Research on treatment outcomes associated with EN is scarce, but there is some indication that severe EN can make it difficult for individuals to benefit from treatments that are currently available. Some researchers have proposed that treatments targeting hyperarousal might indirectly alleviate EN symptoms, while others have called for the development of new treatments specifically targeting EN.

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See also: Avoidance; Depression; Diagnosis of Traumatic Stress Disorders (*DSM & ICD*); Posttraumatic Stress Disorder; Posttraumatic Stress Disorder, Diagnosis of

EMPATHY

See: Psychotherapeutic Processes; Therapeutic Relationship

ENDOCRINE FUNCTION

See: Biology, Neurochemistry

EPIDEMIOLOGY

Epidemiology is the study of the distribution and determinants of disease. Epidemiology has two main goals. First, epidemiology aims to estimate the occurrence of a disease or health indicator in a population. Central measures of disease occurrence include incidence, which is a measure of the number of new cases of disease that occur in a population over a particular period of time, and prevalence, the number of cases (both new and existing) of disease in a population over a period of time. Second, epidemiology aims to identify the causes of disease by calculating estimates of the effect of an exposure (e.g., a particular behavior such as smoking, an environmental factor such as automobile pollution, an aspect of the physical or social environment such as the built environment or poverty, or a policy such as the ban on smoking indoors) on a health indicator. In the context of traumatic event exposures, epidemiologic methods can be used to document the prevalence and incidence of traumatic event exposures, of the mental health consequences of such events, and of the variables that influence the distribution of those effects.

The majority of epidemiologic studies of the mental health consequences of traumatic events are focused on posttraumatic stress disorder (PTSD). The aim of many of these studies is to estimate the prevalence of PTSD in a population. Some studies examine the prevalence of PTSD among people who have experienced a particular traumatic event, such as rape victims or victims of a natural disaster, or in a certain segment of the population. Other studies identify risk factors for PTSD following exposure to traumatic events. For example, psychiatric history, history of childhood trauma, and family history of mental disorders have consistently been identified as risk factors for PTSD among persons exposed to traumatic events (Breslau, 2002). Epidemiologists

also examine the duration or change in severity of PTSD symptoms, as well as other mental health problems—such as depression, other anxiety disorder, and substance abuse/dependence—that people experience after a traumatic event and often concurrently with PTSD.

Longitudinal Cohort Epidemiologic Studies

Epidemiologic studies can generally be categorized into three main groups, based on their study design. The first, and arguably most useful study design in the examination of the psychological consequences of trauma experience, is the cohort, or longitudinal, study. Participants are divided into two groups of people, the exposed and the unexposed, neither of whom have the disease at the beginning of the study. In this case, the "exposed" group is a group of people who have experienced the traumatic event and the "unexposed" are those who did not experience the event. These two groups are then followed over time (longitudinally) to compare the occurrence of psychological disease between groups. The purpose of the study is to assess whether the group that experienced the trauma has a higher incidence of disease than the group that did not experience the trauma, which would allow us to attribute disease occurrence to experiencing the particular traumatic event.

Longitudinal cohort studies have helped researchers identify the risk factors of psychological disease as well as understand the course of disease. For example, Galea et al. (2008) utilized this type of study to examine predictors of PTSD among adult residents of New York City. This study design allowed the investigators not only to identify factors associated with PTSD incidence, but also to assess how incidence levels of PTSD change over time. Incident stressors and traumas such as family problems and sexual assault, low income, female gender, and Latino ethnicity were all found to be independent predictors of PTSD incidence, after adjusting for both recent and lifetime history of PTSD. The investigators also found that ongoing stressors also increase the risk of developing PTSD.

Although rare in the area of trauma and its psychological consequences, randomized intervention trials build on the longitudinal cohort follow-up design by randomly assigning persons to a particular exposure. The randomization (if carried out correctly) ensures comparability between groups, minimizes confounding, and allows investigators to draw causal inferences about the determination of disease without worrying about temporal ambiguity. In other words, because the population is disease-free before the traumatic event, the investigator can assume that the trauma preceded the mental health outcome. This gives strength to the conclusion that the disease was caused by the event. In the context of trauma-related research, randomizing persons to the receipt of trauma is obviously not a feasible method. However, randomized controlled trials have a place in the evaluation of interventions aimed at mitigating the consequences of traumatic event exposures. Also, a cohort study of the psychological consequences of trauma can be very similar to a randomized intervention trial and can be considered a "natural experiment" if, as in a randomized intervention trial, the trauma is "assigned" to one group randomly, as is the case in a natural disaster such as an earthquake or flood. In this case, an investigator could compare the incidence of disease among those who lived in an area affected by the catastrophe to the incidence of disease among those who live elsewhere.

Though the cohort study has many advantages, it also has limitations. First, conducting these types of studies, which often requires following people over a long period of time and conducting several interviews, can be time-consuming and expensive. Following every study participant over the entire duration of the study can also prove difficult because participants may die, move away, or simply decide they do not want to finish the study. If those people who remain in the study differ in some way from the people who leave the study before its conclusion, the estimate of the effect of the traumatic event on the disease may be under- or overestimated, sometimes leading us to incorrect conclusions.

Case Control Epidemiologic Studies

In a case control study, investigators first identify persons who have the disease and then controls (i.e., persons who do not have the disease). These groups are then compared to assess any difference in exposure to the traumatic experience. To illustrate, imagine that investigators want to see if people who abuse drugs and/or alcohol are more likely to experience PTSD after a sexual assault. Using this type of study design, investigators would identify a group of people who have been sexually assaulted and have been diagnosed with PTSD ("cases") and a group of people who have experienced this type of trauma but do not have PTSD ("controls"). Next, participants from both groups are asked if they abused drugs in the past. Investigators then determine whether or not past drug abuse was more prevalent among those who experienced the trauma and developed PTSD than it was among those who experienced the trauma but did not develop PTSD.

This type of study design, although very useful, is not utilized as much as it could be in mental health epidemiology. Case-control studies can be much more efficient than cohort studies in that they require a smaller sample size and are often less expensive and time-consuming. This study design, however, suffers from its own limitations. First, it is often difficult to be certain that the exposure preceded the traumatic event, which is an important criterion for determining causation. For example, the participants in the study could have abused drugs following the sexual assault, perhaps in an attempt to cope with this trauma. Second, this type of study often relies on participants' recollections of having this exposure in the past, which could be influenced by having the mental health problem, leading to biased effect estimates. Finally, to correctly estimate the effect of an exposure on an outcome, the cases and controls must also be selected from the same source population, which is often a difficult task because the base population (i.e., those who constitute persons at risk of traumatic event exposure) may be hard to define.

Cross-Sectional Epidemiologic Studies

Most of the early studies of PTSD employed a cross-sectional study design. Cross-sectional studies examine a population at a particular time, assessing both exposure to a traumatic event and mental health outcome for each study participant at this time. Often, cross-sectional studies are the only type of study that is feasible after a mass trauma and are useful in calculating prevalence of a disease in a population. This type of study can be completed more quickly and inexpensively than longitudinal studies (which require multiple assessments with participants over several months or years). Cross-sectional studies can provide public health practitioners with information regarding the prevalence and burden of a mental health outcome—such as PTSD—in a population in general, or following a disaster so that appropriate resources can be provided to those who were affected.

Cross-sectional studies of representative community populations such as the National Comorbidity Study (NCS; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995) and the NCS Replication study (Kessler, Chiu, Demler, & Walters, 2005) have estimated the prevalence of PTSD among adults in the United States and Europe (Perkonigg, Kessler, Storz, & Wittchen, 2000) to be between 2% to 7%, and higher (4% to 15%) in less developed countries (Zlotnick et al., 2006). Higher prevalence estimates are obtained when populations have been exposed to a mass psychological trauma. For example, 12% to 16% prevalence estimates have been obtained in the first year after mass terrorist incidents, although these levels tend to decrease over time (DiMaggio & Galea, 2006). Other studies have found a higher prevalence of other mental health disorders (generalized anxiety disorder, panic disorder, depression, and substance abuse disorder) in persons who developed PTSD after a traumatic event compared to those who were exposed to the event but did not develop PTSD (Breslau, 2002; North et al., 1999). For example, North et al. (1999) reported that among persons who experienced the Oklahoma City bombing, 63%

of persons who developed PTSD also developed other psychiatric disorders, while only 9% of persons who did not develop PTSD developed other psychiatric disorders.

Epidemiologists choose a study design based on what information they are seeking and what resources and data are available. A common goal of these three basic types of studies is to compare groups that have all of the same characteristics except for the traumatic event experience. Achieving this type of comparability is important in that it allows us to attribute adverse outcomes (such as PTSD or associated biopsychosocial problems) to the traumatic event itself, not to some other factor. It is important to note that while some study designs are considered "better" than others, the most informative studies are those that are thoughtfully designed and well executed.

Considerations in Epidemiologic Analyses

Three important issues that influence epidemiologic analyses are confounding, effect modification, and bias. Confounding occurs when the groups being compared differ by a third variable, that is, a factor other than the exposure and disease of interest, which can influence the estimate of association between the exposure and the outcome. It is possible, then, that the difference in outcomes found between groups is due to a difference in that third variable as opposed to a difference in exposure to the traumatic event. Some examples of these variables, called *confounders*, that are frequently seen in epidemiologic studies of psychological and physical health consequences of trauma are neuroticism and risk-taking behavior. These psychological constructs can influence both whether or not a person acquires a psychological disease and whether they are exposed to a traumatic event. Therefore, if these confounders are not accounted for, investigators can incorrectly infer a causal role for the traumatic event exposure and the psychological manifestations, even if the relation between the two is explained by the presence of the third variable—the confounder.

Effect modification occurs when a third variable—a factor other than the exposure and outcome of interest—modifies the relationship between the traumatic event exposure and the psychological or physical health outcome. For example, income status could influence the association between experiencing a traumatic event, such as a natural disaster, and risk of PTSD. A person who does not have the financial resources to help cope with the destruction of property following a hurricane may experience additional stress after the disaster and may be more likely to suffer from PTSD. Other variables that have not been fully considered but may modify the relationship between experiencing a traumatic event and suffering from a mental health problem are gender and ethnicity. We note that effect modification is synonymous with moderation in the terminology frequently used in psychology and described thoroughly by Baron and Kenny (1986).

Because confounding and effect modification can strongly influence a study's conclusions, they should be controlled for in the design or in the analysis of the study. In the design phase of the study, stratification, restriction, and matching are techniques that are used to control for confounders and effect modifiers. Investigators may stratify the group that experienced the traumatic event and the group that did not experience it into additional groups by the confounder, and then estimate the effect of the exposure on the mental health outcome within these groups. They may also restrict the group of participants in the study based on the confounding variable. For example, if they believe that gender might be a confounder, they will choose only women as participants in the study. Finally, the study team might form groups by matching subjects based on a factor that they believe may be a confounder. In the analysis phase of the study, investigators may control for confounders and effect modifications using statistical techniques. If, for example, regression models are used as a statistical analytic tool, potential confounders may be controlled for by inclusion in multivariable models and effect modification may be assessed by using interaction terms. For example, in a

study aimed at understanding why Latinos have higher incidence of PTSD after traumatic event exposures than do other ethnic groups, Galea et al. (2004) showed that income may be a confounder of the relation between Latino ethnicity and risk of PTSD but also that level of social support may be an effect modifier of the relation between membership in particular Latino ethnic groups and risk of PTSD.

Bias occurs when there is a systematic error in the design, execution, or analysis of a study. This type of error can result in an association between a traumatic exposure and mental health outcome that does not actually exist, or in the masking of a true association. There are two main types of bias in epidemiologic studies: selection bias and information bias. Selection bias occurs when the exposure or outcome of interest influences how participants are chosen for the study. This type of sampling issue may arise particularly in the study of vulnerable populations. For example, investigators of depression after a sexual assault may chose participants from a list of clients utilizing mental health clinic for help with their depression. If those people who seek out care are less likely to have experienced a sexual assault (because those who experienced this type of trauma feel too ashamed or afraid to seek help), the investigators may underestimate the association between experiencing sexual assault and depression.

Information bias is caused by a misclassification of traumatic exposure or a misclassification of mental health status. Misclassification may result from the difficulty associated with defining or measuring trauma. For example, exposure to a traumatic event is a criterion required in positively diagnosing a person with PTSD. However, it might not always be clear if a certain event qualifies as a true "traumatic exposure," leading investigators to categorize participants as "exposed" or "unexposed" incorrectly, which can lead to under- or overestimated effect estimates (Weathers & Keane, 2007). A systematic error in recalling prior traumatic events is also a type of information bias. For instance, if a person suffers from a mental health problem that is commonly associated with experiencing this type of event, then they might "recall" having experienced the event when in fact they did not. In other words, the participants may misclassify themselves as having been "exposed" when in truth they were not. This can result in an overestimation of the association between exposure to the traumatic event and the psychological problem of interest. Case-control studies of psychological trauma can suffer most from this type of bias because participants often must recall a past experience.

Conclusion

Epidemiology plays an important role in the study of the psychological consequences of trauma. Epidemiologic methods are used to estimate the burden of psychological disease in populations affected by trauma, determine why certain populations are more likely to develop mental health problems after a traumatic event, and identify determinants of disease. Epidemiology ultimately informs the development and implementation of interventions and policies that may reduce the risk of developing a mental health problem following a traumatic event or lessen the severity of the psychological consequences of traumatic events.

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See also: Public Health; Research Methodology

ETHICS

See: Professional Standards and Ethics

ETHNIC CLEANSING

See: Genocide

ETIOLOGY

Etiology is a term referring to the cause of a disease or some other phenomenon and is derived from the Greek word for cause. The causes of psychological disorders are particularly difficult to identify and are commonly thought to be located in the complex interplay of nature (i.e., genetic endowment) and nurture (i.e., environmental influences). As its name implies, posttraumatic stress disorder (PTSD) is believed to be related to the stress from an antecedent life event of a traumatic nature. Scientists and theoreticians have studied people exposed to extreme stressors and PTSD patients in an effort to ascertain the causal (i.e., etiological) contributions attributable to various environmental and individual characteristics that are known to be associated with the development of this disorder. But establishing the etiology of PTSD is vastly complicated by the fact that a large number of factors can affect how individuals respond to potentially traumatic stressors.

The factors that appear to have causal significance for the development of PTSD include characteristics of individuals (such as genetic or biological tendencies, developmental level and experiences, past trauma exposure, life stress, and gender), varying aspects of high magnitude stressors (such as severity, intentional or accidental nature, and duration), and differences in posttraumatic life experiences