

School closures and prescription medication use among children and adolescents before and during the COVID-19 pandemic in the USA, 2019–2022

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To cite: Mirza A, Shooshtari A, Qato DM. School closures and prescription medication use among children and adolescents before and during the COVID-19 pandemic in the USA, 2019–2022. *BMJ Paediatrics Open* 2024;**8**:e002632. doi:10.1136/bmjpo-2024-002632

► Additional supplemental material is published online only. To view, please visit the journal online (<https://doi.org/10.1136/bmjpo-2024-002632>).

Received 13 March 2024
Accepted 12 May 2024



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ABSTRACT

The impact of schools closing for in-person instruction in the USA during the COVID-19 pandemic on the use of prescription medications is not known. In this study, we examined changes in the total prescriptions filled, specifically for attention deficit hyperactivity disorder (ADHD) medications, among school-aged children and adolescents aged 10–19 years during periods before and after complete school closures between October 2019 and September 2022. Our findings indicate that complete school closures were associated with declines in the use of ADHD medications among younger populations in the USA. These findings suggest that the underuse of ADHD medications may be an overlooked contributor to declines in academic performance observed during periods of school closures during the COVID-19 pandemic.

INTRODUCTION

The US public health response to the COVID-19 pandemic included school closures, with nearly all public schools completely closed for in-person instruction by the end of March 2020 for the academic year and not reopening until January 2022.¹ Despite evidence that the COVID-19 pandemic and school closures led to worsening mental health, including suicidality,^{2 3} academic performance^{4–6} and declines in the dispensing of prescription medications for acute infections, in children and adolescents in the USA,⁷ the association between school closures and the use of prescription medications, particularly antidepressants and attention deficit hyperactivity disorder (ADHD) medications, is not known. In this study, we analysed changes in the use of prescription medications alongside patterns of school closures in the USA. We hypothesised that the use of ADHD medications has declined during periods of complete school closures, while antidepressants have increased, compared with periods during the

COVID-19 pandemic when schools partially or completely reopened. This information may inform future strategies and response efforts in the context of public health crises, specifically policies regarding school closures.

METHODS

We analysed data from IQVIA's National Prescription Audit, which captures prescription fills for 92% of retail and mail-order pharmacies in the USA, to estimate the monthly volume of prescriptions dispensed for children and adolescents aged 10–19 years between October 2019 and September 2022 in the USA. We examined changes in total prescriptions filled and for commonly used drug classes, specifically antidepressants and ADHD medications, and short-acting beta-agonists (eg, albuterol inhalers).

Data on school closures for in-person instruction for public schools from kindergarten through grade 12 during the COVID-19 pandemic were publicly available through Ballotpedia⁸ and Burbio's School Opening Tracker.⁹ Time periods were grouped into four categories based on school operations: (1) pre-pandemic (October 2019–February 2020); (2) complete school closures (March 2020–August 2020); (3) partial re-openings/closures (September 2020–December 2021) and (4) complete re-openings/no closures (January 2022–September 2022).

We used descriptive statistics to quantify trends in monthly fill rates (number of prescriptions filled per month) overall and by drug class between October 2019 and September 2022. We analysed changes in monthly fills during the four time periods of school closures for ADHD medications and beta-agonists for older age groups (20–39,

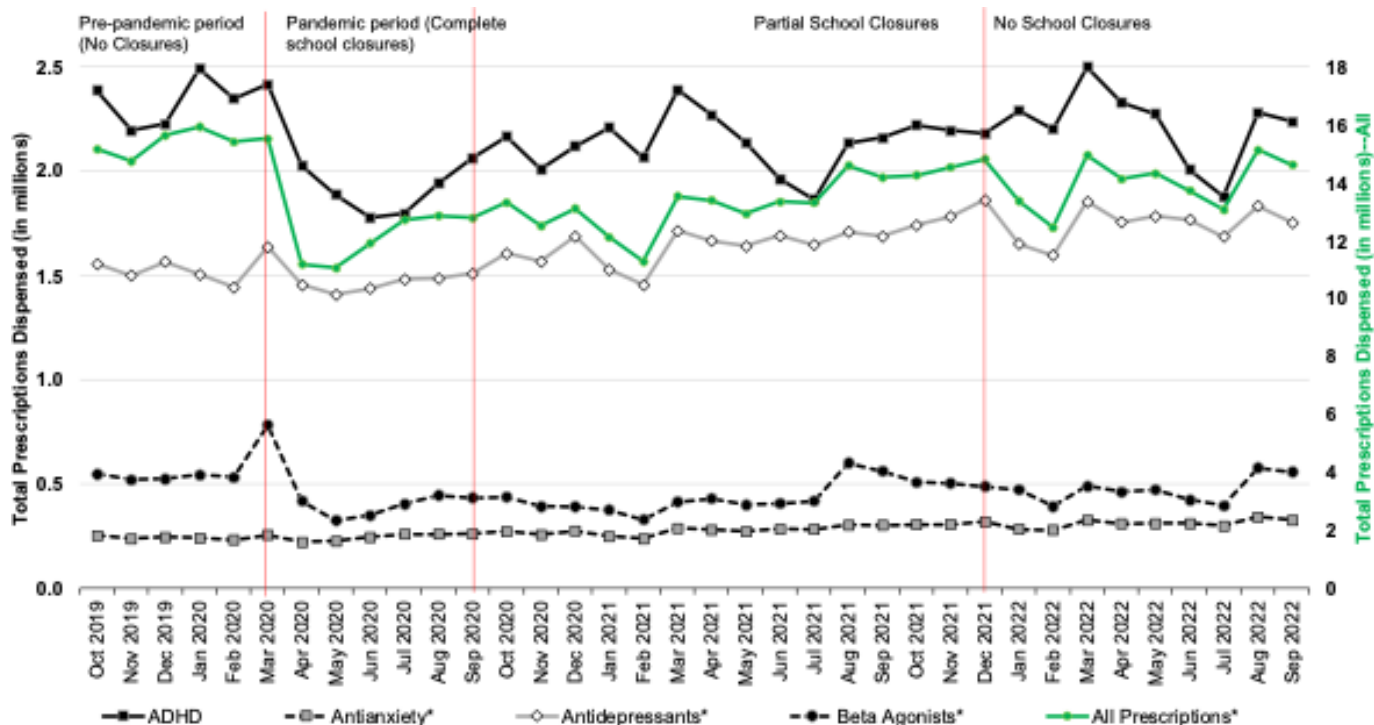


Figure 1 Trends in number of total prescription medications dispensed to children and adolescents aged 10–19 years, in the USA, October 2019–September 2022 authors' analysis of IQVIA National Prescription Audit data between October 2019 and September 2022. ADHD, attention deficit hyperactivity disorder.

40–59) not affected by school closures in order to better determine whether observed changes in younger populations were due to school closures. The University of Southern California Institutional Review Board does not consider this study to constitute human subjects research. All statistical tests were two-sided with a statistical significance threshold of $p < 0.05$. All analyses were conducted using Stata V.18.0 (StataCorp, LLC).

RESULTS

Trends in prescriptions dispensed to children and adolescents aged 10–19 years between October 2019 and September 2022 are depicted in [figure 1](#). A substantial decline in all prescriptions was observed during the period of complete school closures between starting in April 2020 and May 2020 before increasing steadily during the period of partial school closures in early 2021 and reaching a plateau at pre-pandemic levels beginning in late 2021. Initial declines during periods of complete school closures were largely driven by ADHD medications; the number of monthly ADHD prescriptions filled declined by ~20% from the pre-pandemic period to the period of complete school closures (from 2 342 406 to 1 884 897 mean monthly fills; $p < 0.001$) ([table 1](#)) and then steadily increased during the periods of partial closures (mean 2 132 864) and complete re-openings or no school closures (mean 2 220 449 fills per month) of schools. Similar trends were observed for beta-agonists, which significantly declined during the period of complete school closures. In contrast, antidepressants

and antianxiety medications steadily and significantly increased starting in June 2020 and throughout periods of partial and complete school re-openings in 2021 and 2022 where the number of monthly fills started to exceed pre-pandemic levels ([figure 1](#)).

Declines in ADHD prescription fills during the period of complete and partial school closures were only observed among aged 10–19 years ([table 1](#)). In contrast to these younger school age populations, no significant change was observed in older age groups during the period of complete closure and a significant increase was observed during periods of partial closures. For example, for adults aged 20–39 years, the monthly fills for ADHD increased by 14.4% from 2 302 068 during the pre-pandemic period to 2 634 481 during the period of partial closures ($p < 0.001$). Declines in beta-agonists were observed during the period of complete school closures for adults aged 20–39, but these increased during the periods of partial and no school closures.

DISCUSSION

In this study, we found an association between complete school closures and declines in the use of ADHD medications and beta-agonist inhalers in school-aged children and adolescents 10–19 years old in the USA. These findings suggest that the underuse of ADHD medications may be an overlooked contributor to declines in academic performance observed during COVID-19 pandemic lockdown, particularly among children with learning disabilities.^{4,5} Furthermore, declines in the use of beta-agonist

Table 1 Changes in number of ADHD and beta-agonist prescriptions dispensed by age group and periods of varying levels of school closures during the COVID-19 pandemic in the USA, October 2019–September 2022

	Mean monthly fills (95% CI)			
	Pre-pandemic baseline period (October 2019–February 2020)	Complete school closures (April 2020–August 2020)	Partial school closures (September 2020–December 2021)	No school closures (January 2022–September 2022)
ADHD				
10–19 Years	2 342 406 (2 248 370 to 2 436 441)	1 884 897 (1 791 419 to 1 978 374)***	2 132 864 (2 069 852 to 2 195 876)**	2 220 449 (2 097 727 to 2 343 171)
20–39 Years	2 302 068 (2 226 745 to 2 377 390)	2 341 591 (2 282 792 to 2 400 390)	2 634 481 (2 549 793 to 2 719 161)***	2 997 874 (2 901 608 to 3 094 141)***
40–59 Years	1 577 508 (1 519 957 to 1 635 059)	1 610 610 (1 578 637 to 1 642 584)	1 739 386 (1 694 991 to 1 783 781)***	1 935 735 (1 878 413 to 1 993 057)***
Overall	6 946 650 (6 709 291 to 7 184 010)	6 553 314 (6 462 715 to 6 643 913)*	7 241 363 (7 072 655 to 7 410 071)	7 916 347 (7 691 734 to 8 140 960)***
Beta-agonists				
10–19 Years	576 040 (491 880 to 660 201)	390 294 (345 527 to 435 060)***	443 992 (407 779 to 480 205)***	472 218 (428 734 to 515 701)*
20–39 Years	941 039 (752 211 to 1 129 868)	775 797 (684 491 to 867 102)*	842 860 (800 933 to 884 786)	854 784 (792 290 to 917 279)
40–59 Years	1 603 670 (1 349 482 to 1 857 857)	1 436 068 (1 296 261 to 1 575 874)	1 472 378 (1 411 547 to 1 533 209)	1 473 678 (1 384 572 to 1 562 784)
Overall	4 751 292 (4 036 902 to 5 465 688)	4 089 465 (3 763 300 to 4 415 629)*	4 347 135 (4 173 416 to 4 520 855)	4 530 184 (4 316 140 to 4 744 228)

Authors analyses of IQVIA NPA (National Prescription Audit) data from September 2019 to October 2022. Linear regression models were used for test statistical significance in the difference in mean monthly fills in periods of varying levels of school closures when compared to the pre-pandemic baseline period. Statistical tests were two-sided with a significance threshold of $p < 0.05$. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. ADHD, attention deficit hyperactivity disorder.



inhalers extend findings from prior studies that report paediatric emergency room visits and hospitalisations for asthma have substantially declined during the first year of COVID-19 pandemic secondary to school closures.¹⁰ Finally, persistent increases in prescription fills for antidepressants and anti-anxiety medications are consistent with prior studies of worsening mental health and suicidality during periods of school closure. Therefore, future strategies and response efforts in the context of public health crises, specifically policies regarding school closures, may consider strategies that facilitate access to ADHD medications.

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Contributors AM carried out the initial analyses, drafted the initial manuscript and revised the manuscript. AS coordinated and supervised data curation and analyses, carried out the final analyses, and critically reviewed and revised the manuscript. DQ conceptualised and designed the study, drafted the initial manuscript, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

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