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Editorial

Author

Dr Abdulrazak Abyad

Chief editor

Population and dynamics of aging is attracting the attention of regional researchers. In this issue two papers from Bangladesh discussed this issue. The first paper attempts to estimate some mortality measures such as age specific death rates (ASDRs), infant mortality rate (IMR) and crude death rate (CDR) in Bangladesh in 2006. The author used two abridged life tables for males and for females and they have been constructed using the corresponding secondary data on life expectancy at birth of Bangladesh in 2006 taken from UN (2006). He built a mathematical model fitted to the number of persons surviving at an exact age x (l_x) for males and for females.

In the second paper the author stressed the rapid increase in the elderly population in Bangladesh. It is essential for society and the government to realize that the aged population needs not to be regarded as 'demographic refuse' and given a congenial atmosphere, they can still contribute to the family and community combining old values and new expectations.

A paper from Jordan discussed the causes of impaired vision in south of Jordan.

The author included 900 Jordanian patients with a mean age of 64 years. Visual impairment was determined using presenting and best-corrected visual acuity. The causes of visual impairment were cataract (43.0%), macular degeneration (18.0%), and amblyopia (10.0%). The author concluded that most causes of blindness in Jordan can be controlled by various educational and medical programmes. A prospective study from Iran looked at the hip bone mineral density of 100 patients (50 men, 50 women) and 100 control individuals (50 men, 50 women) between 50-90 years old measured by Dual-energy X-ray absorptiometry. This study showed that bone mineral density in the patients group was 0.6333 gr/cm² versus 0.7589 gr/cm² in the control group. The authors concluded that every person whose bone density is below 0.6333 gr/cm² is prone to hip fracture.

Aydin S et Gemalmaz A looked at the knowledge of residents about patients' rights, informed consent, and euthanasia. The authors followed a cross-sectional study, an anonymous, volunteer-based, structured questionnaire consisting of 31 open- and closed-ended questions about socio-demographic features, thoughts and knowledge level of residents on patients' rights, informed consent, and euthanasia which was applied to the residents of a uni-

versity hospital. The mean knowledge score was 7.2 ± 1.9 , and obtaining 9 points or more was considered to be "sufficient". Of the total, only 23.9% was determined as having sufficient knowledge about patients' rights, informed consent, and euthanasia and 52.3% declared that they needed education about these subjects. The authors stressed that the knowledge level and awareness of residents about patient rights, euthanasia, and informed consent was insufficient. These issues should be included in the undergraduate and postgraduate medical education curriculum.

Pourreza A, examines health care expenditure trends for developed countries and the impact of changing demographics on health expenditure. The influential factors on the growth of ageing, policies and policymakers' responsibilities in this respect, is analyzed. An attempt was made to discuss and analyze ageing and escalating costs of long-term care of elderly in the context of social problems. The author stressed that there is a need to reassess our views towards ageing, elderly's health, and their roles and functions in family and community.

Causes of Impaired Vision in South of Jordan

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ABSTRACT

Aims: To determine the possible causes of visual impairment in South of Jordan.

Methods: 900 Jordanian patients with a mean age of 64 years, attending the ophthalmology clinic in Prince Zaid bin al-Hussein Hospital in south of Jordan. All participants visited the clinic for an extensive eye examination and interview. Visual impairment was determined using presenting and best-corrected visual acuity.

Results: The causes of visual impairment ((low vision: visual acuity of less than 6/18 to 3/60 in the better eye; blindness: visual acuity of less than 3/60 in the better eye) according to the best-corrected vision were cataract (43.0%), macular degeneration (18.0%), and amblyopia (10.0%). However, according to the presenting vision, uncorrected refractive errors were the most frequent primary cause (35.0%), the other main causes of visual impairment in the study patients were cataract (33.0%), macular degeneration (10.0%), and amblyopia (8.0%).

Conclusion: Most causes of blindness in Jordan can be controlled by various educational and medical programmes. The treatment of uncorrected refractive errors and cataract needs to be stressed because they have a major role in the causes of visual impairment in Jordan.

Keywords: Blindness, Cataract, refractive error, Jordan.

Introduction

The World Health Organization's (WHO) definition of blindness is a visual acuity of less than 3/60 (20/200, 0.05), and low vision is less than 6/18 (20/50, 0.3) in the better eye with the best-correction giving that. An estimated 45 million people are blind, and an additional 135 million have severe visual impairment^{[1][2]}. Most blind people live in the developing countries, and in whom blindness is either curable or preventable^[3]. So visual impairment and disability is a worldwide health problem. The causes of visual impairment are complicated and controlling the problem needs to be region specific, which will depend on the data provided by that community. Thus, providing this data is one of the first steps in these communities. There are few published studies about the status of the problem in the

Jordanian population, so the study was conducted in a sample of south Jordanian patients to determine the possible causes of vision impairment in this population of the country.

Materials and Methods

All 900 patients with a mean age of 64 years attending the clinic received thorough eye examinations. The examination included measuring uncorrected, and best-corrected visual acuity; subjective (manifest) and cycloplegic refraction; colour vision test; intraocular pressure; examination of the external eye, anterior segment, media, and fundus examination, in addition to an interview about past history of eye diseases,

eye trauma, diabetes mellitus, hypertension, previous ophthalmic surgeries and the degree of literacy.

Visual acuity was determined by using a Topcon chart projector (visiontester VT-SE; Topcon Co, Japan) with E letters at a distance of 6 meters. Patient's visual acuity without correction was measured separately for each eye. Then visual acuity was tested with best spectacle correction. Visual acuity was recorded as the smallest line in which the patient could read three letters correctly. If the patient was unable to read the largest E letters in the chart (20/400 E letters) at 4 meters, then finger counting was done at 1 meter. The examiner stood 1 meter away in front of the patient and asked if the patient could see his hand. The examiner slowly waved his hand and asked the participant if he/she could see what the hand was doing. If the patient was able to see the examiner's hand moving, "hand motion" was recorded on the examination form. If the patient could not see the examiner's hand, a penlight was held in front of the patient's eye and he/she was asked if he/she could tell when the light was on or off. If the patient could correctly identify when the light was on, "light perception" was recorded. If the patient was unable to see the light, "no light perception" was recorded.

The International Classification of Diseases 10th edition (ICD10) defines visual impairment as a visual acuity of less than 6/18 (20/60, 0.3) in the better eye with the best correction^[4]. Visual impairment has been divided into blindness and low vision. A visual acuity of less than 3/60 (20/400, 0.05) in the better eye with the best correction has been considered blindness. While low vision has been defined as the best corrected visual acuity of less than 6/18 (20/60, 0.3) but not less than 3/60 (20/400, 0.05) in the better eye.

We determined the cause of visual impairment. Using best judgment, we determined one cause for each eye as the principal cause in either eye. When multiple disorders were present, we attempted to identify the disorder causing the greatest decrease in vision. When two causes appeared to have an equal contribution to visual impairment the primary cause was assigned to the one that was amenable to treatment to restore vision. Cataract was regarded as the main cause of severe low vision if the fundus was obscured by lens changes or if no evident fundus abnormalities were observed in eyes with significant cataract. We analyzed the causes of visual impairment as percentages of the total patients participating in the study.

Results

Of the 900 participants, 540 females and 360 males

who were involved in the ophthalmic examination the principle causes of both best corrected and presenting visual impairment are shown in [table 1] and [graph 1]. While the main causes of visual impairment according to the presenting vision were uncorrected refractive errors and cataract, according to the best corrected vision cataract, macular degeneration, and amblyopia were the most frequent primary causes of visual impairment in our patients. In visually impaired people, as a result of uncorrected refractive errors, 48.9% had myopia, 42.2% had hyperopia, and 8.9% had astigmatism.

Table 1. Causes of visual impairment

Causes	Best corrected visual acuity	Presenting visual acuity
Refractive errors	0	203 (35%)
Cataract	139 (43%)	191 (33%)
Macular degeneration	55 (18%)	58 (10%)
Amblyopia	32(10%)	44(8%)
Corneal opacity	19 (5%)	18 (3%)
Vascular retinopathy	12 (4%)	14 (2%)
Glaucoma	10 (3%)	13 (2%)
Optic atrophy	7 (2%)	12 (2%)
Keratoconus	8 (2%)	12 (2%)
Others*	30 (9%)	26 (5%)
Total	320	580

*Trauma, absent globe, diabetic retinopathy, optic nerve hypoplasia.

Discussion

The burden of visual impairment especially for refractive errors and cataract, in terms of visually impaired person years, is even more significant than we can think, and refractive error visual impairment mostly starts at a young age and probably causes significant economic and social burden to society^[5].

Consistent with other studies, cataract was the leading cause of visual impairment based on best-corrected visual acuity^{[6][7][8]}. However, refractive errors were the principal cause of visual impairment using presenting visual acuity. Refractive errors are also one of the leading causes of visual impairment in different parts of the world^{[9][10][11]}. On the basis of presenting vision, as much as 68% of visual impairment in the study patients, is due to cataract and refractive errors that are easily curable. And we have to notice that our study was carried out on a sample of South of Jordan patients with special socioeconomic characteristics so that we cannot extrapolate the results to the whole population of the country. More research in other regions including rural areas is indicated.

This study reports less glaucoma than some other surveys in other countries^[12]. This could be because the visual field examination was not performed, which may result in a potential underestimation.

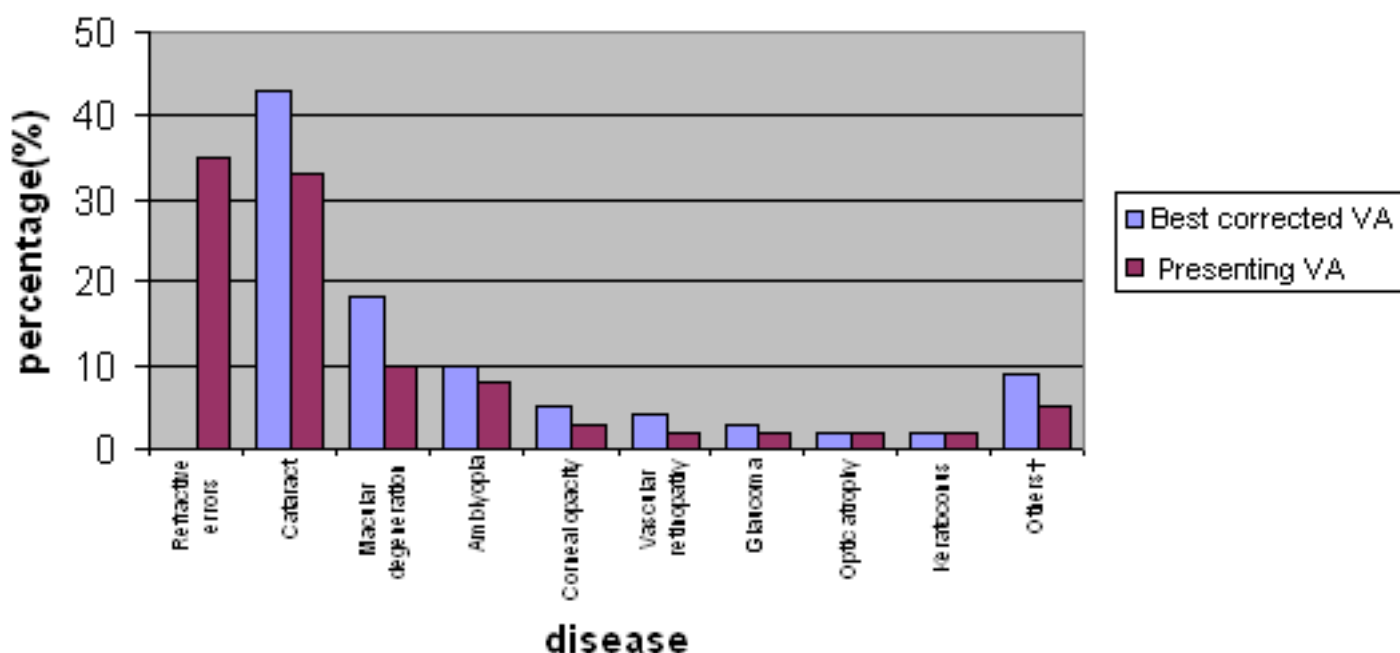
A higher rate of visual impairment in illiterate people was detected in this study, which could indicate strong association between visual impairment and education. The observed associations show us that we have to find interventional programmes against the treatable visual impairments in this part of the community, stressing those with little or no education as a high-risk groups.

A planned, systematic, educational intervention programme needs to be designed and implemented to reduce the avoidable and treatable causes of visual impairment in the country. The aim must be to improve community awareness on the consequences of undiagnosed and untreated eye disease and how to access primary and secondary eye health care. This would also provide a more effective use of the eye healthcare system.

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graph 1
Percentage of eye disease according to best corrected VA and Presenting VA



What do Residents Know About Patient's Right, Informed Consent and Euthanasia?

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ABSTRACT

Objectives: Since the Human Rights Act was published by the United Nations in 1948, patients' rights have become an important issue worldwide. The aims of this study were to call our residents' attention to this subject, to define their knowledge and thoughts, the factors related, and to identify their deficient points.

Methods: In this cross-sectional study, an anonymous, volunteer-based, structured questionnaire consisting of 31 open- and closed-ended questions about socio-demographic features, thoughts and knowledge level of residents on patients' rights, informed consent, and euthanasia was applied to the residents of a university hospital. Chi square and student t- tests were performed for the statistical evaluation. A p value smaller than 0.05 was accepted as statistically significant.

Results: There were in total 123 residents, and, 88 (71.5%) of them participated in the study. The mean age was 30.04±3.7 (23-39) years. The ratio of the residents who had read the PRR was 26.6%. Residents, who had read the PRR and who had more years of higher service, had fewer problems in patient-doctor communication. The mean knowledge score was 7.2±1.9, and obtaining 9 points or more was considered to be "sufficient". Of the total, only 23.9% was determined as having sufficient knowledge about patients' rights, informed consent, and euthanasia and 52.3% declared that they needed education about these subjects.

Conclusion: The knowledge level and awareness of residents about patient rights, euthanasia, and informed consent was insufficient. These issues should be included in the undergraduate and postgraduate medical education curriculum.

Key Words: patients' rights, euthanasia, informed consent, residents.

Introduction

Since the Human Rights Act was published by the United Nations in 1948, patients' rights have become an important issue worldwide⁽¹⁾. Since then, patients' rights have been addressed in many global meetings. At the beginning of the 1990s, the European Office of World Health Organization (WHO) declared the Rights of Patients. With respect to the patients' rights laws, Turkey's basic laws are concordant with those of other western countries⁽²⁾. The Turkish constitution, which

was ratified in 1982, states that the Government has to provide necessary interventions to maintain physical and psychological health for everyone. It also states that without the patient's approval, an individual cannot be used as a research subject, and no part of their body can be touched other than for medical necessity and legal requirements⁽³⁾. Although, there is a code for patients' rights (Patients' Rights Regulation-PRR), which was legislated in 1998, to date, there is no law about this issue in Turkey. Currently in Turkey, the Turkish Physician Association Law, Turkish Penal Code, and the Code for

Medical Ethics regulate physician's practices⁽⁴⁾. Turkish Ministry of Health require all hospitals to display a copy of the Patients' Rights Regulation (PRR), in abbreviated form, in a visible place where it can be easily accessed by patients, healthcare professionals and visitors.

Informed consent is the autonomous authorization of an individual for medical intervention⁽⁵⁾. In professional and legal regulations, informed consent is considered to be an important element of good clinical practice and one of the indispensable issues of patients' rights⁽⁶⁾.

The researcher is required to inform research subjects in lay terms about the research goal, methodology, expected benefits and potential side effects according to the Code for Medical Ethics. This code also states that written informed consent has to be arranged⁽¹⁾. The Turkish Ministry of Health requires all hospitals to display a copy of the Patients' Rights Regulation (PRR), in abbreviated form, in a visible place where it can be easily accessed by patients, healthcare professionals, and visitors.

Euthanasia is a Greek word, which means willing for terminating the life of oneself in a painless way⁽⁶⁾. Regarding euthanasia, laws around the world vary greatly. Although it is generally disapproved and punished in many countries like Turkey from Hippocrates till now, it is legal in some nations⁽⁷⁾. Nowadays, this issue is being discussed as it can cause moral conflicts for the individual and among different cultures, religions, and other groups. To our knowledge, in Turkey, there are only a limited number of studies that present physician's thoughts, knowledge, and attitudes about euthanasia.

Residents in tertiary care hospitals deal with the majority of the population as tertiary care is mostly preferred and used as primary care by the public in Turkey. Typically, the residents are a patient's first point-of-contact for both in- and out-patient care⁽⁸⁾. Physicians' thoughts and understanding of patients' rights, informed consent, and euthanasia may affect their attitudes toward the patients. If a physician contravenes the rights of a patient, the patient may sue the physicians. According to the Ministry of Health's instructions⁽⁹⁾, malpractice trials have increased in recent years. So to avoid these trials, physicians need to understand and obey the legal rules regarding patients' rights. Currently, this subject is not included as part of residency training. In Turkey, there are a limited number of research studies investigating physicians' knowledge of patients' rights and their associated responsibilities.

Therefore the goals of this study are:

1. to call our residents' attention to this subject;
2. define their knowledge of and thoughts regarding patient rights and determine any related factors;

3. identify any deficient points; and
4. to educate our residents on this subject.

Methods

Data were collected from December 1, 2005 through to January 31, 2006. Our target population was all residents, who were dealing directly with patients in Adnan Menderes University Research Hospital. This hospital serves a population of about 2 million in the Egean part of Turkey, which is considered as developed and has a better socio-economic status. Departments of clinical medical sciences can be divided into two basic parts: internal medicine and surgical. There were 19 departments, which have both out- and in-patient clinics. Each department was visited once in the morning and then at the end of the day to collect the questionnaires. An anonymous, volunteer-based, structured questionnaire was developed and used. The questionnaire consisted of 31 open- and closed-ended questions about socio-demographic features, thoughts and knowledge level of residents on patients' rights, informed consent, and euthanasia. The residents who did not volunteer or who were absent on that day were not followed up.

The cut-off point of the total knowledge score was determined to be 9 out of 14 because 8 was the mean knowledge score of the residents (7.2 ± 1.9). Obtaining 9 points or more was considered to be "sufficient" for this study. Years of service in the medical profession was grouped as Group I = "5 years or less" and Group II = "6 years or more."

The answers for open-ended questions were categorized for data entry. The data were presented numerically and in percentages. The socio-demographic features were given as means \pm standard deviations (SD). Chi square and student t- tests were performed for the statistical evaluation. A p value smaller than 0.05 was accepted as statistically significant.

Results

There were totally 123 residents (41 were from surgical, 82 were from internal medicine departments). Of the total, 88 (71.5%) participated in the study. The mean age was 30.04 ± 3.7 (23-39) years. The mean of the years of service in the medical profession was 6.1 ± 3.6 . Table 1 shows the distribution of residents according to departments and gender.

Table 1. Residents according to gender and departments

Gender	Departments			Total
	Internal	Surgical		
Female	30	9		39
Male	32	17		
Total	62	26		88

The ratio of the residents, who read PRR, was 26.6%. Residents who read the PRR had a better mean knowledge score on patients' rights ($p=0.004$). There was no statistical significance of the residents' knowledge of patients' rights after reading the PRR based on their gender; however, the more years of service of the residents ($p=0.041$) did correlate to an increased understanding of patients' rights after reading the PRR. Residents who read the PRR and who had more years of service, had fewer problems in patient-doctor communication, but these findings were not statistically significant ($p=0.063$ and $p=0.059$, respectively).

The mean knowledge score was 7.2 ± 1.9 , and of the total, only 23.9% was determined as having sufficient knowledge about patients' rights, informed consent, and euthanasia. Of the total, 52.3% declared that they needed education about these subjects. The remainder, who declared that they did not need any education on these subjects, thought that their knowledge was sufficient. There was no relationship between the resident's knowledge level and gender, department, years of service, or wish to be educated.

Of the group, 79.7% thought that they obeyed the PRR rules, but 40.5% thought that other doctors did not obey those rules. 74.1% of participants stated that patients' rights should not be considered as more important than the rights of the doctors. Residents in Group I supported this idea much more than those in Group II ($p=0.003$). There was no statistical significance according to gender, department, or knowledge level.

Of the participants, 71.6% declared that they had problems with their patients. 40.2% indicated that they had had problems with their doctors when they were the patient. When they were dealing with patients, 37.3% of doctors complained about problems originating from their patients, 37.3% experienced problems resulting from a lack of communication, and 25.4% thought that the problems were due to the health system. When the doctors were in another doctor's office as a patient, lack of communication accounted for 37.5% of the problems, and problems originating from their doctor's behaviors comprised 62.5%.

Of the total, 86.4% could describe what is meant by informed consent, and the most common description was "giving total information to the patients about the procedure and their health status". Residents thought that informed consent was required during interventions and treatments in which the risk of death was higher.

Of the residents, 43.2% declared that euthanasia is a kind of suicide, and 38.6% thought that it was legal in Turkey (which was the wrong answer). 54.3% thought that euthanasia was one of the patients' rights (which was the wrong answer, also). 46.2% of the residents stated that euthanasia should be legal, and of those residents, 20% indicated that the most important reason for their statement was to alleviate the patient from suffering pain. The second common reason for legalization of euthanasia among the residents was their thinking that euthanasia was one of the patients' rights. Among the residents who thought that euthanasia should be forbidden, the most common reasons given were the probable abuse of legal and religious beliefs.

Discussion

Nowadays, patient rights reflect human rights and are the basic issues of patient care. The importance of ensuring patients' rights is the need to provide better health care. Considering laws on patients' rights, Turkey's basic laws are concordant with many other countries. This study indicates that 75% of our residents have not read the PRR, and their knowledge about patients' rights, informed consent, and euthanasia is minimal. In a study by Özdemir et al.⁽¹⁰⁾, 63% of the physicians have not read PRR, and 40% of the physicians were unaware of any legal arrangements associated with patients' rights. These results are concordant with our study.

We found that when the years of service increased, the number of doctors who had read the PRR also increased. This finding is discordant with Özdemir's study that found PRR reading decreased with years of service. We also found that residents, who read the PRR and had longer years of service, had fewer problems with patients. This may indicate that reading the PRR and experience in the profession can lessen the problems as PRR reading significantly increased the mean knowledge score of patients' rights.

In our study, the knowledge level of our residents about patients' rights was low, which was concordant with other studies that were conducted in Turkey^(10,11). Despite the fact that less than 25% of the residents had sufficient knowledge of patients' rights, only half of them declared that they needed education about this subject. This can be considered as an unawareness of the residents about their

knowledge level.

Years of service was found to be an important factor with regard to having read and understood the PRR. This correlated to a doctor having fewer problems with patients and giving priority to patient rights over those of the physician⁽¹⁰⁾. Most of the residents, 4 out of 5, thought they obeyed the PRR rules, but of the total, 2 out of 5 declared that other doctors did not. We considered this finding as a self-bias. The ratio of the residents, who had problems with patients, was 71.6%, and most of those were patient-related problems.

For the in-patient situation, 40.2% had problems with other doctors and most of those were doctor-related problems. This can be also considered as self-bias and an unawareness issue.

The ratio of the residents who knew the definition of informed consent was 86.4%. This result is concordant with the findings of Ozdemir's study⁽¹⁰⁾.

Although in Turkey, euthanasia is illegal, considered to be assisted suicide, and accepted as violating the human rights of the individual, less than half of the residents knew this fact⁽¹²⁾. Furthermore, 54.3% thought that euthanasia was one of the patients' rights.

Nearly half of the residents stated that euthanasia should be legal mostly because of alleviating a patient suffering from pain. The remainder of the residents thought euthanasia should be forbidden because of religious beliefs, as suicide is considered to be a sin in the Islamic religion.

Our study can be considered as valuable because it is one of the first studies which searches the residents' knowledge and attitudes about patients' rights and euthanasia. Although our questionnaire was not validated, as participation rate was high, these findings can be considered as representing all of our residents. Further studies are needed to explore the real attitudes of the residents and patients' satisfaction on residents' care.

In conclusion, the knowledge level and awareness of residents about patients' rights, euthanasia, and informed consent was insufficient. Consequently, education should be provided earlier because it takes a long time for knowledge and opinions to change behaviors, so these issues should be included in the undergraduate and postgraduate medical education curriculum.

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Health Care Expenditure and Ageing: Experiences of Developed Countries for Developing Countries such as Iran

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ABSTRACT

This study examines health care expenditure trends for developed countries and the impact of changing demographics on health expenditure. The characteristics of the life of the elderly in relation to individual, social and general changes facing the aged, together with attitudes toward it, and major components regarding elderly are explained. Disease and burden of disease of ageing as central to the areas of Health and Health Economics is emphasized. The influential factors on the growth of ageing, and policies and policymakers' responsibilities in this respect, is analyzed.

An attempt was made to discuss and analyze ageing and escalating costs of long-term care of elderly in the context of social problems. The quality of interactions between elderly and community, attitudes toward the elderly and its consequences, as well as gaps between generations, were examined.

There is a need to reassessment of views towards ageing, elderly health, and their roles and functions in the family and community. This approach may enable us to utilize the effective potential of the elderly and use their experience to resolve some existing conflicts among genders and generations.

The ideas of scholars either from other countries or Iran extracted from literature, will be the starting point of the present paper, since it may help to provide a rather broad and comprehensive picture of life, which ageing is considered as an important part of. This picture, however, would demonstrate the weak points of services provided and delivered to the elderly in Iran, while for some developed countries such as the USA, Canada, Germany, and Japan per capita health expenditure has increased fastest among those aged 65 and over.

Therefore, experiences of health care expenditures on ageing among developed countries could be applied for developing countries such as Iran.

Key Words: Ageing, Health Economics, Disease's Theories, Health Expenditure.

Introduction

Over the next half-century the proportion of people aged 60-plus around the world is expected to more than double, from 10 to 22 percent. For the purpose of better understanding of ageing as part of our life, a glance on the concept of life, which leads to aging and ultimately to death, seems to be necessary.

There are varieties of definitions presented by Literates, Poets, and Philosophers for life. But life can be defined as the evolving of human beings around the axis of time in terms of appearance and form on one hand and the replacement of periods of life successively, in terms of content and quality, on the other.

It is evident that the process of replacement takes place in a way that no body experiences it in a very concrete and tangible form. This is why Leo Tolstoy says that "Ageing ambushes all of us", and some other scholars call the process as "Gray Zone problem" in which there is no definite line between white and black.

Physical and social characteristics and values dominate human beings during all courses of life, and aging, of course, is not an exception. Physically there are changes which take place in organisms: Bones become depreciated and osteoporosis appears, muscles degenerate, fat is redistributed and accumulated in specific parts of body such as the waist, and attitudes restructure.

These changes reduce vitality and compatibility of aged people with sudden and somehow unpredictable circumstances and make it difficult for the elderly to readjust to new conditions. Therefore, health needs of aged people are defined differently from those of other age groups.

Ageing is considered on one hand, as an inevitable phenomenon, this is shown by the nonstop snow falls which sits on our hair and eyebrow (Shamlou, 1998), and on the other, is a financially burdensome social phenomenon. There is still another view which believes that ageing is an incurable illness. In an Old Persian text it has been stated that "be merciful to the elderly since it is an illness that nobody and no therapist knows its cure except death", and there is a hope for all ill people to be recovered except the elderly who get worse every day until she/he dies (Onsorolmaaly, 1986).

Development of Theories of Illness

It is a fact that ageing is not an illness but a nonstop, natural process which all human beings experience. Aging, like other periods of life is a battle field of health and illness, though the pattern of disease, disabilities and sufferings are quite different from previous periods of life.

A glance on theories and transitions of illnesses may help us to have a precise analysis on the elderly, and its expanding ratio among more developed and even developing countries.

In Pastor's time, as a result of his devoted work, an external origin for disease, namely pathogens or microorganisms, was discovered.

But this great achievement, as the main cause of disease, was not able to explain all features of illness and their

development, nor was it compatible with social theories and views which define several causes for a phenomenon.

Epidemiologists criticized Pastor's approach or explanatory model of disease since they believed that microorganisms alone cannot develop illnesses. According to epidemiologic theory of disease, microorganisms as agents need hosts and an environment to be active and able to develop disease. This is called the triangle theory of epidemiology. This approach was recognized as useful in explanation of illnesses, particularly in analysis of infectious and communicable diseases (Locker, 1999).

But nowadays, analysis of disease is not limited to these factors. There is a broad network of social factors affecting health and illness known as "social determinants of health". In fact social aspects of health and illness are bonded. This is in contrast to previously explained theories with emphasis on individual characteristics of health or illness. This view on health issues has emerged in a period which is called epidemiologic transition.

Chronic, not easily preventable disease with no definite cure, related to behavioural, economical, social, cultural factors and life style are known as dominant patterns of disease in this transition. Most disease affecting the aged population belongs to epidemiological transition pattern.

Similar reasons have been reported as the main causes for both population aging and chronic diseases. These are as follows:

Major reasons for growing chronic disease and population aging:

- Increasing of health services and preventive medicine.
- Decreasing fertility and mortality rates over time, which is a starting point for emerging aged populations.
- Development of medical technology and more effective treatment of acute illnesses, and
- Increased life expectancy (Scott *et al*, 2003).

Such a phenomenon leads burden of disease towards a chronic state, which is neither easily preventable nor requires less spending for recovery. It is worth noting that developing countries suffer from burden of both communicable diseases and non-communicable disease (Witter *et al*, 2003).

Developing countries face particularly serious challenges as they attempt to improve the well-being of their populations, achieve economic development objectives, and integrate themselves with the global economy. Health care financing is a particular concern for these countries,

which account for 84 percent of the world's population, and 93 percent of its disease burden, but only 18 percent of its income and 11 percent of its health expenditures. Imbalances between spending and the disease burden will be exacerbated as a result of the changing composition of illness toward non-communicable disease and injuries, which by 2020 will account for almost 80 percent of these countries' disease burdens, compared with just 50 percent at present. These diseases are more expensive to treat and harder to prevent than the infectious diseases that were previously the leading causes of illness and death (Schieber, 1997).

Moreover, international aids for prevention and treatment of these diseases may be essentially reduced.

Aged population, illness and medical expenditure

Although, ageing is not considered as an illness,

its economic burden is very significant. The higher frequency of disease such as hypertension, heart disease, diabetes, cancer, respiratory, and musculo-skeletal deficiencies are known as effective factors in it. Since demographic transition has taken place earlier among European industrialized countries, aged people have dominated their population structure. It has been said that about one-fourth of the Western Europe population are 65 years old or more. It has also been reported that about 8,500 people over 100 years old lived in Japan in the late 1990s. The rate of growth of aged population in this country has been calculated as increasing 10 persons over 65 per birth. The rate will reach 15 per birth in next 20 years (Scott et al, 2003).

Table 1 indicates health expenditure for the elderly among eight developed countries.

Table 1: Health spending for the elderly in eight developed countries, 1993-1995

Country	Percent of Total Health Spending on the Elderly	Ratio of Health Spending for Persons Age 65 and Older to Persons under Age 65	Estimated Percent of GDP Spent on Health for the Elderly	Percent of GDP Spent on Health	Health Spending per Capita, 1997
Australia (1994)	35%	4	3.0%	8.3%	\$5,348
Canada (1994)	40	4.7	3.6	9.3	6,764
France (1993)	35	3	3.4	9.6	4,717
Germany (1994)	34	2.7	3.5	10.4	4,993
Japan (1995)	47	4.8	3.4	7.3	5,258
New Zealand (1994)	34	3.9	2.5	7.6	3,870
United Kingdom (1993)	43	3.9	2.8	6.7	3,612
United States (1995)	38	3.8	5	13.6	12,090

Source: John P.Geyman, Health Care in America, 2002

In the USA, 5 to 10 percent of people over 65 years of age account for about two thirds of annual health care expenses for this age group. In other words, the elderly, 12% of total population, has spent 36% of health care expenditure. It is said that one third (33%) of hospital admissions and 44% of total in-patient days belonged to the elderly. In this country, Medicaid annually pays about 70,000 million for geriatric care expenditure of which 20% is for physician visits, 40% for in-patient expenditure and 20% is spent in nursing home. This expenditure has an upward trend. If the current trend holds in the United States, by 2050 government health care spending will claim one-third of GDP (Kotlikoff *et*

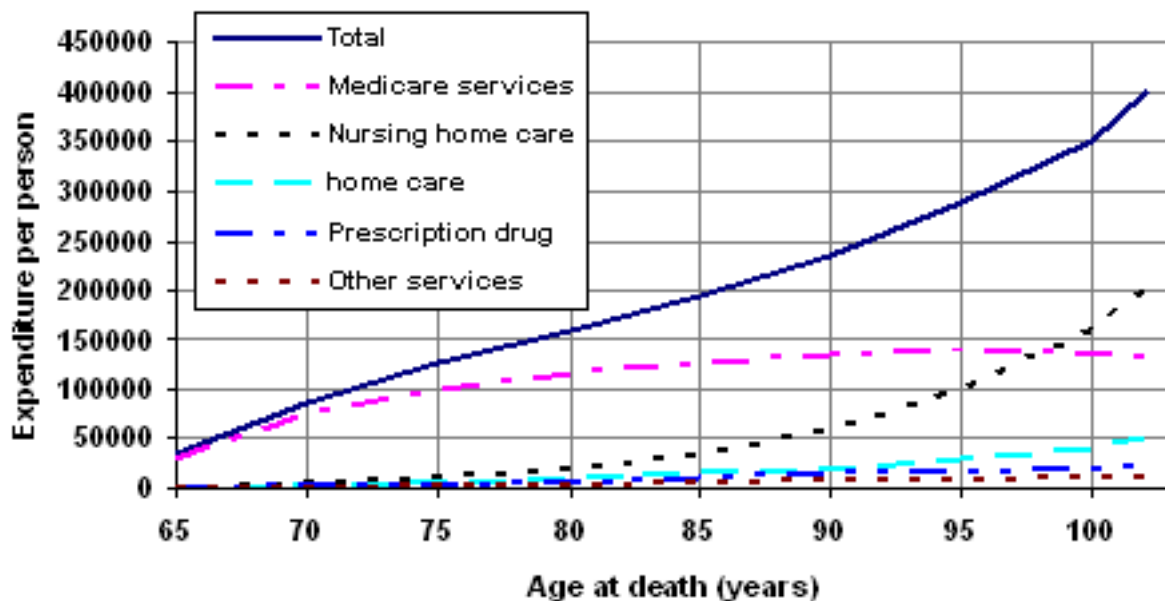
al., 2006).

By 2040 Medicaid's portion of total spending on long - term care alone could reach \$ 125 billion. Moreover, long term care expenditure, particularly in nursing homes is increasing more rapidly than that of acute care among the elderly, parallel to the increase of their ages. In fact aging is divided into two categories, namely young aged (65-80) and old aged (80 +). The highest health care expenditures belongs to the latter.

Cumulative expenditure for the ages 65 years to death were found to be about \$ 157,000 for persons dying at

Figure 1 shows health care expenditures for the aged in the USA.

Figure 1: Health care expenditures for the age of 65 years until death, according to the type of health service and age at death (USA)



Source: Geyman, 2002

80, \$ 235,000 for persons dying at 90, and \$407,000 for persons at 101 and over, years of age (Geyman, 2002).

The care of chronically ill elderly patients with their dense concentration of morbidity is complex and requires coordination with a broad spectrum of public and private resources in many instances. Unfortunately, however, much of this care is fragment and uncoordinated.

Although physicians play an essential and critical role in

geriatric care, comprehensive care necessarily requires a multidisciplinary team approach.

Many other health professionals are actively involved in care of the elderly including nurses, social workers, pharmacists, dietitians, psychologists, physical therapists, and occupational therapists. In managed care environments, case management may be provided by a primary care physician or nurse case manager. Table 2 shows total health expenditure by region.

Table 2:

Total health expenditure, by region, 2000-2003

	Health expenditure as percentage of GDP				Health expenditure per capita (current United States dollars)			
	2000	2001	2002	2003	2000	2001	2002	2003
Developed countries	103	108	112	113	2705	2806	3019	3415
Developing country regions								
Africa	5.4	5.5	5.6	5.6	41	43	48	54
South and East Asia	4.3	4.5	4.6	4.6	38	38	38	43
West Asia	6.3	6.9	6.6	6.6	257	242	251	288
Latin America & the Caribbean	6.9	7.0	6.6	6.6	268	260	251	221
Economies in transition	5.7	5.7	5.9	5.8	76	87	102	124

Source: UNESCO based on World Bank Development indicators Online, available from www.worldbank.org/data/online/databases/online/databases.html

Health care expenditure of ageing is known as direct and measurable costs. Ageing, also imposes indirect costs to either individuals, families or communities. Lower age of retirement together with increased life expectancy, adoption of policies meeting compulsory retirement and womens participation in labour market (mainly due to low wages) bear a higher burden on retirement funds. On the other hand, early discharge of skilled and experienced workforces from service and production markets, make organizations vulnerable by losing human capital and at the same time affect free home care for the elderly which is delivered largely by women, resulting in free home care provided, to be medicalized and marketized.

Another perspective on ageing

Some scholars of “positive ageing” argue that “most aged people are productive and provide more benefits to families and communities, and they are not a burden to the others”.

According to this group “degeneratives” and “disabilities” among elderly even aged over 75, are not a common but an exceptional phenomenon. Most aged people are healthy and do practice preventive activities much better than the younger population. They also have potential to practice healthy behavior and diet, exercise, and cease smoking and increase their quality of life and life expectancies as well.

Studies indicate that a healthier lifestyle, even if adopted in later years of life, can increase life expectancy and decrease both disability and health care costs (Bret, 1994; Lundy et al., 2001; Stanhope et al., 2000).

It is now recognized that many of the health risks of older adults can be reduced by an active preventive program, including diet and exercise. Falls can be reduced or prevented by physical training; cardiovascular fitness can be maintained by aerobic exercise, and weight training can limit muscle loss and preserve strength (Kalache, 1999). According to these experiences, WHO launched a plan on “elderly health” in 1995, putting more emphasis on promoting public health, and quality of life particularly among the elderly and the healthy process of aging.

Loneliness may be a main cause of contracting or aggravating illness in the elderly. Correlations have been found between depression rates (as an outcome of loneliness) and attempt of suicide, parallel to an increase in age. In Western Europe the rate of attempting suicide increased among men at the threshold of retirement.

This phenomenon takes place among women when their children leave home, and their motherhood roles are

downgraded. These types of behaviors are very dependent on cultural norms and values as well as the social status of aged people in a given community, and may not be true in any community over time. Depression and aging do not necessarily support each other. It can be said that even parallel to an increase in age, depression rate begins to be decreased. Moreover, depressed aged people react more positively to anti-depression drugs, which help them to be treated easily and conveniently

In fact, what makes the elderly positive or negative is not merely human beings’ natural and biological characteristics, but the socio-cultural context and values in which elderly is found.

Ageing for a human being is a bio-psycho-social phenomenon. Different cultures value aging differently. For example, aged people in China do not suffer from dementia and on occasions they demonstrate high scores of intelligence.

Another problem related to elderly life is the problem of their residency, with or without their families. According to some studies the elderly among Indians and Eskimos leave their own tribes when they cannot either move with the others or are compatible with tribal life. They leave to die.

In advanced European countries such as Denmark, Italy, and Australia, elderly residency has been demonstrated as a major social problem. It has been stated that elderly prefer to live in their own homes and to keep and save their independency. Living in nursing homes, even in a more modern and well-equipped one such as that of Copenhagen, do not satisfy the elderly, since they, particularly aged women, strongly feel loneliness. In Italy nursing homes are the last choice of aged people to live in. This may be partly because of low quality services delivered in nursing homes.

In Australia, the commonwealth government allocated higher subsidies for nursing homes services, which led to a growth of nursing homes. But later studies demonstrated that only 20% out of 60% of aged people have had a daily bath, and 50% of aged living in nursing homes are unnecessarily put in wheelchairs resulting in loss of their physical mobility. More importantly was that 80% of allocated funds to nursing homes were utilized on only 4% of elderly.

Demographic shifts and population growth predicted, show only 18 percent of the observed increases in health care expenditures in England and Wales, compared to 68 percent, 44 percent and 34 percent for Japan, Canada and Australia respectively. These differential changes in costs for older age groups over time invite future research

into the driving forces behind these costs (Seshamani et al., 2003). It is important to bear in mind that changes in demographic structure and in health status are only part of a much wider set of influences on future health expenditure. Demographic change will also affect the health care workforce, which is typically one of the largest in most developed countries (Grey, 2005).

In Iran, studies conducted by welfare organizations demonstrate an escalating trend of taking elderly to nursing homes. The trend is also dominant among not very well to do families, and different segments of the community, on the living and residency of elderly with or without family in nursing homes, after their children get married and produce their own families (Mohseni, M, Pourreza, A. et al, 2000; Teymoori et al., 2006).

Health care spending changes over time because of changes in the age structure of the population. Government health care expenditure has grown much more rapidly than the economy.

Conclusion

Ageing as a multi-facet phenomenon, is discussed from different points of view. Historically, in human literature, it is described as a natural phase of the human life span which mainly covers the last segment of it. This period, essentially, is accompanied by physical weakness, mental retardation, illness, and hopelessness.

Today the aged population is a great social, economic, and health concern around the world, particularly for developed countries. In fact, because of technological advancement, epidemiologic transition and changes in patterns of diseases affecting populations, changes in population pyramids, and development of new theories of health and illness, aged care has become a core policy issue for particularly welfare states. The most striking issue of the elderly in the health domain for governments is the cost of illness and burden of disease, affecting them.

Different approaches have been developed to analyze and demonstrate economic consequences of aged care health services.

Apart from these approaches, the social status of the elderly in different settings was briefly pointed out. It is stressed today that the elderly are a productive segment of population, even though they do not actively participate in the formal labor market. They can and do cope with their health conditions and overcome the difficulties faced as adult generations. They do need and prefer to live independently and to be treated as independent

individuals.

The aged population is, however, growing rapidly and becoming the significant concern of governments, national and international organizations and NGOs, dealing with elderly problems. This is, now, the major responsibility of governments to work appropriately towards solving the problems of this important segment of the human population.

In general, developing countries, particularly low-income ones, tend to spend a much lower share of their national income on health care. For example, per capita health expenditure in sub-Saharan Africa is over 50 times less than the average of such expenditure in the developed world (World Bank, 2006).

Policies and practical experiences of health care expenditure on ageing among developed countries could be applied for developing countries such as Iran.

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Dimension of Population Ageing in Bangladesh

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ABSTRACT

The elderly comprise a much larger proportion of the population today than ever before. The aging situation should get due attention not only from the demographic angle but it also acquires special significance in a situation when the country swings at different levels on the continuum of tradition and modernity. It is essential for society and the government to realize that the aged population needs not to be regarded as 'demographic refuse' and given a congenial atmosphere, they can still contribute to the family and community combining old values and new expectations.

Introduction

Population ageing is defined as an increase in the proportion of population, which is elderly. It is a product of history, individual experiences and social forces (Morgan and Kunkel, 2001). It is not a separate issue from social integration, gender advancement, economic stability or poverty. Until very recently in developing countries like Bangladesh problems associated with aging were generally perceived as issues to be considered and resolved at the level of the individual or family concerned. Among the Asia-Pacific region, Bangladesh has experienced a steady decline in mortality accompanied by modest decline in fertility (NAS, 1981, ESCAP, 1981; Mabud, 1987; Kabir and Uddin, 1987). This process may have a significant impact on the well-being of older persons, especially in the less developed regions where social support for the older

person is largely provided by the immediate family (Hoyert, 1991; Wolf, 1994). Now the number of elderly is rapidly increasing and the system of joint family has been changing to prefer a new system of nuclear family of husband-wife and unmarried children. The process of aging of the population is creating significant problems and consequently the issues such as public health measures, and dependency ratios are required to be addressed by the policy makers in entirely different perspectives (Hossain, 1998). The aging process might have started in Bangladesh. Thus, the aging situation should get due attention not only from the demographic angle but it also acquires special significance in a situation when the country swings at different levels in the continuum of tradition and modernity (Randhawa, 1991).

The elderly comprise a much larger proportion of the

population today than ever before. The rapid and faster technological progresses in medical science control the fertility and mortality rates considerably, and the average composition exhibits a relatively larger proportion of elderly persons. Increased age normally brings considerable change in individual needs. For instance, health conditions typically decline with advancing age, and this suggests an escalation in the demand for long-term care (Pollard, 1995; Crimmins, 1997). Again, increasing longevity can also result in rising medical costs and increasing demands for health services, since older people are typically more vulnerable to chronic diseases (de Jong-Gierveld and van Solinge, 1995; Holliday, 1999). The old age segment of the population represents an important subset of the aggregate population and the elderly as a separate and identifiable group with their own specific needs has emerged as an issue quite recently. In view of the ever-increasing importance being given to ageing, this paper is an attempt to throw some light on the matter in Bangladesh.

Data Sources

This study is based on secondary data from the Bangladesh Population Census 1991 and 2001. The data source is officially published by Bangladesh Bureau of Statistics (BBS, 1994 and BBS, 2003) a sponsored agency of the Bangladesh Government.

Size of the Aged population and Ageing Index

Almost all aspects of human behaviour and attributes are regulated by one of the most fundamental characteristics; age structure of its population. The specific problems and requirements of a country vary in a large part with age. A population with a high proportion of old persons may differ considerably from that of young persons in its productive activities, consumption patterns, socio-cultural and political issues and other necessities and problems of life. Distribution of the age structure of population has been presented in Table 1.

It is clear from Table 1 that during ten years from 1991 to 2001, the size has increased by nearly 2.0 millions. From the Table we observed that, the percentage of population in age group 0-14 years has declined over the past three decades but the percentage of population in the age group 15-59 years has increased till 2001. This may indicate a decline in fertility levels in the recent past. In 2001 we also observed that 45.46% population is dependent upon the rest of 54.54% working population, the most striking feature which increases dependence upon the rest of the working population. So, these figures are alarming. A low population percent of change indicates that fertility decreased in the previous decades. Also the results show the enormous increase in the index of aging is due to faster rate of increase in the old age population accompanied by an equally faster rate of decline in the child population.

Table 1: Size and percentage distribution of the aged population

Year	Age group			Total	Change in size		Index of aging
	<15	15-59	60+		Number	Percent	
1974	34372000 (48.04)	33118000 (46.28)	4058000 (5.68)	71548000 (100)	--	--	11.8
1981	40601000 (46.60)	41616000 (47.77)	4904000 (5.63)	87121000 (100)	15573000	21.8	12.1
1991	47997906 (45.14)	52614321 (49.50)	5702765 (5.36)	106314992 (100)	19193992	22.0	11.9
2001	48716100 (39.33)	67544680 (54.54)	7590340 (6.13)	123851120 (100)	17536128	16.5	15.6

Note: Parenthesis indicates the percentage

Some Aging indicators

Ageing indicators such as growth of the aged population, percentage of aged, dependency ratio, ageing index median age, sex ratio are presented in Table 2.

An increasing trend is observed for the aged population in Bangladesh. From the difference of the growth rate of the last two decades, it is observed that the total growth rate of Bangladesh increased slightly while the aged

growth rate has become approximately double. Though the percentage of the elderly population has steadily and slowly increased and rural percentage is higher than the urban areas, the elderly and overall population has grown faster than in the rural areas, mainly because of increase in the expectation of life. It may be attributed that the main factors involved in the rapid urban elderly population growth are natural growth, rural to urban migration and the changes in the delimitation and definition of urban areas.

The dependency ratio is a simple statistics measure of the impact of the age structure on the economic potential of the population. Though this percentage is normally used to denote the burden of the productive population due to age consideration but in reality in developing countries like Bangladesh many persons aged above 60 years work hard to earn their livelihood and many children under 15 years also work to support themselves and their family members. From Table 2 we observed that the percentage of aged dependency ratio is increasing whereas the overall dependency ratio is decreasing with advancement of time.

The relatively faster increase in the elderly population will contribute to a higher dependency ratio of the population in non-productive age group, whereas the decline in fertility has reduced overall (youth + elderly) dependency ratio.

The index of aging has increased for overall Bangladesh during the ten years from 1991 to 2001. The growing number of older persons and reduction of young population increase the index of aging, reflecting the change in the age structure composition of the population of Bangladesh. Among many indicators of whether a population is aging or not; the median age is perhaps the strongest one. From Table 2 we observe that the median age for the elderly population for Bangladesh in 1991 is almost similar for the year 2001. That means more

of the aged population are of 60-69 years of age. In the meantime the overall median age increased slightly from 1991 to 2001.

Generally, sex ratio i.e. masculinity ratio among the elderly reveals another interesting aspect of the situation likely to occur in Bangladesh. From Table 2 we observed that the sex ratio of Bangladesh population has been decreased from 1991 to 2001. This ratio is significantly differing for urban and rural areas. Whereas the overall sex ratio for Bangladesh in 1991 is almost similar as 2001, this ratio significantly varies between rural and urban areas. It is observed from the Table that the sex ratio of the urban population is always higher than its rural counterpart. It can be noted that urban areas of the country are the place of work for many people who migrated from rural areas to urban areas in search of work. In the context of Bangladesh the employment opportunity for the males is wider than the females. Therefore, people migrating from rural areas to urban areas for better jobs and work are mainly the male population. The influxes of females to urban areas is comparatively less. Moreover, of those males who work in the urban areas, their spouses stay in the rural areas because of cost of living in the urban areas is high, particularly the cost of accommodation in the urban area is extremely high, which cannot be met by the low-income groups of urban people. Thus the urban population is male dominated with high sex ratio.

Table 2: Some indicators of population aging

Locality	1991		Percentage of the elderly population	Dependency Ratio		Index of aging	Median Age		Sex Ratio	
	Elderly	Overall		Elderly	Overall		Elderly	Overall	Elderly	Overall
	Urban	3.39		4.46	4.3		7.82	80.49	10.76	67.12
Rural	1.20	1.46	5.6	11.67	108.12	12.11	67.23	17.26	127.6	103.4
Bangladesh	1.39	2.01	5.36	10.84	102.07	11.88	67.21	17.89	128.6	106.1
2001										
Urban	4.09	3.15	4.76	7.80	63.70	13.9	67.32	20.74	132.3	117.2
Rural	2.61	1.10	6.54	12.44	90.22	16.0	67.76	20.29	122.8	103.6
Bangladesh	2.86	1.53	6.13	11.24	83.36	15.6	67.68	20.41	124.4	106.6

Marital status of the elderly population

Marital status is the most important factor in population dynamics as it affects fertility tremendously and mortality and migration to a lesser extent. Also, its effect on other social and economic characteristics, such as school attendance and labour force participation is very important in the late adolescent and young adult age group (Henry, et al., 1971). Marital status is an important consideration, especially for the elderly because of its influence on their physical and mental stability. The distribution of the elderly population by marital status is presented in Table 3.

From Table 3 we observe that married elderly among the overall population and among the total aged population increases with time and as married elderly increases, the widowed decreases. The percentage of married elderly is quite the same according to the locality. The Table also shows that widowed involves a greater percentage. The main reason why the widows outnumber widowers may be because of the fact that men used to be older than women by 5 or more years at the time of their marriage. Generally, men remarry after the death of their wives, but widows do not have the similar social circumstances or expectation. This is an indication of the discrimination against women and low status given to

them in Bangladesh. The Table also shows that there is a significant increase in the percentage of the never married elderly among the overall population as well as among the total aged population from 1991 to 2001.

Table 3: Percentage distribution of the elderly population by marital status and locality

1991								
Locality	Elderly among the overall population				Elderly among the total aged population			
	Never married	Married	Widowed	Divorce/ Separate	Never married	Married	Widowed	Divorce/ Separate
Urban	.04	3.17	1.11	.014	1.00	73.14	25.62	.24
Rural	.04	4.08	1.52	.011	.64	72.72	27.07	.19
Bangladesh	.04	3.88	1.44	.011	.69	72.26	26.85	.20
2001								
Urban	.26	3.45	1.03	.015	5.49	72.54	21.65	.32
Rural	.30	4.73	1.49	.016	4.60	72.36	22.80	.24
Bangladesh	.29	4.44	1.38	.015	4.76	72.39	22.59	.25

Literacy, work status and household types of the elderly population

Education is the backbone of a nation. Higher literacy rates indicate the higher level of development. So the data on literacy levels and trends are of crucial significance to the policy makers, researchers and planners for socio-economic and educational planning of a country. Again in many countries of the less developed regions, there are large concentrations of older workers in agriculture and other sectors of the economy (notably the informal sector) who have little or no social security coverage (International Labour Office, 2000). The status of literacy and work participation rates for the elderly population (60+) are presented in Table 4.

There is an increase in literacy in the year 2001 than 1991. Literacy rates in urban areas are higher than that of rural areas in both years. It is observed from Table 4, that illiteracy in rural areas is almost double that of urban areas. A remarkable gap between urban and rural areas is found for females. A wide difference between males and females in literacy rates was found in both the census years 1991 & 2001. Gender inequality is greatly pronounced in this respect, as most males are literate while the females are mostly illiterate. The low percentage of literacy in Bangladesh is a well-known phenomenon. It is hoped that the gap between the urban and rural adult literacy level will gradually decrease over time and the gender difference will also become narrower.

The percentage of working aged among the total aged population is decreasing a little. The proportion of elderly workers in rural areas is greater than other areas in both years. It is noticed that the majority of the elderly engage in agriculture. Although the decline in labour force participation means fewer jobs in the future, it also means that a proportion of the elderly people are not working.

About 19.32% of male elderly and 29.86% of female elderly in the rural areas were not working in 2001. This rate is quite high in urban areas. It is noticeable that if this situation prevails then pressure will increasingly fall on the limited resources to provide good services for this portion of the population. Therefore, planning in respect of future employment opportunities for the elderly is of urgent need.

The socio-economic development of a country has direct bearing on the housing condition of people and the consumption of households. The care and support provided to parents is usually in the form of shared housing, food and other necessities and less often in the form of direct transfer of income (Kabir,1999; Knodel and Debavalya, 1992). Households have been classified into three categories namely - dwelling, institutional and other. Dwelling households are those which are mainly used for residential purposes. Hostel, hospitals, clinics, jails, barracks or orphanages where a person or a group of persons spent census night are considered as institutional households and households other than dwelling and institutional households are considered as ‘other households’. According to the type of classification how many percentage of elderly population live in those categories by sex and locality is presented in Table 4.

The percentage of the elderly who are living in dwelling places is not significantly different by sex and locality, and that pattern is quite similar in both the years. We also have observed that the percentage of male elderly in “Institutions” is more than double the percentage of the female population in urban areas in both censuses. Rural to urban migration for better facilities, such as education, employment etc. may be responsible for that.

Table 4: Percentage distribution of the elderly by educational status, work status, household types, sex and locality

1991														
Locality	Elderly among the overall population							Elderly among the total aged population						
	LI	IL	DNW	DW	D	I	O	LI	IL	DNW	DW	D	I	O
Ur	1.46	3.78	1.06	3.27	4.19	.04	.09	33.77	66.23	24.48	75.52	96.80	.99	2.21
Ru	1.11	4.49	1.09	5.33	5.59	.01	.01	19.86	80.14	19.42	80.58	99.53	.14	.33
Bd	1.18	4.18	1.08	4.27	5.32	.02	.03	22.07	79.93	20.21	79.78	99.10	.29	.61
Male														
Ur	2.14	2.44	.80	3.78	4.37	.06	.15	46.75	53.25	17.43	82.52	95.23	1.41	3.36
Ru	1.90	4.30	.78	5.41	6.16	.01	.03	30.62	69.38	12.72	87.28	99.38	.19	.43
Bd	1.95	3.88	.79	6.39	5.80	.02	.05	33.23	66.77	13.49	86.51	98.72	.39	.89
Female														
Ur	0.66	3.38	1.37	2.67	3.99	.02	.01	16.36	83.64	33.92	66.08	99.06	.45	.49
Ru	0.31	4.71	1.40	3.61	5.00	.01	.01	6.15	93.85	27.94	72.06	99.69	.09	.22
Bd	0.37	4.46	1.39	3.44	4.81	.01	.01	7.73	92.27	28.87	71.13	99.60	.15	.25
2001														
Ur	1.96	2.80	1.49	3.27	4.63	.05	.08	41.22	58.78	31.27	68.73	97.31	1.10	1.59
Ru	1.69	4.85	1.57	7.97	6.50	.02	.02	25.89	74.11	24.05	75.95	99.48	.25	.28
Bd	1.76	4.37	1.55	4.58	6.07	.02	.03	28.64	71.36	25.35	74.65	99.09	.40	.51
Male														
Ur	2.65	2.38	1.34	3.67	4.83	.07	.12	52.69	47.31	26.65	73.35	96.14	1.47	2.39
Ru	2.56	4.52	1.37	5.71	7.04	.02	.02	36.15	63.85	19.32	80.68	99.38	.30	.32
Bd	2.85	4.00	1.36	5.22	6.51	.03	.05	39.20	60.80	20.67	79.33	98.78	.52	.70
Female														
Ur	1.16	3.29	1.26	2.11	4.40	.03	.02	26.04	73.96	37.39	62.61	98.87	.61	.52
Ru	.79	5.18	1.78	4.19	9.95	.01	.01	13.29	86.71	29.86	70.14	99.59	.18	.23
Bd	.87	4.77	1.68	3.71	5.62	.01	.02	15.50	84.50	31.17	68.83	99.57	.25	.28

Notes: LI = Literate, IL = Illiterate, DNW = Does not work, DW = Does work, D= Dwelling, I = Institutions, O = Others, Ur = Urban, Ru = Rural, Bd = Bangladesh

Concluding Remarks

The trend in the size and growth of the elderly population in Bangladesh reveals that ageing will become a major social challenge in the future when considerable resources will need to be directed towards the support, care and treatment of the elderly. The process of aging in Bangladesh now is taking place at a time when the pattern of life is changing, kinship bonds are weakening and family composition is undergoing a rapid transformation. But with their rapid increase and under the condition of changing family pattern, the elderly population already seems to be experiencing difficulties. Most of the elderly people of Bangladesh live in rural areas where health and recreational facilities are very limited. The majority of them are illiterate; economic facilities and job opportunities are limited. More than half of the elderly women are widowed, divorced or single. In all these respects elderly women are more disadvantaged than elderly men. A large proportion of elderly men are still in the labour force both in rural and urban areas. But job opportunities are very limited in the country. It is difficult for them to get jobs commensurate with their

ages (Abedin, 1996).

In view of the above findings, it is essential for society and the government to realize that the aged population needs not to be regarded as ‘demographic refuse’. Since this segment of the population will continue to increase gradually in future in Bangladesh, given a congenial atmosphere, they can still contribute to the family and community combining old values and new expectations.

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Estimation of Some Mortality Measures, Modeling of l_x and Age Associated with Force of Mortality of Bangladesh in 2006

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ABSTRACT

The aim of the present study is to estimate some mortality measures such as age specific death rates (ASDRs), infant mortality rate (IMR) and crude death rate (CDR) in Bangladesh in 2006. For this purpose, two abridged life tables for males and for females have been constructed using the corresponding secondary data on life expectancy at birth in Bangladesh in 2006 taken from UN (2006). These estimates are compared to the corresponding values in 2005 and it is observed that these are showing a decreasing trend during 2005-2006. Moreover, a mathematical model has been fitted to the number of persons surviving at an exact age x (l_x) for males and for females. Model validation technique, cross validity prediction power (CVPP) and F-test, showed that the mathematical model is valid and hence, fit is well. Age associated with instantaneous force of mortality (μ_x) for males and females has been estimated. And it is found that is exhibiting a decreasing trend up to age 25 and increasing in the remaining age group but rapidly increasing after age 55 years to infinity.

Keywords and Phrases: Life expectancy at birth Interpolation Life table Mortality measures Modeling Bangladesh.

Introduction

Bangladesh is placed in southern Asia, and borders the Bay of Bengal, between Burma and India and occupies a total of 1,44,000 square kilometers and it is situated latitudinally between $21^{\circ}5'$ and $26^{\circ}4'$ North and longitudinally between $88^{\circ}5'$ and $92^{\circ}5'$ East. The country has a tropical climate with cool, dry weather conditions from October to March. The monsoon season is characterized by heavy rainfall from June to October and summers are hot and humid. It is, at times, affected by severe natural disasters such as floods, cyclones, water logging and droughts. Bangladesh is hilly in the Southeast consisting mostly of flat alluvial plains. More or less around 73 percent of the land of Bangladesh is arable. The landscape has an extensive network of rivers that is very important in boosting the socioeconomic status of the nation. Ganges-Padma, Brahmaputra-Jamuna, and the Megna are the main ones among them.

The population has increased from 42 million in 1941 to 129.25 million, of which 65.84 million were male and 63.41 million are female in 2001, published by Bangladesh Bureau of Statistics (BBS) (BBS, 2001).

Bangladesh is one of the most developing countries in modern times with accelerated population growth at a rate of 1.47 percent per year. It is one of the most densely populated countries. In fact, it is the ninth most populous country on this globe having a population density of 834 persons per square k.m. (Mitra and Associates, 2001).

Bangladesh, like many other developing countries, has not yet started completing a Vital Registration System (VRS) though the Bangladesh Demographic Health survey (BDHS) collects data on a sampling basis but they did not provide sufficient information of mortality data. For this, information on mortality fully depends on censuses as well as other sources using some sophisticated indirect techniques. A number of works on fertility has been carried out but mortality works are studied on a limited scale in our country. For this reason, an effort has been given attention to estimate indirectly some mortality measures from very simple data. In this study, firstly, two abridged life tables have been constructed. It is to be noted here that a life table is very sophisticated and mathematical tool in Population Science, particularly, in Demography in the modern technological era. Life table is widely used to estimate

various demographic parameters such as IMR, CDR, ASDRS, net reproduction rate (NRR), survival rate, and replacement index. It is also applicable to enumerate net migration rate. It is also broadly used in life insurance companies.

Two abridged life tables, one for males and other for females have been constructed applying Widowhood Method (Ali, 1990). Then, in this report, IMR, CDR and ASDRs for males, females and both sexes were also calculated from the constructed abridged life tables and showed that ASDRs follow a traditional U-shape pattern. In (Islam, 2006), ASDRs, life table CDR and IMR for males, females and both sexes of Bangladesh in 2005 have been estimated indirectly from the constructed abridged life tables in which these were showing a decreasing trend. So, it is seen that there have been changes in mortality levels in Bangladesh.

Therefore, the main objectives of this study are:

- i) to construct life tables for males and females and hence to estimate IMR, CDR, ASDRs of Bangladesh in 2006, and
- ii) to estimate age associated with instantaneous force of mortality (μ_x) for males and females of Bangladesh in 2006.

Data and Methodology

The life expectancy at birth for males is 63 and for females is 65, taken from UN (2006) and is used as raw data in this study.

The linear interpolation technique (UN, 1983) is applied to estimate l_x values for corresponding life expectancy at birth using South Asian Model Life Tables from the United Nations Model Life Tables for Developing Countries (UN, 1982), then to construct an abridged life table using the following functional relationships:

$${}_n d_x = l_x - l_{x+n}, \quad l_{x+n} = l_x {}_n P_x, \quad {}_n L_x = \int_0^n l(x+t) dt \text{ which can}$$

$$\text{be approximated as } {}_n L_x = \frac{n(l_x + l_{x+n})}{2} \quad (x \geq 2) \text{ where as } L_0 = 0.3l_0 + 0.7l_1 \text{ and } L_1 = 0.4l_1 + 0.6l_2,$$

$$T_x = \int_0^\infty l(x+t) dt \text{ that is equivalent to } T_x = \sum_{t=0}^\infty L_{x+t}, \quad e_x = \frac{T_x}{l_x}, \text{ and}$$

$$\mu_x = \lim_{t \rightarrow 0} \frac{l_{x+t} - l_x}{t.l_x} = -\frac{1}{l_x} \frac{d}{dx}(l_x) = -\frac{d}{dx}(\ln l_x) \text{ (Biswas, 1988; Keyfitz, 1968; Shryock,$$

1975). Thereafter, ASDRs are indirectly estimated from the constructed life table using the formula $ASDRs = \frac{{}_n d_x}{{}_n L_x}$

(Barclay, 1958). These are shown in Table 1 and Table 2. Moreover, ASDRs for both sexes are estimated by using the

formula $ASDRs = \frac{{}_n d_x^m + {}_n d_x^f}{{}_n L_x^m + {}_n L_x^f}$ from the constructed life tables of male and female and presented in the last

column of Table 2. Life table CDR is estimated using the formula $CDR = \frac{1}{e_0} \times 1000$; where e_0 is the life

expectancy at birth. For this, the expectation of life at birth for both sexes is estimated from the constructed life tables

using the formula $e_0 = \frac{e_0^f + s e_0^m}{1 + s}$; where as e_0^f is the expectation of life at birth for male, e_0^m is the

expectation of life at birth for female and s is the sex ratio at birth. In the case of this study, it is assumed to be 1.05 as a developing country (UN, 1967). Moreover, IMR is also calculated and in this case it is, in fact, q_0 .

Model Fitting

It appears from the scattered plot of the number of persons surviving at an exact age x (l_x) for males and females by age groups (Fig.1) that l_x can be distributed by a polynomial model for different ages. Therefore, an n th degree polynomial model is treated and the structure of the model is given by

$$i) y = a_0 + \sum_{i=1}^n a_i x^i + u \text{ (Montgomery}$$

and Peck, 1982), where, x is age group; y is l_x for male and female; a_0 is the constant; a_i is the coefficient of x^i ($i = 1, 2, 3, \dots, n$) and u is the error term of the model. Here, in both cases, an appropriate n has been selected such that the error summation of square is least.

Using the software STATISTICA, the mathematical models have been estimated.

Model Validation Technique

To test the stability of the model, the cross validity prediction power (CVPP), ρ_{cv}^2 , is applied here. The method for CVPP is given by

$$\rho_{cv}^2 = 1 - \frac{(n-1)(n-2)(n+1)}{n(n-k-1)(n-k-2)} (1 - R^2)$$

; where, n is the number of cases, k is the number of predictors in the model and the cross-validated R is the correlation between observed and predicted values of the dependent variable. The shrinkage of the model is the absolute value of the difference ρ_{cv}^2 of and R^2 . Moreover, the stability of R^2 of the model is equal to (1-shrinkage) (Stevens, 1996).

F-test

The F-test is applied to the model to verify the measure of the overall significance level of the model as well as the significance of R^2 . The formula for F-test is affirmed as

$$F = \frac{R^2 / (k-1)}{(1-R^2) / (n-k)} \text{ with } (k-1, n-k) \text{ degrees of}$$

freedom (d.f.); where k = the number of parameters to be estimated, n is the number of classes and R^2 = the coefficient of determination of the model (Gujarati, 1998).

Results and Discussion

Two abridged life tables for males and for females have been constructed and shown in Tables 1 and 2 respectively. ASDRs for males and females of Bangladesh in 2006 have been estimated and presented in the respective tables. Moreover, ASDRs for both sexes of Bangladesh in 2006 have also been enumerated and presented in the last column of Table 2. To see the pattern of ASDRs of Bangladesh, these are plotted in graph paper, then, it is seen that they follow a traditional pattern, that is, U-shape pattern. It is to be noted here that traditional pattern of ASDRs is a U-shape pattern (Misra, 1995; Shryock and Associates, 1975). To see the trend of ASDRs during 2005-2006, ASDRs of Bangladesh in 2005 are taken from Islam (2006) and presented in Table 3. It is observed that ASDRs for males, females and both sexes in 2006 are strictly lower at every age, than that of ASDRs for males, females and both sexes in 2005, excepting the last age group. That is, they are indicating a decreasing trend with passing of time.

The CDR and IMR for males, females and both sexes of Bangladesh in 2006 are calculated using the information from the estimated abridged life tables and presented in Table 4. To estimate CDR for both sexes in 2006, life expectancy is estimated as 63.50675 years from the constructed male and female life Tables. To see the trend of CDR and IMR during 2005-2006, these have been taken from Islam (2006) and presented in the first row of Table 4. Here, it is observed that CDR and IMR for male, female and both sexes in 2006 are exhibiting a decreasing trend during 2005-2006.

The fitted model of l_x values for male of Bangladesh in 2006 is:
 $y=93634.87-660.195x+24.27725x^2-0.32979x^3 \dots$ (i)
 t-stat (88.19) (-4.521) (5.49790) (-9.34711) providing the coefficient of determination R^2 is 0.99246 and $\rho_{cv}^2 = 0.9892$.

The fitted model of l_x values for female of Bangladesh in 2006 is:
 $y=94361.12-842.215x+31.30959x^2-0.3807x^3 \dots$ (ii)
 t-stat (106.53) (-6.914) (8.49957) (-12.9340) providing the coefficient of determination R^2 is 0.99384 and $\rho_{cv}^2 = 0.9912$.

The information on model fitting has been shown in Table 5. From this table it is seen that the fitted models are highly cross-validated and their shrinkages are only 0.003279 and 0.002679 respectively. Furthermore, the fitted models will be stable more than 98% and 99%. Moreover, from this table, it is seen from the statistical view that the parameters of the fitted models are highly significant both explaining more than 99% of variance. From t-statistics, it is found that all the parameters of the

model are also highly significant. In both models, the stability of R^2 is more than 99%.

The calculated value of F-test of the models are 789.76 and 968.03 with (3, 18) d.f. whereas the corresponding tabulated value is only 5.09 at 1% level of significance. Therefore, it seems from the statistics that the overall measure of the fitted models and the R^2 are highly statistically significant. Hence, the fit of both models is well.

Age associated with instantaneous force of mortality (μ_x) is calculated from the fitted model of l_x values for male and female populations of Bangladesh in 2006 and that is presented in the 5th and 6th columns of Table 3 and shown in Fig.1. From Table 3 and the figure, it is found that force of mortality for male and female is decreasing up to age group 25 and strictly increasing in the whole range, but rapidly increasing after the age interval 55 and above.

Fig 1. Force of Mortality for Male and Female of Bangladesh in 2006. X: Age group and Y: Force of Mortality

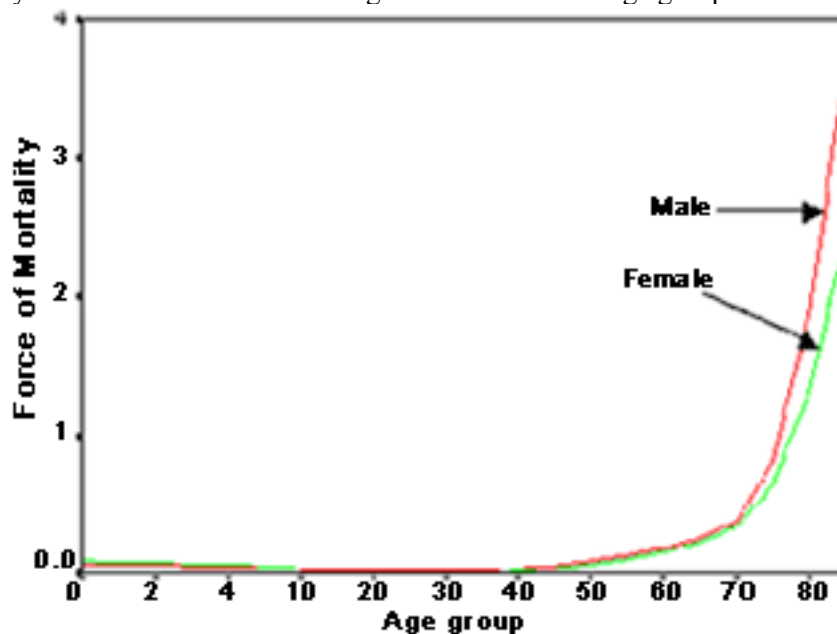


Table 1 An Abridged Life Table and ASDRs for Male of Bangladesh in 2006

age x	l_x	dx	q_x	p_x	L_x	T_x	e_x	ASDRs
0	100000	7518	0.07518	0.92482	94737.4	6254577	62.54577	0.079356
1	92482	1620	0.017517	0.982483	91510	6159840	66.60583	0.017703
2	90862	790	0.008695	0.991305	90467	6068330	66.78623	0.008732
3	90072	476	0.005285	0.994715	89834	5977863	66.36761	0.005299
4	89596	319	0.00356	0.99644	89436.5	5888029	65.71754	0.003567
5	89277	719	0.008054	0.991946	444587.5	5798593	64.95058	0.001617
10	88558	327	0.003692	0.996308	441972.5	5354005	60.45761	0.00074
15	88231	403	0.004568	0.995432	440147.5	4912033	55.67241	0.000916
20	87828	478	0.005442	0.994558	437945	4471885	50.91639	0.001091
25	87350	591	0.006766	0.993234	435272.5	4033940	46.18134	0.001358
30	86759	728	0.008391	0.991609	431975	3598668	41.4789	0.001685
35	86031	1033	0.012007	0.987993	427572.5	3166693	36.80874	0.002416
40	84998	1566	0.018424	0.981576	421075	2739120	32.2257	0.003719
45	83432	2428	0.029102	0.970898	411090	2318045	27.78364	0.005906
50	81004	3896	0.048096	0.951904	395280	1906955	23.54149	0.009856
55	77108	5758	0.074674	0.925326	371145	1511675	19.60465	0.015514
60	71350	8492	0.119019	0.880981	335520	1140530	15.985	0.02531
65	62858	11051	0.175809	0.824191	286662.5	805010	12.8068	0.038551
70	51807	13213	0.255043	0.744957	226002.5	518347.5	10.00536	0.058464
75	38594	13358	0.346116	0.653884	159575	292345	7.574882	0.08371
80	25236	11300	0.447773	0.552227	97930	132770	5.261135	0.115389
85	13936	13936	1	0	34840	34840	2.5000	0.4000

Table 2 An Abridged Life Table for Female and ASDRs for Female and Both Sexes of Bangladesh in 2006

age x	lx	dx	qx	px	Lx	Tx	ex	ASDRs	ASDR(both)
0	100000	7337	0.07337	0.92663	94864.1	6451583	64.51583	0.077342	0.078348536
1	92663	1648	0.017785	0.982215	91674.2	6356719	68.6004	0.017977	0.017839967
2	91015	786	0.008636	0.991364	90622	6265045	68.8353	0.008673	0.008702903
3	90229	464	0.005142	0.994858	89997	6174423	68.43058	0.005156	0.00522713
4	89765	304	0.003387	0.996613	89613	6084426	67.78171	0.003392	0.003479485
5	89461	653	0.007299	0.992701	445672.5	5994813	67.01035	0.001465	0.001541123
10	88808	284	0.003198	0.996802	443330	5549140	62.48469	0.000641	0.00069016
15	88524	385	0.004349	0.995651	441657.5	5105810	57.67713	0.000872	0.000893622
20	88139	461	0.00523	0.99477	439542.5	4664153	52.91815	0.001049	0.001070101
25	87678	532	0.006068	0.993932	437060	4224610	48.18324	0.001217	0.001287353
30	87146	668	0.007665	0.992335	434060	3787550	43.46212	0.001539	0.001611944
35	86478	869	0.010049	0.989951	430217.5	3353490	38.77853	0.00202	0.002217326
40	85609	1212	0.014157	0.985843	425015	2923273	34.14679	0.002852	0.003283339
45	84397	1751	0.020747	0.979253	417607.5	2498258	29.60126	0.004193	0.005042853
50	82646	2825	0.034182	0.965818	406167.5	2080650	25.17545	0.006955	0.008386076
55	79821	4481	0.056138	0.943862	387902.5	1674483	20.97797	0.011552	0.013489274
60	75340	6985	0.092713	0.907287	359237.5	1286580	17.07698	0.019444	0.022276838
65	68355	9917	0.145081	0.854919	316982.5	927342.5	13.56656	0.031286	0.034735648
70	58438	13024	0.222869	0.777131	259630	610360	10.44457	0.050164	0.05402645
75	45414	14800	0.325891	0.674109	190070	350730	7.722949	0.077866	0.080533112
80	30614	13789	0.450415	0.549585	118597.5	160660	5.247926	0.116267	0.115869809
85	16825	16825	1	0	42062.5	42062.5	2.5	0.4000	0.4000

Table 3 ASDRs for Male, Female and Both Sexes in 2005 for Bangladesh and Force of Mortality for Male and Female in 2006 for Bangladesh.

Age (x)	ASDRs (m)	ASDRs (f)	ASDRs (b)	Force of Mortality for Male in 2006	Force of Mortality for Female in 2006
0	0.08423	.0934	.0888	0.007089	0.008925
1	0.019409	.0246	.0220	0.006629	0.00835
2	0.009594	.0121	.0109	0.006179	0.007787
3	0.00581	.0072	.0065	0.005743	0.00724
4	0.003911	.0048	.0043	0.005231	0.006582
5	0.001763	.0021	.0019	0.004378	0.005456
10	0.000801	.0009	.0008	0.003082	0.003717
15	0.000984	.0012	.0011	0.001791	0.001822
20	0.001176	.0015	.0013	0.001059	0.000548
25	0.00146	.0017	.0016	0.00088	0.000156
30	0.001809	.0021	.0019	0.001102	0.000156
35	0.002586	.0027	.0026	0.00194	0.000512
40	0.003951	.0036	.0038	0.003519	0.001715
45	0.006228	.0051	.0057	0.005803	0.003821
50	0.010309	.0083	.0093	0.00889	0.006744
55	0.016109	.0136	.0148	0.013028	0.010622
60	0.026128	.0224	.0243	0.018597	0.015794
65	0.039668	.0354	.0375	0.025515	0.022558
70	0.05996	.0559	.0579	0.038292	0.034251
75	0.085505	.0858	.0857	0.079882	0.063873
80	0.117268	.1249	.1212	0.188511	0.132525
85	0.40000	.4000	.4000	0.366066	0.241458

Table 4 The CDR and IMR for Male, Female and Both Sexes of Bangladesh in 2005 and 2006

Year	CDR (per thousand)			IMR (per thousand)		
	Male	Female	Both Sexes	Male	Female	Both Sexes
2005	16.31	16.48	16.39	80	88	84
2006	15.99	15.50	15.75	75	73	74

Table 5 Information on Model Fittings

Model	n	k	R ₂	R^2_{σ}	Shrinkage	Parameters	Significant Probability (p)
(i)	22	3	0.99246	0.9892	0.003279	a ₀ a ₁ a ₂ a ₃	0.000 0.000 0.00003 0.00000
(ii)	22	3	0.99384	0.9912	0.002679	a ₀ a ₁ a ₂ a ₃	0.000 0.000 0.00009 0.00000

Conclusion

It is found that ASDRs, CDR and IMR for male, female and both sexes are showing a decreasing trend over time during 2005-2006. It is seen l_x that the values for male and female follows the 3rd degree polynomial, i. e. cubic polynomial model. It is observed that force of mortality (μ_x) for males and females is decreasing in the age interval 0 to 25 and increasing in the remaining age interval. We hope the latest findings on the life table as well as mortality, would encourage the government and non-government organizations (NGOs), researchers, academicians and planners to plan to bolster the socio-economic development and health care program in the country. Life insurance companies might be helped by the updated information of life tables in this study to boost their plan of insurance.

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Estimation of Some Mortality Measures, Modeling of l_x and Age Associated with Force of Mortality of Bangladesh in 2006

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ABSTRACT

Background: Because the numbers of hip fractures worldwide are projected to increase, osteoporosis will become an increasing burden on the health care system, in addition to causing pain, disability and reducing quality of life. Mortality rate of hip fracture is 15-20% as compared to 0.91% of other orthopaedic problems.

Objective: To determine the hip bone mineral density level that is predictive of fracture and whether osteoporosis is more prevalent in patients with hip fracture than in the age-and sex-matched group or not.

Method: In this prospective study the hip bone mineral density of 100 patients (50 men, 50 women) and 100 control individuals (50 men, 50 women) between 50-90 years old was measured by Dual-energy x-ray absorptiometry. The patients group had hip fracture after minor trauma. The statistical analysis of the two groups was done by t-test.

Results: This study showed that bone mineral density in the patient group was 0.6333 gr/cm² versus 0.7589 gr/cm² in the control group. The mean Z-score in the patient group was -1.218 versus -0.652 in the control group. The mean T-score in the patient group was -2.98 versus -1.98 in the control group. So hip fracture is associated with osteoporosis, which is more prevalent in the patient group than in the age-and sex-matched control group.

Conclusion: We recommend every person who has been screened by DXA and having bone density below 0.6333 gr/cm² is prone to hip fracture. Also regular annual follow up by DXA is required until BMD reaches at least above 0.6333 gr/cm².

Key words: Bone mineral density, Dual-energy x-ray absorptiometry, Hip fracture.

Introduction

The incidence of hip fracture has increased in recent years. Approximately 40 percent of women will experience one or more fractures after the age of 50⁽¹⁾. At 50 years of age for women the lifetime risk of hip fracture is 17.5%⁽²⁾. Mortality rate of hip fracture is 15-20% as compared to 0.92% mortality of other orthopaedic problems⁽³⁾. Patients with hip fracture have risk of complications such as deep vein thrombosis, bed sores, UTI, etc⁽⁴⁾. Osteoporosis is the single most important risk factor⁽⁵⁾. There are several techniques such as Radiographic absorptiometry, Dual-energy X-ray absorptiometry, Quantitative CT, Ultrasonography, etc, that detect osteoporosis but Dual-energy X-ray absorptiometry is the current gold standard method^(6, 7). We have conducted this study to detect the severity of osteoporosis and to determine the level of bone mineral density that guides us to start preventive therapy of hip fractures.

Patients and Methods

This is a prospective study in which hip bone mineral density was measured by Dual-energy x-ray absorptiometry in 100 patients (50 men, 50 women) who had hip fracture after minor trauma. All 100 patients were evaluated by Dual -energy X-ray absorptiometry within 2 weeks after fracture. The age of patients was between 50 and 90 years. Bone mineral density measurement was done on the side that had no fracture.

The control group consisted of 100 persons (50 men, 50 women) between 50 and 90 years old in whom bone mineral density of hip was measured by Dual-energy x-ray absorptiometry.

- We excluded the following patients
- 1-Patients with metabolic bone diseases.
 - 2-Patients who had old fracture of more than 2 weeks duration.
 - 3-Patients who had previous osteoporosis due to drug consumption.
 - 4-Patients who had major trauma.
 - 5-Patients who had a history of previous fracture or surgery on the other hip.
- Each person had three sets of data:

Bone Mineral density (BMD), T- score, Z- score

- 1- BMD that is mineral content of bone and recorded in gr/cm²
- 2- T-score that compares BMD of each person with young person.
- 3-Z-score that compares BMD of each person with age-matched persons.

After collection of all data, by comparing the patient group with the control group, T- test analysis was done and then results were reported.

Results

The mean age in the patient group was 70 years (S.D: 10.3) and in the control group was 68 years (SD: 8.82). The statistical analysis revealed no difference between the two groups in terms of age (P.value=0.342). The mean bone mineral density in the patient group was significantly lower than the control group, being 0.6333 gr/cm² (min: 0.345, max: 1, S.D:0.126) versus 0.7589 gr/cm² (min: 0.441, max: 1.099, SD: 0.144) (P.value=0) (Table 1). The mean T score in the patient group was significantly lower than the control group, being - 2.986 (min: 1.2, max: 4.7, S.D: 1.109) versus - 1.98(min: 0.1, max: 4.5, S.D: 1.17) (P. value= 0) (Table 2). The mean Z- score in the patient group was significantly lower than the control group, being-1.218 (S.D: 0.769) versus- 0.652 (S.D: 0.983) (P.value= 0.002) (Table 3).

	Number of cases	Mean age (y/o)	BMD (gr/cm ²)
Control group	100	68	0.7589
Patients group	100	70	0.6333

	Number of cases	Mean age (y/o)	T- score (S.D)
Control group	100	68	-1.98
Patients group	100	70	-2.98

	Number of cases	Mean age (y/o)	Z- score (S.D)
Control group	100	68	-0.652
Patients group	100	70	-1.218

Discussion

Because the number of hip fractures are projected to increase, osteoporosis will become an increasing burden on the health care system, in addition to causing pain, disability and reducing quality of life⁽⁸⁾. Perhaps the major value of bone densitometry in current orthopaedic practice is identification of the patients with osteoporosis who are at increased risk for fracture⁽⁹⁾.

Whether osteoporosis is more prevalent in patients with hip fracture than age and sex-matched groups has remained controversial. Makin in 1987 could not confirm that the degree of osteoporosis is related to the incidence of femoral neck fractures. He concluded that

the incidence of proximal femoral fractures is related to other factors in addition to the degree of osteoporosis⁽¹⁰⁾. In a few studies osteoporosis has not been shown to be more prevalent in those with hip fractures than in age-matched controls⁽¹¹⁾. But Atkin in 1984 demonstrated that patients with hip fractures often have bone that is more osteoporotic than that of age and sex- matched control subjects⁽¹²⁾. Barth and colleagues measured osteon dimensions and numbers in cortical bone specimens obtained from the medial femoral cortex in patients treated with hemiarthroplasty for femoral neck fracture. They compared these measurements to those of 12 age-matched cadavers without fractures. There were fewer osteons per unit area and the osteon haversian canals were larger in the fracture group than in the control group⁽¹³⁾. In our study we found that the patients with hip fracture often have bone that is more osteoporotic than the age- and sex- matched control group (BMD). In the patient group it was 0.1256 gr/cm² lower than the control group). 0.6333 gr/cm² is the level of hip bone mineral density that has an essential risk for hip fracture and needs an aggressive prophylactic therapy for osteoporosis. Also it enables us to find out whether after treatment, the patient has any improvement in bone mass or not. So the physician can effectively follow the effect of treatment and also the duration of prophylaxis needed.

Conclusion

This study shows that hip fracture is strongly associated with osteoporosis and the level of femoral neck bone density that has significant risk for hip fracture is 0.6333 gr/cm². Therefore, we recommend that prophylactic treatment be started for every person screened by DXA who has bone mineral density below 0.6333 gr/cm². Also regular follow up by DXA is needed until BMD reaches at least above 0.6333 gr/cm².

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