

# TRENDS IN CORONARY HEART DISEASE MORTALITY IN SINGAPORE

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## ABSTRACT

Coronary heart disease which was responsible for 2.9% of all deaths 30 years ago, today accounts for 19% of deaths. The rising trend which declined in 1985, appears to be stabilising now. Indians have mortality rates which are 3 times that of Chinese. This is the background against which the Singapore Myocardial Infarction Register was set up in 1987 to provide incidence and prevalence data for coronary heart disease in the country. In 1987 to provide incidence and prevalence data for coronary heart disease in the country.

**Key words:** Coronary heart disease mortality, Age standardised death rates, Ethnic differences, Singapore Myocardial Infarction Register

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## INTRODUCTION

Coronary Heart Disease which has risen to become the single most important cardiovascular cause of premature death and disability in many developed countries, holds the same supreme standing in the health profile of Singapore.

Singapore's population, at its last estimate in mid-1988, numbered 2.65 million people. This was enumerated based on the 1980 Census and updated with annual births and deaths data, captured through the comprehensive vital registration system of the country. The population in 1988 comprised 76% Chinese, 15% Malays, 7% Indians and 2% persons of other ethnic groups.

The last three decades has seen unprecedented socio-economic advancement in this island republic, resulting in a per capita GNP today of US\$7,940, third in Asia, after Japan and Brunei. This period however has also seen with it a rise in the mortality from Coronary Heart Disease such that, as a single disease group, it is now the leading cause of death and poses the largest public health problem to the country today. Coronary Heart Disease in 1987 killed 2,465 persons out of a 13,173 total deaths, leading to the loss of life of 6 to 7 persons a day in this small country. As a cause of premature mortality, Coronary Heart Disease alone was responsible for 20,445 potential years of life lost during the year, ranking third after Cancers and Accidents.

To permit a global comparison, if Singapore's mortality data is computed to be standardised to the 1980 Coronary Heart Disease Mortality study in 27 industrialised countries among persons aged 40 to 69 years, carried out by Pisa and Uemura (1), it is seen that Singapore's experience of Coronary Heart Disease ranks among the low-mortality-experience group of countries (Table 1).

If for comparative purposes, reference is also made in the same study to the other major cardiovascular disease, namely cerebrovascular disease (Table 2), Singapore's ranking globally shows her to belong to the medium-mortality-experience group of countries.

This paper presents an epidemiological review of trends in mortality from Coronary Heart Disease in Singapore for the period 1957 to 1987. This period has seen within it four revisions of the International Classification of Diseases (ICD), the 6th, 7th, 8th and 9th Revisions.

Coronary Heart Disease, synonymous with Ischaemic Heart Disease, comprises the following individual diseases as listed under the 9th (1975) Revision of the ICD:

- Acute Myocardial Infarction (410);
- Other acute and sub-acute forms of Ischaemic Heart Disease (411);
- Old Myocardial Infarction (412);
- Angina Pectoris (413); and
- Other forms of chronic Ischaemic Heart Disease (414).

## SOURCE OF DATA

Data on mortality presented in this paper was obtained from the Registrar of Births and Deaths in Singapore while other vital events information was sourced from the Department of Statistics. National Censuses had been carried out in 1958, 1970 and 1980. Death reporting is a compulsory statutory requirement in Singapore before a burial or cremation permit is issued. Death reporting can therefore be taken to be comprehensive and complete.

Deaths in Singapore currently are medically certified for 65-70% of cases. Furthermore, doctors are obligated to bring all unexpected deaths to the attention of the State Coroner and measures exist to see that this is complied with. One quarter of deaths in the country are certified by the State Coroner. For the remaining 8% of deaths, certification is carried out by special nursing personnel termed Inspectors of the Dead. Police Officers certify a negligible proportion of cases, numbering between 3 to 5 deaths a year.

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Table 1.  
AGE-STANDARDISED MORTALITY FROM CORONARY HEART DISEASE IN 1980\*

Rates per 100,000 population aged 40-69 years		
	Males	Females
United Kingdom (Northern Ireland)	630	208
Finland	599	191
United Kingdom (Scotland)	592	178
Ireland	499	160
United Kingdom (England & Wales)	482	136
New Zealand	468	134
Czechoslovakia	438	133
Australia	421	132
Hungary	410	130
United States of America	398	128
Denmark	392	121
Canada	390	118
Norway	390	112
Sweden	386	100
Netherlands	323	93
Germany, Federal Republic of	314	90
Israel	314	86
Austria	293	80
Poland	282	78
Bulgaria	268	75
Belgium	264	72
Switzerland	219	71
Italy	212	67
Romania	202	66
Yugoslavia	197	53
<b>SINGAPORE</b>	<b>185</b>	<b>47</b>
France	137	30
Japan	65	24

\* Source: "Recent Trends in Cardiovascular Disease Mortality in 27 Industrialised Countries by K Uemura and Z Pisa, World Health Statistics Quarterly, Vol 38, No 2, 1985

Table 2.  
AGE-STANDARDISED MORTALITY FROM CEREBROVASCULAR DISEASE IN 1980\*

Rates per 100,000 population aged 40-69 years		
	Males	Females
Bulgaria	270	183
Hungary	224	134
Czechoslovakia	172	127
Japan	165	101
Romania	161	92
United Kingdom (Scotland)	121	92
Yugoslavia	116	85
Austria	112	85
United Kingdom (Northern Ireland)	105	80
Finland	101	74
Italy	99	74
Poland	95	64
Ireland	89	63
Germany, Federal Republic of	88	62
Israel	88	61
<b>SINGAPORE</b>	<b>85</b>	<b>61</b>
Australia	84	59
United Kingdom (England & Wales)	84	59
New Zealand	81	50
France	75	47
Belgium	74	43
Netherlands	60	42
Norway	60	39
Denmark	56	38
United States of America	56	37
Sweden	56	37
Canada	53	36
Switzerland	46	32

\* Source: "Recent Trends in Cardiovascular Disease Mortality in 27 Industrialised Countries by K Uemura and Z Pisa, World Health Statistics Quarterly, Vol 38, No 2, 1985

### Trends in Coronary Heart Disease Mortality

Coronary Heart Disease on its own is responsible for 19% of all deaths in Singapore today compared with 2.9% three decades ago. The age-adjusted mortality rate for Coronary Heart Disease rose from 27 per 100,000 population in 1957 to peak at 71 in 1984 and then declined to 64 in 1987. The trend in the age-adjusted mortality from all

Cardiovascular Deaths, similarly rose from 120 in 1957 to 142 in 1979 before slowly declining to 118 in 1987.

All-deaths mortality during this period on the other hand has continued to steadily decline from 769 to 352 while Non-cardiovascular deaths fell from 649 to 234 over the same period.

These trends are illustrated in Fig 1 and Table 3.

Fig. 1  
STANDARDISED DEATH RATES FOR ALL CAUSES OF DEATH, CARDIOVASCULAR DISEASES AND NON-CARDIOVASCULAR DISEASES 1957-1987

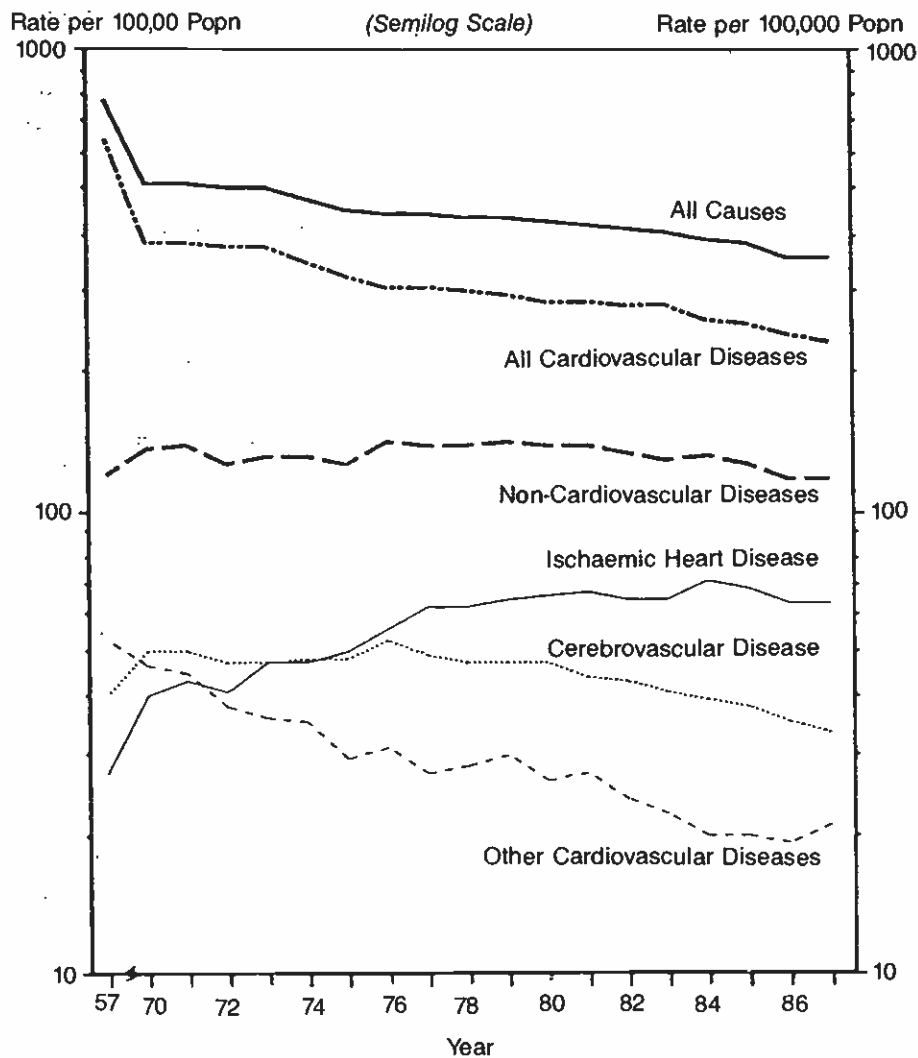


Table 3.  
STANDARDISED DEATH RATES FOR ALL CAUSES OF DEATH, CARDIOVASCULAR DISEASES AND NON-CARDIOVASCULAR DISEASES 1957 TO 1987  
Per 100.00 popn

Cause of Death	1957	1970	1980	1981	1982	1983	1984	1985	1986	1987
All Causes	769	516	425	423	410	406	391	381	356	352
All Cardiovascular Diseases	120	136	139	138	132	128	130	126	117	118
Ischaemic Heart Disease	27	40	66	67	65	65	71	68	63	64
Cerebrovascular Disease	40	50	47	44	43	41	39	38	35	33
Other Cardiovascular Diseases	53	46	26	27	24	22	20	20	19	21
Non-Cardiovascular Diseases	649	380	286	285	278	278	261	255	239	234

Adjusted by direct method using 1970 Singapore population

1957 — ICD 6th revision  
1970 — 8th revision  
1980 to 1987 — 9th revision

**SEX DIFFERENTIAL**

Mortality from Coronary Heart Disease has registered a differential rate of increase among the two sexes in Singapore. When the age-adjusted mortality rate of the population specifically aged 30 years and above is examined, as the sector of the population at risk of the disease, it is seen that where the overall rate increased from 77 in 1957 to reach 215 in 1984 before falling to 193 in 1987, that among males alone rose from 113 to 272 in 1984 and then fell to 230 in 1987. This accounts for a 100% increase in mortality for males over 3 decades.

Female rates however rose much more sharply from 40 to 163 in 1985 before similarly declining to 154 in 1987. This is equivalent to a 300% increase in mortality over the period reviewed.

It can be seen therefore that although the mortality rates for males and females appear to be stabilising, the current levels of mortality among the sexes are such that mortality rates for males are still one and a half times that for females. This sex differential however is commensurate with the picture seen elsewhere in the world<sup>1</sup>.

Table 4.  
**STANDARDISED DEATH RATE OF CORONARY HEART DISEASE BY SEX, 1957 TO 1987**

per 100,000 popn: aged 30 yrs & above

Year	Males	Females	Total
1957	113	40	77
1970	161	74	119
1980	255	138	198
1981	260	137	200
1982	243	145	195
1983	247	142	196
1984	272	155	215
1985	243	163	204
1986	226	150	189
1987	230	154	193

Adjusted by direct method using 1970 Singapore population

**AGE SPECIFIC DEATH RATES**

Cross-sectional age-specific mortality rates computed from 1957 depict that the rising Coronary Heart Disease mortality trend is still largely a phenomenon of the older age groups, namely those aged 60 years and above.

The cross-sectional age-specific mortality rates of those afflicted with Coronary Heart Disease, if traced upwards in a cohort fashion (Fig 2), suggest the decline "due to the birth cohort effect in the younger ages" observed and discussed by Hughes K (2).

Fig. 2  
**AGE-SPECIFIC DEATH RATES OF CORONARY HEART DISEASE 1957-1987**

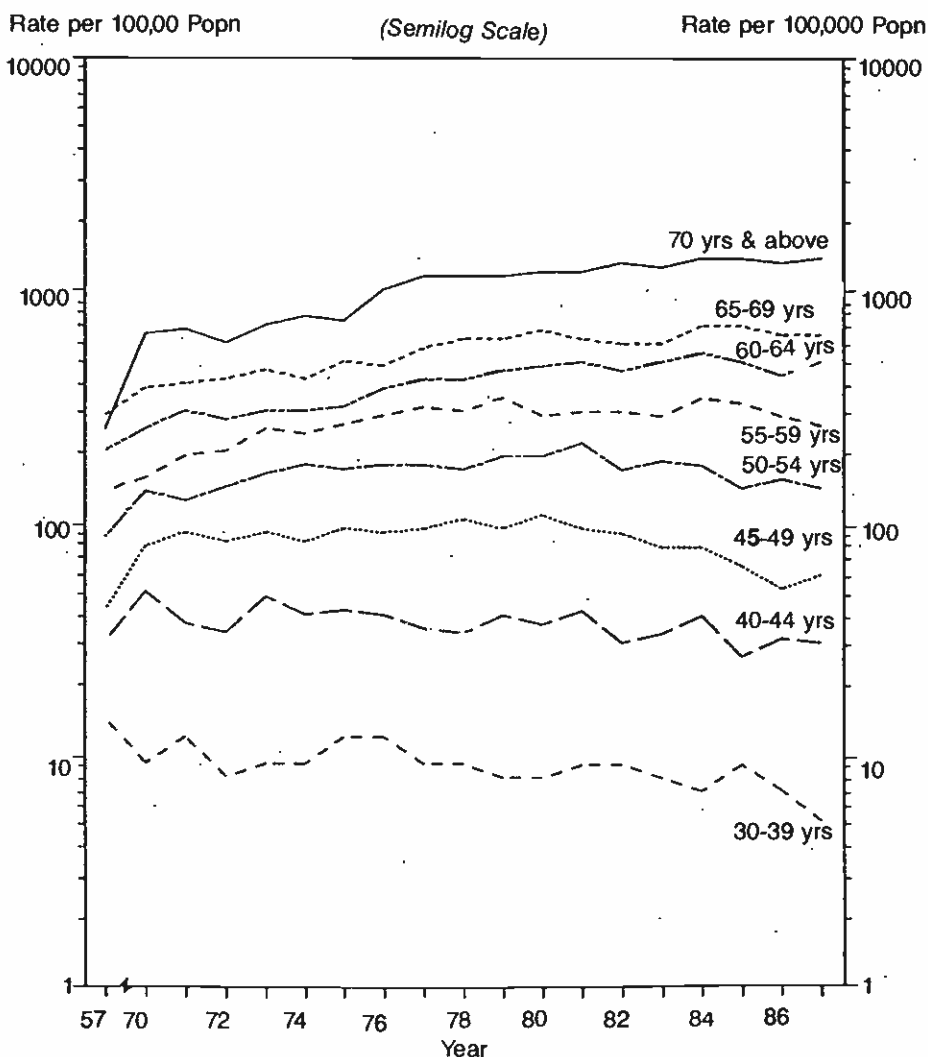


Table 5.  
AGE-SPECIFIC DEATH RATES OF CORONARY HEART DISEASE BY SELECTED AGE GROUPS, 1957 TO 1987

per 100,000 popn

Age Group (in years)	1957	1970	1980	1981	1982	1983	1984	1985	1986	1987
30 - 34	12	5	3	7	6	5	5	3	3	2
35 - 39	16	13	16	14	13	12	11	15	11	8
40 - 44	31	50	36	42	30	34	40	27	32	31
45 - 49	42	79	105	95	91	78	79	66	53	61
50 - 54	87	136	193	216	170	184	176	141	152	140
55 - 59	131	156	290	298	299	288	337	324	284	264
60 - 64	198	254	466	483	459	489	528	498	439	501
65 - 69	292	379	663	613	587	598	703	711	651	640
70 & above	256	641	1204	1201	1328	1291	1406	1367	1298	1361

### ETHNIC DIFFERENTIAL

An analysis of the trends in Coronary Heart Disease among the three main ethnic groups in Singapore (Table 6) illustrates interesting inter-ethnic differences.

The age-adjusted death rate among Malays as a whole today is more than one and a half times that among Chinese. The death rate among the Indians, on the other hand, is three times that of the Chinese. On closer examination, it is seen, once again, that the high levels in the inter-ethnic differences are applicable mainly to males. In fact the levels among Indian males in Singapore approximate the levels seen among males in East Finland (1) who have been demonstrated internationally to have amongst the highest Coronary Heart Disease mortality in

men. The exceptionally high mortality from Coronary Heart Disease among immigrant Indians has also been reported in England and Wales (3), Uganda (4), South Africa (5), Fiji (6) and Trinidad (7).

The ravaging effect of Coronary Heart Disease on the Indian male also manifests its effect at a younger age group compared with that for the national average, with Indian males aged 40 to 49 years already experiencing an age-specific mortality rate of 359 per 100,000 population, a rate which is three and a half times that of Malay males and seven times that of Chinese males within the same age band (Table 7). From then on, the progression of mortality from the disease appears to rise in an almost geometric fashion.

Table 6.  
STANDARDISED DEATH RATES FROM CORONARY HEART DISEASE BY SEX AND ETHNIC GROUP, 1970-1987

per 100,000 popn aged 30 yrs and above

Year	Males				Females				Total			
	Malays	Chinese	Indians	Total	Malays	Chinese	Indians	Total	Malays	Chinese	Indians	Total
1970	168	120	345	161	69	68	189	74	120	95	269	119
1980	320	184	657	255	214	123	237	138	269	154	453	198
1981	311	190	646	260	203	119	323	137	258	155	489	200
1982	324	183	564	243	146	135	318	145	237	160	444	195
1983	339	181	555	247	215	126	333	142	279	154	447	196
1984	350	201	666	272	189	140	368	155	272	171	521	215
1985	325	179	614	243	248	140	457	163	287	160	538	204
1986	329	167	503	226	238	128	366	150	285	149	436	189
1987	281	182	520	230	254	132	397	154	268	158	460	193

Adjusted by direct method using 1970 Singapore population

Table 7.  
AGE-SPECIFIC DEATH RATES OF CORONARY HEART DISEASE BY SEX AND ETHNIC GROUP, 1987  
per 100,000 popn aged 30 yrs and above

Age Group (in years)	Males				Females				Total			
	Malays	Chinese	Indians	Total	Malays	Chinese	Indians	Total	Malays	Chinese	Indians	Total
30-39	17	5	12	8	3	1	—	1	10	3	7	5
40-49	108	51	359	78	—	11	25	12	53	31	203	45
50-59	266	237	740	293	225	68	271	100	246	151	566	198
60-69	909	555	1373	727	720	315	1111	399	828	423	1309	562
70 & above	2083	1314	2577	1501	1867	1186	3111	1257	1985	1237	2714	1361
Total	285	191	625	239	190	160	241	166	238	175	469	203

### Life-Style Related Risk Factors

The three major established Coronary Heart Disease risk factor (namely smoking, hypertension and cholesterol) levels have been established at various stages and are presented next to give an indication of their load in the Singapore community.

**Cigarette Smoking:** The most recent levels of cigarette smoking, determined from two large national surveys carried out in 1984<sup>8</sup> (n=92500) and 1987<sup>9</sup> (n=78600), show that the levels have fallen significantly from 19% to 13.6%. The decline has been seen in both sexes and among all age groups and ethnic groups. Smoking levels among males is now 25% while among females is 2%. Malay males have the highest cigarette smoking (37%) among the 3 ethnic groups, followed by Indian (24%) and then Chinese males (23%).

**HYPERTENSION:** Raised blood pressure levels in the population were last defined and documented by Lee et al in 1977 (10). This, measured as equivalent or higher than 160 mm Hg systolic and 95 mm Hg diastolic was present in 14% of adults aged 20 years and above. This value included known hypertensives controlled by therapy. Among the three major ethnic groups, Malays appeared to have higher prevalence rates (14.9%) of borderline hypertension (either systolic 150-159 or diastolic 90-94) compared with Indians (12.7%) and Chinese (10.8%). These findings have also been noted in some earlier studies (11), (12).

As there have been no major systematic community-based screening or treatment programmes that have been instituted over the last decade or so, it could be assumed that the population levels of hypertension would not have changed significantly.

**Cholesterol:** In a study of 17 Serum Biochemical Constituents conducted in 1978 on 400 apparently healthy Singaporean adults who were blood donors, laboratory personnel or individuals who presented themselves for health screening at a government hospital (13), the mean cholesterol level was 193 mg%. From an earlier study carried out in Malaysia in 1971 on 300 clinically healthy Malaysian blood donors (14), the mean cholesterol of Malays was found to be 200 mg%, that among Chinese 190 mg% while among Indians was 189 mg%.

### DISCUSSION

The findings from the review carried out in this paper show that over the past three decades, Singapore experienced a rising trend in coronary heart disease. There has however been a decline over the last 3 years which appears to be stabilising.

These mortality changes it must be noted took place during an era when the health profile of the country changed perceptibly from one dominated by infectious diseases, to one of chronic degenerative diseases. This, compounded by the good state of health in Singapore, reflected by her Infant Mortality Rate of 7.4 per 1,000 live births today, has resulted in a significant improvement in the expectation of life of the average Singaporean, which rose from 69 years in 1970 to 74 years in 1987. This, no doubt, would have contributed to the exaggerated sur-

facing of cardiovascular diseases as the leading cause of death in the country. Furthermore, during this period, deaths attributable to "Symptoms and Ill-defined conditions" fell from 12% to 2%.

The implications arising out of the findings of this paper on the long term trends in mortality from coronary heart disease among Singaporeans are difficult to enunciate at this stage. Data of 1980 showed Singapore, on an international setting to be within the group of low coronary heart disease mortality experience countries. Mortality has since then declined and appears to be levelling off.

With the rapid ageing of the Singapore population predicted to be of the order of a 300% increase over the next 40 years, Singapore faces the potential problem of increasing numbers of the population dying from coronary heart disease. Against this, should be borne in mind the significant declines in coronary heart disease mortality experienced over the last decade by some major industrialised countries, such as USA, Australia, New Zealand, Finland and more recently, UK.

It has not been the specific purpose of this paper to analyse the reasons for the trends in coronary heart disease mortality in Singapore. What has been highlighted is the need for more detailed and explicit data to enable more tangible conclusions to be drawn about the current status of the disease in this country. For example, it is difficult to postulate from the mortality data alone which has presented, whether the recent declines in coronary heart disease have been due to an actual lowered incidence of the disease itself, which would be the more desirable situation, or whether there has been an improvement in the salvaging of persons afflicted with the disease.

The Singapore Myocardial Infarction Register, which was set up in 1987, will fulfill this important purpose. The Register, which is population-based, is designed to capture ongoing epidemiological data, and as enhancements to the Register, to capture information on risk factor levels, clinical treatment protocols, etc, on an ad-hoc basis. This will permit more in-depth research into the local situation. The Singapore Register which serves the population of 2.6 million people, is reputed to be the largest myocardial infarct register in the world.

Data from the Register over the years will serve several important functions. It will provide valuable and timely data regarding trends in the incidence and prevalence of myocardial infarcts in Singapore. This specific and more relevant information, will enable the many important and costly national health programmes in Cardiology, Cardiothoracic Surgery, Cardiac Rehabilitation and Preventive Medicine which have been greatly intensified over recent years, to be more effectively evaluated. The Register will also provide information for future strategic planning.

In addition, information on Indians afflicted with the disease can be extracted from the Register and studied in detail. This could form the basis for valuable research regarding the vulnerability of this ethnic group to this devastating disease, and in the course of it, perhaps provide a more explicit picture of risks to the disease. The prospects appear promising.

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