

The Impact of Violence and Abuse on Women's Physical Health: Can Trauma-Informed Treatment Make a Difference?

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A history of traumatic experiences has been associated with poor physical health. This study examined associations between trauma and physical health, as well as changes in physical health over time, in women with co-occurring disorders and histories of violence who received either integrated trauma-informed services or usual care. Results revealed that women who had experienced more severe trauma also suffered worse physical health and were more likely to engage in poor health behaviors. Receiving behavioral health care services was associated with improved physical health and health behaviors. Predictors of physical health improvements included reduced interpersonal abuse, reduced severity of posttraumatic symptoms, improved health behaviors, and adequate access to medical care. Implications for primary, secondary, and tertiary prevention are discussed.

Trauma has been described as pervasive, damaging, and an extremely serious threat to public health (Power, 2004). The report of the President's New Freedom Commission

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on Mental Health (2003) identified trauma as one of the four main mental health problems for the nation to address and stated that "the mental health field lacks sufficient information about dealing with trauma" (p. 71). In the United States, 51.9% of women surveyed reported that they had been physically assaulted and 17.6% reported that they had been raped (Tjaden & Thoennes, 2000). Rates of trauma are especially high in clinical populations (Coid et al., 2003). Indeed, women with co-occurring disorders (i.e., those who have drug or alcohol abuse problems as well as another mental health disorder) are more likely to be victims of trauma, with rates of exposure ranging from 48% to 90% (e.g., see Haason, Hesselbrock, Tworkowski, & Swean, 2002).

A growing body of literature also links the experience of childhood and adult trauma to poor physical health (e.g., Felitti et al., 1998). Chronic sexual and physical abuse in particular have been associated with increased rates of heart disease, cancer, gastrointestinal disorders, and chronic pain in adulthood (e.g., Diaz, Simantov, & Rickert, 2002; Felitti, 1991; Lampe, et al., 2003). High rates of other chronic illnesses have been found in women with co-occurring disorders and histories of violence (Larson et al., 2005). Women with past trauma histories experience increased rates of disability (e.g., Rosenberg et al., 2000), often suffer from multiple, nonspecific physical symptoms (McNutt, Carlson, Persaud, & Postmus, 2002), and use more medical services (e.g., Kartha et al., 2005). Psychiatric problems as well as drug and alcohol use may further contribute to physical illness and disability (Baigent, 2003). Women with co-occurring disorders often rely heavily on costly emergency room services for medical care (Farley & Patsalides, 2001).

Several factors may be responsible for the link between trauma and physical health. Trauma has been associated with mental disorders such as posttraumatic stress disorder (PTSD), anxiety, and depression, which are in turn related to various physical health problems. Up to one half of all visits to primary care physicians are due to conditions that are caused or exacerbated by mental or emotional problems (Collaborative Family Healthcare Coalition, 1998). Suffering from past trauma has also been associated with negative health behaviors, such as increased smoking, poor nutrition, physical inactivity, and caffeine use as well as the use of alcohol and drugs, all of which can be detrimental to physical health (Felitti, 2001; McNutt et al., 2002). Women who have experienced trauma and suffer from co-occurring disorders may also have difficulty gaining access to needed medical care and may receive less appropriate care (Druss & Rosenheck, 1998). Finally, trauma may impact brain development and physiology, thereby leading to dysregulation in various bodily systems (Solomon & Heide, 2005). Continued interpersonal abuse in adult life may also contribute to physical health problems. Figure 1 illustrates the possible pathways for the impact of violence and abuse on physical health.

Abuse remains an important public health concern and, in women, it may be a stronger predictor of poor physical health than poverty (Sutherland, Bybee, & Sullivan, 2002). Various authors have reported that women with histories of trauma and co-occurring disorders have multiple complex needs that are poorly served by the existing fragmented service system (e.g., Ridgely, Lambert, Goodman, Chichester, & Ralph, 1998). The Women, Co-Occurring Disorders and Violence Study (WCDVS) was the first major federal effort to respond to the significant lack of services for women with co-occurring mental health and substance use disorders who also have histories of physical and sexual abuse (Giard et al., 2005). The WCDVS was a multisite study funded by the Substance Abuse and Mental Health Services Administration (SAMHSA).

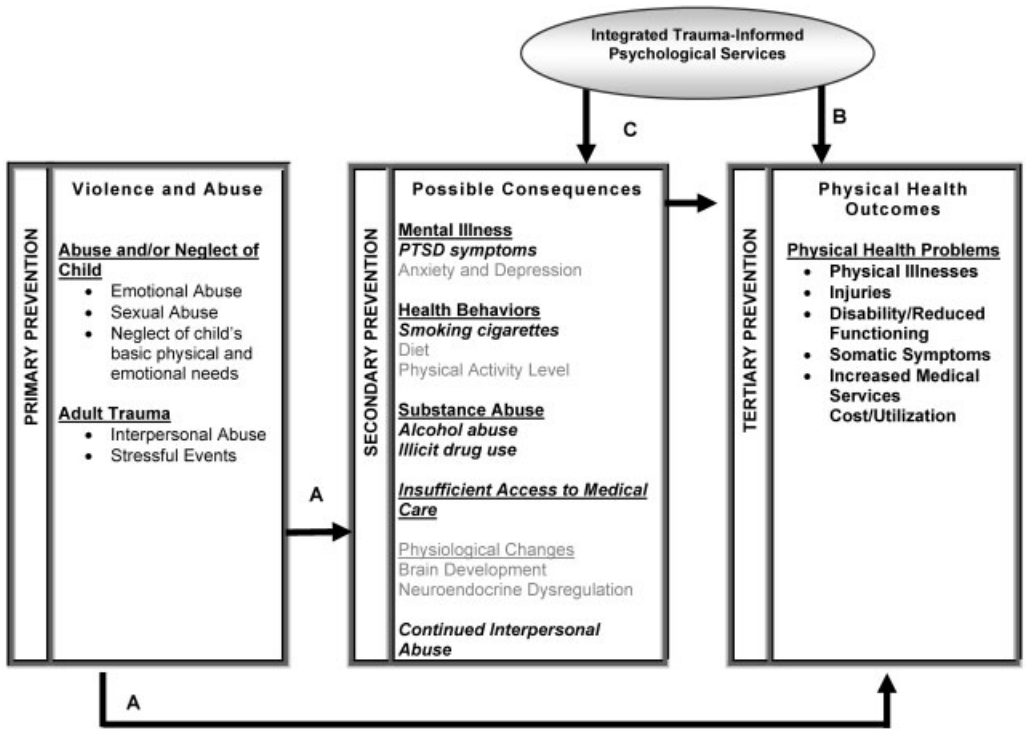


Figure 1. The impact of violence and abuse on physical health. This figure shows a model of the relationship between violence and abuse and physical health problems, including possible pathways of this relationship and the impact of intervention. The constructs printed in bold were measured in this study. The arrows correspond to the three major hypotheses tested in the present study: (a) First, we hypothesized that more severe trauma and trauma symptoms would be related to poorer physical health outcomes (more physical illnesses, injuries, disabilities, somatic symptoms, and higher medical services utilization). We also expected that more severe trauma and trauma symptoms would be associated with poorer health behaviors as measured by smoking, with more drug and alcohol use and with insufficient access to needed medical care (see two arrows labeled A). (b) Second, we hypothesized that the behavioral health services provided in both the intervention and comparison conditions would result in improved physical health outcomes, and that women in the intervention condition who received integrated services would show greater levels of improvement (see arrow B). (c) Third, we hypothesized that decreased posttraumatic symptom severity, improved health behaviors, reduced drug and alcohol use, increased access to needed medical services and decreased exposure to interpersonal abuse would predict positive changes in physical health (see arrow C; predictors examined in this study are shown in italics).

SAMHSA's goal was to develop and evaluate comprehensive and integrated behavioral health services for this group of women, who are often frequent users of publicly funded services (Cocozza et al., 2005).

The WCDVS intervention sites provided behavioral health services that integrated mental health services, substance abuse treatment, trauma-specific services, outreach and engagement, screening and assessment, parenting skills training, research coordination and advocacy, crisis intervention, and peer-run services (Cocozza et al., 2005; McHugo et al., 2005). This integrated, trauma-informed treatment approach is sensible given the high probability of co-occurring conditions in women who have suffered trauma and the likelihood that each condition will exacerbate the others (Veysey & Clark, 2004). Indeed, significant improvements in mental health symptoms, drug abuse severity, and posttraumatic symptoms have been reported with such an approach (e.g.,

see Coccozza et al. and Morrissey et al., 2005). While the connection between trauma and physical health appears to be widely acknowledged, research has not examined the possible impact of integrated, trauma-informed behavioral health treatment on physical health problems (McAllister-Groves, 2001). Given the interrelationship of mental health and behavioral issues with physical health, it appears that such a comprehensive and integrated approach may be especially beneficial. It seems possible that such interventions may improve mental health and health behaviors, reduce substance use, improve access to medical care and lower exposure to abuse (Coccozza et al., 2005), which, in turn, may improve physical health.

In this study, we tested three major hypotheses (see Figure 1). First, we hypothesized that more severe trauma and trauma symptoms would be related to more physical illnesses, injuries, disabilities, somatic symptoms, and higher medical services utilization. We also expected that more severe trauma and trauma symptoms would be associated with poorer health behaviors as measured by smoking, with more drug and alcohol use and with insufficient access to needed medical care (see two arrows labeled A in Figure 1). Second, we hypothesized that the behavioral health services provided in both the intervention and comparison conditions would result in improved physical health outcomes, and that women in the intervention condition, who received integrated services, would show greater levels of improvement (see arrow B in Figure 1). Third, we hypothesized that decreased posttraumatic symptom severity, improved health behaviors, and reduced drug and alcohol use increased access to needed medical services, and decreased exposure to interpersonal abuse would predict positive changes in physical health (see arrow C in Figure 1; predictors examined in this study are shown in italics).

METHODS

Participants

The women in the WCDVS were recruited from mental health treatment, substance abuse treatment and domestic violence programs from across the country. To be eligible to participate in the WCDVS, a woman had to (a) be age 18 or older; (b) meet diagnostic criteria for a DSM-IV Axis I mental disorder or Axis II personality disorder and Axis I substance-related disorder (excluding caffeine and nicotine-related disorders) and have experienced symptoms of either the mental health disorder or the substance abuse disorder within the past 30 days and symptoms of the other disorder within the past five years; (c) have experienced sexual or physical abuse during her lifetime; (d) have had at least two distinct behavioral health treatment episodes during her lifetime, not including self-help therapies such as AA or NA; and (e) be able to converse with an interviewer in English or Spanish. The sites enrolled a total of 2,729 women in the study. The majority of women were non-Hispanic Whites; the study also included African Americans, Hispanics, American Indians, Asians, and women of mixed race or ethnicity. The women were relatively young, with a mean age of 36 years (5th percentile = 29 years; 75th percentile = 42 years), and disability payments were a larger source of their income than payment for employment. Two-thirds (68.5%) reported current health insurance coverage, and the majority were enrolled in a state Medicaid program. Demographics are reported in more detail elsewhere (Becker et al., 2005).

Procedures

Each study site identified and enlisted the cooperation of one or more sites to provide women for a “usual care” comparison group. Following IRB approvals, interviewers obtained informed consent and administered an interview to each woman in the study. This interview consisted of six main sections: personal history, trauma, mental health, substance abuse, services used, and consumer perceptions of care. Women in the study were interviewed with the entire protocol of measures at baseline, 6 months post baseline, and 12 months post baseline.

The Intervention: Trauma-Informed Services

All WCDVS intervention sites had to meet four requirements. First, they had to provide a comprehensive range of services, including mental health services, substance abuse treatment, trauma-specific services, outreach and engagement, screening and assessment, parenting skills training, research coordination and advocacy, crisis intervention, and peer-run services (Cocozza et al., 2005; McHugo et al., 2005). Second, their substance abuse, mental health, and trauma treatment approaches needed to be integrated. Third, they had to provide trauma-informed treatment, which specifically addressed trauma and integrated trauma-specific issues into other services provided (see Giard et al., 2005). Finally, each intervention site needed to involve in all aspects of the study at least one woman who was a survivor of physical or sexual abuse, was in recovery from drug or alcohol abuse and had experience as a consumer of mental health treatment (Cocozza et al., 2005).

Women in the comparison condition received usual care, which reflected the care generally available in the geographic areas served by each intervention site (Cocozza et al., 2005). Further details on the design of integrated trauma-informed services versus comparison group services are provided elsewhere (Giard et al., 2005).

Measures

Personal history. The personal history section of the interview was developed for this study and used to assess five domains, including living situation, education and employment, number of children, involvement with the legal system, and physical health conditions.

Drug and alcohol problem severity. We used selected items from the Addiction Severity Index (ASI), which is widely used and shows good psychometric properties (McLellan et al., 1992) to assess alcohol and drug use severity. The ASI yields a Drug Composite score (ASI-D) and an Alcohol Composite score (ASI-A) that are based on reported use and perceived problem severity over the past 30 days. Higher scores indicate greater problem severity. We used two items in the section on substance abuse to assess smoking behavior, including number of years of cigarette use and average number of cigarettes smoked per day during the past 30 days.

Trauma history. We assessed trauma history using the Life Stressor Checklist–Revised (LSC-R; Wolfe, Kimerling, Brown, Chrestman, & Levin, 1996), which was modified for this study (McHugo et al., 2005). This checklist yielded five variables for our analyses:

frequency of childhood abuse, lifetime frequency of interpersonal abuse, current exposure to interpersonal abuse, lifetime exposure to other stressful events, and current exposure to other stressful events.

Severity of current trauma symptoms. We assessed current trauma-related symptoms using the 17-item PTSD Symptom Scale (PSS; Foa, Riggs, Dancu, & Rothbaum, 1993). The longer, 49-item version of this instrument has been used to detect and diagnose PTSD. The PSS inquires about PTSD symptoms the respondent has experienced in the past 30 days. The sum across all items represents symptom severity, with higher scores corresponding to more severe symptoms.

Subjective physical health rating. We assessed perceived health status using the subjective health rating from the SF-12 Health Survey. The SF-12 is one of the most widely used measures of health functioning (Ware, Kosinski, & Keller, 1996). The question "How would you rate your overall health right now?" is answered on a 5-point Likert scale from 1 (*excellent*) to 5 (*poor*). Lower scores, therefore, correspond to better health ratings.

Physical illnesses, disabilities, and injuries. Interviewers asked participants to respond "yes" or "no" to the close-ended question, "Do you have any serious physical illnesses or disabilities?" If respondents answered yes, interviewers asked about the type of serious physical illness or disability and recorded the number of physical illnesses. To allow us to track changes in physical illness over time, only conditions subject to change (e.g., back or neck problems, lung/breathing problems, stomach/gastrointestinal problems, gynecological or "women's problems," and weight problem) were included in longitudinal analyses, while chronic conditions that were not likely to change (e.g., a diagnosis of cancer) were excluded. For each condition mentioned, the interviewer also asked: "Does this illness/disability currently affect your daily activities?" The number of conditions affecting daily activities was used in our analyses. The number of injuries ("fractures, bone/joint injury" and "other injury") was recorded and analyzed separately.

Somatic symptoms. The 53-item Brief Symptom Inventory (BSI) is a shortened version of the Symptom Checklist (SCL-90) and is one of the most widely used standardized instruments for measuring mental health outcomes (Derogatis, 1993). We used the Somatic subscale of the BSI (Derogatis, 1993) to measure somatic symptoms (e.g., "pains in heart or chest," "nausea or upset stomach") that participants had experienced in the last seven days. Higher scores on the Somatic subscale represent more severe somatic symptoms.

Utilization of medical services and access to care for physical illness. This section of the interview was adapted for the WCDVS from the service use section of the cross-site protocol used in a SAMHSA-funded multisite study of managed care and vulnerable populations (Leff et al., 2005). Interviewers asked participants about all of the medical services they had received during the 3 months prior to the interview. This section of the interview was administered at baseline, 3 months, 6 months, 9 months, and 12 months. The number of instances participants received services for a physical complaint across settings (e.g., hospitalization, visits to the emergency room, visits to

medical clinics) was used as a measure of medical services utilization. Insufficient access to needed medical care was measured in the same section with the item: "Which of the following services have you felt you needed but haven't received in the past 3 months?" For the present study, only answers pertaining to medical services were used in the analyses.

Analyses for Testing the Main Hypotheses

Hypothesis A. More severe trauma and trauma symptoms will be associated with poorer physical health, poorer health behaviors as measured by smoking and more medical services utilization. We used partial Pearson correlations to examine associations between exposure to trauma and trauma symptoms at baseline and physical health, health behaviors, and medical services utilization at baseline. We controlled for age and education, and we used a two-tailed significance level of $p < .05$ for all analyses. In order to ensure that relationships between variables were not accounted for by substance use only, partial correlations also controlled for drug and alcohol use. Correlations between trauma and substance use controlled for age and education only. We also considered effect sizes because of our large sample size (see Cohen, 1988).

Hypothesis B. Women who receive a behavioral health intervention, and women in the integrated intervention group in particular will show improvements in physical health over time. To examine possible changes in physical health and health behaviors, we conducted a series of repeated measures analyses of covariance (RMANCOVAs) using baseline, 6-month, and 12-month measures of health. Analyses employed treatment condition (between-subjects factor) and time (within-subjects factor) as independent variables, with respective health outcomes (within-subjects factors) as dependent variables. We used partial Eta², the proportion of total variance attributable to a factor, to measure effect size, and controlled for age, drug and alcohol use, and education. We expected that the integrated intervention would be superior to the comparison condition in predicting improved health, as shown by treatment-by-time interaction effects.

Hypothesis C. Changes in posttraumatic symptoms, health behaviors, alcohol and drug use, access to medical care and interpersonal abuse will predict changes in physical health. To examine predictors of changes in physical health variables, we calculated change scores for each health outcome by subtracting the baseline score from the 12-month score. Negative values therefore corresponded to declines and positive values to improvements in specific physical health measures. We also calculated change scores for predictor variables. In subsequent hierarchical regression analyses, we entered control variables (age and education) in the first step. We also entered the baseline value of the health outcome variable of interest in the first step to control for effects of regression toward the mean. In the second step, we entered predictors of physical health changes simultaneously, including posttraumatic symptoms, health behaviors (number of cigarettes smoked), alcohol and drug use, and medical services that were needed but not received and changes in interpersonal abuse, which were summed over the entire 12-month time period. Given that we were interested in predictors of physical health change over time and because changes in health could occur in both groups, we pooled data from the intervention and comparison groups.

RESULTS

Examination of Baseline Differences on Major Outcome Measures

Our independent sample *t* tests showed several significant differences between groups in physical health measures at baseline. Participants in the treatment group reported slightly better subjective physical health compared to participants in the comparison group ($M = 3.24$ and $M = 3.34$, respectively; $t = -2.36$, $p = .02$) and a somewhat lower prevalence of chronic illnesses ($M = .63$ and $M = .70$, respectively; $t = -1.96$, $p = .05$) and injuries ($M = .37$ and $M = .42$, respectively, $t = -2.30$, $p = .02$). Consequently, scores on physical health measures at baseline were controlled for in analyses for hypothesis B.

Hypothesis A: Relationships Between Trauma and Physical Health

Results showed small but significant correlations linking the severity of different types of abuse and stressful events with the severity of physical health problems, health behaviors and alcohol and drug use (see Table 1). Women who had experienced more severe childhood abuse reported poorer subjective health, more injuries, more disabling health conditions, more severe somatic symptoms, and more cigarette smoking. Women who had experienced more lifetime exposure to interpersonal violence and were currently experiencing interpersonal abuse reported the same problems as well as more drug and alcohol use. There were significant correlations between lifetime

Table 1. Partial Pearson Correlations Between Exposure to Trauma and Measures of Health and Health Behaviors at Baseline^a. (N = 2,189)

	Childhood abuse Frequency	Exposure to interpersonal abuse (frequency)		Exposure to other stressful events (frequency)		PTSD symptoms
		Lifetime	Current	Lifetime	Current	
Physical health						
Subjective physical health	.115*	.154*	.079	.162*	.098	.277*
Number of physical illnesses	.093	.127*	.028	.188*	.091	.147*
Number of injuries	.182*	.104	.091	.034	.108	.144*
Number of disabling conditions	.223*	.125*	.097	.073	.122*	.212*
Somatic symptoms	.179*	.256*	.199*	.288*	.222*	.536**
Medical services received	.056	.079	.085	.155*	.151*	.043
Health behaviors						
Years of cigarette smoking	.132*	.120*	-.008	.090	.015	.033
Cigarettes smoked per day	.094	.110*	.013	.099	.008	.144*
Alcohol and drug use						
Alcohol use	.010	.080	.158*	.070	.098	.119*
Drug use	.032	.109*	.187*	.118*	.182*	.106*
Medical services needed						
but not received	.036	.034	.024	.046	-.003	.046

^aControlling for age, drug and alcohol use, and education.

*indicates small effect size. **indicates moderate effect size. All correlations with small to moderate effect sizes were significant at the $p < .0001$ level.

exposure to other stressful events and poorer subjective health, more physical illnesses, more severe somatic symptoms, and greater medical services utilization and more drug use. Posttraumatic symptoms showed the strongest relationships with poorer subjective health, more injuries, more disabling conditions, more severe somatic symptoms, and more cigarette smoking and drug and alcohol use (but not with greater medical services utilization).

Hypothesis B: Effect of Integrated Behavioral Health Services on Physical Health

Multivariate analyses showed an effect of treatment condition but no significant effect of time on subjective physical health ratings: $F(1, 1865) = 8.30, p < .01$, partial $\text{Eta}^2 = .004$ for treatment condition; $F(2, 3730) = 2.79, p = .062$ for time. Participants in the intervention group showed better overall health ratings. There was no significant effect of treatment condition on the number of physical illnesses, $F(1, 1869) = .013, p = .911$, but participants reported slightly fewer physical illnesses over time, $F(2, 3738) = 3.25, p < .05$, partial $\text{Eta}^2 = .002$. Significant effects of treatment condition, $F(1, 1869) = 7.11, p < .01$, partial $\text{Eta}^2 = .004$, as well as time, $F(2, 3738) = 3.26, p < .05$, partial $\text{Eta}^2 = .002$, were observed for number of injuries. The comparison group reported more injuries than the intervention group, and both decreased over time. No significant effects of treatment condition or time were detected for the number of disabling conditions: $F(1, 1869) = 3.28, p = .07$ and $F(2, 3738) = 1.33, p = .26$, respectively. Somatic symptom severity decreased over time, $F(2, 3732) = 8.14, p < .001$, partial $\text{Eta}^2 = .004$, regardless of treatment condition, $F(1, 1866) = 2.19, p = .139$. Similarly, medical services utilization declined slightly over time, $F(2, 3738) = 3.49, p < .05$, partial $\text{Eta}^2 = .002$, regardless of treatment condition, $F(1, 1869) = .041, p = .840$. Furthermore, both time and treatment condition affected the number of cigarettes smoked per day: $F(2, 1366) = 3.05, p < .05$, partial $\text{Eta}^2 = .002$ for time; $F(1, 1866) = 4.28, p < .05$, partial $\text{Eta}^2 = .003$ for treatment condition. All participants smoked fewer cigarettes over time, while women in the intervention condition smoked less overall. Regarding the number of medical services needed but not received, neither effects of intervention condition nor time reached significance: $F(2, 3730) = 1.60, p = .206$ for treatment condition; $F(2, 3730) = .678, p = .508$ for time. None of the analyses detected a significant interaction effect that would have indicated differences in change over time between one treatment condition and the other. Mean scores for all physical health outcome variables are shown in Table 2.

Hypothesis C: Predictors of Changes in Physical Health

In the hierarchical regression model for subjective physical health, covariates entered in Step 1 (age, education, and subjective health at baseline) significantly predicted subjective physical health: $\Delta R^2 = .25, F(3, 1500) = 166.06, p = .000$. Individually, lower age ($pr = .14$) and lower health ratings at baseline ($pr = -.50$) emerged as significant predictors of improved physical health. The addition of change scores for smoking behavior, drug and alcohol use, access to healthcare, interpersonal abuse, and posttraumatic symptom severity as predictor variables in Step 2 added significant explanatory power to the model: $\Delta R^2 = .28, F(6, 1494) = 12.99, p = .000$. Of these components, decreased drug use ($pr = .088$) and decreased posttraumatic symptom severity ($pr = .17$) independently predicted positive change in subjective physical health.

Table 2. Means and Standard Deviations for Physical Health Measures at Baseline, 6 Months, and 12 Months

		<i>N</i>	<i>Baseline</i>	<i>6 months</i>	<i>12 months</i>
Subjective physical health	I	949	3.27 (1.07)	3.13 (1.10)	3.10 (1.10)
	C	922	3.37 (1.02)	3.21 (1.09)	3.26 (1.07)
Number of physical illnesses*	I	952	.28 (.58)	.25 (.59)	.23 (.55)
	C	923	.28 (.59)	.23 (.51)	.26 (.54)
Number of injuries*	I	952	.38 (.53)	.35 (.53)	.36 (.53)
	C	923	.43 (.56)	.40 (.56)	.41 (.54)
Number of disabling conditions	I	952	.69 (1.14)	.60 (1.14)	.58 (1.07)
	C	923	.74 (1.18)	.67 (1.12)	.69 (1.14)
Somatic symptoms*	I	949	1.03 (.84)	.86 (.79)	.84 (.79)
	C	923	1.05 (.83)	.92 (.84)	.91 (.84)
Medical services received*	I	767	1.54 (1.26)	1.33 (1.20)	1.25 (1.17)
	C	781	1.57 (1.28)	1.31 (1.20)	1.26 (1.09)
Cigarettes smoked per day*	I	691	14.92 (9.82)	14.38 (10.04)	14.40 (9.87)
	C	681	16.08 (10.15)	15.25 (9.19)	15.31 (9.56)
Medical services needed but not received	I	952	.05 (.21)	.02 (.13)	.02 (.15)
	C	923	.04 (.19)	.02 (.13)	.02 (.14)

Note. SDs shown in parentheses. I = intervention group; C = comparison group.

*denotes significant change over time.

In the hierarchical regression model for physical illnesses, lower age ($pr = .15$) and a greater number of chronic illnesses at baseline ($pr = -.57$) were associated with a decrease in the number of reported chronic illnesses: $\Delta R^2 = .33$; $F(3, 1501) = 249.65$, $p = .000$. The addition of the predictor variables did not add significant explanatory power to the model: $\Delta R^2 = .331$, $F(6, 1495) = .79$, $p = .576$. Similarly, in the models for injuries and disability, lower age ($pr = .19$ and $pr = .20$, respectively) and a greater number of injuries and disabling conditions at baseline ($pr = -.55$ and $pr = -.51$, respectively) were associated with a decrease in reported injuries and disability: $\Delta R^2 = .30$; $F(3, 1501) = 213.47$, $p = .000$ for injuries and $\Delta R^2 = .25$; $F(3, 1501) = 171.84$, $p = .000$ for number of disabling conditions. The addition of predictor variables in Step 2 did not add significant explanatory power to the model individually or as a group: $\Delta R^2 = .30$, $F(6, 1495) = .726$, $p = .629$ for injuries and $\Delta R^2 = .30$, $F(6, 1495) = .1.91$, $p = .076$ for number of disabling conditions.

In the hierarchical regression model for somatic symptoms, lower age ($pr = .16$) and more severe somatic symptoms at baseline ($pr = -.50$) predicted reduced somatic symptom severity: $\Delta R^2 = .28$; $F(3, 1501) = 194.71$, $p = .000$. In Step 2, decreased drug use ($pr = .082$), decreased interpersonal abuse ($pr = .078$), and decreased posttraumatic symptom severity ($pr = .36$) independently predicted reduced somatic symptom severity: $\Delta R^2 = .41$, $F(6, 1495) = 54.37$, $p = .000$.

In the hierarchical regression model for health care utilization, lower age ($pr = .12$) and greater medical services utilization at baseline ($pr = -.67$) were associated with decreased medical services utilization: $\Delta R^2 = .46$; $F(3, 1501) = 426.33$, $p = .000$. In Step 2, decreased exposure to interpersonal abuse ($pr = .05$), decreased posttraumatic symptom severity ($pr = .093$) and increased smoking ($pr = -.06$) were associated with decreased medical services utilization: $\Delta R^2 = .467$, $F(6, 1495) = 4.37$, $p = .000$.

DISCUSSION

This study tested a model of the impact of violence and abuse on physical health, which included potential pathways for change and intervention (see Figure 1). Results showed that more severe childhood abuse, lifetime interpersonal abuse, and lifetime exposure to other stressful events were related to poorer perceived health, more physical illnesses, more disabling conditions, more severe somatic symptoms, more years of cigarette smoking, and more drug use.

Of all of the variables we examined for links to physical health, we observed the strongest relationships between posttraumatic symptom severity and physical health. The finding that heavier smoking was related to the frequency of childhood abuse is consistent with data from the Adverse Childhood Experiences study, which reported a similar dose-response relationship between childhood trauma and the probability of current smoking (e.g., Felitti, 2001). It is also notable that nonspecific somatic symptoms (e.g., upset stomach, dizziness) showed especially strong relationships with past trauma and specifically with posttraumatic symptoms. These findings suggest that, in addition to suffering high rates of physical illness (Larson et al., 2005) and exhibiting poor health behaviors, women who have suffered more severe trauma and posttraumatic symptoms tend to have more severe health complaints. Furthermore, while we had hypothesized that the intervention condition would have a greater positive impact than the comparison condition on participants' physical health, our results showed significant reductions in the number of physical illnesses, the number of injuries, the severity of somatic symptoms, medical services utilization, and cigarette smoking in all participants, regardless of treatment condition. These findings are similar to those of another study on the same sample, in which mental health and substance abuse improved in both the comparison and intervention conditions, with somewhat more improvement among intervention group participants (e.g., Coccozza et al., 2005).

It is notable that participants' physical health improved despite the fact that, unlike mental health and substance abuse, physical health was not directly addressed in either treatment condition. We detected no significant associations between trauma and insufficient access to needed medical care at baseline, and there was no change in this variable over time. The vast majority of women (91%) reported sufficient access to medical services at baseline; i.e., a low score on medical services needed but not received. Thus, it would be difficult to detect associations between this and other variables. Given that there was no change in women's reports of medical services needed but not received, it is also unlikely that access to medical services can explain observed changes in self-reported physical health.

Predictors of improved physical health (as measured by improved subjective physical health, decreased severity of somatic symptoms, and decreased health care utilization) included reduced exposure to interpersonal abuse, reduced severity of posttraumatic symptoms, and reduced drug use. These predictors represent pathways through which behavioral health interventions may improve physical health in women who have experienced trauma and violence. An unpredicted and counterintuitive finding was that increased smoking was also a predictor of this outcome. None of the proposed factors predicted changes in physical illnesses, injuries, or disabling conditions.

Our study had several limitations. The study design was quasi-experimental with a nonrandom design, and it was performed within the context of a large multisite trial (Coccozza et al., 2005). Despite the requirement that each intervention site incorporates four program elements (integration, comprehensiveness, trauma-informed treat-

ment, and peer involvement), the extent to which these elements were implemented varied across sites (Cocozza et al., 2005). Some other outcome studies using data from the WCDVS have demonstrated variations in outcomes by study site (Cocozza et al., 2005). Consistent with a previous study on outcomes in this sample, however, our study showed that both comparison and intervention groups improved on major outcome variables (Cocozza et al., 2005).

One could argue that we obtained relatively small changes in physical health and health behaviors over time. However, this study only examined a relatively brief 12-month view of this population. Since participants were already high users of behavioral health services before the study, the treatment conditions were unlikely to have as great an impact as they would on populations that had received no services prior to the study. Furthermore, poor health generally develops over long periods of time, often involving continual stress on physiological systems (e.g., McEwen, 1998), and improvements in health driven by physiological changes, improved mental health, or better health behaviors may require longer time periods to manifest. Given these limitations, it seems notable that we still observed several positive changes in physical health and health behaviors. Furthermore, we performed a large number of analyses in the present study, which, combined with the large sample size, increases the probability of spurious associations. It should be noted, however, that our results were largely consistent with the proposed model and supported our hypotheses. Another limitation was that our model did not examine the role of potential protective factors, such as social support, that might buffer the effects of trauma on physical illness.

Our findings may have implications for intervention and policy at several levels. Strategies for primary prevention include reducing the occurrence of violence and abuse against women and children, as well as providing immediate intervention and support for children who have been subjected to trauma and violence (Kilpatrick, Resnick, & Acierno, 1997; McAllister-Groves, 2001), which may decrease their likelihood of developing physical dysregulation, mental illness, poor health behaviors and substance use problems that could contribute to adverse health outcomes in adult life. Our finding that younger women showed greater health improvements over time than older women further supports the importance of early intervention. On the other hand, our findings also suggest that there may be a greater need for intervention for women as they age. Physical health in older women with a history of trauma may be more difficult to change or may require different types of interventions or longer timeframes. Future research is needed to elucidate these important issues.

Regarding secondary prevention, our findings suggest that providing behavioral health services could cause a domino effect by positively affecting several variables that lead to improved physical health, including interpersonal abuse, PTSD symptoms, and drug use. Behavioral health services may further improve physical health if they include programs in stress management, weight control, physical exercise, and smoking cessation (Kilpatrick et al., 1997).

The connection between trauma and nonspecific somatic symptoms is consistent with the finding that women with co-occurring disorders and histories of violence often utilize primary care clinics (Mollica, 2001). One study found that medical costs for victims of assault were predictably high in the year after the assault but also remained elevated during the following three years (Koss, Koss, & Woodruff, 1991). Consequently, screening for trauma at medical clinics and providing appropriate intervention may be an effective tertiary prevention strategy (Mollica, 2001). As trauma and posttraumatic symptoms have been associated with increased medical services utiliza-

tion and disability in this and other studies (e.g., Kartha et al., 2005), the medical costs related to trauma and violence are likely to be high. Our finding that reductions in posttraumatic symptoms were related to lower medical services utilization at follow-up suggests that treating trauma may be cost-effective.

CONCLUSION

Our data revealed several connections among trauma, poor physical health, poor health behaviors, and alcohol and drug use with a positive correlation between the severity of the trauma and the severity of the health and health behavior problems. Our findings suggest that behavioral interventions not only reduce substance use and improve mental health (Cocozza et al., 2005; Morrissey et al., 2005) but may also improve health behaviors and physical health. The number of interrelationships between trauma and health make a case for a multifaceted approach that decreases the impact of trauma on physical health and reduces the associated social and economic costs to the individual and to society, as well as trauma's personal costs to the survivor.

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