Adolescent Trauma and Smoking Behaviors

By Michael Burrows, Elizabeth Frankenberg, and Cecep Sumantri

Exposure to traumatic events may result in the adoption of risky behaviors, if such behaviors constitute a coping strategy or if exposure to trauma changes individuals' preferences regarding risks. In this paper we will use data from before and after the 2004 Indian Ocean tsunami to examine how smoking behaviors are affected by exposure to an unanticipated and traumatic natural disaster. We draw on data from a unique longitudinal panel survey implemented in the Aceh and North Sumatra provinces of Indonesia before and after the 2004 Indian Ocean tsunami.

The 2004 Indian Ocean Tsunami

On December 26, 2004 the Sumatra-Andaman earthquake occurred in the Indian Ocean. The quake ruptured a 1200-mile segment of the ocean floor and generated a tsunami surge that slammed into the island of Sumatra. The event took a heavy toll on human life. An estimated 160,000 people perished when the tsunami hit - roughly 4% of the population of Aceh, the province most severely affected.

Exposure to the tsunami was not uniform along the coast: instead, complex interactions of slope, wave type, water depth, and coastal topography determined the force and extent of water inundation (Romakrishnan 2005). Many individuals lost their lives, and many survivors in exposed communities lost homes, businesses, and other assets when the tsunami struck land. Others endured the psychological trauma of watching family, friends and neighbors struggle and perish.

Data

STAR is a multiwave longitudinal study that draws on a subset of respondents to the 2004 National Socioeconomic Survey (SUSENAS), implemented 10 months before the tsunami. With Statistics Indonesia assistance, we fielded the first wave of STAR between May 2005 and July 2006. Survey teams sought to recontact roughly 30,000 individuals originally interviewed in 6900 households in 487 enumeration areas in Aceh and North Sumatra. These communities span a continuum of damage, from near complete destruction to no direct damage from the tsunami (though these may have experienced earthquake damage).

The first post-tsunami interview took place in 2005/06. Additional follow-ups were conducted annually through 2010 and again in 2014. We established survival status for roughly 98% of the original respondents. Among survivors, 96% were reinterviewed in at least one post-tsunami resurvey. Detailed demographic and socioeconomic data was collected on individuals, their families, and community leaders. Communities were stratified into three damage classifications based on triangulation across satellite imagery, surveyor reports, and informant interviews (Gillespie et al. 2009).

Background

Smoking is one behavior that confers strong risks of health problems, but that is relatively common and that is easy to observe in that stigmas regarding smoking are weak. In Indonesia, smoking is widespread, and people will report that they do it, unlike drug use or risky sexual practices.

Our analysis considers how exposure to the tsunami is related to smoking behaviors along two dimensions. First, we compare rates of uptake between exposed and unexposed individuals. Second, we compare smoking volume among exposed and unexposed smokers. This approach follows a literature examining smoking prevalence and volume related to trauma exposure (Hapke et al. 2005, Parslow and Jorn 2006, Roberts et al. 2008).

With the data from STAR we can consider exposure at the community level as well as individual-level exposure on smoking behavior. As mentioned above, the community-level measure of exposure is developed from a combination of satellite imagery, "ground-truthing" (reports from supervisors in the field shortly after the disaster), and interviews with community leaders who described the destruction to the built and natural environment. This damage measure is connected with a respondent's reported location at the time of the pre-tsunami SUSENAS baseline.

Individual exposure and trauma is more commonly studied in the literature, particularly in the body of work evaluating the relationship between exposure, PTSD, depression, and smoking patterns (Feldner et al. 2007; McLernon et al. 2005; Beckham et al. 1997; Adams and Galea 2005; Acierno et al. 2000; Breslau et al. 1991; Steuber and Danner 2006). In much of this literature, smoking is thought of as a coping mechanism for stress and anxiety (Brandon 1994; Koval and Pederson 1999).

Beyond serving as a coping mechanism, smoking behaviors may change after exposure to the tsunami because individuals shift their attitudes about risk. For example, using STAR data, Ingwersen (2014) finds evidence of increased appetite for risk after the tsunami.

Approach
STAR collects information about age at which individuals start smoking, smoking status at each resurvey, and number of cigarettes smoked per day among current smokers at each resurvey.[1] These data permit us to observe smoking rates in great detail

Surveys of smoking habits in Indonesia regularly indicate that over two-third of Indonesian men smoke. Our data suggest very high rates in Aceh. Figure 1 shows rates of ever smoking from 2004 through 2009 (the most recently completed resurvey) for 10-21 year old males in our sample, divided into four age groups.[2,3] For all age groups smoking appears to increase somewhat between 2004 and 2005. Among 19-21 year olds, smoking is nearly universal, with rates between roughly 85 and 90%. Smoking rates increase particularly rapidly among 13-15 year olds but continue increasing throughout adolescence We turn next to whether uptake of smoking or volume of smoking is related to two different measures of exposure. The first is community-level exposure to the tsunami as measured by satellite imagery, supervisor reports, and interviews with community leaders. The second is individual-level exposure, based on respondent reports of having witnessed friends or family members struggle or perish in the waters.[4]

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[1] Age of first smoking is collected in 2008 and thereafter, so reports of this nature are to a greater or lesser extent retrospective. Age of first smoking is imputed for 7.1% of the smokers aged 10-21. Imputation is based upon initial reports of smoking.

[2] Smoking is extremely uncommon among women in Aceh, so women are excluded from our analysis.

[3] All references to age refer to respondent age at the time of the tsunami.

[4] This measure is combines information from several questions about what events were witnessed during the tsunami. Sample sizes between the two stratifications are somewhat different (~130 respondents) due to some non-response to exposure measures.

Figure 1: Smoking Rates
By year and age group
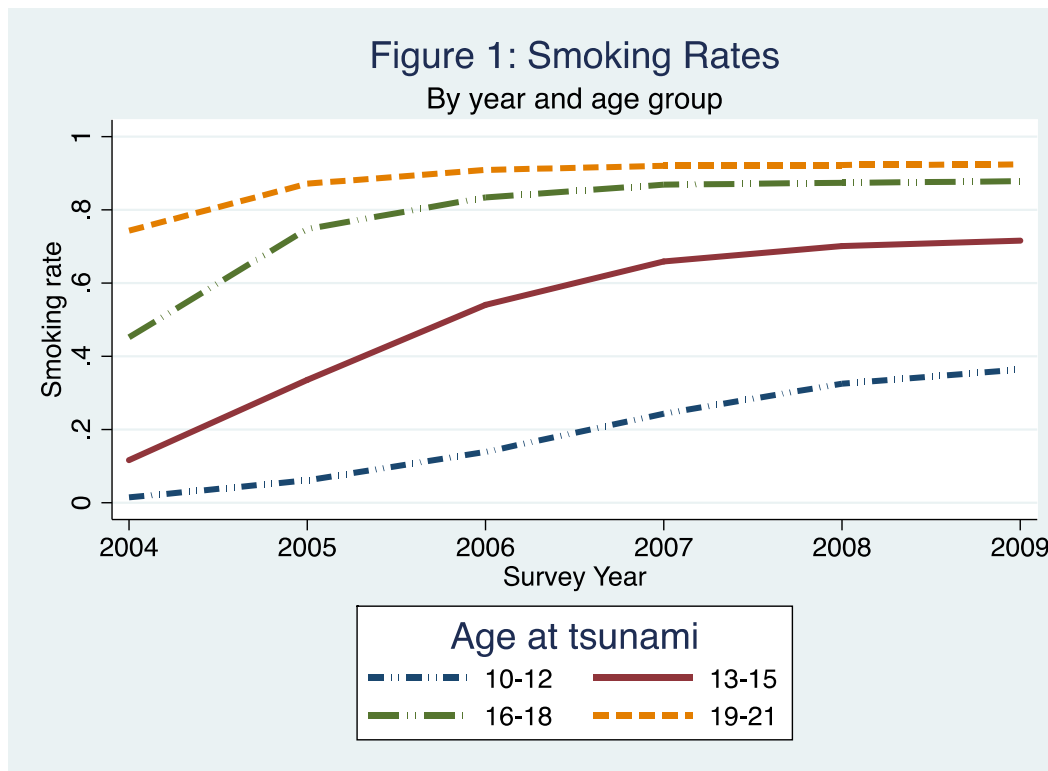
Smoking Uptake

Based on the results in Figure 1, we now turn to smoking uptake, highlighting results for those 10 to 12 – individuals in early stages of adolescence. STAR data permit us to explore in great detail the smoking habits of survey respondents. Figure 2 shows raw changes in smoking status among males age 10 to 12 at the time of the tsunami, stratified by community-level exposure and individual-level exposure. Just after the tsunami in 2005 and not controlling for any factors, smoking rates were roughly equivalent between groups of 10 to 12 year olds in exposed and unexposed communities. However, when using our measure of individual exposure we observe a large and significant difference of around 7 percentage points by 2006 (z=-1.5). By 2009 smoking rates more or less converge.

Table 1 shows the results of linear probability models exploring the relationship between exposure and overall smoking uptake by 2009. We test exposure using four models. Model 1 (based on the largest analytical sample) and is based upon the community measure described above. Model 2 utilizes the individual measure of exposure based upon a respondent witnessing family or friends struggling against the waves. Model 3 is a more direct individual measure of experiencing the death of a family member at the time of the tsunami. Model 4 models the outcome as a result of having lost a father as a result of the tsunami. Models 3 and 4, which involve family death, are restricted to areas of heavy damage (hence the much smaller sample size), since the vast majority of loss of human life occurred in these communities.

We control for age (including age and exposure interactions where possible), pre-tsunami household per capita expenditure, school enrolment, mother's education, and father's smoking status. Testing with these models, the most individually specific model - death of a father - has a large, positive influence on smoking uptake ($\beta=0.21$, se=0.1). Other, more general measures of exposure are not significant. This suggests that post-tsunami household dynamics in households affected by the tsunami could have an important role on smoking behaviors, while broad community-level exposure to the disaster did not promote smoking uptake in a meaningful way.

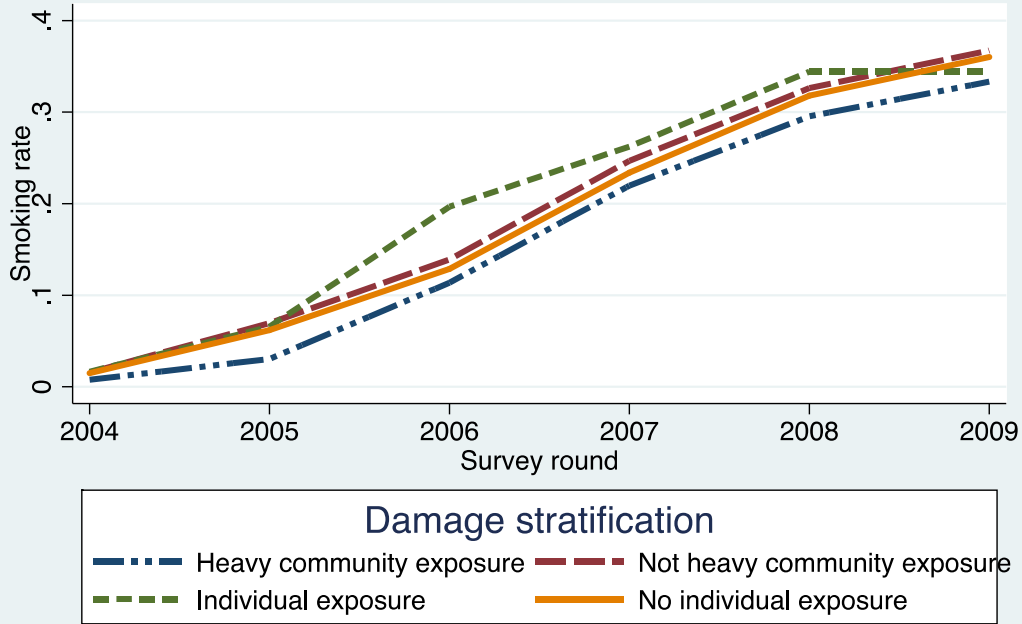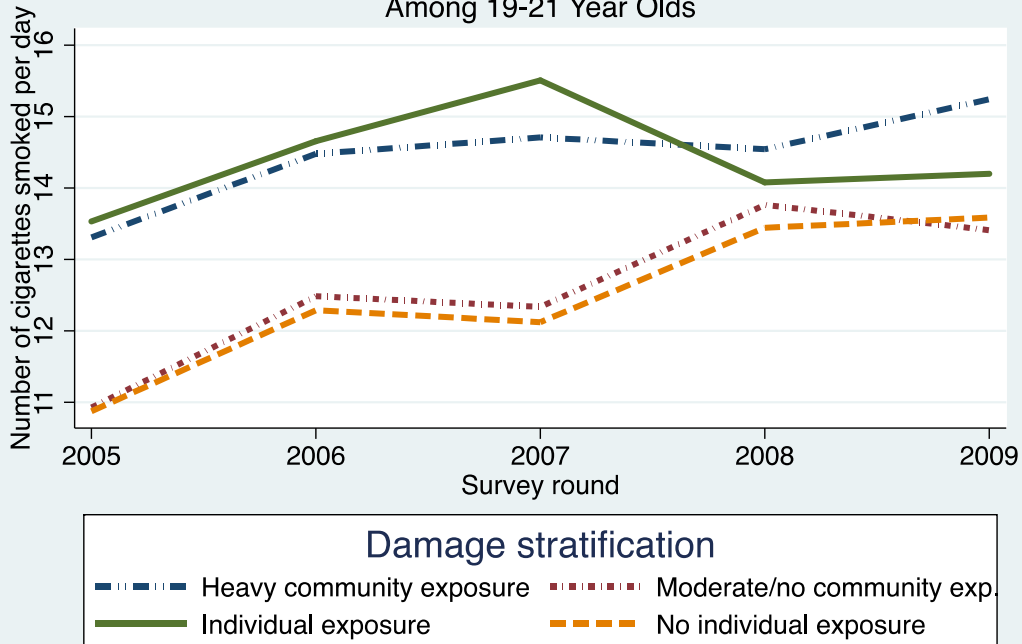## Figure 2: Smoking Uptake After the Tsunami
Among 10-12 Year Olds

Damage stratification
- Heavy community exposure
- Not heavy community exposure
- Individual exposure
- No individual exposure

Figure 3: Smoking Volume After the Tsunami
Among 19-21 Year Olds

Damage stratification
- Heavy community exposure
- Moderate/no community exp.
- Individual exposure
- No individual exposure

Smoking Volume
In Figure 3 we observe differences in smoking volume along the same stratifications. In both cases, there is a difference of roughly 2 cigarettes per day between the two groups. The gap in amount smoked widens then narrows over time. In 2005, both differences are statistically significant (for community-level exposure, t= -2.26; individual-level exposure, t= -2.31).

Table 2 shows the result of linear regressions testing the effect of tsunami exposure on the number of cigarettes smoked per day among all smokers using the same model described above. People living in communities heavily damaged by the tsunami on average smoke roughly 2 cigarettes per day more than people in other communities (β=2.0, se=0.7). This represents an increase of around 20%.[5] Witnessing of events is not significant in this model, but losing a family member of any type suggests a similarly increased intensity of smoking (β=1.8, se=0.9).

Plans for Developing the Paper
The preliminary results presented above provide early evidence of some increase in smoking uptake among males who lost their father in the tsunami. Additionally, we find an increase in smoking intensity among individuals living in communities hit by the tsunami as well as those who experienced the loss of a family member.

These findings are a promising foundation for further exploiting the richness of STAR data to explore the relationship between trauma and smoking. First, the literature suggests an important role of household members on influencing smoking behaviors (Chandola, Head and Bartley 2013; Mckinney et al. 1997). Using STAR's detailed data on household composition, we can observe how family relationships influences smoking behavior. Second, the literature stresses the importance of PTSD and depression as mediators for trauma (Roberts et al. 2009; Shalev et al. 1998; Lime et al. 1991). STAR has numerous measures of PTSR and depression which can be included in the analysis to better understand how this mediating relationship may function. Third, the risk preferences approach suggests that changes to risk preferences after a shock may be temporary. We will consider changes in uptake over each year of data and observe more closely where differences are greatest, and how extensively the effect weakens or strengthens over time. Finally, the 10-year resurvey is currently in the field and will be providing new data for analysis. These data will make it possible to better understand the behavior of individuals already in our analytical sample, and to see how the trauma associated with the tsunami may have affected children younger than 10 at the time in terms of their adoption of risky behaviors.

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[5] This result is robust to restricting the sample of communities to those experiencing heavy damage compared to those experiencing none (results not included).

Table 1: Smoking Uptake by 2009

	(1) Community	(2) Individual (witness)	(3) Individual (family death)	(4) Individual (father death)
	coef/se	coef/se	coef/se	coef/se
Constant	0.925***	0.859***	2.007***	1.906***
	(0.229)	(0.229)	(0.643)	(0.642)
Exposure	-0.025	-0.004	0.101	0.213**
	(0.084)	(0.100)	(0.063)	(0.101)
Ages 10-12	-0.339***	-0.361***	-0.324***	-0.361***
	(0.039)	(0.040)	(0.089)	(0.088)
Ages 13-15	-0.013	-0.024	-0.011	-0.009
	(0.040)	(0.041)	(0.089)	(0.089)
Ages 16-18	0.089**	0.068	0.012	0.026
	(0.042)	(0.043)	(0.094)	(0.093)
Ages 19-21	[omitted]	[omitted]	[omitted]	[omitted]
Exposure*Ages 10-12	0.010	-0.004		
	(0.094)	(0.117)		
Exposure*Ages 13-15	0.035	0.018		
	(0.095)	(0.116)		
Exposure*Ages 16-18	-0.042	-0.006		
	(0.101)	(0.122)		
Exposure*Ages 19-21	[omitted]	[omitted]		
Log PCE (2004)	-0.026	-0.022	-0.104**	-0.095*
	(0.017)	(0.017)	(0.049)	(0.049)
Enrolled in School (2005)	-0.070***	-0.081***	-0.142***	-0.132**
	(0.020)	(0.021)	(0.052)	(0.052)
Mother's Ed: none	[omitted]	[omitted]	[omitted]	[omitted]
Mother's Ed: up to junior high	0.010	0.031	0.036	0.036
	(0.035)	(0.030)	(0.079)	(0.079)
Mother's Ed: high school or more	-0.073**	-0.042	-0.073	-0.078
	(0.037)	(0.033)	(0.082)	(0.082)
Father ever smoker	0.158***	0.172***	0.065	0.078
	(0.041)	(0.043)	(0.099)	(0.099)
Father ever smoker (missing)	0.165***	0.181***	0.035	-0.020
	(0.047)	(0.049)	(0.109)	(0.113)
N	2,316	2,273	372	372
r2	0.150	0.154	0.183	0.187
F	31.139	31.749	8.061	8.284

note: *** p<0.01, ** p<0.05, * p<0.1

Table 2: Smoking Volume by 2009

	(1)	(2)	(3)	(4)
	Community	Individual (witness)	Individual (family death)	Individual (father death)
	coef/se	coef/se	coef/se	coef/se
Constant	12.780***	14.081***	-2.948	-2.087
	(3.942)	(4.056)	(11.044)	(11.168)
Exposure	2.028***	0.736	1.816*	0.343
	(0.745)	(0.833)	(0.954)	(1.458)
Ages 10-12	-5.237***	-5.816***	-6.720***	-7.608***
	(0.614)	(0.600)	(1.561)	(1.499)
Ages 13-15	-2.027***	-2.075***	-2.429**	-2.601**
	(0.522)	(0.531)	(1.233)	(1.240)
Ages 16-18	-0.296	-0.487	-1.325	-1.138
	(0.466)	(0.481)	(1.081)	(1.085)
Ages 19-21	[omitted]	[omitted]	[omitted]	[omitted]
Exposure*Ages 10-12	-3.145**	-1.809		
	(1.512)	(2.053)		
Exposure*Ages 13-15	-0.746	-0.196		
	(1.163)	(1.378)		
Exposure*Ages 16-18	-1.005	0.259		
	(1.117)	(1.240)		
Exposure*Ages 19-21	[omitted]	[omitted]		
Log PCE (2004)	-0.032	-0.077	1.263	1.199
	(0.300)	(0.311)	(0.859)	(0.870)
Enrolled in School (2005)	-1.204***	-1.156***	-1.173	-1.168
	(0.370)	(0.386)	(0.946)	(0.952)
Mother's Ed: none	[omitted]	[omitted]	[omitted]	[omitted]
Mother's Ed: up to junior high	0.817	0.713	2.797**	3.158**
	(0.518)	(0.480)	(1.301)	(1.342)
Mother's Ed: high school or more	0.132	0.347	1.600	2.033
	(0.589)	(0.567)	(1.426)	(1.460)
Father ever smoker	0.607	0.007	-1.301	-0.800
	(0.875)	(0.932)	(2.492)	(2.497)
Father ever smoker (missing)	0.671	0.265	0.125	0.854
	(0.925)	(0.983)	(2.556)	(2.609)
N	1,715	1,630	279	279
r2	0.092	0.091	0.168	0.157
F	13.233	12.511	5.424	5.000

note: *** p<0.01, ** p<0.05, * p<0.1