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Emergency Mental Health Services for Children After the Terrorist Attacks of September 11, 2001

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### Authors

Bruckner, Tim A  
Kim, Yonsu  
Lubens, Pauline  
[et al.](#)

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**Running Head: Emergency Mental Health Services for Children after 9/11**

**Emergency Mental Health Services for Children after the Terrorist Attacks of  
September 11, 2001**

Abstract

Much literature documents elevated psychiatric symptoms among adults after the terrorist attacks of September 11, 2001 (9/11). We, however, know of no research in children that examines emergency mental health services following 9/11. We test whether children's emergency services for crisis mental health care rose above expected values in September 2001. We applied time-series methods to California Medicaid claims (1999 to 2002; N= 127,200 visits). Findings in California indicate an 8.7 percent increase of children's emergency mental health visits statistically attributable to 9/11. Non-Hispanic white more than African American children account for this acute rise in emergency services.

**KEYWORDS:** Emergency, mental health, children, 9/11, racial disparities

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### **Introduction**

Although rare, unexpected disasters elicit both short- and long- term psychological consequences. Much literature finds that the terrorist attacks of September 11, 2001 (hereafter referred to as 9/11) induced such sequelae (Galea et al., 2002; Schlenger et al., 2002; Schuster et al., 2001). National surveys, moreover, find elevated post-traumatic stress disorder and depressive symptoms even among populations outside of the local communities that experienced the attacks (Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002). Although much work on traumatic events such as 9/11 attempts to identify subgroups with elevated clinical symptoms, less attention focuses on help-seeking for mental health services in the emergency setting (Boscarino, Galea, Ahern, Resnick, & Vlahov, 2002; DiMaggio, Galea, & Richardson, 2007). We use the acute and widespread impact of 9/11 to examine whether emergency mental health care utilization among an understudied population—children—rises after traumatic events.

The relation between symptoms of disorder and visits to the emergency setting for psychiatric care, especially after 9/11, remains complex. In adults, DiMaggio and colleagues (2007) found a ten percent increase in emergency department (ED) behavioral and mental health diagnoses for residents within a 3-mile radius of the World Trade Center, but a *lower rate* for New Yorkers just outside this radius. This work raises the obvious question of which of these ED findings generalize to other places with a social, but not geographic, connection to 9/11.

Most research on emergency mental health services following 9/11 examines direct survivors or residents of New York City setting (Boscarino, Galea, Ahern, Resnick, & Vlahov, 2002; DiMaggio, Galea, & Richardson, 2007; Green et al., 2006). From a

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health services perspective, however, administrators may want to anticipate the population demand for emergency care. This circumstance pertains to terrorist attacks such as 9/11 in which the majority of the population with elevated post-traumatic stress and depressive symptoms did not know the persons lost in the attacks and lived outside of New York City. Populations also reportedly experience widespread distress after a disaster even if they never met the deceased, particularly after events in which institutions such as the state fail to maintain safety and security for its members (Catalano & Hartig, 2001). We believe that 9/11 meets this “communal bereavement” possibility. Nationally-representative studies of youth further show elevated depressive and post-traumatic stress symptoms, as well as anxiety, immediately after 9/11 (Stein et al., 2004).

We know of no research on 9/11 that examines children’s use of mental health care in the emergency setting. The mental health services literature cautions against generalizing adult patterns of emergency care to children given their dependence on caretakers, institutions and other authority figures, and children’s distinctive stressors and mental illness profiles (Bringewatt & Gershoff, 2010). This work, and a report in which 62.5% of adolescents felt anxious, distressed, or frightened two weeks after the 9/11 attacks (Gil-Rivas, Holman, & Silver, 2004), raises the possibility that mental health-related emergency visits for youth may show a distinct spike after 9/11.

We use Medicaid data from California, the most populous state in the U.S., to test the hypothesis that children’s emergency visits for crisis mental health care increased immediately after 9/11. In addition, we retrieve emergency setting visit information by race/ethnicity to assess whether help-seeking patterns for crisis care after 9/11 differ by race/ethnicity. A recent report documents African-Americans’ relatively reduced distress

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symptoms after the attacks (Adams & Boscarino, 2005). Consistent with this report, we hypothesize that, after 9/11, African-American youth show a relatively lower frequency of emergency visits for crisis mental health care.

We contribute to the literature in three ways. We provide, to our knowledge, the first test of a rise in youth emergency visits after 9/11. This test may inform future planning efforts for children's increasing reliance on emergency psychiatric care in regions not geographically proximal to terrorist attacks (Snowden, Catalano, & Shumway, 2009; Snowden, Masland, Wallace, Fawley-King, & Cuellar, 2008). Second, analysis of a plausibly exogenous event may bolster the theory of communal bereavement and enhance understanding of population-level causes of youth emergency mental health care. Third, our race/ethnic-specific analyses may uncover specific subgroups in the U.S. whose health care-seeking pattern appears most sensitive to unexpected disasters.

### **Methods**

Variables and Data: We retrieved crisis mental health care visit data for youth participating in California's Medicaid Program. Although California lies geographically distant from the 9/11 terrorist attacks, we know of no reports that California youth sheltered themselves from this distress. The California Department of Mental Health (CADMH) provided us with monthly counts of crisis mental health care visits for Californians aged 5 to 21 years, from July 1999 to June 2003. Our study used de-identified, aggregate level data; therefore, the study qualified as exempt from Human Subjects Review.

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CADMH provided us visit information for all youth participating in Medicaid's Early Periodic Screening, Diagnosis, and Treatment (EPSDT) program. EPSDT provides integrated care which includes screening, diagnostic, and treatment services for Medicaid beneficiaries. The EPSDT program provides comprehensive specialty mental health case management, routine outpatient treatment, and crisis care in both in-patient and out-patient settings. These services currently cost the State of California over \$1 billion annually. Given that the State reimburses the EPSDT claims, the California Department of Health Care Services routinely conducts audits, quality checks and validation efforts on the procedure code and service type variables contained in the EPSDT dataset. All children eligible for Medi-Cal may seek services through the EPDST program.

From the period of July 1999 to June 2003, we acquired data on all visits for crisis mental health care among children aged 5 to 21 years and participating in EPSDT, California's Medicaid program (i.e., Medi-Cal) for mental health care among youth. This 48 month time span represents the longest time series with consistent data collection methodology and administrative reporting protocols. Approximately 100,000 children per month seek services through EPSDT. We classified about 2,650 visits per month as youth crisis ED visits for mental health care (n=127,213 total over the time period analyzed). We excluded from the analysis all but the child's first crisis mental health visit within each calendar month period.

The California Code of Regulations, Title 9, Chapter 11, defines EPSDT as "mental health related diagnostic services and treatment, other than physical health care, available under the Medi-Cal program only to persons under 21 years of age," (Scott-Lee, n.d.). Based on this definition, EPSDT does not include mental health ED visits among

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youth who do not participate in the Medicaid program (i.e., those with private health insurance or no insurance). The EPSDT program provides unplanned crisis care in both in-patient and out-patient settings. According to EPSDT, unplanned crisis services refer to a service, lasting less than a 24-hour period, which requires more timely response than a planned service. These services include crisis intervention, crisis stabilization, medication support services, assessment, evaluation collateral, and therapy. Services can be delivered anywhere in the community and across a variety of settings. Whereas crisis intervention must occur face-to-face with a health care provider, all other support services may take place over the phone. The majority of unplanned crisis visits for youth occur in a hospital setting.

We defined our outcome variable as the monthly count of unduplicated youth clients with unplanned crisis visits in EPSDT. Unplanned visits include two of the 13 services offered by EPSDT: crisis intervention and crisis stabilization. California Code of Regulations, title 9, chapter 11, defines these unplanned crisis services as care lasting less than 24 hours, to or on behalf of a child, for a condition that requires more timely response than regularly scheduled visits. For brevity, we refer to unplanned crisis services as emergency services. Previous research validates the categorization of these crisis services as “emergencies” that respond to sudden perturbations in the ambient environment (e.g., economic downturns) (T. Bruckner, Kim, & Snowden, 2014). For the analysis of racial/ethnic-specific responses after 9/11, we classified by race/ethnicity the unduplicated monthly count of crisis services within EPSDT. We analyzed racial/ethnic groups with a sufficient number of crisis service visits (i.e. greater than 20 per month) to

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permit stable time-series analyses. This restriction yielded the following groups: non-Hispanic white, non-Hispanic African-American, Hispanic, and Asian.

Analysis: We follow in the analytic tradition of the interrupted time-series quasi-experiment. Our time-series analysis uses monthly, population-level data to test whether 9/11 precedes an increase above expected levels in the monthly count of child emergency visits for crisis mental health care. Most statistical tests assume that the mean value of the outcome for all months best predicts the “expected” value for any month. Most tests further assume that a high or low observed value outside an appropriate confidence interval of that mean supports the argument of a discovered difference. Monthly emergency services for youth in California, however, exhibit secular trend, seasonality, and the tendency to remain elevated or depressed after high or low values. For instance, due to expansions in Medi-Cal, policy changes, and outreach to minorities which increased the scope and age range of services offered, EPSDT client enrollment increased over fourfold since its 1995 inception (Snowden, Masland, Wallace, & Evans-Cuellar, 2007). The beginning of the school year (e.g., September and October) also shows localized increases in emergency mental health service utilization among youth. These patterns, referred to as autocorrelation, complicate tests like ours because the statistically expected value of emergency services in September 2001 is not the mean of past months.

We applied Box-Jenkins time series methods (Box, Jenkins, & Reinsel, 1994), often used in the emergency mental health services literature ( Bruckner, Kim, Chakravarthy, & Brown, 2012), to address this autocorrelation problem. These autoregressive, integrated, moving average (i.e., ARIMA) routines identify and remove autocorrelation in the outcome variable before examining the effect of the independent



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variable. This process yields a time series of residual, or unexpected, components whose monthly values have no temporal pattern and are statistically independent of one another. As it relates to our test, Box-Jenkins methods use the past history of emergency services to arrive at the expected value of services in September 2001.

The time-series routines developed by Box and colleagues (Box, Jenkins, & Reinsel, 1994) include autoregressive and moving average parameters. Autoregressive parameters best describe patterns that persist for relatively long periods, whereas moving average parameters parsimoniously describe less persistent patterns. Time-series methods also use an integrated parameter which models a series that exhibits a non-stationary mean (e.g., upward trend). ARIMA routines parsimoniously model time series using a combination of the autoregressive (AR), integrated (I), and moving average (MA) processes.

For the racial/ethnic-specific analyses, we build on the logic above and implement a more rigorous strategy (Catalano & Serxner, 1987). We used as a control series in the time-series equation the monthly count of EPSDT emergency visits among white youths. Inclusion of this control variable removes any shared patterns in emergency visits induced by forces at work for both ethnic minorities and whites. The “control group” time-series strategy also provides a straightforward interpretation of the coefficient for 9/11, which now captures the *racial/ethnic-specific difference* in emergency mental health responses.

Our analysis proceeded as follows. First, we identified and removed autocorrelation in the time series of youth emergency mental health services over the test period (n=48 months). Second, we added a binary 9/11 variable to the model, coded as

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“1” in September 2001 and “0” for all other months. We also included two month lags of the 9/11 variable—into October 2001 and November 2001—to ensure capturing any delayed associations. Third, we estimated the 9/11 variable’s association with crisis emergency services for mental health. Fourth, we inspected the unexpected (residual) components of emergency visits to insure they displayed no temporal patterns. Fifth, we assessed whether outliers in the series (other than the 9/11 outlier we hypothesize) distorted the 9/11 coefficient by inflating the standard error of the relatively short time series. Finally, we repeated steps 1 through 5 above, but separately for African-American, Hispanic, and Asian youth. For all race-specific analyses, we used emergency services among non-Hispanic white youth as the control series.

## **Results**

From July 1999 to June 2003, over 4.8 million mental health visits for California youth occurred under the auspices of the EPSDT program. Of these visits, we classified 2.6 percent as emergency mental health services (mean= 2,650 per month). The fraction of visits classified as emergency differ by race/ethnicity (Table 1). Consistent with previous literature, African-Americans utilize mental health care in the emergency setting disproportionately more than do other race/ethnicities. Figure 1 plots the count of emergency mental health services, by race/ethnicity, for the 48 month study period. For all race/ethnicities, the series show a general increase in the mean over time. The series also exhibit substantial month-to-month variation.

As shown in Table 2, the ARIMA time-series routines detected autocorrelation in emergency mental health services. The autoregressive parameter at lag 1 month indicates

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that high (or low) values tended to be “remembered” in the subsequent month with similarly high (or low) values. The series also indicated strong non-stationary seasonality, which required differencing the series at lag 12 (i.e., values at month  $t-12$  subtracted from values at  $t$ ). The routines further detected a moving average parameter at lag 12 months to account for this strong seasonal pattern. We refer the reader to Liu (2004) for a detailed statistical description of the autoregressive, moving average, and differencing parameters.

The 9/11 coefficient (Table 2) supports our hypothesis in that, in aggregate, youth visits for emergency mental health services rise above their expected value in September 2001 (coef: 229.5, standard error [SE] = 113.4;  $p < .05$ ). The coefficient implies an excess of 229.5 emergency visits in September 2001 statistically attributable to 9/11.

Application of this value relative to the monthly mean (i.e., 2,650 in Table 1) implies an 8.7% increase in emergency mental health visits among youth in September 2001. We observe no deviation of emergency services from expected values in October or November 2001.

Our test turns on whether unplanned crisis visits for youth rise above statistically expected values following 9/11. However, outliers in the series, other than that which we hypothesize, could inflate standard errors and attenuate our results. To assess this possibility, we performed outlier detection and correction routines recommended in the time series literature (Chang, Tiao, and Chen, 1988). This method iteratively adds binary variables for each month to find any month that, if added to the equation, would have coefficients with  $t$  values greater than 3.5. The method also adjusts the time-series parameters as outliers are added. We detected no outliers in the overall test.

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We then assessed whether the increase in emergency visits in September 2001 arose due to an overall spike in help-seeking for both routine and crisis mental health care. It remains plausible that, after 9/11, an overall increase in help-seeking might have led to an influx of clients into emergency settings that represented an “overflow” of routine visits which could have been better treated in a non-crisis setting. To test this possibility, we created as an outcome variable the monthly proportion of all mental health service visits that qualify as emergency care (i.e., crisis visits divided by the sum of crisis and non-crisis visits). We then repeated the time-series routines as described in the Methods. The 9/11 coefficient for the incidence of emergency visits for September 2001 became even stronger with respect to rejecting the null hypothesis (coef: .0027, SE=.0009,  $p < .01$ ). This result indicates that, whereas emergency visits for mental health among youth rose in September 2001, non-emergency visits for youth (i.e., the denominator in the incidence measure) fell in that same month.

Table 3 displays results from three additional analyses, by race/ethnicity, in which we used non-Hispanic white emergency visits as the control series. The strong statistical significance of the coefficient for white emergency visits, for all three tests, reflects the shared temporal patterns in EPSDT utilization across race/ethnicity. We focus on the 9/11 coefficient for African-American children given our hypothesis regarding their differential response to 9/11 relative to whites. The 9/11 coefficient for September 2001 is negative and reaches conventional levels of statistical significance (coef: -116.5; SE = 46.4,  $p < .05$ ). This result indicates that African American youths have relatively 116 fewer emergency psychiatric visits than do whites in September 2001.

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To assist the reader with interpreting this value, we divided the discovered 9/11 coefficient by the mean monthly white / African-American difference in mental health emergency visits (i.e., 406). Based on this calculation, we find a 22 percent increase in September 2001 in the racial/ethnic difference in help-seeking for emergency mental health care that we statistically attribute to 9/11. We then assessed the sensitivity of these results to outliers and to reformulation of the outcome variable as an incidence measure of emergency psychiatric visits (i.e., emergency visits divided by the sum of routine and emergency visits). Inference remained essentially unchanged from the original test in Table 3.

## **Discussion**

Whereas much literature documents psychological sequelae among adults and children after the terrorist attacks of 9/11 (Galea et al., 2002; Schlenger et al., 2002; Schuster et al., 2001; Silver et al., 2002; Boscarino et al., 2002; DiMaggio et al., 2007; Green et al., 2006 ), we know of no research that tests whether children's help-seeking for emergency psychiatric services rose immediately following the attacks. Time-series results using children participating in California's Medicaid program indicate a rise above expected values in emergency psychiatric services during the month of September 2001. Additional analyses show that white more than African American children account for this rise in emergency psychiatric services.

We view the higher than expected emergency psychiatric service visits in September 2001 as consistent with a nationally representative report which finds that 35 percent of children experienced extreme levels of psychological distress within a few

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days after 9/11 (Schuster et al., 2001). Longitudinal studies on psychological distress after the terrorist attacks reveal that the percentage of respondents that reported substantial distress in September 2001 dropped substantially by early November (Silver et al., 2002). This and another report (Stein et al., 2004) suggests that acute responses to the 9/11 attacks differ from an ongoing psychological response in that severity of psychological responses appear greater in September than in subsequent months. In line with the notion of an acute and transient exposure, a media study finds that coverage of the 9/11 attacks appeared strongest during the month of September but shifted towards invasion of Iraq by early October (Silver et al., 2002).

We find a decrease in crisis visits among African American children as compared with non-Hispanic white children. Although we hesitate to speculate on reasons for this result, previous research and theory indicated that African American children's responses differ from that of White children. One explanation may involve differences in coping methods in that African Americans appear more likely than whites to make salutary behavioral changes regarding personal security as well as turning to religion (Chu, Seery, Ence, Holman, & Silver, 2006). Another explanation involves the "effect-budget" notion that economic worries predominate over other concerns among African-Americans in our Medicaid population. Medicaid and EPSDT provide coverage to poor children, but poor African Americans are almost three-times as likely as poor Whites to live in deep poverty— that is, below 50% of the poverty threshold (DeNavais, Proctor, & Smith, 2011). Poor African Americans more often experience the psychology of scarcity, identified by behavioral economists as a by-product of deep poverty (Mullainathan & Shafir, 2013). Lack of material resources may increase preoccupation with food, shelter,

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and other necessities. Research finds that declining economic conditions lead to more African American's than White's psychiatric emergency care (T. Bruckner et al., 2014). We, however suspect that other catastrophes, which remain highly visible but not economic in nature, may adversely affect African American children less than they do for Whites. Consistent with this effect budget notion, Mattingly reports that although African American were shocked and dismayed after 9/11, many members of the community felt that the event represented the least of their daily worries and did not affect their routine expectations and obligations (Mattingly, Lawlor, & Jacobs- Huey, 2002). We remind the reader that causes of help-seeking for emergency care are quite complex, and that our explanations of the observed racial difference should be viewed as informed speculation. We also note that the 9/11 literature on racial/ethnic responses does not converge (Freedy, Saladin, Kilpatrick, and Resnick, 1994; Galea et al. 2002; Adams & Boscarino, 2005; Shore, Tatum, and Vollmer,1986).

Limitations include that we use crisis mental health visits among children to gauge variation in mental disorder despite the fact that myriad factors other than the severity of disorder may affect help-seeking (Atdjian & Vega, 2005; Goldman-Mellor, Saxton, & Catalano, 2010). However, we know of no better time-varying, population-based surveillance measure of mental health among youth than what we analyzed. In addition, although we have no reason to believe that higher incomes somehow sheltered children from 9/11, results using Medicaid participants may not generalize to higher-income families. The racial/ethnic composition of Medicaid recipients includes a larger fraction of African-Americans than the general California population (Kaiser Family Foundation, n.d.). For this reason, the incidence of emergency visits, and help-seeking

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patterns for children with private health insurance, may differ from that of lower-income families. We also did not have access to children's crisis visits in other regions (e.g., New York City). We expect that other researchers may have the data resources necessary to replicate our results in other places.

We also cannot rule out the possibility that other factors that coincide with, but are not caused by, 9/11 led to increased help-seeking in September 2001, especially among African American youth. Such a rival factor, however, would have to account for an abrupt rise in crisis, but not routine, visits for children's mental health care. The absence of clinical diagnoses in our dataset did not allow for analysis of particular conditions or symptoms with which the children present. We also used aggregate monthly counts of crisis mental health care, which occur in both the hospital and community settings. This circumstance implies that our outcome represents a population-level indicator of crisis care. We caution the reader against using the population-level result to infer individual-level causes of help-seeking.

We postulate that two key pathways may have led to an increase in help-seeking for crisis mental health care. First, children's mental health reportedly responds to the mental health of their parents. Maternal depression and stress vary positively with externalizing behaviors and depressive symptoms in adolescents (Shore JH, 1986; Fergusson, Horwood, & Lynskey, 1995). The events of 9/11 may have induced such stress transmission from parents to their children.

Second, fixation on, and adverse reaction to, media coverage in the wake of 9/11, coheres with the notion of communal bereavement. This term refers to grieving by community members for persons with whom they share no personal connection (Catalano



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& Hartig, 2001). Such practices outwardly involve the creation of shrines or memorials to share the grief borne by total strangers who have suffered a trauma (Moodley & Costa, 2006). From a public health perspective, however, witnessing media coverage of the attacks may have produced trauma-related symptoms in children (Kennedy, Charlesworth, & Chen, 2004). Parental witnessing of these traumatic events, moreover, may have led to their reduced availability and/or neglect of children's needs that otherwise may have been addressed. Previous research on the 1986 explosion of the space shuttle Challenger and the 1995 bombing of the Alfred P. Murrah Federal Building in Oklahoma City show such a traumatic response (Terr et al., 1999; B. Pfefferbaum et al. 2003). We expect that future work may elucidate whether the two mechanisms we invoke—or other mechanisms—account for the increase after 9/11 in children's crisis care for mental health.

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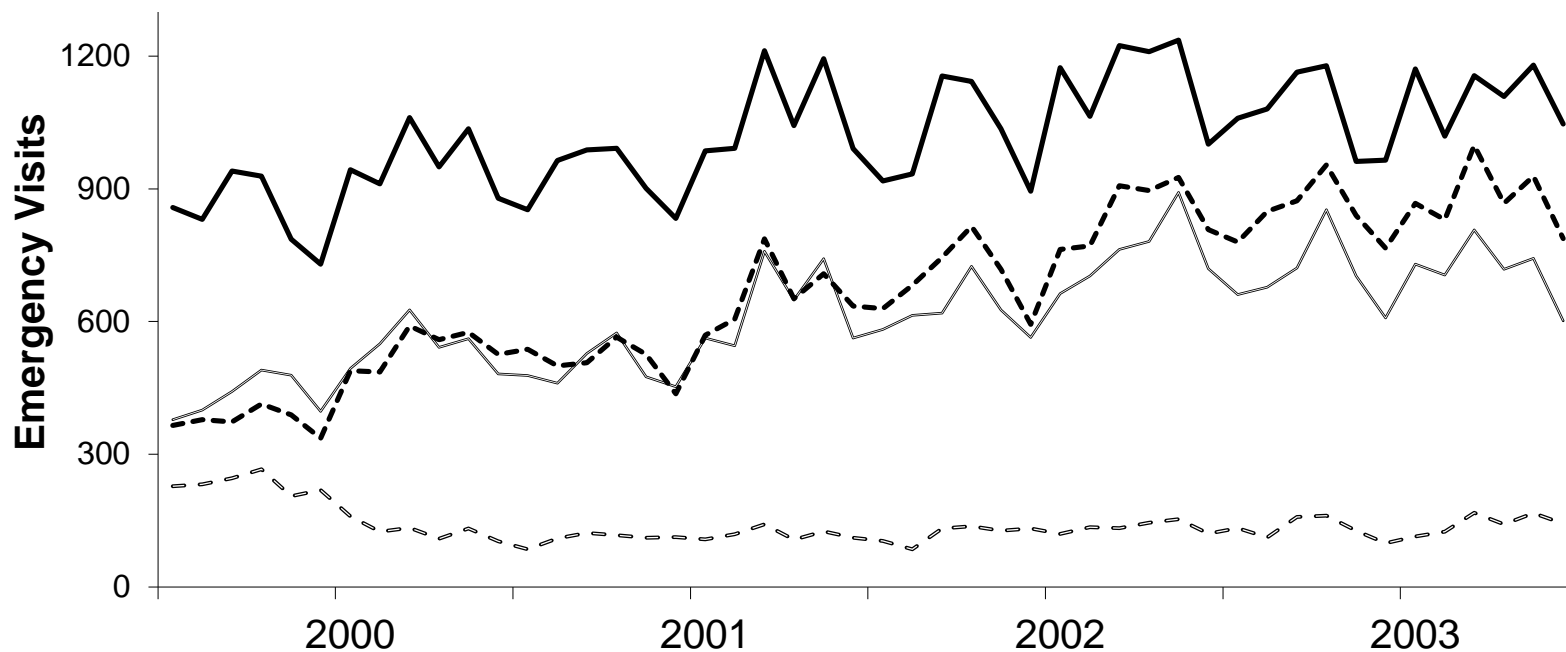
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**Table 1.** Characteristics of mental health visits among children aged 5 to 21 years and enrolled in California’s Medicaid Program, July 1999 to June 2003 (n=48 months).

	<b>n</b>	<b>%</b>	<b>Monthly Mean (SD)</b>
<b>All races/ethnicities</b>			
Emergency service visits	127,200	2.6	2,650 (65)
Routine (planned) visits	4,717,865	97.4	98,288 (2,528)
<b>Non-Hispanic White</b>			
Emergency service visits	48,885	2.7	1,018 (126)
Routine (planned) visits	1,772,592	97.3	36,929 (4,521)
<b>African-American</b>			
Emergency service visits	29,412	2.9	613 (124)
Routine (planned) visits	975,203	97.1	20,317 (4,246)
<b>Hispanic / Latino</b>			
Emergency service visits	32,104	2.4	669 (181)
Routine (planned) visits	1,293,029	97.6	26,938 (7,473)
<b>Asian</b>			
Emergency service visits	6,703	2.5	140 (40)
Routine (planned) visits	257,122	97.5	5,357 (1,176)

## Running Head: Emergency Mental Health Services for Children after 9/11

**Figure 1.** Racial/ethnic-specific monthly counts of emergency mental health visits among children aged 5 to 21 years and enrolled in California's Medicaid Program, July 1999 to June 2003. From highest to lowest volume of visits, Non-Hispanic White children shown in bold line, Hispanics in dash-dot line, African-Americans in faint line, and Asians in faint dashed line.



**Running Head: Emergency Mental Health Services for Children after 9/11**

**Table 2.** Time-series results in California for all youths in emergency mental health care as a function of the September 11<sup>th</sup>, 2001 variable and autocorrelation (n=48 months).

<b>Variable</b>	<b>Coef (SE)</b>
Constant	None
Differencing	Yes; at 12 months
Autoregressive Parameters	$B^1 = .95 (.046)***$
Moving Average Parameters	$B^{12} = .66 (.20)**$
September 11 <sup>th</sup> variable lagged at:	
September 2001	229.5 (113.4)*
October 2001	215.6 (130.8)
November 2001	167.4 (113.3)

p<.05; 2-sided test; \*\*p<.01; 2-sided test; \*\*\*p<.001; 2-sided



## Running Head: Emergency Mental Health Services for Children after 9/11

**Table 3.** Time-series coefficients, by race/ethnicity, in California for youth visits in emergency mental health care (n=48 months). Emergency visits modeled as a function of the September 11<sup>th</sup>, 2001 variable, emergency visits for non-Hispanic white youth, and autocorrelation. Standard errors appear in parentheses.

Variable	African Americans	Hispanics	Asians
Constant	none	none	none
Differencing	none	First Differences	none
Emergency visits for non-Hispanic whites	.62 (.017)***	.57 (.06)***	.11 (.01)***
September 11 <sup>th</sup> variable at			
September 2001	-116.5 (46.4)*	-46.8 (41.9)	4.8 (18.7)
October 2001	4.8 (51.8)	46.4 (47.7)	5.2 (19.4)
November 2001	-24.8 (46.1)	27.0 (40.5)	1.3 (18.3)
Moving Average Parameters	--	--	B <sup>1</sup> = .35 (.16)*
Autoregressive Parameters	B <sup>1</sup> = .60 (.11)***	--	B <sup>1</sup> = .81 (.06)***

\*p<0.05; two- tailed test; \*\*\*p<0.001; two- tailed test