each database, either the lead author or re-
search assistant first conducted a broad search using the search terms “school and (pandemic or influenza).” In
instances where that search strategy yielded fewer than 1000 results, we reviewed all abstracts and did not run additional searches. In contrast, when more than 1000 results were returned, we conducted two additional, narrower searches. We first re-ran “school and (pandemic or influenza),” and required that these terms appear in the title and/or abstract. We then also ran the search terms “school AND (influenza OR pandemic) AND (soc-
ad distancing OR practices OR measures OR inter-
ventions).” Table 1 shows the databases searched, final search terms, and results.

Both the lead author and research assistant reviewed the same set of approximately 2000 unique abstracts that were identified through these database searches, as well as the reference lists of relevant articles, selecting 46

| Table 1 Literature Search Strategy, 2000–2016 |
|-----------------------------------------------|
| Database | Search Terms | Results |
| EBSCO (Academic Search Premiere) | School (abstract) AND (pandemic or influenza) (abstract) | 998 |
| Education abstracts | (school) and (pandemic or influenza) | 214 |
| Eric | (school) and (pandemic or influenza) | 143 |
| Google Scholar | (school and (influenza or pandemic)) | 200a |
| JSTOR | (ab:(school) AND ab:(influenza or pandemic)) AND ((social distancing or practices or strategies or measures)) | 66 |
| Psych INFO | (schools and pandemic or influenza and (social distancing or practices or measures or interventions or strategies)) | 106 |
| PubMed | (schools[Title/Abstract] AND ((social distancing)[Title/Abstract] OR influenza[Title/Abstract] OR pandemic[Title/Abstract]) | 480 |
| Scopus | School and (influenza or pandemic) (AB) | 610 |
| Social Sciences Abstracts | school and (pandemic or influenza) (Title/Abstract) | 104 |
| Sociological Abstracts | school and (pandemic or influenza) (Title/Abstract) | 40 |
| Web of Science | TITLE: (school) AND TOPIC: ((pandemic or influenza) AND (practice or strategy or measure or intervention or social distancing)) | 215 |
| WorldCat | school and (influenza or pandemic) and (strategies or measures or interventions or practices or social distancing) | 891 |

Notes: *Only first 200 results reviewed
articles for full text review. Abstracts were excluded if they were: (1) not related to K-12 school practices or policies to promote social distancing in an infectious disease outbreak; (2) focused on schools other than K-12 (e.g., university planning for pandemic influenza); (3) published in a language other than English; or (4) only focused on sustained school closure rather than other potential school practices. The majority of abstracts were excluded because they were not related to K-12 school practices or policies to promote social distancing in an infectious disease outbreak (e.g., abstract focused on routine hygiene practices in schools).

Of the 46 articles that were selected for full text review, 30 did not mention a single (non-school closure) strategy, leaving 16 for our review.

To obtain relevant information from each reviewed article in a standardized manner, we developed an abstraction form. The form included the following items: article abstract, study design, study location/population, school practices identified, barriers to implementation, impact of school practices, and notes/observation. A researcher or research assistant collected data on each article using that form.

**State government planning document review**
We first conducted Google searches to identify state-level documents from 50 states and the District of Columbia to support public school planning. We sought to identify one document per state that provided guidance to its local education agencies (LEA) or schools. We excluded general pandemic influenza preparedness plans that were not directed to local education agencies or schools. To locate these documents, we conducted online searches that had various combinations of the following terms: [name of state], school, education, pandemic influenza, infectious disease, communicable disease, emergency response, guidance, and plan. Our goal was to identify pandemic-specific documents, either stand-alone documents or chapters or annexes in a larger emergency plan. However, when we could not identify a document specific to pandemic influenza, we then searched for materials related to infectious disease or emergency planning more broadly. In instances where we identified more than one guidance document within a state that met inclusion criteria, we selected the document that was published most recently.

Each plan/planning document was reviewed by a researcher or research assistant, and the following information was extracted: state name, type of plan (pandemic, infectious disease, emergency plan), author of plan, year plan was written, whether hygiene practices were discussed, whether school closure was discussed, whether distance learning was discussed, whether school practices to promote social distancing were discussed (and if yes, what types), and any included details about barriers, facilitators, or considerations for social distancing. RAND’s Institutional Review Board approved this study, determining that it did not involve human subjects and informed consent did not apply.

**Results**

**Literature review**
Of the 16 articles that met all inclusion criteria, 6 (38%) presented the results of agent-based simulation studies/modeling, and 5 (31%) presented the results of surveys regarding school practices during the 2009 H1N1 pandemic. The other five articles were a combination of commentaries, magazine or newsletter articles, and miscellaneous research articles.

Included articles identified more than a dozen different types of school practices to promote social distancing, many of which were slight variations on one another. Table 2 shows these practices as they were initially presented.

For ease of interpretation, we created categories of practices and calculated how often they were mentioned across articles (Table 3). The practices identified most frequently included canceling or postponing after-school activities ($n = 6, 38$%), increasing space among students during in-person instruction ($n = 5, 31$%), and canceling classes or activities with a high rate of mixing/contact that occur within the school day ($n = 5, 31$%). While canceling or postponing activities was mentioned frequently, it is unclear whether the intent of this practice, as implemented during the 2009–2010 H1N1 pandemic, was to reduce contact among students or a logical response to high rates of absenteeism or community concern.

Distance learning was mentioned in 2 (13%) articles [13, 14]. Ash et al. explained that distance learning is supported by various technologies such as the Internet, telephone, radio, TV, text messaging via cellphones, email, and podcasts [14]. Furthermore, during the H1N1 pandemic, there were examples of lessons being broadcast on public access television and studies using text messaging for study groups. However, because distance learning is used in combination with other practices such as school closure, partial school closure, or reduced schedule to achieve the social distancing of students enrolled in traditional bricks and mortar K-12 public schools, we do not list distance learning practices in Table 3.

Surveys of school responses to the H1N1 pandemic provided some data on how often schools implemented different practices. No single social distancing practice, aside from school closure, was widely used. The two most common practices were rearranging classrooms to increase the physical distance between students (implemented in 14% of schools across the state of Michigan.
in one study) and canceling or postponing various school activities (implemented by 5–16% of schools in one study, depending on the activity) [15]. No other practice was implemented by more than 10% of surveyed schools in any given study [16–19]. There were, however, widespread practices to limit disease spread that were not forms of social distancing. For example, schools routinely isolated ill students and promoted hand hygiene and respiratory etiquette during the H1N1 pandemic.

Very few of the articles (n = 2) we reviewed discussed barriers to implementing school practices to support social distancing. Ridenhour et al... mentioned the challenge of enforcing restrictions on the movement of students within a school (e.g., hall restriction, lunchroom restriction) [20], while Ash et al touched on the challenges of implementing distance learning in instances where students do not have access to broadband Internet or required hardware, such as laptops [14]. Additionally, young children and their families may not have the necessary technical skills to participate in online instruction, as opposed to the traditional delivery of instruction that occurs in-person.

All of the studies that used agent-based simulation models, and one epidemiologic study, reported that at least one school practice to promote social distancing could reduce contact among students and/or disease transmission (Table 4). Because articles focused on different practices, with the exception of class or grade closure, it is difficult to draw any conclusions about the

### Table 2 Articles Included in Literature Review, 2000–2016

| Article Type             | Location                  | School Practice(s)                                                                 |
|--------------------------|---------------------------|-----------------------------------------------------------------------------------|
| Agent-Based Simulation Model |                           |                                                                                   |
| Ridenhour [20]           | Peer-reviewed             | Hall restriction: Defined walking area between classrooms, lunchroom, and schoolyard (e.g., right-hand side of any hall); classroom restriction: Must remain seated while in class; schoolyard restriction: Must stay in a randomly specified schoolyard area (may or may not be classroom-specific); lunchroom restriction: Must only eat with classmates; different schedules/each classroom follows one of three schedules (current schedule, a shift of 45 min, a shift of 90 min) |
| Adalja [31]              | Peer-reviewed             | Segregating small clusters of children to different parts of the room; lunch in classrooms/no congregating for lunch; cancel gym class |
| Fumanelli [32]           | Peer-reviewed             | Class or grade closure (in contrast to full school closure) |
| Gemmetto [33]            | Peer-reviewed             | Class closure; grade closure                                                       |
| Lofgren [34]             | Peer-reviewed             | Closure of playground/common areas                                                |
| Cooley [35]              | Peer-reviewed             | Shorter school week: 4 days instead of 5                                           |
| Commentary/Newsletter/Magazine Article |                   |                                                                                   |
| McGiboney [13]           | Commentary                | DeKalb County, Georgia; Cancel fieldtrips; cancel afterschool activities; distance learning (e.g., cable channel lesson plans, study packets, online lessons) |
| Education Digest [36]    | Newsletter/Magazine       | National; Move desks apart; cancel classes that bring together children from different classrooms |
| Ash [14]                 | Newsletter/Magazine       | National; Distance learning                                                        |
| Surveys of Practices during 2009 H1N1 Pandemic |                   |                                                                                   |
| Miller [16]              | Peer-reviewed             | Pennsylvania; Cancel activities                                                    |
| Nasrullah [17]           | Peer-reviewed             | Georgia; Cancel or postpone activities                                             |
| Rebrmann [18]            | Peer-reviewed             | 26 states; Discourage face-to-face meetings in schools                              |
| Shi [15]                 | Peer-reviewed             | Michigan; Rearrange classroom to keep students further apart                      |
| Dooyema [19]             | Peer-reviewed             | Michigan; Move desks apart; cancel or postpone fieldtrips, performances, practices, after-school programs; divide classes into smaller groups; hold class outdoors (0%); move classes into larger spaces; crowd-reducing methods of transportation (e.g., no busing) |
| Epidemiologic Study      |                           |                                                                                   |
| Stehle [37]              | Peer-reviewed             | France; Class closure; altered schedules to prevent mixing                          |
| Sugisaki [38]            | Peer-reviewed             | Japan; Grade closure; class closure; later start to school day; cancel activities   |

*Interventions not tested as described. Discussed in discussion section

Data collection on face-to-face interactions

Analysis of school closure data
likely effectiveness of different practices at this phase of research.

**State government planning document review**

In our review of planning documents, we found that 38 of 51 (75%) states had published guidance for local education agencies or schools to support planning for pandemic influenza or communicable disease outbreaks in schools (Table 5). Among the guidance documents we identified, 42% (16 of 38) mentioned one or more school practices to promote social distancing. By contrast, almost all guidance documents (n = 36, 95%) discussed

**Table 3** Most Common Types of School Practices Discussed in Literature to Create Physical Distance Among Students Enrolled in Brick-and-Mortar Public Schools, 2000–2016

| Category | Examples | # (%) (n = 16 articles) |
|----------|----------|------------------------|
| Cancelling or postponing after school activities | Cancel performances, sports practices, or games | 6 (38%) |
| Increasing space among students during in-person instruction | Move class outdoors; re-arrange desks to increase space; divide classes into smaller groups; require that students remain seated while in class | 5 (31%) |
| Cancelling classes or activities that occur within the school day with a high rate of mixing/contact | Cancel physical education class; cancel field trips; cancel choir | 5 (31%) |
| Partial closure | Closure of one class; closure of one grade | 4 (25%) |
| Reduced schedule | Shorter school week; shorter school day; students come on alternating days | 3 (19%) |
| Suspending use of common areas | Lunch in class rather than in lunch room; no recess | 2 (13%) |
| Segregating students within common areas | Require that students only eat with classmates in lunchroom; require that students stay in assigned section of school yard | 1 (6%) |
| Reducing the load on common areas through altered scheduling | Let classes out at different times so fewer students are in the hall at any one time | 1 (6%) |
| Implementing standard workplace social distancing measures for teachers and other staff | Reduce face to face meetings; cancel staff meetings | 1 (6%) |
| Reducing mixing during transport | Suspend buses; discourage use of public transportation | 1 (6%) |

**Table 4** Impact of School Practices on Influenza Transmission, 2000–2016

| Article | Type of practice | Impact Summary |
|---------|-----------------|----------------|
| Sugisaki [38] | Class closure | Two-day class closure carried out day after 10% absenteeism rate (compared to no class closure or two-day or three-day closures carried out ≥2 days after a 10% absentee rate) is effective for mitigating influenza outbreaks in elementary school; school actions should be conducted at the class level as a basic strategy. |
| Lofgren [34] | Suspending use of common areas | Closing the playground and other common areas when 5% of students were symptomatic (compared to requiring symptomatic students to leave school) significantly reduced the total number of infected students. |
| Gemetto [33] | Class and grade closure | While the closure of one class yields a smaller mitigation effect than the closure of the whole elementary school, the closure of the corresponding grade (two classes) leads to a reduction of large outbreak probability and a reduction of epidemic size that are similar to those obtained by closing the entire elementary school. |
| Fumanelli [32] | Class and grade closure | Reactive gradual (e.g., starting from class-by-class), reactive school-by-school, and county-wide school closure gave comparable outcomes in terms of infection attack rate reduction, peak incidence reduction or peak delay, while national closure of all schools of the country at the same time was not able to reach the same levels of mitigation. |
| Cooley [35] | Reduced schedule: 3 day weekend | Using a 3-day weekend as an intervention strategy (compared to a 2-day weekend) could be effective at reducing the peak attack rate for mild epidemics similar in severity to the 2009 H1N1 pandemic. |
| Ridenhour [20] | Classroom restriction, hall restriction, schoolyard restriction, lunchroom restriction, different classroom schedules | Classroom restrictions were the best single intervention at lower infection probabilities. At higher transmission rates, employing staggered classroom schedules is the best single intervention. |
| State | Type of plan | Author | Year | Address | Address | Address | Listed School Practices to Promote Social Distancing |
|-------|--------------|--------|------|---------|---------|---------|-----------------------------------------------------|
| AL [39] | Pandemic Influenza | AL Department of Education | 2014 | Yes | Yes | Yes | 1) Cancel all extra-curricular activities.  
2) Limit or discontinue all meetings, gatherings, field trips, extracurricular activities, etc., until county health department lifts pandemic conditions.  
3) Limit or discontinue travel within the school district.  
4) Suspend all transportation and work at the bus shop.  
5) Limit or discontinue access to vendors and visitors from outside the school district. |
| AK [40] | Infectious Disease | AK Department of Health and Social Services | 2013 | Yes | No | No | None listed |
| AZ [41] | Pandemic Influenza | AZ Department of Education | 2009 | Yes | Yes | Yes | 1) Incorporate flexible work hours and schedules while also utilizing employee spacing techniques to reduce crowding and close proximity (e.g., staggered shifts, telecommuting, teleconference meetings, separate office spaces). |
| AR [42] | Pandemic Influenza | AR Department of Health | 2014 | Yes | Yes | No | 1) Snow days: simultaneous closure of offices, schools, and other non-essential community activities for a specified period of time. |
| CA [43] | Pandemic Influenza | CA Department of Education | 2014 | Yes | Yes | Yes | 1) Alternate scheduling  
2) Before- and after-school programs closures |
| CO [44] | Pandemic Influenza | CO Department of Public Health | 2009 | Yes | Yes | Yes | None listed |
| CT [45] | Clinical Procedure Guidelines for School Nurses | CT Department of Education | 2012 | Yes | Yes | Yes | None listed |
| DC [46] | General Emergency | DC Department of Education | 2009 | Yes | Yes | Yes | 1) Staggered school times  
2) Canceling sports events and other mass gatherings  
3) Spacing students’ desks three feet apart in small pods or clusters.  
4) Discouraging prolonged congregation in hallways, lunch rooms, etc.  
5) Staggering bus routes so there are fewer people on each route.  
6) Limiting group activities and interaction between classes.  
7) Canceling gym class, choir, or other school activities that place individuals in close proximity. |
| DE [47] | General Emergency | DE Department of Education | 2010 | Yes | Yes | No | None listed |
| FL | NG* | | | | | | |
| GA [48] | Pandemic Influenza | GA Department of Education | 2015 | Yes | Yes | Yes | 1) Students’ desks be spaced three (3) feet apart  
2) Limit group activities and interaction between classes.  
3) Cancel or modify gym class, choir or other school activities that place individuals in close proximity. |
### Table 5  State Government Plans that Include Guidance to Local Education Agencies or Schools on Pandemic Influenza Preparedness (Continued)

| State | Type of plan | Author | Year | Address hygiene | Address school closure | Address distance learning | Listed School Practices to Promote Social Distancing |
|-------|--------------|--------|------|-----------------|------------------------|--------------------------|----------------------------------------------------|
| HI    | NG*          |        |      |                 |                        |                          | 4) Gatherings of groups larger than normal class size should be cancelled and avoided (e.g. assemblies, recess). |
| ID    | Pandemic Influenza | ID Department of Health and Welfare | 2006 | Yes | Yes | No | None listed |
| IL    | Pandemic Influenza | IL Department of Public Health | 2006 | Yes | Yes | Yes | None listed |
| IN    | Communicable Disease | IN Department of Health, Epidemiology Resource Center | 2015 | Yes | No | No | None listed |
| IA    | General Emergency | IA Department of Public Health & Iowa Department of Education | 2012 | No | No | No | None listed |
| KS    | NG*          |        |      |                 |                        |                          |                                                   |
| KY    | NG*          |        |      |                 |                        |                          |                                                   |
| LA    | Pandemic Influenza | LA Department of Health and Hospitals | 2011 | Yes | Yes | Yes | None listed |
| ME    | NG*          |        |      |                 |                        |                          |                                                   |
| MD    | Communicable Disease | MD Department of Education; MD Department of Health and Mental Hygiene; MD State School Health Council | 2002 | Yes | No | No | None listed |
| MA    | NG*          |        |      |                 |                        |                          |                                                   |
| MI    | Pandemic Influenza | MI Department of Community Health | 2006 | Yes | Yes | Yes | 1) Cancel extracurricular activities 2) Modify work practices/schedules |
| MN    | NG*          |        |      |                 |                        |                          |                                                   |
| MS    | Pandemic Influenza | State of MS | 2013 | Yes | Yes | Yes | None listed |
| MO    | Communicable Disease | MO Department of Health and Senior Services | 2011 | Yes | Yes | No | None listed |
| MT    | Pandemic Influenza | MT Office of Public Instruction | 2007 | Yes | Yes | Yes | None listed |
| NE    | General Emergency | NE Department of Health and Human Services | 2012 | Yes | Yes | Yes | None listed |
| NV    | NG*          |        |      |                 |                        |                          |                                                   |
| NH    | Pandemic Influenza | NH Department of Education, School Health consultant | 2008 | Yes | Yes | No | None listed |
| NJ    | Pandemic Influenza | NJ Department of Health | 2015 | Yes | Yes | No | None listed |
| NM    | Pandemic Influenza | NM Public Education Department and Department of Health | 2007 | Yes | Yes | Yes | None listed |
| State | Type of plan | Author | Year | Address hygiene | Address school closure | Address distance learning | Listed School Practices to Promote Social Distancing |
|-------|--------------|--------|------|-----------------|------------------------|--------------------------|-----------------------------------------------------|
| NY    | Pandemic Influenza | NY Department of Health | 2007 | Yes | Yes | Yes | 1) Cancel any non-academic events (in the case of school closure) |
| NC    | Pandemic Influenza | NC Department of Health and Human Services | UK | No | Yes | No | 1) Reduced school activity calendar |
| ND    | NG*          |        |      |                 |                        |                          |                                                     |
| OH    | Pandemic Influenza | OH Department of Education | 2009 | Yes | Yes | Yes | 1) Cancel non-academic events |
| OK    | General Emergency | OK Department of Health | UK | Yes | Yes | Yes | 1) Cancel non-academic events |
| OR    | Pandemic Influenza | OR Department of Education | 2008 | Yes | Yes | Yes | None listed |
| PA    | Pandemic Influenza | PA Department of Health | 2009 | Yes | Yes | No | None listed |
| RI    | NG*          |        |      |                 |                        |                          |                                                     |
| SC    | NG*          |        |      |                 |                        |                          |                                                     |
| SD    | NG*          |        |      |                 |                        |                          |                                                     |
| TN    | Pandemic Influenza | TN Department of Education and Department of Health | 2009 | Yes | Yes | Yes | 1) Rotating teachers between classrooms while keeping the same group of students in one classroom 2) Canceling classes that bring students together from multiple classrooms 3) Holding classes outdoors 4) Postponing class trips 5) Discouraging use of school buses and public transit 6) Dividing classes into smaller groups, 7) Moving desks farther apart, and 8) Moving classes to larger spaces to allow more space between students |
| TX    | Infectious Disease | TX Association of School Boards | 2014 | Yes | Yes | Yes | 1) Non-essential travel for sports, other competitions, or field trips may be cancelled by a district superintendent or designee. 2) Spacing students’ desks three (3) feet apart, in small pods or clusters. 3) Discourage prolonged congregation in hallways, lunchrooms, etc. 4) Staggered bus routes, so fewer people are on each route 5) Limit group activities and interaction between classes 6) Cancelling gym classes, choir, or other activities that place individuals in close proximity. |
| UT    | Pandemic Influenza | UT Department of Health and Utah Office of Education | 2006 | Yes | Yes | No | None listed |
| VT    | Pandemic Influenza | VVT Agency of Human Services | 2008 | No | Yes | Yes | None listed |
| VA    | Pandemic Influenza | VA Department of Education | 2008 | Yes | Yes | Yes | None listed |
hand hygiene and/or sanitation, a large majority ($n = 34, 89\%$) discussed school closure, and a little less than half ($n = 16, 42\%$) discussed distance learning. As noted in Table 5, the plans and guidance were developed from 2002 to 2016. However, 23 (61\%) were published on or after 2009, with 7 (18\%) in 2009 alone. Pandemic planning was likely accelerated by the H1N1 pandemic that occurred from 2009 to 2010.

Among the 16 guidance documents that mentioned social distancing, the practices identified most frequently included canceling or postponing after-school activities ($n = 11, 69\%$), canceling classes or activities with a high rate of mixing/contact that occur within the school day ($n = 7, 44\%$), and reducing mixing during transport ($n = 6, 38\%$) (Table 6). State-level guidance documents discussed all of the practices identified in the literature and also identified two unique practices not covered elsewhere: instituting homeroom stay (in which students remain in one classroom and teachers rotate in and out) ($n = 1, 6\%$) and limiting visitors ($n = 1, 6\%$).

In general, state government guidance documents devoted very little space to school practices to promote
social distancing and typically included practices among lists of potential response options, without any details regarding barriers, facilitators, or considerations. Only one document discussed barriers or considerations regarding the implementation of school practices to promote social distancing. Connecticut’s guidance document mentioned that any practice that reduces the number of instructional hours will require waivers of instruction requirements.

Discussion
Our review revealed a very limited literature on school practices to promote social distancing other than school closure and limited incorporation of school practices to promote social distancing into state-level guidance documents. Fewer than half of all states with guidance documents mentioned a single school practice to promote social distancing, and none provided any substantive detail about the policies or practices needed to enact the listed school practice. This lack of detail is not surprising, given that school practices to promote social distancing have not been prominently featured in previous federal guidance to schools, and many state governments use federal guidance to inform their planning efforts [21].

Although we hypothesized that the evidence would be scant, we were surprised to see how few school practices were identified or described. For example, although the Centers for Disease Control and Prevention (CDC) mentions homeroom stay in some of its guidance materials [22], none of the articles, and only two state-level guidance documents we reviewed, mentioned this practice. Our review of guidance documents identified certain practices that do not appear in the peer-reviewed and grey literature. For example, homeroom stay and visitor restrictions were mentioned in guidance, but did not appear in our peer-reviewed and grey literature review. Furthermore, guidance documents more frequently discussed reducing mixing during transport to and from school.

According to survey data, schools focused their efforts on hand hygiene, respiratory etiquette, and cleaning/disinf ecting school buildings, but seldom implemented practices to promote social distancing as a response to the H1N1 pandemic. Nevertheless, published studies that used simulation modeling generally found that practices to promote social distancing could be effective (and less disruptive to society compared to school closure) in curbing disease transmission. However, it is unclear whether these theoretical benefits would be realized.

Table 6 Most Common Types of School Practices Included in State-level Guidance Documents to Create Physical Distance Among Students Enrolled in Brick-and-Mortar Public Schools

| Category                                           | Examples                                                                 | # (%) | (n = 16) |
|----------------------------------------------------|--------------------------------------------------------------------------|-------|----------|
| Canceling or postponing after school activities    | Cancel performances, sports practices, or games                         | 11 (69%) |          |
| Canceling classes or activities that occur during the school day with a high rate of mixing/contact | Cancel P.E.; cancel field trips; cancel choir                           | 7 (44%) |          |
| Reducing mixing during transport                   | Suspend buses; discourage use of public transportation                  | 6 (38%) |          |
| Increasing space among students during in-person instruction | Move class outdoors; re-arrange desks to increase space; divide classes into smaller groups; require students to remain seated in classroom | 5 (31%) |          |
| Reduced schedule                                   | Shorter school week; shorter school day; students come on alternating days | 4 (25%) |          |
| Suspending use of common areas                     | Lunch in classrooms rather than in lunch room; no recess                 | 4 (25%) |          |
| Implementing standard workplace social distancing measures for teachers and other staff | Limit face to face meetings; cancel staff meetings                      | 3 (19%) |          |
| Partial Closure                                    | Closure of one class; closure of one grade                              | 2 (13%) |          |
| Instituting home room stay                         | Children remain with one group of children all day and teachers rotate through the room | 2 (13%) |          |
| Segregating students within common areas           | Require that students only eat with classmates in lunchroom; require that students stay in assigned section of school yard | 1 (6%) |          |
| Reducing density/load in common areas through altered scheduling | Let classes out at different times so fewer students are in the hall at any one time | 1 (6%) |          |
| Limiting visitors*                                 | Do not allow parents or other visitors; restrict vendor access to school | 1 (6%) |          |

*School practice mentioned only in pandemic plans/guidance and not in the published literature

16 state-level guidance documents mentioned one or more school practices to promote social distancing.
following implementation in real-world settings. At the present time, there are only a handful of studies that explore a variety of different practices under a range of different assumptions. As such, it is premature to draw any conclusions about the likely impact of these practices in schools during pandemics.

In the literature and documents we reviewed, school practices were not clearly defined and terms were used inconsistently. This was especially true for school closure. In certain cases, authors used this term to refer to sustained closures (which is out of scope for this review) of weeks or months; however, a one-day “snow day” or class or grade closure were also referred to as “school closure” in select circumstances. To address this issue, we developed a classification system for practices other than sustained school closure and included concrete examples of practices within each defined category. This system, fully characterized in Table 5, can be used going forward to: (1) provide a menu of options to schools selecting among social distancing measures and (2) ensure that educators and policy-makers are speaking a common language regarding school practices to promote social distancing.

Our study has several limitations. First, as described above, terms related to school practices are used inconsistently in the literature and, as such, our search strategy may have inadvertently excluded relevant articles (e.g., articles that refer to school dismissal or school closure but actually cover scenarios of partial closure). Second, we only reviewed publicly available guidance documents targeting local education agencies and/or schools that were posted on the Internet. It is possible that certain states have relevant guidance documents that are not posted and, as such, were not included in this review. It is also possible that, in general, pandemic influenza plans and guidance documents (excluded in this review) could have content relevant to school practices to promote social distancing. To test this possibility, we reviewed eight general pandemic influenza plans from states without school-specific guidance and did not find examples of school social distancing practices other than school closure [23–30]. Despite certain limitations, this is the first review of school practices, other than sustained school closure, and state government guidance on pandemic influenza that we are aware of.

Conclusions
Our findings suggest that little information is available to schools to develop policies and procedures on social distancing. School leaders and decision-makers can use the findings presented here to understand the range of potential school practices available to them and the evidence supporting their use. Additional research and guidance is needed to assess the feasibility and effectiveness of school practices to promote social distancing to inform federal, state, and local planning efforts going forward.

Abbreviations
CDC: Centers for disease control and prevention; K-12: Kindergarten through Grade 12; LEA: Local education agency

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Disclaimer
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Authors’ contributions
LUP helped to design the study and wrote the first draft of the manuscript. FA, YZ, AU, and H5 helped to design the study and supported interpretation of results. EM and GB supported data collection and analysis and wrote sections of the manuscript. All authors read and approved the final manuscript.

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RAND’s Institutional Review Board determined that this study did not involve human subjects.

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