Children of Iniki:
Effects of Evacuation and Intervention

By

Roger S. Hamada

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CHILDREN OF INIKI:

EFFECTS OF EVACUATION AND INTERVENTION

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by

Roger S. Hamada, Ph.D.

Kapiolani Medical Center for Women and Children

and

John A. Burns School of Medicine

University of Hawaii at Mano'a

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INTRODUCTION

Background

Effects of disaster on adults' postdisaster psychosocial adjustment have been well documented.[1] A growing literature also documents the effects of natural disaster on children's emotional and behavioral adjustment following the event. Vogel and Vernberg, in a comprehensive review of the literature, conclude that common responses of children to natural disaster include specific fears, separation difficulties, sleep problems, and symptoms associated with posttraumatic stress disorder (PTSD).[2] Also reported are symptoms of anxiety, depression, somatization, and behavioral disturbance.[3]

A recent large-scale study by Lonigan and his colleagues[4,5] studied 5,687 children in grades five through 12 who were exposed to Hurricane Hugo in South Carolina in 1989. Using the Frederick Reaction Index for Children (RI)[6], they found that 5.42% of children in their sample met diagnostic criteria for self-reported PTSD. Further, they found that rates of self-reported PTSD were higher in younger children than in older children (9.2% in 9-12 year-olds; 4.2% in 13-15 year-olds; 3.1% in 16-19 year-olds).

Various factors besides age have been hypothesized to account for differences in children's reactions to disaster. These include degree of exposure to the event[7], race and gender[4], premorbid mental health[8], the ability of the community to offer support[9], and whether or not children were separated from their parents[3]. Data regarding the relevance of these factors for postdisaster

adjustment is only beginning to accrue, and some of this evidence is contradictory.

For example, Milne[10] found that children who were evacuated after cyclone Tracy in Australia in 1974 and who did not return were more detrimentally affected than children who did not evacuate or who evacuated and returned. These results are consistent with an hypothesis that evacuees who did not access the community support available to non-evacuees fared worse. In contrast, Najarian[11] found that children who experienced the Armenian earthquake of 1988 and remained in the earthquake zone manifested a higher incidence of PTSD than did children who experienced the earthquake but relocated out of the disaster zone. A number of factors may contribute to these contrasting findings including whether children were separated from their parents and whether and what kind of psychosocial interventions children participated in after the disaster.

In their comprehensive review of psychological interventions with children after natural disaster, Vernberg and Vogel[12] conclude, "So little outcome research exists in the disaster literature that there is little solid evidence to support (or question) the different treatment recommendations in terms of efficacy, or even to demonstrate that any of the interventions have important effects on child and adolescent adjustment." (p. 496) Nevertheless, interventions are applied to children and adolescents after disasters in an effort to mitigate postdisaster psychological morbidity. School-based interventions have included story-telling, art projects, role playing, group projects, coloring books, structured play activities, and "debriefing." [13-16]

We are aware of only two intervention studies which have compared treated to untreated groups of children following disaster. Yule[17] compared twenty-four 14-year-old girls receiving small group debriefing interventions with girls not receiving the intervention. Both groups had witnessed, a few weeks earlier, the deaths of two seamen in a cruise ship accident, and experienced an ensuing chaotic evacuation. At a five month followup assessment, Yule[17] found that treated girls had significantly lower scores on the Impact of Event Scale[18] and a fear survey than untreated girls, but did not differ on measures of anxiety and depression. In a study of school-based intervention by mental health professionals, Galante and Foa[19] provided seven one-hour group therapy sessions over the course of a year to first through fourth graders in one Italian village following an earthquake. Following treatment, these children earned lower scores on a measure of "risk for antisocial or neurotic tendencies" than did children from a neighboring village who had experienced the earthquake but had not received intervention.

The Current Study

On September 11, 1992 Hurricane Iniki, a category 4 storm, struck the island of Kauai, Hawaii. The hurricane carried sustained winds of 145 miles per hour with gusts up to 175 mph. Seventy-one percent of homes on the island were damaged or destroyed. Damage was estimated to be close to two billion dollars. The entire community was affected.

Research reported here was designed to address three questions.

(1) What was the incidence of PTSD symptoms among elementary-school-aged

children on Kauai following Hurricane Iniki? Was it comparable to rates reported by Lonigan and his colleagues? What was the incidence among first through fourth graders, a group not studied by Lonigan?

(2) Did incidence of PTSD symptoms differ between children who were evacuated from the island postdisaster and non-evacuees? If yes, in what direction?

(3) Did the large-scale school-wide interventions implemented on Kauai in the weeks following the hurricane mitigate incidence and severity of PTSD symptoms in children who participated in the interventions compared to those who did not?

It was hoped that data relevant to questions (2) and (3) might contribute to decisions regarding evacuation and psychological interventions following future natural disasters.

METHOD

Subjects

Four hundred fifty-two children from grades one through six comprised the sample. All the children had experienced Hurricane Iniki on Kauai, the island over which the eye of the storm had passed. The children ranged in age from six to 12 years of age (Mean = 8.9, S.D. = 1.77). With permission from the Hawaii Department of Education (DOE) and the principals of the individual schools, data were obtained from students in two schools on Kauai to which investigators had access (Koloa Elementary: N = 236 (52.2% of sample) and Kapaa Elementary: N = 181 (40.0% of sample)) and from 20 schools on the islands of Oahu and Hawaii

(N = 35 (7.7%of sample)). At Koloa Elementary, all students were potential participants. At Kapaa Elementary, two classrooms from each of grades 2 - 6, and one classroom from grade 1 volunteered participation. Potential participants on Oahu and Hawaii were identified from DOE lists of students from Kauai schools who had transferred to off-Kauai schools after the hurricane. A passive consent procedure was utilized wherein letters describing the study were sent to parents under school principal and project principal investigator signatures. Parents were asked to return a form included in the letter within 10 days if they did not want their children to participate in the study. If no form was returned, it was assumed that the parent consented to their child's participation. A total of 42 parents, 40 from Kapaa Elementary, withheld consent.

Slightly over half the children were boys (56.9%). Information on ethnicity, as reported by their classroom teachers, was available for 440 children. The primary groups represented were Caucasian (21.8%), Hawaiian or part-Hawaiian (20.7%), Filipino (19.8%), Japanese (8.9%), and a category comprised of children with mixed ethnicity (24.5%). The remaining 19 children comprised such small samples of their ethnic groups that they were not included in analyses involving ethnicity. Other ethnicities reported were Other Asian (3), African American (2), Hispanic (6), and Other (8).

In order to address the hypotheses of interest, the 452 children were divided into a group who had been evacuated off Kauai in the two weeks following the hurricane (N = 35) and a group who remained on Kauai (N = 417). The sample

was further divided into a group that received hurricane-related classroom interventions in the week following their return to school (N = 399; 88.5%) and a group who did not (N = 52). Most of the evacuated children did not receive intervention (N = 26). Information regarding intervention was not available for one evacuated child. Children in the no-intervention group who remained on Kauai were, for the most part, absent on the days classroom interventions were conducted.

Interventions were unsystematic and varied in intensity, modality, and mode of delivery. Possible interventions included allowing children to describe and talk about their hurricane experiences in class, drawing what happened and how they felt, utilizing a hurricane coloring book, other art projects, singing about the disaster, researching and writing about hurricanes, and acting out various vignettes about the hurricane experience. In one school (Koloa Elementary) the school counselor personally conducted the classroom exercises, in another (Kapaa Elementary) classroom teachers performed this function in consultation with counselors. On Oahu and Hawaii, counselors met individually with children if, in their assessment, the children evinced emotional or behavioral difficulties.

Measures

In order to maximize comparability across studies, we used instruments and procedures in the current research which were similar to ones used by Lonigan and his colleagues[4,5] in their large-scale evaluation of children following Hurricane Hugo. Therefore, in addition to information regarding age, gender, grade, and teacher-

rated ethnicity, the following two measures were administered.

Revised Children's Manifest Anxiety Scale (RCMAS)[20]. The RCMAS is a 37-item true/false self-report measure of trait anxiety. It was obtained as an estimate of children's pre-hurricane (i.e., trait) levels of anxiety. This instrument has been demonstrated to have adequate psychometric properties and is widely used.

Child Reaction Inventory (CRI). Children completed a child adaptation of the self-report version of the Frederick's Reaction Index[6]. Wording of the instrument was slightly altered for this study to make it specific to Hurricane Iniki and to facilitate comprehension by the relatively young children assessed in this study. The result was a 34-item scale designed to measure presence or absence of symptoms of PTSD as defined in the DSM-III-R[21]. Each item was rated on a five-point scale (i.e., 1 = No, 2 = A little of the time, 3 = Some of the time, 4 = Much of the time, 5 = Almost all the time).

Frederick[6] reported that the correlation between Reaction Index scores and diagnosed cases of PTSD was 0.91 for children and 0.95 for adults. Using an interview version of the RI, Pynoos[7] found that scores of children who were victims of or had witnessed violence were correlated to their degree of exposure to the traumatic event. Lonigan[4,5] administered Reaction Index questionnaires to over 5,600 fifth- through eleventh-graders who had experienced Hurricane Hugo and found that self-reported PTSD symptoms were related to levels of trait anxiety, emotional reactivity during the hurricane, and exposure to the hurricane and its effects. In the current study, the CRI showed high overall internal consistency

(alpha = .848), but lower internal consistency for item clusters reflecting the Intrusion, Avoidance, and Arousal symptoms of the DSM-III-R PTSD diagnosis (alpha = .728, .401, and .581, respectively).

Procedure

Questionnaires were administered approximately three to four months after Hurricane Iniki during December 1992 and January 1993. For children assessed on the island of Kauai, participating homeroom teachers administered the RCMAS and the CRI to their entire classrooms. Teachers read each item to their students, and the children marked their responses on sheets which included the questions. A visual analogue was used to provide children with a concrete representation of the five response categories for each question on the CRI. The questionnaires from those students whose parents had declined their participation were later removed and destroyed by research staff without further examination. Since there were so few such students, we felt that this way of handling the data would be less likely to single out and possibly stigmatize the nonparticipants in the class than would excluding them from taking the questionnaires. For children assessed off Kauai (the Evacuation group), researchers went to the children's new schools and administered questionnaires to the children in groups of one to four students. This procedural variation was necessary for the evacuated children because we felt the small number of such children in each off-Kauai school made classroom-wide administration untenable. Procedures were otherwise identical for both evacuated and nonevacuated groups.

Children's responses on the CRI were scored in two ways. One way followed the scoring of Lonigan et al.[4,5] wherein individual CRI items were identified for their correspondence to DSM-III-R symptoms of PTSD. Two groups of six items each were judged to correspond to Criterion B and D symptoms, and a group of seven items to Criterion C symptoms. A symptom was judged to be present if the child endorsed "Much of the time" or "Almost all the time." A symptom was judged to be absent if the child endorsed "No," "A little of the time," or "Some of the time." From this scoring and using the cutoffs dictated by DSM-III-R, children were classified as manifesting a "self-reported posttraumatic-stress-disorder-like syndrome" ("self-reported PTSD") or not. Because structured clinical diagnostic interviews were not used and because intensity and duration of symptoms parameters were not obtained, PTSD diagnoses could not be made. An alternative scoring method assigned values of one through five to responses of "No" through "Almost all the time," respectively. These values were then summed across the 19 items corresponding to DSM-III-R symptoms to give a continuous posttrauma score or scores for each grouping of items representing reexperiencing, avoidance, and arousal dimensions of symptoms.

RESULTS

Subjects

Children in the two Evacuation groups did not differ significantly in grade ($t = 1.9$, $df = 450$, $p > .06$), total raw score on the RCMAS ($t = 1.62$, $df = 450$.

$p > .10$), grade distribution ($\chi^2 = 3.06$, $df = 2$, $p > .21$), or gender ($\chi^2 = 1.06$, $df = 1$, $p > .30$). The two groups differed in age ($t = 2.34$, $df = 450$, $p < .05$), with mean age for evacuated children being slightly lower, and ethnicity ($\chi^2 = 11.49$, $df = 4$, $p < .05$), with the evacuated group having proportionately more part-Hawaiian and mixed ethnicity children, and fewer Caucasian and Japanese children (Table 1). Children in the two Intervention groups did not differ significantly in age ($t = 1.16$, $df = 449$, $p > .24$), grade ($t = 0.9$, $df = 449$, $p > .36$), total RCMAS raw score ($t = 0.25$, $df = 449$, $p > .80$), grade distribution ($\chi^2 = 1.85$, $df = 2$, $p > .39$), gender ($\chi^2 = 1.90$, $df = 1$, $p > .16$) or ethnicity ($\chi^2 = 7.54$, $df = 4$, $p > .10$) (Table 1).

Insert Table 1 About Here

Dichotomous Self-Reported PTSD

Some children gave no response to some items on the Children's Reaction Index. For those children with missing data for whom sufficient information was available to classify them as having self-reported PTSD by the criteria outlined above, they were included in the PTSD group. Other cases with missing data were included in the no-PTSD group. It is possible, therefore, that some children with missing data who would otherwise have met PTSD criteria were included in the no-PTSD group.

Forty-three of 452 children (9.5%) met criteria for self-reported PTSD. This prevalence rate was not significantly related to gender ($\chi^2 = 1.32$, df = 1, $p > .25$) or ethnicity ($\chi^2 = 2.23$, df = 4, $p > .69$). Rate of self-reported PTSD was significantly related to grade ($\chi^2 = 13.49$, df = 2, $p < .002$). Post hoc 2 x 2 chi-square analyses revealed that children in grades 5 and 6 experienced lower rates of self-reported PTSD than did children in either grades 1 and 2 or grades 3 and 4 (3.3% vs. 14.5% and 12.8%, respectively). The two younger grade groups did not differ significantly from each other. Correspondingly, children with self-reported PTSD were significantly younger than children without self-reported PTSD (8.00 (s.d. = 1.53) vs. 9.09 (s.d. = 1.76), respectively; t = 13.32, df = 409, p = .0003). The self-reported PTSD group reported significantly more trait anxiety on the RCMAS than did the non-PTSD group (13.47 (s.d. = 6.49) vs. 11.43 (s.d. = 6.16), respectively; t = 4.21, df = 451, $p < .05$).

Counter to expectations, classroom intervention was not significantly related to prevalence of self-reported PTSD ($\chi^2 = 0.34$, df = 1, $p > .55$) with 9.0% (36/399) of the children who received and 11.5% (6/52) of those who did not receive classroom interventions reporting PTSD-like syndrome. Neither was evacuation significantly related to self-reported PTSD ($\chi^2 = 1.00$, df = 1, $p > .32$) with 9.1% (38/417) of the non-evacuees and 14.3% (5/35) of the evacuees reporting PTSD-like syndrome.

As a check, children with missing data who were classified as non-PTSD were dropped from the sample and the same analyses were recalculated. Because

of the decreased sample size, rate of self-reported PTSD increased to 14.2% (43/303). The results of the analyses reported above were otherwise unchanged.

Continuous Scoring of Self-Reported PTSD Symptoms

Two-by-two analyses of variance with Intervention (Yes/No) and Evacuation (Yes/No) as independent variables were conducted on the total score for the Children's Reaction Index as well as on the scores for each of the three CRI subscales. Because of missing data, degrees of freedom varied depending on the dependent measures being analyzed. None of the main effects or interactions on any CRI scores were statistically significant (for Intervention and Evacuation, respectively, Total CRI: $F(1,299) = 0.001$, $p > .97$; $F(1,299) = 0.535$, $p > .46$; Intrusion: $F(1,329) = 0.668$, $p > .41$; $F(1,329) = 0.014$, $p > .90$; Avoidance: $F(1,413) = 0.831$, $p > .36$; $F(1,413) = 3.54$, $p = .06$; Arousal: $F(1,419) = 0.300$, $p > .58$; $F(1,419) = 0.138$, $p > .71$). The main effect for Evacuation on Avoidance scores was near significant ($p = .06$). Because the two evacuation groups differed in age, an analysis of covariance with age as a covariate was performed in order to statistically control for the possible confounding effect of age on Evacuation. The ANCOVA revealed that when age was taken into account, the main effect for Evacuation on Avoidance scores was not significant ($F(1,412) = 1.484$, $p > .22$).

Mirroring the results of analyses conducted on the dichotomous data, total CRI scores were significantly correlated with age ($r = -.25$, $p < .001$; $-.28$, $p < .001$; $-.32$, $p < .001$; $-.20$, $p < .001$ for Total score and Intrusion, Avoidance,

and Arousal subscales, respectively). ANOVA's conducted on CRI total and subscale scores revealed that grades differed significantly from each other on total and subscale scores ($F(5, 303) = 4.67$, $p = .0004$; $F(5, 328) = 5.79$, $p < .0001$; $F(5,412) = 9.14$, $P < .0001$; $F(5, 418) = 3.77$, $p < .003$ for Total, Intrusion, Avoidance, and Arousal, respectively). Post hoc comparisons using the Scheffe test at the .05 significance level indicated that for total CRI and Intrusion subscale scores, grades one and three differed significantly from grade six. For the Avoidance subscale, grades one, two, and three differed from grade six, and grade two also differed from grade 5 significantly. For the Arousal subscale, grade one differed significantly from grade six (see Table 2).

Insert Table 2 About Here

Examination of relationships between CRI symptom scores and demographic variables reveals that besides age, only School was a significant factor, and then only on the Arousal subscale ($F(2, 421) = 3.25$, $p < .04$). Scheffe test indicated that Kapaa Elementary students earned significantly higher Arousal scores than Koloa Elementary. The two schools also differed in mean age of students sampled ($F(1, 408) = 4.88$, $p < .03$) with students at Kapaa being, on average, older than those at Koloa. Therefore, ANCOVA was used to compare Arousal subscale scores between Kapaa and Koloa schools while statistically controlling for age differences by using age as a covariate. Results of this analysis reveal that, even with age

differences accounted for, the schools differed significantly on their students' Arousal subscale scores ($F(1, 387) = 7.99$, $p = .005$; adjusted means for Kapaa: 13.06, Koloa: 11.74).

DISCUSSION

The overall prevalence rate for self-reported PTSD found in this sample, 9.5%, is higher than that reported by Lonigan's[4,5] group for Hurricane Hugo. The children assessed in Hawaii were younger than those studied by Lonigan. When we compared the PTSD prevalence rates for the Hawaii and South Carolina children who were comparable in age (i.e., 9-12-year-olds), we found, in fact, that Hawaii's children had a lower rate of self-reported PTSD (6.0% in Hawaii vs. 9.2% in South Carolina). This finding may reflect the actual prevalence rates, or it may be associated with culture-specific response biases wherein Asian/Pacific Islander cultures underreport psychiatric symptoms.[22]

Another difference between the current data and Lonigan's study is that no statistically significant relationships between gender or ethnic differences and PTSD prevalence or patterns of symptom expression were found in the Hawaii sample. However, our data replicated Lonigan's finding of a strong relationship between prevalence of PTSD and age, with younger children reporting higher rates of PTSD and higher intensity of symptoms. The current work extended this finding downward to include six through eight-year-old children. Again, there is a question about whether this is a valid finding or whether it is influenced by response bias or

limitations of younger children to adequately complete self-report instruments, even with teacher guidance.

The results of comparisons between evacuees and non-evacuees were somewhat surprising. We found no statistically significant differences between these groups either on rates of PTSD or when analyzing CRI scores, although the data showed a trend for evacuees to have higher rates and scores. This trend suggests that evacuation after Hurricane Iniki may have had a detrimental effect on children's postdisaster adjustment. It is unclear whether this could have been due to being deprived of established social support in the home community, separation from parents, or not participating in the "honeymoon" recovery phase in the days immediately following the hurricane.

Similarly and contrary to our expectation, no statistically significant differences in PTSD prevalence or CRI scores were found between children who received school-based interventions and those who did not. Again, there was a trend in the expected direction, but we expected a much stronger effect. This lack of a finding certainly requires further exploration and replication. It may be related to a number of factors including but not limited to (1) perhaps the interventions employed indeed are ineffective at alleviating postdisaster adjustment difficulties; (2) more systematically planned and implemented interventions employed by trained personnel (such as that used by LaGreca[23] and colleagues in Florida after Hurricane Andrew) may have been more effective; (3) the comparison groups studied were not randomly assigned to treatment so that some preexisting

differences in the groups may have compromised the data. For example, perhaps the children who did not receive intervention because they did not attend school after the hurricane had fewer or milder adjustment problems than children who did attend school; and (4) perhaps the children who did not participate in school-based intervention received help from community-based agencies and programs.

Children at Kapaa Elementary earned significantly higher scores on the CRI Arousal subscale only. This finding is somewhat puzzling and, because it does not generalize across subscales, is probably not related to implementation or intervention differences. Rather, this difference may be attributable to the more extensive hurricane-related damage suffered by Kapaa and its school than by Koloa.

Further research should address whether posthurricane adjustment was mediated by exposure to the hurricane, or family and social support-related variables; by receiving any community-based interventions; should obtain larger samples of evacuees and assess which of these were separated from their parents and which evacuated with their parents, as well as whether there were differences between evacuees who returned to the disaster site vs. those who never returned; and should evaluate the effects of more systematic postdisaster interventions employing trained personnel using a structured treatment protocol.

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Table 1

Demographic characteristics of Intervention x Evacuation groups

Characteristic	Intervention[a]				Overall[a]			
	Yes		No					
	Evacuation		Evacuation		Intervention		Evacuation	
	No	Yes	No	Yes	No	Yes	No	Yes
Age								
Mean	8.97	8.13	9.08	8.23	8.65	8.96	8.98	8.26
SD	1.76	1.89	1.79	1.73	1.79	1.77	1.76	1.74
Gender (%)								
Male	58.3	50	46.2	50	48.1	58.1	57.6	48.6
Female	41.7	50	53.8	50	51.9	41.9	42.4	51.4
Grade (%)								
1	12.3	37.5	11.5	19.2	15.4	12.8	12.2	22.9
2	14.1	0	15.4	23.1	19.2	13.8	14.1	17.1
3	15.3	12.5	3.8	15.4	9.6	15.3	14.6	14.3
4	17.4	12.5	34.6	11.5	23.1	17.3	18.5	14.3
5	20.2	25	7.7	19.2	13.5	20.3	19.4	20
6	20.7	12.5	26.9	11.5	19.2	20.6	21.1	11.4

Table 1, cont.

Characteristic	Intervention[a]				Overall[a]			
	Yes		No					
	Evacuation		Evacuation		Intervention		Evacuation	
	No	Yes	No	Yes	No	Yes	No	Yes
Ethnicity (%)								
Caucasian	21.1	0	46.2	15.4	30.8	20.7	22.7	11.4
Hawaiian	20.3	37.5	11.5	30.8	21.2	20.7	19.8	31.4
Filipino	19.8	0	26.9	19.2	23.1	19.4	20.2	14.3
Japanese	10.3	0	0	0	0	10.1	9.6	0
Other Asian	0.5	0	0	3.8	1.9	0.5	0.5	2.9
Hispanic	1.6	0	0	0	0	1.6	1.5	0
African-American	0.5	0	0	0	0	0.5	0.5	0
Mixed	23.7	62.5	15.4	0	23.1	24.5	23.2	40
Other	2.1	0	0	0	0	2.1	2	0
Total RCMAS								
Mean	11.52	14.63	11.00	12.62	11.81	11.58	11.47	13.26
SD	6.17	5.58	6.38	6.74	6.55	6.17	6.18	6.45

[a]Totals may not match because intervention status was unknown for one child.

Table 2
Means and standard deviations on CRI Total, Intrusion, Avoidance, and Arousal Scores for each grade*

	Grade					
CRI Scale	1	2	3	4	5	6
Total						
Mean	43.5[a]	40.8	44.2[b]	39.6	40.4	34.7[a,b]
SD	11.9	9.9	11.2	12.0	11.7	10.4
Intrusion						
Mean	13.9[a]	11.9[b]	13.6	12.0	11.8	9.5[a,b]
SD	6.3	4.3	4.6	4.7	5.4	4.0
Avoidance						
Mean	16.6[a]	17.3[b,c]	15.9[d]	14.9	14.6[c]	13.0[a,b,d]
SD	4.6	4.1	4.5	4.8	4.1	4.2
Arousal						
Mean	13.5[a]	12.8	12.8	12.9	12.3	10.6[a]
SD	4.3	4.1	5.1	4.7	4.9	3.8

*Shared letters indicate differences significant at the .05 level.