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The impact of stay-at-home orders on the rate of emergency department child maltreatment diagnoses

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A B S T R A C T

Background: There is limited data regarding the rates and severity of child maltreatment in medical settings during the COVID-19 pandemic, and the reports are somewhat contradictory.

Objective: To examine the rates of emergency department (ED) child maltreatment (CM) diagnosis before and after the California statewide stay-at-home order, as well as potential disparities by age, gender, race/ethnicity, and Medicaid status.

Methods: A retrospective pre-post interrupted time series was conducted using data from the electronic health records of children (<18 years) with at least one emergency department visit between January 1, 2019 and September 30, 2021. Enactment of the stay-at-home order in California, March 2020 was used to determine a change in trend of rates of diagnosis of CM in the ED.

Results: Overall the study included 407,228 pediatric ED visits. There was a significant change in the percentage of CM visits immediately after the stay-at-home order, followed by small month to month decreases returning to near pre-stay-at-home order levels. This significant increase was driven by higher risk for children <4 years old. The increased rate of CM in the first month after the stay-at-home order was also elevated for female, Black, and Hispanic children.

Conclusions: Our results indicated the rates of CM diagnoses in the ED doubled after the March 2020 stay-at-home order in California. Additionally, our findings suggest that some children may be at higher risk than others, which supports the importance of social safety nets for children in times of national emergency.

A global report on child abuse from the World Health Organization demonstrates the enormous impact that the COVID-19 pandemic has had on the rates of violence against children.\cite{World_Health_Organization,2020} The increased challenges for parents because of pandemic-related stressors such as fear of infection, loss of employment, and lack of childcare likely increased rates of abuse (i.e., sexual, physical, or emotional abuse) and neglect\cite{Douglas,Katikireddi,Taulbut,McKee,McCarty,2020,Le,Lee,2020,Seddighi,Salmani,Javadi,Seddighi,2021,Usher et al.,2021}. At the same time, stay-at-home orders mandated the closure of in-person schooling and other social safety nets such as afterschool programs, sports teams, and learning centers which reduced access to the most prevalent mandated reporters such as teachers\cite{Baron,Goldstein,Wallace,2020,Brown,Orsi,Chen,Everson,Fluke,Abbreviations}.
Medical providers are another important safety net for children, yet the volume of in-person visits in pediatric primary care and emergency departments dropped dramatically after the national stay-at-home order (Brown et al., 2021; Even et al., 2020; Haddadin et al., 2021; Hartnett et al., 2020; Pines et al., 2021; Schweiberger, Patel, Mehrotra, & Ray, 2021). This confluence of closures and reduction in in-person services resulted in a concerning drop in the number of reports of suspected child abuse across the US (Brown et al., 2022; Campbell, 2020; Martinkevich et al., 2020; Thomas, Anurudran, Robb, & Burke, 2020), while it is more likely that cases increased (Seddighi et al., 2021; Usher et al., 2021).

There is limited data regarding the rates and severity of child maltreatment in medical settings during the COVID-19 pandemic, and the reports are somewhat contradictory. Several studies show a drop in volume of child abuse related emergency department (ED) visits after the National stay-at-home order (Kaiser et al., 2021; Swedo et al., 2020), yet only one examined and found an increase in the relative proportion of ED visits with a child maltreatment diagnosis (Swedo et al., 2020). In addition, although one study showed a higher percentage of child maltreatment ED visits converted to hospitalization after the stay-at-home order, suggesting more severe abusive injuries (Swedo et al., 2020), others found no increase in the severity of physical abuse seen in the ED during the COVID-19 pandemic compared to prior years (Kaiser et al., 2021). Importantly, none of these studies examined particular subpopulations that are established to be at higher risk for child maltreatment. Data show that infants (Farst, Ambadwar, King, Bird, & Robbins, 2013; Forjuoh, 2000; Friedman, Sheppard, & Friedman, 2012), adolescents (Karatekin, Almy, Mason, Borowsky, & Barnes, 2018), females (Forjuoh, 2000; Karatekin et al., 2018; Raghavan et al., 2015; Sediak et al., 2010), and Black (Farst et al., 2013; Farjuoh, 2000; Rovi, Chen, & Johnson, 2004) youth are at highest risk for child maltreatment (U. S. Department of Health and Human Services, 2021). It is likely that the impacts of the COVID-19 pandemic are disproportionately experienced by some youth and may exacerbate known disparities in child maltreatment. Additional research is needed to understand the impact of the stay-at-home-order on rates of child maltreatment diagnosis and identify the most vulnerable children.

The present study sought to advance our understanding of child maltreatment risk during the COVID-19 pandemic by examining the impact of the public health stay-at-home order on ED child maltreatment diagnoses and conversion to hospitalization, and describe any potential disparities by age, gender, Medicaid status, and race/ethnicity.

1. Methods

1.1. Data and population

We conducted a retrospective cohort study of all pediatric (age < 18 years old) Emergency Department (ED) encounters at a large integrated healthcare delivery system in California from January 1, 2019 to September 30, 2021. This healthcare system serves over 4.6 million racially and socio-economically diverse members, including 1.5 million children. It has 15 medical centers (including inpatient and outpatient services) and 233 medical offices (outpatient). Health care is coordinated through an integrated electronic health record (EHR) system that captures comprehensive information on the healthcare members receive at owned and contracting facilities. The healthcare system also obtains claims data on any out-of-network care that members receive. The study was approved by the Institutional Review Board of the healthcare system and included a waiver of informed consent.

2. Measures

2.1. Child maltreatment diagnosis

Child maltreatment (CM) diagnosis codes from the International Classification of Disease 9th and 10th revision (ICD-9 and ICD-10) were used to indicate a diagnosis of child abuse or neglect. ICD-9 codes included 995.5 to 995.59 and ICD-10 codes included ‘child abuse neglect and other maltreatment confirmed’ T74.02 to T74.92 (XA, XD, XS) as well as ‘child abuse neglect and other maltreatment suspected’ (T76.02 to T76.92 (XA, XD, XS). Prior work validated these maltreatment ICD codes (Negriff et al., 2020).

2.2. Hospital admission

Hospital admissions for the ED CM-related encounters were identified using inpatient records.

2.3. Demographics

All demographics were available from the membership information of the child. Gender was coded male versus female, race/ethnicity was categorized as Asian/Pacific Islander, Black, Hispanic, White, and other/unknown. For this analysis, we excluded individuals who had other/unknown gender (n = 47).

3. Statistical analysis

We evaluated trends in the monthly proportion of CM-related ED encounters before and after the California COVID-19 stay-at-home order (implemented March 19, 2020) using generalized estimating equation segmented logistic regression models. This model is the favored method to evaluate the impact and trends before and after an intervention and has been used in several previous intervention studies (Fretheim et al., 2015; Taljaard, McKenzie, Ramsay, & Grimshaw, 2014). The basic equation for segmented logistic regression
is:

$$\log \left( \frac{Y_t}{1 - Y_t} \right) = \beta_0 + \beta_1 \times \text{Time}_t + \beta_2 \times \text{Intervention}_t + \beta_3 \times \text{Time after intervention}_t + \epsilon_t,$$

where $Y_t$ is the probability for the outcome for time $t$, “Time” is the value of the time (from 1 to $k$) from the start of the preintervention to the end of postintervention, and equals $t$. “Intervention” = 1 for present, 0 for absent at time $t$. “Post intervention” is 0 if pre-intervention and otherwise equals the number of time periods form the start of the intervention to the current time period. $\beta_0$ is the baseline level of the outcome at time 0, $\beta_1$ is the change in log odds of outcome per increment in time interval in the preintervention period, $\beta_2$ is the change in log odds of the outcome after the start of the intervention, $\beta_3$ is the difference in the change in log odds of the outcome per unit time in the post-intervention period compared to the pre-intervention period (difference in difference). The sum of $\beta_1$ and $\beta_2$ is the change in log odds of the outcome per unit of time in the post-intervention period (Fretheim et al., 2015; Mascha & Sessler, 2019; Wagner, Soumerai, Zhang, & Ross-Degnan, 2002).

For the purposes of our analyses, we defined the period prior to the stay-at-home order as our “pre-intervention” period which was from January 1, 2019 to March 18, 2020. The “intervention” was the start of the stay-at-home order on March 19, 2020, and the “post-intervention” period was defined as April 1, 2020 to September 30, 2021. We chose to begin the post-period on April 1st to allow for a 2 week washout period after the enactment of the order. Due to the small sample for CM encounters we included the data for the washout period in the pre-intervention. Sensitivity analyses excluding those 2,200 encounters during that two week washout period did not change the results meaningfully. Therefore, we report the pre-period until March 31st and the post-period from April 1st. The model included the odds of CM-related encounter as the outcome and terms for the monthly trend prior to the stay-at-home order, change in level of the proportion of CM encounters immediately following the stay-at-home order, and change in monthly trend in the period after the stay-at-home order (April 1, 2020 to September 30, 2021). The change in level was defined as the difference in the proportion of CM encounters from the last month prior to the stay-at-home order (March 2020) to the first month after the stay-at-home order (April 2020), while the change in monthly trend was defined as the difference in trend before and after the stay-at-home order. As a secondary analysis, we also evaluated trends in the proportion of CM encounters admitted to the hospital from the ED before and after the stay-at-home order. This analysis used the same segmented logistic regression model as the primary analysis, but was limited to only CM encounters and included odds of admission as the outcome. All models included age (continuous), gender (male, female), race/ethnicity (Asian/Pacific Islander, Black, Hispanic, White, other/unknown), and Medicaid insurance (yes vs no) as covariates. To account for correlation between repeated ED encounters from the same patient, we included a clustering variable for patient in all of the models.

For the proportion of CM-related ED encounters, we also ran models within subgroups defined by age (0-4 yrs., 5-10 yrs., 11-17 yrs), gender, race/ethnicity, and Medicaid insurance. Race/ethnicity-specific analyses were not conducted among those with other/unknown race/ethnicity due to low sample sizes in this group. Heterogeneity was assessed using models that included interaction terms for the subgroup of interest and the pre-trend, change in level and post-trend (e.g., subgroup*pre-trend, subgroup*change in

### Table 1

Sample characteristics.

| Age (continuous) | Not CM-related | CM-related | All ED encounters | $p$  |
|------------------|----------------|------------|-------------------|-----|
|                  | ($n = 406,310$) | ($n = 918$) | ($n = 407,228$)   |     |
| Mean (SD)        | 7.3 (5.75)     | 7.3 (5.87) | 7.3 (5.75)        | 0.679 |
| Median           | 6              | 6          | 6                 | 0.009 |
| Q1, Q3           | 2.0, 13.0      | 2.0, 13.0  | 2.0, 13.0         |     |
| Range            | (0.0–17.0)     | (0.0–17.0) | (0.0–17.0)        |     |
| Age category (years) |     |            |                   |     |
| 0–4              | 169,545 (41.7 %) | 401 (43.7 %) | 169,946 (41.7 %) | 0.001 |
| 5–10             | 98,519 (24.2 %) | 183 (19.9 %) | 98,702 (24.2 %)  |     |
| 11–17            | 138,246 (34 %) | 334 (36.4 %) | 138,580 (34 %)   |     |
| Gender           |                |            |                   |     |
| Male             | 214,751 (52.9 %) | 356 (38.8 %) | 215,107 (52.8 %) | 0.001 |
| Female           | 191,559 (47.1 %) | 562 (61.2 %) | 192,121 (47.2 %) |     |
| Race/ethnicity   |                |            |                   |     |
| Asian            | 26,668 (6.6 %) | 35 (3.8 %)  | 26,703 (6.6 %)   |     |
| Black            | 43,833 (10.8 %) | 162 (17.6 %) | 43,995 (10.8 %)  |     |
| Hispanic         | 228,340 (56.2 %) | 491 (53.5 %)  | 228,831 (56.2 %) |     |
| White            | 86,037 (21.2 %) | 185 (20.2 %)  | 86,222 (21.2 %)  | 0.465 |
| Other/Unknown    | 21,432 (5.3 %) | 45 (4.9 %)   | 21,477 (5.3 %)   |     |
| Medicaid insurance |            |            |                   |     |
| Yes              | 137,879 (33.9 %) | 322 (35.1 %)  | 138,201 (33.9 %) |     |
| No               | 268,431 (66.1 %) | 596 (64.9 %)  | 269,027 (66.1 %) |     |
| Time period      |                |            |                   |     |
| Jan 1 2019-March 31, 2020 | 166,721 (41 %) | 464 (50.5 %)  | 167,185 (41.1 %) | 0.001 |
| April 1,2020-September 30, 2021 | 239,589 (59 %) | 454 (49.5 %)  | 240,043 (58.9 %) |     |

Note: group differences tested with chi-square.
level, subgroup*post-trend). Each interaction term was assessed individually in a separate model. We did not perform subgroup analyses for the proportion of admitted CM encounters due to limited sample sizes.

All analyses were conducted using SAS 9.4.

4. Results

The cohort consisted of 407,228 total pediatric ED encounters (among 258,512 unique patients) from January 1, 2019 to September 30, 2021, of which 918 encounters were CM-related. Over 50% of the patients had only one encounter (median: 1, interquartile range: 1–2). CM-related encounters were more common among younger (age 0–4), female, and black patients (Table 1).

The volume of ED encounters dropped substantially at the start of the pandemic, from an average of approximately 16,000 encounters per month during January 1, 2019-February 29, 2020, to an average of 7000 encounters per month during March 1–April 30, 2020. ED encounter volume remained low throughout the first year of the pandemic (average of 8000 encounters per month), but started to increase starting April 1st, 2021 (Fig. 1a). By contrast, the volume of CM encounters dropped from an average of 29 (January–February, 2020) to 17 in the month after the stay-at-home order, but generally fluctuated between 20 and 45 encounters per month throughout the study period (Fig. 1b).

The observed proportion of CM encounters per 100,000 ED encounters increased considerably from 254.8 in March 2020 to a peak of 400.1 in May 2020 (Fig. 2a). This proportion fluctuated and remained elevated for the first year of the pandemic, but began to decrease in May 2021, reaching 216.3 per 100,000 ED encounters by September 2021. From the modeling, the monthly trend prior to the stay-at-home order was generally stable (OR 1.01, 95% CI 0.98, 1.03), but doubled the month immediately after the order was implemented (OR 2.14, 95% CI 1.64, 2.78), then slowly decreased to nearly baseline rates after 17 months with a negative change in trend (OR 0.96, 95% CI 0.93, 0.98) (Fig. 2b, Table 2; see Supplemental Table 3 for full model output.

In comparison, the observed proportion of CM encounters admitted to the hospital did not show a clear pattern before and after the stay-at-home order (Fig. 2c). There was a non-significant 65% increased odds of admission for a CM-related ED visit immediately after
Fig. 2. Monthly breakdown of the proportion of CM encounters per 100,000 ED encounters (A – observed, B – predicted from model) and proportion of child maltreatment encounters admitted (C – observed, D – predicted from model). Gray bar represents the stay-at-home order and separates the period before (January 1, 2019 to March 31, 2020) and after (April 1, 2020 to September 30, 2021) its implementation.
the stay-at-home order (OR 1.65, 95 % CI 0.94, 2.92), but there was no change in the monthly trend afterward (OR 1.01, 95 % CI 0.95–1.08) (Fig. 2d, Table 2; see Supplemental Table 4 for full model output).

When comparing trends in the proportion of CM-related ED encounters by subgroups, we observed significant differences by age group in the immediate change after the stay-at-home order (p-interaction = 0.008). The odds of CM tripled for those aged 0–4 years (OR 3.37, 95 % CI 2.27, 5.00) and doubled for those aged 5–10 years (OR 1.99, 95 % CI 1.15–3.43), but there was no significant change for those aged 11–17 years (OR 1.28, 95 % CI 0.81–2.02) (Fig. 3a, Table 2).

We did not detect any differences by gender (p-interaction = 0.14), but the immediate change appeared stronger among females (2.34, 95 % CI 1.66, 3.29) compared with males (OR 1.84, 95 % CI 1.22, 2.79) (Fig. 3b, Table 2). In addition, the immediate change after the stay-at-home order was more pronounced among Asian children (OR 3.63, 95 % CI 1.02, 12.88) and Black children (3.08, 95 % CI 1.63, 5.82), but there was no significant heterogeneity (p-interaction = 0.98, Fig. 3c, Table 2). Of note, the proportion of CM-related encounters was considerably higher among Black children compared with the other races/ethnicities (Fig. 3c). There was no significant interaction in the trends or immediate change across Medicaid insurance (Fig. 3d, Table 2).

5. Discussion

The COVID-19 public health mitigation strategies such as the stay-at-home order likely impacted risks for child abuse and neglect and exacerbated known disparities. The present study examined the rates of child maltreatment diagnosis seen in the emergency department before and after the California stay-at-home order by age, gender, and race/ethnicity.

Similar to other studies, we found a decline in CM cases corresponding with the stay-at-home order enacted in March 2020 (Kaiser et al., 2021; Swedo et al., 2020). However our data also showed that the rate of CM diagnoses in the ED increased significantly after the stay-at-home order. Our results correspond with data published by the Centers for Disease Control and showing that the percent of ED visits related to child maltreatment increased after the national stay-at-home order (Swedo et al., 2020). The overall drop in volume mirrors reports from child welfare agencies. The California Department of Social Services reported that calls for suspected abuse dropped 28 % from April to August 2020 compared to the same time period in 2019 (https://ccwip.berkeley.edu, retrieved Dec 2, 2021). While the overall volume of both CM and non-CM related ED encounters decreased after the California state stay-at-home order, it is concerning that the proportion of visits for child abuse increased significantly. We found that although the decrease in volume of ED visits was greater for non-CM than CM-related ED visits it does not fully explain the increased proportion of CM-related ED visits. The post-trend for the 18 months after the enactment of the stay-at-home order indicates a slow gradual return to pre-pandemic CM rates in the ED. This is likely due to removal of closure mandates, return to school, and increases in exposure to other types of mandated reporters in the post-trend period. This may not necessarily indicate that CM rates are decreasing, but that CM is being identified in other settings than the ED. Lastly, the findings did not indicate a significant increase in hospitalization following an ED visit for CM, which contradicts data from the across the US (De Boer et al., 2022). It should be noted that in our data there were small cell sizes for inpatient admission resulting in low power and our inability to infer significance. The increase in child abuse diagnosis immediately

| Table 2 | Adjusted odds ratios from segmented logistic regression with clustering variable for patient comparing odds of outcome. |
|-----------------|-----------------------------------------------------------------------------------------------------|
| Outcome | Subgroup | Trend before stay-at-home order | Immediate change after stay-at-home order | Change in trend after stay-at-home order |
|-----------------|-----------------------------------------------------------------------------------------------------|
| Proportion of CM-related ED encounters | Entire | 1.01 (0.98, 1.03) | 2.14 (1.64, 2.78) | 0.96 (0.93, 0.98) |
| | cohort | 0.99 (0.96, 1.02) | 3.37 (2.27, 5.00) | 0.96 (0.92, 1.00) |
| | 0–4 yrs | 1.03 (0.98, 1.07) | 1.99 (1.15, 3.43) | 0.91 (0.86, 0.97) |
| | 5–10 yrs | 1.01 (0.97, 1.05) | 1.28 (0.81, 2.02) | 0.98 (0.93, 1.03) |
| | p-interaction | 0.091 | 0.008 | 0.107 |
| | Male | 1.01 (0.98, 1.04) | 1.84 (1.22, 2.79) | 0.95 (0.91, 0.99) |
| | Female | 1.00 (0.97, 1.03) | 2.34 (1.66, 3.29) | 0.96 (0.93, 1.00) |
| | p-interaction | 0.254 | 0.143 | 0.234 |
| | Asian | 1.00 (0.91, 1.10) | 3.63 (1.02, 12.88) | 0.91 (0.79, 1.05) |
| | Black | 1.02 (0.96, 1.07) | 3.08 (1.63, 5.82) | 0.90 (0.84, 0.97) |
| | Hispanic | 1.00 (0.97, 1.03) | 2.26 (1.58, 3.23) | 0.96 (0.93, 1.00) |
| | White | 1.02 (0.98, 1.08) | 1.37 (0.77, 2.43) | 0.96 (0.91, 1.03) |
| | p-interaction | 0.853 | 0.984 | 0.234 |
| | No Medicaid | 1.01 (0.98, 1.03) | 2.00 (1.44, 2.78) | 0.95 (0.92, 0.99) |
| | Medicaid | 1.00 (0.96, 1.04) | 2.42 (1.56, 3.76) | 0.96 (0.92, 1.01) |
| | p-interaction | 0.258 | 0.186 | 0.231 |
| Proportion of CM encounters admitted | Entire | 0.97 (0.92, 1.01) | 1.65 (0.94, 2.92) | 1.01 (0.95, 1.08) |

Note: Time periods defined as before (January 1, 2019–March 31, 2020), immediately after (April 1, 2020), and 16 months after (May 1, 2020–September 30, 2021) the California stay-at-home order. Reference group for covariates in full model were males, White children, and those with no Medicaid. Age was treated as continuous covariate. For the interaction models age was treated as categorical as indicated in the table.
Fig. 3. Monthly breakdown of the proportion of CM encounters per 100,000 ED encounters predicted from the segmented regression model, by A) age group, B) gender, C) race/ethnicity, and D) Medicaid insurance. Gray bar represents the stay-at-home order and separates the period before (January 1, 2019 to March 31, 2020) and after (April 1, 2020 to September 30, 2021) its implementation.
after the stay-at-home order was implemented indicates a need for child abuse prevention efforts to focus on developing overlapping system of care for children so that if one or more resource is unavailable children are not without a social safety net.

Importantly these increased rates of CM diagnosis were driven by young children (<4 years). This is consistent with national data showing that rates are highest for infant and decrease with age (U. S. Department of Health and Human Services, 2021). Our data did not have adequate numbers of CM cases to parse age categories further, and we chose <4 years to coincide with entry to elementary school. This is particularly concerning as young children are less able to articulate abusive experiences and may sustain more severe injuries (Chance & Scannapieco, 2002; Hegar, Zuravin, & Orme, 1994). While the interaction effects for gender and race were not significant, the figures show that the rates were being driven by girls and Black and Hispanic youth. This is consistent with national studies showing that higher rates of maltreatment are found for females and Black youth in particular (Sedlak et al., 2010). In addition, data on natural disasters and past pandemics suggests that females may be more vulnerable to violence exposure (Seddighi et al., 2021; Usher et al., 2021). Our findings bolster the disproportionate impact that pandemic-related stressors may have on violence toward young girls. In addition, these disparities in CM rates may be widened by the unequal burden of COVID-19 on Black families (Garcia et al., 2021; Millett et al., 2020). Surprisingly, we did not find an effect of Medicare status on rate of CM diagnosis, implying that low-income status did not increase risk for CM visits to the ED after the stay-at-home order. This differs from studies showing that, generally, poverty is a risk for child maltreatment (Kim & Drake, 2018; Maguire-Jack & Font, 2017). Overall, these findings demonstrate the disproportionate impact of the stay-at-home order on vulnerable children. This does not imply that public health measures should not be implemented, but that more consideration should be given to how families and children might be supported during extended public health crises.

5.1. Limitations

There are a number of limitations that should be taken into account when interpreting these findings. First, this analysis was based on the electronic health records from one region in the US, it is possible that differences in vulnerability to pandemic-related stressors as well as CM may differ based on geographic location. However, our findings align with those from the Centers for Disease Control and Prevention (CDC) which used national data. Second, CM was determined from ICD diagnosis codes in the electronic health records. It does not capture potential abusive injuries that were captured only in notes. Third, the overall rates of CM were small, especially for hospitalization. This may have reduced our ability to detect significant effects for both main effects and interactions. Lastly, these analyses do not explain why CM diagnosis rates increased after the stay-at-home order. As noted previously, there are a number of pandemic-related stressors that may increase risk for family violence. We can only infer from these observed increases that remaining at home without access to school, childcare centers, or other social resources was associated with more children being seen in the ED for child maltreatment.

5.2. Conclusions

Our results indicate an increase in the proportion of child maltreatment diagnosed in emergency department visits immediately after the stay-at-home order, which then slowly decreased to baseline rates over the next year and a half. Not surprisingly, there was a disproportionate effect on younger children, girls, and children of black race and Hispanic ethnicity. Future research will be needed to determine whether these disparities in child maltreatment risk during the stay-at-home order have long-term impacts.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chiabu.2022.105821.

Funding/support

None.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article to disclose.

Data availability

The authors do not have permission to share data.

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