
Risk Factors for Suicide in Later Life

Yeates Conwell, Paul R. Duberstein, and Eric D. Caine

Suicide rates are higher in later life than in any other age group. The design of effective suicide prevention strategies hinges on the identification of specific, quantifiable risk factors. Methodological challenges include the lack of systematically applied terminology in suicide and risk factor research, the low base rate of suicide, and its complex, multidetermined nature.

Although variables in mental, physical, and social domains have been correlated with completed suicide in older adults, controlled studies are necessary to test hypothesized risk factors. Prospective cohort and retrospective case control studies indicate that affective disorder is a powerful independent risk factor for suicide in elders. Other mental illnesses play less of a role. Physical illness and functional impairment increase risk, but their influence appears to be mediated by depression. Social ties and their disruption are significantly and independently associated with risk for suicide in later life, relationships between which may be moderated by a rigid, anxious, and obsessional personality style.

Affective illness is a highly potent risk factor for suicide in later life with clear implications for the design of prevention strategies. Additional research is needed to define more precisely the interactions between emotional, physical, and social factors that determine risk for suicide in the older adult. Biol Psychiatry 2002;52:193–204 © 2002 Society of Biological Psychiatry

Key Words: Suicide, aged, risk factor

Introduction

In May 2001 the Office of the Surgeon General of the United States released the National Strategy for Suicide Prevention: Goals and Objectives for Action (U.S. Public Health Service 2001). The prevention of suicide in later life is a central objective of that strategy. Older adults are at higher risk for suicide than any other age group. They are also the fastest growing segment of the population. Individuals born in the post-World War II “baby boom”

have carried with them substantially higher suicide rates than preceding or subsequent birth cohorts (Blazer et al 1986). As large numbers of this high-risk cohort enter later life in coming decades, therefore, the absolute number of seniors who take their own lives may rise dramatically (Haas and Hendin 1983). We must be prepared to intervene.

The design of effective suicide prevention strategies hinges on the definition and quantification of risk and protective factors for suicide in the target population of older adults. Our objective with this paper is to evaluate the strength of the evidence for whether correlates of suicide in each of three broad domains—mental health, physical health, and social factors—constitute risk factors for suicide in later life. We begin with consideration of methodological issues that pose challenges for the definition of suicide risk and protective factors in older adults. We then provide a brief overview of the prevalence of suicidal behaviors—suicidal ideation (SI), attempted suicide (AS), and completed suicide (CS)—in U.S. seniors. In the remainder of the paper we focus primarily on observed correlates of CS in later life, emphasizing the evidence derived from a recent series of retrospective, case control, psychological autopsy studies. The conclusion to which they lead is that affective illness (its prevention, early recognition, effective diagnosis, and aggressive treatment) should be the leading target of later life suicide prevention efforts.

Methodologic Issues

A number of methodologic issues complicate the study of suicide in later life. First, the terms used in the literature and clinical settings to describe suicidal behavior are often ill defined and loosely applied, making the interpretation and generalization of findings difficult. As well, SI, AS, CS are often conflated in discussions of suicidal behavior, leading to an inaccurate understanding of risk. Consensus on a precise typology of aggressive and self-destructive behaviors has been elusive despite organized efforts to promulgate standardized definitions (O’Carroll et al 1996).

The relationships between SI, AS, and CS are uncertain (Linehan 1986). Whereas ideators and attempters tend to be younger and female, completed suicide is more com-

From the University of Rochester School of Medicine, Department of Psychiatry and Center for the Study and Prevention of Suicide, Rochester, New York.

Address reprint requests to Dr. Y. Conwell, University of Rochester Medical Center, Department of Psychiatry, Center Study/Prevention of Suicide, 300 Crittenden Boulevard, Rochester NY 14642.

Received November 15, 2001; revised January 23, 2002; accepted January 29, 2002.

mon in older men. SI is a significant predictor of both attempted and completed suicide (Alexopoulos et al 1999; Goldstein et al 1991), and AS is among the most potent predictors of subsequent CS (Goldstein et al 1991), although most who kill themselves have not previously attempted to take their own lives. SI, AS, and CS, therefore, appear to be distinct, but overlapping populations. At this stage of knowledge, it can not be assumed that risk factors for ideation or suicide attempts are the same as for completed suicide in seniors. Because our primary long term goal is reduction in the number of completed suicides in later adulthood, our focus in this paper will be limited to risk factors for CS rather than AS or SI.

The term “risk factor” is often applied in suicide studies where the less rigorous term “correlate” would be more appropriate. As defined by Kraemer and used here, a risk factor is a measurable characteristic of each subject in a specific population that precedes the outcome of interest and which can be used to divide the population into groups on the basis of their relative risk for that outcome (Kraemer et al 1997). Until recently, very few studies of suicidal behavior at any point in the life course met the methodological requirements for evaluating the risk associated with particular characteristics; almost none that focused on later life. Because investigators rarely included control groups with which to establish base rates in the population, risk factors for suicide could not be identified and the relative risk associated with them could not be quantified.

Additional methodologic issues include ethical concerns inherent in prospective follow-up of high-risk samples (Pearson et al 2001) and the low base rate of suicide in elders. Because CS and AS are relatively rare outcomes, acquisition of the sample sizes necessary to result in sufficiently powered prospective cohort studies is prohibitively expensive. The case control method is better suited than prospective cohort studies to the examination of rare outcomes (Gordis 1996). Psychological autopsy (PA) is the term used to describe the method by which information is gathered retrospectively about suicides from relatives, friends, caregivers, others familiar with the decedent, and relevant records (Hawton et al 1998) for use in case control studies. Limitations of the PA approach stem primarily from its retrospective nature and the potential for acquisition and reporting bias. Examples of the latter include the risk that respondents would over-report stressful life events and depressive symptoms as explanations of the suicide; however, recent important advances have made the PA approach a powerful tool for determining risk factors where prospective data collection would be impractical. These include recommendations for the use of standardized, behaviorally keyed rating scales; clear defi-

nition of cases, controls, and the sampling frame; the use of multiple informants; and strategies defined *a priori* for handling missing and discrepant data (Clark and Horton-Deutsch 1992). Empirical research has demonstrated the validity of the PA method (Brent et al 1993a; Conner et al 2001a; Conner et al 2001b; Kelly and Mann 1996). Large, methodologically sound PA studies of older adults have recently been completed in four countries. All utilized standardized methods, carefully defined populations of both late life suicides and controls, proper sampling procedures, and analytic methods that enable quantification of risk associated with a range of hypothesized factors (Beautrais 2002; Conwell et al 2001; Conwell et al 2000; Harwood et al 2001; Waern et al in press).

Finally, the complexity of suicide and the heterogeneity of the aged population have yet to be adequately addressed. Risk factors for a 60-year-old elder and an 85-year-old elder probably differ considerably. In addition to differences within age subgroups of elders, risk profiles may vary with gender, race, and socioeconomic status. As at any point in the life course, later life suicide is a complex, multidetermined behavior. Psychological as well as social and biological influences interact in intricate ways to determine an individual’s risk for suicide. Further, the level of risk is in constant flux, reflecting the dynamic interaction of influences. Psychiatric illness is clearly a risk factor for suicide, but it is also an insufficient explanation; only a small minority of individuals with mental illness take their own lives. While the delineation of main effects is helpful to identify populations at risk, it is only through studies that define moderating and mediating factors that we can develop a more precise target for high risk intervention strategies. These studies, which require even larger samples to generate sufficient statistical power, have yet to be conducted with the required degrees of comprehensiveness and complexity.

Prevalence of Suicidal Behaviors in Later Life

Suicidal Ideation

Older adults are less likely to endorse suicidal ideation than are younger subjects (Gallo et al 1994; Blazer et al 1986; Duberstein et al 1999). Estimates of the prevalence of suicidal ideation in older adults vary widely. Lish and colleagues found that 7.3% of an older sample in VA primary care practices had suicidal ideation, with rates seven times higher in patients with a history of mental health treatment (Lish et al 1996). Using a more stringent criterion set for suicidal ideation (within the last week, with a plan or actively struggling against the thoughts), Callahan and colleagues found from 0.7–1.2% of a primary care sample to be suicidal, all of whom had an

affective syndrome (Callahan et al 1996). Skoog et al (1996) reported that 16% of a nondemented sample of Swedes age 85 years and over had either active thoughts of taking one's own life or passive suicidal ideation (wished for death/life not worth living) in the month preceding interview. Rates were twice as high in women than men. The frequency was higher in subjects with mental disorders, those taking anxiolytic and neuroleptic agents, and those with a history of cardiac disease, peptic ulcer, and three or more defined physical disorders.

Less than 6% of respondents aged 60 years and older in a Florida community survey endorsed ever having had suicidal thoughts (Schwab et al 1972). In the Berlin Aging Study, 21% of subjects aged 70–105 years expressed suicidal ideation on a single item measure (Linden and Barnow 1997). Independent psychiatric assessment found psychiatric illness in 80–100% of the suicidal subjects. Seven percent of a sample aged 81 years and over in Great Britain had considered suicide within the last 2 years and 16% endorsed a strong wish to die (Rao et al 1997). There were significant associations of suicidal thinking with depressive symptoms and with dementia and depression diagnoses.

Attempted Suicide

Data on attempted suicide are far fewer and less reliable than completed suicide because there is no systematic surveillance mechanism in the U.S. to track its incidence. As with suicidal ideation, attempted suicide is far less frequent in later life than among younger age groups (Moscicki 1997). In adolescence the ratio of attempted to completed suicides has been estimated to be 200:1 (Langley and Bayatti 1984), while the estimated risk for the general population is from 8:1–33:1 (Paykel et al 1974). In contrast, there are approximately four attempts for each completed suicide in later life (Parkin and Stengel 1965). The increased lethality of self-destructive behaviors in older adults reflects their diminished physical resilience and greater isolation (less likelihood of rescue), as well as their greater determination to die (Conwell et al 1998). Elderly suicides give fewer warnings to others of their suicidal plans, use more violent and potentially deadly methods to commit suicide, and apply those methods with greater planning and resolve. These findings suggest that prevention after onset of a suicidal crisis may be less successful in late life than at younger ages.

Completed Suicide

In contrast to SI and SA, the rates of completed suicide are higher in later life than in younger adults. In 1998 there were over 5800 suicides among senior citizens, an overall rate of 16.9/100,000 (National Center for Health Statistics,

2001). Suicide was the 13th leading cause of death in elders. Rates for white men in the U.S. increase with age to a peak of 62/100,000, over five times the nation's age adjusted rate. In contrast, rates among nonwhite men peak in younger adulthood, while those of women peak in midlife and remain stable or decline slightly thereafter. This gender difference in patterns of age associated risk in the United States is somewhat atypical, as later life is the time of highest risk for suicide for both men and women in the majority of countries that report statistics to the World Health Organization (Pearson and Conwell 1995).

Risk Factors for Suicide in Older Adults

In the following sections we review evidence for later life suicide risk factors in three broad domains – mental health, physical health, and social function. Each section provides a brief overview of descriptive studies that were important in the characterization of elders at risk for suicide. Our emphasis, however, is on the small number of PA studies that meet (with varying degrees of success) rigorous methodological standards for evaluating risk (Kraemer et al 1997).

Mental Health

Table 1 lists the psychiatric diagnoses of completed suicides made in PA studies of older adults (Barracough 1971; Carney et al 1994; Clark 1991; Conwell et al 1991; Henriksson et al 1995; Beautrais 2002; Conwell et al 2001; Conwell et al 1996; Harwood et al 2001; Waern et al in press). From 71–95% of suicide victims aged 65 years and over had a major psychiatric disorder at the time of death. Primary psychotic illness (schizophrenia, schizoaffective illness, delusional disorder), personality disorders, and anxiety disorders appear to play a relatively small role in suicide among the elderly. Similarly, alcohol and other substance use disorders are present in a smaller proportion of completed suicides at older than younger ages (Conwell et al 1996).

In contrast, older suicide victims are more likely to have suffered from depressive illness than their younger counterparts (Conwell and Brent 1995). In a PA study of 141 completed suicides, Conwell and colleagues demonstrated that greater age at death was significantly associated with a diagnosis of single episode, unipolar major depression (Conwell et al 1996). These clinical depressions were of moderate severity and infrequently associated with comorbid substance use disorders, suggesting the likelihood of response to standard therapies. Relative to its prevalence in the old age population, dementia is infrequently diagnosed in completed suicides by the PA method.

The evidence from these studies is that affective illness

Table 1. Psychiatric Diagnoses made by Psychological Autopsy in Studies of Late Life Suicides

Site	West Sussex, UK	Chicago	Monroe County, NY	San Diego	Finland	Monroe County, NY	
Investigator	Barraclough (1971)	Clark (1991)	Conwell et al (1991)	Carney et al (1994)	Henriksson et al (1995)	Conwell et al (1996)	
<i>n</i>	30	54	18	49	43	36	14
Age (years)	≥65	≥65	≥50	≥60	≥60	55–74	75–92
Diagnosis: % with . .							
Major depression	}87	54	67	}54	44	47	57
Other mood disorder		11	17		21	17	21
Alcohol abuse/dependence	3	19	}42	}22	25	43	27
Other drug abuse/dependence	—	—			5	3	7
Nonaffective psychoses	0	0	0	—	12	6	0
No diagnoses or insufficient data	13	24	11	14	9	8	29

Site	Christchurch, NZ	Western NY	Central England, UK	Goteborg, Sweden
Investigator	Beautrais, 2002	Conwell et al, 2001	Harwood et al, 2001	Waern et al, in press
<i>n</i>	31	73	100	85
Age (years)	≥55	≥50	≥60	≥65
Diagnosis: % with . .				
Major depression	}86	}71	}63	46
Other mood disorder				36
Alcohol abuse/dependence	}14	}18	5	}27
Other drug abuse/dependence			5	
Nonaffective psychoses	—	7	4	8
No diagnoses or insufficient data	9	12	23	5

Bracket numbers indicate the study combined two diagnoses.

is the predominant psychopathology associated with suicide in later life. What evidence is available from controlled studies, however, to test these hypotheses?

CONTROLLED STUDIES. Ross and colleagues reported the only prospective, nonclinical cohort study of older adults to date in which completed suicide was the outcome. They conducted evaluations of almost 12,000 retirement community residents, of whom 19 died by suicide over 5 years of follow-up (Ross et al 1990). Using a nested case control design, they determined that in addition to a widowed or divorced conjugal status, the strongest predictor of suicide was self-rated depression symptom severity. Subjects in the poorest summary score category were 23 times more likely to commit suicide than subjects with the least depressive symptomatology. Sleeping nine or more hours per night (OR = 4.6; *p* = .02) and drinking more than three alcoholic beverages a day (OR = 3.5; *p* = .04) also were significant predictors of completed suicide in multivariate analyses. Generalizability of the findings is limited by the highly selected nature of the cohort. Residents of a retirement community are not representative of all older adults. Two thirds were women and the great majority was upper middle class and Caucasian.

Five PA studies of later life suicides have been reported that included comparison samples with which to establish

base rates of putative risk factors, and thus the relative risk associated with each factor. The characteristics of the case and control groups are important to appreciate in interpreting the findings, because each study took a slightly different approach (Table 2). Four out of five specifically addressed the risk associated with psychiatric illness.

The presence of any Axis I disorder is clearly and powerfully associated with elevated risk for suicide in older adults, with significant odds ratios ranging in the four studies from 27.4 (Conwell et al unpublished data) to 113.1 (Waern et al unpublished data). Mood disorders stand out as a significant predictor of suicide in all four studies. Waern et al (in press) examined depressive subtype in greatest detail. Recurrent major depressive disorder was associated with the greatest relative risk in multivariate analyses (OR = 162.4; 95% CI = 19.9–1326.5), although single episode major depression, dysthymia, and minor depression were also significant predictors of completed suicide.

Three of four studies that examined dementia diagnoses found no significant difference between suicides and controls (Conwell et al 2001; Conwell et al 2000; Waern et al in press), and psychotic disorders were predictive of suicide in only one of five studies (Waern et al in press). None found anxiety disorders to distinguish cases from controls, with the exception of the Göteborg study in which elevated odds for suicide associated with anxiety

Table 2. Retrospective Case Control Studies of Suicide in Later Life — Mental Health Factors

Site	Christchurch, NZ	Monroe County, NY	Western NY	Central England, UK	Maricopa County, AZ	Göteborg, Sweden
						Waern et al, in press Rubenowitz et al, in press Waern et al, 2001
Investigators	Beautrais, 2002	Conwell et al, 2000	Conwell et al, 2001	Harwood et al, 2001	Miller, 1978	
Sample	Cases: 31 suicides age ≥ 55 yrs and 22 who made serious suicide attempts Controls: 269 subjects age ≥ 55 yrs selected from electoral rolls	Cases: 42 suicides age ≥ 60 yrs seen by a PCP within 30 days of death Controls: 196 living PCP patients age ≥ 60 yrs	Cases: 73 suicides age ≥ 50 years Controls: 68 age, sex, race, county of residence matched living subjects	Cases: 54 suicides age ≥ 60 yrs Controls: age and sex matched, natural deaths in hospital	Cases: 30 male suicides age ≥ 60 yrs Controls: 30 deceased men (natural causes) matched on age, race marital status, county of residence	Cases: 85 suicides age ≥ 65 yrs Controls: 153 age and sex matched living persons selected from tax roster
Psychiatric Illness						
Any Axis I	OR = 43.9 (19.6–98.3)	$\chi^2 = 45.1; p < .001$	OR = 27.4 (11.0–68.3)	—	—	Univariate analysis: OR = 113.1 (32.9–389.2)
Depression	Current mood d/o: OR = 184.6 (57.8–589.3) Lifetime hx: OR = 12.5 (5.9–26.1)	Any mood d/o: $\chi^2 = 64.8; p < .001$ Major depression: $\chi^2 = 57.2; p < .001$	Any mood d/o: OR = 21.6 (8.5–54.8) Major depression: 64% of suicides; 0% of controls	Depressive episodes OR = 4.0 (1.6–9.9)	—	Major dep. - single episode: OR = 8.9 (2.3–34.0) - recurrent: OR = 59.3 (7.9–445.9) Dysthymia: OR = 13.9 (1.7–112.5) Minor dep: OR = 15.2 (3.9–58.4)
Substance use d/o	OR = 4.4 (1.7–11.0) Lifetime hx: OR = 4.1 (1.8–9.5)	$\chi^2 = 10.8; p < .001$	<i>ns</i>	<i>ns</i>	—	OR = 43.1 (5.9–329.7)
Dementia	—	<i>ns</i>	<i>ns</i>	OR = .2 (.04–.8) (Delirium also higher in controls)	—	<i>ns</i>
Anxiety d/o	<i>ns</i>	—	<i>ns</i>	<i>ns</i> (included as “other”)	—	OR = 3.6 (1.3–10.0)
Psychotic d/o	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	—	OR = 10.7 (1.3–89.8)
Suicide attempt hx	OR = 36.3 (14.8–89.3)	$\chi^2 = 12.4; p < .001$	OR = 10.8 (2.4–48.6)	—	—	—
Psychiatric treatment	Admission in last year: OR = 48.2 (5.9–394.7)	Lifetime hx: $\chi^2 = 64.4; p < .001$	—	—	—	—

PCP, primary care physician; d/o, disorder; hx, history; dep, depression.

disorders observed in univariate analyses no longer held when depression was accounted for in multivariate analyses (Waern et al in press). The results for substance disorders were mixed, with three of five studies showing a statistically significant elevation of risk (Beautrais 2002; Conwell et al 2000; Waern et al in press). All three studies that examined a prior history of suicide attempts found it to be a statistically significant risk factor as well (Beautrais 2002; Conwell et al 2001; Conwell et al 2000).

OTHER PSYCHOLOGICAL FACTORS. In uncontrolled studies, personality traits associated with suicide in later life include timidity and shy seclusiveness (Batchelor and Napier 1953), hypochondriasis, hostility and a rigid, independent style (Batchelor and Napier 1953; Clark 1993; Farberow and Shneidman 1970). Of the controlled studies that are available, only one assessed *personality disorder diagnoses*, finding no significant difference between cases and controls (Harwood et al 2001).

Two studies included standardized measures of *personality traits*. In the Monroe County sample, Duberstein and colleagues (1994) demonstrated that suicides over age 50 years were distinguished from age matched controls by higher levels of Neuroticism (N) and lower scores on the Openness to Experience (OTE) factor of the NEO Personality Inventory (Costa and McCrae 1992). Low OTE describes individuals with muted affective and hedonic responses, a constricted range of interests, and comfort with the familiar. The authors hypothesize that suicide risk is increased in older persons with low OTE because of their restricted adaptability to the challenges of aging, and because their distress may be more difficult for others to detect. Harwood and colleagues compared suicides and natural death controls age 60 years and over on ICD-10 “personality trait accentuation” (Harwood et al 2001). Anankastic (obsessional) and anxious traits, which the authors note are qualitatively similar to low OTE, significantly distinguished the groups. The relationships of these traits to the depressive conditions so common in older suicide victims, and their potential role as moderators of other putative risk factors, remain to be studied.

Physical Health

The prevalence of physical illness in later life, as well as its salience to the well being of elders, contribute to the common assumption that physical health factors determine late life suicide risk. Such assumptions are central to the active national debate on physician assisted suicide. Uncontrolled PA studies have yielded the estimate that physical illness directly contributes to suicide in almost 70% of victims over 60 years of age (Dorpat et al 1968). In a review of 235 prospective studies with at least two

years of follow-up and no more than ten percent attrition, Harris and Barraclough calculated standardized mortality ratios for suicide in over 60 medical disorders and treatments (Harris and Barraclough 1994). The disorders that they concluded confer increased risk for suicide were, in general, more characteristic of middle age or young old than old old adults – HIV/AIDS, Huntington’s Disease, multiple sclerosis, peptic ulcer, renal disease, spinal cord injury, and systemic lupus erythematosus. The exception was malignant neoplasms. Seizure disorders and other CNS conditions, cardiopulmonary complications, and urogenital disease in men have been implicated by other authors (Mackenzie and Popkin 1987; Whitlock 1986). None of these studies, however, analyzed whether the effects of physical illness remained after adjusting for comorbid affective disorders or other psychopathologies in multivariate analyses. This strategy is particularly important to pursue, as studies by Chochinov and colleagues (Chochinov et al 1995) and Brown et al (Brown et al 1986) demonstrate. Both groups found that suicidal ideation among seriously ill people was extremely rare in the absence of clinically significant mood disturbance. Far better characterization of physically ill elders with elevated risk for suicide is critical, not only because of the high prevalence of physical illness in later life, but because the great majority of older adults in a suicidal crisis are in active treatment with a primary care provider (Conwell 1997). Their access to care offers an important opportunity to intervene in an efficient manner if those at high risk can be distinguished from physically ill elders at lower risk.

CONTROLLED STUDIES. Data from community based cohort studies concerning the risk for suicide associated with physical health factors are extremely limited. In their study of retirement community residents Ross and colleagues (Ross et al 1990) found that current smoking increased the relative risk of suicide by almost ten times, while practicing breast self exams was associated with a 10-fold risk reduction. When entered in a multivariate analysis that included alcohol use and depressive symptoms, however, neither remained predictive.

Results from case control studies concerning the risk for suicide associated with physical illness in older adults are mixed (Table 3). Conwell et al (Conwell et al 2001) found that physical illness burden and the presence of a current serious physical condition significantly distinguished suicides from controls; however, the presence of depressive symptoms or syndromes was not accounted for in analyses. Waern and colleagues did report that serious physical illness in any organ category was an independent risk factor for suicide in the multivariate regression model, but when the sexes were analyzed separately, serious physical illness was associated with suicide only in men (Waern et

Table 3. Retrospective Case Control Studies of Completed Suicide in Later Life — Social and Physical Health Factors

Site	Christchurch, NZ	Monroe County, NY	Western NY	Central England, UK	Maricopa County, AZ	Göteborg, Sweden
Investigators	Beautrais, 2002	Conwell et al, 2000	Conwell et al, 2001	Harwood et al, 2001	Miller, 1978	Waern et al, in press Rubenowitz et al, in press; Waern et al, 2001
Social Factors	Living alone: <i>ns</i> Low social interaction: OR = 4.2 (2.1–8.6) Relationship problem: OR = 4.4 (1.7–11.4) Financial problem: OR = 3.3 (1.2–8.8)	Living alone:	Living alone: $\chi^2 = 18.2$; OR = 5.1; $p < .0001$ Controls received significantly greater instrumental support ($p < .0001$) and had greater social interaction ($p < .01$) than suicides.	—	Controls more likely to have a confidant ($p < .05$) Suicides had fewer visits with friends and relatives ($p < .02$)	Significant life events in last 6 months: –somatic illness; OR = 2.8 (1.5–5.2) –family discord; OR = 18.8 (7.4–47.8) –financial problems; OR = 9.1 (1.9–43.0) –Any event; OR = 8.7 (3.0–25.6) Significant protective factors for men and women: active club membership; active hobby
Gun access	—	—	Gun possession: OR 2.3 (1.1–4.8)	—	Gun possession: <i>ns</i> Recent acquisition: $p < .004$	—
Physical Health	Current serious physical illness: <i>ns</i> PCP visit in last month: <i>ns</i>	Physical illness burden: $t = 4.1$; $p < .001$ Current serious physical illness: $\chi^2 = 30.1$; $p < .0001$	Physical illness burden: $t = 2.66$; $p < .01$ Current serious physical illness: OR = 7.6 (2.7–21.4) Cancer, CNS disorders, and COPD predict suicide	—	—	Current serious physical illness: OR = 5.9 (2.0–17.8) Vision loss, cancer, and CNS disorders predict suicide
Functional status	—	Physical functioning: $t = -4.2$; $p < .001$ Overall functioning (IADLs): $t = 4.7$; $p < .001$	Physical functioning: $t = 3.7$; $p < .001$ Overall functioning (IADLs): $t = 6.3$; $p < .0001$	—	—	Require assistance in daily living: Men— <i>ns</i> Women—OR = 6.3 (1.8–21.7)

PCP, primary care physician; IADL, instrumental activities of daily living; CNS, central nervous system; COPD, chronic obstructive pulmonary disease.

al 2001). In both univariate and multivariate models Beautrais found that neither serious physical illness nor the likelihood of a visit to a primary care provider in the last month was associated with increased risk (Beautrais 2002). Our group reported that a greater physical illness burden, the presence of serious physical illness, and associated functional impairment all significantly distinguished elderly suicides in primary care from age matched to primary care controls. Importantly, however, after controlling for mood disorders, physical health and functional measures no longer distinguished the groups (Conwell et al 2000). This variability in results can be accounted for in part by methodologic differences; however, the evidence is highly suggestive that while physical illness and functional impairment are associated with suicide in older adults, much if not all of the risk associated with physical health factors is mediated by their relationship with affective disorder.

Social Factors

Stressful life events cluster in the weeks and months before suicide attempts in the elderly (Luscomb et al 1980). The specific types of life events most pertinent to suicide in later life differ from those of younger victims (Carney et al 1994; Conwell et al 1990; Heikkinen and Lonnqvist 1995). Interpersonal discord, financial and job problems, and legal difficulties are more typical of suicides in young and middle adulthood, whereas physical illness and other losses are the most common stressors in older adults who end their own lives. Studies comparing the living situation of suicide victims with census data conclude that elder suicides were more likely than other older adults in the community to have lived alone, suggesting that social isolation and loneliness are important factors to consider (Barraclough 1971). There does not appear to be a difference between younger and older suicide victims in the extent of their social contacts (Carney et al 1994; Heikkinen and Lonnqvist 1995). More pertinent may be the complex construct of social support and the moderating role that it may play in determining the risk for suicide associated, for example, with stressful life events such as bereavement. Uncommon, but high profile cases of homicide-suicide in older adults suggest that risk may be associated with caregiver burden as well (Cohen et al 1998).

CONTROLLED STUDIES. Three case control studies using the psychological autopsy method compared the proportions of suicides and controls that lived alone (Table 3) (Beautrais 2002; Conwell et al 2001; Conwell et al 2000), of which one found a significant difference between groups (unadjusted OR = 5.1)(Conwell et al 2001).

Two studies examined specific stressors in cases and controls. Financial and relationship problems (Beautrais 2001) and family discord (Rubenowitz et al in press) distinguished the groups in univariate analyses, but when other factors, including depression, were controlled for, only family discord remained predictive.

Results that concern social support constructs are more consistent across studies than findings regarding living situation and stressful life events. Miller reported that controls were significantly more likely than suicides to have had a confidante and to visit with friends and relatives (Miller 1978). In unadjusted analyses, Conwell and colleagues found that controls had received significantly greater support with the practical tasks of day to day life and had greater social interaction than suicides (Conwell et al 2001). Low social interaction was also a significant risk factor for suicide in the New Zealand sample studied by Beautrais (OR = 4.5) even after adjustment for physical and mental health variables (Beautrais 2002).

Life events and social supports appear in case control studies to constitute risk factors and/or buffers to suicide in later life; however, it is unclear the extent to which their effects may be mediated by associations with other variables, including depression. As well, the potential roles of effect moderators, such as personality and culture, warrant further investigation.

Other Putative Risk Factors

Access to Means

Older adults tend to use more immediately lethal methods for suicide than do younger age groups. In 1998, for example, 57% of suicides in the United States were committed with a firearm (62% of men and 39% of women) (Murphy 2000). Seventy-one percent of elderly suicide victims, however, used guns. Brent and colleagues demonstrated that the presence of a firearm in the home was a significant risk factor for suicide among adolescents regardless of whether the weapon was stored in a secure place, with or without ammunition (Brent et al 1993b). In his 1978 PA study Miller found no difference between cases and controls in the proportion of who owned a gun (Miller 1978); however, a significantly greater proportion of suicides than controls had acquired that weapon within the last year. Conwell and colleagues have reported a significant increase in suicide risk associated with the presence of a gun in the home of older adults (OR = 2.3; 95% CI = 1.1–4.8) (Conwell et al 2001).

Neurobiological Factors

There is a rapidly developing and compelling literature on the neurobiological bases of suicidal behavior (Mann

Table 4. Significant Risk Factors in Multivariate Analyses — Cohort and Case Control Studies

Risk Domain	Prospective Cohort Study	Retrospective Case Control Studies		
	Ross et al (1990)	Conwell et al (2000)	Beautrais (2002)	Waern et al in press; Rubenowitz et al (in press)
Mental Health	Depression > 9 hrs/day sleep > 3 drinks/day	Depression	Mood d/o in prior month Psychiatric admission in past year	Major depression Dysthymia Minor depression Substance use d/o Psychotic d/o
Physical Health	—	<i>ns</i>	<i>ns</i>	<i>ns</i>
Social Factors	Widowed or divorced	—	Low social network	Family discord

d/o, disorder.

1998). Serotonergic, noradrenergic, and neuroendocrine systems are implicated most consistently. The dramatic rise in suicide rates with age among men in the United States suggests that aging- and possibly gender-related changes in these or other neurobiological systems may contribute to suicide risk in older adults. Based on extensive evidence that abnormalities in central serotonergic function are associated with a predisposition to impulsive and aggressive acts, Mann and others have proposed a stress-diathesis model in which individuals with an impulsive/aggressive style and a tendency to experience suicidal ideation under stress are more likely to act on their suicidal feelings than persons without those predispositions (Mann et al 1999). Preliminary evidence indicates that age-related effects on serotonergic and other monoamine systems may be more pronounced in men (Mann and Stoff 1997), and findings of lower CSF levels of 5-HIAA in elderly depressed patients who had attempted suicide compared with elderly depressed controls suggest that the model may apply in later life as well (Jones et al 1990).

Tests of neuropsychological functioning in depressed suicidal attempters in controls have implicated abnormalities in executive function (Keilp et al 2001), including in older adults (King et al 2000). Rubio and colleagues reported significantly greater hippocampal neurofibrillary pathology in postmortem analysis of elderly suicides and controls (Rubio et al 2001). Ahearn and colleagues found that elderly depressives with lifetime histories of suicide attempts had significantly more subcortical gray matter hyperintensities on MRI than did carefully matched depressives with no previous suicide attempts. They noted a trend toward more periventricular white matter hyperintensities as well (Ahearn et al 2001). In combination, these findings raise the possibility that suicide in later life is associated with disruption of neural pathways critical to the regulation of mood, cognition, and behavior. Additional research is necessary to confirm and extend these functional and neuroanatomical findings, define their neurochemical correlates, and establish whether they repre-

sent early, subtle presentations of vascular or other degenerative neuropathology. At this stage, however, the neurobiology of suicide in later life is largely unknown and without application to prevention strategies.

Summary and Implications

Demographic characteristics associated with elevated risk for suicide are better termed “fixed markers” because they are immutable (Kraemer et al 1997). These include older age, male gender, and white race. Epidemiologic studies provide strong evidence that unmarried conjugal status confers risk for suicide as well.

Table 4 lists risk factors for suicide in older adults in mental health, physical health, and social domains that are derived from statistical testing of multivariate models in methodologically sound, controlled studies. The evidence is suggestive, but not strong, that stressful life events represent independent risk factors for suicide in later life. Bereavement and family discord, both factors that may lead to isolation of the older adult, have been demonstrated most convincingly. The evidence is stronger that social support variables may act both as risk enhancers and buffers. Physical illness confers elevated risk for suicide in older adults, with its effect largely mediated by depressive disorders. Personality traits also may play an important role, but as yet these are defined insufficiently.

Factors in each of these domains interact within an older individual to determine his/her level of risk at any particular point in time. For example, vulnerability to becoming depressed and suicidal in the face of physical illness may be higher among individuals low in OTE, but only in the absence of social supports that act to buffer the functional or financial impact of the illness. Examination of more complete multivariate models is essential for increasing our understanding of these myriad potential interactions.

It is well established, nonetheless, that substance use disorders place elders at increased risk for suicide, just as they do at younger ages. Even more pronounced, however,

is the risk associated with affective illness. Every study to date has reinforced the powerful association of either depressive symptomatology or an affective disorder diagnosis with completed suicide in later life, all at considerably greater odds than for any other risk factor. While major depressive disorder (single episode or recurrent) has been studied most intensively, the available evidence demonstrates that risk is elevated across mood disorder diagnoses and the range depressive symptom severity.

What implications do these findings have for suicide prevention strategies? Population attributable risk (PAR) is a statistic indicating the reduction in suicide that would result from elimination of a confirmed risk factor from the population. Beautrais and colleagues estimated the PAR associated with each significant risk factor in their multivariate model (Beautrais et al 2002). Low social network yielded a PAR of 27%, highlighting its importance as a target for late life suicide and preventive interventions. The presence of a mood disorder, however, was associated with an astonishing PAR of 74%, the proportion of late life suicides that would be prevented were affective illness eliminated from the population.

The implication is clear that reduction in the prevalence of mood disorders in older adults should be a prime target of the National Strategy for Suicide Prevention. This objective can be operationalized as universal prevention strategies (e.g., public education campaigns about the signs, symptoms, treatment options, and prognosis for depression in later life) as well as selected and indicated interventions. Examples of the latter include outreach programs to engage undiagnosed elders with depression in diagnostic and treatment systems and models of collaborative care to improve the effectiveness of late life depression and treatment. Even more important over time will be the design and implementation of policies and practices that prevent the onset of mood disorders.

Of course, only a small proportion of elderly depressives engages in self-harming behavior. The “cause” of suicide in later life must be understood as a complex combination of interactive effects in which mood disorders take a central role. Our ability to more precisely target preventive interventions, therefore, will hinge on a better understanding of those relationships. This objective will in turn require larger studies with more patients characterized with rigorous, standardized methodologies, enabling examination of complex interactions between risk factors.

This work was supported in part by NIMH K24 MH01759 (Dr. Conwell).

Aspects of this work were presented at the conference, “Unmet Needs in Diagnosis and Treatment of Mood Disorders in Late Life,” October 9–10, 2001 in Washington, DC. The conference was sponsored by the National Depressive and Manic-Depressive Association (National DMDA) through unrestricted educational grants provided by Abbott Laboratories, AstraZeneca, Forest Laboratories, GlaxoSmithKline, Jans-

sen Pharmaceutica, Eli Lilly and Company, Merck & Co., National Institute of Mental Health, Organon, Pfizer Inc, and Wyeth-Ayerst Laboratories.

References

- Ahearn EP, Jamison KR, Steffens DC, Cassidy F, Provenzale JM, Lehman A, et al (2001): MRI correlates of suicide attempt history in unipolar depression. *Biol Psychiatry* 50: 266–270.
- Alexopoulos GS, Bruce ML, Hull J, Sirey JA, Kakuma T (1999): Clinical determinants of suicidal ideation and behavior in geriatric depression. *Arch Gen Psychiatry* 56:1048–1053.
- Barracough BM (1971): Suicide in the elderly: Recent developments in psychogeriatrics. *Br J Psychiatry* (suppl 6):87–97.
- Batchelor IRC, Napier MB (1953): Attempted suicide in old age. *Br Med J* 2:1186–1190.
- Beautrais AL (2002): A case control study of suicide and attempted suicide in older adults. *Suic Life-Threaten Behav*.
- Blazer DG, Bahn AK, Manton KG (1986): Suicide in late life: Review and commentary. *J Am Geriatr Soc* 34:519–525.
- Brent DA, Perper JA, Moritz G, Allman CJ, Roth C, Schweers J, et al (1993a): The validity of diagnoses obtained through the psychological autopsy procedure in adolescent suicide victims: Use of family history. *Acta Psychiatr Scand* 87:118–122.
- Brent DA, Perper JA, Moritz G, Baugher M, Schweers J, Roth C (1993b): Firearms and adolescent suicide. A community case-control study. *Am J Dis Children* 147:1066–1071.
- Brown JH, Henteleff P, Barakat S, Rowe CJ (1986): Is it normal for terminally ill patients to desire death? *Am J Psychiatry* 143:208–211.
- Callahan CM, Hendrie HC, Nienaber NA, Tierney WM (1996): Suicidal ideation among older primary care patients. *J Am Geriatr Soc* 44:1205–1209.
- Carney SS, Rich CL, Burke PA, Fowler RC (1994): Suicide over 60: The San Diego study. *J Am Geriatr Soc* 42:174–180.
- Chochinov HM, Wilson KG, Enns M, Mowchun N, Lander S, Levitt M, et al (1995): Desire for death in the terminally ill. *Am J Psychiatry* 152:1185–1191.
- Clark DC (1991): Suicide among the elderly. Final report to the AARP Andrus Foundation.
- Clark DC (1993): Narcissistic crises of aging and suicidal despair [see comments]. *Suic Life-Threaten Behav* 23:21–26.
- Clark DC, Horton-Deutsch SL (1992): Assessment in absentia: The value of the psychological autopsy method for studying antecedents of suicide and predicting future suicides. In: Maris RW, Berman AL, editors. *Assessment and Prediction of Suicide*. New York: Guilford, pp 144–182.
- Cohen D, Llorente M, Eisdorfer C (1998): Homicide-suicide in older persons. *Am J Psychiatry* 155:390–396.
- Conner K, Conwell Y, Duberstein PR (2001a): The validity of proxy-based data in suicide research: A study of patients 50 years of age and older who attempted suicide. II. Life events, social support and suicidal behavior. *Acta Psychiatr Scand* 104:452–457.
- Conner K, Duberstein P, Conwell Y (2001b): The validity of proxy-based data in suicide research: A study of patients 50

- years of age and older who attempted suicide. I. Psychiatric diagnoses. *Acta Psychiatr Scand* 104:204–209.
- Conwell Y (1997): Management of suicidal behavior in the elderly. *Psychiatr Clin North Am* 20:667–683.
- Conwell Y, Brent D (1995): Suicide and aging. I: Patterns of psychiatric diagnosis. *Int Psychogeriatr* 7:149–164.
- Conwell Y, Duberstein PR, Cox C, Herrmann J, Forbes N, Caine ED (1998): Age differences in behaviors leading to completed suicide. *Am J Geriatr Psychiatry* 6:122–126.
- Conwell Y, Duberstein PR, Cox C, Herrmann JH, Forbes NT, Caine ED (1996): Relationships of age and axis I diagnoses in victims of completed suicide: A psychological autopsy study. *Am J Psychiatry* 153:1001–1008.
- Conwell Y, Lyness JM, Duberstein P, Cox C, Seidlitz L, DiGiorgio A, et al (2000): Completed suicide among older patients in primary care practices: A controlled study. *J Am Geriatr Soc* 48:23–29.
- Conwell Y, Olsen K, Caine ED, Flannery C (1991): Suicide in later life: Psychological autopsy findings. *Int Psychogeriatr* 3:59–66.
- Conwell Y, Rotenberg M, Caine ED (1990): Completed suicide at age 50 and over. *J Am Geriatr Soc* 38:640–644.
- Costa PT, McCrae RR (1992): *Revised NEO Personality Inventory and NEO Five Factor Inventory: Professional Manual*. Odessa, FL: PAR.
- Dorpat TL, Anderson WF, Ripley HS (1968): The relationship of physical illness to suicide. In: Resnik HPL, editor. *Suicidal behaviors: Diagnosis and Management*. Boston: Little, Brown, pp 209–219.
- Duberstein PR, Conwell Y, Caine ED (1994): Age differences in the personality characteristics of suicide completers: Preliminary findings from a psychological autopsy study. *Psychiatry* 57:213–224.
- Duberstein PR, Conwell Y, Seidlitz L, Lyness JM, Cox C, Caine ED (1999): Age and suicidal ideation in older depressed inpatients. *Am J Geriatr Psychiatry* 7:289–296.
- Farberow NL, Shneidman ES (1970): Suicide among patients with malignant neoplasms. In: Shneidman ES, Farberow NL, Litman RE, editors. *The Psychology of Suicide*. New York: Science House, pp 324–344.
- Gallo JJ, Anthony JC, Muthen BO (1994): Age differences in the symptoms of depression: A latent trait analysis. *J Gerontol* 49:251–264.
- Goldstein RB, Black DW, Nasrallah A, Winokur G (1991): The prediction of suicide. Sensitivity, specificity, and predictive value of a multivariate model applied to suicide among 1906 patients with affective disorders. *Arch Gen Psychiatry* 48:418–422.
- Gordis L (1996): Case-control and cross-sectional studies *Epidemiology* Philadelphia, PA: Saunders, pp 124–140.
- Haas AP, Hendin H (1983): Suicide among older people: Projections for the future. *Suic Life-Threaten Behav* 13:147–154.
- Harris EC, Barraclough BM (1994): Suicide as an outcome for medical disorders. *Medicine* 73:281–296.
- Harwood D, Hawton K, Hope T, Jacoby R (2001): Psychiatric disorder and personality factors associated with suicide in older people: A descriptive and case-control study. *Int J Geriatr Psychiatry* 16:155–165.
- Hawton K, Appleby L, Platt S, Foster T, Cooper J, Malmberg A, et al (1998): The psychological autopsy approach to studying suicide: A review of methodological issues. *J Affect Disord* 50:269–276.
- Heikkinen ME, Lonnqvist JK (1995): Recent life events in elderly suicide: A nationwide study in Finland. *Int Psychogeriatr* 7:287–300.
- Henriksson MM, Marttunen MJ, Isometsa ET, Heikkinen ME, Aro HM, Kuoppasalmi KI, et al (1995): Mental disorders in elderly suicide. *Int Psychogeriatr* 7:275–286.
- Jones JS, Stanley B, Mann JJ, Frances AJ, Guido JR, Traskman-Bendz L, et al (1990): CSF 5-HIAA and HVA concentrations in elderly depressed patients who attempted suicide. *Am J Psychiatry* 147:1225–1227.
- Keilp JG, Sackeim HA, Brodsky BS, Oquendo MA, Malone KM, Mann JJ (2001): Neuropsychological dysfunction in depressed suicide attempters. *Am J Psychiatry* 158(5):735–741.
- Kelly TM, Mann JJ (1996): Validity of DSM-III-R diagnosis by psychological autopsy: A comparison with clinician ante-mortem diagnosis. *Acta Psychiatr Scand* 94:337–343.
- King DA, Conwell Y, Cox C, Henderson RE, Denning DG, Caine ED (2000): A neuropsychological comparison of depressed suicide attempters and nonattempters. *J Neuropsychiatry Clin Neurosci* 12(1):64–70.
- Kraemer HC, Kazdin AE, Offord DR, Kessler RC, Jensen PS, Kupfer DJ (1997): Coming to terms with the terms of risk. *Arch Gen Psychiatry* 54:337–343.
- Langley GE, Bayatti NN (1984): Suicides in Exe Vale Hospital, 1972–1981. *Br J Psychiatry* 145:463–467.
- Linden M, Barnow S (1997): 1997 IPA/Bayer Research Awards in Psychogeriatrics. The wish to die in very old persons near the end of life: A psychiatric problem? Results from the Berlin Aging Study *Int Psychogeriatr* 9:291–307.
- Linehan MM (1986): Suicidal people: One population or two? In: Mann JJ, Stanley M, editors. *The Psychobiology of Suicidal Behavior* New York: New York Academy of Sciences, pp 16–33.
- Lish JD, Zimmerman M, Farber NJ, Lush DT, Kuzma MA, Plescia G (1996): Suicide screening in a primary care setting at a Veterans Affairs Medical Center. *Psychosomatics* 37:413–424.
- Luscomb RL, Clum GA, Patsiokas AT (1980): Mediating factors in the relationship between life stress and suicide attempting. *J Nerv Ment Dis* 168:644–650.
- Mackenzie TB, Popkin MK (1987): Suicide in the medical patient. *Int J Psychiatry Med* 17:3–22.
- Mann JJ (1998): The neurobiology of suicide. *Nat Med* 4:25–30.
- Mann JJ, Stoff DM (1997): A synthesis of current findings regarding neurobiological correlates and treatment of suicidal behavior. *Ann NY Acad Sci* 836:352–363.
- Mann JJ, Waternaux C, Haas GL, Malone KM (1999): Toward a clinical model of suicidal behavior in psychiatric patients. *Am J Psychiatry* 156(2):181–189.
- Miller M (1978): Geriatric suicide: The Arizona study. *Gerontologist* 18:488–495.
- Moscicki EK (1997): Identification of suicide risk factors using epidemiologic studies. *Psychiatric Clin North Am* 3:499–517.
- Murphy SL (2000): Deaths: Final data for 1998. DHHS Publi-

- cation No 2000–1120:Hyattsville, MD, National Center for Health Statistics. National Vital Statistics Report, 48(11).
- National Center for Health Statistics. Death rates for 72 selected causes by 5-year age groups, race, and sex: United States, 1979–1998. Available at: <http://www.cdc.gov/datawh/statab/unpubd/mortabs/gmwk291.htm>. Accessed September 20, 2001.
- O'Carroll PW, Berman AL, Maris RW, Moscicki EK, Tanney BL, Silverman MM (1996): Beyond the tower of Babel: A nomenclature for suicidology. *Suic Life-Threaten Behav* 26: 237–252.
- Parkin D, Stengel E (1965): Incidence of suicidal attempts in an urban community. *Br Med J* 2:133–138.
- Paykel ES, Myers JK, Lindenthal JJ, Tanner J (1974): Suicidal feelings in the general population: A prevalence study. *Br J Psychiatry* 124:460–469.
- Pearson JL, Conwell Y (1995): Suicide in late life: Challenges and opportunities for research. Introduction. *Int Psychogeriatr* 7:131–136.
- Pearson JL, Stanley B, Fisher C, King C. Issues to consider in intervention research with persons at high risk for suicidality. National Institute of Mental Health. Available at: <http://www.nimh.gov/research/highrisksuicide.cfm>. Accessed 1-2-02
- Rao R, Denning T, Brayne C, Huppert FA (1997): Suicidal thinking in community residents over eighty. *Int J Geriatr Psychiatry* 12:337–343.
- Ross RK, Bernstein L, Trent L, Henderson BE, Paganini-Hill A (1990): A prospective study of risk factors for traumatic death in the retirement community. *Prev Med* 19:323–334.
- Rubenowitz E, Waern M, Wilhelmsson K, Allebeck P (in press) Life events and psychosocial factors in elderly suicides – a case control study. *Psychological Med*.
- Rubio A, Vestner AL, Stewart JM, Forbes NT, Conwell Y, Cox C (2001): Suicide and Alzheimer's pathology in the elderly: A case-control study. *Biol Psychiatry* 49:137–145.
- Skoog I, Aevansson O, Beskow J, Larsson L, Palsson S, Waern M, et al (1996): Suicidal feelings in a population sample of nondemented 85-year-olds. *Am J Psychiatry* 153:1015–1020.
- U.S Public Health Service (2001): National Strategy for Suicide Prevention: Goals and Objectives for Action. U.S. Department of Health and Human Services (ed). Rockville, MD: Public Health Service, pp 1–204.
- Waern M, Runeson B, Allebeck P, Beskow J, Rubenowitz E, Skoog I et al (in press): Mental disorder in elderly suicides. *A J Psychiatry*
- Whitlock FA (1986): Suicide and physical illness. In: Roy A, editor. *Suicide*. Baltimore: Williams & Wilkins, pp 151–170.