

Report

Epidemiological transition of some diseases in Oman: a situational analysis

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النُّقْلةُ الوبائية لبعض الأمراض في سلطنة عُمان: تحليل للوضع

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الخلاصة: شهدت سلطنة عُمان خلال الأعوام الخمسة والثلاثين المنصرمة نُقْلةً اجتماعية واقتصادية ووبائية سريعة، تجلّت في انخفاض حاد في وفيات ومراضة الأطفال والبالغين نتيجة لانحسار مختلف الأمراض السارية بما في ذلك الأمراض التي يمكن توقيها باللقاحات. وكانت الحكامة الرشيدة والتخطيط الجيد بجانب القيادة والالتزام الحكومي عاملاً هاماً في تحقيق هذا الإنجاز. إلا أن الازدهار المتنامي قد أدى إلى ظهور أمراض غير سارية مرتبطة بنمط الحياة، تمثل تحديات صحية مستجدة، وفي طليعتها الأمراض القلبية الوعائية، والسكري، والسمنة. وقد ناقش الباحثون الاستراتيجيات الوقائية الملائمة للحد من عبء الأمراض غير السارية.

ABSTRACT During the past 35 years Oman has undergone a rapid socioeconomic and epidemiological transition leading to a steep reduction in child and adult mortality and morbidity due to the decline of various communicable diseases, including vaccine-preventable diseases. Good governance and planning, together with leadership and commitment by the government, has been a critical factor in this reduction. However, with increasing prosperity, lifestyle-related noncommunicable diseases have emerged as new health challenges to the country, with cardiovascular diseases, diabetes and obesity in the lead among other chronic conditions. Appropriate prevention strategies for reducing the burden of noncommunicable diseases are discussed.

Transition épidémiologique de certaines maladies à Oman : analyse de la situation

RÉSUMÉ Au cours des 35 dernières années, Oman a connu une rapide transition socioéconomique et épidémiologique qui a entraîné une forte réduction de la mortalité et de la morbidité chez les enfants comme chez les adultes, en raison du recul de plusieurs maladies transmissibles, notamment celles pouvant être évitées par la vaccination. La gouvernance et la planification avisées, de même que la direction éclairée et la détermination dont ont fait preuve les pouvoirs publics, ont joué un rôle déterminant dans ce recul. Toutefois, l'accroissement de la prospérité s'est accompagné de l'apparition de maladies non transmissibles liées aux modes de vie – au premier rang desquelles des pathologies chroniques telles que les maladies cardiovasculaires, le diabète et l'obésité – et le pays doit aujourd'hui faire face à ces nouveaux problèmes sanitaires. Des stratégies de prévention permettant de réduire la charge de ces maladies non transmissibles sont à l'étude.

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Introduction

The health services in Oman have made phenomenal progress during the past three and a half decades. Oman's health system was rated first for its overall performance, and eighth for its health system performance, among 191 countries by the World Health Organization (WHO) in 2000 [1].

Other international agencies such as the United Nations Children's Fund (UNICEF) and the United Nations Development Programme (UNDP) also lauded the country's remarkable strides in health system development. This has included rapid epidemiological and demographic transition, observed in the form of improvement in all the demographic, reproductive and child health indicators along with a declining trend for various communicable diseases [2]. With this reduction in communicable diseases, chronic noncommunicable diseases related to lifestyle—such as coronary heart disease, hypertension, diabetes mellitus and cancer—are now emerging as new health challenges for the country [3].

However, so far no epidemiological study has been undertaken to evaluate the trends and differential effects on the outcome of health programmes regarding the reduction of important communicable diseases, especially malaria and tuberculosis.

In the present paper, an epidemiological analysis of some important communicable diseases was conducted, with special reference to malaria, tuberculosis and vaccine-preventable diseases, based on the available data from a variety of sources covering the past 15 years. Data are also presented regarding the emergence of a few important chronic and noncommunicable diseases related to lifestyle.

Methods

These secondary data were compiled and analysed after review of the relevant literature: the WHO world health report for 2000; the Oman national health survey from 2000; the Oman decennial census report from 2003; annual health reports from 1991 to 2005 from the Ministry of Health in Oman; the mortality and health transition report by the government of Oman, UNICEF and WHO Regional Office for the Eastern Mediterranean Region (EMR); and the demographic and health indicators of various Gulf countries for 2005 [1,4–7]. After perusing the morbidity data, a review of the literature was carried out to document the patterns of various communicable diseases, especially malaria and tuberculosis. This review also aimed to study the prevailing trend in the increase of certain noncommunicable diseases which are posing challenges to the country's health administrators.

Morbidity rates were estimated and expressed as morbidity per 1000 mid-year population, and the corresponding morbidity index rates were obtained relative to the year 1991. The estimated burden of disease and disability-adjusted life years (DALYs) for communicable and noncommunicable diseases in the region were also reviewed [8–12]. Finally we searched the Medline database for peer-reviewed publications on noncommunicable diseases pertinent to Oman, including the key words “diabetes”, “hypertension”, “cancer” and “Oman”.

Results

Childhood diseases

The epidemiological situation in Oman of selected communicable diseases for the

Table 1 Epidemiological trend of selected communicable diseases in Oman 1991-05

Year	Malaria		Tuberculosis		Measles		Tetanus		Viral hepatitis		Pertussis	
	No.	Rate/1000	No.	Rate/1000	No.	Rate/1000	No.	Rate/1000	No.	Rate/1000	No.	Rate/1000
1991	19 274	11.50	405	0.24	220	0.13	8	0.005	1066	0.63	26	0.02
1992	14 827	8.30	348	0.19	1834	1.00	10	0.005	1465	0.80	45	0.02
1993	16 787	8.32	275	0.14	3108	1.56	7	0.003	1322	0.67	239	0.12
1994	7 215	3.58	300	0.14	181	0.09	7	0.003	1969	0.94	168	0.08
1995	1 801	0.86	276	0.13	68	0.03	7	0.003	2631	1.26	108	0.05
1996	1 265	0.59	300	0.14	24	0.01	3	0.001	2167	1.01	73	0.03
1997	1 026	0.48	298	0.13	12	0.005	5	0.002	1943	0.86	694	0.31
1998	1 091	0.48	287	0.13	5	0.002	5	0.002	1219	0.53	484	0.21
1999	901	0.39	249	0.11	9	0.003	1	0.0004	1308	0.56	205	0.09
2000	694	0.29	313	0.13	15	0.006	6	0.002	1164	0.48	190	0.08
2001	635	0.26	289	0.12	15	0.006	3	0.001	1555	0.63	54	0.02
2002	590	0.23	288	0.11	5	0.002	4	0.002	2188	0.86	96	0.04
2003	740	0.32	250	0.11	1	0.0004	3	0.001	1243	0.53	149	0.06
2004	616	0.26	285	0.12	18	0.007	3	0.001	684	0.28	76	0.03
2005	544	0.22	257	0.10	19	0.008	0	-	866	0.35	36	0.01

period 1991 to 2005 is shown in Table 1. It can be observed that most of the communicable diseases show a very steep declining trend, which can be linked to the effective implementation of national health programmes in Oman. The incidence of measles also shows a declining trend, with occasional sporadic cases reported (15 each in 2000 and 2001 and 19 in 2005) [13]. However, the incidence of pertussis continued to range from 1 to 6 per 100 000 population between 2001 and 2005. It should also be noted that some childhood diseases such as poliomyelitis, diphtheria and neonatal tetanus have been eliminated, with no cases reported since 1985. The elimination of these childhood diseases can be attributed to the effective implementation of the Expanded Programme on Immunization in Oman.

Malaria

In Oman, malaria was one of the most important public health problems in the 1970s and 1980s. Table 1 shows a remarkable reduction of 97.2% between 1991 (19 274 cases) and 2005 (544 cases) [13]. The malaria cases were further analysed, considering the various malariometric indices such as annual parasite incidence (API), annual blood examination rate (ABER), slide positive rate (SPR), per cent of *Plasmodium falciparum* infection out of total cases and epidemiological classification of

Table 2 Epidemiological situation of malaria in Oman 1991–2005

Year	Total malaria cases		<i>Plasmodium falciparum</i> cases		<i>P. vivax</i> cases	Mixed infection cases	Annual parasite incidence rate	Slide positive rate	Annual blood examination rate
	No.	No.	%	No.	No.	%	%	%	
1991	19 274	17 817	92.4	1 426	31	11.50	7.69	14.9	
1992	14 827	13 958	94.1	845	24	8.30	7.00	11.9	
1993	16 787	16 063	95.7	694	30	8.32	6.71	12.4	
1994	7 215	6 543	90.7	669	3	3.58	2.44	14.6	
1995	1 801	1 282	71.2	513	6	0.86	0.39	21.8	
1996	1 265	754	59.6	500	11	0.59	0.24	23.8	
1997	1 026	552	53.8	469	5	0.48	0.21	21.5	
1998	1 091	523	47.9	551	17	0.48	0.25	19.2	
1999	901	456	50.6	416	29	0.39	0.18	21.3	
2000	694	316	45.5	366	12	0.29	0.14	20.6	
2001	635	283	44.6	336	16	0.26	0.12	21.0	
2002	590	266	45.1	315	9	0.23	0.12	19.5	
2003	740	299	40.4	428	13	0.32	0.18	17.6	
2004	616	449	25.7	158	8	0.26	0.19	13.9	
2005	544	153	26.7	387	4	0.22	0.21	10.3	

positive cases as *P. vivax*, *P. falciparum* or mixed infections (Table 2) [6].

As evident from Table 2, in the early 1990s (1991–1994) more than 90% of cases were due to *P. falciparum* infection, whereas the trend declined steadily to 26.7% in 2005. Simultaneously, there was an increase in the proportion of *P. vivax* infections that usually give rise to lesser complications and fewer deaths. According to the latest Ministry of Health report, the country had its last “indigenous” case of malaria in 1999. In 2005, a total of 544 cases were reported in Oman, all of which were imported, either from East Africa or the Indian subcontinent. Similarly, 615 cases were investigated during the year 2004 and all were found to be imported [6].

The API, a measure of the incidence of malaria in a community, was 11.50% in 1991 and has been showing a declining trend since that year, corresponding to the

launch of the national malaria eradication programme in Oman. It reached a minimum of 0.22% in 2005. Similarly, the SPR, another sensitive parameter for measuring malaria infection rates, decreased steadily from 7.69% in 1991 to 0.21% in 2005. ABER, based on the collection and examination of blood slides from fever cases, varied between 14.9% in 1991 and 10.3% in 2005. According to WHO recommendations, a minimum of 10% of blood slides from fever cases should be examined for effective case detection, and this has been continually observed during the past 15 years in Oman.

Tuberculosis

The number of pulmonary tuberculosis cases showed a declining trend, from 405 cases in 1991 to 257 in 2005, a reduction of 36.5% (Table 1), albeit a gradual decline (Figure 1). The breakdown of tuberculosis cases in Oman from 2000 to 2005 is shown

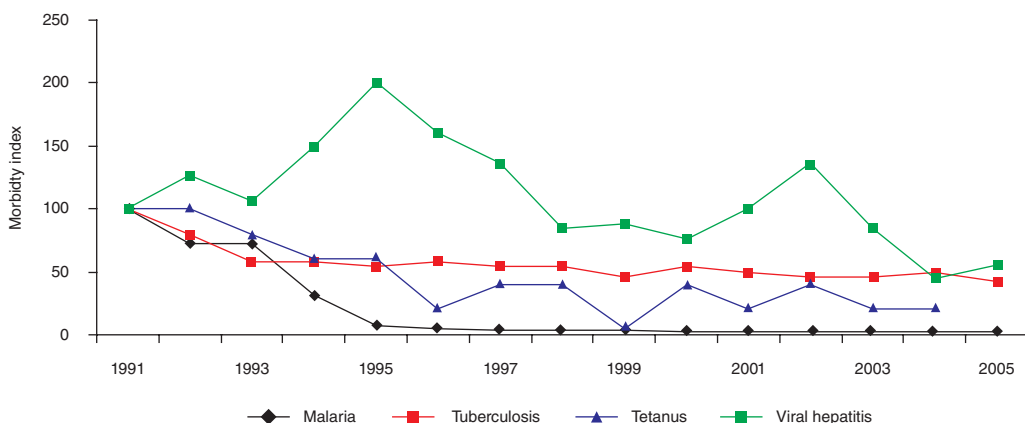


Figure 1 Trends for selected communicable diseases in Oman 1991–2005

Table 3 Annual tuberculosis cases in Oman 2000–2005

Pulmonary cases	2000	2001	2002	2003	2004	2005
Sputum-positive	164	156	151	112	160	131
Sputum-negative	37	29	27	35	39	37
Extrapulmonary cases	112	104	110	103	86	89
Total new cases	313	289	288	250	285	257
Cases cured	242	215	238	194	218	188

Source: Annual health reports, 2000–2005, Ministry of Health, Oman

in Table 3. The national tuberculosis control programme was initiated in 1981 in Oman and was revitalized in 1991. The aim of the control programme is to detect new tuberculosis cases and treat sputum-positive cases as a priority so as to prevent emergence of new cases. This is being done through detection among contacts as well as by vaccination of newborn children with bacille Calmette-Guérin (BCG). In addition, the strategy of directly observed treatment, short course (DOTS) chemotherapy was implemented in Oman during 1996, which has resulted in a more than 90% conversion and cure rate. This was accompanied by a sharp decline in the number of deaths from tuberculosis [6]. During 2005, there were 257 cases, an incidence of about 5.2 per

100 000 sputum-positive cases compared to 6.8 per 100 000 in 2004.

Emergence of noncommunicable diseases

Table 4 and Figure 2 show inpatient morbidity data for some noncommunicable diseases in Oman since 1991. It can be seen that the rates for diabetes and cancer showed a rising trend whereas ischaemic heart disease remained constant. The trends for DALYs in the countries of the Eastern Mediterranean Region, including Oman, are shown in Figure 3. These clearly reveal the dominant burden of a rising trend in noncommunicable diseases and a declining trend of communicable diseases.

Table 4 Epidemiological trend for selected noncommunicable diseases in Oman 1991–2005

Year	Hypertension		Diabetes		Ischaemic heart disease		Cancer	
	No. of cases	Per 1000 population	No. of cases	Per 1000 population	No. of cases	Per 1000 population	No. of cases	Per 1000 population
1991	2502	1.48	2072	1.22	4077	2.41	2215	1.31
1992	2960	1.62	2407	1.32	4427	2.42	2150	1.18
1993	3234	1.63	2892	1.46	4783	2.41	2296	1.16
1994	3495	1.67	3099	1.48	5348	2.55	1862	0.89
1995	3300	1.58	3340	1.60	5505	2.63	2220	1.06
1996	3403	1.59	3663	1.71	5170	2.42	2490	1.17
1997	2892	1.28	3054	1.35	5455	2.42	3493	1.55
1998	3406	1.49	3766	1.65	5244	2.29	3205	1.40
1999	3355	1.44	3653	1.57	5561	2.39	3533	1.52
2000	2250	0.94	3695	1.54	5747	2.39	3378	1.41
2001	3328	1.34	3796	1.53	5882	2.37	3181	1.28
2002	2949	1.16	3801	1.50	5619	2.21	2915	1.15
2003	2862	1.22	4013	1.71	5582	2.38	2929	1.25
2004	2698	1.12	3940	1.63	5538	2.29	3147	1.30
2005	2167	0.86	4117	1.64	5640	2.25	3382	1.35

Various reports indicate that the leading cause of death among inpatients in 1999 was circulatory disease (37% of total morbidity) to which ischaemic heart disease, hypertension and cardiac dysrhythmia were the main contributors. Neoplasms constituted 13% of all deaths [6,14]. Data compiled over

the past 2 decades show a high prevalence of chronic conditions. The 1991 and 2000 surveys have shown that over 11% of the population aged 20 years and above suffer from diabetes mellitus [4,15,16]. More than half the population suffer from either overweight or obesity [17], while the metabolic

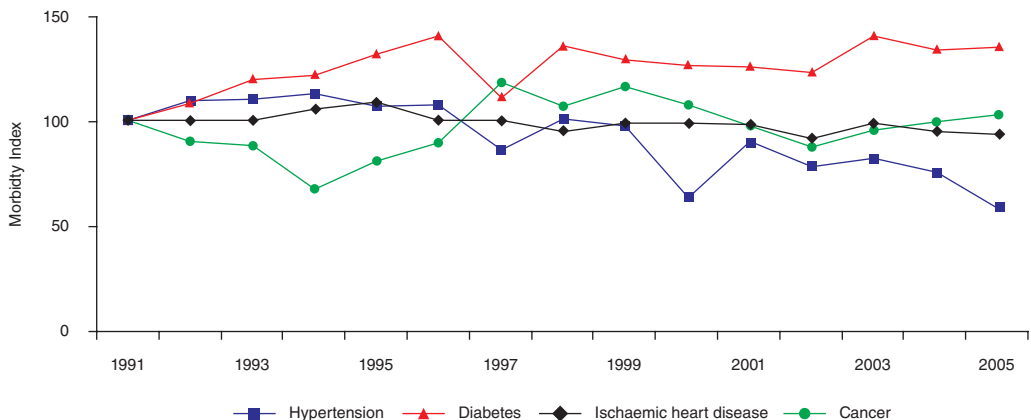


Figure 2 Trends for selected noncommunicable diseases in Oman 1991–2005

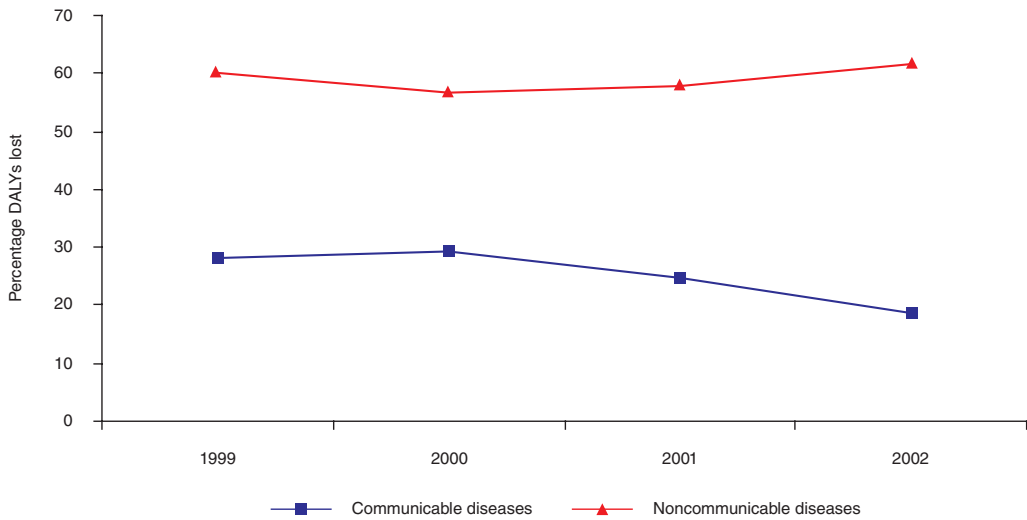


Figure 3 Trend for disability-adjusted life years (DALYs) lost due to communicable and noncommunicable diseases in the Eastern Mediterranean Region 1999–2002

syndrome is as prevalent in Oman (21%) as in the United States of America (23%) [18]. The prevalence of hypertension (blood pressure $\geq 140/90$ mmHg) was 33% (35.2% in men and 30.9% in women) [4,14,19]. Smoking is gaining popularity among youth with 15.5% of men and about 2% of women aged ≥ 15 years reporting current use [20].

Discussion

Oman has been transformed from an undeveloped country to a modern welfare state over the past 35 years. Before 1970, communicable diseases, such as diarrhoeal diseases, cholera, malaria, tuberculosis and trachoma were common health problems. Since then, the health of the Omani people has improved dramatically as political and economic reforms have taken place. This is witnessed by the decline in infant and childhood morbidity and mortality due to various communicable diseases over a very short period of time [2,3].

In 1999, Scrimgeour et al. reviewed the important notifiable diseases in Oman, which included malaria and tuberculosis [21]. Although malaria was a major public health problem at that time, since 1999 not a single case of local transmission of malaria has been reported. The success of the control phase encouraged the government to embark on the eradication phase in 1991, which has led to further rapid declines in the number of malaria cases. Despite the fact that local transmission is ebbing now, it is feared falciparum malaria might be reintroduced by visitors or migrants from East Africa or the expatriate workforce from the Indian subcontinent. However, to combat such an eventuality, measures such as the distribution of prophylactic drugs and screening of passengers arriving from Africa are in place. Private health institutes (where most expatriates seek health care services) were recently included in the national surveillance system to cover the cases coming from such areas [6].

The incidence of tuberculosis declined significantly until 1993, after which the decline slowed over the years. A similar trend was confirmed by Al-Maniri et al. in Oman [22]. Efforts towards further control of tuberculosis now include continuous monitoring and follow-up of all cases, prompt and extensive contact screening, and detailed epidemiological investigation of all cases to establish the possible source of infection and risk factors together with operational research and ensuring a high quality of DOTS [6,22].

The concept of running crucial health programmes such as malaria eradication and tuberculosis control vertically, in parallel with horizontal programmes such as the nationwide immunization programmes for the control of other communicable diseases, proved to be critical in the rapid control of such infectious diseases [13]. It must be added that these achievements would not have been possible without 2 other important factors: first, the politically stable environment which Oman has enjoyed for over 30 years and secondly the strong commitment of the government to provide universal health coverage to all its citizens free of charge. Clearly, the latter was supported by revenues from the oil sector.

Greater economic prosperity over the past 4 decades has led to a shift in the epidemiological patterns of diseases in Oman, with chronic diseases being the most dominant. Noncommunicable diseases are expected to account for 7 out of 10 deaths by 2020 and beyond in developing countries including the Arab countries [23], and this is likely to put increasingly heavy demands on the Omani health care system. As the country continues through the epidemiological transition and socioeconomic development, the burden of noncommunicable diseases, particularly cardiovascular diseases and diabetes, can only be expected to increase.

The current Strong Heart Study findings revealed that diabetes alone increases the risk of cardiovascular disease 2.9-fold compared with normotensive nondiabetic subjects [24]. Furthermore, the current high rates of overweight and obesity will contribute to the impending epidemic of chronic diseases in Oman if sufficient steps are not taken to intervene.

Proven interventions to control chronic disease epidemics include community-based initiatives, such as behavioural changes for dietary intake, weight control, increased physical activity, reduction of stress and smoking cessation services [25]. Such programmes invariably include secondary prevention strategies (screening for raised cholesterol, blood pressure and blood sugar). Health promotion and educational and communication strategies are an integral part of any community-based initiative [26].

Our report has some limitations. Our analysis relied mostly on data produced and compiled by the main public health sector, the Ministry of Health of Oman. While these data have not been formally evaluated by any study, the Department of Health Information System is recognized for its well-developed infrastructure, making Oman a frequent destination for WHO fellows from various Member States in the EMR to learn about its functions and organization. Further, Oman's data on cancer incidence were scrutinized by the International Agency for Research on Cancer and found to be reliable enough to be published in its publication of cancer incidence in 5 continents, making Oman one of only 2 countries among the 22 Member States of the Region to be included.

Another limitation is that our analysis was in part limited to only a single public health agency (the Ministry of Health). This is mainly attributed to 2 reasons. First, the Ministry of Health is the main public

sector, which caters for 85%–90% of the population. Other institutions (the police, army, university and some private companies) and the private sector health services provide only limited services and mostly on an outpatient basis. Secondly, the ministry is the only institution that conducts regular nationwide health surveys on various health problems and risk factors. Thus the scope of our report covered over 85% of the Omani population.

In conclusion, Oman has achieved remarkable improvements in health indicators, including a rapid decline in communicable diseases during the past 3 decades. Increased expenditure on health has resulted in improved indicators of health services, health manpower development and health care. Planning and implementation of various vertical health programmes have paid rich dividends in the reduction of preventable diseases. However, chronic noncommunicable diseases related to lifestyle are emerging as new health challenges for the country. Since the treatment of confirmed

cases is costly and often palliative for most of the noncommunicable diseases, especially at the advanced stages, preventive strategies, including primary prevention, early diagnosis and treatment, are being given priority. Primary prevention is receiving special attention in the prevention of noncommunicable diseases. Many adult health problems such as obesity, diabetes and hypertension have their origin in childhood, when lifestyles (including eating patterns, smoking habits and regular physical activity) are formed. Efforts can be made to impart health promotion in early life as well as throughout adulthood [23].

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