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Did Prognosis After Acute Myocardial Infarction Change During the Past 30 Years? A Meta-Analysis

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Much effort has been spent to improve survival after acute myocardial infarction. To investigate how effective this effort has been, a meta-analysis was performed of studies published between 1960 and 1987 concerning mortality after acute myocardial infarction. Thirty-six studies were analyzed. They were classified with respect to deaths in the hospital and at 1 month and the 5-year mortality rate starting at hospital discharge.

Mortality was assessed from all studies by comparing studies from different institutions with use of identical inclusion criteria (externally controlled studies) and by analyzing studies reporting on changes in mortality in two or more comparable patient cohorts admitted to the same institution at different time periods (internally controlled studies). Reports on clinical trials (for example, thrombolytic therapy, beta-adrenergic blockade) in acute myocardial infarction were excluded.

Average overall in-hospital mortality decreased from 29% during the 1960s to 21% during the 1970s and to 16% during the 1980s. The externally controlled studies also showed a declining trend: from 1960 to 1969, 32%, from 1970 to 1979, 19% and from 1980 to 1987, 15%. The 1-month overall mortality rate decreased from 31% during the 1960s to 25% during the 1970s and 18% during the 1980s externally controlled studies. Most internally controlled studies also showed significant improvement in in-hospital and 1-month survival. In contrast, 5-year mortality after hospital discharge did not significantly decrease (33% from 1960 to 1969 and 33% from 1970 to 1979).

It is concluded that in the prethrombolytic era, short-term prognosis after acute myocardial infarction has improved since 1960. Changes in long-term prognosis after hospital discharge, however, could not be demonstrated. Information about the effect of thrombolytic therapy and early revascularization is urgently needed.

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Coronary artery disease is still the main cause of death in many parts of the world. Acute myocardial infarction accounts for 33% of the total mortality associated with coronary artery disease (1). Therefore, much effort has been spent during the last decades to improve treatment of the acute and chronic phase of myocardial infarction and to prevent complications and recurrences. For this purpose, many new diagnostic, monitoring and treatment strategies have been developed, such as the coronary care unit (2), coronary angiography (3), coronary bypass surgery (4), percutaneous transluminal coronary angioplasty (5), hemodynamic monitoring (6) and treatment with intraaortic balloon counterpulsation (7). In addition, new drugs have been introduced, such as beta-adrenergic blocking agents (8), calcium channel antagonists, angiotensin-converting enzyme inhibitors and agents influencing the coagulant state and thrombus formation (for example, coumarin derivatives [9], aspirin [10] and fibrinolytic drugs [11,12]).

Improvement in prognosis has been shown after certain interventions in selected populations, for example, the use of beta-blocker therapy (8) after acute myocardial infarction or the effect of fibrinolytic agents during the acute stage of infarction (10). It is also important to know whether prognosis has improved in unselected populations because this more appropriately reflects the overall effects of improvement in treatment.

During the last decades, many studies reported on prognosis after acute myocardial infarction. Few, however, compared prognosis in different time periods. The time interval between different observations was frequently relatively short and never >10 years. The question whether mortality rates after acute myocardial infarction have declined during the past 30 years can therefore only be answered by a meta-analysis.

Methods

Meta-analysis. This technique of quantitative reviewing is thought to be an efficient way to summarize numerous published reports (13). Meta-analysis can give more insight

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and often makes it possible to reach stronger conclusions and bring effects into sharper focus. Meta-analysis is helpful in highlighting gaps in published studies, providing insight into new directions for research and finding mediating or interactional relations that cannot be hypothesized and tested in an individual study (13).

To search for studies concerning prognosis after myocardial infarction, we used the Medline data base from the U.S. National Library of Medicine (containing all volumes of *Index Medicus* published between 1983 and 1988). The following key words were used: myocardial infarction, long-term prognosis, short-term prognosis, survival, mortality, case fatality, in-hospital mortality and 5-year mortality. By reviewing these references, we identified relevant studies published before 1983 to the present.

We included studies reporting on in-hospital, 1-month and 5-year mortality after acute myocardial infarction. Only one publication from investigators reporting data over the same time period was included. We excluded reports concerning prognosis after acute myocardial infarction that did not report on mortality rates. Reports on clinical trials (for example, thrombolytic agents, beta-blockade) were also excluded because such trials usually report on selected patient groups. Finally, studies performed before 1960 were excluded because during that period, enzymatic confirmation of myocardial infarction was not generally available.

From each publication, the following information was collected: year of publication, design of the study, demographic and baseline characteristics of the study population, methods and results, site and time period during which the study was performed. Studies were analyzed with regard to short- and long-term prognosis. Because short-term prognosis is reported as either in-hospital mortality or 1-month mortality after admission, the results of both types of studies were analyzed separately. Because 5-year survival rates are reported in most long-term follow-up studies, results of this follow-up period were pooled.

Studies were divided according to three periods: 1960 to 1969, 1970 to 1979 and 1980 to 1987. The studies were analyzed in three ways: 1) overall mortality, and mortality assessed by 2) "externally controlled" studies and 3) "internally controlled" studies.

Overall mortality. To obtain global information on prognosis during these three periods, results of all studies were pooled. Studies were separately analyzed with regard to in-hospital, 1-month and 5-year mortality.

Externally controlled studies. Because results may be biased when data from studies with different inclusion criteria are compared, a subanalysis of studies was done by controlling for inclusion criteria. We termed these reports "externally controlled studies." Included in this analysis were studies that met the following diagnostic criteria: 1) the presence of at least two of the following three criteria for myocardial infarction (typical chest pain, typical electrocardiographic [ECG] changes and typical serum enzyme elevations). Apart from these diagnostic criteria, the following baseline criteria were used: no limitations according to 1) gender, 2) age, 3) infarct location, and 4) first and recurrent infarctions, and 5) the period of patient inclusion in the study analyzed should not be >5 years. Baseline characteristics of the different study populations were recorded.

Internally controlled studies. This term is used for the analysis of studies reporting changes in mortality in two or more patient cohorts admitted to the same institution at different times. These studies are considered separately because they compare patient cohorts prospectively and the patients are from the same geographic location and are studied by the same institution.

Analysis of data and statistical methods. Mortality rates from studies performed during the same time periods (1960 to 1969, 1970 to 1979 or 1980 to 1987) were analyzed and pooled. When not reported specifically by the authors, in-hospital, 1-month or 5-year mortality rates were derived from the data presented.

For each time period, a weighted average mortality rate was calculated by dividing the total number of deaths during one period by the total number of patients studied during the same period. Chi-square analysis was used to calculate significant differences between time periods according to average mortality rates. Results were considered to be significant at the level of $p < 0.05$. Correlation between the year in which studies were performed (independent variable) and mortality rates (dependent variable) was assessed and regression lines were constructed (14). Regression lines were based on the size of the different studies; this means that weighting factors of studies consist of the number of patients studied.

Results

Fifty-four studies (1,15–67) reporting on prognosis after acute myocardial infarction and performed between 1960 and 1987 were initially identified. Thirty-six studies (15–50) with a total of 36,561 patients reported on in-hospital and 1-month or 5-year mortality, or both (Table 1) and therefore were included in this meta-analysis.

Baseline characteristics. In Table 1, information is also given on number of patients, age, gender and geographic location. Baseline characteristics of externally controlled studies are listed in Table 2. The following baseline characteristics were commonly reported: gender distribution, mean age, previous myocardial infarction, previous angina, infarct location and risk factors such as positive family history, smoking, hypertension, diabetes mellitus and hypercholesterolemia.

Short-Term Prognosis: In-Hospital Mortality

All studies. Eighteen (15–32) of 36 studies reported on in-hospital mortality. A total of 25,508 patients were included in this analysis. Seven studies were performed from 1960 to 1969 in 3,405 patients, 10 studies from 1970 to 1979 in

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Table 1. Characteristics of 36 Analyzed Studies

Ref	Year of Pub	First Author	Year of Study	Country	No. of Pts	M/F (%)	Mean Age (yr)	In-Hospital Mortality Rate (%)	1-Month Mortality Rate (%)	5-Year Mortality Rate (%)	Population-Institution-Based Studies
15	1969	Woodhouse	1960–1964	Canada	783	64/36		26.2		31.7	Institution
16	1973	Geismar	1963	Denmark	1,094			41.0		48.0	Population
17	1968	Norris	1966–1957	New Zealand	757	68/32	64.0	26.0			Institution
18	1976	Weinberg	1967–1958	USA	208	75/25	60.5	22.0		27.5	Institution
19	1977	Kitchin	1966–1969	Great Britain	508			17.3		30.0	Institution
20	1987	Djiane	1970–1974	France	731	76/24	63.5	19.2			Institution
			1984–1986		755	74/26	63.7	12.6			
21	1986	Blanc	1972–1973	France	223	59/42	65.0	20.0			Institution
			1982–1983		243	64/36	66.4	20.6			
22	1982	Goldman	1973–1974	USA	4,782			22.0			Population
			1978–1979		4,786			23.0			
23	1976	O'Rourke	1967–1969	Australia	*			26.0			Institution
			1973–1975		620		59.4	14.2			
24	1988	Goldberg	1975	USA	763			22.2			Population
			1978		833			20.3			
			1981		978			17.8			
			1984		689			15.1			
25	1988	Dubois	1977–1980	Belgium	1,013	83/17	60.5	11.8			Institution
26	1987	Reznik	1979–1980	Australia	2,265	69/31	64.0	21.0			Institution
27	1987	Arita	1975–1979	Japan	122	81/19	60.9	18.0			Institution
			1980–1985		264			14.4			
28	1987	Deckers	1981–1982	Netherlands	529			13.6			Institution
29	1988	Deckers	1985–1987	Netherlands	392	66/34	59.5	14.0			Institution
30	1987	Hiramori	1977–1985	Japan	1,060	79/21	62.4	14.9			Institution
31	1987	Shibata	1961–1970	Japan	55	73/27	59.0	32.7			Institution
			1971–1975		167	79/21	61.3	22.8			
			1976–1980		261	74/26	62.4	20.3			
			1981–1985		439	73/27	63.3	19.8			
32	1976	Cannom	1971	USA	188	77/23		14.4			Institution
33	1968	Weinblatt	1961–1965	USA	881	100/0	52.1		36.0	19.0	Population
34	1977	Hunt	1969–1970	Australia	300	79/21			27.0		Institution
			1974–1975		300	80/20			12.0		
35	1980	Pohjola	1970–1971	Finland	1,224	70/30			40.5	30.1	Population
36	1983	Martin	1970–1971	Australia	1,078	75/25			38.0	33.6	Population
37	1987	Gomez-Marin	1970	USA	739	73/27	60.6		21.9		Population
			1980		776	71/29	61.1		14.9		
38	1984	Fukui	1972–1975	Japan	29	76/24	61.4		24.1		Institution
			1976–1977		101	78/22	61.2		26.7		
			1978–1979		148	79/21	62.8		23.0		
			1980–1981		214	75/25	61.6		15.4		
39	1983	Wolfenbuttel	1973–1977	Netherlands	254	18/82	57.0		13.0		Institution
40	1982	Sanz	1975–1979	Spain	300	100/0	50.0		5.3		Institution
41	1987	Fukui	1975–1979	Japan	274				22.6		Institution
			1980–1984		516				14.9		
42	1984	Norris	1977–1982	New Zealand	425	100/0	50.0		6.0		Institution
43	1983	Leeder	1979–1980	Australia	614	77/23			26.0		Population
44	1979	Henning	1969–1973	USA	221	77/23	59.6		21.0		Institution
45	1984	Beaglehole	1974	New Zealand	†				21.5		Population
			1981		905	76/24			23.1		
46	1981	Elveback	1965–1969	USA	300	67/33			18.0	26.8	Population
			1970–1975		385	63/37			9.3	27.2	
47	1976	Helmers	1968–1969	Sweden	475	66/34	65			37.9	Institution
48	1980	Luria	1970–1973	USA	143					33.0	Institution
49	1986	Smyllie	1975	Great Britain	175					32.0	Institution
50	1979	Fabricius-Bjerre	1971–1972	Denmark	276	64/36	66			47.0	Institution

*The number of patients in the 1967 to 1969 study was not given and the study was not included in this report's overall and externally controlled analysis. †In the 1974 study results were given for subgroups of patients without supplying the total number of patients and the study was not included in this report's overall and externally controlled analysis. F = female; M = male; Pts = patients; Pub = publication; Ref = reference.

Table 2. Baseline Characteristics of Externally Controlled Studies Reporting on In-Hospital Mortality Rate

Ref	M/F (%)	Mean Age (yr)	Previous Infarct (%)	Previous Angina (%)	Infarct Location: Ant (%)	Infarct Location: Post (%)	Positive Family Hx (%)	Smoker (%)	HTN (%)	DM (%)	Hyperchol (%)
A) In-hospital mortality											
1968–1969											
15	64/36										
16	*										
17	68/32	64.0	29.0	25.0	32.2				19.0	10.0	
1970–1979											
20	76/24	63.5	14.0	29.6			21.6	55.4	29.8	16.7	29.4
21	59/41	65.0	16.0	41.0	34.6	51.1	32.0	33.0	44.0	6.5	45.0
24	*		34.0								
25	83/17	60.5	27.7	62.5	39.4			84.7	33.3	10.3	
26	69/31	64.0	28.0	46.0			32.0	36.0	38.0	9.0	
1980–1987											
20	74/26	63.7	15.0	17.2			19.2	57.8	31.0	15.0	27.8
21	64/36	66.4	19.0	38.0	34.1	40.8	31.5	33.0	44.0	6.0	32.0
24	*		36.0								
28	*										
29	66/34	69.5									
30	79/21	62.4	28.4		54.2	40.4					
B) 1-year mortality											
1970–1979											
36	73/27	60.6									
37	76/24	61.4	17.2		41.7	54.2					
	78/22	61.2	17.8		56.6	36.1					
	79/21	62.8	29.7		50.0	42.3					
43	77/23	59.6	26.0		51.0						
1980–1987											
36	71/29	61.1									
37	75/25	61.6	28.0		52.6	42.2					
44	76/24										

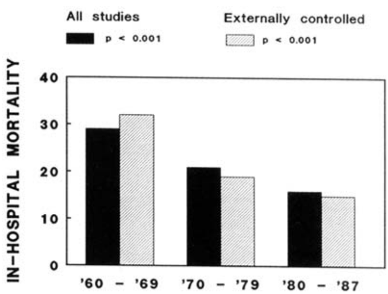
*These studies did not report baseline characteristics. Ant = anterior; DM = diabetes mellitus; F = female; HTN = hypertension; Hx = history; Hyperchol = hypercholesterolemia; M = male; Post = posterior; Ref = reference.

16,754 patients and 8 studies from 1980 to 1987 in 5,349 patients. The average overall in-hospital mortality rate during the 1960s was 29% and declined to 21% during the 1970s and to 16% during the 1980s (Fig. 1). When results from all 18 studies were pooled, linear regression analysis showed a significant decline in in-hospital mortality over time ($y = -0.75x + 78$, $r = -0.72$).

Externally controlled studies. Eleven (15–17,20,21,24–26,28–30) of 18 studies including 13,108 patients reporting on in-hospital mortality met the inclusion criteria, whereas 7 studies (18,19,22,23,27,31,32) failed to meet the criteria. The average in-hospital mortality rate calculated for the 1960s, 1970s and 1980s showed a decrease from 32% to 19% to 15%, respectively (Fig. 1). Linear regression analysis of the results from these studies also showed a significant reduction in in-hospital mortality over time ($y = -0.85x + 85$, $r = -0.82$) (Fig. 2). Only eight studies reported on baseline characteristics of the study populations (Table 2A).

Internally controlled studies. Six studies (20,21,23,24,27,31) that included 7,143 patients compared mortality rates between different time periods (Fig. 3). Two studies showed a decline in the in-hospital mortality rate between the 1960s and 1970s. Five studies reported on in-hospital mortality in patient cohorts admitted during the 1970s and 1980s. Three of these studies showed a reduction in in-hospital mortality; the other two showed no differences. Goldman et al. (22) investigated two groups of patients admitted during 1973 to 1974 and 1978 to 1979. The in-hospital mortality rate was 22% and 23%, respectively.

Figure 1. Decline in in-hospital mortality rates as derived from all studies (**black bars**) and from externally controlled studies (**hatched bars**).



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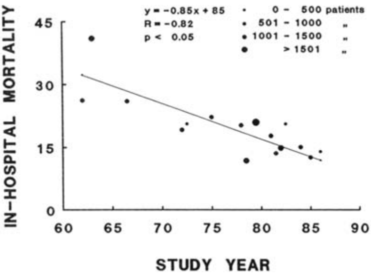


Figure 2. Linear regression analysis of in-hospital mortality rates as derived from externally controlled studies.

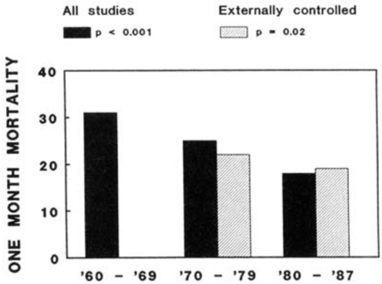


Figure 4. Decline in 1-month mortality rates as derived from all studies (black bars) and from externally controlled studies (hatched bars).

One-Month Mortality

All studies. The 1-month mortality rate was documented in 14 studies (33–46) that included 9,984 patients. In two studies with a total of 1,481 patients performed during the 1960s, the average 1-month mortality rate was 31%. Eleven studies with a total of 6,092 patients were performed during the 1970s, resulting in an average 1-month mortality rate of 25%. During the 1980s, the average 1-month mortality rate was 18% as derived from four studies containing 2,411 patients (Fig. 4). In this analysis, a significant decline in overall mortality was also observed ($y = -1.1x + 109$, $r = -0.59$).

Externally controlled studies. Four (37,38,44,45) of 14 studies that reported on 1-month mortality used identical inclusion criteria. Results of these studies were pooled. During the 1960s, no studies that met the inclusion criteria of this analysis were performed. During the 1970s, three studies including 1,238 patients were analyzed. The average 1-month mortality rate was 22% compared with 19% during the 1980s as derived from three studies in a total of 1,895 patients (Fig. 5). Linear regression analysis of results from these studies also showed significant declining mortality rates ($y = -0.35x + 47$, $r = -0.41$). These studies reported only on gender distribution, mean age, previous infarction and infarct location (Table 2B).

Internally controlled studies. Six studies (34,37,38,41,45, 46) that included 4,987 patients reported on serial changes in 1-month mortality (Fig. 4). Two studies (34,46) concerned two groups of patients admitted during the 1960s and 1970s. The 1-month mortality rate decreased from 27% to 12% and from 18% to 9%, respectively. Three studies showed about the same reduction (7% to 9%) in 1-month mortality from the 1970s to the 1980s. One study (45) reported no significant change in 1-month mortality.

Long-Term Prognosis: 5-Year Mortality After Discharge

All studies. Twelve reports containing 13 long-term follow-up studies (15,16,18,19,33,35,36,46–50) investigated the

Figure 3. Decline in in-hospital mortality rates as derived from internally controlled studies.

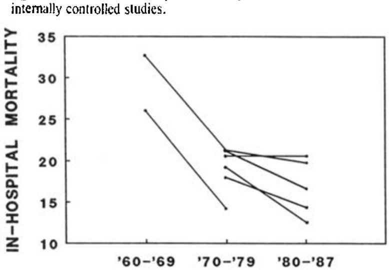
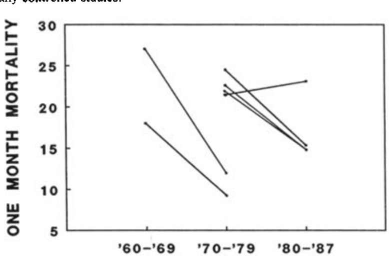


Figure 5. Decline in 1-month mortality rates as derived from internally controlled studies.



5-year mortality rate in hospital survivors. Seven long-term follow-up studies containing 3,091 patients were performed during the 1960s. The average 5-year mortality rate after discharge was 33%. During the 1970s six studies with a total of 2,340 patients were carried out; the average 5-year mortality rate was 33%. Currently, no 5-year follow-up studies are available from the 1980s. Regression analysis showed no decline in 5-year mortality after discharge ($y = -0.05x + 36$, $r = -0.02$).

Externally and internally controlled studies. No study could be included in the "externally controlled" analysis because each used different inclusion criteria according to the patients studied. Among all studies analyzed, there was one internally controlled study (46) reporting on changes in 5-year mortality after acute myocardial infarction. There was no significant difference between the 5-year mortality rate in survivors admitted during 1965 to 1969 (26.8%) and 1970 to 1975 (27.2%).

Discussion

In this study, we investigated changes in prognosis after acute myocardial infarction by performing a meta-analysis of previously reported studies. This analysis shows an improvement in short-term prognosis after myocardial infarction since 1960. Changes in long-term prognosis after hospital discharge could not be demonstrated.

Short-Term Prognosis

All studies. A significant decline in overall in-hospital and overall 1-month mortality over the past 3 decades could be shown.

Externally controlled studies. Because overall results may be biased by differences among studies, a subanalysis was performed. This subanalysis also showed an improving trend in short-term prognosis. It was decided that results from studies that met six criteria as listed in the Methods section were similar enough to be pooled. Other characteristics of the studies, such as institution and country in which the studies were performed, were not taken into account. It is possible, however, that these characteristics are a source of bias because of inconsistent trends among different countries in coronary heart disease mortality. However, most countries, including the United States, Australia, New Zealand, Canada, France, Japan, Switzerland and Italy (52), experienced favorable declines in these death rates since the late 1960s; Kimm et al. (68) also reported on Belgium and Israel. Among the studies analyzed, only Sweden and Denmark experienced an increase in coronary heart disease mortality during the 1960s until the late 1970s (52,68).

Internally controlled studies. In these studies, a significant reduction in in-hospital and 1-month mortality was also shown. O'Rourke et al. (23) reported a decline in in-hospital mortality from 26% during the 1960s to 14% during the 1970s. This latter figure differs markedly from other mortality rates reported during the 1970s. According to O'Rourke et al. (23), this improvement is due to the introduction of the coronary care unit in 1971. Another factor may have been that most patients admitted to the coronary care unit were <70 years of age. Because the authors did not report on characteristics of the group of patients admitted during the 1960s, it is difficult to assess whether these two groups are comparable according to baseline variables.

All (20–24) except two (27,31) internally controlled studies that reported on in-hospital mortality had comparable inclusion criteria for their groups studied. Baseline characteristics were not mentioned by all internally controlled studies. Djiane et al. (20) reported only that baseline characteristics such as mean age, gender, risk factors, infarct location and previous infarction were comparable for both groups studied. The baseline characteristics of mean age, risk factors, previous infarction and previous angina were comparable in two groups studied by Blanc et al. (21). However, group 2 contained more men and infarct location differed significantly in the two groups. Goldman et al. (22) reported only a higher mean age of the patients studied during 1978 to 1979 compared with that of the patients studied during 1973 to 1974. O'Rourke et al. (23) and Goldberg et al. (24) mentioned only that the improvement in in-hospital mortality was not dependent on selection of patients (23) or baseline variables (24).

One-month mortality. Five of six studies (34,37,38,41,45, 46) reported on serial reduction in 1-month mortality. Four trials (34,37,38,45) used the same inclusion criteria for the groups studied. Gomez-Marin et al. (37) observed no differences in gender and age distribution between the groups studied. Four studies (38,41,45,46) did not specifically report on baseline characteristics. Hunt et al. (34) and Elveback et al. (46) studied groups of patients admitted during, respectively, the 1960s and 1970s. One-month mortality decreased from 27% during the 1960s to 12% during the 1970s as reported by Hunt et al. (34). This mortality rate of 12% is low according to mortality rates in other reports (37,38,44,45). However, Hunt et al. (34) mentioned that patients in both groups were remarkably similar. Although the age and gender distributions were similar, there were fewer patients with cardiogenic shock and arrest before admission and more with mild infarction in group 2 than in group 1. Group 1 contained more patients with a history of myocardial infarction, angina and smoking and fewer patients with hypertension and diabetes. Elveback et al. (46) reported a decline in mortality from 18% in the 1960s to 9.3% in the 1970s. These low mortality rates may be explained by the fact that only patients without a previous cardiac history were included.

Causes of improvement in in-hospital mortality. Improved mortality may be due to changes in mean hospital stay during the past 30 years. Therefore, we separately analyzed studies reporting on 1-month mortality and found that a reduction in such mortality could be demonstrated as well. A confounding factor in this regard may be differences in baseline

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characteristics among the patients studied. The admission of patients with less severe disease may have lowered the in-hospital mortality rate (24). However, this factor may have been counteracted by a trend, reported in some internally controlled studies (31,38), toward earlier hospital admission during the past 3 decades, which may have resulted in admission of patients with more severe disease.

There is no wide range in results of studies performed during one decade. It is unlikely that patients admitted in 1979 were very dissimilar from those admitted in 1981. We therefore conclude that differences in mortality rates between different time periods are caused by improved medical care during the 1970s and 1980s. Since 1968, mortality from coronary heart disease has decreased in the United States and many other parts of the world (1,52,69,70). The cause for this decline is complex and includes changes in diet and in life-style, as well as the introduction of new methods in the diagnosis and treatment of coronary heart disease. Acute myocardial infarction accounts for about 33% of coronary heart disease mortality, so it seems likely that improvement in short-term prognosis after acute myocardial infarction has contributed to reduction in overall cardiac mortality.

Long-Term Prognosis

In contrast to short-term prognosis, no change in overall 5-year mortality after hospital discharge could be shown. Subgroups of studies using identical inclusion criteria could not be constructed. Weinblatt et al. (33) included only men with a first acute myocardial infarction. These men had a mean age of 52 years and a 5-year mortality rate of only 19%. Essential baseline information such as age and gender distribution, risk factors and previous history were often incompletely recorded or missing. However, all but one (37) long-term internally controlled study also showed no improvement in long-term prognosis over time. Gomez-Marin et al. (37) observed an improvement in 4-year mortality between 1970 and 1980. Elveback et al. (46) and Weinblatt et al. (51) studied long-term survival in two groups of patients who survived their first myocardial infarction during, respectively, the 1960s and 1970s. No difference in survival between those two periods was found. Goldberg et al. (24,52) reported improved short-term but not long-term survival after acute myocardial infarction in Worcester, Massachusetts from 1975 through 1984.

Reasons for lack of improvement in long-term prognosis. This lack of improved long-term prognosis reported by internally controlled studies could not be explained by differences among groups according to inclusion criteria or baseline characteristics (24,51,52). It may be explained by the progression of underlying coronary artery disease or failure to influence variables that affect discharge survival after hospital discharge (24). Almost all studies that were analyzed reported on patients before the introduction of thrombolytic therapy and coronary angioplasty after myocardial infarction.

A recent study by Simoons et al. (71) showed that in a selected group of patients with acute myocardial infarction, administration of thrombolytic therapy improved 5-year survival. The long-term value of these interventions needs to be documented in less selected groups of patients

Limitations of this study. Publication bias may be a confounding factor in meta-analysis, because studies that report less favorable results are often not published and therefore not included. It is unlikely that publication bias may explain the decline in short-term mortality over time. It is, however, likely that a study reporting a 25% in-hospital mortality rate would not be submitted for publication at present, whereas this apparently was not a problem in the 1960s when these figures were not unusual.

Meta-analysis has been criticized for comparing and aggregating studies that include very different methods, treatments and populations. We tried to solve this problem by performing two subanalyses.

To facilitate comparison of studies on prognosis after myocardial infarction in the future, investigators should use more comparable inclusion criteria. They also must report more extensively on baseline characteristics than has been done in the past.

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