Journal of Psychiatric Research 92 (2017) 212–218

Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/psychires

Trauma exposure, incident psychiatric disorders, and disorder transitions in a longitudinal population representative sample

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ARTICLE INFO

Article history:
Received 12 December 2016
Received in revised form
24 April 2017
Accepted 4 May 2017

Keywords:
Trauma
Child maltreatment
Disorder transitions
Heterotypic continuity

ABSTRACT

Heterotypic continuity, whereby individuals transition from one disorder to another, is common; however, longitudinal studies examining transdiagnostic predictors of heterotypic continuity are lacking. The current study examined whether trauma exposure during childhood (maltreatment) and adulthood (interpersonal and non-interpersonal trauma) is associated with heterotypic continuity in a national sample. Men and women (N = 34,653) who participated in Waves 1 (2001–2002) and 2 (2004–2005) of the National Survey of Alcohol and Related Conditions (NESARC) completed face-to-face interviews about trauma exposure and psychopathology. Risk ratios and population attributable risk proportions (PARPs) quantified the effects of childhood maltreatment and interpersonal and non-interpersonal trauma exposure between Waves 1 and 2 on risk for incident disorders and transitions between specific types of disorders. Twenty percent of respondents reported a Wave 2 incident disorder. Those with any Wave 1 disorder were at increased risk of incident mood (RR range = 1.2–2.1) and anxiety (RR = 1.5–2.7) disorders at Wave 2. Child maltreatment and interpersonal trauma exposure since Wave 1 were associated with roughly 50% of the risk for disorder transitions (RR range = 1.2–2.7); non-interpersonal trauma was associated with 30% of the risk for disorder transitions (RR range = 1.0–1.7). Findings suggest that new onset disorders were common in U.S. adults and trauma exposure explained a large proportion of disorder incidence as well as progression from one disorder to another. Universal prevention efforts that begin early in life, rather than those targeted at specific disorders, would be fruitful for reducing the burden of population mental health and preventing a cascade of mental disorders over the life course.

1. Background

Psychiatric disorders are highly comorbid, with 80% of individuals with a lifetime disorder meeting criteria for at least one additional disorder (Kessler et al., 1994). Comorbidity is associated strongly with disorder severity, with much of the population burden of lifetime psychiatric disorders concentrated among individuals who meet criteria for multiple disorders (Kessler et al., 1994, 2005a). Identifying predictors of comorbidity and transitions across different disorders has important clinical and public health implications, as early identification and treatment of psychopathology can potentially prevent a cascade of psychiatric problems throughout the life course.

Comorbidity can refer to meeting criteria for more than one disorder at the same time (i.e., concurrent comorbidity) or multiple psychiatric disorders over time, reflecting temporal relationships among different forms of psychopathology (i.e., successive comorbidity) (Angold et al., 1999). This more common type of comorbidity, whereby individuals transition from one disorder to another disorder at a later time, also has been termed heterotypic continuity (Lahey et al., 2014; Copeland et al., 2009).

There is consistent evidence for heterotypic continuity. For example, in the Great Smoky Mountain Study, 9–13 year old children with a prior psychiatric disorder were three times more likely to develop a new disorder compared to those without a

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http://dx.doi.org/10.1016/j.jpsychires.2017.05.001
0022-3956/

prior diagnosis (Costello et al., 2003). In this sample, adolescent oppositional defiant disorder, generalized anxiety disorder (GAD), and depression predicted multiple disorder onsets in young adulthood (Copeland et al., 2009). Finally, data from the National Epidemiologic Survey of Alcohol and Related Conditions (NESARC), a two-wave nationally representative study of US adults, provided evidence for heterotypic continuity, such that having a disorder at Wave 1 predicted the onset of multiple Wave 2 disorders, even after controlling for homotypic continuity (i.e., disorder at one point predicts the same disorder at a later point) (Lahey et al., 2014). Despite evidence for high rates of heterotypic continuity, few studies have examined whether specific types of transitions are more common than others, particularly in adulthood, or identified predictors of particular heterotypic continuity patterns. Consequently, efforts to tailor early interventions to those with psychiatric disorders who are at highest risk for transitioning to new disorders and developing a complicated comorbidity profile have been stymied. The few population representative adult studies that have examined specific transitions focus on a small number of disorders. For example, in a longitudinal birth cohort of individuals from Dunedin, New Zealand, GAD and depression were sequentially related such that each disorder increased the likelihood of later onset of the other disorder (Moffitt et al., 2007). However, these findings have not been extended to samples from other geographic locations, nor have other disorders been considered.

Clinical recognition of high rates of concurrent comorbidity and heterotypic continuity has led to the development of conceptual frameworks to identify environmental, cognitive, affective, and neurobiological processes that are shared across disorders and underlie the transitions from one type of psychopathology to another (Ehring and Watkins, 2008; Nolen-Hoeksema and Watkins, 2011; Harvey et al., 2004; Eaton et al., 2015). Trauma exposure including child maltreatment (Green et al., 2010; McLaughlin et al., 2010a) and interpersonal violence (e.g., rape) (Breslau et al., 2000; Kessler et al., 1995) has been shown to play a meaningful role in the etiology of most common psychiatric disorders (Kessler et al., 1995; Kendler et al., 1999; Manfro et al., 1996). Prevailing theories suggest that violence engenders neurobiological changes and problems with cognitive and emotional regulation that increase susceptibility to psychopathology [e.g., (Hankin, 2005)]. Unknown, however, is whether the timing (childhood vs. adult) or type (interpersonal vs. non-interpersonal) of trauma exposure predicts transitions among psychiatric disorders, and we are aware of no studies that have examined trauma exposure as a transdiagnostic predictor of disorder transitions in a population-based sample. Better understanding predictors of disorder transitions can provide preliminary evidence of a clinical profile that suggests heightened risk for heterotypic continuity and increased need for early intervention.

The present study extends prior work on heterotypic continuity by quantifying the risk for particular types of transitions over time (e.g., mood to anxiety) as well as associations between trauma exposure and these transitions in a population-representative sample (the NESARC). First, we estimate Wave 2 disorder incidence (i.e., novel disorder onsets) separately for individuals with and without a Wave 1 lifetime psychiatric disorder. Second, we quantify the likelihood of transitioning to a particular type of disorder (i.e., mood, anxiety, substance) based on the presence of prior disorders. Third, we determine whether trauma exposure is associated with incident disorders and disorder transitions. Finally, because anxiety, mood, and substance use disorders vary in median age of onset (Kessler et al., 2005a) and prevalence estimates and comorbidity patterns differ by sex (Kessler et al., 2005b), we evaluate whether associations vary as a function of age and all analyses are stratified by sex.

2. Methods

2.1. Sample and procedures

Participants were 34,653 men and women from Waves 1 (2001–2002) and 2 (2004–2005) of the NESARC, a face-to-face survey of non-institutionalized adults living in households and group quarters (Hasin et al., 2007; Grant et al., 2008). The Wave 2 re-interview response rate among eligible Wave 1 participants was 86.7%, yielding a cumulative response rate of 70.2% (Grant et al., 2008). Young adults, Blacks, and Hispanics were oversampled and data were weighted in accordance with the 2000 census demographics (Grant et al., 2008). The study received full ethical review and approval (Grant et al., 2008).

2.2. Measures

The Alcohol Use Disorder and Associated Disabilities Interview, Schedule IV (AUDADIS-IV) assessed the lifetime presence of mood (Mania, Dysthymia, Major Depression), anxiety (Social Phobia, Generalized Anxiety Disorder, Panic Disorder, Specific Phobia), and substance use [alcohol, nicotine, marijuana, and other drugs (sedative, tranquilizer, opioid, amphetamine, hallucinogen, cocaine, inhalant, and heroin) disorders at each wave. Similar to other structured interviews, two-to-three month test-retest reliability for these diagnoses range from fair (*Kappa* = 0.42, panic disorder) to excellent (*Kappa* = 0.84, alcohol dependence) (Ruan et al., 2008; Grant et al., 2003). Convergent and discriminant validity of the AUDADIS-IV has been demonstrated in numerous studies (Ruan et al., 2008; Chatterji et al., 1997; Üstün et al., 1997).

The AUDADIS-IV also assessed childhood maltreatment and interpersonal and non-interpersonal trauma exposure at Wave 2. As detailed elsewhere (Keyes et al., 2012), eighteen questions adapted from the Adverse Childhood Experiences study (Dube et al., 2001) that were originally part of the Conflict Tactics Scale (Straus, 1979) and the Childhood Trauma Questionnaire (Bernstein and Fink, 1998) assessed child maltreatment prior to age eighteen. Response options ranged from *1=never* to *5=very often* and were summed with higher scores reflecting more severe abuse; based on preliminary analyses and consistent with epidemiologic studies using binary variables to reflect maltreatment (Green et al., 2010; McLaughlin et al., 2010a, 2010b, 2012), those above the 75th percentile were considered maltreated. Ten yes/no items assessed interpersonal trauma (combat, sexual assault, physical assault by romantic partner, physical assault by someone else, stalking, kidnapped/held hostage, mugged, injured in terrorist attack, witnessing injury/killing/dead bodies, civilian in war), and two yes/no items assessed non-interpersonal trauma (life-threatening accident, natural disaster) since the last interview. Respondents were coded 1 if they endorsed that type of trauma since the last interview or 0 if they did not report exposure. A dichotomous variable reflecting any exposure to interpersonal or non-interpersonal trauma prior to Wave 1 also was coded for sensitivity analyses.

2.3. Statistical analysis

Analyses were completed in five steps using SAS 9.3. First, the prevalence of incident mood, anxiety, and substance use disorders was estimated separately for individuals with and without a lifetime disorder other than the focal disorder. Second, transitions between disorder types from Wave 1 to Wave 2 were estimated using risk ratios based on predicted marginals in a logistic regression examining incident disorder onset at Wave 2 by disorder type at Wave 1. Third, risk ratios between three types of trauma

Table 1
Wave 2 incident disorders among those with and without a wave 1 prior lifetime disorder (weighted[a]).

Onset of:	Among those with:			Men, among those with:			Women, among those with:		
	Prior Psychiatric Disorder Other than Focal Disorder (n = 16,713)	No Prior Psychiatric Dx (n = 17,940)	Chi Square, p-value	Prior Psychiatric Disorder Other than Focal Disorder (n = 7987)	No Prior Psychiatric dx (n = 6577)	Chi Square, p-value	Prior Psychiatric Disorder Other than Focal Disorder (n = 8726)	No Prior Psychiatric Disorder (n = 11,363)	Chi Square, p-value
Any Psychiatric Disorder	3483 (19.99%)	4141 (22.67%)	24.50, <0.01	1286 (15.88%)	1436 (21.93%)	55.96, <0.01	2197 (24.71%)	2705 (23.21%)	3.95, 0.05
Any Mood Disorder	924 (5.47%)	1286 (6.78%)	16.90, <0.01	412 (5.34%)	312 (4.48%)	3.80, 0.06	512 (5.62%)	974 (8.47%)	40.99, <0.01
Mania	647 (3.71%)	381 (2.06%)	53.36, <0.01	253 (3.29%)	134 (2.03%)	14.84, <0.01	394 (4.19%)	247 (2.09%)	45.52, <0.01
Dysthymia/Depression	1506 (8.53%)	1078 (5.67%)	71.43.<0.01	530 (6.61%)	233 (3.3%)	57.03, <0.01	976 (10.74%)	845 (7.42%)	42.55, <0.01
Any Anxiety Disorder	2608 (14.71%)	2174 (11.29%)	59.72, <0.01	910 (11.01%)	500 (7.27%)	43.37, <0.01	1698 (18.96%)	1674 (14.26%)	49.32, <0.01
Social Phobia	493 (2.78%)	234 (1.15%)	81.54, <0.01	194 (2.32%)	70 (0.95%)	30.56, <0.01	299 (3.31%)	164 (1.31%)	56.84, <0.01
Panic	545 (2.99%)	292 (1.66%)	43.91, <0.01	150 (2.01%)	62 (1.01%)	16.80, <0.01	395 (4.13%)	230 (2.14%)	38.58, <0.01
Specific Phobia	1186 (6.71%)	894 (4.63%)	45.82, <0.01	378 (4.59%)	203 (3.1%)	15.35, <0.01	808 (9.14%)	691 (5.76%)	49.88, <0.01
Generalized Anxiety	842 (4.81%)	395 (2.2%)	106.91, <0.01	248 (3.11%)	80 (1.02%)	55.50, <0.01	594 (6.77%)	315 (3.06%)	81.01, <0.01
Any Substance Use Disorder	397 (2.37%)	1819 (10.77%)	610.83, <0.01	125 (1.57%)	956 (15.06%)	487.98, <0.01	272 (3.29%)	863 (7.6%)	116.53, <0.01
Alcohol Use Disorder	454 (2.82%)	912 (5.37%)	93.36, <0.01	218 (2.81%)	570 (8.7%)	151.90, <0.01	236 (2.83%)	342 (2.91%)	0.07, 0.79
Marijuana Use Disorder	461 (3.08%)	108 (0.75%)	143.78, <0.01	312 (4.05%)	81 (1.39%)	64.03, <0.01	149 (1.96%)	27 (0.27%)	67.63, <0.01
Nicotine Dependence	866 (5.44%)	995 (5.87%)	1.89, 0.18	493 (6.25%)	452 (7.16%)	3.23, 0.08	373 (4.5%)	543 (4.91%)	1.13, 0.29
Other Drug Use Disorder	169 (1.09%)	102 (0.62%)	12.98, <0.01	83 (1.09%)	43 (0.67%)	4.51, 0.04	86 (1.09%)	59 (0.58%)	8.36, <0.01

[a] Sampling, stratification, and cluster weights were applied.

exposure (child maltreatment; interpersonal and non-interpersonal trauma between Waves 1 and 2) and incident disorder onsets at Wave 2 were estimated among those with and without a Wave 1 lifetime disorder. To further quantify the effect of each trauma type on risk for a Wave 2 incident disorder, Population Attributable Risk Proportions (PARPs) were computed using the following formula: (Ie-Iu)/Ie, where Ie is incidence in the exposed group and Iu is incidence in the unexposed group (Keyes and Galea, 2014). The resulting PARP reflects the proportion of risk for Wave 2 incident disorders associated with each trauma type. Fourth, risk ratios and corresponding PARPs between trauma types and disorder transitions from Wave 1 to Wave 2 were examined. Fifth, the probability of transitioning from a Wave 1 to Wave 2 disorder by age (young adulthood:18–30; middle adulthood:31–50; older adulthood:51–70) and type of Wave 1 diagnosis was examined. All analyses were stratified by sex, and accounted for sampling weight, clustering, and stratification.

3. Results

3.1. Trauma exposure descriptives

More than one-quarter (25.89%) of the sample had a score of 33 (75th percentile) or higher on the child maltreatment measure, 7.21% reported interpersonal trauma, and 4.92% reported non-interpersonal trauma since the last interview.

3.2. Incident disorder prevalence

Table 1 displays the weighted prevalence of incident psychiatric disorder onsets at Wave 2 among individuals with and without a Wave 1 lifetime disorder, separately by sex. Chi-square tests for differences in incidence based on Wave 1 disorder presence also are presented. A similar proportion of those with (20%) and without (23%) a Wave 1 lifetime disorder met criteria for a Wave 2 incident disorder. A similar proportion of women with (25%) and without (24%) a Wave 1 disorder developed a Wave 2 disorder; however, a smaller proportion of men with (16%) with versus without (22%) a Wave 1 disorder developed a Wave 2 disorder.

Incident anxiety disorder onsets were most common, and were higher among those with (15%) versus without (11%) a Wave 1 disorder. Incident substance use disorders were the next most common and were more likely among those *without* (11%) versus with (2%) a Wave 1 disorder. Incident mood disorders were least common and were more common among those *without* (7%) versus with (5.5%) a Wave 1 disorder. Although prevalence varied, men and women displayed similar patterns of disorder type onset.

3.3. Disorder transitions

Table 2 presents risk ratios for Wave 2 incident disorder onset by type of Wave 1 lifetime disorder. Any Wave 1 disorder was associated with elevated risk for Wave 2 incident mood and anxiety disorders. Incident substance use disorder risk was only elevated among women with a prior mood disorder (RR = 1.2). Incident anxiety disorder risk was more than twice as high among men and women with a mood disorder than those without (RR = 2.2 and 2.2, respectively), and incident mood disorder risk was elevated among men and women with a prior anxiety (RR = 3.1 and 1.6, respectively) or substance disorder (RR = 1.5 and 1.4, respectively).

3.4. Trauma exposure and incident psychiatric disorders[1]

Table 3 presents risk ratios and PARPS for incident disorder onsets associated with each form of trauma exposure separately for

Table 2
Risk ratios (95% CI) for New psychiatric disorder onset at wave 2 by type of disorder at wave 1 (weighted[a]).

W1 Lifetime Disorder	Full Sample		
	Incident Mood Disorder (n = 27,571)	Incident Anxiety Disorder (n = 30,698)	Incident Substance Use Disorder (n = 21,946)
Mood	–	**2.74 (2.54, 2.96)**	0.97 (0.84, 1.12)
Anxiety	**2.11 (1.80, 2.49)**	–	0.99 (0.81, 1.19)
Substance	**1.24 (1.12, 1.38)**	**1.47 (1.36, 1.58)**	–
Men			
Mood	–	**2.21 (1.92, 2.54)**	0.89 (0.70, 1.15)
Anxiety	**3.05 (2.33, 3.98)**	–	0.99 (0.72, 1.38)
Substance	**1.54 (1.28, 1.84)**	**1.60 (1.41, 1.82)**	–
Women			
Mood	–	**2.17 (2.01, 2.35)**	**1.23 (1.03, 1.47)**
Anxiety	**1.58 (1.30, 1.94)**	–	1.18 (0.94, 1.50)
Substance	**1.36 (1.19, 1.56)**	**1.69 (1.56, 1.83)**	–

Note: We also examined concurrent co-morbid disorders at Wave 1 but results were similar to those presented here and we elected to remove so as not to be redundant. Bolded risk ratios are significant as confidence intervals do not cross 1.
[a] Sampling, stratification, and cluster weights were applied.

Table 3
Risk ratios (95% CI) and Population Attributable risk proportion (PARPs) for wave 2 incident disorders among those with and without prior psychiatric disorder overall and stratified by sex (weighted[a]).

Risk Ratios (CIs)	No Prior Psychiatric Disorder			W1 Psychiatric Disorder		
	W2 Mood	W2 Anxiety	W2 Substance	W2 Mood	W2 Anxiety	W2 Substance
N=	1172	1952	1740	880	2508	384
Child Maltreatment	2.18 (1.88, 2.54)	2.1 (1.87, 2.35)	1.55 (1.36, 1.76)	1.6 (1.35, 1.9)	1.62 (1.47, 1.78)	1.27 (0.98, 1.65)
Interpersonal Violence	1.75 (1.40, 2.18)	1.85 (1.57, 2.18)	1.96 (1.66, 2.32)	1.69 (1.34, 2.14)	1.51 (1.32, 1.72)	1.09 (0.76, 1.57)
Non-interpersonal Violence	1.39 (1.04, 1.85)	1.26 (1.00, 1.6)	1.52 (1.22, 1.88)	1.27 (0.93, 1.74)	1.33 (1.11, 1.59)	1.21 (0.69, 2.10)
Men						
N=	287	458	912	388	874	120
Child Maltreatment	2.48 (1.85, 3.34)	2.42 (1.91, 3.05)	1.53 (1.28, 1.83)	1.64 (1.27, 2.13)	1.73 (1.47, 2.02)	0.87 (0.52, 1.44)
Interpersonal Violence	1.63 (1.08, 2.47)	1.6 (1.15, 2.24)	1.69 (1.35, 2.11)	1.82 (1.32, 2.53)	1.66 (1.34, 2.06)	1.00 (0.51, 1.94)
Non- interpersonal Violence	1.16 (0.67, 2)	1.4 (0.89, 2.19)	1.43 (1.08, 1.88)	1.36 (0.91, 2.02)	1.5 (1.15, 1.96)	1.60 (0.71, 3.59)
Women						
N=	885	1494	828	492	1634	264
Child Maltreatment	2.05 (1.73, 2.43)	1.97 (1.73, 2.24)	1.59 (1.32, 1.92)	1.58 (1.27, 1.97)	1.48 (1.32, 1.65)	1.45 (1.06, 1.97)
Interpersonal Violence	1.91 (1.48, 2.46)	2.09 (1.74, 2.5)	2.26 (1.75, 2.92)	1.53 (1.11, 2.13)	1.44 (1.23, 1.69)	1.19 (0.78, 1.82)
Non- interpersonal Violence	1.56 (1.12, 2.17)	1.28 (0.98, 1.66)	1.48 (1.03, 2.13)	1.11 (0.65, 1.91)	1.32 (1.06, 1.65)	1.06 (0.5, 2.22)
PARPs						
Child Maltreatment	0.47	0.47	0.32	0.28	0.32	0.17
Interpersonal Violence	0.48	0.52	0.63	0.43	0.40	0.20
Non- interpersonal Violence	0.34	0.24	0.4	0.22	0.29	0.21
Men						
Child Maltreatment	0.51	0.51	0.32	0.29	0.35	−0.10
Interpersonal Violence	0.44	0.43	0.57	0.47	0.45	0.13
Non- interpersonal Violence	0.23	0.35	0.41	0.28	0.38	0.40
Women						
Child Maltreatment	0.46	0.46	0.34	0.27	0.27	0.22
Interpersonal Violence	0.56	0.62	0.68	0.39	0.40	0.28
Non-interpersonal Violence	0.41	0.22	0.33	0.12	0.30	0.11

[a] Sampling, stratification, and cluster weights were applied.

those with and without a prior disorder. Nearly all types of trauma exposure were associated with elevated risk for all incident disorder types *except* Wave 2 incident substance use disorders among those with a prior psychiatric disorder. Among those with a prior psychiatric disorder, child maltreatment was associated with the greatest risk for mood (RR = 2.2) and anxiety (RR = 2.1) disorders while interpersonal trauma since Wave 1 was associated with the greatest risk for substance use disorders (RR = 2.0). Comparatively, estimates for non-interpersonal trauma since Wave 1 were smaller (RR range = 1.0–1.5) and inconsistently associated with incident disorders when examined by sex. Controlling for any pre-wave 1 trauma exposure resulted in slightly attenuated, but similar patterns of associations with PARPs indicate that trauma exposure accounted for a substantial proportion of the risk for Wave 2 incident disorders; this effect was more pronounced among individuals *without* (range = 22%–68%) versus with (range = 11%–47%) a Wave 1 disorder. For instance, interpersonal trauma was associated with roughly half of the risk for incident mood and anxiety disorders among those without a Wave 1 disorder, but less than 20% of the risk for incident substance use disorders among those with a Wave 1 disorder. To ensure that incident disorders associated with trauma exposure since Wave 1 could not be better accounted for by pre-Wave 1 trauma exposure or the development

[1] We also conducted sensitivity analyses for the transdiagnostic predictors that only included participants whose first violence exposure did not occur between wave 1 and 2 of the NESARC; a relatively small number of participants were removed from each analysis and results were largely similar thus we chose to report results for the larger sample. These sensitivity analyses are available upon request, however.

of PTSD at Wave 2, supplemental analyses controlling for pre-Wave 1 trauma exposure and excluding those with Wave 2 PTSD also were conducted. With few exceptions, patterns of associations were similar to the primary analyses (see Supplemental Tables 3a and 3b).

3.5. Trauma exposure and disorder transitions

Table 4 presents risk ratios and PARPs for disorder transitions from Wave 1 to Wave 2 by trauma exposure type. All trauma types were associated with all disorder transitions with few exceptions: no trauma types were associated with the anxiety to substance use disorders transition; interpersonal and non-interpersonal trauma were not associated with the mood to substance use disorder transition; and non-interpersonal trauma was not associated with the anxiety to mood transition. Among men, all trauma types were associated with transitioning from mood or substance use to anxiety disorder, but none were associated with transitioning to a substance use disorder. Among women, child maltreatment and interpersonal trauma were associated with nearly all disorder transitions; however, non-interpersonal trauma was only associated with transitioning from mood to anxiety disorder.

PARPs suggest that child maltreatment, interpersonal trauma, and non-interpersonal trauma were associated with 39–50%, 25–61%, and 16–43% of the risk for transitioning to a new disorder, respectively. Supplemental analyses controlling for pre-Wave 1 trauma exposure and excluding those with Wave 2 PTSD revealed a similar pattern of associations between trauma exposure and disorder transitions as the primary analyses with few exceptions (see Supplemental Tables 4a and 4b).

Probability of Transitioning from a Wave 1 to Wave 2 Disorder by Life-Course Stage.

Table 5 presents risk ratios for disorder transitions as a function of life-course stage. Those aged 18–30 were more likely than those aged 51–70 to transition from a mood disorder to an anxiety or substance use disorder. Those aged 18–50 were more likely than those aged 51–70 to transition from a substance use disorder to a mood or anxiety disorder. Patterns were similar across men and women with one exception: men, but not women, aged 31–50 were more likely than those aged 51–70 to transition from mood to anxiety disorder.

4. Discussion

This investigation extended research suggesting that heterotypic continuity is common by examining specific disorder transitions and predictors of these transitions in a large, nationally representative sample. Although the burden of psychiatric disorders is thought to be concentrated among a small subset of the population (Kessler et al., 2005b), findings indicated that incident psychiatric disorders were common in adulthood and cut across disorder categories. Individuals with a Wave 1 disorder had elevated risk of transitioning to a Wave 2 anxiety or mood disorder but not a substance use disorder. These findings were somewhat unexpected in light of longitudinal studies suggesting that anxiety disorders frequently emerge in childhood and early adolescence and precede the onset of mood and substance use disorders in late adolescence and early adulthood (Wolitzky-Taylor et al., 2012; Roza et al., 2003; Wittchen et al., 2000). However, findings cohere with data showing that adolescents with mood and behavior disorders are at increased risk for anxiety disorders in adulthood (Kim-Cohen et al., 2003). Mood disorder symptoms (e.g., anhedonia) and substance use may promote immediate avoidance, which in turn may increase risk for anxiety disorders over time. Results suggest that public health efforts aimed at primary prevention of all disorder types in adulthood and secondary prevention of anxiety disorders in particular may be important for improving population mental health.

Consistent with transdiagnostic models emphasizing the role of child maltreatment (Green et al., 2010; McLaughlin et al., 2010a)

Table 4
Risk ratios (95% CI) and Population Attributable risk proportions (PARPs) for transdiagnostic predictors of disorder type transitions from wave 1 to wave 2 (weighted[a]).

Risk Ratio (CI)	W1 Mood to W2 Anxiety	W1 Anxiety to W2 Mood	W1 Mood to W2 Substance	W1 Substance to W2 Mood	W1 Anxiety to W2 Substance	W1 Substance to W2 Anxiety
Full sample						
N=	1359	220	301	782	163	1925
Child Maltreatment	2.7 (2.36, 3.09)	2.18 (1.52, 3.13)	2.01 (1.50, 2.69)	1.99 (1.54, 2.57)	1.2 (0.66, 2.18)	1.74 (1.48, 2.04)
Interpersonal Violence	2.38 (1.99, 2.85)	2.46 (1.52, 3.99)	1.46 (0.98, 2.16)	1.43 (1.03, 1.99)	1.16 (0.43, 3.16)	1.39 (1.13, 1.71)
Non-interpersonal Violence	1.68 (1.31, 2.17)	1.52 (0.80, 2.90)	1.32 (0.73, 2.40)	1.57 (1.21, 2.04)	0.98 (0.47, 2.05)	1.52 (1.29, 1.78)
Men						
N=	334	77	90	368	50	789
Child Maltreatment	2.84 (2.17, 3.73)	1.73 (0.94, 3.2)	1.19 (0.67, 2.09)	2.17 (1.66, 2.84)	1.42 (0.65, 3.12)	2.13 (1.8, 2.53)
Interpersonal Violence	3.21 (2.31, 4.47)	2.49 (1.22, 5.08)	1.21 (0.59, 2.51)	1.83 (1.27, 2.63)	1.22 (0.40, 3.71)	1.71 (1.34, 2.18)
Non- interpersonal Violence	2.14 (1.36, 3.39)	2.5 (1.16, 5.39)	1.44 (0.59, 3.51)	1.38 (0.91, 2.08)	2.34 (0.64, 8.55)	1.51 (1.14, 2.01)
Women						
N=	1025	143	211	414	113	1136
Child Maltreatment	2.58 (2.22, 3.01)	2.59 (1.65, 4.06)	2.53 (1.79, 3.57)	2.42 (1.9, 3.08)	2.51 (1.53, 4.12)	2.38 (2.07, 2.75)
Interpersonal Violence	2.18 (1.77, 2.68)	2.46 (1.27, 4.75)	1.69 (1.06, 2.69)	2.15 (1.51, 3.07)	1.24 (0.63, 2.47)	1.80 (1.46, 2.21)
Non- interpersonal Violence	1.63 (1.22, 2.19)	0.54 (0.15, 1.95)	1.35 (0.61, 3.00)	1.39 (0.80, 2.43)	0.54 (0.15, 1.96)	1.31 (0.98, 1.76)
PARPs						
Child Maltreatment	0.50	0.42	0.39	0.43	0.41	0.46
Interpersonal Violence	0.61	0.58	0.43	0.55	0.25	0.50
Non- interpersonal Violence	0.43	0.32	0.30	0.33	0.16	0.33
Men						
Child Maltreatment	0.51	0.3	0.16	0.42	0.21	0.44
Interpersonal Violence	0.69	0.58	0.34	0.49	0.23	0.47
Non- interpersonal Violence	0.56	0.58	0.39	0.32	0.56	0.39
Women						
Child Maltreatment	0.49	0.48	0.46	0.45	0.47	0.47
Interpersonal Violence	0.6	0.59	0.51	0.59	0.32	0.54
Non-interpersonal Violence	0.4	−0.89	0.27	0.30	−0.81	0.26

[a] Sampling, stratification, and cluster weights were applied.

Table 5
Risk ratios and 95% confidence intervals reflecting the probability of transitioning to new disorder type by age and stratified by sex (weighted[a]).

	N=	W1 Mood to W2 Anxiety	N=	W1 Anxiety to W2 Mood	N=	W1 Mood to W2 Substance	N=	W1 Substance to W2 Mood	N=	W1 Anxiety to W2 Substance	N=	W1 Substance to W2 Anxiety
Full Sample												
N=		1359		220		301		782		163		1925
18–30	396	**1.45 (1.21, 1.73)**	64	1.27 (0.81, 1.99)	125	**1.97 (1.39, 2.79)**	125	**1.82 (1.41, 2.35)**	49	1.39 (0.83, 2.33)	497	**1.44 (1.24, 1.67)**
31–50	660	1.12 (0.95, 1.33)	99	1.18 (0.78, 1.78)	107	0.70 (0.48, 1.01)	107	**1.62 (1.29, 2.04)**	76	1.14 (0.70, 1.86)	1007	**1.31 (1.15, 1.5)**
51–70	303	1.00 (1.00, 1.00)	57	1.00 (1.00, 1.00)	69	1.00 (1.00, 1.00)	69	1.00 (1.00, 1.00)	38	1.00 (1.00, 1.00)	421	1.00 (1.00, 1.00)
Male												
N=		334		77		90		368		50		789
18–30	98	**2.21 (1.52, 3.21)**	22	1.72 (0.76, 3.89)	42	**2.27 (1.16, 4.42)**	109	**2.00 (1.39, 2.88)**	14	1.28 (0.46, 3.55)	185	**1.32 (1.05, 1.67)**
31–50	172	**1.71 (1.21, 2.43)**	39	1.82 (0.87, 3.78)	30	0.67 (0.33, 1.37)	188	**1.59 (1.14, 2.22)**	26	1.37 (0.53, 3.51)	407	**1.24 (1.02, 1.51)**
51–70	64	1.00 (1.00, 1.00)	16	1.00 (1.00, 1.00)	18	1.00 (1.00, 1.00)	71	1.00 (1.00, 1.00)	10	1.00 (1.00, 1.00)	197	1.00 (1.00, 1.00)
Female												
N=		1025		143		211		414		113		1136
18–30	298	**1.23 (1.01, 1.51)**	42	1.03 (0.61, 1.75)	83	**1.8 (1.21, 2.68)**	107	**1.62 (1.15, 2.28)**	35	1.42 (0.79, 2.55)	312	**1.53 (1.26, 1.86)**
31–50	488	0.96 (0.8, 1.15)	60	0.86 (0.52, 1.42)	77	0.7 (0.46, 1.07)	232	**1.66 (1.22, 2.26)**	50	1.02 (0.57, 1.8)	600	**1.37 (1.14, 1.63)**
51–70	239	1.00 (1.00, 1.00)	41	1.00 (1.00, 1.00)	51	1.00 (1.00, 1.00)	75	1.00 (1.00, 1.00)	28	1.00 (1.00, 1.00)	224	1.00 (1.00, 1.00)

Bolded risk ratios are significant as confidence intervals do not cross 1.
[a] Sampling, stratification, and cluster weights were applied.

and interpersonal trauma exposure (Breslau et al., 2000) in predicting psychopathology, trauma exposure was associated with a substantial proportion of incident disorders and transitions, which highlights the critical role of trauma exposure in shaping risk for psychopathology throughout the life course. Although shared correlates of both trauma exposure and mental disorders (e.g., genetic factors) could account for some variance in the observed associations, previous studies have provided evidence for specific mechanisms through which trauma may influence mental health. Specifically, trauma exposure has been linked with HPA axis dysregulation (Trickett et al., 2010) and emotion dysregulation (Ehring and Quack, 2010), which could increase risk for incident disorders and transitions between disorders. Trauma appears to be an important correlate of a cascade of psychiatric disorders, although future studies should incorporate other correlates of trauma and utilize genetically-informative designs to understand genetic influences in these pathways. Public health campaigns aimed at destigmatizing treatment seeking (Link et al., 2001) and encouraging trauma exposed individuals to seek help in response to early warning signs *before* a psychiatric disorder emerges may mitigate the complex and often chronic negative effects that accompany comorbidity.

Some sex differences warrant mention. First, heterotypic continuity was more common among women, which may reflect women's increased risk for anxiety disorders (Seedat et al., 2009). Second, men had a greater risk for transitioning from anxiety to a mood disorder while risk for transitioning from mood to substance use disorder was only significant for women. Relative to women, men may be less likely to seek treatment for anxiety due to stigma (Addis and Mahalik, 2003) and may isolate when feeling anxious, which may increase anhedonia and mood symptoms. For both sexes, substance use disorder onset more often occurred in the absence of prior psychopathology; however, women may have been more likely to self-medicate their mood symptoms with substances in a way that increased risk for disorder. Women who experienced child maltreatment or interpersonal trauma since Wave 1 had more than two times the risk of transitioning to nearly all disorders. In contrast, the effects of trauma exposure for men were circumscribed primarily to transitions between mood or substance use to anxiety disorders and anxiety to mood disorders. Findings may reflect women's increased vulnerability to experience trauma such as child maltreatment and rape and/or develop psychopathology following such exposure (Tolin and Foa, 2006).

Limitations of the current study should be noted. First, although several lifetime disorders were examined, the NESARC does not assess every possible psychiatric disorder at both waves (e.g., PTSD is only assessed at Wave 2). Therefore, the current study likely represents an underestimate of incident psychiatric disorders and transitions between disorders. Second, transdiagnostic predictors including child maltreatment and both interpersonal and non-interpersonal trauma exposure were only assessed at Wave 2. Ideally, these events would have been assessed at both waves. Additionally, because trauma exposure and Wave 2 disorders were both assessed since Wave 1, the temporal sequencing of variables during that period cannot be established. Third, the average age of participants was 45, which is beyond the onset risk period for most disorders. Findings that younger individuals were more likely to transition to a new disorder suggest future studies could focus on this high-risk period. Fourth, although the overall sample was large, some cell sizes for disorder transitions by age group were small.

Despite these limitations, the current study illustrated in a nationally representative US sample that incident disorders in adulthood were common, and those with a mood, substance, or anxiety disorder had increased risk of transitioning to an incident mood or anxiety disorder. Trauma exposure during childhood and adulthood was significantly associated with transitioning from one disorder type to another. Encouraging trauma-exposed individuals to seek help to effectively regulate emotions and cope with distress prior to disorder onset and de-stigmatizing mental health treatment once a disorder has emerged may prevent a cascade of deleterious psychiatric disorders over the life course.

Disclosures

The authors have no conflicts of interest to report.

Acknowledgements

This research was funded by National Institutes of Health grants K01AA021511 (Keyes), LODA036213 (Walsh), T32DA031099 (PI: Hasin), and K01MH092526 (McLaughlin).

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jpsychires.2017.05.001.

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