Drug-Related Deaths in the United States —First Decade of an Epidemic—

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THIS STUDY TOOK its origin from an earlier analysis of vital statistics relating to the Province of Ontario in which attention was drawn to a recent increase in the rate of suicide among women (*1*). Statistics published annually by the Registrar General of Ontario (*2*) permit some elaboration of this finding since deaths in the category of accidents, poisoning, and violence are cross-classified according to the nature of the external cause (for example, accident or suicide) and the nature of injury (for example, fractures, burns, and effects of poisons). From this source it was established that, within the general increase of female mortality caused by suicide, there had been a disproportionate rise in suicide by means of poisons and that deaths of males by self-poisoning had also increased (although this increase had a smaller impact on the male suicide rate as a whole).

For these reasons we decided to focus our study on death by poisoning, however the external cause had been certified, rather than on the suicide rate, whose validity as a measure is widely and wisely doubted. Scrutiny of more detailed statistics implicated prescription drugs above all other classes of poison as responsible for the recent increase of fatal poisoning in Ontario; this situation is also apparent in U.S. statistics (*3*), which are the subject matter for the following analyses.

Recent Upturn in Drug-Related Deaths

Deaths occasioned by the ingestion of medical drugs may be counted under any of several separate rubrics of the International Statistical Classification (*4*), and the numbers of these deaths must therefore be combined in order to construct the aggregate of interest. The relevant titles are those listed, together with the absolute numbers of deaths so classified in 1958 and in 1967.

Rubric		*1958*	*1967*
323	Drug addiction other than alcoholism	69	202
E870–878	Accidental poisoning by ... drugs	549	1,860
E953	Therapeutic misadventure in administration of drugs or biologicals	148	210
E970	Suicide and self-inflicted poisoning by analgesic and soporific substances .	1,163	2,689

Figure 1 shows the trend of the crude death rate per million from these four cause-groups combined for available years within the period covered by the 6th and 7th revisions of the International Classification (*4*). Over the first 10 years of this period the rate varied within the narrow limits of 10.5 ± 0.8, although there were certainly shifts, seemingly spurious, within this aggregate. Beginning about 1959 there was a period of increase so rapid that the rate more than doubled within a decade.

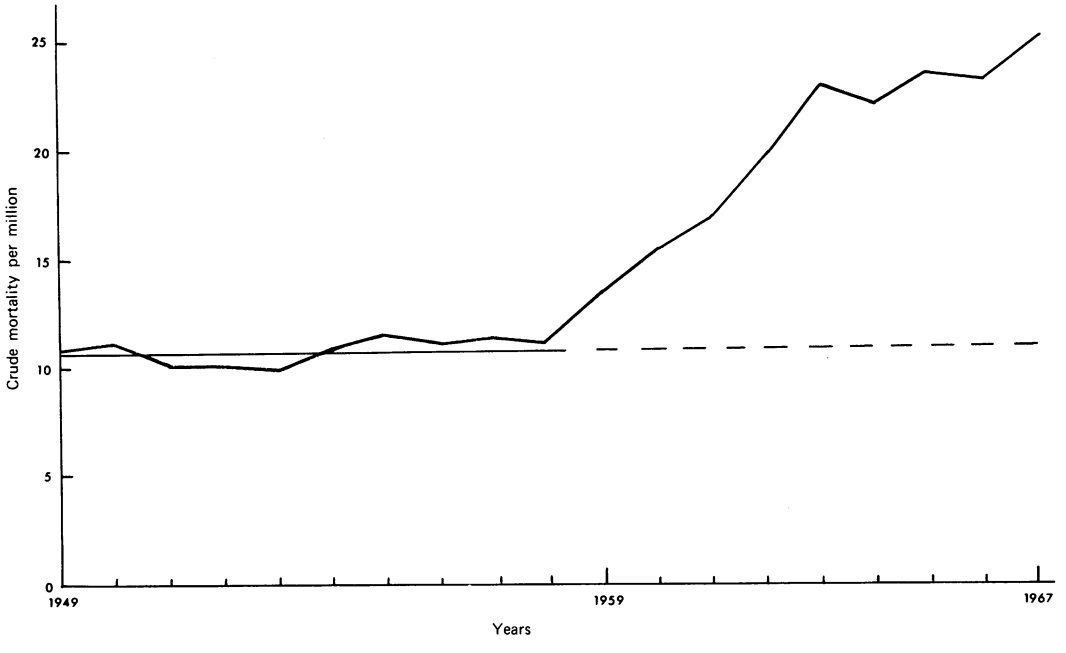
Before one concludes that the trend of figure 1 reflects a true net increase in risk of death, it is necessary to consider what shifts may have occurred into the aggregate of drug-related deaths from certain other cause-of-death groups. The first such group to be considered comprises the deaths attributed to various effects of alcohol. This group is important because of the arbitrariness of selecting an underlying cause when alcohol and barbiturates have been taken together and because overt suicide is excessively common among alcoholics (*5*). Table 1 shows that, between 1954–57 and 1964–67 when the drug-related death rate increased by 109 percent, there was no compensating decline in deaths attributed to effects of alcohol. Table 1 also shows that death from certain classes of poison other than drugs also increased over the same period, so there is no evidence of a shift from that quarter. The rate for suicide by means other than poison did decline (table 1), but only by an amount that was small compared with the increase in drug-related deaths (0.3 per million, compared with 12.2 per million).

To summarize the evidence presented in table 1—there are only limited possibilities of accounting for any part of the apparent increase in drug-related deaths in terms either of changes in certification and coding practice or of changes in methods used by persons who commit suicide. It has to be accepted that the higher rates for 1964–67 do reflect the occurrence of many deaths that would not have occurred under the conditions of the 1950s. It is therefore appropriate to refer to the "excessive prevalence" (*6*) of drug-related deaths in the 1960s as an epidemic.

Demographic Profile of Drug Casualties

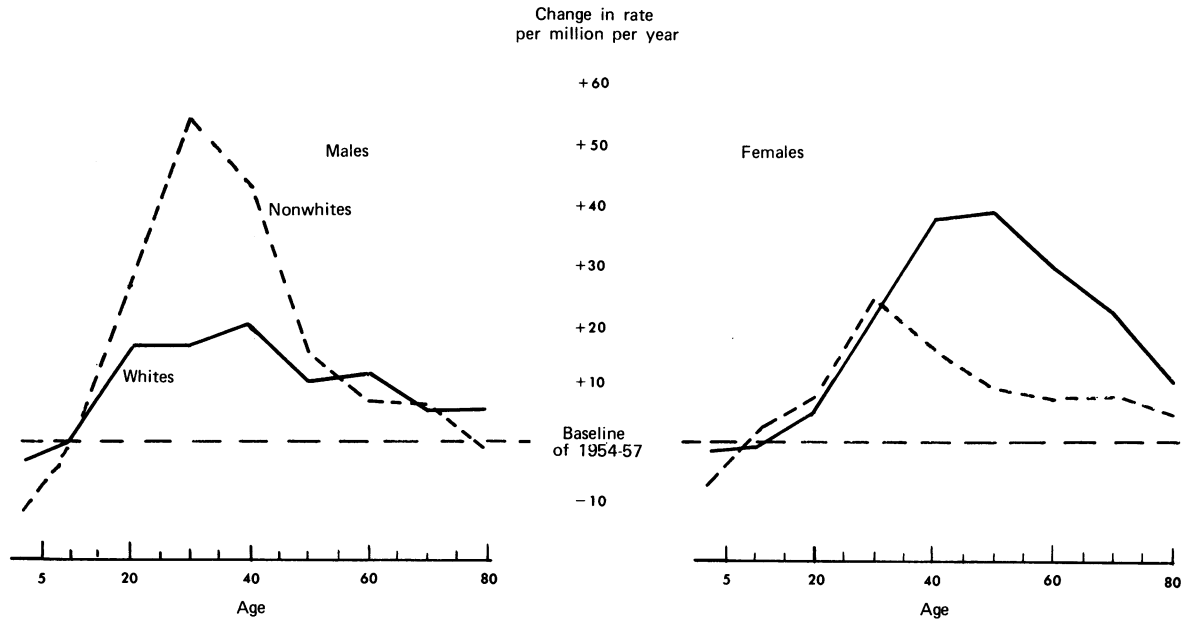
The incidence of excess death in various sections of the population defined by age, sex, and color is depicted in figure 2. As a zero or baseline from which to measure added mortality in each such section, we took age-sex-color-specific rates for the period 1954–57, plotted in the figure along the broken horizontal line. Because no finer cause-of-death classification is available in pub-

Figure 1. Trend of drug-related mortality, United States, 1949–67



NOTE: Deaths were those classified as ISC 323, E870–878, E953, and E970, 6th and 7th revisions.

Figure 2. Poison deaths per million, 1964–67, measured from a baseline of 1954–57, by age, sex, and color



lished tables that give data on age, it was necessary to derive figure 2 from rates of suicide by any poison and of accidental poisoning by any "solid or liquid substance," rather than by drugs alone. In the immediate context this distinction is unimportant except possibly for ages under 15, where truly accidental cases predominate and poison control programs appear to have made some gain. All adult age groups show some increase in deaths caused by poison, the impact being maximal around age 30 for nonwhites, in the 40–50 year group for whites, and negligible beyond the age of 75. In terms of absolute numbers it can be estimated that by the mid-1960s some 2,500 "extra" poisoning deaths were occurring each year in the United States, the modal victim being a white woman in her early forties. Based on 1959–61 life table values (7), the average forfeit of life expectancy associated with these deaths was close to 32 years.

Broadly speaking, the age, sex, and race selection of the newer casualties resembles that of poison deaths in the pre-epidemic period. Put another way, the percentage increases in mor-

Table 1. Comparison of certain mortality rates in latest available period with those of a decade previously

Cause group (I.S.C. numbers, reference 4)	Crude annual rate, per million		10-year change	
	1954–57	1964–67	Absolute	Percent
Drug-related deaths (323; E870–878; E953; E970):	11.2	23.4	+12.2	+109
Suicide (E970)	5.6	13.7	+ 8.1	+145
Accidental	5.6	9.7	+ 4.1	+ 73
Alcohol poisoning and addiction (322; 880)	13.9	15.4	+ 1.5	+ 11
Other poison deaths (879; 881–888; E971–973; E980)	25.2	26.4	+ 1.2	+ 5
Suicide, other than by poison (E963; E974–979)	79.7	79.4	− .3	− .4
Drug-related deaths by type of agent and circumstance:				
Barbiturates (871; E970B)	6.77	11.92	+ 5.15	+ 76
Analgesic and soporific substances and other drugs for which no separate coded classification exists (874; 878; 970H; 970M)	1.78	7.53	+ 5.75	+313
Morphine, salicylate, strychnine, belladonna, etc. (balance of 870–878 and E970), plus drug addiction (323) plus therapeutic misadventure (E953)	2.61	3.94	+ 1.33	+ 51

tality have been fairly uniform over age and sex. This generalization does not cover the exceptionally rapid increase in suicides of young black males, which has been the subject of comment elsewhere (*8*).

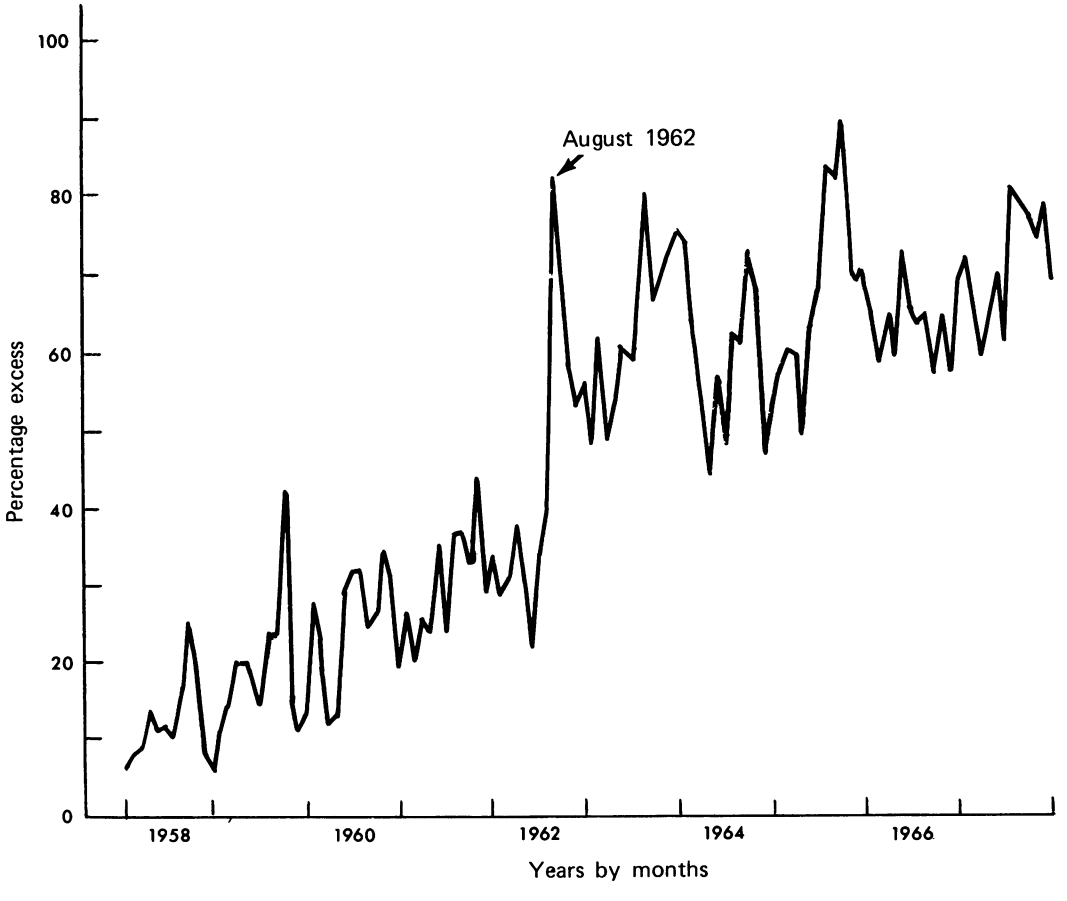
Short-Term Movements

The onset of the rising trend in drug-related mortality seen in figure 1 is so abrupt as to suggest that an analysis in terms of periods shorter than a whole year could be informative. Data are, in fact, published for individual months (*3*) and can be rendered more meaningful by an adjustment for variations in the number of days per month, together with a correction to discount for the widely recognized seasonal effect on suicide rates.

Most analyses of this seasonal pattern, including the recent and otherwise elaborate analysis by Spiers (*9*), have treated suicide as a single entity, without distinction among the means used for self-destruction. The two groupings available in the published table of monthly totals may be regarded as providing a rough distinction between predominantly "outdoor" means (drowning and jumping from high places, but also including cutting and stabbing), and predominantly "indoor" means (poisoning, hanging, and also firearms). Suicides in both these groupings have their seasonal maximum in April, but in December, when suicide by "indoor" means is some 12 percent below peak, the rate of suicide by "outdoor" means is 25 percent below peak. The idea of inconvenience as a factor limiting the number of suicides will be taken up subsequently in the Discussion section.

In figure 3 the monthly numbers of deaths by accidental poisoning by any solid or liquid sub-

Figure 3. Monthly average deaths per day (number of accidental poisonings by solid or liquid substance and suicides by poisons) expressed as a percentage of the average number for the corresponding month for the base period 1954–57



stance and suicides by poisons have been plotted as a percentage of the average number for the corresponding month of the base period 1954–57. The statistical significance of the fluctuations shown in figure 3 cannot be readily assessed. On general grounds, one would expect some negative autocorrelation between successive terms in any such series where the events counted may be subjected to varying degrees of delay or acceleration, and this autocorrelation would make the variance between months greater than for a pure Poisson process (*10*). Hence, the magnitude of the deviations from the trend in individual months is of less interest than the location of the major peaks and their possible matching with events in the social, medical, and pharmaceutical history of the period. Dates at which some temporary peak is suggested by the appearance of figure 3 include August-October 1958, September 1959, August-September 1962, September 1963, and July-September 1965.

By far the most remarkable monthly total was that for August 1962, when psychiatrists practicing in widely separated locations were aware of an unusual frequency of suicide (*11*). This high frequency has been plausibly interpreted as a response to the death in California of the 36-year-old actress Marilyn Monroe, from an overdose of sleeping pills, on August 6, 1962. The whole of the increase in fatal poisonings between July and August of that year occurred within the subtotal certified as suicidal (541 in July, 699 in August); the rate of suicide by means other than poison did not change (1,289 deaths in July and 1,295 in August) (*3*).

To carry out a more exacting test of the hypothesis that Marilyn Monroe's death precipitated an outbreak of imitative acts, it would be necessary to re-sort the original data for July–August 1962 by sex and by exact day of death. The hypothesis would be greatly weakened if the sudden increase were found to involve men as well as women, or if it predated August 6, or if it was delayed by more than a week after that date.

Constancy of the Geographic Pattern

Previous statistical studies with a focus on suicide have detected a tendency for rates to be relatively high in the westernmost part of Canada (*12*) as well as in the western United States (*13*). We will show that risk of fatal poisoning has a geographic pattern resembling—but more intense than—that of suicide by means other than poison. This pattern was essentially the same in the mid-1960s as it had been in the pre-epidemic period.

In order to avoid confounding geographic with racial factors, the analyses on which tables 2 and 3 are based have been restricted to the white population of each State. (Deaths of nonwhites within individual States are not numerous enough to support a parallel analysis.) The mortality measure used in these analyses is the proportional mortality rate, that is, the numbers of deaths from selected causes expressed per 1,000 deaths from all causes, which dispenses with the need for intercensal estimates of State populations by age. As in the two previous sections, it was necessary to include, together with the drug-related deaths, certain categories of poisoning that have not shown any increase. Even for this aggregate, however, table 2 shows a 60 percent rise in the average rate for females (from 2.99 to 4.77), which thus overtook the corresponding male rate.

The intensity of the geographic pattern is indicated by the coefficient of variation of the State rates (standard deviation expressed as a percentage of the mean). For age-adjusted mortality rates from all causes (not shown in table 2) the coefficient of interstate variation is about 6 to 7 percent, but for poison deaths alone, as table 3 shows, it is 6 to 10 times as large, indicating much greater geographic contrasts than occur with the risk of death in general (and implying that little information is lost by using all deaths as the denominator of the poison mortality rate, rather than numbers of the living population at risk). The intensity of the geographic pattern is about twice as great for poison deaths as for nonpoison suicides and, within each of these cause categories, appreciably stronger for females than males. Constancy of the geographic pattern of deaths caused by poison is indicated by a correlation between the two periods exceeding +.9 in each sex, while the pattern of nonpoison suicides is also fairly stable (correlations of +.87 and +.71).

Correlation coefficients can also be used to express the degree of match between the geographic patterns of other pairs of rates. For example, when rates for males and females are compared, State by State, a higher degree of resemblance is found for the poison deaths (coefficients averaging +.88) than for nonpoison suicides (+.69). Cor-

relation between these two cause categories is high in the rates for females (+.75), but only moderate for the rates for males (+.49).

Of the many possibly valid ways in which the geography of fatal poisoning might be summarized, the simplest and most matter-of-fact is in terms of the excessive rates in western States. This description fits best the rates for females, for whom the top third of State rates include those for 10 of the 11 westernmost States (that is, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Washington, and Wyoming, the exception being Utah). Another and smaller cluster of States with high rates lies near the nation's Capital, comprising Delaware, Maryland, and Virginia. What facet of "western-ness" may be the most relevant to the risk of fatal poisoning lies beyond the scope of this paper to determine.

However, because of the prominence given in the literature of psychiatric epidemiology to characteristics of migrants and to the experience of migration, it seems appropriate to make a preliminary test of the hypothesis that the States with high rates of deaths by self-poisoning may tend to be those to which a high proportion of the residents have migrated. Table 3 presents the results of such a test. The index of migration that we used was the percentage of young men in a medically examined sample whose birthplace lay outside their State of residence at the time of their recruitment into the Navy (*14*). As required by the hypothesis, there is a substantial positive correlation between this index and the rate of fatal poisoning, as there also is with the rate of suicide by means other than poison. However, table 3 shows that this index does not correlate with the all-causes, age-adjusted death rate.

Discussion

If it is legitimate to refer to recent developments in drug-related mortality as marking the onset of an epidemic, one may next ask, following Lipinski (*15*) and others, what understanding of the phenomenon can be gained by analyzing it in terms of the classic epidemiologic triad: host, environment, and agent. It is hard to believe that any important changes in host factors have oc-

Table 2. Deaths from selected cause per 1,000 deaths from all causes, by State of residence

Sex	Accidental poisoning by solid and liquid substances plus suicide by any poison		Suicide other than by poison	
	1954–57	1964–67	1954–57	1964–67
Males				
Mean of State rates	3.68	4.17	14.33	13.88
Standard deviation	± 1.56	± 1.95	± 3.26	± 3.96
Coefficient of variation (percent)	42	47	23	29
Correlation between periods	+0.91		+0.87	
Females				
Mean of State rates	2.99	4.77	4.33	4.49
Standard deviation	± 1.93	± 3.41	± 1.42	± 1.57
Coefficient of variation (percent)	65	71	33	35
Correlation between periods	+0.93		+0.71	

Table 3. Correlation over individual States between a measure of inward migration and certain mortality measures of white persons

Sex	Percent of all deaths in 1964–67 that were certified to—		All causes, age-adjusted death rate, 1960
	Accidental poisoning by solid or liquid substance and suicide by poison	Suicide by means other than poison	
Males	+ .645	+ .607	+ .057
Females	+ .740	+ .680	+ .036

NOTE: The measure of migration for a State is the percentage of U.S. Navy recruits whose birthplace was not their State of residence at recruitment. Percentages for 48 States were derived from reference 14.

curred, for if the propensity for self-destruction had been rising in the American population generally, one would surely have seen some upward movement in the rate of suicide by means other than poison, concurrent with the rapid rise in drug-related deaths. That there has been little change in sex, age, and geographic differentials argues against change in the environment as a cause of the epidemic, unless one can think of an environmental factor that, beginning about 1959, has applied equally to all sections of the adult white population. It is easier to name a new "agent," for indeed a multiplicity of new agents, in the form of potentially lethal prescription drugs, have come into circulation during the period in question.

Precisely because they were new, the drugs did not have their own readymade category in the coding used for cause of death statistics, but tended to fall under one of the "other" rubrics constituting the second group in the lower part of table 1. For this group alone, the mortality more than quadrupled in 10 years. The timing of the upturn depicted in figure 1 is consistent with an effect at least partly attributable to certain nonbarbiturate soporifics and antidepressant drugs that came into common use at the end of the 1950s and in the early 1960s.

The impact of these new drugs on the mortality rate is likely to have been the greater because, as with some infectious disease agents, it is the susceptible persons who are the most heavily exposed. Resort to mood-modifying drugs may itself be regarded as a mild form of self-destructive behavior (*16*). Therefore these drugs must often be prescribed to the very class of patient that, whether intentionally or not, is most likely to take an overdose.

Another factor tending to increase population exposure to barbiturates, as well as the newer agents, may have been the spread during this period of membership in prepaid medical plans providing coverage for prescription drugs.

Additionally, outpatient treatment with the newer drugs has been, for some patients, the alternative to confinement in an institution where the risk of overdose is much smaller than in a home setting. Yet we cannot attribute much importance to this relaxation of the physical restraints on psychiatric patients while there is no evidence of a net increase in suicides by means other than poison.

Analysis of the mortality record has thus led us to the conclusion that greater availability of substances that can be used for suicide (and "attempted" suicide) has brought about a substantial net increase in the frequency of suicide. We are aware that this conclusion commits us to a particular view of the etiology of suicide, for it means that suicidal acts may often occur through a fortuitous combination of impulse and opportunity, rather than as the more or less inevitable outcome of a deep and persistent depression.

The distinction between these two views has more than academic importance because it has a bearing on clinical and on public policy. For instance, is gun control an issue that properly lies within the domain of public health? The rate of suicide by firearms is more than 10 times as high in the United States as in England and Wales, although the rate for suicide by means other than firearms is lower; the "excess" of suicides by firearms in the United States runs into several thousands every year. More attention is usually focused on the U.S. to British ratio for the rate of homicide by firearms, which is more than 100, but the number of deaths involved is quite small compared with the excess of suicide in the United States. Hence the lives that might be saved by more stringent control over gun ownership are, in the main, those of the would-be owners.

Could control over one means of self-destruction really reduce the total number of suicides? A recent report from Birmingham, England, shows how this can happen. The carbon monoxide content of the domestic gas supply in that city was reduced over a period of years from about 20 percent to 2.5 percent; during this time the number of suicides by domestic gas fell dramatically, and there was no compensating increase in other forms of suicide, while accidental deaths certified as caused by coal-gas poisoning also declined (*17*). In England and Wales as a whole, suicides by gas fell from 50 per million to 10 per million during the sixties. Although suicide by solid or liquid poisons (mainly medicines) doubled in only 3 years (1960–62), "it has remained constant since and has not reached a level high enough to replace all the gas poisoning suicides which have been avoided" (*18*). In Australia, restriction of the quantity of sedatives that may be supplied on a single prescription has been credited with reversal of the rising trend in overall suicide mortality seen in that country during the early

1960s (*19*).

Another hypothesis to be considered in relation to the mortality record concerns the idea of "contagious suicide" (*11*). It seems that one well-publicized poisoning of a sufficiently prominent person may be enough to precipitate scores of fatal occurrences of a similar kind, just as a socially deviant act like an aircraft hijacking may, through wide publicity, set off imitative acts. If this is so, one would expect the modern mass media to have influenced the pattern of occurrence, if not the total frequency of suicide. In drawing his analogy between mental and physical epidemiology, Penrose (*20*) laid some stress on the sheer size of the crowd into which an agent (micro-organism or pathogenic idea) is introduced as determining the risk that propagation will occur. Certainly television has increased the size of the crowd that can be exposed simultaneously to morbid psychological stimuli.

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Between the mid-1950s and mid-1960s mortality due to ingestion of medically prescribed drugs doubled. This increase was a real change in risk, not a statistical artifact, because it refers to an aggregate that includes deaths certified as accidents as well as those certified as suicides, and because there was no compensating decline in suicide by means other than poisoning, in other accidental poisoning, or in deaths ascribed to alcohol and other addictions. Both before and during this epidemic, rates have been higher in areas that receive many migrants. By the mid-1960s there were about 2,500 "extra" drug-related deaths per year, the modal victim being a white woman in her early forties. Greater availability of one means of self-destruction appears to have raised the death rate for suicides; control over other means (such as guns) would be likely to reduce it.
