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IN THE UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF CALIFORNIA

TRACY RIFLE AND PISTOL LLC et al., Plaintiffs, **v.** **KAMALA D. HARRIS, in her official capacity as Attorney General of California, et al.,** Defendants.	2:14-cv-02626-TLN-KJN (TEMP) **EXPERT WITNESS REPORT OF PROFESSOR J. JOHN MANN**

TABLE OF CONTENTS

INTRODUCTION

1. I am the Paul Janssen Professor of Translational Neuroscience and Director of the Molecular Imaging and Neuropathology Division in the Department of Psychiatry and Columbia University and the New York State Psychiatric Institute. Counsel for defendants in *Tracy Rifle & Pistol LLC v. Harris* (E.D. Cal. Case No. 2:14-cv-02626-TLN-KJN (TEMP)) has asked me to offer an opinion in the case. The following report sets forth my opinion.

PRELIMINARY CONSIDERATIONS

I. QUALIFICATIONS

2. I received my medical degree from the University of Melbourne, and then completed an internship and residency at the Royal Melbourne Hospital. I was trained in Psychiatry and Internal Medicine and have a Doctorate in Neurochemistry. My research employs functional brain imaging, neurochemistry, epidemiology and molecular genetics to probe the causes of depression and suicide. I have published over 600 peer-reviewed papers and edited 11 books on the subjects of the biology and treatment of mood disorders, suicidal behavior and other psychiatric disorders and have been continuously funded by the NIH since 1984. In private practice I specialize in the treatment of mood disorders and suicidal behavior and have been repeatedly named as one of America's and New York's Best Doctors by Castle Connolly.

3. I am a Past President of the United States Society of Biological Psychiatry (SOBP), the International Academy of Suicide Research and the American Foundation for Suicide Prevention. I have been a member of Council and served as Program Chair for the SOBP. I am a Distinguished Life Fellow of the American Psychiatric Association and a Fellow of the American College of Neuropsychopharmacology. I have been Chairman of the Scientific Council of the American Foundation for Suicide Prevention as well as its President and a member of its Board of Directors. I have served on grant review committees for the National Institutes of Health and Advisory Committees for the Food and Drug Administration

4. I have received numerous research and teaching awards, including the American Suicide Foundation Research Award, the American Association of Suicidology Louis I. Dublin

Award, the New York State Office of Mental Health Research Award, the Klerman Senior Investigator Award from the National Depressive and Manic Depressive Association, the Columbia University Department of Psychiatry Medical Student Teaching Award, the Stengel Award from the International Association for Suicide Prevention, the Morselli Medal from the International Academy of Suicide Research and the Mood Disorders Research Award from the American College of Psychiatrists.

5. A copy of my current curriculum vitae is attached to this Report as Exhibit A.

II. COMPENSATION

6. I am being compensated for services performed at an hourly rate of $850 for reviewing materials and meetings and $950 for report preparation, depositions and court appearances (including travel time), and report writing. My compensation is not in any way dependent on the outcome of this or any related proceeding, or on the substance of my opinions.

III. MATERIALS CONSIDERED

7. The materials I have considered are cited in the notes accompanying the text of this report. Counsel for defendants has provided me with the material contained in Exhibit B.

IV. PAST PUBLICATIONS AND WORK AS AN EXPERT WITNESS

8. My curriculum vitae contains a complete list of my publications, including the published material that I have authored in the last 10 years.

9. In the last four years, I have testified as an expert in the following matters:

- *Michael D Zinck Amd of Estate of Gary Zinck v. Emad Alshami*, Court of Common Appeals, Warren County Ohio, case no. 13 cv 85684;
- *Cabbage v. State of Iowa/University of Iowa Hospital*, Iowa District Court for Johnson County, case no. LACV074908;
- *Linda Martignetti/Estate of John J Meier Jr v. Sergei T Celestin MD*, 17th Judicial Circuit, Broward County, Florida, case no. 11-5179;
- *Nelson v. Multicare Health System*, Superior Court of the State of Washington, County of Pierce, case no. 11-2-1336-0;
- *Anestis v. United States of America*, Eastern District of Kentucky, (Lexington) US District Court case no.11-cv-28.

ASSIGNMENT

10. Counsel for defendants has asked me to express opinions on the following topics:

- **Topic One:** whether there is a connection between impulsive personality traits and suicide.
- **Topic Two:** whether the availability of a firearm, particularly a handgun, in the home increases the risk of suicide for impulsive individuals.
- **Topic Three:** whether attempted suicides with firearms are more fatal than attempted suicides by other means.
- **Topic Four:** whether a single intervention or type of intervention will solve the problem of firearm suicide.
- **Topic Five:** Assume that the invalidation of California Penal Code section 26820 would result in an increase in handgun purchases by people with impulsive personality traits. Would more impulsive handgun purchases result in an increase in handgun suicides?

SUMMARY OF OPINIONS

11. My opinion on topic one is that impulsive personality traits increase the risk of suicide.

12. My opinion on topic two is that the availability of a firearm, particularly a handgun, in the home increases the risk of suicide for impulsive individuals.

13. My opinion on topic three is that attempted suicide using a firearm is more often fatal than any of the other means of suicide that are amongst those in the top ten most frequently used methods.

14. My opinion on topic four is that prevention of firearm suicide requires multiple different strategies because the factors involved are complex and one strategy is insufficient.

15. Considering the assumption provided to me by counsel, my opinion on topic five is that, if California Penal Code section 26820 were invalidated, it would result in more handgun suicides in direct proportion to the increase in handgun purchases by a vulnerable subgroup of the general population characterized by more pronounced impulsive personality traits.

ANALYSIS

I. TOPIC ONE: IMPULSIVE PERSONALITY TRAITS INCREASE THE RISK OF SUICIDE

16. Multi-determined behaviors such as suicide and nonfatal attempted suicide are best understood by using an explanatory model that describes the potential causal pathways and

interrelations between clinical, genetic, familial and environmental factors that play a role in determining the risk for suicidal behavior. One such model, that my colleagues and I have proposed, is a stress-diathesis model of suicidal behavior.[1]

17. Stressors are generally more immediate triggers of suicidal behavior and examples are a new episode of major depression and the occurrence of an adverse life event. We know from interviewing family members and significant others in the lives of those who have died by suicide, that about 90% of such individuals in western nations like the USA die by suicide during a psychiatric illness.[2]

18. In most cases the illness is untreated at the time of death or inadequately treated. The most common illness is an episode of major depression and it accounts for about 60% of the diagnoses. On the other hand, most people with a stressor such as a major depressive episode or who experience an adverse life event, never make a fatal or nonfatal suicide attempt. Something more is needed, and that something is a predisposition to suicidal behavior that we term the diathesis. The components of the diathesis that have been generally identified include a more pronounced trait of impulsiveness, that is most commonly manifested by behaviors such as reactive aggression because people experience angry feelings vastly more frequently than the wish to die by suicide. Suicidal behavior is transmitted in families and the familial transmission is linked to the transmission of this trait of impulsiveness.[3] We find this trait is more pronounced from childhood in the children of a parent who has suffered from depressions and made a suicide attempt. But the suicidal behavior first appears in early adolescence in those children who go on to manifest suicidal behavior. The onset of the suicidal behavior is at about 16 years of age, coinciding with the onset of a mood disorder in those individuals. The depression generates the

[1] Mann JJ, Waternaux C, Haas GL, Malone KM. Towards a clinical model of suicidal behavior in psychiatric patients. *Am J Psychiatry*. 1999 Feb;156(2):181-189. PMID:9989552.

[2] Harris, E. Clare, and Brian Barraclough. "Suicide as an outcome for mental disorders. A meta-analysis." *The British Journal of Psychiatry* 170.3 (1997): 205-228.

[3] Brent DA, Melhem NM, Oquendo M, Burke A, Birmaher B, Stanley B, Biernesser C, Keilp J, Kolko D, Ellis S, Porta G, Zelazny J, Ivengar S, Mann JJ. Familial pathways to early-onset suicide attempt: a 5.6-year prospective study. *JAMA Psychiatry*. 2015 Feb;72(2):160-168.

suicidal thoughts, and impulsiveness increases the chances of acting on those suicidal thoughts. This impulsive trait has been related to deficits in executive function, whereby the person when making a decision about making a suicide attempt or opting for the possibility of help through antidepressant treatment that has a 70% chance of working in 6-8 weeks, opts for the quick fix for their emotional pain by making a suicide attempt. Other factors that increase the probability of deciding to make a suicide attempt are negative or rigidly pessimistic cognitive or thought processes, impaired problem solving, social distortions and recurrent mood disorders.[4]

19. Reactive aggression reflects a more general propensity to act on powerful emotions and in the case of suicide this means feelings of sadness, despair or hopelessness and guilt sometimes called emotional pain. This propensity is driven by deficient executive function that mediates restraint and involves brain areas like the dorsal lateral prefrontal cortex. In young people that function is less developed than in older people partly because that part of the brain has not finished developing biologically. Transmission speeds in that part of the brain are slower in young people because the insulation on the nerve fibers is not fully developed yet. This may explain why teens and young adults are more impulsive, more aggressive and make more suicide attempts than older adults. Suicide rates rise dramatically in mid-teens towards adult rates. Family studies suggest this onset of suicidal behavior is related to a combination of greater impulsiveness that is present from childhood as a trait, but it is the onset of depressive episodes in the mid teens, that brings about this increase in suicide rates at that stage of life.[5] Impulsive behavior plays a bigger role in the suicide risk profile of teens and young adults compared with older adults, but greater impulsiveness goes on playing a role in suicide risk during adult life.

20. Problem solving and learning from past experience is not as good in those who make more serious suicide attempts compared with people who have the same psychiatric illness but

[4] van Heeringen K, Mann JJ. The neurobiology of suicide. *The Lancet Psychiatry*. 2014;1(1):63-72. Doi:10.1016/S2215.0366(14)70220-2.

[5] Brodsky BS, Mann JJ, Stanley B, Tin A, Oquendo M, Birmaher B, Greenhill L, Kolko D, Zelazny J, Burke AK,, Melhem NM, Brent D. Familial transmission of suicidal behavior: factors mediating the relationship between childhood abuse and offspring suicide attempts. *J Clin Psychiatry*. 2008 Apr; 69(4):584-596.

have never made a suicide attempt. It is not clear that this varies between young adults and older people.

21. The final domain of the diathesis that we will address is that of social distortion. Young people at risk for suicidal behaviour show a bias towards over-reacting to angry facial expressions and under-reacting to positive sentiments. This helps explain scenarios seen in high school, college and the work place where a confrontation with a teacher or parent or in a bullying context leads to a suicide.

22. In clinical practice we assess for the presence of this predisposition by asking about a previous history of suicidal behavior or in their first or second-degree relatives since familial risk of suicide is increased due to familial transmission of the diathesis or predisposition to suicide. If there is such a personal or familial history of suicidal behavior, it suggests the patient may have the predisposition to suicidal behavior.

II. TOPIC TWO: THE AVAILABILITY OF A FIREARM, PARTICULARLY A HANDGUN, IN THE HOME INCREASES THE RISK OF SUICIDE FOR IMPULSIVE INDIVIDUALS

23. Research shows that having a handgun in the home is a risk factor for firearm suicide.[6] In 2014, suicide was the second leading cause of death among people 10–34 years of age.[7] Of the 42,773 suicides in all age groups that year, 21,334 (49.9%) involved a firearm. Firearms accounted for 33,599 deaths in 2014 (suicides, homicides, accidental deaths, and undetermined).[8] The United States has the highest per capita rate of gun ownership in the developed world. About 38% of households own at least one gun, making firearms widely available to those at risk of suicidal or homicidal behaviors.[9] Prevention of firearm suicide therefore has relevance for other types of firearm deaths.

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[6] Mann and Michel. Prevention of firearm Suicide in the United States: what works and what is possible. American Journal of Psychiatry, in press 2016.

[7] Centers for Disease Control and Prevention: WISQARS: Fatal Injury Reports, National and Regional, 1999–2014.

[8] Centers for Disease Control and Prevention: WISQARS: Fatal Injury Reports, National and Regional, 1999–2014.

[9] Hepburn L, Miller M, Azrael D, et al: The US gun stock: results from the 2004 national firearms survey. *Inj Prev* 2007; 13:15–19.

24. Suicidal behavior is generally impulsive and 70% of suicide attempters act less than one hour after deciding to kill themselves,[10] meaning they tend to use a readily available method. A suicidal crisis is often transient. Since, only 10% of those who survive an almost fatal suicide attempt, later die by suicide,[11] surviving a suicide attempt generally means long-term survival. Method substitution by a less lethal method increases the chances of surviving a suicide attempt and the long-term prognosis of such individuals is very promising.[12]

25. Approximately 57 million individuals own 283 million firearms (about five guns per owner), and 38% of U.S. households have at least one gun.[13] In the United States greater firearm availability is associated with greater risk of firearm suicide.

26. Beginning in the 1980s, over a 22-year period, household gun ownership in the USA declined from ~46% to ~36%. A 10% fall in household firearm ownership rate was accompanied by a 4.2% decline in firearm suicide rate. In children and adolescents, a 10% decline in firearm ownership was associated with an 8.3% drop in firearm suicide rate.[14] Firearm availability is more closely related to firearm suicide in younger people compared with midlife.[15]

27. From 2000 to 2002, the 15 states with the highest household firearm ownership rate (47%) had 9749 firearm suicides compared with 2606 firearm suicides in the six states with the lowest firearm ownership (15%). Non-firearm suicides and the total populations of the two sets of states were comparable.[16] These findings translate into a 1% decrease in household firearm

[10] Simon OR, Swann AC, Powell KE, et al: Characteristics of impulsive suicide attempts and attempters. *Suicide Life Threat Behav* 2001; 32(suppl):49–59.

[11] Owens D, Horrocks J, House A: Fatal and non-fatal repetition of self-harm: systematic review. *Br J Psychiatry* 2002; 181:193–199

[12] Reisch T, Steffen T, Habenstein A, et al: Change in suicide rates in Switzerland before and after firearm restriction resulting from the 2003 "Army XXI" reform. *Am J Psychiatry* 2013; 170:977–984.

[13] Hepburn L, Miller M, Azrael D, et al: The US gun stock: results from the 2004 national firearms survey. *Inj Prev* 2007; 13:15–19.

[14] Miller M, Azrael D, Hepburn L, et al: The association between changes in household firearm ownership and rates of suicide in the United States, 1981–2002. *Inj Prev* 2006; 12:178–182.

[15] Birckmayer J, Hemenway D: Suicide and firearm prevalence: are youth disproportionately affected? *Suicide Life Threat Behav* 2001; 31:303–310.

[16] Miller M, Lippmann SJ, Azrael D, et al: Household firearm ownership and rates of

(continued…)

ownership potentially reducing the firearm suicide rate by 3.5% and a greater reduction in adolescents.[17]

28. Guns are twice as common in homes of adolescent suicides compared with homes of adolescent nonfatal suicide attempters or of nonsuicidal adolescent psychiatric controls.[18] A locked gun closet, keeping guns unloaded, and locking or storing ammunition in a different part of the house each reduces the risk of suicide by 55%–73%.[19] Risk of firearm suicide appears to increase with more handguns being purchased.[20]

III. TOPIC THREE: ATTEMPTED SUICIDE USING A FIREARM IS MORE OFTEN FATAL THAN ANY OF THE OTHER MEANS OF SUICIDE AMONGST THOSE IN THE TOP TEN MOST FREQUENTLY USED METHODS

29. A self-inflicted gunshot wound is amongst the most highly lethal methods for attempting suicide, with a mortality rate of 92%, compared with hanging (78%), drowning (67%) and intentional overdoses (2%).[21]

IV. TOPIC FOUR: PREVENTION OF FIREARM SUICIDE REQUIRES MULTIPLE DIFFERENT STRATEGIES BECAUSE THE FACTORS INVOLVED ARE COMPLEX AND ONE STRATEGY IS INSUFFICIENT

30. There are many modifiable factors that can reduce the risk of firearm suicide and therefore prevention involves many strategies, each of which can potentially save lives.[22] This is

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(…continued)
suicide across the 50 United States. *J Trauma* 2007; 62:1029–1034.

[17] Miller M, Lippmann SJ, Azrael D, et al: Household firearm ownership and rates of suicide across the 50 United States. *J Trauma* 2007; 62:1029–1034.

[18] Brent DA, Perper JA, Allman CJ, et al: The presence and accessibility of firearms in the homes of adolescent suicides: a case-control study. *JAMA* 1991; 266:2989–2995; Brent DA, Perper JA, Goldstein CE, et al: Risk factors for adolescent suicide: a comparison of adolescent suicide victims with suicidal inpatients. *Arch Gen Psychiatry* 1988; 45:581–588.

[19] Grossman DC, Mueller BA, Riedy C, et al: Gun storage practices and risk of youth suicide and unintentional firearm injuries. *JAMA* 2005; 293:707–714.

[20] Miller M, Hemenway D: The relationship between firearms and suicide: a review of the literature. *Aggress Violent Behav* 1999; 4:59–75.

[21] Chapdelaine A, Samson E, Kimberley MD, et al: Firearm-related injuries in Canada: issues for prevention. *CMAJ* 1991; 145:1217–1223; Spicer RS, Miller TR: Suicide acts in 8 states: incidence and case fatality rates by demographics and method. *Am J Public Health* 2000; 90:1885–1891.

[22] Mann, J. John, et al. "Suicide prevention strategies: a systematic review." *JAMA* 294.16 (2005): 2064-2074.

shown by the fact that States in the USA that have enacted more broad or multifaceted legislation have been more successful at lowering firearm suicide rates.[23] Guns used for suicide are bought a mean of 11 years before the suicide.[24] One implication for prevention is that it is more important for suicide prevention of depressed suicidal persons to restrict access to already owned guns than it is to prevent them from purchasing a gun.[25] However, young people and many adults are at risk for suicide because they are more impulsive and therefore more likely to buy a gun impulsively, especially if they cannot gain access to a gun in the household. They are therefore likely to be better protected by approaches such as the requirement for a waiting period or if there is less advertising of gun sales analogous to the restrictions on advertising sale of cigarettes. Even if the firearm is eventually purchased, a "cooling off" period, or more difficulty finding stores that sell guns, allows the suicidal crisis to potentially pass.[26] The suicide risk crisis period is transient and if the means for dying by suicide are more difficult to obtain, then the urge to die by suicide may diminish or cease. In California, 10.3% of firearms used for suicide have been reported to be purchased within a year of the suicide, and the risk is higher in the first week after the gun was purchased in terms of the gun purchaser using the gun to die by suicide.[27] This indicates that a subgroup of individuals likely bought the gun for that specific purpose, and this law may protect some of these individuals by reducing the chances they will buy a gun and use it to kill themselves. Grassell et al. reported that in California, gun buyers made up less than 1% of the

[23] Mann and Michel. Prevention of firearm Suicide in the United States: what works and what is possible. *American Journal of Psychiatry*, in press 2016.

[24] Miller M, Hemenway D: The relationship between firearms and suicide: a review of the literature. *Aggress Violent Behav* 1999; 4:59–75.

[25] Gibbons RD, Brown CH, Hur K, et al: Suicidal thoughts and behavior with antidepressant treatment: reanalysis of the randomized placebo-controlled studies of fluoxetine and venlafaxine. *Arch Gen Psychiatry* 2012; 69:580–587.

[26] Parker GF: Circumstances and outcomes of a firearm seizure law: Marion County, Indiana, 2006–2013. *Behav Sci Law* 2015; 33:308–322.

[27] Wintemute et al. Mortality Among Recent Purchasers of Handguns. *N Eng J Medicine* 1999; 341(21):1583-1589.

population but 14.2% of firearm suicides, further indicating a link between gun purchasing and the use of the gun for suicide.[28]

31. Firearm restrictions, including permit to purchase (PTP), waiting periods, safe storage, background checks, and registration guidelines, are associated with both lower firearm suicide rates and overall suicide rates.[29] Implementation of PTP laws in Connecticut was associated with a 15% reduction in the firearm suicide rate, and repeal of PTP laws in Missouri was associated with a 16% increase in the firearm suicide rate.[30]

32. Means restriction counseling by gatekeepers like primary care physicians, mental health clinicians, and emergency department personnel for families with an adolescent at risk of suicide is recommended by most experts in suicide prevention but is against the law in Florida, demonstrating how challenging suicide prevention is in the United States.[31] Compliance has been inadequately studied, but one study found that only a quarter of the families of depressed adolescents heeded the clinician's recommendations to remove firearms from the household for the duration of treatment.[32] This shows how important opportunities are wasted that may protect

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[28] Grassell et al. Association between handgun purchase and mortality from firearm injury. *Inj Prev* 2003; 9:48-52.

[29] Anestis MD, Anestis JC: Suicide rates and state laws regulating access and exposure to handguns. *Am J Public Health* 2015; 105:2049–2058; Anestis MD, Khazem LR, Law KC, et al: The association between state laws regulating handgun ownership and statewide suicide rates. *Am J Public Health* 2015; 105:2059–2067; Fleegler EW, Lee LK, Monuteaux MC, et al: Firearm legislation and firearm-related fatalities in the United States. *JAMA Intern Med* 2013; 173:732–740; Rodríguez Andrés A, Hempstead K: Gun control and suicide: the impact of state firearm regulations in the United States, 1995–2004. *Health Policy* 2011; 101:95–103; Price JH, Thompson AJ, Dake JA: Factors associated with state variations in homicide, suicide, and unintentional firearm deaths. *J Community Health* 2004; 29:271–283; Conner KR, Zhong Y: State firearm laws and rates of suicide in men and women. *Am J Prev Med* 2003; 25:320–324; Boor M, Bair JH: Suicide rates, handgun control laws, and sociodemographic variables. *Psychol Rep* 1990; 66:923–930.

[30] Crifasi CK, Meyers JS, Vernick JS, et al: Effects of changes in permit-to-purchase handgun laws in Connecticut and Missouri on suicide rates. *Prev Med* 2015; 79:43–49.

[31] Runyan CW, Brown TL, Brooks-Russell A: Preventing the invisible plague of firearm suicide. Am J Orthopsychiatry 2015; 85:221–224; Kuehn BM: Battle over Florida legislation casts a chill over gun inquiries. *JAMA* 2015; 313:1893–1895.

[32] Brent DA, Baugher M, Birmaher B, et al: Compliance with recommendations to remove firearms in families participating in a clinical trial for adolescent depression. *J Am Acad Child Adolesc Psychiatry* 2000; 39:1220–1226.

those at risk for suicide from the risk of a gun in the house. We need to come up with more creative solutions to prevent people from gaining access to firearms. Many solutions may have a beneficial effect and no one solution is enough.

V. TOPIC FIVE: IF CALIFORNIA PENAL CODE SECTION 26820 WERE INVALIDATED, IT WOULD RESULT IN MORE HANDGUN SUICIDES IN DIRECT PROPORTION TO THE INCREASE IN HANDGUN PURCHASES

33. The basis for my opinion on topic five is as follows: Counsel has asked me to assume that, in the event that California Penal Code section 26820 is invalidated, there will be an increase in handgun purchases by people with impulsive personality traits. Given that assumption, in the event section 26820 is invalidated, I would predict that there would be an increase in the number of handgun suicides in proportion to the increase in handgun purchases. This opinion is based on the strong relationship between gun availability and risk of firearm suicide.[33] The more handguns that are purchased the more handgun suicides will happen. This effect will be particularly seen in a subgroup of young people, who suffer from a psychiatric illness like major depression and also tend to be more impulsive as a group, and in those adults who suffer from a psychiatric illness like major depression and who have more pronounced impulsive personality traits than other adults. Published studies suggest the increase in firearm suicides will be twice as great in young people, which makes sense since impulsiveness is a more prominent risk factor in young people than in adults.[34] I would therefore predict an increase in suicides in those who impulsively purchase firearms if California Penal Code section 26820 is repealed.

Dated: July 26, 2016

J. JOHN MANN, M.D.
Paul Janssen Professor of Translational Neuroscience
Director, Molecular Imaging and Neuropathology Division
Department of Psychiatry
Columbia University/New York State Psychiatric Institute

[33] Mann and Michel. Prevention of firearm Suicide in the United States: what works and what is possible. *American Journal of Psychiatry*, in press 2016.

[34] Miller M, Lippmann SJ, Azrael D, et al: Household firearm ownership and rates of suicide across the 50 United States. *J Trauma* 2007; 62:1029–1034.

MANN EXPERT REPORT EXHIBIT A

CURRICULUM VITAE

Name: J. John Mann, M.D.

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ACADEMIC TRAINING

1964-1965	Melbourne Boys' High School	Matriculation 1965
1966-1971	University of Melbourne Faculty of Medicine	MBBS 1971 (Medicine)
1972-1974	Royal Melbourne Hospital	FRACP Part 1 1974 (Internal Medicine Boards)
1974-1976	Royal Melbourne Hospital	DPM 1976 (Diploma of Psychological Medicine) FRANZCP 1977 (Psychiatry Residency and Boards)
1974-1976	University of Melbourne	MD 1977 (Doctorate of Medicine by Thesis in Neurochemistry)

LICENSES

Comm. of Pennsylvania
New York State
Amer. Board of Psychiatry & Neurology
Drug Enforcement Administration

PROFESSIONAL ORGANIZATIONS AND SOCIETIES

1979-present	American Association for the Advancement of Science
1979-1990	New York Academy of Sciences
1977-2000	Royal Australian and New Zealand College of Psychiatrists (Fellow effective 1981)
1979-present	American Psychiatric Association (Life Distinguished Fellow, effective 2003)
1979-present	Society of Biological Psychiatry, President 2009-2010
1982-present	Society for Neuroscience
1987-present	American College of Neuropsychopharmacology
1992-present	Collegium Internationale Neuro-Psychopharmacologicum
1993-1996	American Society of Clinical Psychopharmacology
1997-present	International Academy of Suicide Research, President 2004-2006
1998-2011	Society for Nuclear Medicine
2011-2012	New York Academy of Sciences
2011-	ECNP Network on Suicide Prevention

ACADEMIC APPOINTMENTS

1974-76	University of Melbourne Department of Psychiatry	Clinical tutor
1977-78	University of Melbourne Department of Psychiatry	Associate
1978-80	New York University Medical School Department of Psychiatry	Research Assistant Professor
1980-83	Cornell University Medical College	Assistant Professor of Psychiatry
1980-89	Laboratory of Psychopharmacology Department of Psychiatry Cornell University Medical College	Director
1983-88	Cornell University Medical College	Associate Professor of Psychiatry (tenured)
1984-89	Cornell University Graduate School	Associate Professor
1987-88	Rockefeller University (Laboratory of Dr. Paul Greengard)	Visiting Associate Professor
1988-89	Rockefeller University	Adjunct Faculty
1988-89	Cornell University Medical College	Professor of Psychiatry (tenured)
1989-94	University of Pittsburgh School of Medicine	Professor of Psychiatry (tenured)
1994-	College of Physicians & Surgeons at Columbia University	Professor of Psychiatry (tenured)

1997-	College of Physicians & Surgeons at Columbia University	Professor of Psychiatry (in Radiology) (tenured)
2005-	College of Physicians & Surgeons at Columbia University	The Paul Janssen Professor of Translational Neuroscience (in Psychiatry and Radiology)
2006-2010	College of Physicians & Surgeons at Columbia University	Vice Chair for Research, Department of Psychiatry
2007-2010	College of Physicians & Surgeons at Columbia University	Scientific Director, Kreitchman PET Center

HOSPITAL APPOINTMENTS

1972	Royal Melbourne Hospital. Rotations included: general medicine, general surgery, infectious diseases, anaesthetics, Emergency Department and urology	Junior Resident Medical Officer
1973	Royal Melbourne Hospital. Rotations: psychiatry, pediatrics, intensive care unit, admitting officer	Senior Resident Medical Officer
1974-76	Royal Melbourne Hospital	Psychiatric Registrar
1977-78	Royal Melbourne Hospital	Psychiatrist
1977-78	Royal Talbot Rehabilitation Centre	Psychiatrist
1978	Glenhuntly Rehabilitation Centre Mental Health Authority of Victoria	Psychiatrist in Charge
1978-80	Bellevue Psychiatric Hospital	Assistant Psychiatrist
1979-80	University Hospital New York University	Assistant Attending Psychiatrist
1980-83	The New York Hospital	Assistant Attending Psychiatrist Associate Inpatient Unit Chief
1980-89	Psychopharmacology Clinic and Affective Disorders Clinic Payne Whitney Clinic, The New York Hospital-Cornell Medical Center	Director
1983-88	The New York Hospital	Associate Attending Psychiatrist
1988-89	The New York Hospital	Attending Psychiatrist

1989-94	Laboratories of Neuropharmacology Department of Psychiatry University of Pittsburgh School of Medicine Western Psychiatric Institute and Clinic	Director
1994-	Molecular Imaging & Neuropathology (new Division name 7/1/07) (Formerly Neuroscience) The New York State Psychiatric Institute	Chief/Research Scientist VIII
1995-	Presbyterian Hospital in the City of New York	Attending Psychiatrist
2006-2010	The New York State Psychiatric Institute	Director of Research

AWARDS AND HONORS

1981	Fellow, Royal Australian and New Zealand College of Psychiatrists
1981-83	Teacher Scientist Award from the Andrew W. Mellon Foundation
1986-90	Irma T. Hirschl Trust Research Scientist Award
1989	Fellow, American Psychiatric Association
1995	American Suicide Foundation Research Award
1996	American Association of Suicidology Louis I. Dublin Award
2000	New York State Office of Mental Health Research Award
2001	Klerman Senior Investigator Award from the National Depressive and Manic Depressive Association
2001-04	President, American Foundation for Suicide Prevention
2004-06	President, International Academy for Suicide Research
2002	Columbia University Department of Psychiatry Medical Student Teaching Award
2007-	Honorary Professor of the University "Ss. Cyril and Methodius", Skopje, Macedonia
2007	Stengel Award, International Association for Suicide Prevention
2009-2010	President, Society of Biological Psychiatry
2010	Morselli Medal, International Academy of Suicide Research
2011	Mood Disorders Research Award, American College of Psychiatrists
2011	Visiting Professor Award, Royal Australian and New Zealand College of Psychiatrists
2012	American Psychiatric Association Distinguished Life Fellow
2012	George Thompson Award, Society of Biological Psychiatry
2011-16	Best Doctors in America
2011-16	America's Top Medical Specialists

SPECIAL AND NAMED LECTURES (selected 2001->)

2001	Plenary Lecture, National Medical Association, Nashville
2001	Lecture, Macedonian Academy of Arts and Sciences, Skopje, Macedonia
2001	Plenary Lecture, Polish Psychiatric Association, Poland
2001	Plenary Lecture, Taiwan Psychiatric Association, Taipei

2001	Invited Public Lecture, University of Melbourne and Mental Health Research Institute
2001	Plenary Lecture, Italian Psychiatric Society Annual Meeting
2002	Plenary Lecture, Spanish Psychiatric Association Annual Research Conference
2002	Plenary Lecture, Slovenian Psychiatric Association Annual Meeting
2002	Plenary Lecture, ILCA Annual Conference
2003	22nd Annual Philip M. Johnson Memorial Lecture, Columbia University, New York
2004	Plenary Lecture, Society of Biological Psychiatry Annual Meeting
2004	Invited Speaker, Roundtable on Suicide, Society for Neuroscience Annual Meeting
2004	Plenary Lecture, The 3 T's: Turning the Tide of Suicide, Dublin Ireland
2005	Plenary Lecture, International Life Sciences Institute Annual Meeting
2005	Invited Speaker, Keck Center for Behavioral Biology at North Carolina State University
2005	Invited Plenary Speaker, International Symposium on Neuroplasticity, Neurotrophic Factors and Affective Disorders, Pisa Italy
2005	Invited Plenary Speaker, International Meeting on Suicide: Interplay of Genes and Environment, Ghent, Belgium
2005	Invited Speaker, World Congress on Biological Psychiatry, Vienna, Austria
2005	12th Annual Seymour Perlin Lecture, George Washington University
2006	Invited Speaker, XI Congress of the Italian Psychopathology Society, Rome, Italy
2006	Invited Speaker, First International Conference on Hot Issues in Psychiatry, Pisa, Italy
2006	Plenary Lecture, Academy of Molecular Imaging Annual Meeting, Orlando, Florida
2006	Invited Speaker, World Psychiatric Association Congress, Madrid, Spain
2006	Invited Speaker, CINP Congress, Chicago, IL
2006	Plenary Lecture, 11th European Symposium on Suicide and Suicidal Behavior, Portoroz, Slovenia
2007	Allene Rubin Memorial Lecture, Department of Psychiatry, Johns Hopkins University School of Medicine
2007	Plenary Lecture, International Association for Suicide Prevention, Ireland
2008	Plenary Lecture, Second International Conference on *Understanding Youth Suicide*, Jerusalem, Israel
2008	Plenary Lecture, 12th European Symposium on Suicide and Suicidal Behaviour, Glasgow, Scotland
2009	Plenary Lecture, Israel Biological Psychiatry, Conference, Tel Aviv, Israel
2009	Best Doctors, Inc., Aiken, South Carolina
2010	Dukoff Lecture, Department of Psychiatry, Memorial Sloan-Kettering Cancer Center, New York, NY
2010	The Feinberg Lecture, Schneider Children's Hospital, Israel
2010	Plenary Lecture, Conference Frederic Joliot, Lilles, France
2010	Plenary Lecture, ESSSB, Rome, Italy
2009	Plenary Lecture, Canadian Society for Neuropsychopharmacology and Neuroscience
2012	Rector's Lecture, Koper. Slovenia
2012	Keynote Speaker, VA/DoD Suicide Prevention CPG Meeting, Canandiagua, NY
2012	Plenary Lecture, 14th European Symposium on Suicide and Suicidal Behaviour (ESSSB) Tel Aviv, Israel
2014	Plenary Lecture, ESSSB, Tallinn, Estonia

2014 Plenary Lecture European Psychiatric Association Annual Meeting
2014 Plenary Lecture, ECNP, Berlin
2015 Plenary Lecture, Israel Psychiatric Association, Tel Aviv
2015 Plenary Lecture, Second Helenic Suicide Conference, Athens, Greece
2015 Marilyn G. Karmason, M.D. Memorial Lecture, Department of Psychiatry, New York Presbytrian Hospital and Weill Cornell Medical College, New York, NY
2016 Kaplan Lecture, Department of Psychiatry, Cincinatti

FELLOWSHIPS AND GRANT SUPPORT (selected grants commencing after 2000 and where Dr. Mann is the PI)

2000-2011 Center Director/Principal Investigator, NIMH 5 P50 MH062185: *Conte Center for the Neuroscience of Mental Disorders (CCNMD): The Neurobiology of Suicidal Behavior*, TC (Y06-10) DC: $1,500,000/yr

2003-2009 Principal Investigator, NIMH MH040695: *Neurobiology of Depression and Antidepressants*, Total Cost (Y13-17): $3,011,656.

2004-2009 Co-Director, Research Methods Core, NIMH 1 P30 MH071478, *ACISR for Pediatric Psychiatry Disorders* (PI: David Shaffer, M.D.); Direct Cost Y01: $1,304,354.

2005-2009 Principal Investigator, GlaxoSmithKline, *In Vivo PET Imaging of Mild Cognitive Impairment, Early Alzheimer's Disease and Healthy Elderly with 11C-6-OH-BTA-1 and 18F FDG*; DC $500,000.

2006-2008 Co-Principal Investigator 1R01 DK077493, *PET Imaging of Human Beta Cell Mass* (PI: PaulHarris) ; DC: $308,663

2007-2012 Core Director, UL1 RR024156 *CTSA Integrated Imaging Core of the Irving Institute's Clinical and Translational Research Award Program* (Center Director: Henry Ginsberg) DC: $200,000/year

2008-2012 Principal Investigator, NARSAD Distinguished Investigator Award: Imaging Ketamine-induced Changes in Glutamate Release with MRS in the Treatment of Depression. Total Direct Cost: $100,000

2008-2013 Principal Investigator (coordinating site) R01 MH082041, *Suicidal Behavior in Mood Disorders: Genes and Intermediate Phenotypes* [multi-site with Canada (PI: Gustavo Turecki) & Germany (PI: Dan Rujescu)] TC: $2,368,833

2009-2014 Principal Investigator, NIMH 2R01 MH056390, *Familial Pathways to Early-Onset Suicide Attempts*, Total Cost: $2,263,699; [collaborative site with Pittsburgh (PI: David Brent)

2009-2011 Co-Principal Investigator (09-10)/Scientific Advisor (10-11), NIMH U01 MH087981, *Modifiable Risk and Protective Factors for Suicidal Behaviors in the US Army* (PI: Robert J. Ursano, M.D.) (PIs Columbia Site: Maria Oquendo/Barbara Stanley)Total Costs (Y01-05) $9,999,678.

2009-2011 Co-Principal Investigator (09-10)/Scientific Advisor (10-11), NIMH U01 MH087981, Supplement: *Modifiable Risk and Protective Factors for Suicidal Behaviors in the US Army*

(PI: Robert J. Ursano, M.D.) (PI Columbia Site: Maria Oquendo) Total Costs (Y01-02) $645,420

2010-2015 Principal Investigator, NIMH 2R01 MH040695: *Neurobiology of Depression and Antidepressants*, Total Cost (Y18-22): $3,177,655.

2013-2018 Principal Investigator, NIMH 1P50MH090964.Conte Center: Neurobiological and Developmental Antecedents to Suicidal Behavior, Total Cost (Y1-5): $10,011,829

2015-2020 Principal Investigator, NIMH 2R01 MH056390, *Familial Pathways to Early-Onset Suicide Attempts*, Total Cost: $1,988,858; [collaborative site with Pittsburgh (PI: David Brent)

DEPARTMENTAL AND UNIVERSITY COMMITTEES

Department of Psychiatry: Columbia University

1994-1996 Brain Imaging Advisory Committee
2003-2004 HIPAA Research Security Committee
2004-2007 Committee on Appointments and Promotions
2005- Executive Advisory Committee
2007-2010 Vice Chair Committee and Executive Committee
2007-2010 Development Committee
2007-2010 Space Committee

Department of Psychiatry: Columbia University

a) NIH Research Training Grants:

1998- Research Training in Child Psychiatry - T32 MH016434 Moira Rynn (Faculty Advisor)

2000- Schizophrenia Research Training - T32 MH018870, Jonathan Javitch, PI (Faculty Advisor)

2006- Neurobehavioral Sciences Research Training Program – T32 MH015174, Rene Hen, PI; (Faculty Advisor)

2007- Basic Neuroscience Training Grant T32 DA016224, David Sulzer, PI;(Faculty Advisor)

2008- Developmental Neuroscience and Behavior - T32 MH018264, Michael Myers, PI; (Previous PI; Myron Hofer) (Faculty Advisor)

2009- Mood and Anxiety Disorders: From Animal Models to Patients - T32 MH015144, Steve Roose, PI; (Faculty Advisor)

2009 - Late Life in Neuropsychiatry - T32 MH020004. Steven Roose, PI; (Faculty Advisor)

b) Fellowship Programs

2005- The Paul Janssen Fellowship in Translational Neuroscience – Chair, Selection Committee
2009- Doris Duke Clinical Research Fellowship Program – Advisory Committee

Columbia University College of Physicians & Surgeons

1994-2004 Joint Radiation Safety Committee
1995-1998 Faculty Council of the Faculty of Medicine (Voting Member)
1998-2000 Executive Committee of the Faculty Council of the Faculty of Medicine
2000-2011 Radioactive Drug Research Committee
2000-2010 PET Center Executive Committee
2003 Department of Medicine Chair Search Committee
2006 Dean's Office NIH Summer Research Fellowship Selection Committee
2008 Department of Radiology Chair Search Committee
2008-2010 Program for Imaging and Cognitive Sciences (PICS) - Oversight Committee

The Research Foundation for Mental Hygiene, Inc.

2004-2011 Board of Directors

Food and Drug Administration Advisory Panels (since 2008)

2008 Neuronetics NeuroStar TMS Therapy System Committee,
2008, 2015 Psychopharmacologic Drugs Advisory Committee (PDAC)

TEACHING

(I) Trainees

1981-1982 Michael DeMeo, M.D., Postdoctoral Fellow. Project *"Serotonin responsivity in depressed and suicidal patients"*. Currently: Assistant Professor, Mt. Sinai Hospital.

1982-1986 P. Anne McBride, M.D., Postdoctoral Fellow. Project *"Serotonin receptors in adult and child psychiatric disorders"*. NIMH First Award. ACNP Travel Awardee. Currently: Associate Professor, Cornell University Medical College.

1982-1983 Shelley F. Aaron, M.D., Postdoctoral Fellow. Project *"Prediction of antidepressant outcome on monoamine oxidase inhibitors"*. Currently: Assistant Professor, Cornell University Medical College.

1983-1984 Richard P. Brown, M.D., Postdoctoral Fellow. Project *"Hypothalamic-pituitary-adrenal function in depression"*. Currently: Associate Professor, Columbia University.

1984-1987 James P. Halper, M.D., Postdoctoral Fellow. Project *"Lymphocyte Immune Function in Depression"*. ACNP Travel Awardee. Currently: Assistant Professor, Columbia University.

1984-1987 Peter M. Marzuk, M.D., Postdoctoral Fellow. Project *"Epidemiology of Suicide in New York City"*. Co-investigator NIMH and NIDA grants. Reader's Digest Research Fellow. Currently: Professor, Cornell University Medical College and Associate Dean for Education.

1988-1989 Philip J. Wilner, M.D., M.B.A., Postdoctoral Fellow. Project *"Noradrenergic Activity in Depression"*. Reader's Digest Research Fellow Small Grant Awardee. Currently: Vice President and Medical Director, Dept. of Psychiatry, Weill Medical College of Cornell University / New York-Presbyterian Hospital.

1990-1992 Joyce E. Myers, M.D., Postdoctoral Fellow. Project *"Serotonin responsivity and the action of antidepressants"*. Currently: Bristol Myers Squibb, Company.

1992-1993 Shitij Kapur, M.D., Postdoctoral Fellow. Project *"Biochemical Mechanisms of Action of ECT"*. APA-Dista Postdoctoral Research Fellowship. Currently: Director, Schizophrenia PET Imaging Program, University of Toronto.

1991-1993 Kevin M. Malone, M.D., Postdoctoral Fellow. Project *"Predicting the Risk of Suicidal Behavior in Depressed Patients"*. Fogarty Research Fellow and American Suicide Foundation Grantee. Currently: Lecturer, Columbia University; Associate Professor of Clinical Psychiatry, Mater Hospital, Dublin, Ireland.

1993-1994 Elizabeth Corbitt, Ph.D., NIMH Postdoctoral Fellow. Project *"Personality Disorders and Suicidal Behavior"*.

1994-1997 Margaret FitzGerald, M.D., NIMH Postdoctoral Fellow. Project *"Altered Serotonin Function and Behavioral Changes in DSM-IV Premenstrual Dysphoric Disorder and Mood Disorders"*. Currently: Consultant Community Psychiatrist, St. Vincent's University Hospital / Health Service Executive, Dublin, Ireland.

1995-1998 Lawrence Kegeles, M.D., Ph.D., NIMH Postdoctoral Fellow. Project *"Measurement of Hippocampal Volume and Glutamate Concentration in Schizophrenia Utilizing Proton Magnetic Resonance and Studies of Dopamine Function Using SPECT"*. K08 Award. Currently: Associate Professor of Clinical Psychiatry (in Radiology) at Columbia University.

1997-2000 Ramin V. Parsey, M.D., Ph.D., NIMH Postdoctoral Fellow. Project *"The Role of 5-HT$_{1A}$ Receptors in the Biology and Treatment of Depression."* K08 Award. Currently: Associate Professor of Clinical Psychiatry at Columbia University.

1998-2001 Giovanni Placidi, M.D., Project *"Polymorphism at the tryptophan hydroxylase locus in psychotic disorders with and without suicidal behavior."* Currently: Assistant Professor, University of Florence

2000-2003 Brian Blum, M.D., Project *"Morphometry of dopaminergic and GABAergic neurons in the ventral tegmental area and substania nigra."*

2002-2005 Matthew Milak, M.D., NIMH Postdoctoral Fellow. Project *"PET Mapping of Serotonergic Correlates of Psychometric Deficits in Mood Disorders."* Currently: Assistant Professor, Columbia University. K08 Award.

2004-2007 Elizabeth Sublette, M.D., NIMH Postdoctoral Fellow. Project "*The Arachidonic Acid Cascade in Bipolar Mood Disorder: A Pilot Study."* Currently: Assistant Professor, Columbia University. K08 Award and NARSAD.

2004-2007 Peter Freed, M.D., NIMH Postdoctoral Fellow. Project *"Longitudinal fMRI Study of Adult Human Grief and Grief Resolution".* Currently: Assistant Professor, Columbia University. K08 Award 2009-2014.

2003-2005 Gil Zalsman, M.D., Postdoctoral Fellow. Project *"Genetic Studies of Suicide"* Currently: Deputy Director, Chief of Child and Adolescent Psychiatry, Director of Adolescent Day Unit, Geha Mental Health Center, Israel

2004-2005 Atsuo Nakagawa, M.D., Postdoctoral Fellow. Project *"Psychobiological Factors Underlying Mood Disorders and Suicidal Behavior."* Department of Psychiatry, Keio University School of Medicine, Tokyo, Japan

2006-2007 Rajan Murthy, M.D. NIMH Postdoctoral Fellow. Project *"Quantifying in vivo regional 5HT$_{1A}$ receptor densities by PET with [^{11}C]-DWAY: Reproducibility"*

2007-2009 Jeffrey Miller, M.D., Postdoctoral Fellow. Project "Predicting Response to the Treatment of Depression". NARSAD 2007, Janssen Fellowship in Translational Neuroscience 2009 and currently: Assistant Professor: K08 Award 2009-2014.

2010-2011 Charles Mikell M.D, Postdoctoral Janssen Fellow. Project "Elucidating the role of the dopamine system in novelty signaling using intraoperative microelectrode recording: implications for schizophrenia

2011-2012 Erin Kinnally, Ph.D, Postdoctoral Janssen Fellow. Project "Epigenetic Plasticity and Risk for Depression Following Childhood Abuse."

2014-2015 Spiro Pantazatos, Ph.D, Postdoctoral Janssen Fellow. Project "Genomic and Brain Imaging Data Integration."

2012-2013 Martin Lan, M.D. Ph.D. Postdoctoral Fellow. Project "Brain Imaging Prediction of Treatment Outcome in Bipolar Disorders".

(II) Courses (1999-2002)

Co-Director, Course on Bipolar Disorder & Management of Suicide Risk (CME credit program)

(III) Resident Training and Medical Student Teaching

1999-2016 1st Year Medical Students Course on Psychiatric Medicine

1999- NYS Psychiatric Institute Research Fellows Seminars

1999- Columbia University SURF Summer Program

2000-2003 Lecturer, PGY-II Course in Mood Disorders

2001 School of Public Health, Course on Biological Aspects of Psychiatric Disorders

2001-2003 PET Imaging Mini-Fellowship Conference

2001- Research Fellows Methodology Seminar

2001- Residency Training

2006 Graduate Course in Neuropsychopharmacology

2006- Irving Institute CTSA course for graduate students

2011 Irving Institute Imaging Seminar: Use of PET to Study the Brain in Health and Disease

2011-12 Lecturer, PGY2 Evidence Based Clinical Practice Course

2011- Medical Students Course on Suicidal Behavior

Preceptor/Advisor for Residents Research Elective:

1999 Dr. Andres San Martin

2002-2003 Dr. Mark Eldaief

Ph.D. Thesis Committee:

2007 Michelle Umali

OTHER PROFESSIONAL ACTIVITIES

1991-1994 Allegheny County, PA, Deputy Coroner

Editorial Boards

1992 - Present	Biological Editor, Journal of Suicide and Life-Threatening Behavior
1993 - Present	Editorial Board, Journal of Psychiatric Research
1992 - Present	Editorial Board, Psychiatric Annals
1993 - Present	Editorial Board, Crisis
1993 - 1997	Editorial Board, Neuropsychopharmacology
2002 - Present	Editorial Board, Neuropsychopharmacology
1993 - 1997	Editorial Board, Convulsive Therapy
1997 - Present	Editorial Board, Archives of Suicide Research
1998 - 2001	Editorial Board, Biological Psychiatry
1998 - 2008	Editorial Board, Bipolar Disorders, International Journal of Psychiatry and Neurosciences
2000 - Present	Editorial Board, Clinical Neuroscience Research
2006 – 2010	Editor in Chief, Central European Journal of Medicine
2007 - Present	Editorial Board, Neuropsychiatric Genetics, Part B of the American Journal of Medical Genetics
2008 - Present	Editorial Board, Spanish Journal of Psychiatry and Mental Health, Spanish Psychiatry Society
2010 -	Editorial Board, Frontiers
2012 -	Editorial Board, PeerJ.
2012 -	Editorial Board, World Journal of Biological Psychiatry
2013 -	International Advisory Board, Israel Journal of Psychiatry

Journal Referee (partial list)
Psychopharmacology
Biological Psychiatry
Psychiatry Research
Science
Journal of Neurochemistry
Journal of Endocrinology
Journal Clinical Pharmacology and Therapeutics
Archives of General Psychiatry
American Journal of Psychiatry
New England Journal of Medicine
Lancet
JAMA
Journal of Molecular Psychiatry

Other Research-Related Activities:

1980-1983	Scientific Program Committee - American Psychiatric Association District Branch:
1984-1985	New Research Review Committee - American Psychiatric Association:
1985-1987	TDA2 Study Section - National Institute of Mental Health
1988-1991	TDA2 Study Section - National Institute of Mental Health
1990-1993	Program Committee - American College of Neuropsychopharmacology
1990-1992	Program Committee - Society of Biological Psychiatry
1994	NIMH Intramural Imaging Program Review
1994-1995	NIMH Human Brain Project 20 Special Review Committee
1994-1996	Education and Training Committee-American College of Neuropsychopharmacology
1997-1999	Government Relations Committee-American College of Neuropsychopharmacology
1999-	Chairman, Scientific Council, American Foundation for Suicide Prevention
2000-	Membership Committee - Society of Biological Psychiatry
2000-	Program Committee - Society of Biological Psychiatry
2000-2001	Committee Member - Institute of Medicine's Board on Neuroscience and Behavioral Health Pathophysiology & Prevention of Adolescent & Adult Suicide
2000-2002	Credentials Committee - American College of Neuropsychopharmacology
2001-2003	Task Force on Unipolar Major Depressive Disorder - World Fed. of Soc. Biol. Psychiatry
2001-2003	International Organizing Committee, IASP
2001-2003	Local Organizing Committee, Human Brain Mapping
2002-2003	International Organizing Committee, IASP
2002-	Scientific Advisory Board, National Depressive and Manic-Depressive Association
2002-	Member, New York State Suicide Prevention Council
2002-2006	Board of Directors, Research Foundation for Mental Hygiene, Inc.
2003-2005	President, International Academy for Suicide Research
2003-	Scientific Council, National Alliance for Research on Schizophrenia & Depression (NARSAD)
2005-	Member of Suicidology Section, World Psychiatric Association
2009-	Nominating/Governance Committees, American Foundation for Suicide Prevention
2009-	NIH Study Section: Neural Basis of Psychopathology, Addictions and Sleep Disorders (NPAS)
2009-	IASP Task Force, The Genetics and Neurobiology of Suicide
2009-2010	President – Society of Biological Psychiatry
2010	NIMH Prevention Research Workshop/Convention (6/1/2010)
2011	NIMH Study Section: Reviewer, Alzheimer's Association International Research Grant Program

PUBLICATIONS

A. Peer Reviewed Articles

1. Mann J, Branton LG, Larkins RG. Hyperosmolality complicating recovery from lithium toxicity. *Br Med J.* 1978 Jun 10;1(6126):l522-1523. PMID:656782 PMC1605053

2. Mann J, Chui E. Platelet monoamine oxidase activity in Huntington's chorea. *J Neurol Neurosurg Psychiatry.* 1978;4l(9):809-8l2. doi:10.1136/jnnp.41.9.809

3. Mann J. Altered platelet monoamine oxidase activity in affective disorders. *Psychol Med.* 1979 Nov; 9(4):729-736. PMID:515270

4. Mann J, Thomas KM. Platelet monoamine oxidase activity in schizophrenia. Relationship to disease, treatment, institutionalization and outcome. *B. J Psychiatry* 1979 Apr;134:366-371. PMID:36192

5. Mann JJ, Stanley M, Gershon S, Rossor M. Mental symptoms in Huntington's disease and a possible primary aminergic neuron lesion. *Science.* 1980 Dec;2l0(4476):1369-137l. PMID:6449080

6. Georgotas A, Mann J, Bush D, Gershon S. A clinical trial of zimelidine in depression. *Commun Psychopharmacol.* 1980;4(1):7l-77. PMID:6447007

7. Mann J, Gershon S. L-deprenyl, a selective monoamine oxidase type-B inhibitor in endogenous depression. *Life Sci.* 1980 Mar 17;26(11):877-882. PMID:6768943

8. Mann J, Peselow ED, Snyderman S, Gershon S. D-phenylalanine in endogenous depression. *Am J Psychiatry.* 1980 Dec;137(12):1611-1612. PMID:7435725

9. Mann JJ, Friedman E, Georgotas A, Gershon S. The antidepressant effects of trazodone and inhibition on platelet serotonin reuptake. *Commun Psychopharmacol.* 1980;4(4):293-30l. PMID:7273703

10. Mann JJ, Kaplan RD, Georgotas A, Friedman E, Branchey M, Gershon S. Monoamine oxidase activity and enzyme kinetics in three subpopulations of density-fractionated platelets in chronic paranoid schizophrenics. *Psychopharmacology (Berl).* 1981;74(4):344-348. PMID:6794079

11. Gershon S, Mann J, Newton R, Gunther BJ. Evaluation of trazadone in the treatment of endogenous depression: Results of a multicenter double-blind study. *J Clin Psychopharmacol.* 1981 Nov;1(6):39S-44S.

12. Mann JJ, Georgotas A, Newton R, Gershon S. A controlled study of trazodone, imipramine, and placebo in outpatients with endogenous depression. *J Clin Psychopharmacol.* 1981 Mar;l(2):75-80. PMID:7028798

13. Mann JJ, Stanley M, Neophytides A, de Leon MJ, Ferris SH, Gershon S. Central amine metabolism in Alzheimer's disease: in vivo relationship to cognitive deficit. *Neurobiol Aging.* 1981 Spring;2(1):57-60. PMID:7266742

14. Frances A, Brown RP, Kocsis JH, Mann JJ. Psychotic depression: a separate entity? *Am J Psychiatry.* 1981 Jun; 138(6):83l-833. PMID:7246818

15. Georgotas A, Mann J, Gershon S. Safety data on zimelidine hydrochloride following an overdose. *Acta Psychiatr Scand* Suppl. 1981;290:257-26l. PMID:6452795

16. Feldman GM, Mann JJ, Charney AN. Effect of lithium ingestion on water and electrolyte transport in rat intestine. *Gastroenterology.* 1981 Nov;8l(5):892-897. PMID:6269945

17. Georgotas A, Mann J, Friedman E. Platelet monoamine oxidase inhibition as a potential indicator of favorable response to MAOI's in geriatric depression. *Biol Psychiatry.* 1981 Oct;l6(10):997-l00l. PMID:7306621

18. Mann JJ, Frances A, Kaplan RD, Kocsis J, Peselow ED, Gershon S. The relative efficacy of L-deprenyl, a selective monoamine oxidase type B inhibitor in endogenous and nonendogenous depression. *J Clin Psychopharmacol.* 1982 Feb;2(1):54-57. PMID:6802883

19. Mann JJ, Frances A, Peselow ED, Gershon S. Differential efficacy of L-deprenyl, a selective MAO type-B inhibitor, in endogenous and nonendogenous depression. *Psychopharmacol Bull.* 1982 Oct; l8(4):l82-l84. PMID:6818606

20. Brown RP, Frances A, Kocsis JH, Mann JJ. Psychotic vs nonpsychotic depression: comparison of treatment response. *J Nerv Ment Dis.* 1982 Oct;l70(10):635-637. PMID:6125562

21. Biegon A, Rainbow RC, Mann JJ, McEwen BS. Neurotransmitter receptor sites in human hippocampus: a quantitative autoradiographic study. *Brain Res.* 1982 Sep 16;247(2):379-382. PMID:6289987

22. Kaplan RD, Mann JJ. Altered platelet serotonin uptake kinetics in schizophrenia and depression. *Life Sci.* 1982 Aug 9;3l(6)583-588. PMID:7132568

23. Georgotas A, Forsell TL, Mann JJ, Kim M, Gershon S. Trazodone hydrochloride: a wide spectrum antidepressant with a unique pharmacological profile. A review of its neurochemical effects, pharmacology, clinical efficacy and toxicology. *Pharmacotherapy.* 1982 Sep-Oct;2(5):255-265. PMID: 6763207

24. Stanley M, Mann JJ. Increased serotonin-2 binding sites in frontal cortex of suicide victims. *Lancet.* 1983 Jan 29;l(8318):2l4-2l6. PMID:6130248

25. Georgotas A, Friedman E, McCarthy M, Mann J, Krakowcki M, Siegel R, Ferris S. Resistant geriatric depressions and therapeutic response to monoamine oxidase inhibitors. *Biol Psychiatry.* 1983 Feb; l8(2):l95-205. PMID:6830930

26. Stanley, M., Mann, J.J. and Gershon, S. 1983. Alterations in pre- and post-synaptic serotonergic neurons in suicide victims. *Psychopharm. Bull.* l9:684-687.

27. Mann JJ, Stanley M, Kaplan RD, Sweeney J, Neophytides A. Central catecholamine metabolism *in vivo* and the cognitive and motor deficits in Parkinson's disease. *J Neurol Neurosurg Psychiatry.* 1983 Oct;46(10):905-9l0. PMID:6644314 PMC1027603

28. Mann JJ. Loss of antidepressant effects with long-term monoamine oxidase inhibitor treatment without loss of monoamine oxidase inhibition. *J Clin Psychopharmacol.* 1983 Dec;3(6):363-366. PMID: 6315778

29. Mann, J.J., Aarons, S.A., Frances, A., Bernstein, W., Douglas, C. and Sickles, M. 1983. Symptoms of atypical depression as a predictor of response to L-deprenyl. *Psychopharm. Bull.* l9:333-335.

30. McBride PA, Mann JJ, McEwen B, Biegon A. Characterization of serotonin binding sites on human platelets. *Life Sci.* 1983 Nov 14;33(20):2033-204l. PMID:6645789

31. Mann JJ, Stanley M. Postmortem monoamine oxidase enzyme kinetics in the frontal cortex of suicide victims and controls. *Acta Psychiatr Scand.* 1984 Feb;69(2):l35-l39. PMID:6702476

32. Shear MK, Devereux RB, Kramer-Fox MS, Mann JJ, Frances A. Low prevalence of mitral valve prolapse in patients with panic disorder. *Am J Psychiatry.* 1984 Feb;l4l(2):302-303. PMID:6691504

33. Halper JP, Mann JJ, Weksler ME, Bilezikian JP, Sweeney JA, Brown RP, Golbourne T. Beta adrenergic receptors and cyclic AMP levels in intact human lymphocytes: effects of age and gender. *Life Sci.* 1984 Aug 20;35(8):855-863. PMID:6090853

34. Mann JJ, Aarons SF, Frances AJ, Brown RD. Studies of selective and reversible monoamine oxidase inhibitors. *J Clin Psychiatry.* 1984 Jul;45(7 Pt 2):62-66. PMID:6429130

35. Mann JJ, Frances AJ, Brown RP, Aarons SF, Kocsis JH. Monoamine oxidase inhibitors: Yesterday, today and tomorrow. *J Clin Psychiatry.* 1984;2:27-3l.

36. Brown RP, Mann JJ. Current theories of antidepressant action and the biochemical basis of depression. *JCP Monograph.* 1984;2:3-6.

37. Robinson DS, Corcella JC, Feighner JP, Pohl R, Kelwala S, Mann JJ, Chien CP, Gerner RH. A comparison of trazodone, amoxapine and maprotiline in the treatment of endogenous depression. *Curr Therap Res.* 1984;5:549-560.

38. Brown RP, Mann JJ. A clinical perspective on the role of neurotransmitters in mental disorders. *Hosp Community Psychiatry.* 1985 Feb;36(2):l4l-l50. PMID:2579012

39. Aarons SF, Frances AJ, Mann JJ. Atypical depression: a review of diagnosis and treatment. *Hosp Community Psychiatry.* 1985 Mar;36(3):275-282. PMID:3979979

40. Kocsis JH, Frances A, Mann JJ, Sweeney J, Voss C, Mason B, Brown RP. Imipramine for treatment of chronic depression. *Psychopharmacol Bull.* 1985;2l(3):698-700. PMID:3898184

41. Barnett J, Frances A, Kocsis J, Brown R, Mann JJ. Peripheral edema associated with trazodone: a report of ten cases. *J Clin Psychopharmcol*. 1985 Jun;5(3):l6l-l64. PMID:3998206

42. Escobar JI, Mann JJ, Keller J, Wilkins J, Mason B, Mills MJ. Comparison of injectable molindone and haloperidol followed by oral dosage forms in acutely ill schizophrenics. *J. Clin Psychiatry.* 1985 Aug; 46(8 Pt2):l5-l9. PMID:3894337

43. Weiden P, Mann JJ, Shaw E, Bruun R. Munchausen's syndrome simulating torsion dystonia. *N Engl J Med.* 1985 Oct 24;3l3(17):l088.

44. Mann JJ, Brown RP, Halper JP, Sweeney JA, Kocsis JH, Stokes PE, Bilezikian JP. Reduced sensitivity of lymphocyte beta-adrenergic receptors in patients with endogenous depression and psychomotor agitation. *N Engl J Med.* 1985 Sep 19;3l3(12):7l5-720. PMID:2993884

45. Mann JJ, Kaplan RD, Bird ED. Elevated postmortem monoamine oxidase B activity in the caudate nucleus in Huntington's disease compared to schizophrenics and controls. *J Neural Transm.* 1986; 65(3-4):277-283. PMID:29403336

46. Brown RP, Mason B, Stoll P, Brizer D, Kocsis J, Stokes PE, Mann JJ. Adrenocorticol function and suicidal behavior in depressive disorders. *Psychiatry. Res.* 1986 Apr;l7(4):3l7-323. PMID:3714913

47. Kocsis JH, Voss C, Mann JJ, Frances A. Chronic depression: demographic and clinical characteristics. *Psychopharmacol Bull*. 1986;22(1):l92-l95. PMID:3726065

48. Shaw, E.D., Mann, J.J., Weiden, P.J., Sinsheimer, L.M. and Brunn, R.D. 1986. A case of suicidal and homocidal ideation and akathisia in a double-blind neuroleptic crossover study (letter). *J. Clinical Psychopharmacology* 6:l96-l97.

49. Mann JJ, McBride PA, Stanley M. Aminergic receptor binding correlates of suicide: methodological issues. *Psychopharmacol Bull.* 1986;22(3):741-743. PMID:3025908

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MANN EXPERT REPORT EXHIBIT B

EXHIBIT 17

The Association between the Purchase of a Handgun and Homicide or Suicide

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ABSTRACT

Objectives. The purpose of this study was to determine whether purchase of a handgun from a licensed dealer is associated with the risk of homicide or suicide and whether any association varies in relation to time since purchase.

Methods. A case–control study was done among the members of a large health maintenance organization. Case subjects were the 353 suicide victims and 117 homicide victims among the members from 1980 through 1992. Five control subjects were matched to each case subject on age, sex, and zip code of residence. Handgun purchase information was obtained from the Department of Licensing.

Results. The adjusted relative risk for suicide was 1.9 (95% confidence interval [CI] = 1.4, 2.5) for persons with a history of family handgun purchase from a registered dealer. The adjusted relative risk for homicide, given a history of family handgun purchase, was 2.2 (95% CI = 1.3, 3.7). For both suicide and homicide, the elevated relative risks persisted for more than 5 years after the purchase.

Conclusions. Legal purchase of a handgun appears to be associated with a long-lasting increased risk of violent death. (*Am J Public Health.* 1997;87:974–978)

Introduction

In the United States in 1994 there were 31 142 suicides and 24 926 homicides with respective age-adjusted mortality rates of 12.0 and 9.6 per 100 000; firearms were used in 60% of suicides and 72% of homicides.[1] Guns are thought to be present in 49% of US households,[2] and 33% of gun owners report that protection is the primary reason for ownership.[3] Firearms can sometimes provide safety benefits to their owners.[4,5] Whether the benefits of firearm ownership outweigh the risks is debated.[6–9]

Evidence that access to firearms may increase the risk of suicide and homicide comes from five case–control studies.[10–14] These studies have several limitations. First, they used information from proxy respondents for case subjects, but often interviewed control subjects directly; this difference might have biased the results.[15] Second, interviews were used to ascertain gun ownership; bias could have resulted if there was deception by some respondents and the degree of deception differed between the case and control subjects. Third, two of the studies were confined to events in homes.[12,14] Persons without guns might choose a suicide method that necessitated leaving the home and there might be no association between gun ownership and all suicides.[16] Only 24% of murders in the study area occurred in the home,[14] so the association between gun ownership and most homicides is unknown.[17] Fourth, three of the studies were confined to adolescents.[10,11,13] Finally, the study of homicides[14] was criticized[17] because the socioeconomic status of many victims was low. It is conceivable that firearms might be a risk factor for homicide among the poor but not among others.

To address these issues, we studied the predominantly middle-class members of a health maintenance organization. Our main question was whether purchase of a handgun from a licensed dealer was associated with an increased or decreased risk of suicide or homicide. In addition, we asked whether risk or benefit varied in relation to the time since purchase, number of handguns purchased, or caliber of weapon purchased.

Methods

Group Health Cooperative of Puget Sound, a health maintenance organization in Washington State, grew from 320 000 members in 1980 to 450 000 members in 1992. Compared with the 1984 adult population of the United States, a random sample of 1133 adult Group Health members in 1984 were more often female (55% vs 52%), more likely to have completed high school (91% vs 70%),

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Editor's Note. See related editorial by Morgenstern (p 899), comment by Kellermann (p 910), and commentary by Webster et al. (p 918) in this issue.

less often African American (3% vs 11%), and less likely to have a family income below $15 000 (20% vs 33%).[18–21]

A case subject was a Group Health member who died of suicide or homicide during the period January 1, 1980, through December 31, 1992. Computerized Washington State death certificates were compared with computerized Group Health membership records to identify case subjects. For each case subject, five control subjects were sought from the membership file. Control subjects were randomly selected from among persons who were Group Health members on the day the case subject died and who matched that person on sex, age (within 6 years), and zip code of residence. If five control subjects could not be found within the case subject's zip code, we selected additional control subjects from adjoining zip codes. The case subject's date of death became the reference date for his or her matched control subjects. For each case and control subject, we identified family members (spouse or children) who were enrolled under the same Group Health policy.

When a handgun (but not a long gun) is purchased from a licensed dealer in Washington State, information about the sale must be reported to the Department of Licensing. This information was computerized for purchases from 1940 through June 1993. This file was linked to the subjects and family members to identify the handgun purchase history of each study subject and his or her family prior to death or reference date. We defined three categories of handgun purchase: (1) family purchase (purchase by the subject or any family member), (2) personal purchase (purchase by the study subject), and (3) family member purchase (purchase by any family member, but not the study subject).

The most recent address prior to death or reference date for each subject was obtained from Group Health files. Computerized geocoding methods (Harte-Hanks Data Technologies, Billerica, Mass) were used to map this address to a census block group. The socioeconomic status of persons in each census block group was measured by means of 1990 census variables: median family income in 1989, median value of owner-occupied homes, and average years of education for persons over 24 years of age.[22]

Person-years of Group Health membership were calculated by age and sex. Age-adjusted rates were directly standardized to the 1940 United States population.[23] Odds ratios from conditional logistic regression, which accounted for the matched design, were used to approximate relative risks.[24] Potential confounding variables examined were the number of family members and the measures of census block group affluence and education. The chi-square approximation of the likelihood ratio statistic was used for tests of heterogeneity, trend, and interaction.

TABLE 1—Incidence of Suicide and Homicide among Members of Group Health Cooperative, Washington State, 1980 through 1992

	Suicides/100 000 Member-Years (95% CI)	Homicides/100 000 Member-Years (95% CI)
All members	8.3 (7.5, 9.2)	2.7 (2.2, 3.2)
Age, y		
0–12	0.1 (0.0, 0.7)	1.2 (0.6, 2.3)
13–19	8.8 (6.3, 11.2)	3.9 (2.3, 6.1)
20–49	9.3 (8.0, 10.7)	2.8 (2.1, 3.6)
50+	12.4 (10.4, 14.7)	2.9 (2.0, 4.1)
Sex		
Men	13.4 (11.9, 15.1)	2.9 (2.2, 3.7)
Women	3.8 (3.0, 4.6)	2.4 (1.9, 3.2)
Deaths involving firearms		
Men	8.6 (7.4, 9.9)	1.6 (1.2, 2.3)
Women	1.2 (0.9, 1.8)	1.4 (1.0, 2.0)
All	4.7 (4.1, 5.4)	1.5 (1.2, 1.9)

Note. CI = confidence interval.

Results

Incidence Rates

From 1980 through 1992, there were 4 407 197 person-years of Group Health membership, with 366 suicides and 117 deaths by homicide (Table 1). Age-adjusted Group Health mortality per 100 000 persons per year was 7.8 for suicide and 2.7 for homicide. The incidence of suicide was 3.6 times higher for males, while homicide rates showed little difference by gender. Among suicides, 52.7% used a gun, and 56.4% of homicides involved a firearm.

Comparison of Case and Control Subjects

Five matched control subjects were identified for 96.3% of all case subjects. No control subjects were found for 13 suicides, but at least one was found for each homicide victim. Among control subjects, 97.8% had an age at reference date that differed from their respective case subject's age at death by less than 2 years, and 99.1% resided in the same zip code as their matching case subject. Case subjects were more likely than control subjects to have no family members (33.7% vs 25.4% for suicides and 31.9% vs 26.1% for homicide victims).

Not all addresses could be geocoded; census block group data could be linked to 83.4% of all matched case subjects and 83.4% of all control subjects. Suicides showed little difference from control subjects for the census variables; P values for trend tests were all greater than .8. Homicide victims were more likely than control subjects in the same zip code area to reside in poor neighborhoods, as judged by median family income (test for trend, $P = .01$), but showed little difference from control subjects in median value of neighborhood homes (test for trend, $P = .8$) or in the educational attainment of neighborhood adults (test for trend, $P = .6$).

Suicide and Handgun Purchase

Persons who committed suicide were more likely than control subjects to have a history of family handgun purchase (24.6% vs 15.1%). The relative risk for suicide, given a family handgun purchase, was 1.9 (95% confidence interval [CI] = 1.4, 2.5) (Table 2). The relative risks for suicide given a personal or family member handgun purchase were also elevated, although the elevated risk for family member purchase was not statistically significant. These estimates are adjusted for the matching variables; further adjustment for family size or the socioeconomic status variables resulted in no important change. The relative risk for suicide involving a gun was 3.1 (95% CI = 2.2, 4.4) for persons with a family handgun

TABLE 2—Handgun Purchase History and Relative Risk Estimates for Matched Suicides and Control Subjects

Handgun Purchase History	Suicides (n = 353) No.	(%)	Control Subjects (n = 1756) No.	(%)	Adjusted Relative Risk[a]	95% Confidence Interval	P[b]
Category of purchase							. . .
Family	87	(24.6)	265	(15.1)	1.9	1.4, 2.5	
Personal	62	(17.6)	177	(10.1)	2.0	1.4, 2.8	
Family member	25	(7.1)	88	(5.0)	1.5	0.9, 2.5	
Time since family purchase, y							.03[c]
<1	11	(3.1)	12	(0.7)	5.7	2.4, 13.5	
1–4	11	(3.1)	37	(2.1)	1.7	0.8, 3.4	
≥5	65	(18.4)	216	(12.3)	1.7	1.3, 2.3	
No. family purchases							.06
1	45	(12.7)	162	(9.2)	1.6	1.1, 2.2	
2	14	(4.0)	44	(2.5)	1.8	1.0, 3.4	
≥3	28	(7.9)	59	(3.4)	2.7	1.7, 4.4	
Maximum caliber of family purchase[d]							.3
.22–.30	30	(8.5)	107	(6.1)	1.6	1.0, 2.4	
.32–.45	56	(15.9)	153	(8.7)	2.1	1.5, 2.9	

[a]Adjusted for age, sex, zip code area, and reference date.
[b]Statistical significance of any trend across the presented categories.
[c]Test for heterogeneity of exposure categories.
[d]Data missing for 1 case and 5 control subjects.

TABLE 3—Handgun Purchase History and Relative Risk Estimates for Matched Homicide Victims and Control Subjects

Handgun Purchase History	Homicide Victims (n = 117) No.	(%)	Control Subjects (n = 582) No.	(%)	Adjusted Relative Risk[a]	95% Confidence Interval	P[b]
Category of purchase							. . .
Family	25	(21.4)	69	(11.9)	2.2	1.3, 3.7	
Personal	11	(9.4)	29	(5.0)	2.2	1.0, 4.7	
Family member	14	(12.0)	40	(6.9)	2.1	1.0, 4.2	
Time since family purchase, y							.3
<5	3	(2.6)	17	(2.9)	1.0	0.3, 3.6	
5–9	5	(4.3)	11	(1.9)	2.9	0.9, 8.9	
≥10	17	(14.5)	41	(7.0)	2.5	1.3, 4.7	
No. family purchases							.004
1	7	(6.0)	37	(6.4)	1.1	0.5, 2.5	
2	7	(6.0)	20	(3.4)	2.1	0.8, 5.2	
≥3	11	(9.4)	12	(2.1)	6.2	2.4, 15.6	
Maximum caliber of family purchase[c]							.2
.22–.30	5	(4.3)	23	(4.0)	1.3	0.5, 3.4	
.32–.45	20	(17.1)	44	(7.6)	2.7	1.5, 5.0	

[a]Adjusted for age, sex, zip code area, and reference date.
[b]Statistical significance of any trend across the presented categories.
[c]Data missing for 2 control subjects.

purchase compared with others, while the relative risk for suicide not involving a gun was 0.8 (95% CI = 0.4, 1.3).

The median interval between the first handgun purchase by the victim or any family member and any suicide with a gun was 10.7 years (range, 11 days to 52.5 years). The relative risk for suicide given a family handgun purchase was greatest within the first year after purchase but remained elevated even after 5 years (Table 2).

The association between handgun purchase and suicide tended to become stronger as the number of handguns purchased increased (test for trend across categories, $P = .06$) (Table 2). When persons were classified by the largest caliber of any family handgun purchase, the relative risk of suicide showed little variation by caliber.

The association between family handgun purchase and suicide was estimated in several subgroups. No statistically significant differences in the relative risk estimates were found for categories of sex, age, or neighborhood median family income (data not shown).

Homicide and Handgun Purchase

Homicide victims were more likely than control subjects to have a history of family handgun purchase (21.4% vs 11.9%). The relative risk of death by homicide for those with a family handgun purchase was 2.2 (95% CI = 1.3, to 3.7) (Table 3). The relative risks for death by homicide given a personal or family member purchase were also elevated, although these estimates were of borderline statistical significance. These estimates are adjusted for the matching variables; further adjustment for family size or the census variables resulted in no important change. The relative risk for death by homicide involving a gun was 2.2 (95% CI = 1.1, 4.4) for persons with a family handgun purchase compared with others, while the corresponding relative risk for homicide not involving a gun was 2.0 (95% CI = 0.9, 4.7).

The median interval between first family handgun purchase and any homicide death with a gun was 11.3 years (range, 5.1 to 21.9 years). The relative risk of death by homicide associated with family handgun purchase bore no statistically significant relationship to time since purchase (Table 3).

There was a stronger association between handgun purchase and death by homicide as the number of handguns purchased increased (test for trend across categories, $P = .004$) (Table 3). When persons were classified by the largest caliber of any family handgun purchase, the relative risk of homicide did not show a statistically significant variation by caliber.

When subgroups were analyzed, the association between family handgun purchase and death by homicide was not statistically different by categories of sex, age, or neighborhood median family income (data not shown).

Discussion

Members of a health maintenance organization whose families had a history of registered handgun purchase had risks of death by suicide and homicide that were twice as high as the risks of members of the same age, sex, and neighborhood who had no history of handgun purchase. The increased relative risks persisted for more than 5 years after the purchase.

From 1980 through 1992, the age-adjusted suicide rate in the Group Health population was 7.8 per 100 000 persons per year; the corresponding rate was 13.2 in Washington State and 11.5 in the United States (mortality and population data from the National Center for Health Statistics). The middle-class nature of the study population is reflected in the low age-adjusted homicide rate: 2.7 per 100 000 persons per year for Group Health members during the study period, compared with 5.3 for all of Washington and 9.5 for the United States.

Inability to measure and control for other differences between case and control subjects could have biased our relative risk estimates. Three previous studies of the association between gun ownership and suicide[11–13] and the only previous study regarding death by homicide[14] adjusted their relative risk estimates for variables that we did not measure, including psychiatric history, substance abuse, criminal history, and previous household violence. In three of these studies[12–14] these adjustments increased the relative risk estimates.

Residual confounding in our study can be assessed indirectly by examining the relative risk estimates for suicide and homicide deaths without a gun; we would expect handgun purchase to have little positive association with deaths that do not involve a gun. For suicide by means other than a firearm, the relative risk was 0.8 (95% CI = 0.4, 1.3) among those with a history of handgun purchase. The finding that this estimate is close to 1.0 suggests that the underlying risk of suicide was similar between handgun purchasers and nonpurchasers apart from purchase history.

For death by homicide by means other than a gun, the relative risk was 2.0 (95% CI = 0.9, 4.7) among those with a history of family handgun purchase. Although chance could explain this finding, another explanation may be that handgun purchasers were more inclined toward violence or lived in more dangerous surroundings and these factors induced them to purchase handguns. This violent personality or environment may have increased the risk for both gun-related and other homicide death, regardless of exposure to handgun purchase. If this theory is true, then the apparent association between handgun purchase and all homicide deaths may be due to uncontrolled confounding. Another explanation might be that some handgun purchasers were encouraged by their ownership of a gun to engage in activities that increased their risk for homicide by any means.

Handgun purchase from a licensed dealer can be considered a proxy measure for handgun ownership. Some study subjects classified as exposed to handguns may have disposed of their handguns; others classified as not exposed may have possessed handguns that they purchased legally from sources other than a registered dealer, purchased out of state, or obtained illegally. If such errors in classification occurred with similar frequency among case and control subjects, the relationship between handgun ownership and risk could have been underestimated in our study.[25] It is also possible that persons inclined to commit homicide may have been more likely to procure handguns exclusively by private or illegal means; these transactions are not reported to the state. If this pattern is present, it would tend to bias our relative risk estimates for homicide toward zero.

There is evidence that handgun purchase records did not grossly underestimate exposure to handguns in our study. In 1992, of 1000 Seattle adults interviewed, 14.2% reported household ownership of a handgun.[26] This figure is similar to the prevalence of family handgun purchase history among our control subjects matched to suicide and homicide victims (15.1% and 11.9%, respectively).

Defining exposure as purchase of a handgun from a dealer offered some advantages. Because exposure was recorded before the outcome, recall bias was eliminated. We did not have to rely on proxy respondents for exposure information regarding the case subjects, and deception regarding exposure was eliminated. Those who recommend purchase of a handgun for protection are referring to legal purchase, and many of these purchases would be from dealers. If this exposure is associated with an increased risk of death, the overall risk of legal handgun purchase may outweigh any protective benefit.

Our finding of an increased relative risk for suicide among persons in families that purchased handguns agrees in general with the findings of previous case–control studies of suicide and gun ownership. Three studies were conducted among adolescents in western Pennsylvania.[10,11,13] Using inpatients as control subjects, the first study reported that the relative risk for suicide among those with firearms in the home was 2.7,[10] and the second study gave an estimate of 2.1.[11] The third study used population-based control subjects and reported an adjusted relative risk for suicide, given a handgun in the home, of 9.5 (95% CI = 1.7, 53.9).[13] A study conducted in Tennessee and Washington estimated that the relative risk for suicide in the home among handgun owners was 5.8.[12]

Our finding regarding death by homicide and purchase of a handgun was similar to that of the only previous case–control study of this association. In Tennessee, Washington, and Ohio, victims of homicide in the home were compared with population-based control subjects; the relative risk for homicide, adjusted for matching variables, was 1.9 (95% CI = 1.4, 2.7) among handgun owners.[14] The authors reported a relative risk of 2.7 among owners of any firearm compared with nonowners, after further adjustment for other variables, but a fully adjusted relative risk estimate for handguns was not given.

Some persons may purposely buy a handgun to commit suicide or homicide. There was evidence in our data that this was true for suicide; within the first year after purchase, the relative risk of suicide was more than fivefold higher among those with a family history of handgun purchase. After the first year the increased relative risk of suicide persisted at a lower level, consistent with the theory that the presence of a handgun in the home may facilitate suicide during a period of despondency. For homicide the results were different; no Group Health member was murdered with a gun within 5 years of any first handgun purchase, and the elevated risks for death by homicide associated with handgun purchase did not show any statistically significant variation by time since purchase. This suggests that in the Group Health population, deliberate

legal purchase of a handgun to commit murder within a family is a rare event.

Our findings should be of interest to persons who own a handgun or are considering the purchase of a handgun. While there are occasional situations in which handguns offer protection against violent death, our study and previous studies agree that on average, the acquisition of a handgun appears to be associated with an increased risk of violent death. □

Acknowledgment

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EXHIBIT 18

Special Article

MORTALITY AMONG RECENT PURCHASERS OF HANDGUNS

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ABSTRACT

Background There continues to be considerable controversy over whether ownership of a handgun increases or decreases the risk of violent death.

Methods We conducted a population-based cohort study to compare mortality among 238,292 persons who purchased a handgun in California in 1991 with that in the general adult population of the state. The observation period began with the date of handgun purchase (15 days after the purchase application) and ended on December 31, 1996. The standardized mortality ratio (the ratio of the number of deaths observed among handgun purchasers to the number expected on the basis of age- and sex-specific rates among adults in California) was the principal outcome measure.

Results In the first year after the purchase of a handgun, suicide was the leading cause of death among handgun purchasers, accounting for 24.5 percent of all deaths and 51.9 percent of deaths among women 21 to 44 years old. The increased risk of suicide by any method among handgun purchasers (standardized mortality ratio, 4.31) was attributable entirely to an excess risk of suicide with a firearm (standardized mortality ratio, 7.12). In the first week after the purchase of a handgun, the rate of suicide by means of firearms among purchasers (644 per 100,000 person-years) was 57 times as high as the adjusted rate in the general population. Mortality from all causes during the first year after the purchase of a handgun was greater than expected for women (standardized mortality ratio, 1.09), and the entire increase was attributable to the excess number of suicides by means of a firearm. As compared with the general population, handgun purchasers remained at increased risk for suicide by firearm over the study period of up to six years, and the excess risk among women in this cohort (standardized mortality ratio, 15.50) remained greater than that among men (standardized mortality ratio, 3.23). The risk of death by homicide with a firearm was elevated among women (standardized mortality ratio at one year, 2.20; at six years, 2.01) but low among men (standardized mortality ratio at one year, 0.84; at six years, 0.79).

Conclusions The purchase of a handgun is associated with a substantial increase in the risk of suicide by firearm and by any method. The increase in the risk of suicide by firearm is apparent within a week after the purchase of a handgun and persists for at least six years. (N Engl J Med 1999;341:1583-9.)

HANDGUN ownership is common in the United States; 16 to 19 percent of the population (26 to 30 percent of men and 7 to 8 percent of women) own a handgun.[1-3] Handguns are acquired more frequently for self-defense than for all other reasons combined.[3] The wisdom of keeping a firearm for protection remains a subject of active debate. Estimates of the frequency with which firearms are used for self-defense range from fewer than 100,000 to 2.5 million instances per year.[4,5] Defensive use of firearms is not rare; the true frequency is probably between 200,000 and 500,000 instances annually.[6]

Nevertheless, access to handguns may actually increase the risk of violent death. The presence of a handgun in the home has been associated with an increased risk of suicide by means of a firearm among adults in general,[7,8] women,[9] and adolescents[10] and has also been associated with an increased risk of homicide.[8,9,11] These data were gathered in case–control studies that were geographically limited. Only one study related the risk of death to personal ownership of handguns.[8] Another case–control study, conducted in New Zealand, where handgun ownership is tightly regulated, found no association between access to firearms and the overall risk of suicide among men.[12]

We report the results of a large, population-based cohort study of the risk of death among persons who have recently purchased a handgun. Our study population comprised the 238,292 persons who purchased handguns from licensed firearm dealers in California in 1991. We compared the mortality in this group with that in the general adult population of California from 1991 through 1996 to determine whether recent purchasers of handguns were at increased risk for death by suicide or homicide, whether by means of a firearm or another method, or were at increased risk for death by other causes.

METHODS

A roster of all persons who purchased handguns from licensed firearm dealers in California in 1991 was provided by the California

From the Violence Prevention Research Program, University of California, Davis. Address reprint requests to Dr. Wintemute at the Violence Prevention Research Program, University of California, Davis, Medical Center, 2315 Stockton Blvd., Sacramento, CA 95817.

Department of Justice. Records included each purchaser's full name, date of birth, address, and date of application for handgun purchase.

California law required completion of an application for handgun purchase, followed by a 15-day waiting period, during which time criminal records were searched for offenses disqualifying the applicant from purchase and a search was conducted for records of mental illness or incapacity as determined by a court. Felons, persons under 21 years of age, and certain others are prohibited from purchasing handguns under long-standing federal and state statutes. A 1991 California law also prohibited persons with convictions for common violent misdemeanors (such as simple assault and brandishing a firearm) from purchasing firearms.

Information on deaths from 1991 through 1996 was obtained from the state's automated mortality file (the Death Statistical Master File). Tentative matches between handgun purchasers and persons listed in the mortality file were made according to last name and date of birth. Data with respect to other variables were then compared to confirm a tentative match.

The sex of handgun purchasers was not supplied by the California Department of Justice but was determined for 98.5 percent of handgun purchasers by comparing their names with sex-specific frequency tabulations of first and middle names for persons who died in California from 1989 through 1996 (derived from the mortality file) or who were born in the United States or Canada in 1994 or 1995.[13] Data on race or ethnic background were not available.

The observation period with respect to mortality among handgun purchasers began 15 days after the date of the purchase application (the first day after the required waiting period, referred to as the day of purchase for purposes of this study) and ended on December 31, 1996. Results were calculated for the first year after handgun purchase and for the entire period of observation. Since purchases occurred throughout 1991, first-year results were determined by making comparisons with average annual statewide mortality rates for 1991 and 1992 combined.

The risk of death was calculated in terms of the standardized mortality ratios, with adjustment for age, sex, or both, with the general adult population of the state as the reference group. Mortality rates for the general population were calculated by dividing the average annual number of deaths during a given period by the population at the midpoint of that period, as estimated by extrapolation from the 1990 census[14] to the projected population of the state in 2000.[15] Since we examined data for an entire population, confidence intervals were not calculated.

Crude rates of suicide by means of firearms among handgun purchasers were calculated as the number of deaths by this means during a given period, divided by the number of person-years at risk during that period; rates for periods of less than one year were annualized. For comparison, rates for the adult population of the state were calculated as described above, with adjustment for age and sex.

RESULTS

As compared with the general adult population, the 238,292 purchasers of handguns in California in 1991 included a far greater proportion of men (Table 1). Nearly half (49.2 percent) of the handgun purchasers (but only 36.4 percent of the state population) were 34 years old or younger; in contrast, just 3.5 percent of handgun purchasers (but 15.0 percent of the state population) were 65 years old or older.

Suicide by any method was the leading cause of death among handgun purchasers in the first year after handgun purchase; it accounted for 24.5 percent of all deaths in this cohort (Table 2). Suicide by means of a firearm (188 of 857 deaths) ranked second among all causes of death, after heart disease (207 deaths) and ahead of cancer (160 deaths). Among all adults in California in 1991 and 1992, suicide ranked ninth among all causes of death and accounted for 1.7 percent of all deaths. There were, on average, 1822 suicides by firearms annually in California during 1991 and 1992, of which 10.3 percent were committed by persons who had purchased handguns in 1991. The percentage of all suicides that were committed with firearms and the percentage of all deaths that were suicides, whether committed with firearms

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF THE 238,292 PERSONS WHO PURCHASED HANDGUNS IN CALIFORNIA IN 1991 AND OF ALL ADULTS IN CALIFORNIA IN 1991.*

CHARACTERISTIC	HANDGUN PURCHASERS	ADULTS IN CALIFORNIA
	percent	
Sex		
Male	88.0	49.1
Female	12.0	50.9
Age (yr)		
21–24	15.8	9.5
25–34	33.4	26.9
35–44	24.9	22.9
45–54	15.2	14.9
55–64	7.1	10.9
65–74	2.9	8.9
≥75	0.6	6.1

*Because of rounding, percentages do not always sum to 100.

TABLE 2. ONE-YEAR MORTALITY FROM SUICIDE AMONG PERSONS WHO PURCHASED HANDGUNS IN CALIFORNIA IN 1991 AS COMPARED WITH THE AVERAGE ANNUAL MORTALITY FROM SUICIDE AMONG ALL ADULTS IN CALIFORNIA IN 1991 AND 1992.*

VARIABLE	HANDGUN PURCHASERS	ADULTS IN CALIFORNIA
	percent (no./total no.)	
Suicides by firearm (in relation to all suicides)		
Men	91.1 (164/180)	58.7 (1577/2686)
Women	80.0 (24/30)	29.7 (245/826)
Total	89.5 (188/210)	51.9 (1822/3512)
Suicides by firearm (in relation to all deaths)		
Men	21.0 (164/780)	1.4 (1577/109,432)
Women	31.2 (24/77)	0.2 (245/99,187)
Total	21.9 (188/857)	0.9 (1822/208,619)
Suicides (in relation to all deaths)		
Men	23.1 (180/780)	2.5 (2686/109,432)
Women	39.0 (30/77)	0.8 (826/99,187)
Total	24.5 (210/857)	1.7 (3512/208,619)

*Since handgun purchases occurred throughout 1991, first-year comparisons were made to average annual statewide mortality for 1991 and 1992 combined.

or by any method, were substantially higher among persons who had recently purchased a handgun than in the adult population of the state (Table 2).

Suicide by means of a firearm accounted for 31.2 percent of all deaths during the first year among women who purchased handguns, as compared with only 0.2 percent of all deaths among all women in California in 1991 and 1992. Women 21 to 44 years old made up 75.4 percent of all women who purchased handguns. Among these younger women, more than half of those who died during the first year (51.9 percent) had committed suicide, and 37.0 percent had committed suicide with use of a firearm. Among all women 21 to 44 years old in California in 1991 and 1992, 6.5 percent of those who died had committed suicide, and 2.8 percent had committed suicide with a firearm.

Information about the type of firearm was available for 116 (61.7 percent) of all suicides by firearm among persons who had purchased handguns within the preceding year; handguns had been used in 114 (98.3 percent) of these suicides. The type of firearm was available for 2401 (65.9 percent) of all 3643 suicides by firearm among adults in California in 1991 and 1992; of these suicides, 1750 (72.9 percent) involved handguns.

After adjustment for age and sex, handgun purchasers, as compared with the general adult population during the same period, were at substantially greater risk for suicide in the first year after a handgun purchase (standardized mortality ratio, 4.31), and the increase was attributable entirely to the substantial excess mortality from suicide by firearm (standardized mortality ratio, 7.12) (Table 3). Women who purchased handguns were at particularly high risk for suicide with a firearm (standardized mortality ratio, 38.71). The excess risk of suicide by any method and of suicide by firearm declined slightly for all purchasers until the age of 44, rose thereafter, and was highest for those 75 years old or older.

The rate of suicide by firearm among handgun purchasers was greatest immediately after the purchase and declined thereafter (Fig. 1). Two purchasers committed suicide by means of a firearm during the 15-day waiting period, before the observation period began, and 48 did so during the first 2 weeks after the waiting period ended. The rate for the first week after purchase was 644 per 100,000 person-years, 57 times as high as the adjusted statewide rate (11.3 per 100,000 persons per year). Of all handgun purchasers who committed suicide by firearm during the six-year observation period, 25.0 percent of women and 13.7 percent of men did so within a month after buying their handguns.

Forty-two purchasers of a handgun were murdered in the first year after their purchase; firearms were involved in 40 (95 percent) of these cases. Homicide by means of a firearm accounted for 4.7 percent of all deaths in this cohort. In the state as a whole during 1991 and 1992, firearms were involved in 70.5 percent of homicides, and homicide by firearm accounted for 1.2 percent of all deaths. After adjustment for age, homicide by firearm accounted for fewer deaths than expected among male handgun purchasers (standardized mortality ratio, 0.84) but more deaths than expected among women (standardized mortality ratio, 2.20) (Table 3).

TABLE 3. STANDARDIZED MORTALITY RATIOS FOR SUICIDE AND HOMICIDE AMONG HANDGUN PURCHASERS IN THE FIRST YEAR AFTER HANDGUN PURCHASE IN 1991, AS COMPARED WITH AVERAGE ANNUAL MORTALITY FROM SUICIDE AND HOMICIDE AMONG ALL ADULTS IN CALIFORNIA IN 1991 AND 1992.*

CHARACTERISTIC	SUICIDE			HOMICIDE		
	ALL METHODS	FIREARMS	OTHER METHODS	ALL METHODS	FIREARMS	OTHER METHODS
Total†	4.31	7.12	0.99	0.70	0.87	0.14
Sex‡						
Male	3.85	6.36	0.76	0.66	0.84	0.07
Female	16.13	38.71	4.84	1.83	2.20	1.41
Age (yr)§						
21–24	3.98	6.16	0.84	0.70	0.81	0.00
25–34	3.76	6.58	0.81	0.65	0.83	0.00
35–44	3.45	5.98	1.11	0.42	0.62	0.00
45–54	4.21	6.82	1.09	0.87	1.08	0.55
55–64	5.07	7.84	0.63	2.19	2.60	1.67
65–74	7.76	9.36	3.28	4.76	10.53	0.00
≥75	15.00	20.83	0.00	0.00	0.00	0.00

*Since handgun purchases occurred throughout 1991, first-year comparisons were made to average annual statewide mortality for 1991 and 1992 combined.

†Values have been adjusted for age and sex.

‡Values have been adjusted for age.

§Values have been adjusted for sex.

Among men who purchased a handgun, there were fewer deaths than expected from heart disease (standardized mortality ratio, 0.78), cancer (0.67), unintentional injury (0.67), and all causes (0.73) in the first year after the purchase of a handgun. Mortality from all causes among women was greater than expected (standardized mortality ratio, 1.09), though there were fewer deaths than expected from heart disease (standardized mortality ratio, 0.78), cancer (0.47), and unintentional injury (0.46). For women 21 to 44 years of age, the standardized mortality ratio for death from all causes was 1.53. In both cases, the entire increase in the risk of death from all causes could be accounted for by the excess number of deaths from suicide by firearm.

The rate of suicide by firearm among handgun purchasers remained greater than the rate in the general population throughout follow-up (Fig. 2). Standardized mortality ratios for suicide by all methods and for suicide by firearm were lower than those for the first year after purchase but remained high; those for

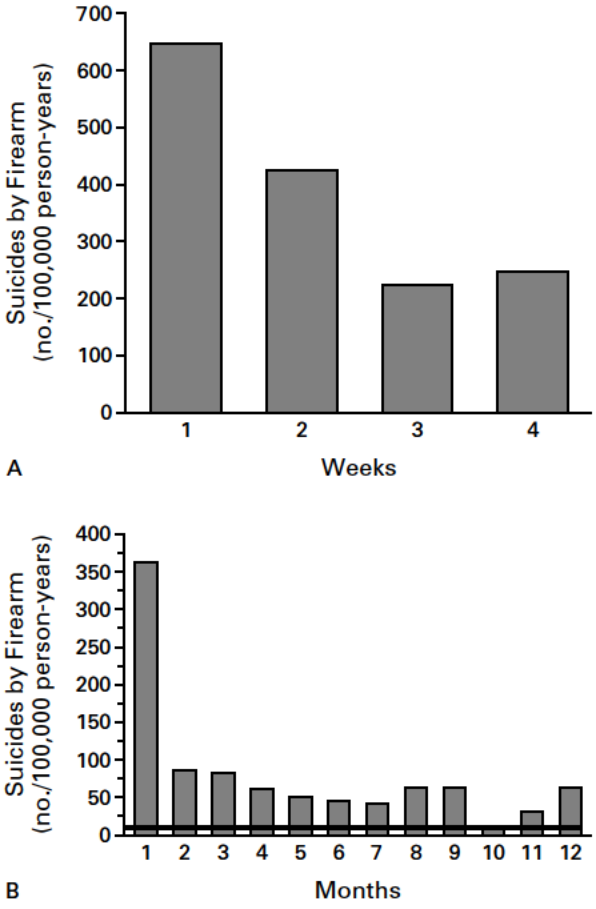

Figure 1. Rates of Suicide by Firearm in the First Four Weeks (Panel A) and the First Year (Panel B) after Purchase among Persons Who Purchased Handguns in California in 1991.

The horizontal line in Panel B indicates the age- and sex-adjusted average annual rate of suicide by firearm in California in 1991 and 1992 (11.3 per 100,000 persons per year).

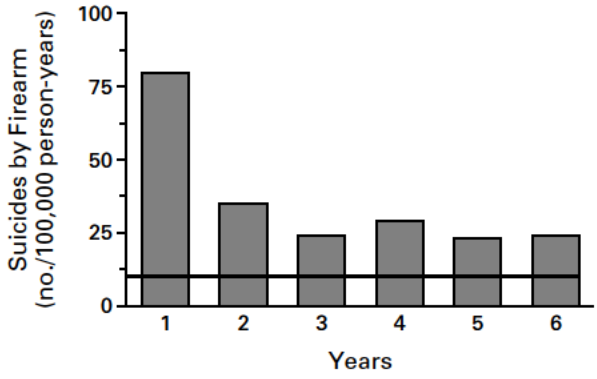

Figure 2. Rates of Suicide by Firearm during the Six Years after Purchase among Persons Who Purchased Handguns in California in 1991.

The horizontal line indicates the age- and sex-adjusted average annual rate of suicide by firearm in California in 1991 through 1996 (10.7 per 100,000 persons per year).

TABLE 4. STANDARDIZED MORTALITY RATIOS FOR SUICIDE AND HOMICIDE AMONG HANDGUN PURCHASERS DURING UP TO SIX YEARS' OBSERVATION AFTER PURCHASE IN 1991 (1991 THROUGH 1996), AS COMPARED WITH AVERAGE MORTALITY FROM SUICIDE AND HOMICIDE AMONG ALL ADULTS IN CALIFORNIA IN 1991 THROUGH 1996.

CHARACTERISTIC	SUICIDE			HOMICIDE		
	ALL METHODS	FIREARMS	OTHER METHODS	ALL METHODS	FIREARMS	OTHER METHODS
Total*	2.16	3.50	0.66	0.67	0.81	0.22
Sex†						
Male	1.98	3.23	0.56	0.64	0.79	0.18
Female	6.83	15.50	2.54	1.55	2.01	0.97
Age (yr)‡						
21–24	2.53	3.97	0.67	0.68	0.78	0.00
25–34	1.69	2.75	0.66	0.60	0.70	0.20
35–44	1.89	3.28	0.73	0.62	0.80	0.22
45–54	2.01	3.34	0.54	0.88	1 22	0.32
55–64	2.71	4.00	0.47	1.10	1.70	0.29
65–74	3.70	4.58	1.32	1.68	2.70	0.78
⩾75	5.49	7.33	0.51	0.00	0.00	0.00

*Values have been adjusted for age and sex.

†Values have been adjusted for age.

‡Values have been adjusted for sex.

homicide were little changed (Table 4). Women who purchased a handgun remained at high risk for both suicide by means of a firearm (standardized mortality ratio, 15.50) and death by homicide with a firearm (standardized mortality ratio, 2.01).

Men remained at decreased risk of death from causes other than suicide or homicide and from all causes combined (standardized mortality ratio, 0.69). Mortality from all causes was no longer increased for women overall (standardized mortality ratio, 0.94), but it remained greater than expected for women 21 to 44 years old (standardized mortality ratio, 1.43); 71.4 percent of this increase was attributable to excess deaths from suicide and homicide, and 49.6 percent was attributable specifically to suicide by firearm.

DISCUSSION

The purchase of a handgun is associated with substantial changes in the risk of violent death. Among people who purchased a handgun in California in 1991, suicide was the leading cause of death in the first year after the purchase; suicide specifically with a firearm ranked second, after heart disease. The rate of suicide by firearm among handgun purchasers during the first week in which they could have had possession of their handguns, at 644 per 100,000 person-years, was similar to rates of suicide by all methods combined among male veterans who had been hospitalized for affective disorders (695 per 100,000 per-

sons per year) or schizophrenia (456 per 100,000 persons per year).[16]

The increased risk of death associated with the purchase of a handgun resulted specifically from an increased risk of violent death; there were fewer deaths than expected from other causes among both men and women who purchased handguns. This finding is most likely due to an affluent-gun-buyer effect. The prevalence of handgun ownership rises with socioeconomic status,[3] and increasing socioeconomic status is associated with a lower risk of death from most causes.[17] Persons who in any year spend as much as $600 to purchase handguns are even more likely than other handgun owners to be of higher socioeconomic status than the general population. The risk of suicide generally decreases as socioeconomic status increases, however,[18-20] suggesting that adjustment for socioeconomic status might reveal the increase in the risk of suicide after a handgun purchase to be even larger than we report here.

Two distinct explanations may be proposed for the increased risk of suicide by firearm among recent purchasers of handguns. The near absence of suicides by firearm during the waiting period and the marked increase in the first month after the end of the waiting period suggest that some purchasers owned no other firearms and bought handguns with the intention of killing themselves. Most suicides by firearm occurred after a longer period of ownership, however. In these cases, preexisting access to a handgun may have added to other newly arising risk factors. This possibility would be consistent with the finding that fewer than 10 percent of persons who committed or attempted suicide with a firearm acquired the firearm for that purpose.[21-23]

Some suicides that occurred soon after purchase may have been planned by persons with terminal illnesses so as to avoid further suffering. Our data suggest that this circumstance was not common, however. If it were, some persons who initiated such plans would probably not have completed them, and an increase in early deaths from cancer and heart disease, which we did not observe, would have resulted. On the contrary, studies of survivors suggest that suicide by means of a firearm usually occurs impulsively; alcohol use and conflict with an intimate partner are often involved.[21,23,24]

Our finding that the risk of death from homicide was lower among male purchasers of handguns than among men in the general population appears to conflict with findings in previous studies.[8,11] Differences in study populations may be responsible. The previous studies were based on current ownership of firearms, whereas we focused on the recent legal purchase of handguns. The presumably high socioeconomic status of our study population relative to that of the general population would lessen the risk of homicide[25,26]; the previous studies sought to minimize differences in socioeconomic status. The handgun purchasers in our cohort also passed a background check; none had a conviction for any felony or violent misdemeanor or were known to have been judged mentally ill or to be addicted to controlled substances. The absence of such potential risk factors for death by homicide means that our estimates may be subject to a "good boy" bias.[27] Finally, in the previous studies, the risk of death by homicide for persons in households with firearms was compared with the risk for persons in households without firearms. We compared this risk among recent purchasers of handguns with that in a general population in which the prevalence of handgun ownership may have been 25 percent after adjustment for sex.[2,3] If any access to handguns increases the risk of death by homicide,[8,11] then our estimate of the relative risk of death by homicide among recent handgun purchasers is artifactually low.

The findings for women are striking and suggest an additional, sex-specific link between handgun purchase and violent death. Women are at greater risk for death by homicide committed by an intimate partner with a firearm than by a stranger with all methods combined.[28] Homicide committed by an intimate partner accounts for the increased risk among women of death by homicide when there is a firearm in the home.[9,11] It may be that many women purchase handguns for protection against violence from an intimate partner and that these handguns are used by the partners against them or are at any rate not protective. Women in abusive relationships are also at increased risk for suicide.[9,21,29]

How might suicide among purchasers of handguns be prevented? Focusing efforts on a population at high risk does not substantially reduce rates of suicide.[30-32] As noted in one report, "there is no single, readily identifiable, high-risk population that constitutes a sizeable proportion of overall suicides and yet represents a small, easily targeted group."[30] In our study, handgun purchasers accounted for only 10.3 percent of those who committed suicide by firearm statewide in the year after their handgun purchases and accounted for a smaller proportion thereafter. A screening test for handgun purchasers with a sensitivity and specificity of 99 percent for identifying the 188 persons who committed suicide by means of a firearm within a year would have had a positive predictive value of only 7.2 percent, generating 12.8 false positive results for every true positive.

Reducing access to firearms within an entire population can prevent suicides by firearm.[30-37] Rates of suicide by firearm correlate very closely, both geographically and temporally, with measures of the availability of firearms.[33,38-40] In cross-sectional studies, stricter controls on access to firearms have been found to be associated with lower rates of suicide by firearm.[33,40,41] In New York City, where handgun own-

ership has been strictly regulated since the early 20th century, rates of suicide by firearm are very low; rates of suicide by other methods vary directly with the availability of those methods.[42]

More direct evidence comes from time-series studies. A near-ban on the sale and possession of handguns in Washington, D.C., was associated with a rapid and specific 25 percent decrease in the rate of suicide by firearm.[43] Substantial decreases in suicides by firearm were reported in Queensland[34] and Tasmania,[36] Australia, and in Ontario, Canada,[35] after waiting periods of 21 to 28 days and other restrictions on access to firearms were adopted, although in Queensland there was an increase in suicide by other methods. Tasmania's 21-day waiting period resulted in a 51 percent decrease in the proportion of suicides involving firearms that were committed with recently acquired firearms.[36]

Our findings are subject to several limitations. Results may be different in states where demographic features of the population, the base-line prevalence of firearm ownership, or public policy differs from that in California. New York and New Jersey enforce long waiting periods for the purchase of a handgun, and the very high rates of suicide that we observed in the period immediately after purchase may not occur in those states. Conversely, rates of suicide by firearm soon after purchase may be still higher in the 23 states that, because they have no stronger state law, are subject to the Brady Handgun Violence Prevention Act, where waiting periods for most purchases of firearms from licensed dealers were replaced by the National Instant Check System in November 1998.[44]

Policy differences at the state level also affect eligibility to purchase firearms. Few states deny firearms to persons with previous convictions for violent misdemeanors. Since a history of violence or aggression is a risk factor for both suicide[7,9,18,19,45] and homicide,[9,11,46] the risk of violent death associated with recent purchase of a handgun may be higher in most states than we observed in California.

It should be emphasized that we did not compare the risk of death between people who owned firearms and people who did not. If firearm ownership is a risk factor for violent death,[7-9,11] we have underestimated the risk of both suicide and homicide associated with the purchase of a handgun by a person who did not previously own a firearm.

We cannot determine the extent to which increases or decreases in the risk of violent death are attributable specifically to the purchase of a handgun, since we lack information about other risk factors. In addition to a history of violence, alcohol and drug abuse and psychiatric disorders are risk factors for both suicide and homicide.[16,46-48] An increased risk of suicide by firearm might be due to an increased prevalence of these risk factors among handgun purchasers, and not due to the handgun purchase itself. On the other hand, such risk factors may be less common among persons who have recently passed a background check than they are in the general population; this difference might account for the lower risk of death by homicide among men who have recently purchased a handgun than among men in the general population.

We do not know whether the handguns purchased by persons in our study cohort were actually involved in the deaths we analyzed. However, the percentages of firearm-related suicides and homicides that involved handguns were much higher among handgun purchasers than in the state as a whole.

In 1997, suicide by firearm accounted for 54.2 percent of all deaths by firearm nationwide; firearms were used in 62.0 percent of suicides among men and 39.3 percent among women.[49] Suicide by firearm may be most effectively prevented by reducing overall access to firearms. (Unfortunately, however, reduction in access to the means to commit suicide is not among the interventions included in the 1999 *Surgeon General's Call to Action to Prevent Suicide*.[50]) Rates of death by both suicide and homicide among handgun purchasers might also be reduced by prohibiting those with risk factors such as a history of violence or alcohol and drug abuse from purchasing handguns.

A substantial percentage of persons who commit suicide seek medical attention shortly before death.[30] Clinicians need to identify persons who are at acute risk for suicide and to intervene appropriately.[30,51] A patient's declaration of intent to purchase a handgun may also be an indication to determine whether other risk factors for violent death are present.

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EXHIBIT 19

ORIGINAL ARTICLE

Association between handgun purchase and mortality from firearm injury

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Objective: To determine the association between mortality from violent or firearm related injury and previous handgun purchase.
Methods: Case-control study of 213 466 Californians ages 21 and older who died in 1998; cases were the 4728 violent or firearm related injury deaths, with subsets by specific cause and means of death, and controls were the 208 738 non-injury deaths. The exposure of interest was the purchase of a handgun during 1996–98. The main outcome measure was the odds ratio for handgun purchase, adjusted for age, sex, race, education, and marital status.
Results: Handgun purchase was more common among persons dying from suicide (odds ratio (OR) 6.8; 95% confidence interval (CI) 5.7 to 8.1) or homicide (OR 2.4, 95% CI 1.6 to 3.7), and particularly among those dying from gun suicide (OR 12.5; 95% CI 10.4 to 15.0) or gun homicide (OR 3.3; 95% CI 2.1 to 5.3), than among controls. No such differences were seen for non-gun suicide or homicide. Among women, those dying from gun suicide were much more likely than controls to have purchased a handgun (OR 109.8; 95% CI 61.6 to 195.7). Handgun purchasers accounted for less than 1% of the study population but 2.4% of gun homicides, 14.2% of gun suicides, and 16.7% of unintentional gun deaths. Gun suicide made up 18.9% of deaths among purchasers but only 0.6% of deaths among non-purchasers.
Conclusion: Among adults who died in California in 1998, those dying from violence were more likely than those dying from non-injury causes to have purchased a handgun.

Although firearm mortality rates in the United States have decreased since 1993, firearms accounted for 28 663 deaths in 2000 and ranked 11th among all causes of death.[1] Gun homicide rates have fallen dramatically in the last decade,[2] but gun suicide rates have seen little change. In 2000 there were 16 586 gun suicides among persons age 21 and older, outnumbering the 10 801 gun homicides by 54%.[1]

Case-control studies find that gun availability increases risk of homicide,[3–6] while one cohort study finds this to be true for women, but not for men.[7] With one exception,[8] studies of suicide have consistently shown that the risk of suicide increases when a firearm is available.[3 5–7 9] The majority of these studies, however, inferred a passive exposure to a handgun (for example, a handgun present in the home). Little is known about the relationship between handgun purchase itself—the conscious decision to undergo a sustained close exposure to firearms—and subsequent risk of violent or firearm related mortality.

In a cohort study of handgun purchasers in California in 1991, the purchase of a handgun was associated with a substantial increase in risk of firearm suicide that was present within a week of purchase and persisted for at least six years.[7] The continuing decline in overall rates of firearm related death since that study was conducted may have affected the association between handgun purchase and mortality. In addition, that earlier study left several important questions unanswered: Among those who die from gun violence, particularly suicide, what proportion have recently purchased a handgun? Are very recent handgun purchasers most likely to die from violence, especially firearm related violence?

To answer these questions, we performed a case-control study of all people age 21 and older who died in California in 1998. Our hypothesis was that people dying from violence, and especially firearm related violence, were more likely to have bought a handgun in the three years before their death than those who died from non-injury causes. We also hypothesized that those who died from violence were much more likely to have bought a handgun very recently—within one year of death—than were those who died from non-injury causes. We also compared the prevalence and ranking of deaths from violence and firearm related injury among handgun purchasers and non-purchasers.

METHODS

California's automated Death Statistical Master File contains information on all deaths that occur in the state. We used this file to identify all persons age 21 and older who died in California in 1998 (n=221 317). The file provided information on sex, age, race, marital status, years of education, date of birth, date of death, and cause of death (*International Classification of Diseases*, 9th revision, codes including four digit E codes).[10] We used California's state handgun purchase data from 1996–98 to identify handgun purchasers. The handgun purchase data contain records of all legal handgun purchases made from licensed California firearm retailers. Handgun sales between private parties would be included in these data if they were conducted legally, as California law requires all such sales to go through a licensed retailer. Any private sales or transfers not going through a licensed retailer would not appear in the purchase data.

The mortality file was joined with the purchase data by matching on last name and date of birth. Apparent matches were manually reviewed and verified using additional data such as sex, place of birth, and middle name. Subjects in the mortality file with no match in the purchase data were considered not to have purchased a handgun within three years of death.

Abbreviations: CI, confidence interval; OR, odds ratio

We used a case-control study design, rather than a proportional mortality design, to enhance the validity of the study.[11 12] As recommended by Rothman and Greenland[11] and Miettinen and Wang,[12] cases in such a design are persons who died from the causes of death that are being investigated. In selecting controls, it is then important to exclude persons for whose causes of death an association with the exposure of interest is "known, suspected, or merely plausible" (Rothman and Greenland, p 77[11]).

In applying that principle to selecting controls for this study, we noted that firearm ownership generally,[13] the ownership of semiautomatic and automatic firearms specifically,[14] and carrying a firearm on one's person[15] are all associated with abusive consumption of alcohol. As alcohol abuse is one of the most important risk factors for death from unintentional injury, we considered it likely that handgun purchase is associated, though perhaps indirectly, with risk for an unintentional injury death. We therefore excluded from our control population persons who died from unintentional injuries, such as motor vehicle crashes and falls (n=7617). We also excluded persons who died from injuries of undetermined intent (n=185), legal intervention (n=47), and injuries resulting from operations of war (n=2).

The main outcome measure for the study is the exposure odds ratio: the odds of having purchased a handgun before death among cases relative to controls. We used logistic regression to calculate odds ratios and 95% confidence intervals, which we adjusted for age, sex, race, education, and marital status. Age was treated as a categorical variable (table 1). We developed multiple models to compare subsets of our case population with the control group. These subsets included persons who died of any intentional violence, homicide, suicide, and unintentional firearm deaths. We stratified subsets related to violence by whether or not deaths were firearm related. The control population remained constant across all comparisons.

RESULTS

A total of 213 466 people age 21 and older who died in California in 1998 made up our study population: 4728 cases died from a violent or firearm related injury (2.2% of the study population), and 208 738 controls died from non-injury causes (97.8% of the study population) (table 1). The 1162 persons (0.5% of the study population) who were known to have purchased a handgun between 1996 and 1998 were considered to have sustained the exposure of interest.

Men accounted for 79.3% of cases but only 48.8% of controls (table 1). Those who died from violent or firearm related injury were younger (mean age 44.6) than those who died from non-injury causes (mean age 74.7). There were much higher proportions of Hispanics and black people and a lower proportion of white people among cases compared with controls. There was little difference in educational history between the two groups, but those dying from violent or firearm related injury were more likely to be single or divorced, and less likely to be married or widowed, than were those dying from non-injury causes.

Persons who died from intentional violence were more likely than those who died from non-injury causes to have purchased a handgun (odds ratio (OR) 5.7; 95% confidence interval (CI) 4.8 to 6.8) (table 2). This was also true for the subsets of cases dying from suicide (OR 6.8; 95% CI 5.7 to 8.1) and homicide (OR 2.4; 95% CI 1.6 to 3.7), and particularly for those dying from gun suicide (OR 12.5; 95% CI 10.4 to 15.0) or gun homicide (OR 3.3; 95% CI 2.1 to 5.3). No such difference was seen for cases dying from non-gun suicide or homicide.

Very recent handgun purchase, defined as purchase within one year of death, was strongly associated with violent or firearm related injury death (table 3). This was again the case for both suicide (OR 12.5; 95% CI 10.0 to 15.6) and homicide (OR 3.9; 95% CI 2.2 to 6.8), and particularly gun suicide (OR 22.7; 95% CI 18.2 to 28.4) and gun homicide (OR 5.8; 95% CI 3.1 to 10.8).

Table 1 Characteristics of Californians age 21 and older who died in 1998; results are number (%)

Characteristics	Violent injury death (n=4728)	Non-injury death (n=208738)
Purchaser*		
Yes	275 (5.8)	887 (0.4)
No	4453 (94.2)	207 851 (99.6)
Recent purchaser†		
Yes	200 (4.2)	369 (0.2)
No	4528 (95.8)	208 369 (99.8)
Sex		
Male	3748 (79.3)	101 864 (48.8)
Female	980 (20.7)	106 874 (51.2)
Age		
21–24	553 (11.7)	410 (0.2)
25–34	1113 (23.5)	2311 (1.1)
35–44	1097 (23.2)	6800 (3.3)
45–54	744 (15.7)	13 473 (6.5)
55–64	417 (8.8)	21 394 (10.2)
65–74	340 (7.2)	42 075 (20.2)
≥75	464 (9.8)	122 275 (58.6)
Race		
White	2788 (59.0)	158 063 (75.7)
Hispanic	1003 (21.2)	21 803 (10.4)
Black	578 (12.2)	15 563 (7.5)
Asian	283 (6.0)	11 483 (5.5)
Other, unknown	76 (1.6)	1826 (0.9)
Years of education		
<12	1079 (22.8)	53 946 (25.8)
12	1792 (37.9)	79 490 (38.1)
13–15	884 (18.7)	35 259 (16.9)
16	503 (10.6)	20 689 (9.9)
≥17	314 (6.6)	12 729 (6.1)
Unknown	156 (3.3)	6625 (3.2)
Marital status		
Married	1705 (36.1)	86 231 (41.3)
Single	1718 (36.3)	16 326 (7.8)
Divorced	833 (17.6)	25 976 (12.4)
Widowed	381 (8.1)	78 623 (37.7)
Unknown	91 (1.9)	1582 (0.8)

*Purchased a handgun between 1996 and 1998.
†Purchased a handgun within one year of death.

The association between handgun purchase and violent death was stronger among women than in the study population as a whole (table 4). In particular, women who died from gun suicide were much more likely to have purchased a handgun than women who died from non-injury causes (OR 109.8; 95% CI 61.6 to 195.7). Since 79.3% (3748 of 4728) of the cases were men, odds ratios for men were very similar to those for all cases and are not shown separately.

Almost 22% (252 of 1162) of deaths among handgun purchasers were firearm related. Gun suicide accounted for 18.9% of deaths among handgun purchasers and 0.6% of deaths among non-purchasers. Gun suicide was the third leading cause of death among male handgun purchasers, accounting for 17.5% of all deaths (188 of 1076), but made up only 1.1% of deaths among male non-purchasers (1155 of 104 536). Gun suicide was the leading cause of death for female purchasers and accounted for 37.2% of all deaths in that group (32 of 86), but accounted for only 0.2% of deaths among female non-purchasers (171 of 107 768). Gun suicide was also the leading cause of death among persons who purchased a handgun within one year of death, accounting for 29.3% of all deaths in that population (167 of 569).

Handgun purchasers made up just 0.5% of our study population (1162 of 213 466 persons), but accounted for 5.8% of all violent deaths (275 of 4728), 7.8% of suicides (237 of 3035), and 1.9% of homicides (32 of 1657). Similarly, purchasers accounted for 14.2% of gun suicides (220 of 1546), 2.4% of gun homicides (26 of 1102), and 16.7% of unintentional gun deaths (six of 36). Of all handgun purchasers who died in 1998, 48.9% (569 of 1162) bought a handgun within one year of their deaths.

Table 2 Crude and adjusted odds ratios for handgun purchase within three years of death among Californians age 21 and older who died from selected injury causes in 1998, compared with persons who died from non-injury causes

	No exposed/No unexposed		Odds ratios (95% confidence intervals)		
Cause of death	Cases	Controls	Unadjusted	Adjusted*	p Value
Intentional violence†	269/4423	887/207 851	14.3 (12.4 to 16.4)	5.7 (4.8 to 6.8)	<0.001
Any gun injury	252/2432	887/207 851	24.3 (21.0 to 28.1)	10.2 (8.5 to 12.2)	<0.001
Suicide	237/2798	887/207 851	19.8 (17.1 to 23.0)	6.8 (5.7 to 8.1)	<0.001
Gun suicide	220/1326	887/207 851	38.9 (33.2 to 45.5)	12.5 (10.4 to 15.0)	<0.001
Non-gun suicide	17/1472	887/207 851	2.7 (1.7 to 4.4)	0.9 (0.6 to 1.6)	0.814
Homicide	32/1625	887/207 851	4.6 (3.2 to 6.6)	2.4 (1.6 to 3.7)	<0.001
Gun homicide	26/1076	887/207 851	5.7 (3.8 to 8.4)	3.3 (2.1 to 5.3)	<0.001
Non-gun homicide	6/549	887/207 851	2.6 (1.1 to 5.7)	1.3 (0.6 to 2.9)	0.551
Gun unintentional	6/30	887/207 851	46.9 (19.5 to 112.9)	18.5 (7.0 to 48.6)	<0.001

*Adjusted for age, sex, race, education, and marital status.
†Combines homicide and suicide.

Table 3 Crude and adjusted odds ratios for handgun purchase within one year of death among Californians age 21 and older who died from selected injury causes in 1998, compared with persons who died from non-injury causes

	No exposed/No unexposed		Odds ratios (95% confidence intervals)		
Cause of death	Cases	Controls	Unadjusted	Adjusted*	p Value
Intentional violence†	197/4495	369/208 369	24.7 (20.8 to 29.5)	10.7 (8.6 to 13.4)	<0.001
Any gun injury	185/2499	369/208 369	41.8 (34.9 to 50.1)	19.3 (15.4 to 24.2)	<0.001
Suicide	179/2856	369/208 369	35.4 (29.5 to 42.5)	12.5 (10.0 to 15.6)	<0.001
Gun suicide	167/1379	369/208 369	68.4 (56.5 to 82.7)	22.7 (18.2 to 28.4)	<0.001
Non-gun suicide	12/1477	369/208 369	4.6 (2.6 to 8.2)	1.6 (0.9 to 3.0)	0.130
Homicide	18/1639	369/208 369	6.2 (3.9 to 10.0)	3.9 (2.2 to 6.8)	<0.001
Gun homicide	15/1087	369/208 369	7.8 (4.6 to 13.1)	5.8 (3.1 to 10.8)	<0.001
Non-gun homicide	3/552	369/208 369	3.1 (1.0 to 9.6)	1.8 (0.6 to 5.9)	0.308
Gun unintentional	3/33	369/208 369	51.3 (15.7 to 168.1)	19.6 (5.4 to 70.5)	<0.001

*Adjusted for age, sex, race, education, and marital status.
†Combines homicide and suicide.

Table 4 Crude and adjusted odds ratios for handgun purchase within three years of death among female Californians age 21 and older who died from selected injury causes in 1998, compared with women who died from non-injury causes

	No exposed/No unexposed		Odds ratios (95% confidence intervals)		
Cause of death	Cases	Controls	Unadjusted	Adjusted*	p Value
Intentional violence†	37/942	49/106 825	85.6 (55.6 to 131.9)	26.2 (15.0 to 45.8)	<0.001
Any gun injury	32/323	49/106 825	216.0 (136.5 to 341.7)	73.2 (41.0 to 130.7)	<0.001
Suicide	36/635	49/106 825	123.6 (79.8 to 191.4)	33.9 (19.3 to 59.3)	<0.001
Gun suicide	32/171	49/106 825	408.0 (255.0 to 652.8)	109.8 (61.6 to 195.7)	<0.001
Non-gun suicide	4/464	49/106 825	18.8 (6.8 to 52.3)	4.6 (1.5 to 14.5)	0.009
Homicide	1/307	49/106 825	7.1 (1.0 to 51.6)	2.5 (0.3 to 20.1)	0.400
Gun homicide	0/151	49/106 825	–	–	–
Non-gun homicide	1/156	49/106 825	14.0 (1.9 to 101.8)	4.0 (0.5 to 32.8)	0.195
Gun unintentional	0/1	49/106 825	–	–	–

*Adjusted for age, race, education, and marital status.
†Combines homicide and suicide.

DISCUSSION

Among Californians who died in 1998, those whose deaths resulted from violence or firearm related injury were more likely than those who died from non-injury causes to have purchased a handgun between 1996 and 1998. While this association was strongest among persons dying from suicide, there was no evidence that the purchase of a handgun produced a protective effect against homicide; homicide victims were also more likely to have purchased a handgun than those dying from non-injury causes. Over one fifth of deaths among handgun purchasers, but just 1.1% of deaths among non-purchasers, were from gun related injury—an increase that was attributable almost entirely to an increase in gun suicide. Handgun purchasers constituted just 0.5% of our study population, but they committed 14.2% of gun suicides.

Among women, the association between violent death and handgun purchase was remarkably strong, again due largely to gun suicide. Although the number of female purchasers in our study population was small, these results should not be dismissed. Handgun manufacturers have recently increased the marketing of guns to women by touting the protection handguns may provide them.[16] Our findings show, however, that women who died from violence were more likely, not less, to have purchased a handgun within the three years before death.

For three reasons, our findings probably underestimate the association between violent or firearm related death and prior purchase of a handgun. First, although our non-purchasers had not bought a handgun from a licensed California gun retailer within three years before their deaths, they could have

done so earlier. They could also have recently purchased a handgun from a source other than a licensed retailer without producing a record of the transaction. This has been illegal in California since 1991, but we believe it occurs frequently: perhaps 40% of all transfers of firearms are between private parties,[17 18] but less than 10% of sales records forwarded to the California Department of Justice are for such private party sales (unpublished data on file with the authors). Second, non-purchasers could be passively exposed to guns. Some 35% to 40% of all households in the United States have a gun, and as many as 25% have a handgun.[18–21] Even passive exposure appears to increase the risk of a gun related death and therefore would increase the risk of dying by gun violence in our non-purchasing population.[4–6 9] Our odds ratios are therefore probably lower than would be observed if handgun exposure, whether by personal acquisition or passively, could be measured perfectly.

Third, we are unable to eliminate completely from our control population persons dying from causes of death that are "plausibly" (Rothman and Greenland, p 77[11]) related to our exposure of interest. Alcohol abuse, for which an association with both gun use and unintentional injury death led us to exclude injury deaths from our control group, is also related to death from some forms of cancer and cardiovascular disease and other causes—though the attributable risk is both less in absolute terms and not as predominant as it is for unintentional injury. Handgun purchase may be indirectly associated with many causes of death if it is associated with other common behavioral risk factors; including these causes of death in our control population is another source of conservative bias in our estimates of association.

Our results are subject to other limitations. Since all members of our study population died, we could not estimate the actual risk of dying from gun related causes. We do not know if the gun deaths of the purchasers in our study population involved the handguns they bought between 1996 and 1998, nor do we know if any purchasers resold their guns before death and were no longer exposed. The study population does not include persons less than 21 years of age, because they are prohibited from purchasing a handgun. We measured the effect a handgun purchase had on causes of death among purchasers who died in 1998, not on other members of their households.

We also did not have data for attributes such as mental illness, isolation, alcohol and other drug abuse, exposure to violence, and a prior criminal history, that earlier studies have found to have a relationship, independent of household gun ownership, to risk for homicide or suicide.[4–6] It is important to note that those studies used live controls. In this study, where all subjects died and case-control assignment was made on cause of death, not vital status, the relationship between such attributes and the primary exposure and outcome of interest could be quite different.

Because our data allowed us to measure the effects of an individual's decision to assume the risks associated with handgun ownership, the results of this study differ from those of past case-control studies. With one exception,[3] previous studies only measured the risk of a passive exposure to a handgun present in the household.[4–6 9] In addition, this study focused on recent exposure to a handgun, whereas exposure in all other studies but one[3] was of unknown duration.

Our findings document a very strong association between handgun purchase and subsequent gun suicide. There are few evidence based solutions to the problem of suicide. It would, for example, be difficult to screen potential gun buyers for suicide risk factors.[7] General restrictions on handgun ownership, on the other hand, have been found to reduce gun suicide rates without an increase in suicide by other means.[22] Since those who die from gun suicide are likely to have been recent handgun purchasers, it is possible that an extended waiting period could have a "cooling off" effect.[23–25] It is also possible, however, that this "cooling off" period would only delay suicides, not prevent them. Temporary prohibitions on gun purchase by persons who have been involuntarily hospitalized for mental health reasons, a policy that was recently adopted in California, may be of some benefit.

Key points

- Among adults dying in California in 1998, a handgun purchase during 1996–98 was more common among persons dying from suicide (OR 6.8), gun suicide (OR 12.5), homicide (OR 2.4), and gun homicide (OR 3.3) than among those dying from non-injury causes.
- Among women, handgun purchase was much more common among those dying from suicide (OR 33.9) and gun suicide (OR 109.8). Gun suicide accounted for 37.2% of all deaths among women who purchased handguns.
- Persons who bought a handgun during 1996–98 made up 0.5% of those who died in 1998, but accounted for 5.8% of all violent deaths, 2.4% of gun homicides, 14.2% of gun suicides, and 16.7% of unintentional gun deaths.
- Gun suicide accounted for 18.9% of deaths among handgun purchasers and 0.6% of deaths among non-purchasers.

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LACUNAE

Zipper slips suffered in silence

They may be the tip, so to speak, of a very substantial iceberg. The 13 men and boys who have fronted up to Queensland hospitals in the past four years with trouser-zipper injuries to the penis are probably outnumbered many times by those who bear their affliction privately.

Richard Hockey, data analyst at the Queensland Injury Surveillance Unit, reveals that "people probably try to treat themselves first". "The embarrassment factor might put you off", he said.

Mr Hockey said he was surprised to discover that trapped genitals were far and away the leading cause of clothing related injury when he analysed emergency department statistics from 1998 to 2001. It could be a subtropical issue, Mr Hockey said. "Maybe it is seasonal. In the hotter weather, anecdotally, people are going without underpants. Perhaps it is now time to return to button flies".

In total, clothes were implicated in 81 injuries, including finger dislocations from putting on or removing socks, and fractures sustained in falls during that tricky stage when one leg is in the pants and the other is trying to locate the other hole.

Dressing was a highly personal ritual, Mr Hockey said, and one, perhaps, that people did not adapt sufficiently to with their age, mobility, and health. "People keep on doing it the same way, but maybe when they are a bit older can't reach their feet as well" (from the *Sydney Morning Herald*. Contributed by Richard Hockey).

Mike Hayes, *Injury Prevention* deputy editor adds: A similar cause of injury to children showed up several years ago when we undertook work on clothing safety for the UK's Department of Trade and Industry. I would not describe the UK as tropical!

IP

Association between handgun purchase and mortality from firearm injury

K M Grassel, G J Wintemute, M A Wright and M P Romero

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Notes

EXHIBIT 20

The NEW ENGLAND JOURNAL of MEDICINE

Perspective

SEPTEMBER 4, 2008

Guns and Suicide in the United States

Matthew Miller, M.D., Sc.D., and David Hemenway, Ph.D.

This past June, in a 5-to-4 decision in *District of Columbia v. Heller*, the Supreme Court struck down a ban on handgun ownership in the nation's capital and ruled that the District's law requiring all firearms in the home to be locked violated the Second Amendment. But the Supreme Court's finding of a Second Amendment right to have a handgun in the home does not mean that it is a wise decision to own a gun or to keep it easily accessible. Deciding whether to own a gun entails balancing potential benefits and risks. One of the risks for which the empirical evidence is strongest,[1] and the risk whose death toll is greatest, is that of completed suicide.

In 2005, the most recent year for which mortality data are available, suicide was the second-leading cause of death among Americans 40 years of age or younger. Among Americans of all ages, more than half of all suicides are gun suicides. In 2005, an average of 46 Americans per day committed suicide with a firearm, accounting for 53% of all completed suicides. Gun suicide during this period accounted for 40% more deaths than gun homicide.

Why might the availability of firearms increase the risk of suicide in the United States? First, many suicidal acts — one third to four fifths of all suicide attempts, according to studies — are impulsive. Among people who made near-lethal suicide attempts, for example, 24% took less than 5 minutes between the decision to kill themselves and the actual attempt, and 70% took less than 1 hour.[2]

Second, many suicidal crises are self-limiting. Such crises are often caused by an immediate stressor, such as the breakup of a romantic relationship, the loss of a job, or a run-in with police. As the acute phase of the crisis passes, so does the urge to attempt suicide. The temporary nature and fleeting sway of many suicidal crises is evident in the fact that more than 90% of people who survive a suicide attempt, including attempts that were expected to be lethal (such as shooting oneself in the head or jumping in front of a train), do not go on to die by suicide. Indeed, recognizing the self-limiting nature of suicidal crises, penal and psychiatric institutions restrict access to lethal means for persons identified as potentially suicidal.

Third, guns are common in

the United States (more than one third of U.S. households contain a firearm) and are lethal. A suicide attempt with a firearm rarely affords a second chance. Attempts involving drugs or cutting, which account for more than 90% of all suicidal acts, prove fatal far less often.

The empirical evidence linking suicide risk in the United States to the presence of firearms in the home is compelling.[3] There are at least a dozen U.S. case–control studies in the peer-reviewed literature, all of which have found that a gun in the home is associated with an increased risk of suicide. The increase in risk is large, typically 2 to 10 times that in homes without guns, depending on the sample population (e.g., adolescents vs. older adults) and on the way in which the firearms were stored. The association between guns in the home and the risk of suicide is due entirely to a large increase in the risk of suicide by firearm that is not counterbalanced by a reduced risk of nonfirearm suicide. Moreover, the increased risk of suicide is not explained by increased psychopathologic characteristics, suicidal ideation, or suicide attempts among members of gun-owning households.

Three additional findings from the case–control studies are worth noting. The higher risk of suicide in homes with firearms applies not only to the gun owner but also to the gun owner's spouse and children. The presence of a gun in the home, no matter how the gun is stored, is a risk factor for completed suicide. And there is a hierarchy of suicide risk consistent with a dose–response relationship. How household guns are stored matters especially for young people — for example, one study found that adolescent suicide was four times as likely in homes with a loaded, unlocked firearm as in homes where guns were stored unloaded and locked.

Data on Suicides in States with the Highest and Lowest Rates of Gun Ownership, 2001–2005.*

Variable	States with the Highest Rates of Gun Ownership	States with the Lowest Rates of Gun Ownership	Ratio of Mortality Rates
Person-years	195 million	200 million	
Percent of households with guns	47	15	
Male			
No. of firearm suicides	14,365	3,971	3.7
No. of nonfirearm suicides	6,573	6,781	1.0
Total no.	20,938	10,752	2.0
Female			
No. of firearm suicides	2,212	286	7.9
No. of nonfirearm suicides	2,599	2,478	1.1
Total no.	4,811	2,764	1.8

* The states with the highest rates of gun ownership included here are Wyoming, South Dakota, Alaska, West Virginia, Montana, Arkansas, Mississippi, Idaho, North Dakota, Alabama, Kentucky, Wisconsin, Louisiana, Tennessee, and Utah. The states with the lowest rates of gun ownership included here are Hawaii, Massachusetts, Rhode Island, New Jersey, Connecticut, and New York. Data on gun ownership are from the 2001 Behavioral Risk Factor Surveillance System. Data on suicides are from the Centers for Disease Control and Prevention Web-Based Injury Statistics Query and Reporting System (WISQARS; www.cdc.gov/ncipc/wisqars).

Many ecologic studies covering multiple regions, states, or cities in the United States have also shown a strong association between rates of household gun ownership and rates of completed suicide — attributable, as found in the case–control studies, to the strong association between gun prevalence and gun suicide, without a counterbalancing association between gun-ownership levels and rates of nongun suicide. We recently examined the relationship between rates of household gun ownership and suicide in each of the 50 states for the period between 2000 and 2002.[4] We used data on gun ownership from a large telephone survey (of more than 200,000 respondents) and controlled for rates of poverty, urbanization, unemployment, mental illness, and drug and alcohol dependence and abuse. Among men, among women, and in every age group (including children), states with higher rates of household gun ownership had higher rates of firearm suicide and overall suicides. There was no association between firearm-ownership rates and nonfirearm suicides. To illustrate the main findings, we presented data for the 15 states with the highest levels of household gun ownership

matched with the six states with the lowest levels (using only six so that the populations in both groups of states would be approximately equal). In the table, the findings are updated for 2001 through 2005.

The recent Supreme Court decision may lead to higher rates of gun ownership. Such an outcome would increase the incidence of suicide. Two complementary approaches are available to physicians to help counter this possibility: to try to reduce the number of suicide attempts (e.g., by recognizing and treating mental illness) and to try to reduce the probability that suicide attempts will prove fatal (e.g., by reducing access to lethal means). Many U.S. physicians, from primary care practitioners to psychiatrists, focus exclusively on the first approach. Yet international experts have concluded that restriction of access to lethal means is one of the few suicide-prevention policies with proven effectiveness.[5]

In our experience, many clinicians who care deeply about preventing suicide are unfamiliar with the evidence linking guns to suicide. Too many seem to believe that anyone who is serious enough about suicide to use a gun would find an equally effective means if a gun were not available. This belief is invalid.

Restriction of access to lethal means is one of the few suicide-prevention policies with proven effectiveness.

Physicians and other health care providers who care for suicidal patients should be able to assess whether people at risk for suicide have access to a firearm or other lethal means and to work with patients and their families to limit access to those means until suicidal feelings have passed. A Web site of the Harvard Injury Control Research Center can help physicians and others in this effort (www.hsph.harvard.edu/means-matter). Effective suicide prevention should focus not only on a patient's psychological condition but also on the availability of lethal means — which can make the difference between life and death.

No potential conflict of interest relevant to this article was reported.

Dr. Miller is the associate director and Dr. Hemenway the director of the Harvard Injury Control Research Center, Harvard School of Public Health, Boston.

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Drug Warnings That Can Cause Fits — Communicating Risks in a Data-Poor Environment

Jerry Avorn, M.D.

In 2005, after receiving case reports of suicides by patients taking anticonvulsant medications, the Food and Drug Administration (FDA) asked the manufacturers of 11 drugs in this class to report all suicide-related events in the controlled trials they had conducted over many years. This past January, nearly 3 years later, the agency completed its analysis of these data and announced that it had found a near-doubling of suicidal ideation and behavior among trial subjects randomly assigned to receive these drugs rather than placebo[1] (odds ratio, 1.8; 95% confidence interval [CI], 1.2 to 2.7[2]). For patients in epilepsy studies, the risk was 3.5 times that seen with placebo (95% CI, 1.3 to 12.1). The rate of completed suicides, though higher in the active-drug groups, was too low to per-

DECLARATION OF SERVICE BY E-MAIL

Case Name: **Tracy Rifle and Pistol LLC, et al. v. Kamala D. Harris, et al.**
No.: **2:14-cv-02626-TLN-KJN (TEMP)**

I declare:

I am employed in the Office of the Attorney General, which is the office of a member of the California State Bar, at which member's direction this service is made. I am 18 years of age or older and not a party to this matter; my business address is: 2550 Mariposa Mall, Room 5090, Fresno, CA 93721. I am familiar with the business practice at the Office of the Attorney General for collection and processing of correspondence for E-mail.

On July 26, 2016, I served the attached **EXPERT WITNESS REPORT OF PROFESSOR J. JOHN MANN** by transmitting a true copy via electronic mail.

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I declare under penalty of perjury under the laws of the State of California the foregoing is true and correct and that this declaration was executed on July 26, 2016, at Fresno, California.

Nelson R. Richards
Declarant

/s/ Nelson R. Richards
Signature

SA2014119177 / 95188601