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Media Exposure to Collective Trauma, Mental Health, and Functioning: Does It Matter What You See?

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Abstract

Media exposure to collective trauma is associated with acute stress (AS) and posttraumatic stress symptoms (PTSS). Qualities of media exposure (e.g., amount, graphic features) contributing to this distress are poorly understood. A representative national sample (with New York and Boston oversamples; $N = 4,675$) completed anonymous, online surveys 2 to 4 weeks after the Boston Marathon bombings (BMB; Wave 1, or W1) and again 6 months later (Wave 2, or W2; $N = 3,598$). W1 assessed BMB-related AS and media exposure (i.e., hours of media consumption, graphic image content) 1 week post-BMB; W2 assessed PTSS, fear of future terrorism, and functional impairment. Greater exposure to graphic (bloody) images was associated with higher W1 AS and increased PTSS, fear of future terrorism, and functional impairment at W2. W1 AS, W2 PTSS, and fear of future terrorism mediated the association between media and functional impairment. Graphic image exposure is associated with mental-health symptoms linked to impaired functioning.

Keywords

media exposure, graphic images, acute stress, mental health, functioning

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> Many readers thought it was inappropriate to include an image of bloody bodies slumped over tables . . . if we avoid publishing these types of images, we contribute to obscuring the effects of violence and making debates over security and terrorism bloodless.—Takenaga (2019)

On January 15, 2019, the *New York Times* published photographs taken after a terrorist attack in Nairobi, Kenya, had left more than 20 people dead and many more injured. Readers questioned whether it was appropriate to show these graphic, bloody images in this news story. In their response, the *Times* made clear that the decision to publish a bloody photo was not taken lightly. Ideally, such decisions would be made with a body of scientific evidence to support them. Yet, even as large-scale collective traumas (e.g., mass shootings, natural disasters) have become more frequent and severe in recent decades (Blair & Martaindale, 2013; Leaning & Guha-Sapir, 2013), there is limited research to guide decision making.

Advances in technology (e.g., smartphones) combined with the advent and proliferation of social media (e.g., Twitter, Facebook) have facilitated widespread public access to media coverage of these events as they occur in real time. As a result, people the world over can now see vivid media images of potentially traumatic events 24 hr a day, 7 days a week—sometimes live and unfiltered. The growing competition among media

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sources fuels the tendency to use vivid images to lure more viewers (Lubens & Holman, 2017), leading to media displays of very graphic and potentially disturbing imagery. However, we know little about the role graphic media exposure plays in the public's response to real news (see Lang, Newhagen, & Reeves, 1996) or collective tragedy. Understanding whether and perhaps how images of real-world violence may affect media consumers is an important empirical question with potential implications for global public health (Leaning & Guha-Sapir, 2013).

Media Exposure to Collective Trauma

Media-based stories of traumatic events expand the events' boundaries from geographically constrained to virtually boundless experiences, transforming local events into widespread collective traumas (Vasterman, Yzermans, & Dirkzwager, 2015). Although access to media stories about these events may appropriately inform us about events in our world, prolonged exposure to media coverage also may serve to amplify and heighten public anxiety and fear (Holman, Garfin, & Silver, 2014). A growing body of literature suggests that with the 24-hr news cycle and ubiquitous digital news platforms, media coverage following disasters and mass violence events may have a more complex, unintended, injurious impact (Holman et al., 2014; Hopwood & Schutte, 2017; Yeung, Lu, Wong, & Huynh, 2016).

Indeed, exposure to television coverage related to the September 11 terrorist attacks (9/11) shortly after they occurred was associated with high risk for probable posttraumatic stress disorder (PTSD) and other negative emotions (Ahern, Galea, Resnick, & Vlahov, 2004; Bernstein et al., 2007; Schlenger et al., 2002). Early 9/11-related media exposure was subsequently linked to reports of higher acute stress, posttraumatic stress symptoms, and increased incidence of physician-diagnosed physical ailments over time (Silver et al., 2013). Likewise, 6 hr or more of daily media-based exposure to the Boston Marathon bombings (BMB) was associated with higher acute stress than was direct exposure to the BMB (Holman et al., 2014), with a positive, linear relationship between amount of media exposure and distress evident even at smaller doses. Moreover, media-based exposures to disaster and large-scale violence are associated with negative psychological consequences that may be cumulative (Garfin, Holman, & Silver, 2015). The importance of these findings is highlighted by a recent meta-analysis examining the impact of media exposure on psychological outcomes, demonstrating that sensitization to media-based exposures occurred in regions in which communities recently (past 5 years) experienced a similar threat (Hopwood & Schutte, 2017).

However, important questions remain about the implications of psychological distress experienced following media-based exposures to traumatic events (Houston, Spialek, & First, 2018). For example, do the symptoms experienced have a role in respondents' daily functioning following media-based exposure? We know that symptoms of anxiety and depression have been associated with functional impairment (Bryant et al., 2016; Curtiss, Ito, Takebayashi, & Hofmann, 2018; McKnight, Monfort, Kashdan, Blalock, & Calton, 2016). Yet much of what we know about the connection between distress and functioning is based on studies of individuals diagnosed with a clinical disorder (e.g., generalized anxiety disorder; see McKnight et al., 2016, for a review) or directly exposed to a traumatic event (for a review, see Bryant et al., 2016). Exposure to extensive media coverage following collective traumas may have implications for functioning in a much wider audience—the general public—if it feeds into worry and/or fear about experiencing similar events in the future and exacerbates distress (Holman & Silver, 2005). Indeed, fear of future terrorism strengthened the association between 9/11-related acute stress and subsequent cardiovascular health among individuals predominantly exposed to 9/11 via the television (Holman et al., 2008), suggesting that fear may be an important process linking media exposure with poor health-related outcomes. Yet, the specific qualities of media exposure that are associated with these outcomes following real-world events have received little attention. We address this gap by examining the relationships between characteristics of exposure to trauma-related media (e.g., amount, graphic imagery) and distress and functioning over time following a large-scale collective trauma.

Exposure to Graphic Imagery

Understanding how media imagery may contribute to distress and functioning is increasingly important as media access grows and visual coverage becomes more vivid and graphic in nature. Studies addressing graphic images in fictional media (e.g., movies, television, and video games; for a review, see Riddle, 2014) suggest that graphic images are more likely to capture viewers' attention, produce greater physiologic arousal, and evoke more negative emotions than nongraphic images (Lang et al., 1996; Riddle, 2014). The specific qualities of images deemed graphic in these studies include blood, gore, and proximity of the images (i.e., close-up rather than distant scenes of violence). However, this literature is limited by its almost exclusive focus on fictional media (Riddle, 2014).

The importance of examining the psychological correlates of exposure to graphic images in media coverage of collective trauma is highlighted by numerous studies suggesting that such imagery may serve as an "emotional amplifier" (see Holmes & Mathews, 2010, for review, p. 354). Indeed, viewing intrusive, potentially traumatic images (e.g., dead or injured victims of car accidents) can produce flashbacks through activation of areas of the brain linked to fear, visual imagery, and threat processing (Bourne, Mackay, & Holmes, 2013). Consistent with this, children exposed to media-based graphic images of war-related injury and death reported more severe concurrent posttraumatic stress symptoms than unexposed children following the first Gulf War (Nader, Pynoos, Fairbanks, Al-Ajeel, & Al-Asfour, 1993). Subsequent studies of 9/11- and Iraq War–related media exposure suggest that some images are more likely to elicit distress than others (Ahern et al., 2004; Schlenger et al., 2002; Silver et al., 2013), with images depicting severe injury or death linked to the strongest negative responses in individuals directly exposed to 9/11 (Ahern, Galea, & Resnick, 2002). Questions nonetheless remain about (a) the relative impact of quantity and content of trauma-related media exposure and (b) the relative impact of graphic and non-graphic scenes of trauma on responses. Finally, acute stress symptoms following media-based exposure to collective trauma have been associated with higher posttraumatic stress symptoms over time (Silver et al., 2013). If imagery can amplify acute emotional responses that may enhance subsequent distress, it also may play a role in developing and/or maintaining emotional disorders (Holmes & Mathews, 2010) that are linked to impaired functioning. Whether acute and/or subsequent emotional responses associated with media exposure mediate an association with functioning is an empirical question.

The Current Study

We explored the longitudinal relationships among graphic media exposure, acute stress, and subsequent mental health and functioning in a large representative national sample in the aftermath of the 2013 Boston Marathon bombings to clarify the nature of these associations. We examined whether two qualities of BMB-related media exposure—graphicness and amount—had direct and/or indirect associations with psychological symptoms that are linked with functional impairment. We addressed the following hypotheses:

> *Hypothesis 1*: Exposure to graphic (bloody) BMB-related media images will be more strongly associated with BMB-related acute stress and subsequent posttraumatic stress symptoms (PTSS), fear of future terrorism, and functional impairment assessed months later than exposure to non-graphic BMB-related (chaotic nonbloody) media images.

> *Hypothesis 2*: More frequent exposure to graphic BMB-related media images will be associated with greater BMB-related acute stress and PTSS, fear of future terrorism, and functional impairment measured months later, after controlling for key covariates (e.g., daily hours of BMB-related media, direct BMB exposure).

Finally, we explored whether the qualities of BMB-related media exposure (graphic images, amount) would be indirectly associated with subsequent impaired functioning through acute stress, PTSS, or fear of future terrorism.

Method

Between April 29 and May 13, 2013 (2–4 weeks after the BMB), we conducted an Internet-based survey with a representative sample of U.S. residents with oversamples from Boston and New York, all drawn from the GfK KnowledgePanel. GfK uses address-based sampling methods to randomly sample and recruit people within households. To ensure panel representativeness, households without a computer or Internet connection receive a web-enabled device or Internet access. Panelists complete web-based surveys in exchange for compensation as incentive for participation. At Wave 1 (W1), 6,098 panelists received the survey, with e-mail and telephone reminders subsequently sent to encourage response; 4,822 responded, for a 79% study completion rate. We dropped 147 respondents who did not have sufficient outcome data or had unreliably short survey completion times (< 3 min); the final sample included 4,675 complete cases (77% participation rate). Six months after the BMB, between October 17 and November 17, 2013, follow-up surveys were administered to all available panelists ($N = 4{,}429$) from the first wave (W2; $N = 3{,}598$; 81% completion rate).

GfK provided poststratification weights to correct for discrepancies between the study sample and U.S. Census benchmarks. The panel selection methods provide statistical control on the representativeness of GfK panel samples and ensure sample comparability with population benchmarks (for detailed demographic comparisons of the GfK panel and U.S. Census data, see Table S1 in the Supplemental Material available online). GfK provides panel design weights to reflect unequal selection probabilities for different panelists and then poststratifies them to the benchmarks from the most recent U.S. government statistics. The weighted sample closely matched that of the target population as defined by the benchmarks from the American Community Survey from the U.S. Census Bureau (2012). The Institutional Review Board of the University of California, Irvine, reviewed and approved all procedures.

Table 1. Weighted Covariances Between Key Study Variables and Covariates (N = 3,598)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. BMB acute stress (W1)	—												
2. BMB posttraumatic stress (W2)	.50***	—											
3. Fear of future terrorism (W2)	.39***	.59***	—										
4. Functional impairment (W2)	.33***	.43***	.31***	—									
5. BMB media exposure (hr/day) (W1)	.42***	.35***	.27***	.19***	—								
6. Graphic (bloody) images (W1)	.16***	.16***	.17***	.09***	.30***	—							
7. Nongraphic (chaotic) images (W1)	.07*	.07**	.13***	.04	.27***	.71***	—						
8. Direct BMB exposure	.11***	.09**	.08**	−.002	.14***	.18***	.17***	—					
9. Pre-BMB mental health	.12***	.08**	.05*	.26***	.03	.04	.02	−.004	—				
10. Age	−.04	−.01	.09***	.04	.03	.08**	−.15***	−.07**	.01	—			
11. Female gender	.08**	.01	.08**	.07**	.004	.01	.02	.02	.13***	.02	—		
12. Income	−.14***	−.12***	−.05*	−.22***	−.06*	.11***	.11***	.15***	−.09***	−.03	−.05*	—	
13. College education	−.06**	−.10***	−.06**	−.12***	−.05**	.02	.02	.12***	−.07***	−.03	−.02	.35***	—
14. Non-Hispanic White	−.11***	−.17***	−.06*	−.10***	−.06*	.08**	.13***	.09***	.06**	.21***	.01	.14***	.03

Note: BMB = Boston Marathon bombings; W = Wave; gender: female = 1, male = 0; education: college = 1, less than college = 0; ethnicity: non-Hispanic White = 1, Minority populations (i.e., Black, non-Hispanic, mixed-race/other non-Hispanic, Hispanic) = 0.
*p < .05. **p < .01. ***p < .001.

Measures

Pre-W1 demographics. GfK collects basic demographic information from all individuals recruited onto the KnowledgePanel (age, gender, income, education, race, ethnicity, marital status) and updates this information at regular intervals.

Pre-BMB mental health. When recruited onto the GfK panel, and periodically thereafter, panelists complete a comprehensive health profile that includes questions about mental health. In this survey, the large majority of respondents reported whether a physician had diagnosed them with depression or anxiety using items modified from the U.S. Centers for Disease Control's National Center for Health Statistics annual National Health Interview Survey (NHIS). Comparisons between NHIS and the KnowledgePanel responses indicate an average difference of less than 1.5% (Baker, Bundorf, Singer, & Wagner, 2003). Over two thirds of the sample had provided this information before the BMB (N = 3,351; 71.7%); for those who had not, missing values were imputed using Sequential Hot-deck Imputation (Andridge & Little, 2010; Cox, 1980). Analyses conducted with and without the imputed data produced consistent findings with comparable effect sizes.

W1 acute stress symptoms. Panelists completed the Stanford Acute Stress Reaction Questionnaire (SASRQ; Cardeña, Koopman, Classen, Waelde, & Spiegel, 2000), a validated and reliable measure of acute stress symptoms, to report how often they had experienced 30 possible symptoms "since the Boston Marathon bombings and their aftermath" on a 6-point scale from 1 (*not experienced*) to 6 (*very often experienced*). Items were summed to create a continuous acute stress symptom score (range = 30–180, α = .96), consistent with standard practice in postdisaster research (Cardeña et al., 2000), and capture maximum variability in potential responses (cf. MacCallum, Zhang, Preacher, & Rucker, 2002). Respondents were not assumed to have acute stress disorder because many did not meet the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM–IV*) Criterion A (direct exposure; for full diagnostic criteria, see U.S. Department of Veterans Affairs, n.d.).[1]

W1 media-based BMB exposure. Respondents reported how many hours per day (0–11+) they spent engaged with BMB-related content from each of several media sources (i.e., television, radio, online, social media, print) in the week following the BMB (Jones, Garfin, Holman, & Silver, 2016). An index representing the average number of hours of daily exposure across all types of media was computed (Mdn = 3 hr, M = 4.74 hr, SD = 5.51).

W1 graphic (bloody) and nongraphic (chaotic nonbloody) image exposure. Participants reported how often they saw nine BMB-related images on a 5-point scale (1 = *never*, 5 = *very often*). Through exploratory factor analyses and expert consensus, two subscales were derived to distinguish types of image content. Graphic media exposure was defined as seeing BMB-related images that included blood (e.g., bloody victims, blood at the site), and nongraphic media was defined as seeing nonbloody BMB-related images of chaos (e.g., first responders, bomb smoke). The three items containing blood had very good internal consistency (α = .85), and the six items containing images of chaos with no blood had excellent internal consistency (α = .95; see Jones et al., 2016).

W1 direct BMB exposure. Respondents reported whether they or someone close to them was at, injured in, or near the site of the BMB when it occurred or whether they knew someone who died in the BMB in accordance with *DSM–IV* criteria for trauma exposure.

W2 posttraumatic stress symptoms. Respondents completed a modified version of the Primary Care PTSD Screen (PC-PTSD), a four-item screening tool that has been validated against clinician diagnostic interviews, to describe the frequency with which they experienced BMB-related PTSS in the prior month (Prins et al., 2003). The response scale was modified from a yes/no format to a 5-point scale (1 = *never*, 5 = *all the time*) to promote greater variability in response. Items were averaged to form an index of PTSS (α = .80). Note that because respondents did not meet *DSM–IV* Criterion A and the measure used is a screening tool, none of the respondents were assumed to have PTSD.

W2 fear of future terrorism. Respondents completed two items from previous research on terrorism (Holman et al., 2008) that assessed fear of future terrorism (e.g., "I worry that an act of terrorism [bioterrorism, hijacking, etc.] will personally affect me or someone in my family in the future"). Items were scored on a 5-point Likert scale (1 = *never*, 5 = *all the time*) and combined as an index of fear of future terrorism (α = .82).

W2 functional impairment. Participants completed four items modified from the SF-36 (Ware & Sherbourne, 1992) to report how often their physical and emotional health interfered with social- and work-related functioning in the prior week using a 5-point scale (1 = *none of the time*, 5 = *all the time*; α = .87).

Analytic strategy

Bivariate ordinary least squares regressions (OLS) were used to examine the associations between the frequency of bloody versus chaotic image exposure and acute stress, PTSS, fear of future terrorism, and functional impairment. Bloody images and chaotic images were initially tested in separate models because of the high correlation between them ($r = .73$, $p < .001$). If both were significantly linked with an outcome in the bivariate analysis, a second analysis was conducted with both bloody and chaotic image variables in a multivariate model to test whether they had a reliable, unique association with each outcome. We then tested whether these associations remained robust when hours of media-based BMB exposure and other key covariates (demographics, pre-BMB mental health, direct BMB exposure) were added to the model. We used complete case analysis because of the small amount of missing data (2.7%). Continuous variables were standardized.

We then used the structural equation modeling (SEM) program in STATA 14 (Stata Corp, College Station, TX) to conduct path analysis, which incorporates several multiple regression equations simultaneously and is a parsimonious method to test direct and indirect effects (Kline, 2005). Specifically, we tested whether direct and indirect mediated effects were both present in the same direction for two types of BMB-related media exposure: frequency of specific images seen and the amount of media consumed. STATA 14's SEM program also allows use of survey sampling weights, which are important when making population-based estimates using representative samples. Given that sampling weights already correct for standard errors, we did not use the bootstrapping method common in testing mediation in structural equation modeling because its relative performance when applied to analyses with sampling weights remains unclear (Bollen, Tueller, & Oberski, 2013).

Two path models examined the relationship between media variables (graphic images, amount of BMB-related media exposure) and either W2 PTSS or W2 fear of future terrorism, with both of those dependent variables (PTSS and fear of future terrorism) then predicting W2 functional impairment, controlling for key covariates (demographics, pre-BMB mental health, direct BMB exposure). Path models also specified the direct effects of covariates on the mediator variables (acute stress, PTSS, and fear of future terrorism). Model fit was based on the coefficient of determination (CD) and the standardized root mean square residual (SRMR). The SRMR is an absolute measure of fit representing the difference between the predicted and observed correlation. It is appropriate for complex models and survey data; values less than .08 indicate good fit (Bollen et al., 2013; Hu & Bentler, 1999). The CD is analogous to the R^2 in linear regression and is the percentage of variance the model explains (http://www.stata-press.com/manuals/stata12/sem_glossary.pdf). These fit indices were used rather than other commonly used indices such as the comparative fit index because these estimates are often unstable and biased in complex weighted survey data analysis (Bollen et al., 2013).

Results

Demographic composition of the sample is presented comparing the W1 and W2 samples with the full KnowledgePanel and U.S. Census benchmarks (see Table S1 in the Supplemental Material). The weighted samples were representative of the populations from which they were drawn.

OLS regression analyses

Table 1 presents weighted bivariate covariances among the variables of interest and covariates in the analyses. There are modest, significant associations between all outcomes and hours of daily media exposure and the frequency of exposure to bloody images; the frequency of exposure to chaotic images is associated with all outcomes except functional impairment. In OLS regressions adjusting for key covariates (e.g., demographics, pre-BMB mental health, direct BMB exposure, amount of BMB-related media consumed), exposure to chaotic images was not reliably associated with outcomes. However, exposure to bloody images was significantly associated with each of the outcomes in the adjusted multivariate analyses (see Table 2). Including both bloody images and chaotic images in the analyses produced unstable results because of collinearity between the two image variables. We then compared the effect sizes of bloody images and chaotic images for all outcomes using the online tool created by Lee and Preacher (2013). For all outcomes, the effect size for bloody images was significantly larger than that for chaotic images; z ranged from 3.19 ($p = .0014$) to 7.15 ($p < .0001$). On the basis of these analyses, the final path models included only the bloody-image variable.

Path analyses

Table 3 presents total effects of two SEM path analyses testing whether PTSS and fear of future terrorism each served to mediate the associations between media exposure and functional impairment. Both path analyses indicated good model fit. The SRMR for the SEM

Table 2. Multivariate Ordinary Least Squares Regression Analyses Examining Associations of Graphic (Bloody) Images With Acute Stress (N = 3,492), Posttraumatic Stress Symptoms (N = 3,487), Fear of Future Terrorism (N = 3,468), and Functional Impairment (N = 3,489)[a]

	Dependent variables							
	Acute stress (W1)		Posttraumatic stress (W2)		Fear of future terrorism (W2)		Functional impairment (W2)	
Variable	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Graphic (bloody) images (W1)	0.06*	[0.01, 0.10]	0.08**	[0.03, 0.13]	0.09***	[0.05, 0.14]	0.06*	[0.01, 0.10]
Media exposure to BMB (hr/day) (W1)	0.39***	[0.31, 0.46]	0.32***	[0.25, 0.39]	0.22***	[0.17, 0.27]	0.16***	[0.10, 0.22]
Covariates								
Direct BMB exposure	0.22**	[0.06, 0.39]	0.23	[−0.01, 0.46]	0.15	[−0.02, 0.31]	0.02	[−0.13, 0.17]
Pre-BMB mental health Dx[b]	0.10***	[0.05, 0.15]	0.07**	[0.02, 0.11]	0.04	[−0.01, 0.08]	0.24***	[0.18, 0.29]
Age	−0.04*	[−0.09, 0.00]	0.01	[−0.04, 0.07]	0.10***	[0.05, 0.14]	0.05*	[0.01, 0.10]
Gender[c]	0.14**	[0.05, 0.23]	−0.01	[−0.10, 0.08]	0.14**	[0.05, 0.23]	0.05	[−0.03, 0.13]
Income	−0.11***	[−0.16, −0.07]	−0.07**	[−0.12, −0.03]	−0.02	[−0.07, 0.03]	−0.17***	[−0.21, −0.13]
Education[d]								
High school	−0.16	[−0.42, 0.10]	−0.07	[−0.29, 0.14]	0.01	[−0.19, 0.21]	−0.31**	[−0.53, −0.10]
Some college	−0.27*	[−0.53, −0.02]	−0.09	[−0.29, 0.12]	−0.04	[−0.24, 0.16]	−0.33**	[−0.54, −0.12]
Bachelor's degree or higher	−0.23	[−0.49, 0.03]	−0.24*	[−0.44, −0.03]	−0.011	[−0.31, 0.09]	−0.37***	[−0.58, −0.16]
Ethnicity[e]								
Black, non-Hispanic	0.09	[−0.11, 0.29]	0.24**	[0.06, 0.41]	−0.02	[−0.18, 0.15]	0.12	[−0.06, 0.29]
Hispanic	0.09	[−0.05, 0.23]	0.33***	[0.17, 0.48]	0.27***	[0.11, 0.44]	0.22**	[0.08, 0.37]
Mixed race/other, non-Hispanic	0.47***	[0.23, 0.70]	0.64***	[0.37, 0.92]	0.32***	[0.12, 0.51]	0.28***	[0.11, 0.45]
Model statistics								
F-test	$F(13, 3478) = 19.82$		$F(13, 3473) = 16.67$		$F(13, 3454) = 15.46$		$F(13, 3475) = 18.11$	
p	< .001		< .001		< .001		< .001	
R^2	.23		.18		.11		.16	

Note: W = Wave; CI = confidence interval; BMB = Boston Marathon bombings; Dx = diagnosis.
[a]*N*s differ because of a small amount of missing data. [b]0 = no history of anxiety/depression, 1 = history of either anxiety or depression, 2 = history of anxiety and depression.
[c]Reference group = males. [d]Reference group is less than a high school education. [e]Reference group is non-Hispanic White respondents.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3. Standardized Estimates of Total Effects From Structural Components Predicting Posttraumatic Stress Symptoms, Fear of Future Terrorism, and Functional Impairment

	SEM 1 W2 posttraumatic stress symptoms as mediator (N = 3,486)[a]				SEM 2 W2 fear of future terrorism as mediator (N = 3,467)[a]			
	Posttraumatic stress (W2)		Functional impairment (W2)		Fear of future terrorism (W2)		Functional impairment (W2)	
Variable	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Bloody images (W1)	0.08**	[0.03, 0.13]	0.04	[−0.01, 0.09]	0.09***	[0.05, 0.14]	0.03	[−0.02, 0.08]
Media exposure to BMB (hr/day) (W1)	0.32***	[0.25, 0.39]	0.18***	[0.12, 0.24]	0.22***	[0.17, 0.27]	0.18***	[0.13, 0.24]
Covariates								
Direct BMB exposure	0.23	[−0.01, 0.46]	0.11*	[0.03, 0.19]	0.15	[−0.02, 0.31]	0.08**	[0.03, 0.14]
Pre-BMB mental health Dx[b]	0.07**	[0.02, 0.11]	0.04**	[0.01, 0.06]	0.04	[−0.01, 0.08]	0.03**	[0.01, 0.05]
Age	0.01	[−0.04, 0.07]	−0.001	[−0.02, 0.02]	0.09***	[0.05, 0.14]	0.01	[−0.01, 0.03]
Gender[c]	−0.01	[−0.10, 0.08]	0.02	[−0.02, 0.06]	0.14**	[0.05, 0.23]	0.06***	[0.03, 0.09]
Income	−0.07**	[−0.12, −0.03]	−0.04***	[−0.06, −0.02]	−0.02	[−0.07, 0.03]	−0.03**	[−0.05,−.01]
Education[d]								
High school	−0.07	[−0.29, 0.14]	−0.05	[−0.14, 0.04]	0.01	[−0.19, 0.21]	−0.04	[−0.12, 0.04]
Some college	−0.09	[−0.29, 0.12]	−0.07	[−0.16, 0.02]	−0.04	[−0.24, 0.16]	−0.07	[−0.15, 0.002]
Bachelor's or higher	−0.24*	[−0.44, −0.03]	−0.11**	[−0.20, −0.03]	−0.11	[−0.31, 0.09]	−0.08	[−0.15, 0.003]
Ethnicity[e]								
Black, non-Hispanic	0.24**	[0.06, 0.41]	0.09*	[0.02, 0.17]	−0.02	[−0.18, 0.14]	−0.02	[−0.05, 0.08]
Hispanic	0.33***	[0.17, 0.48]	0.13***	[0.06, 0.19]	0.27**	[0.11, 0.44]	0.08**	[0.02, 0.13]
Mixed race/other, non-Hispanic	0.64***	[0.37, 0.92]	0.28***	[0.17, 0.39]	0.32**	[0.12, 0.51]	0.17***	[0.09, 0.25]
Mediators								
BMB acute stress	0.43***	[0.35, 0.50]	0.29***	[0.23, 0.36]	0.31***	[0.26, 0.37]	0.30***	[0.24, 0.36]
BMB posttraumatic stress	—		0.34***	[0.29, 0.40]	—		—	
Fear of future terrorism	—		—		—		0.21***	[0.16, 0.27]

Note: SEM = structural equation modeling; CI = confidence interval; W = Wave; BMB = Boston Marathon bombings; Dx = diagnosis.
[a]*N*s differ because of a small amount of missing data. [b]0 = no history of anxiety/depression, 1 = history of either anxiety or depression, 2 = history of anxiety and depression. [c]Reference group = males. [d]Reference group = less than high school diploma. [e]Reference group = non-Hispanic White respondents.
*$p < .05$. **$p < .01$. ***$p < .001$.

that examined BMB-related PTSS was .025, CD = .275. The SRMR for the SEM that examined fear of future terrorism was .026, CD = .261.

Figures 1a and 1b present the path models for W2 PTSS and fear of future terrorism, respectively (see Table 3 for total effects). Total hours of media-based exposure to the BMB and exposure to bloody images both had small direct effects on W2 BMB-related PTSS (total hours: $\beta = 0.16$, 95% confidence interval (CI) = [0.09, 0.23], $p < .001$; bloody images: $\beta = 0.06$, 95% CI = [0.01, 0.10], $p = .017$) and fear of future terrorism (total hours: $\beta = 0.11$, 95% CI = [0.05, 0.16], $p < .001$; bloody images: $\beta = 0.08$, 95% CI = [0.03, 0.12], $p = .001$). Both media-exposure variables also had complementary small, indirect effects on W2 BMB-related PTSS (total hours: $\beta = 0.16$, 95% CI = [0.12, 0.20], $p < .001$; bloody images: $\beta = 0.02$, 95% CI = [0.003, 0.05], $p = .028$) and fear of future terrorism (total hours: $\beta = 0.12$, 95% CI = [0.09, 0.15], $p < .001$; bloody images: $\beta = 0.02$, 95% CI = [0.002, 0.03], $p = .028$) that were mediated through BMB-related acute stress.

The path model using PTSS as a mediator indicated that the hours of media-based exposure to the BMB and frequency of exposure to bloody images each had indirect effects on functional impairment that were mediated through both BMB-related acute stress (total hours of media exposure: $\beta = 0.05$, 95% CI = [0.03, 0.08], $p < .001$; bloody images: $\beta = 0.01$, 95% CI = [0.0002, 0.02], $p = .044$) and BMB-related PTSS assessed at W2 (total hours: $\beta = 0.06$, 95% CI = [0.03, 0.08], $p < .001$; bloody images: $\beta = 0.02$, 95% CI = [0.003, 0.04], $p = .019$). A similar pattern emerged when fear of future terrorism was in the model. The hours of media-based exposure to the BMB and frequency of exposure to bloody images each had small, indirect effects on functional impairment that were mediated through BMB-related acute stress (total hours: $\beta = 0.09$, 95% CI = [0.06, 0.12], $p < .001$; bloody images: $\beta = 0.01$, 95% CI = [0.001, 0.03], $p = .033$) and fear of future terrorism at W2 (total hours: $\beta = 0.02$, 95% CI = [0.009, 0.04], $p = .001$; bloody images: $\beta = 0.02$, 95% CI = [0.005, 0.03], $p = .004$). Neither the hours of media-based exposure to the BMB nor frequency of exposure to bloody images had a direct effect on functioning at W2.

Discussion

Using data from a representative national sample, we demonstrated that both the quantity and the visually graphic nature of media exposure to a community trauma were independently associated with subsequent mental health and functional impairment. Although neither media variable was directly associated with W2 functioning in path analyses, acute stress, posttraumatic stress, and fear of future terrorism each mediated associations between media exposure and functional impairment at W2. This suggests early psychological responses following collective trauma may be a conduit through which media is linked with mental health and functioning months later. Although effect sizes were small, the fact that both the amount of exposure to media in general and frequency of exposure to bloody images in particular were indirectly associated with functional impairment 6 months after the BMB suggests that media-related distress may linger, with potentially negative consequences.

Exposure to graphic content may be associated with deleterious outcomes through several plausible avenues. Bloody images, especially those involving large-scale collective violence such as the BMB or 9/11 terrorist attacks, may be associated with fear and worry in the population, which may contribute to symptoms of psychological disorders such as PTSD and anxiety (American Psychiatric Association, 2013; Holmes & Mathews, 2010). To the extent that bloody images amplify emotional responses to a collective trauma, they may promote development of intrusive thoughts about the event (Bourne et al., 2013). Triggering fear and anxiety also may activate attentional biases toward the threat-related stimuli (bloody images; Keogh, Ellery, Hunt, & Hannent, 2001; Mogg & Bradley, 2006), making it difficult for more anxious people to disengage (Fox, Russo, Bowles, & Dutton, 2001).

Because fear is often accompanied by physiologic arousal (McEwen, 2007; Shin & Liberzon, 2010), there may be important health implications for media exposures that need further consideration (see Silver et al., 2013). Vivid imagery of fear-inducing content has been linked with physiologic arousal (Riddle, 2014) that may promote harmful stress responses. Moreover, attentional biases can lead to persistent cognitive engagement with prior stressors or fear about future events—a process known as *perseverative cognition* (Brosschot, Pieper, & Thayer, 2005), a known contributor to stress-related physiologic responses that have negative consequences for physical health (e.g., persistent autonomic dysregulation, cardiovascular, and endocrine disorders; Brosschot et al., 2005; McEwen, 1998; Ottaviani, Thayer, Verkuil, & Lonigro, 2016). Strong emotional responses to bloody images also may increase the likelihood of storing this graphic content in long-term memory (Fahmy, Cho, Wanta, & Song, 2006), with consequences for persistent trauma-related intrusive symptoms that might further exacerbate this cycle.

Limitations

Despite our large national sample and longitudinal design, we recognize some limitations of our study that may guide future research. We note that although

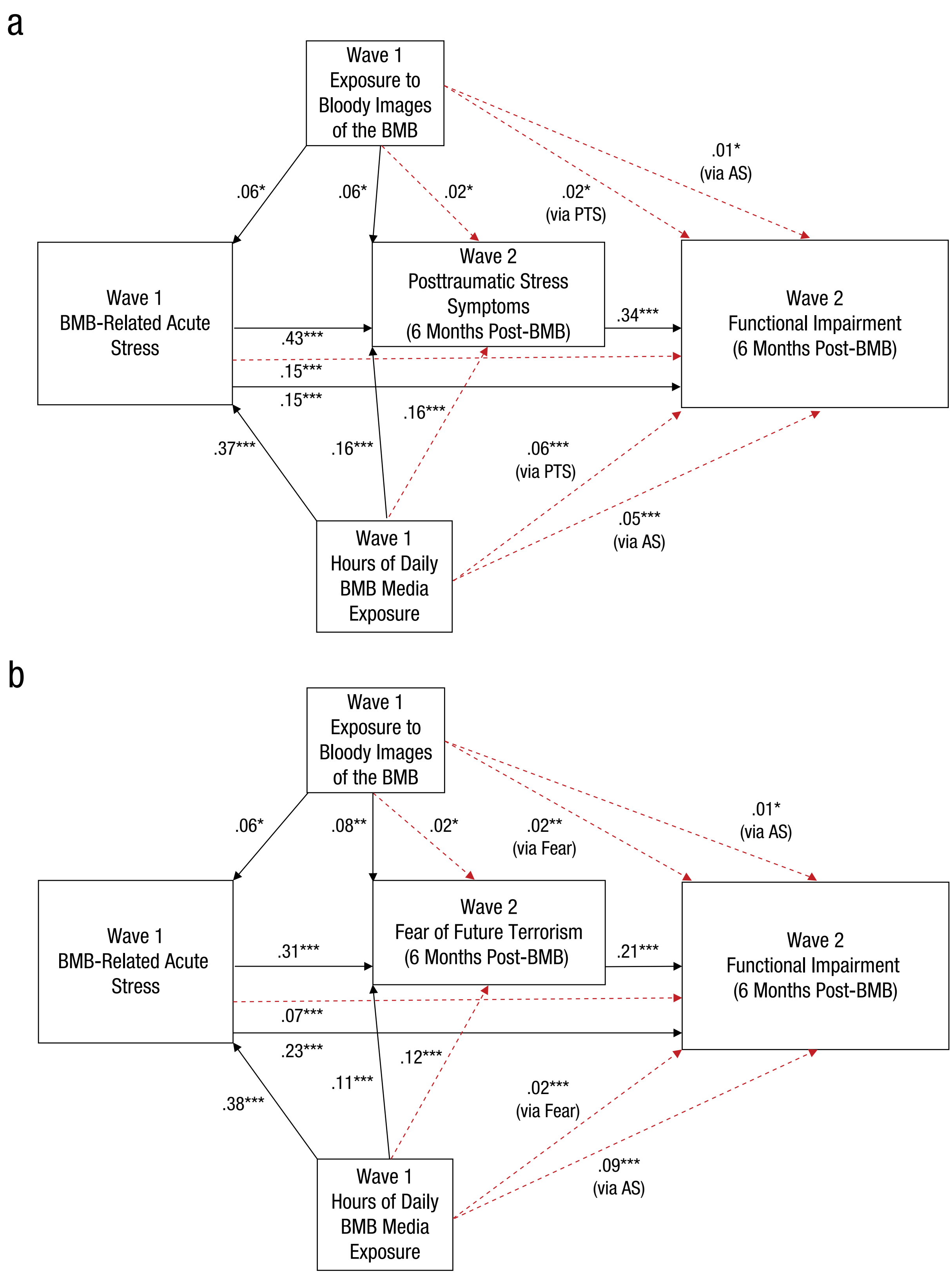

Fig. 1. Path models of relationships. (a) Relationship between media exposure to the Boston Marathon bombings (BMB) and acute stress symptoms, posttraumatic stress symptoms, and functional impairment. (b) Relationship between exposure to the BMB, acute stress symptoms, fear of future terrorism, and functional impairment. Solid arrows represent direct paths, and dashed arrows indicate indirect paths. Asterisks indicate significant paths (* $p < .05$, ** $p < .01$, *** $p < .001$). AS = acute stress; PTS = posttraumatic stress.

exposure to bloody images was directly associated with subsequent mental health outcomes, its indirect effect on functional impairment was very small relative to that of media hours. These small effects may be due to measurement error in our assessments of media exposure that likely made it more difficult to tease apart and test the independent effect of bloody images from our assessment of the number of media hours to which respondents were exposed. That is, although our variable assessing hours of media exposure was fine-grained, it did not include any information about what was seen during those hours. Respondents who watched more hours of coverage were likely to see more bloody images, but our variable assessing exposure to bloody content was limited to three items reflecting three specific images. We do not know whether we captured the specific or even most distressing images seen by respondents—they may have seen other highly distressing images (e.g., dead bodies, people crying out) that we did not assess. These limitations in our measures likely increased error variance in the analyses and contributed to the small effects obtained in this study.

We also do not know whether respondents saw repetitive broadcasts of graphic coverage. It is possible that the repetitive nature of media coverage, rather than viewing bloody images per se, is a better measure of media's effects on mental health. However, because we did not directly measure repetition in the media content consumed, we are unable to tease bloody images apart from the amount or repetitiveness of media exposure. These sources of error would again reduce the precision with which we could test the independent effects of bloody images on subsequent outcomes.

Finally, many individuals voluntarily choose to expose themselves to extensive media coverage of mass events that may include bloody images (see Redmond, Jones, Holman, & Silver, 2019), suggesting the potential for an unmeasured, individual difference variable (e.g., neuroticism) to operate as a potential third variable linking media exposure with the mental-health outcomes we measured. Although we acknowledge this possibility, we note that we have controlled for several likely third variables (prior mental health, direct BMB exposure, demographics) that may provide alternative explanations for our results.

At the same time, we note that there are many ways individuals may be involuntarily exposed to graphic content. For example, monitors showing newsfeed that do not have warnings can be seen at gas stations, graphic images appear on covers of print media in grocery stores, and videos often play automatically in online news sites, Twitter, Facebook, and Instagram. Moreover, some mass shooters are now live-streaming their attacks (e.g., Christchurch, New Zealand, mosque massacre), potentially raising the risk of inadvertently seeing unwanted images that automatically play on unfiltered social media sites. Thus, although these images often are accessed deliberately and people can turn away or turn off media to avoid further exposure to unbidden images, at other times, individuals may not be able to avoid seeing something they would rather not see, however briefly.

Contributions and future directions

This prospective longitudinal study provides evidence that both the quantity and graphic nature of media exposure to collective trauma are associated with subsequent mental health and functioning. Moreover, media-linked acute stress and PTS and fear of future terrorism assessed 6 months later are each potential conduits that link media exposure with functioning months after the BMB. Given the prevalence and widespread media coverage of terrorist attacks and other mass violence events, these findings, should they prove reliable in future studies, may contribute much needed evidence to help media outlets make informed decisions about what content to share following collective traumas.

Future studies should examine patterns of media consumption during and immediately following collective trauma and identify who is most vulnerable to this exposure, their motivations for viewing graphic media coverage (see Redmond et al., 2019), and the specific qualities of media coverage most closely associated with mental-health outcomes. For example, collecting and/or experimentally manipulating fine-grained qualities of media coverage (e.g., sounds such as hearing gunshots, screaming victims) would allow more careful analysis and identification of specific emotional triggers and in so doing provide information that more easily translates to interventions and guidance for media. Given recent work demonstrating that exposure to graphic images of violence may have prosocial effects of eliciting emotions that enhance moral sensitivity (see Grizzard, Tamborini, Sherry, & Weber, 2017), future research also should address a range of psychological processes and behaviors that may be affected by media exposure.

Although our findings identify risks associated with media-based exposure to collective trauma, there are also important ethical concerns that must be addressed when considering what the media should and should not cover (Grizzard et al., 2017). Media becomes a vital source of information for affected communities following disasters that can raise public awareness about local, national, and global events and may prompt policy changes or commitment to humanitarian assistance (see Lubens & Holman, 2017). Although we recognize the importance of raising public awareness and the positive role the media can play during a collective trauma, we also see the potential consequences for individuals who must make a choice about how to engage the media. Future research should address the balance of potential positive and negative consequences of media exposure for individuals and the public.

Conclusion

Exposures to collective traumas are more complex than currently conceptualized. Early media-based exposure is important in terms of persistent symptoms, and it is not just how much one engages the media—what one sees may matter as well. Research addressing the nuances of media impact on stress-related symptoms in the public is relatively new. This study is a first step in a program of research that seeks to tease apart the qualities of media exposure that may render individuals more vulnerable to trauma-related mental and physical health problems over time.

Action Editor

Kelly L. Klump served as action editor for this article.

Author Contributions

R. C. Silver and E. A. Holman obtained project funding and designed the study. R. C. Silver, E. A. Holman, D. R. Garfin performed the research. E. A. Holman, D. R. Garfin, and P. Lubens analyzed the data. E. A. Holman drafted the manuscript with substantive input from D. R. Garfin, P. Lubens, and R. C. Silver. All the authors approved the final manuscript for submission.

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The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

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Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/2167702619858300

Note

1. This measure was used because at the time of the study, the SASRQ had not yet been validated for the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* criteria.

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