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### **Reviewer Comments**

**Comment 1:** There were similar reports (BMC Pediatr. 2020 Sep 7;20(1):427) about the COVID-19 related reduction in pediatric emergency healthcare utilization in PubMed. What is the novel idea in the paper? Please elaborate in the introduction.

**Reply:** Thanks for this suggestion. In the revised manuscript we have added the main findings of the suggested references (Dopfer et al., BMC Pediatr. 2020 Sep 7;20(1):427) to the Introduction. The study of Dopfer et al. is a single-center study and it investigated changes in pediatric emergency healthcare utilization. Our study is a multicenter study and we have investigated not only the utilization of pediatric emergency healthcare service, but also the utilization of outpatient visits, observation room admissions, and inpatient admissions. In the revised manuscript, we have elaborate the novelty of our study in Introduction, and discussed the strength of our study in Discussion.

#### **Changes in the text:**

In a single-center study in Germany, a 63.8% drop in pediatric emergency healthcare utilization was observed in the four weeks after lockdown (12).(*Dopfer et al., BMC Pediatr. 2020 Sep 7;20(1):427*) (*Introduction, page 6, line 2*)

However, few studies have investigated the utilization of pediatric healthcare service across all hospital levels and covering all types of healthcare services. Studies with such designs, which must usually be conducted on a regional level, could provide a better overview of the impact of the COVID-19 pandemic on pediatric healthcare utilization. The present study examined changes in pediatric healthcare utilization in Hunan Province, China, during the COVID-19 pandemic.(*Introduction, page 6, line 7*)

The strengths of this study included it was a multicenter study conducted at a provincial level; it covered all pediatric healthcare types and included all three hospital levels; it investigated changes by visit types and disease categories; and it calculated both percent change and relative ratios for the changes among different service types. Therefore, this study provides a representative reference for future studies and for hospital systems that are facing or will be facing similar challenges. (*Discussion, page 18, line 13*)

**Comment 2:** There were several grammar errors in the text, such as “The COVID-19 pandemic had brought remarkable disruption to the way healthcare was delivered” in the abstract.

**Reply:** The English of this manuscript was proofread by Textcheck (<http://www.textcheck.com>).

For a certificate, please see: <http://www.textcheck.com/certificate/pXWJLr>

**Changes in the text:**

*Original version:* The COVID-19 pandemic had brought remarkable disruption to the way healthcare was delivered

*Revised version:* The COVID-19 pandemic brought remarkable disruption to the ways in which healthcare was delivered. (*Abstract, page 4, line 2*)

**Comment 3:** In the introduction, please provide supported references for “The reduction in patients presenting to hospitals could partly due to the reduced incidences of infectious diseases which was resulted from the measures that were aimed to mitigate and control the spread of SARS-CoV-2”.

**Reply:** We have added references for this sentence; and we have also revised the sentence to improve clarity.

**Changes in the text:** It is widely accepted that the reduction in patients presenting to hospitals could be partly due to the reduced incidence of infectious diseases that resulted from measures aimed at mitigating and controlling the spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (6-9). (*Introduction, page 5, line 6*)

**Comment 4:** Why to focus on only changes of pediatric healthcare?

**Reply:** The main reason for us to focus on only changes of pediatric healthcare is our study was conducted by pediatricians and we only have resources to collect data form pediatrics medical records. However, because the healthcare seeking behavior and disease spectrum among pediatric patients are different from that of adult patients, the utilizations of adult and pediatric healthcare need to be investigated separately. In the revised manuscript, we have described the reason for focusing on pediatric healthcare.

**Changes in the text:** A delay in seeking healthcare could lead to adverse outcomes and increased mortality. This can be especially significant for pediatric patients, for whom delay in treatment could have long-term adverse impacts. Furthermore, healthcare-seeking behavior and the disease spectrum among pediatric patients differ from those of adult patients. Therefore, for the healthcare system to evaluate the

impact of COVID-19 on pediatric healthcare and develop response plans, investigations focusing on changes in pediatric healthcare utilization after the COVID-19 pandemic outbreak are needed. (*Introduction, page 5, line 11*)

**Comment 5:** In the part of results, it was better to add title each paragraph.

**Reply:** Thanks for this suggestion. We have added subheadings for Results. The three subheadings are:

Overall changes in pediatric healthcare visit numbers (*Results, page 10, line 14*)

Changes according to healthcare service type and hospital level (*Results, page 10, line 20*)

Changes in the number of inpatients by disease categories (*Results, page 11, line 19*)

**Comment 6:** It was showed that the reasons, consequences, and responses to these changes should be addressed in further studies and actions. I though the reasons and responses should be discussed in the discussion.

**Reply:** We have revised the Discussion according to this comment. For the main findings of this study, we compared the results of our study with other studies, and then discussed the possible reasons and made suggestions for their implication.

**Changes in the text:**

*Main findings 1:* The utilization of pediatric services in first-, second-, and third-level hospitals has been disproportionately affected by COVID-19. First-level hospitals experienced the greatest changes in volumes of emergency care, observation room use, and inpatient care, suggesting that first-level hospitals are the most vulnerable during and after an epidemic. (*Discussion, page 13, line 10*)

*Reasons 1:* First-level hospitals are supposed to provide the most fundamental healthcare to the community. However, they suffer from constraints of limited medical resources; they are less prepared for an epidemic and find it difficult to adapt quickly to changes under such stress. As a consequence, people seeking healthcare are less likely to choose a first-level hospital during an epidemic. (*Discussion, page 13, line 14*)

*Suggested response 1:* Our findings suggested that emphasis should be placed on strengthening the emergency response capacity of first-level hospitals, especially in remote areas where the community might have limited access to secondary and tertiary hospitals. The roles of the three hospital levels and transport plans should also be addressed as a part of any emergency response. (*Discussion, page 13, line 18*)

*Main findings 2:* A drop of 58.4% in pediatric emergency room attendance was observed in our study. (*Discussion, page 14, line 5*)

*Reasons 2:* Although evidence has shown that the reduction in emergency department presentations was caused by a combination of factors, including a reduction in the incidence of respiratory diseases, reduction in injuries from outdoor activities, parents' hesitancy to visit the hospital during the pandemic, and/or evaluating a condition as non-emergent (4, 11-15, 18). A great concern with regard to the decrease in pediatric emergency department visits was that patients who needed to receive emergency healthcare did not visit the hospital, resulting in delayed treatment and adverse health outcomes (4, 11-15, 18). In addition to differences in the disease spectrum, one large difference between adult and pediatric emergency attendance is that the decision regarding pediatric attendance is usually made by the child's parents or guardians. (*Discussion, page 14, line 8*)

*Suggested response 2:* Therefore, guardians' appropriate evaluation of their children's medical conditions is essential for their subsequent healthcare-seeking behavior. To avoid delayed hospital visits, health services should develop response plans such as delivering education programs for parents to reduce healthcare avoidance or providing pre-hospital phone-call evaluation services to give advice on hospital attendance. (*Discussion, page 14, line 18*)

*Main findings 3:* The odds of (Op+Em)/Ip decreased at all hospital levels. As the absolute number of outpatient and emergency department presentations and inpatient admissions were all decreased, the disproportionate change suggests that patients who did not need inpatient care were less likely to present to hospitals. (*Discussion, page 15, line 1*)

*Reasons 3:* This finding is in accordance with other reports, which found that the majority of reductions in pediatric visits were related to mild conditions or non-severe illnesses (4, 12). For those with mild conditions or non-severe illnesses, parents may have found other ways of accessing treatment without going to the hospital (23, 24). For example, online consultations were provided by many hospitals in Hunan Province as an emergency response. Globally, considerable effort has been made to promote telemedicine during the COVID-19 pandemic (25, 26); (*Discussion, page 15, line 4*)

*Suggested response 3:* however, the efficacy of these supplementary healthcare services should be further investigated. Subsequent monitoring of the ratios of

different healthcare types is also needed, as this could provide valuable information for the allocation of medical resources within hospitals. (*Discussion, page 15, line 11*)

*Main findings 4:* As expected, the number of admissions with infections, especially respiratory infections, markedly decreased at our study sites after the outbreak. (*Discussion, page 15, line 15*)

*Reasons 4:* Zhang et al. built a transmission model and found that the social distancing implemented in China during the outbreak was sufficient to control COVID-19 (6). Therefore, the incidence of other infectious diseases that can be transmitted through daily contacts was likely also controlled during the COVID-19-related social distancing period. Nevertheless, it is impossible to determine how many reductions were due to decreased incidence and how many were due to changes in healthcare-seeking behavior. Like hospitals around the world that had made quick responses to the changes (27, 28), hospitals in Hunan Province were divided, from the main entrance and throughout the hospital, into an infectious channel and non-infectious channel. This adaptation was intended to control in-hospital transmission and reduce the impact on healthcare-seeking for patients with non-infectious diseases. (*Discussion, page 15, line 22*)

*Suggested response 4:* However, patients with infectious diseases might avoid going to the hospital because of fear. Strategies are needed to address this fear among patients with infectious diseases other than COVID-19. (*Discussion, page 16, line 11*)

*Main findings 5:* In our study, the number of inpatients admitted for injuries increased among third-level hospitals. (*Discussion, page 16, line 14*)

*Reasons 5:* Although the number of injuries may have decreased because of reduced outdoor activities, there were concerns that measures being taken to control the spread of COVID-19 could put children at risk of child neglect and abuse (29). Therefore, an increased number of injuries may have been caused by safeguarding failure, parental burnout, and child maltreatment during the COVID-19 pandemic (30). (*Discussion, page 16, line 19*)

*Suggested response 5:* The reasons for the unchanged or even increased number of injury cases in our study warrants further investigation, as such information could be used to guide the development of preventive intervention plans for similar events in the future, such as city lockdowns or school closures. (*Discussion, page 17, line 2*)

*Reasons 6 (for overall healthcare-seeking behavior change):* Guardians may face difficult choices when a child requires healthcare during an epidemic. On the one hand, children are thought to be vulnerable to contacting infectious disease, so guardians are reluctant to take them to the hospital during an epidemic (4); on the other hand, a delay in treatment can be life-threatening or can have life-long adverse effects on a child's health. In addition, restrictions on community services and transportation links during an epidemic could disrupt the routine healthcare-seeking behavior. (*Discussion, page 17, line 11*)

*Suggested response 6:* Therefore, delivery of immediate and adequate information to guide guardians whose child might require healthcare services is essential to the efficient delivery of those services (31). (*Discussion, page 17, line 17*)

**Comment 7:** During COVID-19, non-emergent patients will not go hospital. As a common sense, the changes were happened surely. What is the point?

**Reply:** Followed by this instruction, in the revised manuscript we discussed the concerns of the decreases in the pediatric emergency healthcare utilization.

**Changes in the text:** Although evidence has shown that the reduction in emergency department presentations was caused by a combination of factors, including a reduction in the incidence of respiratory diseases, reduction in injuries from outdoor activities, parents' hesitancy to visit the hospital during the pandemic, and/or evaluating a condition as non-emergent (4, 11-15, 18). A great concern with regard to the decrease in pediatric emergency department visits was that patients who needed to receive emergency healthcare did not visit the hospital, resulting in delayed treatment and adverse health outcomes (4, 11-15, 18). In addition to differences in the disease spectrum, one large difference between adult and pediatric emergency attendance is that the decision regarding pediatric attendance is usually made by the child's parents or guardians. Therefore, guardians' appropriate evaluation of their children's medical conditions is essential for their subsequent healthcare-seeking behavior. To avoid delayed hospital visits, health services should develop response plans such as delivering education programs for parents to reduce healthcare avoidance or providing pre-hospital phone-call evaluation services to give advice on hospital attendance. (*Discussion, page 14, line 8*)

**Comment 8:** Whether there were differences between adult and pediatric emergency healthcare utilization?

Reply: One of the main differences between adult and pediatric emergency healthcare utilization is the pattern of healthcare seeking behavior, and this difference is important for the implication of our study findings. We have added the following discussion to the revised manuscript.

**Changes in the text:** In addition to differences in the disease spectrum, one large difference between adult and pediatric emergency attendance is that the decision regarding pediatric attendance is usually made by the child's parents or guardians. Therefore, guardians' appropriate evaluation of their children's medical conditions is essential for their subsequent healthcare-seeking behavior. To avoid delayed hospital visits, health services should develop response plans such as delivering education programs for parents to reduce healthcare avoidance or providing pre-hospital phone-call evaluation services to give advice on hospital attendance. (*Discussion, page 14, line 15*)

**Comment 9:** The research was an observation. What is the scientific problem resolved in the paper? Please supplement in the discussion.

**Reply:** Indeed, this is an observational study. The study questions/purposes were 1) to quantify changes in the utilization of different types of pediatric healthcare, including outpatient visits, emergency department presentations, observation room admissions, and inpatient admissions, by calculating the percent change relative to 2019; 2) to evaluate these changes among different hospital levels; and 3) to estimate changes in the number of inpatient admissions for infections and injuries (*Introduction, page 6, line 20*). To achieve these objectives, we used epidemiological study design and statistical methods. To address this comment, we have revised our discussion in the following manner: for each study question, we first described our findings, and then compared our findings with other studies (if there is any); based on these findings, we discussed possible reasons for the observed changes and their implications for pediatric healthcare adaptation and for future researches (for changes in the text please see the reply to **Comment 6**).

The most important contribution of this study is this is a multicenter study covered all pediatric healthcare types and all hospital levels, therefore should have good representativeness. We have elaborate this point as strengths of this study.

**Changes in the text:**

The strengths of this study included it was a multicenter study conducted at a provincial level; it covered all pediatric healthcare types and included all three hospital levels; it investigated changes by visit types and disease categories; and it

calculated both percent change and relative ratios for the changes among different service types. Therefore, this study provides a representative reference for future studies and for hospital systems that are facing or will be facing similar challenges. *(Discussion, page 18, line 13)*