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Caregiver-reports of Internet Exposure and Posttraumatic Stress Among Boston-Area Youth Following the 2013 Marathon Bombing

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Abstract

Although practitioners and researchers have considered children's television-based terrorism exposure, Internet-based exposure has not been sufficiently examined. We examined the scope and correlates of children's Internet-based exposure following the Boston Marathon bombing among Boston-area youth (N=460; 4–19 years), and the potential moderating role of age. Further exploratory analyses examined patterns of caregiver attempts to regulate child Internet exposure. Caregivers reported on child Internet-based and direct exposure to traumatic bombing-related events, and youth posttraumatic stress (PTS). Online youth consumed on average over two daily hours of Internet coverage, and roughly one-third consumed over three daily hours of coverage. Internet exposure was particularly high among children over 12. Greater Internet-based exposure was associated with PTS, and 12–15 year olds were particularly vulnerable. Further exploratory analyses found that although most caregivers reported believing media exposure can cause children further trauma, a considerable proportion of caregivers made no attempt to restrict or regulate their child's Internet-based exposure. These findings help practitioners clarify forms of indirect exposure that can place youth at risk following terrorism. Future work is needed to examine the important roles caregivers play as media regulators and as promoters of child coping and media literacy following terrorism.

Keywords

PTSD; Media; Terrorism; Internet; Social Networking; Trauma

Terrorism is associated with elevated and enduring rates of posttraumatic stress disorder (PTSD) among exposed youth¹ (Comer, Dantowitz et al., 2014; Comer & Kendall, 2007;

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¹The term "youth" is used throughout this manuscript to refer broadly to both children and adolescents, unless otherwise stated.

Hoven et al., 2005; Pfefferbaum et al., 1999a). Importantly, emerging research shows serious problems in the aftermath of terrorism among youth near and far (Ford, Udry, Gleiter, & Chantala, 2003; Lengua, Long, Smith, & Meltzoff, 2005; Pfefferbaum et al., 2000; Stein et al., 2004), raising questions for practitioners about the impact of various forms of indirect exposure to terrorism (Comer & Kendall, 2007).

Children's television (TV) exposure to terrorism has been associated with mental health problems

Increasing work has evaluated children's TV-based contact with terrorism, as well as the effectiveness with which parents regulate children's exposure to terrorism-related TV presentations (Comer, Dantowitz et al., 2014; Comer, Furr, Beidas, Weiner, & Kendall, 2008; Comer & Kendall, 2007; Duarte et al., 2011; Otto et al., 2007; Pfefferbaum et al., 2001). By design, the aim of terrorism is larger in scope than death, physical injury, and property destruction, with the broader goal to threaten and intimidate a group of persons much larger than the immediate victims (Comer & Kendall, 2007). Perpetrators of terror seek to broadcast threat to as wide an audience as possible (Nacos, 2003). Technological advances and mass media trends provide an enormous stage from which terrorism can reach global audiences. Given the enormous amount of time youth spend consuming TV (Lapierre, Piotrowski, & Linebarger, 2012), it is not surprising that after terrorist attacks a large proportion of youth consume very high doses of terrorism-related TV news coverage and many parents make no attempt to restrict their television news exposure (e.g., Comer, Dantowitz et al., 2014; Hoven et al., 2005; Pfefferbaum et al., 2001; Schuster et al., 2001). TV coverage of terrorist events can include vivid, frightening, and gruesome images, and can broadcast ongoing threat and alert to consumers—including to many who may not be at any elevated personal risk or vulnerability (Comer & Kendall, 2007). Not surprisingly, exposure to TV coverage in the aftermath of terrorism has been consistently linked with increases in PTSD symptoms and elevated threat perceptions in youth (e.g., Comer, Dantowitz et al., 2014; Comer, Furr, Beidas, Weiner, & Kendall, 2008; Duarte et al., 2011; Otto et al., 2007; Pfefferbaum et al., 2001; Phillips, Prince, & Schiebelhut, 2004).

Children's Internet-based contact with terrorism remains unexamined

We know little about the scope and correlates of children's *Internet*-based contact with terrorism. This is concerning given estimates that up to 70–90% of youth in developed regions like the U.K. access online material regularly (Holloway, Green, & Livingstone, 2013; Ofcom, 2013) and roughly 60–84% of U.S. youth have regular Internet access in their homes (Child Trends Data Bank, 2013; Rideout, Foehr, & Roberts, 2013). Children spend as much time online as they do watching TV, with 12–15 year olds engaging in roughly 2.5 daily hours of online activity and even children 3–8 engaging in roughly 1 hour of daily online activity (Ofcom, 2013). Parental regulation of children's Internet use is minimal (Ofcom, 2014).

In recent years, increasing Internet accessibility, advances in online journalism, and more sophisticated social media platforms have dramatically changed news coverage and consumption, and patterns of people's engagement with new events. In 2008, roughly 40%

in the U.S. reported they primarily accessed and consumed national and international news from the Internet (up from just 13% in 2001), while the proportion reporting print and TV as their primary news sources steadily declined (Pew Research Center, 2008). The trends are even more striking among younger Americans, with roughly 60% of young adults reporting they primarily access news from online sources (Pew Research Center, 2008). Further, over the past decade, social media and networking platforms have changed how youth connect and communicate with one another and the content to which they are exposed. One-sixth of 8–11 year olds and 68% of 12–15 year olds regularly use the Internet for social networking purposes (Ofcom, 2013) and 15% of 12–15 year olds use social networking platforms to access news (Ofcom, 2013). Such platforms do not simply propagate existing news stories, but also allow users to upload their own photos of, experiences with, and reactions to news events and become part of the larger broadcast story. Despite the benefits in user engagement and dissemination inherent in digital networking platforms, the more interactive news experience afforded by social media platforms is not regulated by the same standards, sensitivities, and ethics of traditional print and TV journalism. It is possible that children who come into contact with frightening news events via social media may be confronted with more vivid and horrific images and characterizations than would be allowed to air on TV or in print.

Despite these trends, there has been almost no research on the scope and correlates of children's Internet-based exposure to terrorism, or the extent to which parents regulate such exposure. Duarte and colleagues' (2011) work after 9/11 has been the only study that has specifically examined children's web-based exposure, but Internet usage patterns, speed, and quality were very different at the time of the 9/11 attacks, and the role of the Internet and social networking platforms as serious vehicles for mass news dissemination and engagement had not yet fully emerged. Accordingly, much remains to be learned about the scope and impact of Internet-based exposure among youth following terrorism within the context of the modern mass media landscape.

Potential developmental differences in children's responses to media-based exposure to terrorism

Although research has not yet adequately examined children's Internet-based exposure to terrorism, research examining exposure to TV presentations unrelated to terrorism suggests there may be developmental differences in emotional reactions to terrorism-related Internet coverage. Specifically, TV-focused research finds that youth in pre-K through 1st grade tend to be more frightened by concrete, visual images and fantasy content, whereas older elementary school-aged children show greater fear responses to presentations of realistic (Cantor & Nathanson, 1996; Cantor & Sparks, 1994; Valkenburg, et al., 2000) and local potential threats (Smith & Wilson, 2000). Similarly, Smith and Wilson (2002) found older children were more likely to understand, as well as be frightened by TV news than younger children. In particular, research finds fright reactions to TV coverage of violence perpetrated by strangers specifically increases with age (Cantor & Nathanson, 1996). On a related note, during Operation Iraqi Freedom Smith and Moyer-Guse (2006) found adolescents showed more fear related to televised war coverage than 5–8 year olds, and that older children were

more scared by abstract, verbally communicated threats than younger children. There may be similar developmental differences in the impact of Internet-based terrorism exposure.

The Boston Marathon bombing: A unique opportunity to examine Internet-based exposure to terrorism

The 2013 Boston Marathon bombing was one of the largest terrorist attacks successfully carried out on U.S. soil, and was one of the most captivating breaking news events to occur since the Internet emerged as a serious vehicle for news dissemination and engagement. After the attack, captured videos and images of the bombings and aftermath were quickly circulated on websites and social media. The most gruesome photos were blurred or cropped on TV, but were readily available uncensored online and circulated widely across social media. The bombing marked the beginning of a highly intense week for Boston-area families, during which time state and federal agencies used online networks and social media to alert the public about manhunt activities in real time, and to recruit the public for help providing information on suspect whereabouts. In addition, popular social networking services and news websites circulated photos from the finish line, encouraging users to speculate and identify the bombers from crowd images, and users publically misidentified innocent individuals as terrorists. Accordingly, understanding children's Internet-based exposure to the Marathon bombing and subsequent events provides a unique opportunity for practitioners to evaluate the scope and correlates of Internet-based exposure to terrorism on youth.

Youth with direct and TV-based exposure to the Boston Marathon events have shown elevated mental health concerns (Comer, Dantowitz et al., 2014; Holman, Garfin, & Silver, 2014). Research has also found that psychological responses to the bombing and to the manhunt differed (Comer, Dantowitz et al., 2014), with manhunt exposure affecting a larger number of people and showing associations with a broader range of psychological symptoms in youth than bombing exposure. Further, Comer and colleagues found that one-fifth of the sample watched over 3 hours of TV coverage on the day of the attack, and such TV-based exposure was also significantly linked with PTSD symptoms. Of further concern, only one-third of caregivers in this sample reported making attempts to restrict children's exposure to TV coverage of the bombing events.

The nature and scope of the Boston Marathon bombing and subsequent manhunt, and the prolonged breaking news media spectacle that emerged around it, offers a key opportunity to provide the first comprehensive empirical evaluation of children's Internet-based exposure to terrorism. Specifically, in a sample of 460 Boston-area families after the Boston Marathon bombing, we centrally focused on: (a) patterns in children's Internet-based contact with the bombing and manhunt, (b) relations between child Internet exposure and PTSD symptoms, after accounting for direct traumatic exposure, and (c) the extent to which age may moderate such relationships. Further exploratory. Further exploratory analyses also considered patterns in caregiver attitudes and attempted regulations related to children's Internet-based exposure.

Hypotheses

Based on norms for children's online activities (Ofcom, 2013), we hypothesized that during the week of the Boston Marathon attack, Boston-area children on average consumed at least 1 hour of daily Internet-based news coverage of the bombing and manhunt, and engaged in at least 1 hour of daily bombing- and manhunt-related social media activity, with children 7 years showing less online activity than older youth. Further, we hypothesized that consuming higher doses of Internet-based news coverage and engaging in extensive social media activity at the time of the bombing and manhunt would be linked with elevated PTSD symptoms 2–6 months after the bombing, even after accounting for direct exposure to the events. Given research suggesting older youth are more likely than younger children to comprehend, as well as be frightened by, TV news (Cantor & Nathanson, 1996; Cantor & Sparks, 1984; Smith & Moyer-Guse, 2006; Smith & Wilson, 2002; Valkenburg et al., 2000), as well as research documenting that adolescents consume considerably more online content and engage in substantially more social media activity than younger children (Ofcom, 2013), we hypothesized that age would moderate associations between Internet exposure and PTSD symptoms, with older children showing stronger associations than younger children.

Methods

Design and participants

All procedures were implemented under the approval of the Institutional Review Board of the Boston University. English-speaking caregivers of at least one child between 4–19 years dwelling within 25 miles of the Marathon bombing site and/or Watertown, MA where the manhunt culminated were eligible. A cutoff of 25 miles was selected in order to focus on youth most proximally affected by the events. Participants were recruited between June 15, 2013 and October 15, 2013 (2–6 months post-bombing) to complete an online survey measuring child experiences during the week of the bombing, as well as psychological adjustment of the child. The survey took roughly 45 minutes for caretakers to complete. Recruitment efforts included community-based, school-based, pediatrician-based, and media-based outreach throughout the Boston region (e.g., local superintendents sent letters to parents encouraging participation, staff members attended “Boston Strong” rallies to distribute information about the study).

Interested caregivers contacted study staff or visited a study website for additional information. 460 caregivers out of an initial pool of 1,105 caregivers who initially contacted staff or visited the website to consider participation completed the survey (41.6%). Following informed consent, caregivers completed questionnaires through a data-encrypted Internet-based survey program requiring server authentication. Respondents with multiple children were asked to complete questionnaires about their oldest child in the study age range. Respondents were compensated \$30 and had the option to have their compensation donated directly to the One Fund Boston.

The average age of youth in the sample was 11.8 years ($SD=3.8$), with 21.8% 4–7 years, 34.1% 8–11 years, 27.5% 12–15 years, and 16.5% 16–19 years. Roughly half of the sample reported household incomes of less than \$100,000 (46.7%), with roughly 15% earning less

than \$50,000 and 31% making between \$50–99,999. The majority of caregiver respondents were college-educated (81.3%), biological mothers (76.4%), with non-Hispanic white children (81.3%); 16.9% were biological fathers of the target child, 3.9% were adoptive mothers, 1.5% were relative/guardians, 0.9% were adoptive fathers, and 0.4% were foster mothers. Further demographic details of the sample can be found elsewhere (Comer et al., 2014). Roughly 20% of the sample lived within 5 miles of the bombing site, and 35% of the sample lived within 5 miles of the Watertown, MA site where the second suspect was apprehended. The average child in the study lived 7.0 miles from the bombing site and 7.2 miles from the final apprehension site in Watertown, MA.

Measures

Children's Internet Exposure—Consistent with much of the prior related research examining the impact of media presentations on children's emotional responses (e.g., Cantor & Nathanson, 1996; Cantor & Sparks, 1984; Smith & Moyer-Guse, 2006), a face-valid parent-report methodology of Internet activity was used. Table 1 presents the specific items used to assess children's Bombing-related Internet News Exposure, Bombing-related Social Media Activity, Manhunt-related Internet News Exposure, and Manhunt-related Social Media Activity. Items assessed Internet use by youth on either stationary or mobile computing devices (e.g., desktop computers, smart phones).

Caregiver attempted regulations and attitudes related to children's media exposure—Caregivers were asked whether on the day of the Marathon they restricted their child's Internet-based exposure to the bombing. Parents who did restrict their child's Internet-based exposure to the bombing indicated whether they set (1) a *time-based restriction* (i.e., my child was not allowed to watch/read any Internet coverage, my child was allowed to watch/read Internet coverage for up to 15 minutes, my child was allowed to watch/read Internet coverage for up to 30 minutes, my child was allowed to watch/read Internet coverage for up to an hour); (2) a *co-consumption restriction* (i.e., my child was only allowed to watch/read Internet coverage when I or another caregiver was watching/reading with him/her); or (3) a *content-based restriction* (i.e., I or another adult was sure to discontinue my child's Internet exposure whenever we felt the images or coverage were inappropriate for him/her). Items were not mutually exclusive and caregivers could endorse more than one form of attempted regulation. Parallel questions assessed caregiver's regulations about children's Internet-based exposure during the manhunt. To assess caregiver attitudes about the potential impact of media-based contact with traumatic events on children, caregivers were also asked to indicate "true" or "false" as to whether they believed that "repetitive exposure to traumatic events on TV or the Internet will usually cause a child more trauma."

Children's Direct and Relational Exposure to the Bombing and Manhunt—Child exposure to potentially traumatic events during the bombing and manhunt were assessed using a checklist asking respondents whether their child had any of the 18 experiences included in Table 2. Adding the number of endorsed items between 1 and 7 yielded a total *Bombing Exposure Tally* ranging from 0–7. Adding the number of endorsed items between 8 and 18 yielded a total *Manhunt Exposure Tally* ranging from 0–11. Internal

consistency was high for both Bombing Exposure Tally and Manhunt Exposure Tally ($\alpha=.79$ and $\alpha=.75$, respectively).

Children's Posttraumatic Stress Symptoms—The *UCLA PTSD Reaction Index (RI)*, *Parent-Report Symptom Scale* for DSM-IV was used to assess child PTSD symptoms. The PTSD-RI is the most frequently used assessment of children's post-disaster PTSD (Furr, Comer, Edmunds, & Kendall, 2010) and has demonstrated excellent reliability ($\alpha=.88-.91$) and strong convergent validity (Steinberg et al., 2013); internal consistency was excellent in the present sample ($\alpha=.95$). Total scores offer a continuous measure of PTSD symptoms.

Child age—Age-related analyses examined patterns within the following four groups of youth: 4–7 years, 8–11 years, 12–15 years, and 16–19 years.

Results

Patterns in children's Internet-based contact with the bombing and manhunt

Table 3 presents data on Boston-area children and caregivers' Internet-based exposure to the bombing and to the manhunt. On the day of the Marathon, caregivers reported that 43.3% of children consumed at least some bombing-related Internet news coverage and 39.1% engaged in at least some bombing-related social media activity. Roughly one-quarter of children who reportedly consumed at least some bombing-related Internet content on the day of the Marathon (27.1%) consumed over three hours of Internet news coverage (27.1%), and almost one-third (30.0%) engaged in over three hours of bombing-related social media activity. Between April 16th and April 19th (the day the second suspect was apprehended), 50.2% of children reportedly consumed at least some manhunt-related news coverage on the Internet and 42.8% reportedly engaged in at least some manhunt-related social media activity. Roughly one-fifth of children who reportedly consumed at least some manhunt-related Internet content in the week following the attack (22.5%) consumed over three hours of such coverage, and almost one-third engaged over three daily hours of manhunt-related social media activity. There were moderate associations between children's bombing-related and manhunt-related Internet news exposure. Similarly there were moderate associations between children's bombing-related and manhunt-related social media activity.

Internet-based exposure varied by child age. After controlling for household income, caregiver education, and race/ethnicity, child age was associated with bombing-related Internet news coverage (partial $r=.39$, $p<.001$) and social media use (partial $r=.50$, $p<.001$), as well as with manhunt-related Internet news coverage (partial $r=.35$, $p<.001$), and social media use (partial $r=.34$, $p<.001$). As presented in Table 3, children below 8 reportedly consumed very little bombing- and manhunt-related Internet-based news coverage and social media content, whereas children over the age of 12 reportedly consumed, on average, one to three hours of each form of Internet exposure, with the highest Internet consumption associated with youth ages 16 and over. Only 19.7% and 32.7% of children below 12 consumed *any* Internet news coverage of the bombing and manhunt, respectively; in contrast 72.5% and 73.5% of children 12 and above reportedly consumed at least some Internet news coverage of the bombing and manhunt, respectively (with 85.3% and 82.7% of youth 16 and over consuming at least some Internet news coverage of the bombing and manhunt,

respectively). Similarly, only 13.4% and 19.7% of children below the age of 12 reportedly engaged in *any* social media activity related to the bombing and manhunt, respectively; in contrast 71.5% and 72.5% of children 12 and above reportedly engaged in at least some social media activity related to the bombing and manhunt, respectively (with 86.7% and 82.7% of youth 16 and over engaged in at least some social media activity related to the bombing and manhunt, respectively).

Associations between child Internet exposure and PTSD symptoms

The average child in the sample experienced at least some direct exposure, with 23.2% (N=107) of the sample reporting at least one bombing-related exposure and 67.6% (N=311) experiencing at least one manhunt-related exposure (see Crum et al., in press). The mean number of direct/relational bombing exposures (see Table 2) for 4–7 year olds was .38 (SD=1.0), for 8–11 year olds was .54 (SD=1.2), for 12–15 year olds was .74 (SD=1.8), and for 16–19 year olds was .56 (SD=1.1) [differences were not significant, $F(3,453)=1.27$, $p=.29$]. The mean number of direct/relational manhunt exposures (see Table 2) for 4–7 year olds was 4.26 (SD=3.1), for 8–11 year olds was 5.45 (SD=3.4), for 12–15 year olds was 5.05 (SD=3.4), and for 16–19 year olds was 5.23 (SD=1.8) [differences were not significant, $F(3,449)=.59$, $p=.62$]. As reported previously (Comer, Dantowitz et al., 2014), the mean score on the RI was 8.2 (SD=10.6) and 3.5% met criteria for “likely PTSD” (i.e., RI ≥ 38). “Likely PTSD” was most common among 12–15 year olds (5.4%), followed by 16–19 year olds (4.6%), 8–11 year olds (3.2%), and 4–7 year olds (1.0%). Youth with “likely PTSD” had higher Internet-based exposure to the bombing ($t(437)=4.67$, $p<.001$) and to the manhunt ($t(432)=3.65$, $p<.001$) than youth without “likely PTSD.” Similarly, youth with “likely PTSD” engaged in more bombing-related social media activity ($t(394)=4.55$, $p<.001$) and manhunt-related social media activity ($t(432)=3.35$, $p<.001$) than youth without “likely PTSD.” Those with “likely PTSD” had engaged in roughly 4 hours per day of these activities.

Linear regression models evaluated the role of children’s Internet exposure in predicting PTSD symptoms. Two models were conducted—one for Internet news exposure (model 1) and one for social media activity (model 2). For model 1, the following variables were entered simultaneously to predict child PTSD symptoms: four demographic covariates (race/ethnicity, household income, caregiver education, and continuous child age), Bombing Exposure Tally to account for children’s direct exposure to the bombing, Manhunt Exposure Tally to account for children’s direct exposure to the manhunt, Bombing-related Internet news exposure, Manhunt-related Internet news exposure, the interaction of Bombing-related Internet news exposure $\times$ Age, and the interaction of Manhunt-related Internet exposure $\times$ age. For model 2, the following variables were entered simultaneously to predict child PTSD symptoms: four demographic covariates (race/ethnicity, household income, caregiver education, and continuous child age), Bombing Exposure Tally to account for children’s direct exposure to the bombing, Manhunt Exposure Tally to account for children’s direct exposure to the manhunt, Bombing-related social media activity, Manhunt-related social media activity, the interaction of Bombing-related social media activity $\times$ Age, and the interaction of Manhunt-related social media activity $\times$ age.

Table 4 presents detailed results of models 1 and 2. Model 1 revealed that Bombing-related Internet news exposure and manhunt-related Internet news exposure were both significantly linked with child PTSD symptoms. Similarly, model 2 revealed that child PTSD symptoms were also associated with the extent of children's bombing-related social media activity and manhunt-related social media activity. Effect sizes were in the small-to-medium range. Moreover, child age moderated associations between bombing-related Internet exposure and child PTSD symptoms, with older youth showing greater associations than younger children between bombing-related Internet exposure/social media activity and PTSD symptoms.

Exploratory analyses examining caregiver attitudes and regulations about children's Internet-based exposure

Roughly one-fifth and one-third of caregivers made no attempt to restrict their child's bombing- and manhunt-related Internet exposure, respectively (see Table 5). Among caregivers who did attempt to restrict children's Internet exposure, time-based restrictions were most common, followed by content-based restrictions, and then co-consumption based restrictions. The majority of surveyed caregivers (86.7%) indicated that they believed that media-based exposure to traumatic events usually causes a child more trauma, but caregivers who held this belief made no greater attempts to restrict their children's Internet-based exposure to the bombing or manhunt in any of the manners assessed (see Table 5).

Child age was associated with attempted caregiver regulations related to children's Internet exposure. Table 5 includes breakdown percentages of youth within each of the four age groups whose caregivers attempted to impose each of the Internet restrictions evaluated. Caregivers of the vast majority of youth ages 11 years and below attempted to impose Internet restrictions, whereas caregivers of the vast majority of youth ages 16 and over imposed no Internet restrictions. For example, whereas roughly 90% of caregivers of youth 7 and below attempted to impose time-based Internet restrictions during the bombing, only one-fifth of caregivers of youth 16 and over did so. Similarly, whereas two-thirds of caregivers of youth 7 and below attempted to impose content-based restrictions during the bombing, only one in six caregivers of youth 16 and over did so, and whereas one-third of caregivers of youth 7 and below attempted to impose co-consumption restrictions during the bombing, only one in twenty caregivers of youth 16 and over did so. Caregiver attitudes about whether media-based exposure to traumatic events usually causes a child more trauma did not differ as a function of child age $t(452)=3.07, p=.18$.

Exploratory analyses examining associations between child Internet exposure and parental attitudes and regulations about child Internet-based exposure

After controlling for child age, household income, race/ethnicity, and caregiver education, children of caregivers who attempted to regulate their Internet exposure to the Marathon consumed as much bombing-related Internet news coverage as children of caregivers who made no attempt to regulate their Internet exposure ($F(1,430)=3.48, p=.06$), but children of caregivers who attempted to regulate their Internet exposure to the manhunt did consume less manhunt-related Internet news coverage (.94 versus 2.34 hours; $F(1,427)=18.15, p<.001$). Children of caregivers who made no attempt to regulate their Internet exposure, relative to children of caregivers who did attempt to regulate their Internet exposure,

engaged in significantly more bombing-related social media activity (1.37 versus .80 hours; $F(1,432)=8.04, p<.01$) and manhunt-related social media activity (1.94 versus .75 hours; $F(1,424)=16.95, p<.001$).

Analyses examining types of Internet restrictions, after accounting for the four demographics controls, found children of caregivers who attempted to impose time-based restrictions did not consume significantly less bombing-related or manhunt-related Internet news coverage, or engage in less manhunt-related social network activity, than their peers. In contrast they did consume less bombing-related social media activity (.80 versus 1.43 hours; $F(1,432)=9.67, p<.01$). Attempted co-consumption based regulations and content-based regulations were not linked to the extent of children's Internet news exposure or social media engagement.

Discussion

The present study adds to a growing body of literature documenting for practitioners the mental health portrait of youth exposed to disasters and terrorism (Comer & Kendall, 2007; Furr et al., 2010; La Greca, Silverman, Vernberg, & Roberts, 2002), and extends this work by providing one of the first investigations pursuing the scope, regulation, and correlates of children's web-based exposure in the aftermath of terrorism. Following the 2013 Boston Marathon bombing, Boston-area children's attack-related Internet news exposure and social media activity was extensive, particularly among older children. Children exposed to Internet news coverage or who engaged in bombing- or manhunt-related social media activity spent, on average, over two daily hours engaged in such activities, with roughly one-third consuming over three daily hours of such coverage. Greater doses of Internet-based news exposure, in turn, were associated with elevated child PTSD symptoms, and older children relative to younger children were particularly vulnerable. It is, thus, particularly concerning that although there was widespread sentiment among caregivers that media exposure can cause children further trauma, a considerable proportion of caregivers made no attempt to restrict or regulate their own child's Internet-based exposure to the Marathon bombing and its aftermath. It may be that despite general caregiver consensus about the concerning impact of threat-related media influences on children's mental health, parents do not fully appreciate the negative impact that web-based exposure, specifically, can have on youth. Alternatively, despite consensus about the negative impact Internet exposure can have on children's mental health, it is possible caregivers simply perceive that they have no influence on children's Internet consumption.

Consistency with previous literature on television exposure to terrorism

The present findings are largely consistent with previous findings focused on the scope and correlates of children's TV exposure to terrorism and its aftermath. Research in affected and unaffected regions following the Oklahoma City bombing and the 9/11 attacks found that children's TV exposure to these attacks was considerable (e.g., Duarte et al., 2011; Hoven et al., 2005; Pfefferbaum et al., 2001; Schuster et al., 2001). Prior research has also consistently found that substantial proportions of caregivers made no attempt to limit children's TV exposure following these terrorist events (Lengua et al., 2005; Schuster et al.,

2001), and that greater doses of TV exposure to terrorism are associated with elevated PTSD symptoms and elevated threat perceptions in youth (e.g., Comer, Dantowitz et al., 2014; Comer, Furr, Beidas, Weiner, & Kendall, 2008; Duarte et al., 2011; Otto et al., 2007; Pfefferbaum et al., 2001; Phillips et al., 2004). The present findings extend these earlier studies that were conducted largely prior to the transformative recent growth in Internet technology, accessibility, and usage across developed regions of the world, and provide the first statistical portrait of the scope and impact of Internet-based exposure to terrorist events within the modern context of our vastly evolved mass media landscape.

Clarifying elevated mental health problems among youth indirectly exposed to terrorism

The present findings may help to elucidate for practitioners consistent observations that following acts of terrorism, children far removed from direct threat can show elevated mental health problems and threat perceptions (Barnes, Treiber, & Ludwig, 2005; Comer & Kendall, 2007; Lengua et al., 2005; Pfefferbaum et al., 2000; Schlenger et al., 2002; Stein et al., 2004). To better understand negative post-terrorism outcomes beyond those accounted for by direct, proximal contact with terrorism, studies have increasingly examined the additional roles of terrorism-related bereavement (Pfefferbaum et al., 1999b; Pfefferbaum et al., 2006), parental exposure or involvement in recovery efforts (Comer, Kerns et al., 2014; Duarte et al., 2006), parental distress (Kerns et al., 2014), prior child trauma exposure and psychopathology (Crum et al., 2016; Hoven et al., 2005), and economic impacts on the family and subsequent life disruptions in the aftermath of terrorism (Comer et al., 2010). Given that many of these additional risk factors are largely restricted to youth in geographic regions directly affected by terrorism, it seems increasingly possible that media exposure, such as the Internet-based exposure presently evaluated, may help to explain observed patterns of post-attack maladjustment among youth far removed from terrorist attacks. Indeed, as individuals across the lifespan increasingly turn to online outlets for news coverage and social engagement, the present study underscores the need for serious caution with regard to the extent of children's online activity following community traumas such as disasters and terrorism. An accumulating body of experimental work with children supports the powerful consequences of indirect, vicarious exposure and verbal information pathways to fear acquisition (e.g., Askew & Field, 2007, 2008; Broeren, Lester, Muris, & Field, 2011; Field, Lawson, & Banerjee, 2008; Field & Schorah, 2007; Muris et al., 2009; Ugland, Dyson, & Field, 2013). As the present study was confined to youth dwelling in the Boston area, further post-terrorism research evaluating more geographically removed samples is needed to evaluate the broad impact of Internet-based exposure to terrorist attacks among more distally affected youth, as it has been conducted with adults (Holman et al., 2014).

DSM-5 now explicitly specifies that media-based encounters with stressful events cannot qualify as traumatic exposures for formal diagnosis of PTSD. Although our analysis did not formally diagnose youth with PTSD and instead only looked at PTSD symptoms continuously, we found that even after accounting for direct exposure to the bombing and manhunt, Internet-based exposure accounted for significant variance in PTSD symptoms. Such findings are consistent with related epidemiologic work suggesting non-qualifying stressful experiences are indeed associated with PTSD in youth (e.g., Copeland et al., 2010),

and underscores the need for continued evaluation of the definitional boundaries of qualifying traumatic exposures in the context of child development.

Differential associations across age between bombing-related versus manhunt-related Internet exposure

Interestingly, we found older youth showed stronger associations between *bombing*-related Internet exposure and PTSD symptoms, whereas associations between *manhunt*-related Internet exposure and PTSD were uniform across age. The reason for these differential findings is unclear. It may be that much of the Internet coverage on the day of the bombing was more abstract (e.g., who did this and could they strike again? Are there other bombs throughout the city?), and that the gravity of such threats were lost on younger children. In contrast, Internet coverage of the manhunt showed heavily armed uniformed service personnel with military grade weaponry in active pursuits and searching homes throughout local neighborhoods—the immediacy of threat related to these activities occurring right outside of children’s doors may have been more uniformly threatening to youth regardless of age or cognitive sophistication. It is also possible that on the day of the bombing, only older youth were able to appreciate the true risks and dangers associated with the situation, whereas by the later manhunt days the gravity of the situation was clear to all children, regardless of age.

Caregiver Internet restrictions and child development

It is encouraging that the vast majority of caregivers of children below 12 years attempted to restrict their child’s Internet-based exposure, but importantly links between Internet exposure and child PTSD in younger children were weaker than such links in older youth with regard to bombing-related content. Given that older children were particularly vulnerable to many of the effects of Internet exposure on PTSD symptoms, it is concerning that one-quarter and over one-half of caregivers of 12–15 year olds made no attempt to restrict their children’s Internet-based bombing and manhunt exposure, respectively. The present findings of the particular vulnerability of older children to Internet exposure is consistent with prior work unrelated to terrorism examining children’s responses to TV news, in which older elementary school-aged children and early adolescents have been found to better understand, as well as be more frightened by, televised news than youth in pre-K through early elementary years (Cantor & Nathanson, 1996; Cantor & Sparks, 1984; Smith & Wilson, 2002; Valkenburg et al., 2000). As considered elsewhere (Cantor & Sparks, 1994; Valkenburg et al., 2000) differences in cognitive development across age groups may account for observed differences. Importantly, fear reactions to media may increase in later elementary school years and into adolescence as structural and functional brain developments support more advanced conceptual and abstract reasoning abilities and an ability to process verbal/linguistic threats (Dumontheil, 2014).

Moreover, future work is needed to further evaluate Internet-based exposure to acts of terrorism in the context of cognitive development. Future-oriented threat perception and elaboration of worries require the ability to mentally represent the future and a capacity to go beyond that which is *observable* and consider that which is *possible* (Grist & Field, 2012; Vasey, Crnic, & Carter, 1994; Vasey & MacLeod, 2001). Previous experimental work

evaluating the effects of TV exposure to terrorism has found that whereas older and younger children show comparable post-clip elevations in *personal* threat perceptions (e.g., I am likely to be a direct victim of terrorism in the future), older children respond to such news with greater elevations in *societal* threat perceptions than younger children (e.g., our country is likely to be attacked again) (see Comer, Furr, Beidas, Weiner, & Kendall, 2008). If related research evaluating the impact of Internet-based exposure on children's perceptions of vulnerability reveals similar patterns, it may be that the ability to mentally represent future threat to oneself emerges earlier than the ability to represent future threat to others.

The need to better understand caregivers' role as media regulators following terrorism

Future research utilizing longitudinal designs is needed to evaluate the impact that various caregiver restrictions may have on child PTSD symptoms, as well as the effects of parental commentary following Internet-based exposure. The experimental work of Comer and colleagues (Comer, Furr, Beidas, Weiner, & Kendall, 2008) found that children of parents who were instructed to co-consume terrorism-related TV news with their children and then discuss this news with their child as they typically would at home showed unfavorable outcomes. In contrast, children of parents who were trained by professionals in how to sensitively discuss terrorism-related news with their children showed reduced anxiety and threat perceptions. In the absence of professional guidance, simply telling parents they should co-consume frightening news content with their children may be misguided, as many parents may themselves be distressed by the news content and may inadvertently exacerbate their child's concerns. Research evaluating televised coverage of terrorism suggests that it is most beneficial when co-consuming parents are able to promote "coping and media literacy" (Comer, Furr, Beidas, Weiner, & Kendall, 2008) in which parents model confidence in their family's security, help children challenge any distorted thoughts they may have, introduce positive and hopeful aspects of the situation (e.g., "look at all of those people who helped"), reward coping thoughts ("I'm so proud of you for thinking that" when a child offers that they are probably safe), and educate their children as appropriate about the dramatic nature of breaking news and the lack of proportionality inherent in many news pieces.

Practitioners should be aware that parents serve a critical role as media regulators. During non-crisis times, children whose parents do not impose media restrictions watch more TV than children whose parents do impose viewing restrictions (e.g., Atkin, Greenberg, & Baldwin, 1991; Krosnick, Anand, & Hartl, 2003). Broadly speaking, parental rule-setting regarding the *when* and *where* of children's TV viewing has been associated with less youth aggression (Nathanson, 1999), and research exploring the impact of violent dramatic TV suggests a curvilinear relation between parental TV restrictions and aggression (in which both very low *and* very high levels of restrictions are associated with youth aggression). However, the optimal level of restrictive mediation in regard to threat-related news and to Internet exposure remains unexplored.

Research on normative child media use patterns suggests that younger children most commonly use the Internet for games and older children most commonly use the Internet for schoolwork/homework (Ofcom, 2013). Elementary school-aged and adolescent youth also commonly use the Internet to access information and for social networking. Less than 10%

of youth ages 5–11 and only 28% of youth ages 12–15 are using the Internet regularly to access news (Ofcom, 2013), but the present findings suggest that during times of crisis the Internet becomes a primary medium through which youth above the age of 12 (and in some cases youth above the age of 8) access news. As such, continued work evaluating youth reactions to Internet-based news and ways to remediate the negative impacts of such exposure would do well to focus primarily on the impact of breaking news events.

Finally, some post-hoc analyses included children's exposure to TV news coverage of the bombing as a covariate, and this did not affect the significance or magnitude of effect sizes associated with the Internet news exposure variables (data not shown). Accordingly, the present findings do not simply reflect the potential that elevated PTSD symptoms found among high Internet consumers were an artifact of the impact of higher TV exposure. At the same time, recent evidence suggests that children are increasingly watching TVs while simultaneously using computing devices and browsing the Internet (Roberts, Foehr, & Rideout, 2004). Our survey did not assess such "media multitasking," and so at present it is not possible to evaluate possible synergistic effects linked with simultaneous media consumption during threatening breaking news events.

It is noteworthy that caregivers who attempted to restrict their children's Internet exposure did not report in many cases that their children were exposed to any less Internet content than did caregivers who did not attempt to impose restrictions. This may simply reflect that caregivers who attempted to impose such restrictions had children who naturally would have consumed more Internet content than other children—i.e., without caregiver restrictions these children would have consumed significantly more Internet content than their peers and thus caregiver restrictions were indeed effective. Alternatively, these findings may reflect that caregiver attempts to regulate children's Internet use is largely unsuccessful.

Limitations

Several limitations merit comment. First, because population-based methods were not applied, findings may not generalize to the general population of Boston-area youth. In addition, the survey was only available online and in English, which restricted eligibility to English-speaking caregivers with computer access. Second, only 42% of caretakers who initially contacted study staff consented to and completed the survey. Importantly, this participation rate is consistent with related research conducted in other crisis-affected regions (La Greca et al., 2010; McLaughlin et al., 2009); unfortunately data are not available on non-participating caregivers and so it is not possible to evaluate differences between those who did and did not participate. Third, the design entailed a single time-point assessment and cannot speak to prospective associations between pre- and post-attack functioning, nor can it speak to matters of temporal precedence between Internet use and child distress. It is possible that anxious youth seek-out more threat-related media. That said, previous work in populations unaffected by disasters has found significant associations between children's media use and threat perceptions, even after controlling for child anxiety (Comer, Furr, Beidas, Babyar, & Kendall, 2008), suggesting that links are likely not simply the result of anxious youth who are predisposed to stress reactions also being vulnerable to seeking out frightening media content. In addition, experimental work in which children

have been shown TV news by investigators has found subsequent increases in child anxiety (Comer, Furr, Beidas, Weiner, 2008), suggesting that the present naturalistic findings are likely not simply the result of media self-selection biases. Fourth, our survey did not assess caregiver Internet exposure and television exposure separately.

Fifth, caregivers provided retrospective data about children's Internet exposure, using single-item assessment methods. Younger children are unable to provide valid self-reports and so given the wide age range of the present sample we employed parallel assessment methodology across participants (i.e., caregiver reports) so that differences across age could not be attributed to methodological differences. Sixth, we assessed the quantity of Internet exposure, but we did not evaluate the nature of that content. Seventh, information on child gender was not collected in the present de-identified survey, and thus the impact of gender on study variables cannot be currently assessed. Eighth, although we evaluated child PTSD symptoms, there is a range of outcomes beyond PTSD symptoms that should be evaluated in the aftermath of terrorism exposure (see Comer & Kendall, 2007; La Greca, 2007). Ninth, all participants were from the greater Boston area, and we did not evaluate youth more distally located from the events. Finally, the present study evaluated a U.S. sample following a terrorist attack. Future work in non-U.S. regions is very much needed to assess the generalizability of the present findings to youth in other contexts.

Conclusions

Despite these limitations, the present study offers a rare account for practitioners of the considerable scope and correlates of Internet-based exposure in the aftermath of a terrorist attack. With vastly improving access to the Internet in recent years, along with transformative advances in mobile technologies and increasingly sophisticated platforms for social networking, the ubiquity of online content and networking provides a new mode of potentially traumatic exposure for children following acts of terrorism. Technological advances in mass communications have vastly extended the scope of our perceptions and senses of proximity and connection. Although we have learned over the years a great deal about TV-based exposure to terrorism, the broadening availability of the Internet brings us closer to what media and communications scholar Marshall McLuhan called the "global village" (McLuhan, 1964), in which the limitations of physical space no longer apply and we can interact with the other side of the world with the same speed and facility afforded in geographically proximal interactions. Continued consideration of the scope and potential impact of Internet-based exposure following terrorist attacks is critical to evaluate the full range of youth affected by terrorism, and can inform professional guidelines for parents in the optimal regulation of Internet exposure. Whereas traditional models of terrorism link mental health consequences with physical proximity to the attack (i.e., bulls eye models; Marshall et al., 2007), increasing evidence portrays a more complicated picture. Clinical efforts—in addition to focusing primarily on children most directly affected by terrorist attacks—must also maintain a secondary focus on children who come into high levels of indirect contact with terrorism. The present findings add to a growing body of literature (e.g., Comer et al., 2010; Comer, Dantowitz et al., 2014; Duarte et al., 2011; Pfefferbaum et al., 2001) clarifying for practitioners critical forms of indirect exposure that can place youth at additional risk following acts of terrorism.

Worldwide acts of terrorism appear to be increasing and a number of highly debated issues stand at the intersection of communications, public discourse, and family (Annenberg Public Policy Center, 2002). The rapidly expanding adoption of Internet resources as primary news sources and mediums for social engagement introduce serious questions for the media, mental health professionals, and caretakers. How can Internet sources most responsibly alert the public about threats without unnecessarily alarming the public? Do oversimplified visuals used in Internet pieces accurately reflect the tone of the story and the realistic threats to the larger public? To what extent should user-uploaded content on social networks be vetted when presenting information on matters of national security and public safety, and how do these concerns intersect with proper freedom of the press and freedom of speech? Moreover, what is the proper role of caregivers as media regulators during times of mass crisis? Continued research on the impact on youth of Internet exposure to community traumas is needed to inform all of these critical modern questions.

Take home messages for children's mental health professionals

Mental health professionals should caution caregivers against exposing children to extended doses of Internet-based coverage in the aftermath of terrorism and related community traumas. Although some caregivers may be appropriately concerned about younger children's Internet exposure, professionals should advise caregivers that it is in fact older children and adolescents who may be most vulnerable to the negative effects of Internet-based news exposure. Without intervention, many caregiver attempts to regulate children's Internet use following disasters are unsuccessful; professionals need to help concerned caregivers develop more effective tools, including supported behavioral management techniques, for regulating their children's media use during times of mass trauma.

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Figure 1. Hypothesized model of the relationships between child internet exposure, child PTSD symptoms, and child age

Note: It was hypothesized that links between Internet exposure and PTSD symptoms would be stronger for older youth relative to younger children

Table 1

Caregiver-report items assessing child Internet exposure to the Boston Marathon bombing and manhunt

Child Internet exposure	Item
Bombing-related Internet news exposure	<i>“Approximately how many hours did your child spend on Monday April 15th (the day of the Marathon) watching or reading Internet news coverage of the bombing?”</i>
Bombing-related social media activity	<i>“Approximately how many hours did your child spend on Monday April 15th (the day of the Marathon) communicating with friends and family about the bombing using social media (e.g., Facebook, Twitter, Instagram)?”</i>
Manhunt-related Internet news exposure	<i>“Approximately how many hours per day did your child spend between Tuesday April 16th through Friday April 19th (the day the second suspect was apprehended), watching or reading Internet news coverage of the manhunt or lockdown?”</i>
Manhunt-related social media activity	<i>“Approximately how many hours per day did your child spend between Tuesday April 16th through Friday April 19th (the day the second suspect was apprehended) communicating with friends and family about the manhunt or lockdown using social media (e.g., Facebook, Twitter, Instagram)?”</i>

Table 2

Child direct and relational exposures to the Boston Marathon bombing and manhunt that were presently assessed.

Bombing exposures	Manhunt exposures
1. Attended the Marathon.	8. Was under the subsequent shelter-in-place warning
2. Was injured in the attack.	9. Saw a heavier police presence in his/her neighborhood during the manhunt.
3. Directly witnessed injured people at the bombing.	10. Saw uniformed persons in his/her neighborhood not typically seen in civilian areas (e.g., National Guard, Homeland Security) during the manhunt.
4. Directly witnessed dead bodies at the bombing.	11. Saw officers with guns drawn related to the manhunt.
5. Was evacuated during the attack.	12. Heard manhunt-related gunshots or explosions.
6. Knew a person injured in the bombing.	13. Saw manhunt-related gunshots/explosions.
7. Knew a person killed in the bombing.	14. Saw manhunt-related blood.
	15. Had an officer knock on their door as part of the manhunt.
	16. Had an officer enter/search their home as part of the manhunt.
	17. Knew the officer slain in the manhunt.
	18. Knew the transit officer injured in the manhunt.

Child and caregiver daily consumption of Internet coverage and engagement in social media activity related to the bombing and manhunt during the week of the 2013 Boston Marathon (N=460)

Note: Within rows, values with different superscript letters are significantly different, as tested by Scheffe contrasts ($p < .05$).

Table 4

Details of regressions examining effects of event-related Internet news exposure and social media activity in predicting child PTSD symptoms

	<i>B</i>	<i>SE(B)</i>	<i>β</i>	<i>t</i>
Model 1: Effects of event-related Internet news exposure				
Bombing-related Internet news exposure	1.25	.26	.31	4.76***
Manhunt-related Internet news exposure	.52	.20	.16	2.63**
Bombing-related Internet news exposure × Child age	-.16	.07	-.18	-2.22*
Manhunt-related Internet news exposure × Child age	-.02	.05	-.02	-.33
Model 2: Effects of event-related social media activity				
Bombing-related social media activity	1.39	.38	.35	3.69***
Manhunt-related social media activity	1.05	.38	.25	2.79**
Bombing-related social media activity × Child age	-.27	.09	-.28	-2.94**
Manhunt-related social media activity × Child age	-.10	.07	-.12	-1.36

Note: Models also control for effects of child race/ethnicity, caregiver education, household income, direct bombing exposure, and direct manhunt exposure. These demographic covariates collectively accounted for 4.8% of the variance in child PTSD symptoms, $R(4, 446)=5.65$, $p<.001$.

* $p<.05$,

** $p<.01$,

*** $p<.001$

Table 5

Caregiver regulations of children's Internet-based exposure to the bombing and manhunt during the week of the 2013 Boston Marathon

	Caregiver Internet Regulations									
	Bombing-related Internet regulation					Manhunt-related Internet regulation				
	Caregivers who believe media-based exposure can traumatize youth ²					Caregivers who believe media-based exposure can traumatize youth ²				
	Total Sample ¹	N	%	N	%	Total Sample ¹	N	%	N	%
No caregiver restriction	104	22.6		78	19.5	176	38.2		131	32.8
Time-based restriction	303	65.9		279	69.9	232	50.4		219	54.9
Not allowed to watch/read any	191	41.5		182	45.6	139	30.2		133	33.3
Allowed to watch/read up to 15 min/day	33	7.2		28	7.0	43	9.3		39	9.8
Allowed to watch/read up to 30 min/day	40	8.7		37	9.3	27	5.9		25	6.3
Allowed to watch/read up to 60 min/day	39	8.5		32	8.0	23	5.0		22	5.5
Co-consumption restriction ³	132	28.7		119	29.8	110	23.9		104	26.1
Content-based restriction ⁴	225	48.9		209	52.4	169	36.7		163	40.9

Caregiver Internet Regulations, By Age Group									
	Bombing-related Internet regulation					Manhunt-related Internet regulation			
	4-7years %	8-11years %	12-15years %	16years %	7years %	8-11years %	12-15years %	16years %	
No caregiver restriction	3.0	7.1	28.0	69.3	11.1	20.0	56.0	78.7	
Time-based restriction	89.9	83.2	52.8	21.3	78.8	63.9	33.6	16.0	
Not allowed to watch/read any	71.7	56.8	21.6	4.0	57.6	41.9	13.6	0.0	
Allowed to watch/read up to 15 min/day	2.0	9.0	10.4	5.3	10.1	11.0	8.8	6.7	
Allowed to watch/read up to 30 min/day	8.1	6.5	13.6	5.3	2.0	5.8	8.8	5.3	
Allowed to watch/read up to 60 min/day	8.1	11.0	7.2	6.7	9.1	5.2	2.4	4.0	
Co-consumption restriction ³	36.4	29.0	36.8	5.3	28.3	32.9	22.4	2.7	
Content-based restriction ⁴	63.6	57.4	48.0	16.0	50.5	51.0	27.2	6.7	

¹N=460

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N=399

Child was only allowed to watch/read Internet coverage when caregiver was watching/reading with child

Caregiver would discontinue child's Internet exposure whenever he/she felt images or coverage were inappropriate

Note: Caregivers who reported that they believed media-based exposure can traumatize youth made no greater attempts to restrict their children's Internet-based exposure to the bombing or manhunt in any of the manners assessed.