

Methadone maintenance treatment, criminality and overdose-related deaths

An ecological study, 1983–1999

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Background: Methadone maintenance treatments (MMTs) are the commonest substitution treatments offered to opiate addiction in Switzerland, in order to reduce criminal behaviour, infectious disease transmission and overdose death. **Method:** To investigate the relationship between the increase in the number of methadone maintenance treatments, criminal activity of addicts and overdose-related deaths, an ecological study was undertaken in the Canton of Geneva, from 1983 to 1999. **Results:** The regular and extensive increase in the number of MMTs is not significantly associated, during the 1983–1999 period, with a fall either in drug addict incarcerations or in overdose-related deaths. However, a slight decrease is observed in the number of imprisoned opiate addicts since 1994, and a marked decrease is seen in overdose deaths from 1997 on. An important and stable number of these deaths is due to methadone itself. **Conclusion:** Public health objectives to diminish delinquency and overdose deaths cannot solely be fulfilled by extensive use of MMTs. A positive result could appear when access to MMT is highly favoured. This hypothesis must be proved correct by observational studies conducted on a general population.

Keywords: delinquency, drug abuse, ecological study, methadone, overdose death

The three main aims of public health policies based on large-scale use of methadone maintenance treatments (MMTs) were a decrease in delinquency, prevention of overdoses and a decrease in the spread of infectious diseases by the intravenous route, notably hepatitis and HIV.¹ These health policies were supported by encouraging results from randomized controlled trials and observational studies.² These studies concerned selected populations, which introduces a risk of bias in spite of a precise methodology.³ When MMTs were widely prescribed to the general population, patients did not always undergo equal selection and the results of the MMTs were not always those that had been expected.⁴

A study has been made considering a non-selected general population, in order to appreciate the global results obtained after many years of MMT use in the care and treatment of drug addicts. However, no reliable data on the evolution of the intravenous spread of infectious diseases could be obtained. For this reason, the study considers the impact of MMTs on delinquency and overdose deaths only.

METHODS

The study is designed as an ecological study and analyses the impact of a therapeutic factor (use of MMTs in the medical care of drug addicts) on a delinquency indicator and on a health indicator (mortality by overdose). The

study takes into account the population residing in the canton of Geneva, Switzerland, over a period of 17 years (1983–1999). The number of opiate addicts residing in the canton each year is not known. As a factorial variable, the annual prevalence rate of maintenance treatments per 1000 Geneva residents has been used. The data relating to the residing population in the canton and the number of MMTs was supplied by the Cantonal Office of Statistics.

The variable used to describe the evolution of criminality amongst drug addicts is the prevalence of imprisoned drug addicts per 1000 Geneva residents. Notably, this variable takes into account only delinquency leading to incarceration; false accusations are excluded, since imprisonment of innocents is extremely rare. The prisoners needing an opiate withdrawal treatment or a maintenance treatment have been considered as drug addicts. Data on the number of drug addicts cared for in prison has been provided by the medical staff of the prison system of the canton of Geneva.

The variable used to describe the evolution of overdose deaths due to opiates was the mortality rate per 100,000 Geneva residents.

In the canton of Geneva, information on causes of death is reliable, since by judicial decision any apparently unnatural death is examined by a forensic examiner at the Geneva Institute of Forensic Medicine. All homicidal or accidental deaths, the latter including overdoses, lead to a necropsy and to a blood analysis, in search of toxic substances. In the present study, the annual numbers of overdoses were provided by the Geneva Institute of Forensic Medicine, and not by police records.

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The identification of the substance directly responsible for death depends on the results of the blood analysis. If a given drug, heroin or methadone, is found at potentially lethal doses and if autopsy findings corroborate the intoxication hypothesis, then one or the other substance is retained as causative, even though other licit or illicit drugs may be present at low doses. On the contrary, if the analysis reveals high doses of different substances, the cause of death will then be attributed to a mixed intoxication. Deaths clearly related to heroin or to methadone intoxications have been considered for the entire 1983–1999 period; deaths due to a mixed intoxication, including heroin or methadone, were considered from 1988 on.

Spearman's row correlation coefficient was used to test the significance of the association between the factor and the indicators of mortality and delinquency.

RESULTS

Table 1 shows that the prevalence rate of MMTs has regularly increased, sevenfold between 1983 and 1999. Importantly, the therapeutic factor has been modified significantly during the 17 years of the study.

In table 2, it is observed that the prevalence rate of imprisoned drug addicts continued to rise until 1993, then decreased, before becoming stable from 1996 on. The number of prisoners in need of a withdrawal treatment increased from the beginning of the study period until 1992–1993. From then on, prisoners have been able to continue in prison a MMT that had been started before

incarceration. This has decreased the number of withdrawal treatments and increased the number of maintenance treatments within prisons.

Spearman's row correlation coefficient is $r=0.73$, ($df=15$), $p<0.01$. The increase in MMTs is thereby significantly associated with an increase instead of a decrease in the number of imprisoned drug abusers.

Table 3 shows that the number of overdoses within the Geneva population has varied between 4 and 9 per 100,000 residents, between 1983 and 1999. The rate abruptly fell to 3 per 100,000 from 1997 on. Since 1990, an increase in the number of methadone-related deaths is observed, with stabilization at about 1 to 1.5 cases per 100,000 residents.

Spearman's row correlation coefficient is $r= -0.09$, ($df=15$), NS. It can be concluded that the increase in MMTs is not thereby associated with any significant modification, in one direction or another, of the number of overdose-related deaths. The recent decrease in these deaths is not enough to modify Spearman's coefficient.

Table 4 shows that deaths due to a mixture of substances, including methadone or heroin, are infrequent, even though numbers have tended to rise during recent years. Because of the low number of cases and years examined, no statistical analysis has been conducted.

DISCUSSION

Analyses suggest that the extensive use of MMTs within health policies regarding drug addicts cannot be associated with a decrease in the incarceration of these

Table 1 Number and rate of methadone maintenance treatments (MMTs) in the canton of Geneva

	Year																
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Residents in the canton (thousands)	365	369	371	375	377	379	378	383	385	387	391	396	399	400	401	403	408
Total number of MMTs	200	225	300	340	360	393	389	637	788	808	962	1141	1205	1342	1398	1464	1531
Prevalence rate of MMTs (per 1000 residents)	0.55	0.61	0.81	0.91	0.95	1.04	1.03	1.66	2.05	2.09	2.46	2.88	3.02	3.36	3.49	3.63	3.75

Table 2 Number and rate of incarcerated opiate addicts in the canton of Geneva

	Year																
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Inmates treated with methadone for opiate withdrawal	187	218	212	183	235	210	240	260	280	328	326	282	212	191	157	147	147
Inmates treated with MMT	0	0	0	0	0	0	0	0	0	30	72	84	105	98	137	150	123
Total	187	218	212	183	235	210	240	260	280	358	398	366	317	289	294	297	270
Prevalence rate of incarcerated opiate addicts (per 1000 residents)	0.51	0.59	0.57	0.49	0.62	0.55	0.63	0.68	0.73	0.93	1.02	0.92	0.79	0.72	0.73	0.74	0.66

patients nor with a fall in the number of overdose-related deaths.

Until 1993, it is very clear that MMTs had no effect on the imprisonment of drug addicts. From 1993 until 1999, the number of incarcerations first diminished and then stabilized, but in magnitude such that the direction of the correlation coefficient is not altered. This fall could be explained by a decision taken in 1993 by the justice authorities not to imprison drug addicts solely because of unpaid bills. Other possible hypotheses could be a delayed effect of the MMT or a fall in the number of heroine addicts. However, in 1998 and in 1999, it is observed that the numbers of imprisoned drug addicts who are or are not undergoing MMT are similar. The small impact of MMT on delinquency has already been mentioned in different observational studies conducted in the United States,⁵ Holland,⁶ Canada⁷ and the UK.⁸ Different explanations for this lack of efficiency have been discussed: a widening of the indication to the treatment, a lack of rigour in conduction of the treatment, the existence of delinquency prior to the drug addiction, and the abuse of heroine or of other drugs during the MMT.⁹

The lack of relationship between the increase in the number of MMTs and mortality due to overdose is clearly seen throughout the whole of the studied period. These results are surprising since cohort studies usually show that the mortality of patients undergoing a MMT programme is very low compared to that of patients who have not entered these programmes.¹⁰⁻¹²

One hypothesis could be that, in the absence of the great increase in the number of MMTs, the rate of heroine addicts dying of overdose would have been much higher; this kind of element doesn't appear in an ecological study. The fact that a large number of the overdoses is due to methadone itself is a disturbing result. Numerous studies have shown the dangers of large-scale methadone pre-

scription.¹³⁻¹⁶ A recent study conducted by Hall et al.¹⁷ concerning the UK and Australia shows that, as in this present study, overdoses due to opiates constantly increased in these two countries during the 1980s and 1990s. This was observed despite the MMT programmes. It was also observed that when MMT programmes increase considerably, this is accompanied by a fall in heroine-related overdoses and by an increase in methadone-related overdoses.¹⁷ During the last three years of the Geneva study, overdoses decreased, but half of them were due to methadone. The fall in mortality observed during these three years could be explained by different hypotheses, notably a decrease in the use of opiates due to the emergence of new drugs on the market and the beginning of treatment programmes using medically controlled prescription of heroine.

It is important to recognize the limitations of ecological studies. The results are based on aggregate data and are subject to bias by confounding factors, whose effects are difficult to assess. One of these confounding factors could be, as mentioned above, changes due to new political decisions taken by the justice and police authorities. Changes concerning incarceration decisions as well as those concerning examination requirements for a non-natural death have been rare in Geneva between 1983 and 1999. Variations in the numbers of drug addicts could also be another confounding factor, since we can postulate that they must have increased in Geneva as in the majority of industrialized large cities. This increase is nevertheless lower than the increase in MMTs, which have gone up sevenfold during the period of the study.

In other respects, the increasing simultaneous use of multiple psychotropic substances can lead to a mis-evaluation of the number of deaths due to opiates. This current study shows, during the 1996-1999 period, a

Table 3 Number and rate of lethal opiate overdoses in the canton of Geneva

	Year																	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
Number of heroine-related overdoses	14	13	12	14	14	32	27	22	18	24	16	28	21	20	8	7	9	
Number of methadone-related overdoses	3	2	2	2	4	1	0	5	2	5	7	6	3	6	5	5	4	
Total	17	15	14	16	18	33	27	27	20	29	23	34	24	26	13	12	13	
Mortality due to opiates (per 100,000 residents)	4.66	4.07	3.77	4.27	4.77	8.71	7.14	7.05	5.19	7.49	5.88	8.59	6.02	6.5	3.24	2.98	3.19	

Table 4 Number of overdoses due to different associated substances, including heroine or methadone, in the canton of Geneva

	Year											
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number of overdoses due to mixed intoxication	0	2	0	1	1	4	2	2	4	3	4	4

diminution in deaths related to heroin, whereas the number of overdoses due to methadone or to different associated substances increased. If we consider that abusers who die of a mixed overdose belong to a group similar to the heroin-related death group, then this could confirm the low impact of MMTs. However, one can also consider the fact that individuals abusing multiple psychotropic drugs could form a particular group of abusers that are not involved in MMTs.

Despite these limitations, the ecological design was the most appropriate to evaluate the real impact in the general population of the MMTs on delinquency and mortality due to overdose. These results have an important consequence for research in this field. The fact that a large population of prisoners now benefit from a MMT should be analysed in a comparative study with prisoners without MMT and patients undergoing a MMT that are not incarcerated, so as to understand the reasons for the failure of delinquency prevention.

The improvement in delinquency and mortality indices of the last three years will have to be confirmed by a future study.

On clinical grounds, this study shows that the extensive use of MMTs is not an easy solution to every problem related to heroine addiction. However, these clinical results must be considered cautiously, since the third expected effect of MMTs (a decrease in intravenous spread of infectious diseases) has not been analysed. A longitudinal study conducted by Broers et al. in Geneva has shown a clear decrease in HIV incidence rates amongst drug addicts undergoing a MMT.¹⁸

MMTs are a therapeutic agent in the medical care of heroine addicts, but no major prevention of delinquency or overdose deaths can be expected from these treatments. Moreover, constant changes to the drugs scene require adjustments of the therapeutic and preventive means.

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