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Supplement

Oman World Health Survey: Part 1 - Methodology, Sociodemographic Profile and Epidemiology of Non-Communicable Diseases in Oman

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Abstract

The Oman World Health Survey (OWHS) is community-based household survey conducted in first half of 2008 for Omani and non-Omani population aged 18 years and above. It is a part of the World Health Survey (WHS) series which was developed by the World Health Organization (WHO) as a means to compile comprehensive information on the health of populations in different countries. A multi-stage stratified cluster sampling was designed to select about 5000 eligible subjects 18 years and above. The main objectives of the survey were to determine the national prevalence of Hypertension, Diabetes Mellitus, Obesity, Lipoproteins, Anemia, Visual ability and Cognitive functions. Among Omanis, the prevalence of Hypertension (40.3%), Diabetes Mellitus (12.3%), Obesity using BMI (24.1%), Total cholesterol (33.6%), Anemia in males 20% and in non-pregnant females was 32.2%. In Oman, the increase in lifestyle-related non communicable diseases has emerged as new health challenges to the country which need to be addressed.

Keywords: Oman; Gulf Arab countries, Prevalence; Non-communicable diseases; Hypertension; Diabetes Mellitus; Obesity; BMI; Lipoproteins; Cholesterol; Anemia; Visual ability

The rising burden of non communicable diseases (NCDs) has been an increasing public health concern globally. In 2005, the World Health Organization (WHO) estimated that 61% of deaths (35 million) and 49% of the global burden of disease were attributable to NCDs. If current trends continue, by 2030 chronic diseases will account for 70% of total global deaths and 56% of the global disease burden.[1]

Like many developing countries, Oman bears a high burden of NCDs. Several studies over past 2 decades have documented the distribution of risk factors associated with NCDs along with the increase in lifestyle-related non communicable diseases which have emerged as new health challenges to the country.[2-9]

The results of National Health Survey in 1999-2000,[10] conducted by Directorate of Research and Studies, DG of Planning, MOH, portrayed a worrisome picture of the risk factors for non-communicable diseases. Based on a sample of 2067 households and 5840 subjects 20 years and older, the study showed that the prevalence rate of diabetes was 11.6% fasting (11.8% in males and 11.3% in females), which increased with age and decreased with levels of education. Thirty three percent of the subjects have high systolic or diastolic blood pressure (35.7% in males and 30.9% in females). The prevalence of high cholesterol levels (≥5.2 mmol/l) was 40.6%. About 29% of the subjects were overweight and 19% were obese. Anemia is still prevalent in all age groups particularly among females.

Oman's rapid socioeconomic development coupled with demographic trends over the past 4 decades reflects positively on Oman's health indicators, most notably on the increase in life expectancy at birth. However, such achievements may be overshadowed by the dramatic rise of chronic diseases, including cardiovascular disease, diabetes and other obesity-associated syndromes, chronic renal failure, and cancer, which are costly to treat. If the achievements in the health of the nation accomplished over the past 4 decades are to continue, there must be concerted efforts and coordinated policies on the part of government with greater emphasis on proven, cost-effective primary prevention services that focus on lifestyle and behavior change.[11] The health care system of Oman faces formidable challenges in its efforts to prevent chronic diseases from eroding the achievements of the past 4 decades. Increase in the population size will lead to an estimated 210% increase in the demand for health care by 2025, and treatment of CVD alone will account for 21% of total health care expenditures.[12]

The motivation for conducting the World Health Survey (WHS) in Oman was to obtain good quality data and evidence that will form the basis of health reform in the country against the background situation noted above. The results from the WHS conducted in 2008 are therefore useful in two respects: as an indicator of the health of the Omani population and as a baseline against which the changes to the health system can be assessed and evaluation of the 5 Year Health Development Plan and progress of some indicators of the Millennium Development Goals.

The idea of conducting this WHS in the Gulf Cooperation Council (GCC) countries was raised at a meeting of GCC Ministerial Council in May, 2003. Responding to this meeting in Oman, a National Committee for WHS was established by

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Ministerial Decision No.40 (April, 2004), and promulgated to form the committee, memberships and responsibilities.

The Oman World Health Survey (OWHS) is Community-based household survey (cross-sectional study) conducted in first half of 2008 for Omani and Non-Omani population aged 18 years and above. It is a part of the World Health Survey (WHS) series which was developed by the World Health Organization (WHO) as a means to compile comprehensive baseline information on the health of populations in different countries. Due to the standardized questionnaire, this information is also comparable between countries, and currently the WHS has been implemented in more than 70 countries. The survey was designed on a modular basis, with the intention of providing low-cost information that supplements data from national health information systems in order to build up an evidence base for policy-makers.

Many Workshops were organized by WHO(HQ)/EMRO and GCC for researchers and focal point personnel since 2004 to coordinate, discuss, prepare and revise the tools and sample size for updating and standardization of WHO methodology of World Health Survey (WHS) of Gulf countries (GCC). The workshops were held in Muscat, Riyadh, Kuwait, Doha and Sana'a. Further meetings were carried out to finalize the preparation, time schedule and starting date for training and field work, and lastly for exchange the field work experiences of carried out surveys.

The Oman World Health survey was implemented by a team of experts from Directorate General of Planning, drawn from the fields of public health, epidemiology and statistics. The implementation was assisted by a technical team from WHO. One of its main goals was to facilitate cooperation with other GCC countries to encourage economic and social integration and capacity building of research system.

Aims of the WHS

- Develop a means of providing low cost valid, reliable and comparable information.
- Build the evidence base to monitor progress in healthcare system, to assess achieving the desired goal and evaluate the effectiveness of health interventions in improving health and reducing morbidities.
- Provide policy makers and program experts with the evidence they need to adjust their policies and strategies as necessary.

Objectives

- To determine the national prevalence of Hypertension, Diabetes Mellitus, Obesity, Lipoproteins, Anemia, Visual ability and Cognitive functions
- To describe the background characteristics of household population (Omani and non-Omani) and of respondents by place of residence (rural / urban)
- To identify the socio-demographic determinants of the above chronic health problems

Sample Design: A multi-stage stratified cluster sampling was designed to select about 5000 eligible subjects; stratification was made on two factors; level of urbanization (urban/rural) and geographical distribution (10 health regions at time of sampling). Equal sample were selected from all strata, with increased sample from urban Muscat

The sample size was calculated to provide national estimates, as well as comparisons for urban/rural areas. The sample has been drawn from a frame of census Enumeration Area (EA) Clusters. Ten clusters for urban and 10 clusters for rural areas from each health region were randomly selected (20 clusters were selected from urban Muscat but only 9 clusters were available from Al Wusta region). A total of 109 and 100 clusters were randomly selected from urban and rural areas respectively.

The 2003 census in Oman has defined the "Enumeration Area (EA)" as the area assigned for one enumerator.[13] There are a total of 3167 EAs in the Sultanate of Oman. Each EA contains on average 110 households arranged in two or more "Enumeration Blocks (EB)". A "Household (HH)" is defined as an individual or a group of individuals who may or may not be blood related, who share the same house and one or more of the living conditions. Thus, there are a total of 343,377 households according to 2003 census.

Sample Size: Sample size was calculated to ensure adequate precision, and to allow hypothesis testing ensuring adequate power. The target sample of 4800 households was calculated based on the following assumptions:

- The smallest expected frequency to be detected is 5%
- Precision is 20% of the expected frequency
- Confidence level is 90%
- A design effect because of cluster sampling and adjusting for variance inflation because of equal allocation 1.5
- A non-response rate of 20%
- Non-response and refusal rates are not different in urban and rural

The target sample of 3650 households was calculated for hypothesis testing based on the following assumptions:

- Relative risk (odds ratio) to be detected is 2.0
- Expected frequency of disease (event) in exposed group is 10%
- Confidence level is 95% (that is the probability that if there is significant difference between the two groups tested, this reflects a true difference in the two populations [1-α]
- The power of the study (1-ß) is 80% (the probability that if the two populations differ, the two samples will show a significant difference)
- The prevalence of exposure variables are expected to be 10%
- A non-response rate of 20%
- Non-response and refusal rates are not different in urban and rural

Based on the above considerations of the minimum number of cases required for each region, the target number of households for OWHS was set at about 5003 as shown in the following table; the target sample was equally allocated for urban and rural.

Table: Sample Size.

Region	Urban				Rural			
	No.	Probability of selection	HH per EA	Total HH	No.	Probability of selection	HH per EA	Total HH
Muscat	20	0.0242	24	480	10	0.3333	24	240
Dhofar	10	0.0549	24	240	10	0.1299	24	240
AdDakhiliyah	10	0.0559	24	240	10	0.0562	24	240
North AshSharqiyah	10	0.1351	24	240	10	0.0680	24	240
South AshSharqiyah	10	0.0568	24	240	10	0.1205	24	240
North AlBatinah	10	0.0267	24	240	10	0.0746	24	240
South AlBatinah	10	0.0680	24	240	10	0.0625	24	240
AdDhahira	10	0.0649	24	240	10	0.0709	24	240
Musandam	10	0.3030	24	240	10	0.3704	24	240
AlWusta	9	1.0000	27	243	10	0.2941	24	240
Total	109		243	2,603	100		240	2,400

Sampled Individual

- **Omani and Non-Omani for individual questionnaires:** One individual was targeted to be selected from among eligible individuals in each household. Kish grid tables were used to randomly select one person from the list of eligible men and women (Age 18+) to answer the individual questionnaire.
- **Reproductive health questionnaire:** All ever married women Omani and Non-Omani aged 15-49 years old.
- **Elderly questionnaire (used the same individual questionnaire):** Only for all Omani elderly in household (i.e. those age 60 or older).
- **Genetic disorder and congenital anomalies (KAP) questionnaire:** Only for all Omani individuals (Age 18+) selected for individual questionnaire (subset from the first target group).

Sample weights: The household weights take into account the selection probability of the EAs or clusters within each stratum and the size (the number of household) of the EA. The design weight was adjusted for non-response at the household level. The individual (adults 18+) weight assumes that adult in the same cluster are selected by systematic random sample and the calculation scheme did not take into account the household size. This simple approach may be biased in the key indicators which strongly associated with the household size. Similarly, the individual weight was adjusted for non-response. Additional weight was calculated for ever-married women selected for the reproductive part of the survey, using the same approach above. All weights were normalized and linked to the database. The analysis took into account the survey design (stratification, clustering and weights) using the survey commands in stata software.

Survey Questionnaires: The OWHS involved two core questionnaires: a household questionnaire and an individual questionnaire and other two country specific questionnaires; reproductive health questionnaire and genetic disorder and congenital anomalies (KAP) questionnaire. The household and individual questionnaires were based on the model survey instruments developed by WHO for World Health Survey to be conducted in different countries. Face to face interview technique with the households and eligible individuals was used to fill the forms after extensive pre-testing, standardization and training.

The household questionnaire consisted of eight parts

- Identification and Re-contact Information.
- Household Roster, Consent form, Housing, Transfer in/out families, Assets & Household Income, Household expenditure and Interviewer observations.

The individual questionnaire was administered to one household member age 18 and over selected randomly. It obtained information on the following topics:

- Respondent's background, work history and benefits, health status description/ difficulties, anthropometrics (weight, height, waist and hip circumferences) performance tests and biomarkers (cognition, hand grip, visual ability, lung function, timed walk, blood pressure, fasting blood test, fasting glucose, total cholesterol, HDL, LDL, triglyceride, HbA1c and haemoglobin).
- Risk factors and preventive health behavior, self-reported chronic diseases and health services coverage, utilization of health services (inpatient and outpatient) and health system responsiveness, social cohesion, self assessment welfare and quality of life, the impact of care giving and interviewer assessment.

Fasting blood samples collection at home and handling of the same for biochemical and hematological investigations were conducted as per standard internationally accepted protocol and norms.

Diagnostic Criteria: The WHO criteria[14,15] for diagnosis of hypertension, hypercholesterolemia, anthropometry and glucose, central obesity,[16] vision were used.[17]

Ethical Considerations: The survey was approved by the Ethics, Research and Clinical Studies Committee of Ministry of Health.
Pre-test and Pilot study: A pretest was conducted at the end of January 2007 for 10 days on questionnaires (household and individual) and instruments used for measurement. According to the pretest, minimal editing was conducted to finalize all survey instruments. In November 2007, a pilot study for 3 days was conducted on a sample of 100 household to test the survey consistency and harmony of the research team in the field work.

Quality control: was carried out during fieldwork by quality control supervisor. Ten percent of each interviewer completed work was verified on a daily basis. This was done by random selection of one-in-ten sub sample to verify the interview and random questions were checked for interviewer falsification. In addition, for calculating test/retest reliability a 10% retest from the total sample including interview of the same household informant and individual questionnaire respondent were conducted by different interviewers during the first week after fieldwork start.

Publicity and community orientation: Adequate media was done by the MOH through TV, radio, newspapers and posters.

Data Processing activities

Office editing: In the local region, the field supervisor (sanitarian) was responsible for collecting questionnaires from the team at the end of the day to review them. The office editor's (statistician) main responsibility was to check all completed questionnaires, check any missing information or mistakes, also office editors reviewed questionnaires for consistency and completeness. To provide feedback for the field teams, the office editors were instructed to report any problems detected while editing the questionnaires and inform field supervisor to correct it. If serious errors were found in one or more questionnaires from a cluster, the supervisor of the team working in that cluster was notified and advised of the steps to be taken to avoid these problems in the future. Another central office editing process was followed in the department of research and studies for finally coding and prepared the questionnaire data entry process.
Editing and machine entry: The data from the questionnaires were edited and entered on microcomputers using the Census and Survey Processing System (CSPro), a software package for entering, editing, tabulating, and disseminating data from censuses and surveys.
Data management: was done for extreme values and consistence check to produce a cleaned final data set for data analysis. The process of preparation of data file was completed by June 2008. After the data cleaning was conduct the final data set was exported to SPSS and STATSE format and analysis was under taken using SPSS 18 and STATSE 10.

Sample Coverage: During the fieldwork a total of 5846 households were selected out of these 5465 households were completed with response rate 93.5%. Also, 4717 individual were successfully interviewed out of 5465 identified (86.3% response rate). The Biomarkers were successfully carried out for 3686 individual, with refusal rate 22%).

Data analysis: The survey data were cleaned locally through two syntax programs, initially using Cspro software and then using STATA designed by WHO. Certain values, which were determined to be extremes or outlier's, were removed from the analysis. The analysis consisted of simple tabulations of the data against important subcategories. At all stages sampling weights were used to ensure the results obtained were representative of the population of Oman.

Wealth quantiles: In many countries, it is known that wealth is highly related to health. The measurement of wealth is not simple, and a number of different methods have been used in different reports to capture the wealth of a household. In this survey, a statistical technique called principle components analysis was applied to assets that the household owns, taking into account the number of items per household member. The first factor that was produced using this method was taken as representing wealth. This factor was divided into five different groups using sampling weights and the number of household members, and these have been termed as wealth quantiles. Therefore the wealth quantile variable has the values of 1 to 5, with 1 being the poorest household and 5 the richest. Thus the analysis comparing the bottom quantile to the top quantile within each set reflects those in relative poverty.

Limitations of the survey: The main limitation of Oman World Health Survey was that the information collected on a self reported chronic health problems/ difficulties from individuals interviewed and hence subjected to some form of bias. The vignettes in this survey were intended to solve some responsiveness problems as morbidity and health state valuation, but the survey analysis did not use the vignettes to adjust differential responses between groups.

Also the questionnaire being long and detailed (1146 questions) taking approximately on an average 2 hours and 15 minutes to administer could have caused fatigue and hence altered responses among subjects / interviewers.

Results

Socio-Demographic Profile

Overall, 5465 households were interviewed which included 40179 individuals; out of which about 52% were males.

Characteristics of the Household Population

Table 1 illustrates the household population characteristics by nationality and gender. Overall, the majority of the household population are Omani which means that 85% of the interviewed household population are Omani. Clear variations are observed in the distribution of household population by age groups between Omani and non-Omani. The table shows that 42% of the non-Omani household population are in the age group 30-44 compared to 14% among the Omani population. On the other hand, 44 of the Omani household population are less than 15 years old which is more than double the percentage reported among non-Omani household population.

Looking at the variation in the marital status, the table shows that 55% of the Omani household population have never been married and 39% are currently married with limited differentials by sex. On the contrary, 71% of the non-Omani household population are currently married while 25% have never been married.

Table 1 also illustrates that non-Omani household population attain higher educational levels more than the Omani population. For example, only 7 percent of the Omani household population completed university or higher compared to 31 percent among the non-Omani household population. It is also worth noting that there is a clear variation in the percentage of illiterate among Omani and non-Omani (12 percent and 8 percent respectively).

Respondent's Characteristics

Table 2 presents the distribution of eligible respondents (18 and over years old) by background characteristics. Overall, one–third of respondents are under age 30 years and 38 percent of respondents in the age 30-44 years. Rural respondents are younger than urban respondents (38 percent are under age 30 in rural areas compared with 31 percent in urban areas). Overall, male respondents represent 50 percent which increases to 53 percent in rural areas and decreases to 49 percent in urban areas. Twenty-four percent of respondents are never married, 67 percent are currently married, and 9 percent are widowed or separated/divorced. Seventy–one percent of respondents are Omani, and 29 percent are non-Omani with higher percent of non-Omani in urban than rural (33 percent and 12 percent respectively)

Table 1: Household population by nationality and gender. Percent distribution of the de jure population by age, marital status and education according to nationality, Oman WHS.

Characteristics	Omani			Other			Total*		
	Sex			Sex			Sex		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Age group									
0-4	10.3	9.9	10.3	7.4	6.0	6.7	2091	1921	4012
5-14	24.4	23.4	23.9	13.9	15.2	14.5	4939	4596	9535
15-29	38.5	38.4	38.4	17.4	24.4	20.6	7580	7326	14906
30-44	13.6	14.2	13.9	40.5	42.6	41.5	3133	3036	6169
45-59	8.4	9.7	9.0	19.4	9.2	14.6	2015	1829	3844
60-69	2.6	2.2	2.4	1.3	2.0	1.6	485	403	888
70-79	1.4	1.3	1.4	0.0	0.3	0.2	262	234	496
80+	0.8	0.9	0.9	0.0	0.3	0.1	177	152	329
Marital status									
Never married	59.2	51.2	55.2	27.0	23.3	25.3	8604	7106	15710
Married	39.2	39.7	39.4	73.0	69.5	71.4	6479	6190	12669
Divorced, separated	1.0	2.7	1.8	0.0	2.7	1.2	136	397	533
Widowed	0.7	6.5	3.6	0.0	4.3	2.0	119	871	990
Educational level									
Less than 6 years	12.0	12.0	12.0	8.7	7.0	7.9	2446	2325	4771
Illiterate	8.6	15.4	12.0	5.3	12.0	8.4	2227	3470	5697
No formal education	2.9	2.5	2.7	1.6	6.4	3.8	599	584	1183
Primary incomplete	18.1	17.9	18.0	14.7	14.3	14.5	3731	3630	7361
Primary completed	13.6	12.3	13.0	10.7	9.8	10.3	2919	2465	5384
Preparatory completed	14.3	12.7	13.5	15.1	11.2	13.3	3097	2393	5490
Secondary completed	22.8	20.4	21.6	9.8	11.8	10.7	4178	3437	7615
University+	7.6	6.8	7.2	34.1	27.5	31.0	1485	11193	2678
Total*	18660	17928	36588	2022	1569	3591	20682	19497	40179

**All figures in table were weighted as percentage while total number of population Unweighted.*

Overall, 22% of respondents are with no education with almost same percent with university or more education (23%). Differentials between urban and rural are clear, where 34% of rural respondents are with no education compared with 18% only in urban areas. Also, 6% only of rural respondents are with university or more compared with 23% among urban respondents.

Housing Characteristics and Possessions

Overall, 96% of households have hard floor material with some differences between urban and rural households and across wealth quantiles. Ninety-eight percent of households have durable wall with clear difference between urban and rural households (99% in urban and 93% in rural). Differences are more clear between the Q1(Lowest) and other wealth quantiles, where 91% of Q1(Lowest) households have durable wall compared with virtually all households in the other four wealth quantiles.

Table 3 provides information on household ownership of the housing unit the household live in and crowdedness. Overall, 85% of Omani households own their home. On the other hand, the majority of non-Omani (80%) rent the dwelling they live in. Also, housing unit ownership is much higher in rural than among urban households.

Number of living rooms per households differs between Omani and non-Omani (5.7 rooms and 3.5 rooms, respectively). Number of rooms per household is more in urban than in rural. Also, there is association between number of rooms and wealth quantile, where there is 3 rooms per household in the Q1 (Lowest) quantile, compared to 7.3 rooms among the households in the highest wealth quantile. The mean number of persons per room varied between 1.6 people for Omani household to 1.1 people for non-Omani. Also, rural households are more crowded than urban households. Crowdedness is more in the poorer households than the richer households, where the mean number of persons per room is 1.6 among the Q1 (Lowest) households which declines to 1.2 persons among the Q5 (Highest) households.

Table 2: Background characteristics of respondents(Omani and non-Omani). Percent distribution of adult men and women (18 years old and above) by selected background characteristics according to residence, Oman WHS.

Characteristics	Urban	SE	Rural	SE	Total	SE
Age						
18-29	31.3	1.4	37.8	1.4	32.8	1.1
30-44	39.7	1.6	33.0	1.3	38.2	1.3
45-59	20.1	1.2	16.7	1.1	19.3	1.0
60-69	5.6	0.7	7.2	0.8	6.0	0.6
70-79	2.4	0.5	3.1	0.5	2.6	0.4
80+	0.9	0.2	2.2	0.4	1.2	0.2
Sex						
Male	48.5	1.5	52.7	1.5	49.5	1.2
Female	51.5	1.5	47.3	1.5	50.5	1.2
Marital status						
Never married	24.0	1.3	25.5	1.3	24.4	1.1
Currently married	67.9	1.5	63.5	1.5	66.9	1.2
Separated/divorced	2.9	0.4	3.7	0.6	3.1	0.4
Widowed	5.2	0.5	7.3	1.0	5.6	0.5
Nationality						
Omani	66.6	3.1	88.3	2.3	71.4	2.5
Non-Omani	33.4	3.2	11.7	2.2	28.6	2.6
Education of household head						
No formal education	18.4	1.4	33.6	1.9	21.8	1.1
Less than primary	7.2	0.8	12.3	1.0	8.3	0.7
Primary	8.1	0.7	11.1	0.8	8.8	0.6
Preparatory	11.7	1.0	13.3	1.0	12.0	0.8
Secondary/High school	26.6	1.3	23.6	1.6	25.9	1.0
College/University	22.5	2.0	5.7	0.7	18.8	1.6
Postgraduate	5.6	1.3	0.4	0.1	4.4	1.0
Total	100.1		100.0		100.0	
Total	3656		1061		4717	

Table 3: Ownership of dwelling and crowdness. Distributions of households by ownership of dwelling and crowding by nationality, place of residence and wealth, Oman WHS.

Parameter	Nationality		Residence		Wealth				
	Omani	Other	Urban	Rural	Q1 (Lowest)	Q2	Q3	Q4	Q5 (Highest)
Dwelling ownership status									
Owned	85.2	1.8	59.0	83.7	49.7	72.6	70.5	70.6	59.5
Rented	12.8	79.9	36.2	6.0	31.6	24.2	27.3	25.9	38.1
Free\other	2.0	18.3	4.8	10.3	18.7	3.2	2.3	3.5	2.4
Number of living room per HH									
Mean (S.E)	5.7(0.04)	3.5(0.04)	5.4(0.04)	4.6(0.07)	3(0.05)	4.5(0.05)	5.1(0.05)	6.(0.07)	7.3(0.1)
Persons per room HH									
Mean(S.E)	1.6(0.02)	1.1(0.02)	1.4(0.01)	1.9(0.04)	1.6(0.04)	1.7(0.03)	1.6(0.03)	1.4(0.02)	1.2(0.02)
< 3	91.4	96.6	95.1	84.3	86.4	88.0	94.2	96.0	98.8
>=3 person per room	8.6	3.4	4.9	15.7	13.6	12.0	5.8	4.0	1.2
Number of HH	4114	1351	4236	1229	1093	1093	1096	1090	1093

As regards household ownership of durable goods and other possessions by background characteristics the majority of Omani households own most of the basic appliances. Ninety-five percent of OWHS households own a television, 96% own refrigerator, 95% own GSM and more than eight in ten households own car. Ninety one percent of Omani households have washing machine, 53% own computer, 47% of households have landline and 24% have internet line.

Urban households are more likely to have these items than rural households. For example, 96% of households in urban areas have TV compared to 84% of households in rural areas. Rates of ownership of various household possessions also differ between urban and rural, with higher rates of ownership for most items reported among households in the urban than rural areas. Also, households in the highest wealth quantile are much more likely to own various possessions than those in the lowest wealth quantile.

Medical Measurements and Laboratory Examination

The mean height of Omani respondents was 160.4 cm, and the mean weight was 67.9 kg. The mean height was higher for males (166 cm) than females (155 cm). The mean weight for males (72 kg) was higher than females (64 kg). (Table 4)

Table 4: Mean height and weight of Omani population by sex.

Parameter	Sex		Total
	Male	Female	
True height (cm)	166.1	155.4	160.4
True weight (kg)	71.9	64.3	67.9
Total	71.9	64.3	67.9

Table 5 presents the distribution of the Body Mass Index among the Omani population. In general, 37% of the Omanis were within the normal range. Less than 1 in 10 Omanis were underweight while 30% are overweight and about one-quarter were obese. This indicates that underweight and obesity are slightly higher among the Omani population than the rest of the population.

Underweight is higher in the age group 18-24 and 75 or more, while, overweight and obesity were more common among the age groups 25-74 and the Q5(Highest) wealth quintile. There was no clear pattern between different educational levels and overweight or obesity.

Looking at the obesity among Omani population by age, Fig. 1 indicates that obesity peaks at the age group 35-44 for females and at the age of 45-54 for males. In general, about one-third of Omanis in 35-54 age group were obese. This percentage is much lower among Omanis in the 18-24 and 75-84 age group where about only one in 10 Omani in those age groups were considered obese.

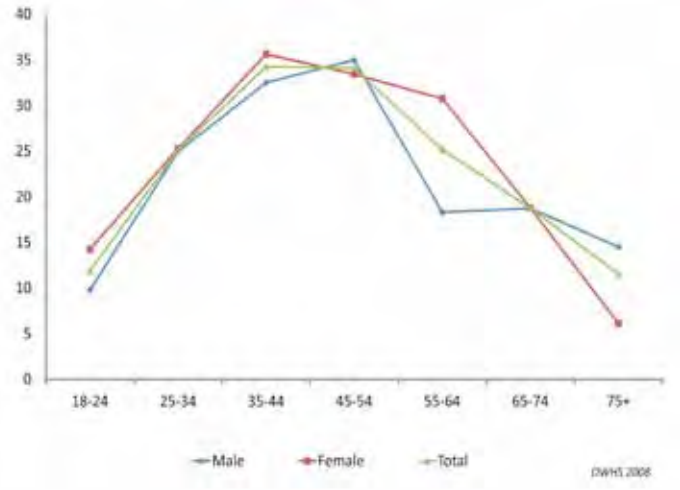

Figure 1: Sex prevalence of obesity in Omani population by age group.

Table 5: Distribution of Body Mass Index among Omani people. Percent distribution of body mass index of Omani people, according to background characteristics, Oman WHS.

Characteristics	Body Mass Index(BMI)				No. of respondents
	Underweight >18.5	Normal 18.5 -<25	Overweight 25 -<30	Obese ≥30	
Sex					
Male	7.7	39.0	31.2	22.0	1579
Female	10.0	36.0	28.0	26.1	1791
Age					
18-24	19.4	50.9	17.8	11.9	779
25-34	6.6	34.9	33.4	25.1	941
35-44	2.2	28.5	35.0	34.3	632
45-54	5.6	25.8	34.5	34.1	398
55-64	5.8	32.0	37.0	25.2	321
65+	20.4	44.3	19.0	16.3	300
Education					
Illiterate/read & write	8.3	36.8	29.5	25.5	936
Primary	5.7	29.7	34.4	30.1	618
Preparatory	11.8	42.2	26.5	19.5	393
Secondary	11.0	41.9	25.5	21.7	1004
University+	7.2	35.0	35.2	22.7	419
Wealth quintile					
Q1(Lowest)	10.6	42.1	28.8	18.5	565
Q2	8.0	36.2	30.3	25.5	815
Q3	9.0	40.0	28.7	22.3	755
Q4	7.0	36.9	30.7	25.5	677
Q5(Highest)	10.7	32.0	28.8	28.5	558
Region					
Muscat	5.3	40.7	29.9	24.1	555
Dhofar	5.3	21.2	28.1	45.4	333
AdDakhiliyah	11.0	39.4	30.3	19.3	480
North AshSharqiyah	10.1	42.3	28.6	19.0	249
South AshSharqiyah	10.0	39.1	26.0	24.9	323
North AlBatinah	10.1	36.4	30.0	23.4	690
South AlBatinah	10.5	41.2	28.8	19.5	410
Adh Dharirah	9.4	35.6	35.4	19.7	251
Musandam	(11.2)	(40.5)	(27.0)	(21.3)	44
Al Wusta	(3.8)	(51.4)	(26.0)	(18.8)	36
Total	8.9	37.4	29.5	24.1	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.
** Male Hb<13 Female Hb<12 Pregnant female <11*

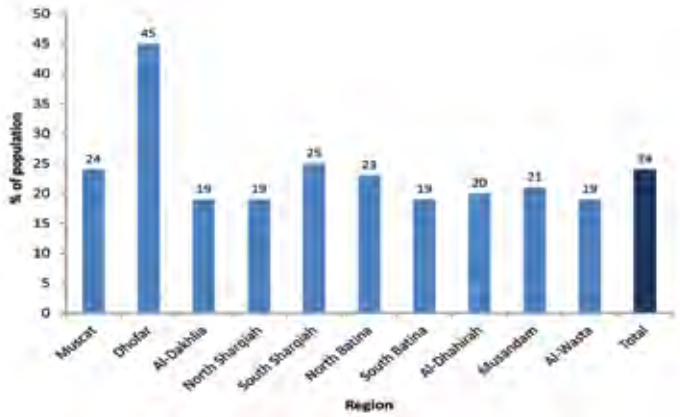

Figure 2: Prevalence of obesity measured by BMI of Omani population by region.

By region, the Omani population living in Dhofar are much more likely to be obese than those living elsewhere. For example, Omanis residing in Dhofar are two times and a half more likely to be obese than those living in Al- Wasta. Slight variations are also observed across the other regions. (Fig. 2)

Waist Circumference (WC), Hip Circumference (HC) and Waist to hip ratio (WHR)

Waist and Hip measurements have also been analyzed for the Omani population. Results in Fig. 3 indicate that the mean WC of Omani males and females were 89.7 cm and 88.7 cm, respectively. Indicating that females are more liable for abdominal fat than males. Also, the mean HC for the Omani females was 99 cm compared to 96.5 cm among the males.

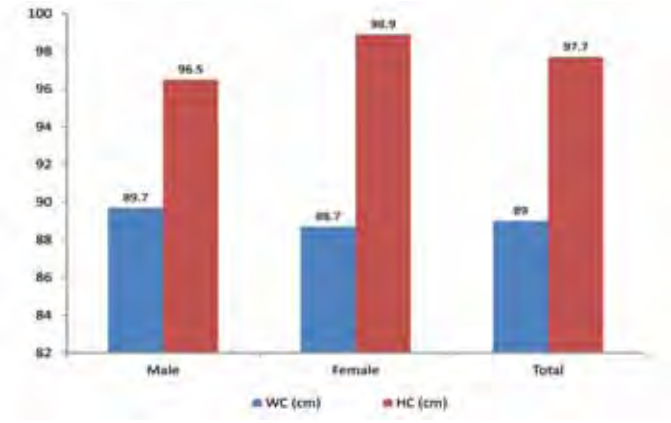

Figure 3: Mean waist (WC) and hip (HC) circumferences of Omani by sex.

Table 6 presents the percentage of the Omani population classified to have central obesity (men whose WC is ≥102 cm and women with WC ≥88 cm) and have abnormal WHR. Overall, more than one third of the Omani population have excess abdominal fat (i.e. centrally obese) while 64% have an abnormal/ high WHR.

Results in the table also shows that obesity decreases by educational level where illiterate Omani persons are more likely to be obese than those with a secondary or university education. Half of the Omanis who are illiterate are centrally obese compared to 27% among those with a secondary education or higher. Also, the majority of the Omanis who are illiterate have a high WHR (78 percent), while 56% of those with university education suffer from high WHR.

Table 6: Distribution of central obesity (waist circumference) and waist to hip ratio (WHR) of Omani persons. Percent distribution of Omani respondents by central obesity (waist circumference) and waist to hip ratio (WHR) of Omani persons, by background characteristics, Oman WHS.

Characteristics	Central obesity		Waist to Hip Ratio		No. of respondents
	Normal	Obese	Normal	Obese	
Sex					
Male	80.3	19.7	38.3	61.7	1579
Female	46.5	53.5	35.0	65.0	1791
Age					
18-24	84.8	15.2	55.8	44.2	779
25-34	64.2	35.8	44.5	55.5	941
35-44	48.6	51.4	24.4	75.6	632
45-54	45.3	54.7	20.9	79.1	398
55-64	44.2	55.8	18.4	81.6	321
65+	60.4	39.6	28.7	71.3	300
Education					
Illiterate/read & write	50.0	50.0	21.9	78.1	936
Primary	50.6	49.4	34.0	66.0	618
Preparatory	71.6	28.4	40.7	59.3	393
Secondary	73.3	26.7	46.7	53.3	1004
University+	72.6	27.4	43.7	56.3	419
Wealth quintile					
Q1(Lowest)	64.1	35.9	30.0	70.0	565
Q2	61.2	38.8	37.1	62.9	815
Q3	65.5	34.5	37.6	62.4	755
Q4	57.1	42.9	37.9	62.1	677
Q5(Highest)	65.7	34.3	38.8	61.2	558
Region					
Muscat	62.8	37.2	38.2	61.8	555
Dhofar	56.2	43.8	29.1	70.9	333
AdDakhiliyah	72.4	27.6	48.8	51.2	480
North AshSharqiyah	68.3	31.7	32.8	67.2	249
South AshSharqiyah	43.6	56.4	24.0	76.0	323
North AlBatinah	61.9	38.1	36.8	63.2	690
South AlBatinah	64.7	35.3	36.3	63.7	410
Adh Dharirah	62.3	37.7	32.6	67.4	251
Musandam	(67.2)	(32.8)	(41.9)	(58.1)	44
Al Wusta	(74.1)	(25.9)	(65.4)	(34.6)	36
Total	62.6	37.4	36.5	63.5	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

By region, Omanis in South Ash Sharqiyah are the most likely to be obese followed by those living in Dhofar. Sixty-seven percent and 71% of Omanis in South Ash Sharqiyah and Dhofar had an abnormal high WHR.

Although the percentage of Omani population is quite high across all groups yet variations are remarkable. Variations by sex shows that Omani females are much more likely to be centrally obese than males (54% are centrally obese compared to 20% respectively). This gap is much narrower for the high WHR where females are 3 percentage points more likely to have an abnormal WHR than males. (Fig. 4)

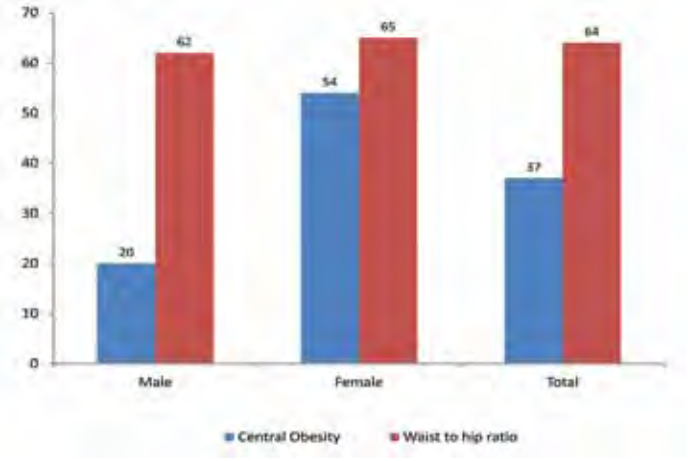

Figure 4: Distribution of central obesity of Omani (waist circumference & WHR) by sex.

Blood Pressure

Hypotension

A noteworthy finding was the presence of hypotension in about 7% of the Omanis with females contributing three times more to the statistics as compared to males.(Fig. 5)

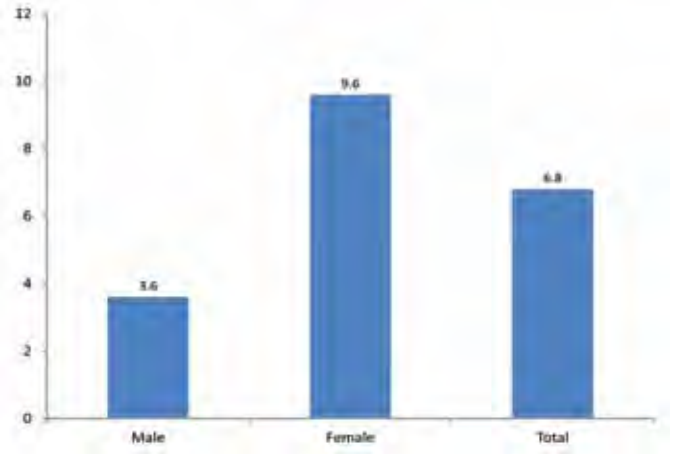

Figure 5: Prevalence of hypotension among Omani population by gender

Table 7 presents the self reported hypertension and that obtained on measurement of respondents. Hypertension was common among the population: 10% self reported and 30% were newly diagnosed during the survey. Data in the table also revealed that 7% of the respondents who reported having hypertension their cases were not controlled and only 3% had their hypertension under control.

The WHO report in 2010 on country profiles estimated that NCDs account for nearly 83% of the total deaths in Oman.[18] and hence special attention should be given to combat these diseases. Community awareness campaigns are needed to increase population's knowledge about symptoms, risk factors, nutrition and life of style that would impose higher risks.

As Fig. 6 shows newly diagnosed cases among males was more than twice that of newly diagnosed among females (44% compared to 19%). On the contrary, females were more likely to self report hypertension.

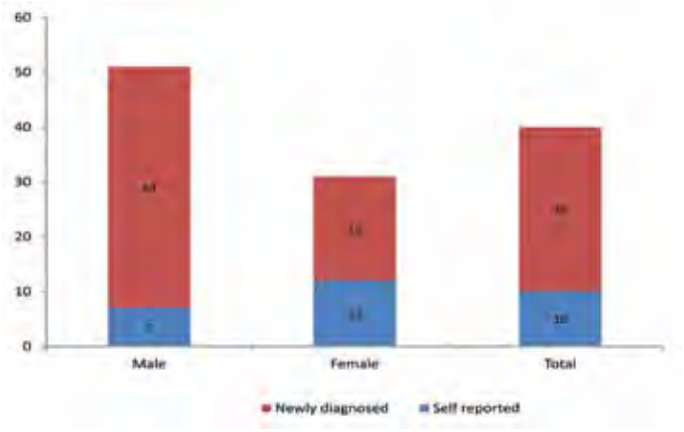

Figure 6: Sex prevalence of total hypertension (self reported hypertension and newly diagnosed cases) among Omani.

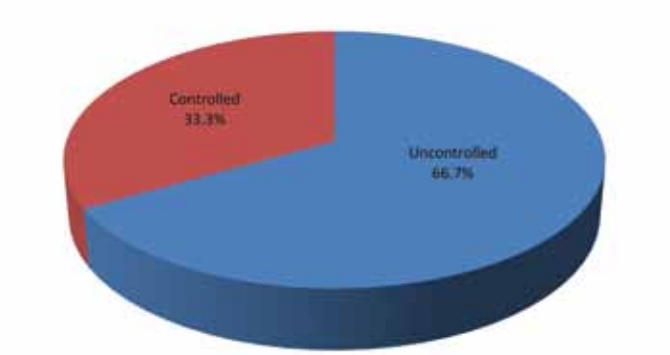

Figure 7: Proportion of controlled hypertension from self reported hypertension.

Fig. 7 highlights that the poor control of hypertension is noted in about 67% of those who reported on their own to have hypertension.

Table 8 illustrates the type of hypertension among Omani population: isolated systolic, isolated diastolic, combined or controlled hypertension. In general, 13% of the Omani population has a high systolic pressure, 7% had a high diastolic pressure and 17% had high systolic and diastolic pressure combine. In addition, results indicated that 3% of the Omanis reported having hypertension but their BP readings were within the normal range (controlled cases).

Omani males were more likely to had a high blood pressure than females. About one-quarter of the Omani males had a high systolic and diastolic blood pressure combined compared to 10% among females. It is also worth noting that females were more likely to have controlled blood pressure (i.e. reported having high blood pressure but measurements were within the normal range) than males.

As expected, Omanis in the age group 75-84 are the most likely to have high isolated systolic pressure (Fig. 8) while those in the age group 35-44 were the most likely to have high isolated diastolic pressure. Also, Omanis in the age group 45-54 were more than twice as likely as those in the age group 18-24 to have a high combined systolic and diastolic pressure.

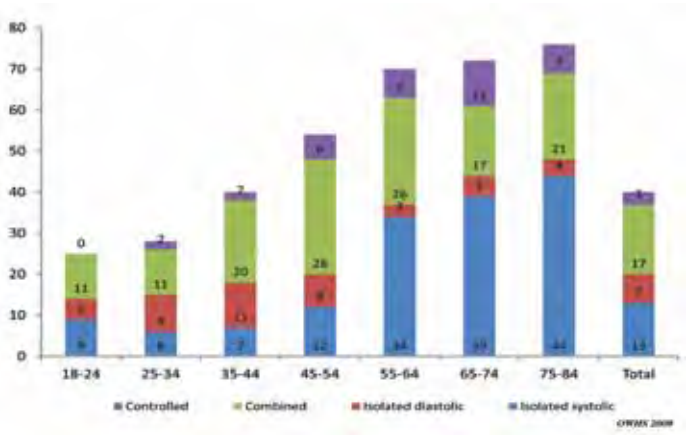

Figure 8: Distribution of hypertension type by age among Omanis

Table 7: Prevalence of hypertension (by self reported and measurement) of Omani persons. Percent distribution of respondents by prevalence of hypertension (by self reported and measurement) of Omani persons, according to background characteristics, Oman WHS.

Characteristics	Self reported		Newly diagnosed cases	Total hypertension	Not hypertensive	No. of respondents
	Uncontrolled	Controlled				
Sex						
Male	5.5	1.8	43.5	50.7	49.3	1579
Female	7.6	4.5	18.9	31.0	69.0	1791
Age						
18-24	1.4	0.3	23.0	24.7	75.3	779
25-34	0.9	1.6	25.1	27.6	72.4	941
35-44	2.4	2.3	34.4	39.1	60.9	632
45-54	12.6	5.8	35.7	54.2	45.8	398
55-64	22.7	7.2	41.1	70.9	29.1	321
65+	21.5	10.7	39.8	72.4	27.6	300
Education						
Illiterate/read & write	18.1	7.9	35.0	61.0	39.0	936
Primary	3.6	2.5	30.1	36.2	63.8	618
Preparatory	1.9	0.8	39.4	42.1	57.9	393
Secondary	1.5	1.3	23.9	26.7	73.3	1004
University+	2.2	1.0	28.1	31.4	68.6	419
Wealth quintile						
Q1(Lowest)	9.3	5.9	29.4	44.6	55.4	565
Q2	4.7	2.3	33.8	40.8	59.2	815
Q3	4.9	3.5	29.9	38.3	61.7	755
Q4	7.9	1.8	31.4	41.1	58.9	677
Q5(Highest)	7.4	3.4	26.2	37.0	63.0	558
Region						
Muscat	7.6	2.3	30.0	39.9	60.1	555
Dhofar	3.2	2.8	27.6	33.6	66.4	333
AdDakhiliyah	7.5	2.3	27.8	37.6	62.4	480
North AshSharqiyah	6.9	2.0	28.2	37.1	62.9	249
South AshSharqiyah	7.9	8.6	25.3	41.8	58.2	323
North AlBatinah	7.4	2.5	38.0	48.0	52.0	690
South AlBatinah	4.9	3.6	34.4	43.0	57.0	410
Adh Dharirah	6.3	3.9	24.3	34.5	65.5	251
Musandam	(6.4)	(4.6)	(24.8)	(35.7)	(64.3)	44
Al Wusta	(2.8)	(0.4)	(17.9)	(21.1)	(78.9)	36
Total	6.6	3.3	30.4	40.3	59.7	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

Table 9 illustrates the risk categories of high blood pressure among the Omani population. It is clear that the majority of those who are hypertensive fall within the Grade 1 (i.e. 140-159/90-99). In addition, 1 in 10 Omanis were moderately hypertensive (i.e. Grade 2 160-179/100-109) while 5% were severely hypertensive and their hypertension measurements were within ≥180/≥110.

In general, almost the same patterns are observed by the different hypertension risk categories. The three hypertension grades were highest among older Omanis.

Grade 2 hypertension increases from 5% among those in the 18-24 age group to 23% among those in the 65-74 age group, and then falls to a level of 15% among those in the 75-84 age cohort. Looking at the variations in Hypertension grade 3 by age, it is obvious that it increases by age. About 1% of Omanis in the 18-24 age group were severely hypertensive compared to 14% among those in the 75-84 age group.

Table 8: Hypertension type of Omani persons. Percent distribution of Omani respondents by hypertension type, according to background characteristics, Oman WHS.

Characteristics	Hypertension type					No. of respondents
	Isolated systolic (sys≥140 &dia<90)	Isolated diastolic (dias≥90 & sys<140)	Combined (sys≥140 & dias≥90)	Controlled (sys<140 & dias<90 & history of hypertension)	Normal	
Sex						
Male	16.2	8.9	23.7	1.8	49.5	1579
Female	10.2	5.6	10.4	4.5	69.2	1791
Age						
18-24	9.1	4.8	10.5	0.3	75.3	779
25-34	5.8	8.8	11.4	1.6	72.4	941
35-44	6.7	10.5	19.6	2.3	60.9	632
45-54	11.7	8.0	28.1	5.9	46.3	398
55-64	34.1	3.2	25.9	7.3	29.5	321
65+	38.9	4.5	17.9	10.8	27.9	300
Wealth quintile						
Q1(Lowest)	16.4	5.9	16.0	5.9	55.8	565
Q2	10.5	8.2	19.9	2.3	59.2	815
Q3	10.5	7.6	16.4	3.5	62.0	755
Q4	15.5	7.6	15.7	1.8	59.3	677
Q5(Highest)	13.7	6.0	13.9	3.4	63.0	558
Total	13.0	7.2	16.6	3.3	59.9	3370

Table 9: Blood pressure risk categories of Omani population. Percent distribution of Omani respondents by blood pressure risk categories, according to background characteristics, Oman WHS.

Characteristics	Blood pressure risk categories					No. of respondents
	Normal <130/<85	High Normal (Pre Hypertension) 130-139/85-89	Hypertension Grade 1 140-159/90-99	Hypertension Grade 2 160-179/100-109	Hypertension Grade 3 ≥180/≥110	
Sex						
Male	31.7	19.6	28.9	12.4	7.5	1579
Female	58.6	15.2	16.1	7.5	2.7	1791
Age						
18-24	59.0	16.5	19.0	4.6	0.8	779
25-34	56.2	17.8	17.4	6.8	1.8	941
35-44	45.3	17.9	22.0	9.6	5.2	632
45-54	36.0	16.2	25.3	13.1	9.5	398
55-64	20.0	16.8	33.8	18.1	11.3	321
65-74	21.2	17.8	28.5	20.4	12.1	300
Wealth quintile						
Q1(Lowest)	42.3	19.6	21.3	12.1	4.8	565
Q2	46.0	15.5	22.6	11.6	4.4	815
Q3	49.3	16.2	22.1	6.0	6.4	755
Q4	41.9	19.2	22.3	10.9	5.7	677
Q5(Highest)	50.0	16.4	21.8	8.8	3.0	558
Total	46	17.2	22.1	9.8	4.8	3370

Prevalence of Anemia

The blood test results presented in for the Omani population show that 28% of the Omanis were anemic with the highest prevalence of anemia being observed among pregnant women (61%). This indicates a risk among those anemic pregnant women to have premature delivery and low birth weight.

Table 10: Prevalence of anemia (gm/dl) among of Omani people. Percent distribution of Omani respondents by prevalence of anemia (gm/dl), according to background characteristics, Oman WHS.

Characteristics	Blood levels of Hemoglobin (gm/dL)		No. of respondents
	Normal	Anemic*	
Sex			
Male	80.0	20.0	1218
Female (not pregnant)	67.8	32.2	1374
Pregnant female	39.5	60.5	78
Age			
18-24	76.6	23.4	616
25-34	73.6	26.4	750
35-44	70.4	29.6	496
45-54	70.9	29.1	321
55-64	59.7	40.3	242
65+	63.4	36.6	300
Residence			
Urban	71.1	28.9	1919
Rural	76.2	23.8	752
Education			
Illiterate/read & write	68.3	31.7	736
Primary	70.5	29.5	503
Preparatory	72.0	28.0	315
Secondary	79.6	20.4	797
University+	68.3	31.7	320
Wealth quintile			
Q1(Lowest)	72.7	27.3	443
Q2	74.1	25.9	658
Q3	74.9	25.1	599
Q4	69.3	30.7	549
Q5(Highest)	70.7	29.3	422
Region			
Muscat	71.1	28.9	347
Dhofar	81.9	18.1	283
AdDakhiliyah	71.6	28.4	316
North AshSharqiyah	84.6	15.4	231
South AshSharqiyah	69.2	30.8	266
North AlBatinah	65.7	34.3	630
South AlBatinah	68.5	31.5	335
Adh Dharirah	79.7	20.3	221
Musandam	*	*	17
Al Wusta	*	*	24
Total	72.5	27.5	2671

*Note: An asterisk indicates a Figure is based on less than 25 cases and has been suppressed. *Male Hb<13 gm/dl, Female Hb<12 gm/dl, Pregnant female Hb<11 gm/dl.*

There was no clear relation between anemia and other background characteristics as Table 10 indicates. For example, the prevalence of anemia increased from 23% among Omanis in the 18-24 age group to 40% among those in the 55-64 age group then droped to 36% among those 65+ years of age. Also, by education, the level of anemia decreased by education from 32% among those who were illiterate to 20% among those with secondary education, then increased to 32% among those with a university degree or higher.

Surprisingly, anemia was not very much affected by the economical status of the respondent. Twenty-seven percent of Omanis falling in the lowest wealth quintile were anemic compared to 29% among those in the highest wealth quintile.

Prevalence of Diabetes Mellitus

Table 11 presents blood test results shows that the vast majority (85%) of Omanis have normal blood glucose. However, 4% are pre-diabetic and 12% are diabetic with no variations by sex.

Diabetes increased considerably by age from less than 1% among Omanis in the 18-24 age group to 35% among those in the 55-64 age group.

Table 11: Prevalence of diabetes mellitus among Omani persons have (self reported and measured). Percent distribution of Omani respondents by prevalence of diabetes mellitus (self reported and measured), according to background characteristics, Oman WHS.

	Normal	Pre diabetes ≥6-<7.0 mmol/L	Diabetes >=7.0 mmol/L	No. of respondents
Sex				
Male	84.1	5.0	12.4	1579
Female	86.2	3.8	12.1	1791
Age				
18-24	97.8	1.5	0.9	779
25-34	94.2	2.8	3.1	941
35-44	85.5	4.5	11.0	632
45-54	70.6	8.4	23.6	398
55-64	61.0	11.2	34.9	321
65+	65.6	3.8	30.7	300
Total	85.2	4.4	12.3	3370

Table 12 reveals that 6% of the Omani respondents did not know they were diabetic as they were diagnosed with the blood sample test. It is also worth noting that 4% of those who reported that they were diabetic; their blood glucose levels were higher than the normal range and only 2% had controlled diabetes.

Data reveals 12% of the Omani population to be diabetic. The percentage of Omani respondents who were diabetic increased among illiterate Omanis (28%) and those aged 45 years or older (24% or more).

Table 12: Control status of diabetes mellitus by measured fasting blood glucose of Omani persons. Percent distribution of respondents by control status of diabetes mellitus by measured fasting blood glucose of Omani persons, according to background characteristics, Oman WHS.

Characteristics	Diabetes by self reported and measurement			Total Diabetes		No. of respondents
	Self reported		Newly diagnosed cases			
	Uncontrolled	Controlled		Normal	Diabetes	
Sex						
Male	4.4	1.4	6.7	87.6	12.4	1579
Female	3.4	2.6	6.1	87.9	12.1	1791
Age						
18-24	0.1	0.0	0.7	99.1	0.9	779
25-34	0.3	0.3	2.4	96.9	3.1	941
35-44	3.6	0.8	6.7	89.0	11.0	632
45-54	7.1	4.0	12.5	76.4	23.6	398
55-64	12.8	6.6	15.4	65.1	34.9	321
65+	10.8	8.3	8.1	69.2	30.8	300
Education						
Illiterate/read & write	9.2	5.9	12.6	72.2	27.8	936
Primary	3.6	1.1	4.9	90.4	9.6	618
Preparatory	1.3	1.2	3.8	93.7	6.3	393
Secondary	1.0	0.2	2.8	96.1	3.9	1004
University+	1.5	0.3	3.9	94.3	5.7	419
Wealth quintile						
Q1(Lowest)	4.1	2.0	6.2	87.7	12.3	565
Q2	4.1	1.7	5.6	88.7	11.3	815
Q3	2.9	2.9	4.6	89.7	10.3	755
Q4	4.0	2.1	8.5	85.5	14.5	677
Q5(Highest)	4.3	1.6	7.5	86.6	13.4	558
Region						
Muscat	3.0	2.1	7.9	87.0	13.0	555
Dhofar	2.9	2.6	5.9	88.6	11.4	333
AdDakhiliyah	2.9	3.6	6.4	87.1	12.9	480
North AshSharqiyah	2.9	2.7	3.3	91.1	8.9	249
South AshSharqiyah	6.7	3.0	5.6	84.7	15.3	323
North AlBatinah	4.0	1.3	7.0	87.7	12.3	690
South AlBatinah	4.2	0.6	6.8	88.5	11.5	410
Adh Dharirah	4.6	2.0	6.4	87.1	12.9	251
Musandam	(2.2)	(1.4)	(8.9)	(87.5)	(12.5)	44
Al Wusta	(1.5)	(0.4)	(4.3)	(93.7)	(6.3)	36
Total	3.8	2.1	6.4	87.7	12.3	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed..

Table 12 also shows that newly diagnosed cases from the OWHS were likely to be observed among illiterate respondents, those in the 55-64 years age group, widowed and those living alone. The table also indicates that diabetes is more likely to be uncontrolled among older respondents and those illiterate. These may indicate that these subgroups lack either knowledge about illness or proper self care and administration of the disease.

Fig. 9 illustrates that about two-thirds of respondents who reported that they were diabetic (i.e. diagnosed before with diabetes) had uncontrolled diabetes and only one-third had their glucose levels under control.

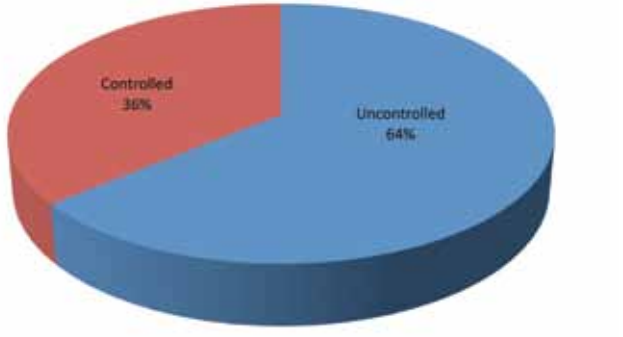

Figure 9: Proportion of controlled diabetic patients from self reported cases.

Prevalence of Cholesterol

Table 13 presents results of total cholesterol analysis among the Omani population. The table indicates that about one-third of the Omanis had high cholesterol levels (≥5.2 mmol/L). The highest levels of cholesterol were noticed among those in the 55-64 age group (65%) and those who were illiterate (53%).

Table 13: Distribution of total cholesterol (mmol/l) of Omani persons. Percent distribution of Omani respondents by total cholesterol (mmol/l), according to background characteristics, Oman WHS.

Characteristics	Total cholesterol		No. of respondents
	Normal <5.2	High ≥5.2	
Sex			
Male	66.9	33.1	1579
Female	66.1	33.9	1791
Age			
18-24	91.7	8.3	779
25-34	73.9	26.1	941
35-44	60.9	39.1	632
45-54	46.7	53.3	398
55-64	35.4	64.6	321
65+	47.5	52.5	300
Education			
Illiterate/read & write	46.6	53.4	936
Primary	63.1	36.9	618
Preparatory	78.8	21.2	393
Secondary	76.8	23.2	1004
University+	79.5	20.5	419
Wealth quintile			
Q1(Lowest)	62.8	37.2	565
Q2	64.8	35.2	815
Q3	67.2	32.8	755
Q4	67.7	32.3	677
Q5(Highest)	70.3	29.7	558
Region			
Muscat	63.9	36.1	555
Dhofar	64.3	35.7	333
AdDakhiliyah	67.4	32.6	480
North AshSharqiyah	56.5	43.5	249
South AshSharqiyah	66.9	33.1	323
North AlBatinah	68.4	31.6	690
South AlBatinah	71.2	28.8	410
Adh Dharirah	69.5	30.5	251
Musandam	(76.9)	(23.1)	44
Al Wusta	(55.7)	(44.3)	36
Total	66.4	33.6	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

In Table 14 the lipoprotein analysis for the Omani population indicated that about two-thirds had a high level of HDL indicating low risk of developing heart diseases while about one-third had a low HDL and thus were at higher risk. Variations in level of HDL by background characteristics are illustrated.

Results revealed that Omani males were more likely than females to have high HDL. About three-quarter of the Omani males had HDL ≥1.3 mmol/L compared to 57% about females. On the other hand, low levels of HDL cholesterol were more common among females: 43% of the Omani females had low HDL while 26% of the Omani males had low HDL.

Table 14: Distribution of low HDL (mmol/l) of Omani persons. Percent distribution of Omani respondents by HDL (mmol/l), categories, according to background characteristics, Oman WHS.

Characteristics	HDL cholesterol		No. of respondents
	Normal ≥1.3	Low(risk) <1.3	
Sex			
Male	73.7	26.3	1579
Female	57.3	42.7	1791
Age			
18-24	71.4	28.6	779
25-34	63.6	36.4	941
35-44	63.4	36.6	632
45-54	57.7	42.3	398
55-64	68.4	31.6	321
65+	60.4	39.6	300
Education			
Illiterate/read & write	60.9	39.1	936
Primary	65.1	34.9	618
Preparatory	65.7	34.3	393
Secondary	67.5	32.5	1004
University+	65.9	34.1	419
Wealth quintile			
Q1(Lowest)	60.1	39.9	565
Q2	63.9	36.1	815
Q3	70.2	29.8	755
Q4	64.6	35.4	677
Q5(Highest)	64.0	36.0	558
Region			
Muscat	55.5	44.5	555
Dhofar	69.1	30.9	333
AdDakhiliyah	66.5	33.5	480
North AshSharqiyah	63.0	37.0	249
South AshSharqiyah	58.6	41.4	323
North AlBatinah	67.0	33.0	690
South AlBatinah	65.4	34.6	410
Adh Dharirah	67.6	32.4	251
Musandam	(80.9)	(19.1)	44
Al Wusta	(64.6)	(35.4)	36
Total	64.8	35.2	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

The highest percentage of low HDL cholesterol was reported among Omanis in the 45-54 age group (42%), those who were illiterate (39%), Omanis falling in the lowest wealth quintile (40%), and those living in the capital (45%).

Distribution of the LDL (normal and high) among the Omani population is presented in Table 15. Almost one-third of the Omani population suffered from high levels of LDL cholesterol (≥3.4 mmol/L) and thus were at higher risk of developing cardiovascular diseases.

Table 15: Distribution of high LDL (mg/dl) of Omani population. Percent distribution of Omani respondents by LDL (mmol/l), categories, according to background characteristics, Oman WHS.

Characteristics	LDL		No. of respondents
	Normal <3.4	High(risk) ≥3.4	
Sex			
Male	67.0	33.0	1579
Female	68.8	31.2	1791
Age			
18-24	90.1	9.9	779
25-34	75.0	25.0	941
35-44	62.1	37.9	632
45-54	47.1	52.9	398
55-64	44.2	55.8	321
65+	51.9	48.1	300
Education			
Illiterate/read & write	50.1	49.9	936
Primary	64.1	35.9	618
Preparatory	78.6	21.4	393
Secondary	79.0	21.0	1004
University+	78.4	21.6	419
Wealth quintile			
Q1(Lowest)	62.9	37.1	565
Q2	66.3	33.7	815
Q3	68.4	31.6	755
Q4	71.0	29.0	677
Q5(Highest)	72.4	27.6	558
Region			
Muscat	77.7	22.3	555
Dhofar	68.2	31.8	333
AdDakhiliyah	70.5	29.5	480
North AshSharqiyah	56.2	43.8	249
South AshSharqiyah	53.5	46.5	323
North AlBatinah	72.3	27.7	690
South AlBatinah	64.8	35.2	410
Adh Dharirah	77.3	22.7	251
Musandam	(79.7)	(20.3)	44
Al Wusta	(56.3)	(43.7)	36
Total	68.0	32.0	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

It is also worth noting that high a percentage of Omani having high LDL was reported among those who were illiterate. Half of the illiterate Omanis had high levels of LDL cholesterol. Differences exist between regions as the percentage of Omanis with high LDL was higher among respondents in the Q1(Lowest) quintiles and lowest among the Q5(Highest).

The percentage of Omanis with high triglycerides by age (Table 16) was highest among respondents in the 35-44 and 55-64 age groups (26% and 24%, respectively). On the contrary, the lowest percentage of Omanis with high triglycerides was reported among those aged 18-24 years.

Table 16: Distribution of triglycerides cholesterol (mmol/l) of Omani persons. Percent distribution of Omani respondents by triglycerides cholesterol(mmol/l), according to background characteristics, Oman WHS.

Characteristics	Triglyceride cholesterol		No. of respondents
	Normal <1.7	High ≥1.7	
Sex			
Male	78.4	21.6	1579
Female	85.1	14.9	1791
Age			
18-24	92.0	8.0	779
25-34	83.1	16.9	941
35-44	74.4	25.6	632
45-54	78.1	21.9	398
55-64	76.0	24.0	321
65+	80.0	20.0	300
Education			
Illiterate/read & write	78.3	21.7	936
Primary	81.9	18.1	618
Preparatory	86.9	13.1	393
Secondary	84.1	15.9	1004
University+	80.8	19.2	419
Wealth quintile			
Q1(Lowest)	82.2	17.8	565
Q2	77.0	23.0	815
Q3	86.6	13.4	755
Q4	87.7	12.3	677
Q5(Highest)	75.8	24.2	558
Region			
Muscat	74.2	25.8	555
Dhofar	83.9	16.1	333
AdDakhiliyah	88.4	11.6	480
North AshSharqiyah	79.9	20.1	249
South AshSharqiyah	82.9	17.1	323
North AlBatinah	82.3	17.7	690
South AlBatinah	85.1	14.9	410
Adh Dharirah	77.8	22.2	251
Musandam	(85.7)	(14.3)	44
Al Wusta	(87.3)	(12.7)	36
Total	82.0	18.0	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

Education appears to have no bearing on high triglyceride levels as 22% of the Omani population who were illiterate had the highest levels of triglycerides followed by those with a university degree or higher (19%), while it ranged from 13 to 18% in the other categories.

There is no clear relation between high levels of triglycerides and wealth quintiles. Slightly less than one-quarter of the respondents in the second wealth quintile and those in the highest wealth quintile had high levels of triglycerides. While 13% and 12% of those in the third and fourth wealth quintile, respectively, had high levels of triglycerides.

Visual Ability

Distance and near vision were assessed during the survey. Vision cards were used, they were placed 3 meters away to assess the distance vision, and another card (i.e., logmar) was placed 40 cm away to assess the near vision ability. The readings were taken separately for each eye, while covering the other eye. If the respondents failed to see the mark for 3 or more letters in the same row then the test was finished and the interviewer recorded vision of the prior row. Also, respondents wearing glasses or lenses were allowed to take the test.

Overall, the vast majority of Omanis had a normal distance vision (20/50: 20/16). However, about 6% of Omanis had low vision (20/60:20/100) and 3% were considered blind since they could not read the largest row. (Table 17)

Omani Females were twice as likely as the males to have low vision (8% *vs.* 4%). Omani Females also reported a higher percentage of blindness than males. It was also clear from the table that the distance vision deteriorated by age. About one-quarter of the Omanis in the 55-64 age group had low vision compared to 1% among those aged 18-24 years.

Table 17 also illustrates that low vision and blindness are more common among illiterate respondents than other respondents (17% and 12%, respectively). Also, Omanis from the lowest wealth quintile were more likely to have low vision or blindness than Omanis at a higher wealth quintile.

By age, as Table 18 shows, the percentage of Omanis with low or severe low vision increased dramatically. Sixty-four percent of Omanis in the 55-64 age group had low near vision compared to 33% among those in the 18-24 age group. Also, one-fifth of the respondents aged 75-84 years had severely low vision compared to 3% among the youngest respondents. No clear association was observed by wealth quintile.

Table 17: Distribution of visual ability (Distance vision) of the Omani population. Percent distribution of Omani respondents by distance vision, according to background characteristics, Oman WHS.

Characteristics	Distance Vision			No. of respondents
	Normal (20/50 : 20/16)	low vision (20/60 : 20/100)	Blind (can't see the biggest raw or blind in both eyes)	
Sex				
Male	93.6	4.0	2.4	1579
Female	88.4	7.6	4.0	1791
Age				
18-24	98.9	1.1	0.0	779
25-34	97.6	2.0	0.4	941
35-44	98.3	1.5	0.2	632
45-54	88.0	10.2	1.8	398
55-64	66.9	23.9	9.3	321
65+	52.2	20.3	27.6	300
Education				
Illiterate/read & write	71.7	16.5	11.7	936
Primary	94.9	4.1	1.0	618
Preparatory	97.0	2.6	0.4	393
Secondary	98.7	1.3	0.0	1004
University+	97.7	2.0	0.3	419
Wealth quintile				
Q1(Lowest)	85.6	8.2	6.2	565
Q2	92.0	4.8	3.3	815
Q3	93.1	4.6	2.3	755
Q4	89.2	7.5	3.3	677
Q5(Highest)	93.1	5.4	1.6	558
Total	90.8	5.9	3.2	3370

Table 18: Distribution of visual ability (Near vision) of the Omani population. Percent distribution of Omani respondents by near vision, according to background characteristics, Oman WHS.

Characteristics	Near Vision				No. of respondents
	Normal (0.8-2.0)	Low (0.12-0.63)	Severe (0.05-0.1)	Absolute Blind	
Sex					
Male	48.5	44.3	5.6	1.6	1579
Female	49.0	42.1	6.0	2.9	1791
Age					
18-24	64.2	33.1	2.6	0.1	779
25-34	62.0	33.9	3.8	0.3	941
35-44	48.1	48.3	3.3	0.3	632
45-54	30.9	60.0	8.7	0.5	398
55-64	19.0	63.7	11.8	5.5	321
65+	18.1	46.1	16.9	18.9	300
Education					
Illiterate/read & write	28.6	51.6	11.7	8.0	936
Primary	48.7	46.0	5.2		618
Preparatory	54.6	42.5	2.6	0.3	393
Secondary	57.6	38.6	3.7	0.1	1004
University+	64.4	32.6	2.4	0.6	419
Wealth quintile					
Q1(Lowest)	48.9	38.7	9.6	2.7	565
Q2	50.3	42.6	4.3	2.8	815
Q3	47.1	45.7	5.5	1.8	755
Q4	46.6	44.5	6.2	2.7	677
Q5(Highest)	51.1	43.2	4.3	1.4	558
Total	48.7	43.2	5.8	2.3	3370

Note: Figures in parentheses are based on 25-49 unweighted cases, and an asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

Cognition

Table 19 shows the mean cognition scores. On average, respondents were able to recall about 6 words in the verbal recall, 5.4 number series, and 3.7 backward number series. Also, respondents were on average likely to name 19 animals in the verbal fluency test. Surprisingly, respondents recalled more words in the delayed verbal fluency test than on the verbal recall.

Table 19: Mean cognition scores. Mean cognition scores (verbal recall (VR), digit span (DS), verbal fluency (VF)) and delayed verbal recall by selected demographic characteristics, Oman WHS.

Characteristics	Mean verbal recall		Digit span forward		Digit span backward		Verbal fluency		Delayed verbal recall		Number of respondents
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Sex											
Male	6.4	0.0	5.6	0.0	3.9	0.0	19.3	0.4	6.8	0.0	2334
Female	6.4	0.0	5.3	0.0	3.6	0.0	17.7	0.4	6.8	0.1	2383
Age											
18-24	6.9	0.1	5.7	0.0	4.2	0.0	16.4	0.3	7.7	0.1	841
25-34	6.7	0.0	5.7	0.0	4.1	0.0	18.9	0.5	7.4	0.1	1369
35-44	6.6	0.0	5.7	0.0	4.0	0.1	20.0	0.7	7.0	0.1	1137
45-54	6.1	0.1	5.3	0.1	3.6	0.1	17.6	0.7	6.4	0.1	693
55-64	5.3	0.1	4.5	0.1	2.6	0.1	18.7	1.2	5.1	0.1	372
65-74	4.6	0.1	3.9	0.1	1.6	0.1	20.0	1.8	4.2	0.2	206
75-84	4.6	0.2	3.6	0.2	1.9	0.2	13.0	1.0	3.5	0.3	78
85+	*	*	*	*	*	*	*	*	*	*	21
Nationality											
Omani	6.3	0.0	5.2	0.0	3.5	0.0	16.9	0.2	6.7	0.0	3370
Other	6.7	0.0	5.9	0.0	4.3	0.0	22.5	0.7	7.2	0.1	1347
Total	6.4	0.0	5.4	0.0	3.7	0.0	18.5	0.3	6.8	0.0	4717

Note: An asterisk indicates a Figure is based on less than 25 cases and has been suppressed.

Young respondents and non-Omani respondents were more likely than their counterparts to have high cognition scores. For example, respondents aged 18-24 years were likely to recall about 7 words compared to 5 words among those aged 75-84 years. However, respondents in the 35-44 and 65-74 age groups had the best verbal fluency score. On the verbal fluency test, the mean number of animals to be reported by Omanis was much less than other respondents (17 words *vs*. 23 words).

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