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Action Begins

Mathur A

The increasing number of older people in Indian society has been well perceived. Proportion of older people is growing faster than of any other age group. While population ageing is a success story of socioeconomic development and good public health practice, it has also led to economic and social crisis due to crumbling support system, with increased demand for health and welfare services.

Responding to the needs of the ever-increasing number of older people, the Government of India (GOI) announced the National Policy on Older Persons (NPOP) in 1999 with Ministry of Social Justice and Empowerment, as the nodal ministry. As far as the health care of the elderly is concerned, with funding support from GOI-WHO collaborative programme trainings of medical specialists, medical officers and health care personnel at the grass root level have been carried out. IEC and training material was also developed under this programme. Yet much more remains to be accomplished in our country.

Though research in geriatrics in past decades has provided insight into various aspects of the health status of the older people, the studies on the health needs and health problems of the elderly are sparse in our country. Various studies have been carried out at state/regional levels in respect of health problems of the elderly, there has never been a uniform study carried out in different parts of the country at the same time adopting similar parameters. Therefore to generate baseline epidemiological data concerning health problems of the elderly, it was felt by the Directorate General of Health Services/ Ministry of Health and Family Welfare to get a multicentric study conducted at ten different geographical locations in the country. This study supported under GOI-WHO collaborative programme was a laudable attempt in the field of geriatrics. This study was a cross-sectional community based study of elderly population aged 60 years and above carried out at ten centers i.e. Chandigarh, Delhi, Shimla, Gauhati, Raipur, Jodhpur, Pune, Trivandrum, Chennai, and Vellore. These ten different centers were chosen across the country with a view to provide regional representation in the data generated.

Medical colleges in these centers were given the responsibility to gather information based on a standard proforma developed for this purpose. Using structured questionnaire 1000 subjects with equal number from rural and urban area were studied at each center. The variables studied were demographic data, perceived health status, health related expectations and needs, health care facilities utilization, clinical examination by a nurse and doctor as well as laboratory investigations like hemoglobin, routine urine examination, fasting blood glucose, serum cholesterol and an electrocardiogram. Poor Vision (45.4%), Hypertension (38.2%), Arthritis (36.1%), Bowel complaints (31.6%), Depression (23.6%), Difficulty in Hearing (20.5%), Weight Loss (19.6%), Anaemia (16.8%), Urinary complaints (13.4%), Diabetes (13.3%), Fall (8.7%), IHD (7.7%), Asthma (6.6%), COPD (4.8%), and Tuberculosis (3.1%) were the common health problems highlighted by the study.¹

India is a vast country and ten centers still may not reflect correct picture. Survey has been cross sectional with its limitations however the strength of the study has been a good sample size (n=10035). It is first of its kind in India and it has covered all important health related issues of elderly required for planning of health programme.

The elderly (people above the age of 60 years) comprise 7.5 percent of India's total population, and making health care available and accessible to them is one of the health priorities of the country. Evidence base generated by the multicentric study will help in planning of health service provision for elderly in our country. The study proposes a simple sustainable and economical health care delivery system for elderly at community level with existing health care services.

It is commendable that there is a strong thrust on health in eleventh five year plan. The 11th Five Year Plan aims at inclusive growth by introducing Sarva Swasthya Abhiyan that will find solutions for strengthening the health services and focus on neglected areas and groups. The 11th Plan envisages a range of services under the National Programme for Older Persons to improve the access to promotive, preventive, curative

and emergency healthcare for older people.

A home health service, entailing home visits to detect health problems, and as a psychological support by health personnel sensitized on such issues will be introduced. Also, a community-based health centre for the aged for educational and preventive activity will be initiated. This will be integrated with the NRHM (National Rural Health Mission) and an allocation made specifically for geriatric care. The Accredited Social Health Activist (ASHA) will be trained in geriatric care and the out-patient medical service, which serves as the base for home health service, will be enhanced.

Finally, an improved hospital-based support service, focusing on their healthcare needs, will also be made

for widows and a few centres on geriatric health will focus only on elderly women. The government will develop two National Institutes for Ageing, one in the North and another in South of India.²

At last real action has commenced, to implement the plans for improving health of our elderly.

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Culprit Effect of Altered Total Antioxidant Status and Lipid Peroxidation Mediated Electrolyte Imbalance on Aging

Saxena R*, Lal A M**

Abstract

Background: Cellular damage by reactive oxygen species including those associated with lipid peroxidation are now accepted to be related with a variety of pathological events including aging and its consequent sequelae. Among various alterations, electrolyte imbalance leading to disturbance in normal homeostasis has been found to be a major event in the progression of aging. It is conceivable that alteration in plasma antioxidant reserve in association with lipid peroxidation may have a crucial role in aging process as well. However, there is a paucity of satisfactory explanation regarding the alteration in non-enzymic antioxidant status and lipid peroxidation mediated electrolyte imbalance with increase in age.

Aim: The objectives of present study were to ascertain the plasma levels of total antioxidant activity (TAA), non-enzymic antioxidants, malonaldehyde (MDA) and serum minerals in the subjects of different age groups and to determine their cumulative effect in the progression of aging process.

Material and Methods: In the present study, 120 healthy subjects were selected and non enzymatic antioxidant reserves (TAA, Vitamin C, E & A, uric acid and albumin), malonaldehyde and serum mineral (Na⁺, K⁺, Mg²⁺ and Ca²⁺) levels were measured using standard methods. Out of 120 subjects, 80 healthy individuals were categorized into two groups: group I (40-55 years) and group II (>56 years) and statistically compared it with that of 40 younger controls (20-30 years) by using student's t-test.

Result: Plasma TAA, vitamin C, E & A, and albumin levels were significantly low (p<0.05, p<0.001) in group I and II as compared to healthy controls whereas erythrocyte MDA level was increased significantly (p<0.05) in both the groups. On the other hand, plasma uric acid level and serum sodium levels were increased significantly (p<0.05) only in group II subjects whereas serum magnesium, potassium and calcium levels revealed significantly low values (p<0.05) in group II subjects as compared to healthy controls. However, these levels were altered insignificantly (p<0.1) in group I subjects.

Conclusion: Our findings indicate that alteration in TAA, non-enzymic antioxidants and serum minerals levels due to augmented oxidative stress contributes aging process not only by inducing bio-molecular deterioration but also by disturbing haemostatic control via electrolyte imbalance. Therefore, maintenance of healthy antioxidant status and electrolyte balance by consuming diet rich in antioxidant vitamins, proteins and minerals with increasing age could be effective in reducing aging and its related complications.

Keywords: Total antioxidant activity, lipid peroxidation, aging, α -tocopherol, electrolyte imbalance. (Abbreviations: TAA - Total Antioxidant Activity; MDA – Malonaldehyde; Na⁺ - Sodium; K⁺ - Potassium; Ca²⁺ - Calcium; Mg²⁺ - Magnesium)

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Introduction

Today's concept of oxygen toxicity and antioxidant defence system is not restricted only to some diseases but it has now been receiving much attention towards solving the unanswered question related to aging process. Oxidative stress ensues when large amount of reactive oxygen species are produced in the cells, that can evade or overwhelm the antioxidant protective mechanisms of cells and tissues, and produce major interrelated impaired cell metabolism including DNA

strand breakage, rise in intracellular free Ca^{2+} , damage to membrane ion transporters and other specific proteins leading to cell death.¹ Prime target to free radicals attack are the polyunsaturated fatty acids in the membrane lipids, causing lipid peroxidation, which has been found to be a major event in the production of pathophysiological alterations in elderly.² Lipid peroxide (malonaldehyde) is most abundant among the reactive aldehydes derived from lipid peroxidation. It has been suggested that binding to these aldehydes to membrane protein may alter their function, tonicity, permeability, rigidity and integrity, and thereby may induce culprit effect on electrolyte imbalance leading to the progression of aging progress.³ However conversely, activation of ion pumps under the influence of free radicals production to normalize perturbed ionic homeostasis has been documented.⁴ The important elements responsible for electrolyte balance, pH and function of enzymes include sodium, potassium, magnesium and calcium, and their optimal concentration for proper physiological activities of the cell is maintained by ion channels. Interestingly, Garg and Sanchette have well elucidated the role of various ion channels in CVD, CNS, taste sensation, skeletal muscle, renal, respiratory, pancreatic, erectile and platelet function.⁵ Inactivation of these ion channels may produce physical and functional disability with age.

These free radicals are efficiently removed by antioxidant defence system, which includes antioxidant enzymes and antioxidants. Total antioxidant activity (TAA) including co-operative action of other widely recognized non enzymatic antioxidants such as vitamin C, E, A, uric acid and albumin, may have a significant role in the physiochemical alterations during aging and have received much attention in preventing age related complications. Vitamin C, an exogenous water soluble antioxidant, functions as primary defense against free radicals in plasma. It plays a key role in protecting plasma lipids against peroxidation, collagen synthesis, wound healing and improving vascular endothelium dependent vasodilation.⁶ Vitamin E, mainly α -tocopherol, is the most potent lipid soluble chain breaking antioxidant which has been theorized to extend life span, enhance cell mediated immunity in elderly people and prevent age related functional decline and diseases.⁷ α -tocopherol quenches and reacts with superoxide anion, hydroxyl and peroxy radicals to protect against oxidative stress mediated biomolecules and membrane damage via lipid peroxidation.⁶ In addition, β -carotene mainly carried on LDL particle, is also an efficient fat

soluble antioxidant that can quench singlet oxygen, inhibit nitric oxide mediated oxidation and responsible for immune response, epithelial growth and repair.⁸ Although previous experimental and epidemiological studies have suggested a modest benefit of these antioxidant vitamins in reducing the electrolyte imbalance and age related deteriorations, in general the evidences are sparse and unconvincing which needs further investigation regarding the role of these non-enzymic antioxidant vitamins in aging.^{7,9}

Similarly, there has been renewed debate about the nature of association between plasma uric acid and age related complications. Ames et al. reported that uric acid, an end product of purine metabolism, is an effective antioxidant in plasma as it scavenges superoxide radical, protects erythrocyte against peroxidative damage and free radical attack.¹⁰ Conversely, its relation with circulating inflammatory markers, vascular injury and endothelium are well documented.¹¹ Moreover, plasma proteins are major cellular, structural and functional constituents and contribute antioxidant defenses.¹² Several investigators also observed that the accumulation of oxidized protein occurs in a number of tissues during aging and there by associated with reduced life expectancy.¹³

Despite these contradictory and limited evidences, there is no conclusive evidence on the total systemic antioxidant activity and other non-enzymic antioxidants in relation with oxidative stress mediated electrolyte imbalance in subjects. Therefore, the overall objectives of present study were to ascertain the plasma levels of TAA, non-enzymatic antioxidant reserves (including vitamin C, E, A, plasma albumin and uric acid levels), malonaldehyde and serum minerals (Na^+ , K^+ , Mg^{2+} & Ca^{2+}) in subjects of different age groups and to determine their cumulative effect in the progression of aging process.

Material and Methods

In the present study, 120 healthy, non-supplemented (not taking any additional vitamins or minerals) subjects of both sex (20 males & 20 females in each group) and different age groups were included from urban area of Allahabad city after taking their informed consent and approval of protocol by ethics committee of the college. These subjects were selected randomly and categorized into three groups depending upon age i.e. control group (younger people) which included 40 healthy subjects of age group 20 – 30 years, Group I included 40 healthy subjects (middle

Table 1: Demographic profile of study subjects (n=120) (mean \pm SD)

S No	Particulars	Control group (n=40)	Group I (n=40)	Group II (n=40)
1	Age (years)	24.5 \pm 4.0	46.0 \pm 6.0	65.0 \pm 8.0
2	M:F ratio	1:1	1:1	1:1
3	Height (meter)	1.57 \pm 0.08	1.53 \pm 0.05	1.61 \pm 0.07
4	Weight (Kg)	54.8 \pm 4.6	57.4 \pm 3.5	61.8 \pm 2.4
5	B.M.I. (Kg/m ²)	22.2	24.5	23.8
6	Systolic blood pressure (mmHg)	102 \pm 8.0	110 \pm 4.8	118 \pm 6.3
7	Diastolic blood pressure (mmHg)	74.0 \pm 3.5	76 \pm 4.8	70.0 \pm 5.0

Table 2: Serum electrolyte levels in different age group subjects. mean \pm SD.

S No	Minerals	Control group (n=40)	Group I (n=40)	Group II (n=40)
1	Sodium level (meq/L)	137.0 \pm 8.6	148.8 \pm 10.7*	165.20 \pm 9.6**
2	Potassium level (meq/L)	3.92 \pm 0.46	2.72 \pm 0.48*	2.49 \pm 0.50**
3	Magnesium level (mg%)	2.94 \pm 0.82	2.63 \pm 0.74*	2.11 \pm 0.56**
4	Calcium level(mg%)	9.41 \pm 0.64	8.67 \pm 0.72*	7.08 \pm 0.64**

Where, * p<0.1 : Not-significant, ** p<0.05 : Significant, *** p<0.001 : Highly significant

aged people) of age group 40 – 55 years and Group II included 40 healthy subjects (elderly people) of age group 56 years onwards. After taking the demographic information, history and limited physical examination, fasting blood samples were collected in plain vial (for serum minerals estimation) and in EDTA vial from antecubital vein avoiding venostasis from each subject after collecting the information of age, sex, height, weight, blood pressure and confirmation of healthy state. Height and weight were measured with subject barefoot and light dressed. The body mass index (BMI) was calculated as BMI = weight (Kg) / height (metre²). Obese (BMI > 25), hypertensives (BP >140/90 mmHg) and smokers were excluded from the study.

Samples were processed immediately for plasma and serum separation. Plasma total antioxidant activity was estimated spectrophotometrically by the method of Koracevic et al.¹⁴ Two milliliter of blood sample was collected in EDTA bottle. Plasma was separated immediately by centrifugation and TAA was measured.

This method is based on the principle that the standardized solution of iron EDTA complex reacts with hydrogen peroxide by a Fenton type of reaction, leading to the formation of hydroxyl radicals. This reactive oxygen species degrades benzoate, resulting in the release of thio barbituric acid reactive substances (TBARS). Antioxidants from the added plasma causes the suppression of production of TBARS. The reaction is measured spectrophotometrically at 532 nm.

Erythrocyte malonaldehyde (MDA) levels were measured as thiobarbituric acid reactive substances, after preparation of hemolysate.¹⁴ The heat induced reaction of malonaldehyde (MDA) with thio barbituric acid (TBA) in the acid solution forms a trimethine coloured substance, which is measured spectrophotometrically at 532 nm.

Plasma ascorbic acid levels were estimated by Burtis and Ashwood method.¹⁵ Ascorbic acid in plasma was oxidized by Cu(II) to form dehydroascorbic acid which reacts with acidic 2,4–dinitrophenyl hydrazine to

Table 3: Plasma Total antioxidant activity (TAA), Malionaldehyde (MDA) and non enzymatic antioxidants level in different age group subjects. mean?SD

S No	Particulars	Control group (n=40)	Group I (n=40)	Group II (n=40)
1	TAA level(m mol/L)	1.32 ? 0.21	1.04 ? 0.13**	0.89 ? 0.14***
2	Ascorbate level(mg%)	0.78 ? 0.16	0.59 ? 0.10**	0.46 ? 0.08***
3	Tocopherol level (mg%)	1.44 ? 0.42	1.15 ? 0.37**	0.88 ? 0.26***
4	Vitamin A(µgm%)	115.84 ? 22.15	85.36 ? 14.6**	78.42 ? 16.8***
5	Uric acid (mg%)	4.62 ? 1.36	5.2 ? 2.4*	6.9 ? 1.72**
6	Malionaldehyde(µmol MDA/ml)	1.57 ? 0.10	2.16 ? 0.13**	2.38 ? 0.09***
7	Albumin (gm%)	3.8 ? 0.68	3.0 ? 0.24**	2.64 ? 0.37**

Where, * p<0.1 : Not-significant, ** p<0.05 : Significant, *** p<0.001 : Highly significant

Table 4: Correlation coefficient between erythrocyte MDA level and serum electrolyte levels in middle aged and elderly subjects.

Particulars	Sodium level	Potassium level	Magnesium level	Calcium level
MDA levels in Group I	+0.216*	-0.185*	-0.282**	-0.228**
MDA levels in Group II	+0.321**	-0.348**	-0.421***	-0.529***

* p<0.1 : Not-significant, ** p<0.05 : Significant, *** p<0.001 : Highly significant

form a red bishydrazone, which is measured at 520nm.

Plasma tocopherol levels were estimated by Hashim and Schuttringer method.¹⁶ Protein in the plasma or serum was precipitated by an equal volume of absolute ethanol, the whole mixture was subjected to extraction by an equal volume of n-heptane. 2,2'-dipyridyl was added followed by Ferric chloride reagent to the system which produced the color, obtained by Emmeric-Engel procedure. It was measured spectrophotometrically at 510 nm.

Plasma uric acid levels were estimated by Caraway's method in which uric acid react with phosphotungstic acid in alkaline medium forming a blue color complex which is measured at 700 nm.¹⁸

Plasma Vitamin A were measured by Sinha method in which vitamin A was extracted from plasma by using absolute alcohol and heptane. The heptane extract was kept in one tube and took same volume of working standard (500 I.U. per 100ml heptane) in another tube. Both the tubes were placed under a

mercury lamp for three hours. The vitamin was destroyed in these solutions which was measured spectrophotometrically at 327 nm against water blank.¹⁷

Plasma albumin levels were estimated spectrophotometrically.¹⁹ The reaction between albumin and bromocresol green produced change in colour that was proportional to the albumin concentration.

Serum electrolytes (Na⁺ and K⁺) levels were measured by Sinha method by using flame photometer in which test sample was aspirated followed by calculation of test sample value from calibration curve of standard solution (i.e. NaCl and KCl solution).²¹ Serum magnesium levels were estimated by Neill and Neely method in which protein free filtrate was treated with titan yellow solution.²² A red color complex is formed which is measured at 520 nm. Serum calcium levels were estimated by Tinder's method.²³ Calcium in an alkaline medium combines with o-cresolphthalein complex to form a purple coloured complex which is measured at 570 nm. The data from both the study group subjects and controls were expressed as mean

(?SD) and compared by using Student t-test, distribution of probability (p) and linear regression for correlation.

Result

In the present study, the mean blood pressure and anthropometric indices of the study group subjects are depicted in Table 1. The observations made revealed significant changes in plasma TAA, erythrocyte malonaldehyde, non-enzymatic antioxidant status (Table 2), and serum minerals levels (Table 3) of different age group subjects. The correlation coefficient between serum minerals and erythrocyte malonaldehyde levels is represented in Table 4. Plasma total antioxidant activity was found to be significantly low ($p < 0.05$ & $p < 0.001$) in both the study groups i.e. 21.0% and 32.5% low as compared to controls. Similarly, plasma ascorbate levels in both the study group subjects were 24.3% and 41.02% low as compared to controls and statistically these values were highly significant. Marked reduction was observed in plasma tocopherol levels (29.4% and 38.8% low), plasma Vitamin A levels (22.0% and 28.9% low) and plasma albumin levels (26.0% and 35.6% low) in both the study group subjects i.e. Group I and Group II respectively as compared to healthy controls. Moreover, erythrocyte MDA levels were 25.3% and 42.0% high in Group I and Group II respectively as compared to healthy controls. Interestingly, MDA levels were found to be inversely related with serum K^+ , Mg^{2+} and Ca^{2+} levels and directly related with serum Na^+ levels of different age group subjects. Significant increase in plasma uric acid and serum sodium levels were observed only in Group II ($p < 0.05$) subjects whereas in Group I subjects, plasma uric acid and serum electrolyte levels were not significantly altered ($p < 0.1$). Although these levels reveal continuous variation with increase in age, statistically these values were not statistically significant (i.e. on comparing Group I and Group II).

Discussion

Aging is a universal and inevitable, normal biological phenomenon associated with physiological changes that lead to functional deterioration of organs with an increased susceptibility to disease.²⁴ The free radical theory of aging also states that aging is a result of cumulative damage incurred by free radical reactions.²⁵ Moreover, the contributory effect of electrolyte imbalance and oxidative stress in aging process has attracted attention among epidemiologists, clinicians and experimental researchers. The mechanisms whereby free radicals may exert cytotoxic

effect related to aging process include damage to cell membrane via lipid peroxidation, ion transporters and electrolyte imbalance. Lipid peroxidation is a deleterious process leading to structural modification of complex lipid protein assemblies associated with cellular malfunction. It has been reported that lipid peroxidation contributes local membrane destabilization that alters the proper trafficking of intracellular vesicles, phagocytosis, degranulation, antigen presentation, receptor mediated ligand uptake and many other process leading to age related deterioration.²⁶ In the present study, malonaldehyde levels, the most abundant reactive aldehyde derived from lipid peroxidation, were also found to be significantly high in both middle aged and elderly subjects ($p < 0.05$, Table 2) in association with significantly altered levels of serum minerals (Na^+ , K^+ , Mg^{2+} and Ca^{2+}) in elderly people (Table 3) which authenticate the hypothesis that aging is closely associated with lipid peroxidation mediated electrolyte imbalance, destruction in cell, subcellular organelles and biomolecules. Our findings were in agreement with the findings of Goldberg et al.²⁷ Marked alteration in serum electrolytes due to successive increase in lipid peroxidation with increase in blood pressure has also been observed in our previous study on hypertensive subjects, between 30 and 65 years of age.²⁸ Similarly, Kim and Akera also reported that free radical mediated lipid peroxidation causes electrolyte imbalance not only by injuring Na^+ - K^+ -ATPase but also by interfering with normal interaction of membrane pumps (including Na^+ - K^+ - $2Cl$ co-transporter and K^+ channel) and production of protein radical in lipid membranes that effects normal ion transport.²⁹

Indeed, these four elements (Na^+ , K^+ , Mg^{2+} and Ca^{2+}) have significant role in maintenance of homeostasis by participating in various physiological activities such as neuromuscular irritability, nerve conduction, cardiac contractility, insulin release in response to changes in blood sugar, vascular smooth muscle proliferation, vasodilation, inhibition of free radical formation, in proper functioning of enzymes which include Na^+ - K^+ -ATPase, Ca^{2+} -ATPase, enzymes of carbohydrate and fatty acid metabolism; cell division, calcification of bones and teeth, in the synthesis of ATP, DNA, RNA and protein; inhibition of platelet aggregation, inhibition of absorption and transfer of toxins from the intestine into the blood and in the prevention of development of obesity and hypertension etc.³⁰⁻³⁴ Altered level of these elements may induce series of events leading to progression of aging and irreversible damage to vital organs.

In addition to electrolyte imbalance and its resultant complications, lipid peroxidation initiates a complex cascade that promotes aging effects such as atherosclerotic plaque formation followed by myocardial infarction, inhibition of NO and prostacyclin synthesis, enhancement of cytosolic free calcium and peripheral vascular resistance leading to hypertension; and leakage of lysosomal hydrolases via breakdown of lysosomal membrane which cause dystrophic changes in muscle fibers leading to weakness of muscles with growing age.^{24,35,36} However, contradictory report regarding the role of free radicals in activating the ion pumps and high MDA levels in younger than in older subjects have been documented.⁴

Electrolyte imbalance and increased production of MDA may be associated with alteration in antioxidant defence system. Vitamin C, vitamin E, β -carotene, uric acid and plasma proteins are major antioxidants. These may confer health benefits and may prevent or postpone the onset of degenerative diseases. Heitzer et al observed that vitamin C alone can afford protection against the oxidant mediated damage to LDL even though it is not lipid soluble.³⁷ Alteration in ascorbate levels have significant effects on collagen synthesis and thereby affect the strength of bones, tendon, teeth, cartilage and blood vessels with age.³⁸ In the present study, plasma ascorbate levels were found to be significantly low ($p < 0.05$, $p < 0.001$) and directly related with low minerals level except Na^+ level in each study group as compared to controls which direct towards its protective and radical scavenging action in elderly. The present findings were in concordance with findings of Singh et al. who observed a decreased level of plasma ascorbate in the population of elderly people and suggested that vitamin C supplementation may delay or postpone age related changes.²⁴ Some additional possible mechanism through which ascorbate may affect electrolyte balance and reduce age related deterioration include its protective effect on Na^+/K^+ -ATPase against peroxidative damage, synergistic action to regenerate β -tocopherol, urate radical repairing action and by enhancing the availability of NO, a potent vasodilator that reduces the risk of stroke and CVD in older people.^{6,24,39}

Vitamin E, a universal lipophilic, chain breaking antioxidant and a stabilizer of biological membranes, prevents accumulation of free radicals and decreases lipid peroxidation. It has been well documented that β -tocopherol not only retards LDL oxidation but also

exerts cardioprotective effect (e.g. inhibition of smooth muscle proliferation, platelet adhesion, aggregation and expression etc.) and preserves cell mediated immunity in older people.^{7,40} Depletion of plasma vitamin E levels as observed in present study ($p < 0.05$, $p < 0.001$) in both middle aged and elderly people is quite similar to that of Culter and may have a significant effect on electrolyte imbalance during aging not only because of its inability to stabilize membrane and limiting lipid peroxidation by scavenging free radicals but also due to reduction in maintaining the body antioxidant reserve and normalization of superoxide formation.⁴¹ Moreover, the association of vitamin E deficiency and age related disorders such as neurological dysfunction, memory problems, cataract formation, maculopathy, myopathies and diminished erythrocyte life span in elderly have been universally accepted.⁴²

Similarly, Vitamin A another fat soluble antioxidant, is believed to play protective role against oxidative damage as it is specifically carried on LDL particle, quenches singlet oxygen and competitively spares selenium in metabolic reactions.^{8,43} Low levels of plasma vitamin A as observed in present study could be explained as it contributes in the prevention of LDL oxidation, in free radical scavenging action in co-operation with other antioxidants and in bone remodeling process. Deficiency of vitamin A in the elderly makes them susceptible to infection and increases the risk of night blindness, xerophthalmia, CVD and other age related complications which can be prevented by improving the blood and LDL-beta carotene status.^{8, 44} Despite data linking antioxidant role of these vitamins, pro-oxidant properties of these vitamins also play a controversial role.^{6, 45}

Uric acid is another endogenous, preventive and chain breaking antioxidant which contributes about 65% of free radical scavenging action, stabilizes ascorbate, protects erythrocytes from peroxidative damage, inhibits free radical damage to DNA and oxidative degradation of hyaluronic acid.¹⁰ In the present study, plasma uric acid levels were found to be significantly high ($p < 0.05$) in elderly subjects while insignificant elevated levels were observed in middle aged subjects which suggests that body is trying to protect itself from the deleterious effects of free radicals with continuous increase in age by increasing uric acid production. Olivieri et al also observed elevated levels of uric acid in elderly people.⁴³ Recently, Ogura et al have reported a positive correlation of hyperuricemia with obesity, hypertension and other complications of

aging.⁴⁶ In contrast, its role in promoting LDL oxidation, in stimulating granulocyte adherence to the endothelium and its association with CVD risk and vascular injury are well documented, which reflects that uric acid has a dual action in aging process.^{11, 47}

Depletion in total antioxidant activity (TAA) indicates a disturbance in the antioxidant defence system of the body, which could be due to decrease in individual antioxidants including plasma albumin levels. In the present study, plasma TAA levels decrease continuously with increase in age ($p < 0.05$, $p < 0.001$) along with serum minerals levels except Na^+ , in middle aged and elderly people which clarify the contributory effect of reduced antioxidant vitamins and plasma albumin levels due to augmented oxidative stress that could not be compensated by increase in some other antioxidants. Recently, marked reduction in TAA in elderly subjects and in Parkinson's disease have been well documented.^{48,49}

About 10-50% of total radical trapping capacity of antioxidants in plasma is contributed by plasma proteins. Albumin, a major plasma protein contributing significantly to TAA, was found to be decreased in middle aged and elderly subjects ($p < 0.05$) along with altered serum minerals level which could not be attributed only to its free radical scavenging action but also due to co-operative action of various events that may contribute aging process such as reduced rate of protein synthesis, reduced absorption of amino acids, increased rate of protein catabolism, inactivation of ion channels and oxidative modification of protein.^{12, 50} Furthermore, oxidative damage can also lead to cleavage of polypeptide chain and formation of cross-linked aggregates as a result the skin, blood vessels and other tissue become less elastic and stiffer with age that contributes a great extent to the medical problems of the old people.^{38, 51}

Conclusion

On the basis of our findings and consistent findings of previous studies, it can be inferred that free radical production increases with increase in age and depletion of total antioxidant status due to their free radical scavenging action may be an indirect marker of oxidative stress during aging. Moreover, it contributes aging process by inducing bio-molecular deterioration and by disturbing homeostatic control via lipid peroxidation mediated electrolyte imbalance. In addition, present study also suggests that consumption of diet

rich in antioxidant vitamins (such as vitamin C, E & A), minerals and proteins should be increased with increase in age which may prevent or postpone the onset of aging and its related complications, not only by increasing antioxidant levels and thereby TAA activity but also by inhibiting lipid peroxidation mediated electrolyte imbalance as well.

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Life-Satisfaction Among Rural Elderly Females in Chittoor District

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Abstract

The aim of this study was (1) To study the level of satisfaction among the aged women (n=400) (2) To ascertain association between life-satisfaction and socio-demographic factors like age, marital status, educational attainment, occupation etc. (3) To analyze the linkage between economic condition and life-satisfaction. The study was undertaken in the villages of Rural Health Centre, Chandragiri, Chittoor district, as part of field practice centre for Community Medicine, Sri Venkateswara Medical College, Tirupati. Results indicate that with increase in age life-satisfaction showed a decline and it was statistically significant. High level of satisfaction was observed in nuclear families (31.9%) while it was 26.4% in joint families. The proportion of widowed or separated respondents scored low on life-satisfaction (35.8%) and it was statistically significant. As literacy level increased, the level of low satisfaction also increased however it is not statistically significant. The elderly women who were engaged in income generation activity, those women whose spouse were head of the family or living with them, women having high economic status and women who were respected and consulted scored high level of satisfaction.

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Introduction

One of the significant aspects of the lives of older people is their feeling of life-satisfaction. The feeling of satisfaction with their lives offers a sense of contentment and fulfillment of a large portion of their felt needs. The correlates of life-satisfaction among elderly were carried out in many researchers on a study on determinants of life-satisfaction. Results showed that, the significant contributors to life-satisfaction were positive health, functional ability, self acceptance of ageing changes, perception of social supports, intergenerational interaction, religiosity, self-rating of ability in activities of daily living, economic security, self rated behavioural flexibility, externality, belief in karma (fate) and rebirth philosophy.¹ Chadha emphasizes on gender differences and reports that elderly females are less satisfied from life than their male counterparts.²

Many of these differences could be traced to the differential roles assigned to women both in urban and rural areas. This gives rise to several prickly issues: is life-satisfaction an intrinsic or extrinsic variable, or is it dependent on factors like age, gender, type of family, literacy status, economic status etc.?

Old age is considered to be the last chapter of life. Though, a universal phenomenon, it is not a uniform experience among senior citizens. Some persons achieve a sense of fulfillment and satisfaction in their old-age, while others turn bitter and lament the decline of their physical abilities and social significance. Erickson asserts that elderly people review their past life and if they feel that most goals of their life have been fulfilled, they feel satisfied (ego-integration). Conversely, a feeling that not much has been achieved, brings a sense of despair among the aged because it may be too late to make amends.

There is a strong positive correlation between life-satisfaction and level of activity among the elderly. Jamuna & Ramamurti and also Abrams record that ageing brings negative changes in self-concept and life-satisfaction with increase in emotionality and rise in

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frustration tolerance.^{3,4} Females more often have low levels of satisfaction and the variable is strongly associated with relational variables like marital happiness, rather than socio-economic factors like income level. Adelman observes that there is a strong positive association between multiple roles and psychological well-being among aged people.⁵ Multiple roles (like spouse, parent, homemaker, grand-parent, caregiver, employee, volunteer etc) are associated with higher life-satisfaction and lower depressive symptoms. Chadha et al. maintain that married older people have a high level of satisfaction as compared to their widow/widower counterparts.⁶ Ardeli asserts that wisdom (defined as a composite of cognitive, reflective and affective qualities) has a profoundly positive influence on life-satisfaction, particularly among aged women.⁷ Study of Elango on life-satisfaction and dependency among rural and urban elderly revealed that there were significant differences between rural and urban elderly with regard to life-satisfaction and dependency.⁸ However when life-satisfaction scores were compared between rural and urban males separately and rural and urban females separately, the differences were not statistically significant.

Due to breakdown of joint family and tremendous influence of modern lifestyles on the younger generation, the attitudes of the young people towards old age are constantly changing and thus for many, old people in the house become a sort of burden and liability. It becomes rather difficult for those elderly to change their ideas, views and opinions suddenly to adjust with the younger generation. Supportive close relationships are particularly crucial for the elderly who left their spouse or other close person. Many old people belonging to lower and middle class groups do not have enough savings to take care of their needs and are economically dependent on their children for their security. Many old people feel that they would prefer to stay independently in the near vicinity of their children and would like to retain their independence.

Though these studies provide invaluable information, these do not pay a focused attention on life-satisfaction among elderly women. The present paper attempts to bridge this gap.

Objectives

- 1) To study the level of satisfaction among the aged women.
- 2) To ascertain association between life-

satisfaction and socio-demographic factors like age, marital status, educational attainment, occupation etc.

- 3) To analyze the linkage between economic condition and life-satisfaction.

Definition: For the purpose of the present study, life-satisfaction may be defined as the feeling of contentment and happiness the aged women has, especially, from her past-life.

Material and Methods

This study was carried out in 9 villages which were selected randomly and these areas were covered by the field practicing areas of Chandragiri Rural Health Centre of S.V. Medical College in Chittoor district of Andhra Pradesh from February 2001 to January 2002.

Data collection was carried out on 400 older women (60+) by house-to-house visit in the study villages. The identified 400 older women were interviewed in their local language and examined. All the women had voluntarily participated in the interview. As per the interview schedule, the socio-demographic information of the sample was collected. Socio-economic status of the women was assessed using the modified version of Udai Pareek classification.⁹

In order to measure life-satisfaction among the respondents, the scale developed by Neugarten, Havighurst and Tobin, namely "Life-Satisfaction Index" was used. The summarized rating scale has 20 items and has the reliability (split-half) of 0.82 ($p < 0.001$). For positive statements, weight '3' was given for the response 'agree', '2' for 'uncertain' and '1' for disagree. Reverse weight was given to negative statements. The life-satisfaction measure is a sum of ratings as five different components. An individual is regarded as enjoying psychological well-being to the extent that i) she takes pleasure from the round of activities that constitute her every day life ii) regards her life as meaningful and accepts resolutely that which life has been iii) feels she has succeeded in achieving her major goals iv) holds a private image of self and v) maintains happy and optimistic attitudes and moods.

Results and Discussion

In the present study, 66.3% of women belonged to 60-69 years of age. With increase in age life-satisfaction level showed a decline (50.9% among 60-69 years age group and only 12.0% among elderly women 80 years and above) and it is statistically

Table 1: Distribution of Elderly Women by Socio-demographic determinants.

Variable	Low Satisfaction (n=118)		Satisfaction (n=132)		High Satisfaction (n=150)		Total	χ ² value	P-value	Significance	
	No	%	No	%	No	%					
1) Age(yrs)											
60-69	27	10.2	103	38.9	135	50.9	265	66.3	164.11	0.000	s
70-79	74	67.2	28	25.5	8	7.3	110	27.5			
≥ 80	21	84.0	1	4.0	3	12.0	25	6.2			
2) Caste									5.99	0.423	ns
ST	1	12.5	3	37.5	4	50.0	8	2.0			
SC	35	26.9	51	39.2	44	33.9	130	32.5			
BC	34	30.1	37	32.7	42	37.2	113	28.2			
OC	52	34.9	41	27.5	56	37.6	149	37.3			
3) Type of the family									6.24	0.182	ns
Nuclear	64	34.1	64	34.0	60	31.9	188	47.0			
Joint	58	27.4	68	32.1	86	26.4	212	53.0			
4) Marital Status									20.06	0.000	s
Separated/ widowed	105	35.8	97	33.1	91	31.1	293	73.3			
Married	17	15.9	35	32.7	55	51.4	107	26.7			
4) Education									6.17	0.629	ns
Illiterate	114	30.2	125	33.2	138	36.6	377	94.3			
Primary	6	33.3	6	33.3	6	33.3	18	4.5			
Middle	1	33.3	0	0	2	66.7	3	0.8			
Secondary	1	100.0	0	0	0	0	1	0.2			
Higher Secondary	0	0	1	100.0	0	0	1	0.2			
5) Occupation									70.22	0.000	s
Not doing any work	41	69.5	14	23.7	4	6.8	59	14.7			
House-wife	50	36.2	41	29.7	47	34.1	138	34.5			
Gainful occupation	31	15.3	77	37.9	95	46.8	203	50.8			
6) Relationship to HOF									27.72	0.000	s
Others	23	40.4	22	38.5	12	21.1	57	14.3			
Mother	64	36.6	57	32.6	54	30.8	175	43.8			
Wife	3	7.3	12	29.3	26	63.4	41	10.2			
HOF	32	25.2	41	32.3	54	42.5	127	31.7			
7) SE Status									12.54	0.014	ns
< 20	77	31.4	83	33.9	85	34.7	245	64.0			
20-30	23	27.4	31	36.9	30	35.7	84	20.3			
≥ 30	22	31.0	18	25.3	31	43.7	71	15.7			
8) Staying with									25.08	0.000	s
Others	27	40.3	24	35.8	16	23.9	67	16.7			
Son	60	34.1	62	35.2	54	30.7	176	44.0			
Husband	9	12.7	21	29.6	41	57.7	71	17.8			
Alone	26	30.2	25	29.1	35	40.7	86	21.5			
9) Status in the family									8.01	0.237	ns
Neglected	13	33.3	12	30.8	14	35.9	39	9.8			
Just neglected	52	35.3	44	29.9	51	34.7	147	36.7			
Looked after well	48	28.7	62	37.1	57	34.1	167	41.7			
Respected & consulted	9	19.1	14	29.8	24	51.1	47	11.8			

HOF (Head of family) S = Significant NS = Non significant

significant. Study of Elango showed that 46.0% of elderly were having life-satisfaction while 21.0% were having somewhat satisfactory life and 33.0% did not have a satisfactory life.⁸ In the study by Padma et al 53.6% of elderly were feeling satisfaction while 46.4% were not feeling so.¹⁰ Singh C et al reported that 46.8% of the aged persons had happy attitude and 53.2% had

either unhappy or indifferent attitude towards life.¹¹

In the current study 37.3% of elderly women belonged to other caste while 32.5% were scheduled caste and 28.2% were back-ward caste. In present study 50.0% of scheduled tribes had high satisfaction followed by other caste (37.6%) who had high satisfaction. 37.2% of back-ward caste had high satisfaction.

In the present study 53.0% of elderly women were living in joint families while 47.0% in nuclear families. High level of satisfaction was observed in nuclear families (31.9%) while it was 26.4% in joint families. Joint families might give more chances of clashes on account of role conflicts, attitudinal differences, etc. Women at the age of 60+ years, living with their unmarried children also suffered from tension and anxiety related to vocational settlement and marriage of their children, which might be the reason for their low levels of life-satisfaction.

Data of the present study showed that among the respondents 73.3% were widowed or separated while 26.7% were married. The proportion of widowed or separated respondents scoring low on life-satisfaction (35.8%) was almost twice higher than their married counterparts (15.9%). Among those respondents who scored high on life-satisfaction, 51.4% were married and 31.1% widowed. So, presence of a life-partner in old age proved crucial for the life-satisfaction. Study of Panda AK revealed that the proportion of widowed or separated respondents scoring low satisfaction (41.9%) was almost twice higher than their married counterparts (22.6%).¹² Asha and Subrahmanian study stated that married aged scored higher on positive self concept and life-satisfaction than their counterparts.¹³

94.3% of the elderly aged were illiterates. Only 0.2% respondents had acquired education upto higher secondary education. As literacy level increased the level of low satisfaction was also increased. This indicates that as the educational level is increasing the adjustment with the family member is also decreasing.

The elderly women who were not doing any work were scoring low on life-satisfaction (69.5%) compared to their counterparts who were housewives (36.2%) or having gainful occupation (15.3%). The study reveals that subjects who were engaged in income generation activity were having high satisfaction level (46.8%). Similarly aged women who continued to maintain their preferred active life-style by involving themselves in household chores generally had higher life-satisfaction (34.1%). The differences were statistically significant.

The women who were wives of head of the family scored high level of life-satisfaction (63.4%) compared to their counterparts [as mother to head of the family – 30.8%; others – (as sister, mother-in-law, sister-in-law, grand-mother etc.) 21.1%] and the differences were

statistically significant. Chadha points out that the aged living with their family score much higher on life-satisfaction than their counterparts.² The study reflects that 'family' is important for the elderly.

The elderly women who were having high socio-economic status scored high levels of life-satisfaction (43.7%) compared to counter parts with low socio-economic status (34.7%). 31.0% of high socio-economic elderly had low levels of life-satisfaction while 27.4% of middle socio-economic group had low life-satisfaction levels and at the same time 31.4% of low socio-economic group had low levels of satisfaction. The differences were not statistically significant.

In the present study, those women who were staying with their husband (57.7%) had high levels of satisfaction than those who were living with their sons (30.7%) or living with their brother, sister, son-in-law etc (23.9%). The women who were staying with their husbands had lesser low levels of life-satisfaction (12.7%) compared to the women who were staying with others (40.3%) or with their sons (34.1%). 30.2% of women living alone had low levels of life-satisfaction and the differences were statistically significant.

Respect given to the elderly women by their family denotes their acceptance. It gives them a feeling of self-worth and being needed. Apparently, this in turn contributes positively to their sense of satisfaction with life. Data of the present study showed that there was a strong and direct relation between the respect given by family members to the elderly ladies and their life-satisfaction. The women who were respected and consulted had high levels of satisfaction (51.1%) compared to neglected (35.9%), just looked after well group (34.7%) and looked after group (34.1%). However the differences were not statistically significant.

Conclusion

Enhancing the quality of life of the elderly is one of the objectives mentioned in the National Policy of Older Persons in 1999. Life-satisfaction is a significant indicator to ascertain the quality of life of elderly persons. It is more or less an intrinsic variable and not dependent on religion, caste, and occupational status. Added to this, married aged women are more satisfied with the life than the widows. The reason may be attributed to cultural conditioning of elderly women that they are dependent – socially, emotionally and financially – on their husband, Thus, it can be inferred that 'young-old' 'old-old', irrespective of caste, creed,

literacy status – all share similar social and psychological challenges and life-satisfaction is, more or less, independent of socio-demographic variables.

Due to breakdown of the cultural and moral factors the elderly women were suffering frequently due to the occurrences of conflicts with their daughter-in-law. Hence aged women are more often dissatisfied in joint families. All interventions should be directed towards empowering the family to care for their elderly relatives. Enhancing their adjustment in families would be a step towards realizing the WHO goal of “Care for the elderly is home bound”.

Elderly having gainful occupation had significant relation with the study variable – life satisfaction. Aged women who had sense of security that their kith and kin would stand by them whenever the need arose were often satisfied with life. Therefore, economic indicator have stronger influence on life-satisfaction among the aged women.

Social acceptance and life-satisfaction go hand in hand. Role in decision-making on family matter is a crucial indicator of the status elderly women enjoy in their families. It also signifies satisfaction with life. The elderly women who are involved in decision making in the families often feel satisfied with life. Added to this, taking initiative in household work is a function of life-satisfaction. Willingly taking up household chores often help aged women scoring higher on life-satisfaction.

For maximizing the life-satisfaction among the aged women, there is a need for holistic approach and concerted efforts of family members, community, NGOs and government agencies. Though programmes like Old Age Pension and Day Care Centres have been a few interventions done by the government to ameliorate some of economic and social problems of the aged, there is a demand for sensitization of the families as well as the elderly about the needs and problems of the elderly.

Formations of self-help groups, counseling, involvement of the elderly women in the family and community affairs depending upon their physical capacity, yoga, meditation, spiritual workshops etc., are a few intervention steps meant for adding life to the grey years.

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Old Age and Frailty: Genesis and Management

Goel A*, Dey A B**

Since 1980s, the use of the term “frailty” in the practice of Geriatric Medicine has increased substantially with increase in older population in the society and better understanding of health problems in old age. It is somehow analogous to the term “failure to thrive” in young children.

Frailty identifies older persons at increased risk of morbidity and mortality. However, it continues to be ill defined in medical literature. Its concept underlines some common concerns of older people:

1. Being dependent on others or at a substantial risk of dependency.
2. Experiencing the loss of physiological reserves.
3. Experiencing detachment from the environment.
4. Having many chronic illnesses.
5. Having complex medical and psychosocial problems.
6. Having atypical disease presentations.
7. Experiencing accelerated ageing.

Frailty is a state of global condition of impaired strength, endurance and balance as well as vulnerability to trauma and other stressors. Some practitioners have limited the use of the term frailty to those older people requiring assistance to perform basic activities of daily living (ADLs). While others consider frailty as low food intake, weight loss, low body mass index (BMI), decrease in ability to carry out important practical and social activities of daily living, or a state that may result in an adverse health outcome. In biological terms frailty denotes decline in multiple physiological functions and most importantly skeletal muscle function in strength,

power and endurance.

Frailty was defined by Campbell and Buchner as a condition or syndrome which results from multi systemic reduction in the reserve capacity to the extent that a number of physiological systems are close to or past the threshold of symptomatic clinical failure.¹ In clinical sense the definition of frailty should include the following: multi-system involvement, instability, deterioration over time, consideration of heterogeneity within the population, an association with increased risk of death and most importantly an association with ageing.

Frailty is often regarded as a biomarker of ageing. However, the chronological age is possibly a proxy for many adverse processes, while frailty, the risk for adverse outcomes due to losses in different domains of functioning, relates directly to these adverse processes. A landmark paper on old age health by American Medical Association in 1990 indicated that a quarter of older people can be regarded as frail and the proportion would rise to close to 50% for those above 85 years of age.² In an ongoing study, the authors classified 35% of hospitalized older patients as frail as per defined criteria. Using frailty as the criterion to select elderly persons who need geriatric interventions and making accurate treatment decisions is better than selecting persons based only on their chronological age.

Why some older persons become frail while others do not? There are several hypotheses to explain the concept of frail health. Rockwood et al, proposed that the state of health in old age is like a beam balance, balancing the health assets and deficits.³ Patients whose assets clearly outweighed deficits would be well and those in whom the balance was precarious or tilted in favor of deficits, are frail. The essential feature of frailty as per this concept is the “notion of risk due to instability.” Campbell and Buchner considered that frailty arises from a decline in the reserve of multiple systems and is a state of “unstable disability”.¹ Lipsitz et al have constructed frailty in the model of mathematical chaos theory suggesting that frailty occurs when the

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responses of an organism "lose complexity in resting dynamics and show maladaptive responses to perturbations".⁴ Bortz uses the concept of symmorphosis which describes how different body structures and functions co-adjust to different levels of organismic energy flow and suggests that frailty is a result of early disease in multiple systems leading to impaired muscle strength, mobility, balance and endurance.⁵ Hougaard considers frailty as "a random effects model for time variables, where the random effect (frailty) has a multiplicative effect on hazard".⁶

Pathogenesis of frailty in old age

The development of frailty depends on the interaction of age-related disease processes with the normative age-related changes in organ functions, genes, lifestyle and environment. As mentioned earlier frail older people have excessive loss of functional muscle tissue (sarcopenia). All disease process that limit an older person's ability to exercise such as pain (due to degenerative joint diseases), cardio-pulmonary diseases (congestive heart failure, chronic obstructive pulmonary disease etc), anemia, neuro-muscular diseases (diabetes, peripheral vascular disease, polymyalgia rheumatica, cerebrovascular diseases etc.), weight loss (due to any cause) and loss of executive mental function (cognitive impairment, dementia, depression etc.) can lead to frailty.

Sarcopenia and ageing

The term sarcopenia denotes loss of muscle mass. A person is considered as sarcopenic when the lean body mass, which is generally considered as a sensitive indicator of muscle mass, is less than two standard deviations of the gender specific mean of a young sample. Lean body mass can be derived from measurements using DEXA, though such determinations are seldom required in clinical practice. There are many simpler and cheaper technologies to achieve that as well. The prevalence of sarcopenia using the above definition is 12% between 60 and 70 years and increases to about 30% above the age of 80 years. It must be noted here that fat accumulation occurs in skeletal muscles as we grow old and there can be uncoupling of muscle cross sectional area and muscle fiber strength with ageing, and lean body mass may not reflect the effective muscle strength in old age.⁷ Several predictors of sarcopenia in old age has been identified. These include: genetic predisposition, birth weight, energy intake, vitamin D status, physical

activity, insulin like growth factor (IGF)-1 level and most importantly testosterone status.

Clinical and biochemical features of frailty

The major clinical correlates of frailty are:

- muscle weakness
- fatigue and inactivity
- slow and / or unsteady gait
- weight loss
- impaired cognition.

It is likely that the manifestations of the primary or underlying diseases would also be easily visible in frail older patients. Various biochemical abnormalities observed in frail older subjects are:

- Increased blood levels of catabolic cytokines: C-reactive protein, IL-6
- Elevated markers of blood coagulation: D-dimer, Factor VIII
- Reduced hemoglobin levels: normocytic subclinical anemia
- Reduced hormonal levels: growth hormone, insulin-like growth factor-1 (IGF-1), testosterone (in men), dehydroepiandrosterone (DHEA) and estradiol (in women)
- Increased hormonal levels: cortisol (especially postmenopausal women); luteinizing hormone (in men)
- Decreased carrier protein levels: transthyretin, retinol binding protein, albumin

Diagnosis of frailty

Several diagnostic criteria have been advocated to identify the frail older person. Each of them has its own advantage and disadvantage. A simple test of frailty would include a timed one-leg standing balance test and timed "Up and Go" (rising from chair, walking 3 meters, turning and sitting down). More methodical tests used for epidemiological research and clinical diagnosis include the one proposed by Brown et al which contains four objective tests: obstacle performance test, a test of hip abduction strength, the semi-tandem portion of Romberg test and the peg board test.⁸

The author, however, follows the diagnostic criteria proposed by Fried et al, which requires demonstration

of three out of five features:⁹

1. Unintentional weight loss of greater than 4.5kg in the last year or BMI <18.5
2. Slow walking speed measured by a stop watch
3. Objective evidence of weakness assessed by grip strength
4. General feeling of exhaustion
5. Low levels of physical activity.

Treatment and prevention of frailty

From the above discussion it may be obvious that older people at some point of time will enter into a phase of frailty as a result of inevitable and progressive biological decline. As has been indicated the common deficits detected in frail older people are muscle weakness, muscle wasting, exercise de-conditioning, functional deficit in multiple domains resulting in frequent falls, decline in mobility and incontinence. These deficits contribute to each other over a period of time finally leading to hospitalization or institutionalization.

Thus the first strategy in the management of frailty is prevention. There is a substantial long term data available in world literature which suggests that with continuous physical exercise programme and adequate nutrition the risk of frailty can be reduced in advancing years. The effective exercise programme which helps preventing frailty in old age should include:

- Aerobic conditioning: At least 20 minutes of physical activity achieving 50-75 percent of target heart rate three times per week. The best example of such an exercise programme is brisk walking which older adults can easily perform.
- Weight resistance training: This includes 3 sets of 8 to 15 repetitions of resistance training at least twice a week.
- Flexibility/stretching training: This includes at least 15 seconds of static stretching per muscle group daily.
- Balance training: Though, there is no standard balance training exercise available some of the promising activities include *yoga-asanas*, tai-chi and dancing.

Good nutrition can prevent many of the contributors of frailty which include osteoporosis, malnutrition and

obesity (and attendant cardiovascular diseases). Evidence suggests that diet with following modifications have substantial influence in reducing the risk of the above morbidity and frailty.

- Low fat: less than 30 per cent of calories and less than 10 per cent derived from saturated fats.
- Low sodium: maximum of 5gm sodium.
- High calcium: 1200mg calcium either from food or supplementation.
- Vitamins and minerals: derived from fruits and vegetables in adequate quantity can provide most vitamins and minerals required by older people. Supplementation of vitamin D, folic acid, vitamin E and selenium is advisable for bone health, controlling homocysteine levels and antioxidants supplementation.
- High fiber: from fruits, vegetables and grains in adequate quantity.

While managing older patients with frailty the emphasis should be on:

- Comprehensive geriatric assessment to detect the deficits in function, risk factors and disease states.
- Treatment of diseases as per established practice.
- Prevention of adverse drug reactions by adopting safe prescription guidelines.
- Physiotherapy and reconditioning of muscle groups.
- Nutrition supplementation for deficits.

Among the common conditions which are amenable to treatment easily are: anemia of chronic disease or renal disease with erythropoietin, relief from pain and thereby muscle wasting by analgesics and physiotherapy, vitamin D deficiency by supplementation and treatment of depression with selective serotonin reuptake inhibitors. While control of diabetes in older patients is not very difficult, management of chronic complications of diabetes, cognitive impairment and intractable heart failure is often challenging.

No single agent can be recommended for treatment of frailty. Molecules which appear promising include specific androgen receptor modulators and growth hormone or its analogues. Anabolic steroids often produce a sense of well being though not sustained

for long periods. Thus the practitioner of old age care must look at diligent assessment and non-pharmacological methods for management rather than looking for any miracle remedy for frailty in old age.

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Post Graduate Diploma in Geriatric Medicine

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This programme is a Diploma Programme of one year duration. It is aimed at MBBS doctors. This programme will equip the in-service doctors with knowledge and skills in the field of Geriatric Medicine and further enable them to deal with the special problems faced by the elderly.

The broad Objectives of the Programme are to:

- ? Upgrade the knowledge and skills for providing comprehensive health care to elderly
- ? Inculcate the inter-disciplinary approach for diagnosing and management of geriatric health problems
- ? Improve the clinical, social and communication skills by providing hands on training in medical colleges and district hospitals

Delirium in Elderly

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Delirium, characterized as an acute decline of attention and cognition, is a common and serious problem for hospitalized elderly. The incidence of delirium is 14-56%, while hospitalized mortality rate varies from 25% to 33%. This has been associated with poor long term outcomes. Moreover, delirium represents one of the most preventable adverse events for hospitalized seniors. It is often iatrogenic and many aspects of hospital care, including adverse drug reactions, complications of procedures and immobilization contribute to its development.¹⁻⁴

Rarely delirium is caused by a single factor; rather it is a multifactorial syndrome resulting from the interaction of vulnerability on the part of patient (i.e. the presence of predisposing conditions, such as cognitive impairment, severe illness or visual impairment) and hospital related insults (i.e. medications and procedures). The risk of delirium increases with number of risk factors.⁵⁻⁹

Therefore, a multicomponent approach targeted to the patient’s risk factors is the most clinically relevant and potentially effective intervention for delirium.

Assessment and Recognition

In all settings, delirium is often unrecognized or mistaken for dementia, depression or acute psychosis.¹ Healthcare professionals and family members often dismiss the signs of delirium as part of normal aging or as an expected part of the terminal illness. Risk factors for under recognition of delirium in older persons also include baseline cognitive impairment, visual or hearing impairment, and lethargy.¹⁰⁻¹⁵

DSM -IV definition¹⁶

A. Disturbance of Consciousness (reduced clarity

of awareness of the environment) with reduced ability to focus, sustain or shift attention.

B. Change in cognition (memory deficits, disorientation, language disturbances) or perceptual disturbances not accounted for by preexisting dementia.

C. Caused by general medical condition or substance-induced (drug of abuse, medication or toxin exposure)

D. Acute change(hours to days) and fluctuation (during the course of day)

P psychomotor	agitated/lethargic	usually normal
H allucinations	may be present	usually not
S leep-wake cycle	abnormal	usually normal
S peech	slow, incoherent	aphasic, anomia

(DSM-IV)

C onscious	↑ or ↓	alert
O nset	acute/subacute	chronic
C ourse	fluctuating	slow decline
O rientation	disorganized	disoriented
A ttention	distracted	usually nl

(DSM-IV)

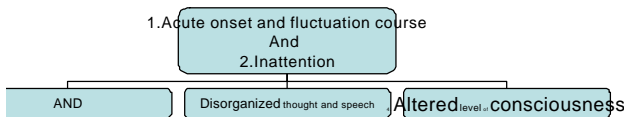
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Confusion Assessment Method (CAM)

1. Acute onset and fluctuating course
2. Inattention
3. Disorganized thinking
4. Altered level of consciousness.
 - Consider Delirium if 1 and 2 and either 3 and 4 present
 - CAM easy to administer, sensitivity 94-100% specificity 90-95%.¹⁷

Confusion Assessment Method (CAM)



Risk Factors for Delirium

The risk factors for delirium are subdivided into predisposing causes and precipitating factors. Predisposing risk factors are present prior to the illness and include cognitive or sensory impairments, polypharmacy, and malnutrition. Precipitating risk factors include events that occur during the illness such as restraints, surgery, and administration of psychoactive medications. It is the interaction of these factors that leads to delirium in elderly population.

For example, an older person with several predisposing risk factors (such as advanced dementia, advanced age, and malnutrition) may only require a minor insult such as a urinary tract infection to develop delirium. Compared to younger patients, older persons tend to have high baseline vulnerability with risk factors that are less amenable to change such as high comorbidity, compromised renal and liver function, and impaired physical and cognitive function. The precipitant risk factors which could be reversible by medical intervention such as medications, immobility, restraints, dehydration, or electrolyte abnormalities. The clinician's task is to identify predisposing and precipitating risk factors which are easily correctable or reduced.¹⁸⁻¹⁹

Common causes

Some common causes for delirium are outlined in a mnemonic for 'delirium' that includes the following: dementia, electrolytes, lung or other organ disease,

infection, rx (medications), injury or pain, unfamiliar environment, and metabolic derangements.

Common predisposing factors

- Age > 80 years
- Psychoactive drugs
- Poly-pharmacy
- Infection
- Metabolic disturbance
- Elevated blood urea, s creatinine

Common Precipitating factors are²⁰⁻²¹

Multiple medical problems

- Dementia
- Sensory impairment
- History of Ethanol abuse
- Limited ambulation
- Limited social interaction
- Fever / hypothermia

Fractures

Medications associated with delirium

In general, older persons even with a normal serum creatinine may have a reduced capacity to metabolize even routine doses of hypnotics and sedatives. Thus, careful attention to dosages and types of agents could help reduce the risk of delirium. Creatinine clearance should always be calculated in the elderly even with a normal serum creatinine. Three classes of drugs are

most often associated with delirium, namely, sedative/hypnotics, narcotics, and anticholinergic medications. Anticholinergic medications include antihistaminic medications such as diphenhydramine, antispasmodics (often used in terminal care to reduce abdominal spasms and to reduce secretions), tricyclic antidepressants (often used as adjunct therapy for neuropathic pain), antiparkinsonian medications, and antiarrhythmics.^{22,23} Other agents often associated with delirium include cardiac medications (digoxin, lidocaine), beta-blockers, H2-blockers, steroids, antibiotics, lithium, anticonvulsants, and NSAID's. Opioid agents are of particular concern in the older population with accumulation of the medication and its metabolites occurring with intake of higher doses and with worsening kidney function.^{3,24} Meperidine should be avoided for many reasons: (1) it is a poor analgesic, (2) it lowers the seizure threshold, and (3) it has the highest risk of delirium among all the opioids due to the slow clearance of its active metabolite, normeperidine.²³ Research has shown that the type and number of medications are also important. Persons taking two or more psychoactive medications are 4.5 times more likely to be delirious. Also, adding more than 3 medications in a 24-hour period results in a relative risk of 4 for developing delirium. Similarly, persons taking 6 or more drugs are 14 times more likely to develop delirium.²³

Although the neuropathogenesis of delirium is not well understood, it is commonly felt that suppression or impairment of the cholinergic system is directly related to delirium. Thus, medications that have strong anticholinergic properties are often linked with the development of delirium. Recent research has improved our understanding of the interaction of different anticholinergic medications and delirium. The concept of total serum cholinergic burden implies that the cumulative or additive effect of anticholinergic medications is not only associated with the development of delirium but also the severity and duration.^{25,26} Thus, multiple small doses of many anticholinergic medications may be as deliriogenic as a large dose of one anticholinergic medication. The clinician should review medications and attempt to reduce or eliminate medications with anticholinergic properties. A trial of safer alternatives should be attempted.

Common herbal therapies are potentially associated with delirium. Several case reports and case series have documented possible links of some psychoactive herbal therapies with delirium. As herbal therapies are considered nutritional supplements in some countries,

they are not monitored stringently. Thus, the true risk of the herbal therapies is unknown. Kava Kava and valerian root are sedating anxiolytics, which may be linked with delirium when taken excessively. St. John's root used for depression can cause delirium when combined with other antidepressants that enhance the serotonin system. Belladonna is a pure anticholinergic agent, that is atropine, and thus is clearly associated with delirium.

Many chinese herbal medicines have been adulterated with medications in toxic doses such as antidepressants, or NSAID's, which may cause delirium among other adverse effects.

Differential diagnosis of Delirium

The common differential diagnoses are dementia, mild cognitive impairment, depression, psychosis secondary to psychiatric disorder and serotonin syndrome.

The clinician should be able to differentiate delirium from depression and dementia and be able to identify the delirium superimposed on dementia or mild cognitive impairment.²⁷⁻²⁸

<u>Delirium</u>	<u>Dementia</u>
Abrupt change	Slow
Brief	Does not remit
Impaired attention	Normal attention except severe cases
Fluctuating, reduced consciousness	Clear level of consciousness (alert)
Incoherent or disorganized speech.	Speech is ordered except anomie or aphasic

Management of Delirium

a. Confirmation of delirium

As described above, the first part of the management of delirium is to identify a change, perform a cognitive assessment and using a delirium tool, determine the presence of delirium. The next part is two-pronged and both steps occur concurrently, (1) the identification and management of potential causes and risk factors and (2) the management of delirium symptoms, particularly agitation. In addition, it is important to maintain close contact with the family and keep them apprised of the plan of care throughout the process.

b. Identification and management of potentially reversible underlying causes

This strategy was developed for hospitalized older persons, but may apply to this population although with some restrictions.²⁹⁻³¹ Work-up may be limited by the setting, home or hospice, where tests may not be easily obtainable and transfer of the patient may not be acceptable. Diagnostic procedures that are unpleasant or painful may be avoided if the focus of care has shifted to comfort. Supportive therapies themselves may also be burdensome. Understanding the patient's and family's goals of care and doing a careful history and physical examination will help guide the evaluation. Key features of the physical exam include fever, focal neurological signs, frontal release signs, and asterixis. Typical signs of dehydration, hypoglycemia, hyper- or hypocalcemia can be sought. Laboratory evaluation can be sought if this is consistent with previously established goals of care. The level of aggressiveness of diagnostic procedures will depend on the patient and family goals of care, the burden of the tests, and the likelihood of a remediable cause. When death is imminent, tests beyond the history and physical examination are likely inappropriate. If a laboratory evaluation is sought, a targeted strategy may include the following:

- Complete blood count
 - Electrolytes (including calcium, magnesium, and phosphorous), blood urea, creatinine, and glucose
 - Urinalysis
 - Pulse oximetry
- Clinicians should emphasize low burden interventions such as:
- Rehydration with hypodermoclysis
 - Treatment of hypercalcemia with subcutaneous bisphosphonates.
 - Identification and treatment of opioid toxicity. Signs include agitation, myoclonus, tactile hallucinations, and hyperalgesia and are due to accumulation of toxic metabolites. Consider changing to a different opioid at a lower equianalgesic dose.
 - Careful review of medications and identification of potentially noxious medications. One can either discontinue, decrease the dosage, or change to an alternate, less toxic agent.

c. Management of delirium symptoms

i. Non-pharmacological strategies

Clinicians can greatly impact the severity and course of delirium by educating patients, families, and staff. Several non-pharmacological strategies may help to prevent delirium and also assist in the treatment of delirium, especially hypoactive delirium. These may include:

- Limit or preferably, avoid the use of restraints. Use family members or sitters to keep agitated patients calm and safe.
- Improvement of sleep with a sleep protocol to minimize interruptions, provide a calming environment at bedtime.
- Encourage cognitive activities, such as reminiscence, event discussions.
- An early mobilization protocol with ambulation or range-of-motion exercises and avoidance of restricting devices like urinary catheters.
- Optimization of visual and hearing impairment with aids. Assessing the patient's dentures, visual and hearing aids at the time of admission. Advising family to bring it in as soon as possible into the hospital.

The family can often be educated and empowered to actively participate in this process by:

- Helping to maintain adequate fluid and nutritional intake.
- Improving the structure and familiarity of the patient's immediate environment with recognizable objects, pictures, blankets, etc.
- Constantly reorienting to decrease anxiety and disorientation.³²

ii. Pharmacological options

An important principle of the care of delirious terminal patients is that the treatment of symptoms of delirium, specifically distressing agitation or perceptual changes, should never be withheld during the evaluation process. Although some have suggested treating hypoactive delirium with stimulants such as methylphenidate, which can also cause or worsen perceptual disturbances and is not generally used.³³ In general, agitated delirium is most responsive to pharmacological treatment.³ Most of the

recommendations concerning which class or agent to use and under what circumstances come from expert opinions.³⁴ Rigorous randomized clinical trials in older persons have yet to be performed to guide pharmacological management of delirium.

Agitation, hyperactivity, and aggressiveness are treated with sedatives or neuroleptics, the latter with the potential added benefit of improving cognition. Among the neuroleptics, haloperidol has remained the most widely used agent to control agitation in hospitalized and terminal patients. It has many advantages; it is versatile (available orally, parenterally), it has a wide therapeutic window, and carries minimal risk of respiratory depression. In older persons, especially those with cognitive impairment, the lowest dose necessary is recommended. Starting doses for haloperidol are 0.5 to 1.0 mg every 30 minutes until effect. Recent evidence shows that dopaminergic receptors may be saturated at 5 mg in a 24-hour period, thus usual maximal doses should not exceed 5 mg per 24 hours.³⁵ In addition, clinicians should keep in mind that parenteral doses are generally twice as potent as oral doses and switching to oral therapy should be accomplished as soon as possible. If further sedation is required, alternating doses with a benzodiazepines (at low doses) is the safest next step.³⁵

Atypical neuroleptics, such as olanzapine and risperidone, are also used empirically in agitated delirium. They are more beneficial for long-term usage due to reduced extrapyramidal effects compared to haloperidol. When sedation is the primary goal, benzodiazepines may be the class of choice due to their rapid onset and ease of titration. They can also be used in conjunction with a neuroleptic. Among the most commonly used are lorazepam and midazolam. The former drug is available orally and parenterally with most clinicians being quite familiar with its use. Again, the lowest possible dose should be used with a plan to decrease or discontinue the medication once symptoms have resolved.³⁵

Conclusion

Delirium is very common to be missed in elderly. This could lead to increase in length of hospitalization and poor quality of life in elderly.

Through prompt identification of precipitating factors and timely management, one can improve the outcome in elderly.

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Health Economics For Geriatrics

Kishore J*, Ingle GK**

Introduction

There are 77 million (7.4%) elderly people in India and this number is expected to rise to 178 million by 2030.¹ Analysis of the census data shows substantial variation in the rate of demographic aging across India: 10.5% of Kerala's population is older than 60 years while in Dadra and Nagarhaveli, this proportion is only 4%. The majority of the elderly are very poor and live in rural areas. The government pension scheme currently reaches only 2.76 million out of 28 million elderly people and this is mainly in urban areas. The elderly have little hope of escaping poverty and subsequently their situation becomes worse as they are increasingly plagued by chronic health problems. Particularly the impoverished elderly women face a difficult situation, especially those who are widows. Considering their low rank in society, the inability to work can mean an inability to survive on their own.

Modernization, urbanization and westernization of Indian society have direct bearing on family particularly elders. Modern society has failed to give due recognition to the elderly which lead to isolation, sense of worthlessness, depression and suicides. India is characterized by the existence of longstanding variations such as rural-urban dichotomy, rich and poor difference; the unequal distribution of resources, and unequal reach of modern technology. In this variation, elderly who is physically weak faces the worst discrimination. There is poor allocation of resources for health which directly affects quantity and quality of services. With an increase in numbers of the elderly, the cost of public health care is expected to increase.² For these reasons an expert of geriatric care must understand the basics of health economy.

Health Economics

Economics revolves around the study of markets or exchange between producers and consumers. Production and consumption are among the most fundamental activities of human being. Economists are trained to examine problems of allocation of scarce resources. Economist focuses on how to do the best maximum with the available resources. They also assess who gets benefit and who loses from the activities.

Economics applied to the health field is *Health Economics*. Health economics seeks inter alia to quantify over time, the resources used in health service delivery, its organization and *financing*; the *efficiency* with which the resources are *allocated* and used for health purposes and the effects of preventive, curative and rehabilitative services on individual and national productivity.

The field of health economics emerged due to very high growth in national health expenditure. Health sector poses formidable challenge to economists due to extreme situation of scarcity and unique complexities. Central concern of medicine is to go into the causes and treatment of ill health. Health economics can contribute to the understanding of and solution to the myriad of problems facing health sector.

Despite important gains in the health status during last few decades, much remains to be done to achieve the health targets. Tight budget, inadequate access to primary health care facilities, inefficiency, poor quality of health care, changing disease profile and persistent high fertility rate are among the causes and manifestations of malfunctioning system. Health economics helps in understanding the problems and improving efficiency of health services. *Efficiency* is a measure of outputs against inputs. It tells the relationship between the results obtained from a health programme or activity and the efforts expended in terms of human, financial and other resources, health processes and technologies, and time. The assessment of efficiency is aimed at improving implementation, and adds to the

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review of progress by taking account of the results.³

Economy of Rural Elderly: Majority of the rural elderly have depended on agriculture for the source of income. Most of them being illiterate and unemployed or low wage employees, continue to work for much longer hours, with greater financial insecurity among them. They do not have legal and other provisions to protect their rights. Due to these reasons they are one of the most vulnerable groups. They do not own productive assets, have little or no savings or income from investments made earlier, have no pension or retirement benefits, and are not taken care of by their children or they live in families that have low and uncertain income and a large contingent on the economic capacity of the family unit. In rural areas, most families suffer from economic crisis, as their occupations do not produce income throughout the year. The tendency is to spend more on their growing children, while minimizing expenditure on aged parents; thus financial security for the elderly is very limited.^{4,5} This could be one of the reasons of higher stress, physical ill health and poor quality of life in rural elderly and poor help seeking inspite of awareness.⁶ Economic condition is worst in rural women because they live longer than their male partner and do not have any social or legal ownership over family resources. In fact widowhood in the lower socio-economic groups condemns elderly female to beg for their food and are left without a meaningful life pattern or social functions. Socioeconomic and emotional problems, negative self concept, feelings of powerlessness, high level of physical and psychological stress are significant aspects of elderly widows.

Health Burden in Geriatrics

In a multi-centric study, it is found that 5.6% of older persons (> 60 years) are living alone, mainly females.⁷ Tobacco use, both as smoking and otherwise is observed in 23.4% of the subjects studied. Poor vision is very common (45%) and 20% predominantly males are suffering from hearing difficulty. Older persons have hypertension (38%), joint related problems (36%), bowel complaints (32%), urinary problems (13%), diabetes mellitus (13%), falls (9%), asthma (6.6%), pulmonary disease (5%) and tuberculosis (3%), and cancers (0.8%). According to another study of the northeast India, 33% males and 47% of the females had at least one disability; 60% of the males and 71% of females are suffering from one chronic illness. Due to this heavy burden of disease, urgent need of health

care to elderly is demanded.⁸ However, according to another report, hypertension was 72%; diabetes mellitus was 53%; coronary artery disease was 31%; arthritis was 20%; prostate enlargement was 8%; cancer was 6%.

Negative stereotypes concerning ageing and old people are prevalent worldwide, which affect policy decisions and subsequent programmes. The proportion of elder people in world's population is on an increase, which is responsible for rising neuropsychiatric disorders particularly dementia and major depression. These two are accounting respectively for one quarter and one sixth of all disability-adjusted life years (DALYs) in this group. With the unprecedented pace of demographic aging, societies will have comparatively little time to develop social and healthcare policies to deal with the healthcare needs of the elderly in their population. Most of the people with dementia live in developing countries, the prevalence rate being 60% in 2001 and predicted to increase to 71% by 2040. Predicted rates of increase of dementia between 2001 and 2040 are by 100% in developed countries, but by more than 300% in India, China and the South Asian and Western Pacific regions. There are hardly any specialized services for old people in the government-run public healthcare services as compared to other specialties in India. General health services remain clinic-based and typically involve long waits in crowded clinics for brief consultations. The usual focus in these settings is on 'treatable' acute pathologies and not on long-term care. Old people find it difficult to get to these clinics as it involves travel and use of transport. Doctors continue to be a rare commodity in rural settings. Free services integrated with primary care will help to reduce the cost of care. Financial support to caregivers who are unable to go for their daily work due to more pressing needs of the elderly, needs serious consideration. Geriatric psychiatry units need to be established in psychiatry departments in all the medical colleges.

Utilization of Health Services

Health care is provided to the people mainly by public and private health sectors. By and large government sector is providing free health services, and private sector is charging fees for service. About 80% of the people are seeking medical care from private practitioners whereas 80% of the indoor patients are admitted to the government hospitals. Elderly in absence of health insurance and family support may find it difficult to get health services.

Health Financing

The resources are scarce. The government has actually committed six percent (of the budget) to education and three percent to health. India's Ministry of Health and Family Welfare has been allocated \$3.4 billion for this year's budget, an increase of \$886 million from last year, to expand health care services in the country, including HIV/AIDS programmes. In terms of GDP it is around 1.3% and along with household expenditure it is around 6% of GDP in our country as compared to 12% spent by USA and UK. Out of total government expenditure 25% is spent by the Central Government and the state governments spend 75%.

The expenditure by the state government varies from state to state. More than 60% is incurred on providing curative services and only 26% on preventive services and remaining on administrative expenses. About 67% of the resources spent have gone to urban areas. There is 93% to 97% expenditure on revenue and only 3% to 7% on capital. Of the revenue expenditure, about 60% goes to salaries and 15% to 30% for supplies and rest on other aspects of health care system.

The pertinent question is why resources should be invested in health care of elderly. Boom in medicine, science and technology celebrates increase in longevity of human beings, which directly affects the economy of the world. Longer productive life of people helps in retaining people in workforce for longer periods i.e., cutting down expenses involved in education, recruitment and vocational training. Another benefit is their cumulative wisdom and experience that could be used for better development. There are social benefits of elderly also because they bridge the two generations by taking care of children, provide adolescent guidance, mentoring, and providing family assistance.⁹

For the Integrated Programme for Older Persons the budget allocation during 2005-2006 was Rs.19.80 crores which was revised to Rs. 14.00 crores, against which the expenditure was Rs.14.00 crores. The budget allocation for the year 2006-07 is kept at Rs 28 crore. The registered societies, public trust, charitable companies or registered self-help groups of older persons in addition to Panchayati Raj Institutions are eligible to get the assistance under this scheme. Against the budget allocation during 2005-06 of Rs 67 lakh, the expenditure was Rs 47 lakh. This allocation is not sufficient as far as proportion of elderly among total population is concerned. The government is

providing facilities for cataract operation free of charge and in some states intra-ocular lenses are also freely implanted. In collaboration with Non-Government Organizations, government is providing ophthalmic care, mobile medicare units, income generating projects and support to old age homes, day care centers for the elderly, research and advocacy as well as emergency relief. There are approximately 728 old age homes in India. Of these 325 are free of charge, 95 are on a pay-and stay basis, and 116 have both free as well as pay-and stay facilities. There are 278 old age homes available for the sick and 101 homes are exclusive for women.² This number is very less as compared to the requirement.

Additional money is required to meet rising cost of health care due to escalation of prices, increase in salaries, increases in cost of material and supplies, advancement of technology, need and demand for better quality care. Hence resources have to be generated. Government alone is not in the position to meet the needs.

The resources can be generated by launching the schemes such as (a) health insurance (b) user charges and (c) other innovative approaches. Regulated privatization would attract more patients releasing pressure and money from public sector. There are advantages, disadvantages and controversies regarding each of the scheme approach.

Efficient utilization of resources

Efficient utilization can be achieved through allocation efficiency and internal efficiency:

Allocation Efficiency is concerned with the allocation of resources to the production of output, which yield the highest value from their use. Thus existing mal-distribution of resources between primary and tertiary health care sectors or preventive and curative health care services needs to be corrected to improve efficiency and results. Allocating more funds for preventive and promotive services can save more lives. It is a wise approach to prevent diseases than allowing diseases to occur and treat them.

It may be emphasized that health service cost is not a valid objective. The objective must be realizing the same benefits from the lower cost or increase benefits without adding to the cost. Neighboring developing countries have better health indicators with less percent of GDP expenditure on health care e.g. Sri Lanka, Maldives, etc.

Internal efficiency is concerned with the avoidance of waste. Such wastage may be caused by deficient administration, a lack of managerial capabilities. Due to under funding of specific complementary input such as drug, fuel and lack of working vehicle there would be non-functioning of the manpower or ineffective treatment leading to inefficiency / wastages. Another example is bulk purchase of drugs of limited use or early expiry. According to reports, equipments worth hundred of crores are lying idle in hospitals of our country.

To improve the efficiency a health professional needs to orient himself and become *cost conscious*. However, it must be properly understood that becoming cost conscious does not mean saving of the money for the sake of saving.

Cost accounting

Cost accounting is the application of costing and cost accounting principles, methods and techniques. It is essential for efficient operations of the hospital or programme. If carried out periodically and methodically it can help the hospital/health administration in:

- i) Determining actual cost of operating each department/service,
- ii) Cost of hospitalization per day,
- iii) Detecting wasteful expenditure

Following cost analysis can be undertaken:

Cost object: A unit of service for which we wish to know the cost. As this becomes more specific, the cost accounting methodology becomes more complex.

Direct and indirect cost: Direct cost applies to only one cost that is directly linked with the service e.g. cost of X-ray film is the direct cost and cost spent on machine, manpower, electricity, and other services required to produce X-rays is indirect cost.

Household cost: Cost incurred by the beneficiaries to seek health care, e.g. expenditure incurred upon transport by the patient.

Full cost analysis: Total amount of money spent on particular health service.

Unit cost analysis: Amount of expenditure incurred on each unit of service, e.g. cost of vaccination of one child.

Fixed cost: The cost incurred upon irrespective of volume of service provided, e.g. cost incurred on building, equipment, salary, etc.

Variable cost: Cost which is dependent on volume of service. Cost incurred upon drugs, reagents, is directly proportional to the number of patient treated.

Marginal cost: Extra cost incurred upon production of one more positive result.

Setting a price: By using fixed and variable cost calculation, the price of the service can be set. Profit can be estimated or subsidies can be worked out.

Opportunity cost: The money which otherwise could have been earned during the lost time or opportunity, or due to restriction of budget allocation from the programme is withdrawn leading to loss of the programme.

Application of Cost Analysis

Cost analysis is beneficial for following reasons:

1. Input can be calculated by taking into consideration all the costs. The input output ratios can be obtained to find out the efficiency and take corrective measures to improve the efficiency. Efficiency is obtained when more results are produced with same inputs (time, person, money) or same results are obtained with less input.

2. The outcome can be studied in term of cost effectiveness, i.e. number of cases prevented, treated, or lives saved by spending particular amount of money.

3. To take a decision regarding introduction of new programme, e.g. prevention and control of hearing loss in elderly programme.

4. Cost of input and amount of money saved which otherwise would have been spent on treatment and other aspects of the patient care should be taken into consideration.

5. Estimations and projections can be made to help health policy makers and managers in decision-making.

Cost containment

Cost of the health services can be reduced without affecting results by taking containment measures such as

- Buy prudently, stock minimally, issue accurately and spent frugally,

- Prevent pilferage and wastage by internal auditing and effective supervision,

- Reduction of 20% of cost on medicine can be achieved without impairing the quality of care and maintaining patient satisfaction.

Physician can play important role in cost containment of health services for elderly by:

- Reducing number of investigations

- Reducing number of prescribed drugs promotes rational use of drugs and decrease resistance.

- Prescribing equally effective cheaper alternatives.

- Reducing average length of stay in the hospital decreases the cost of treatment and increase compliance of treatment.

- Proper scheduling of patients and staff help in reducing waiting and better attention to patients.

- Developing cheaper and innovative technology.

- Evidence based research: There is need to establish priorities for areas of research on ageing and strategies to ensure that the ageing research sector had the capacity, capability and visibility to meet current and future research needs.¹⁰ However, all research work should have component of health economy to justify the need of intervention.

- Develop and support public private partnership to strengthen financial resource for health care.

Thus by generating additional resources, reallocating the resources, taking cost containment measures and avoiding wastages by applying cost evaluating techniques, resources can be efficiently

utilized to provide cost effective health services and health services benefits can be obtained at lower cost.

Conclusion

The objective of health care is to save lives, prevent and cure diseases, promote and maintain health, by providing quality care to older persons. No cost is too great, when it comes to saving the elderly lives but saving money out of extra expenditure may save another life. Health care is oriented to the health needs, service expectation and people's aspiration and is not profit oriented.

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National Health Programmes of India: National Policies and Legislations Related to Health

by J Kishore

This is India's first book on introduction to basic concepts of national health planning, programming, legislation and on the approach to public health problem. In recent years national programmes and policies have become increasingly important in both public health and clinical practice in India. This book consists of three sections. Section-I focuses on the assessment of disease burden in the country, various preventive and control programmes on communicable and non-communicable diseases and reproductive health. Section II has elaborated important policies including National Policy on Older Person and Section III deals with legislations. This new edition is thoroughly updated and new chapters on National Family Health Survey III, gender violence, programmes such as deafness, cardiovascular, stroke and diabetes, organ transplant, programme on elderly, National and International Agencies have been added. After the National Rural Health Mission was launched in 2005, there have been significant changes in government approach. Public health is a dynamic process and so is its information. That is why in a span of 8-9 years the author is continuously updating and has released 7th edition. This book is important for all professionals, experts, and officials who are working in the field of public health. This is also useful for students preparing for civil service examination, PG medical entrance examinations, PG and UG students for community medicine, community nursing, community pharmacy, dentistry, social work, etc. As far as cost and printing of the book is concerned it is of good quality with best economical price.

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Rehabilitation needs for older adults with stroke living at home: perceptions of four populations

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Background: Many people who have suffered a stroke require rehabilitation to help them resume their previous activities and roles in their own environment, but only some of them receive inpatient or even outpatient rehabilitation services. Partial and unmet rehabilitation needs may ultimately lead to a loss of functional autonomy, which increases utilization of health services, number of hospitalizations and early institutionalization, leading to a significant psychological and financial burden on the patients, their families and the health care system. The aim of this study was to explore partially met and unmet rehabilitation needs of older adults who had suffered a stroke and who live in the community. The emphasis was put on needs that act as obstacles to social participation in terms of personal factors, environmental factors and life habits, from the point of view of four target populations.

Methods: Using the focus group technique, we met four types of experts living in three geographic areas of the province of Québec (Canada): older people with stroke, caregivers, health professionals and health care managers, for a total of 12 groups and 72 participants. The audio recordings of the meetings were transcribed and NVivo software was used to manage the data. The process of reducing, categorizing and analyzing the data was conducted using themes from the Disability Creation Process model.

Results: Rehabilitation needs persist for nine capabilities (e.g. related to behaviour or motor activities), nine factors related to the environment (e.g. type of teaching, adaptation and rehabilitation) and 11 life habits (e.g. nutrition, interpersonal relationships). The caregivers and health professionals identified more unmet needs and insisted on an individualized rehabilitation. Older people with stroke and the health care managers had a more global view of rehabilitation needs and emphasized the availability of resources.

Conclusion: Better knowledge of partially met or

unmet rehabilitation needs expressed by the different types of people involved should lead to increased attention being paid to education for caregivers, orientation of caregivers towards resources in the community, and follow-up of patients' needs in terms of adjustment and rehabilitation, whether for improving their skills or for carrying out their activities of daily living.

Discomfort and agitation in older adults with dementia

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Background: A majority of patients with dementia present behavioral and psychological symptoms, such as agitation, which may increase their suffering, be difficult to manage by caregivers, and precipitate institutionalization. Although internal factors, such as discomfort, may be associated with agitation in patients with dementia, little research has examined this question. The goal of this study is to document the relationship between discomfort and agitation (including agitation subtypes) in older adults suffering from dementia.

Methods: This correlational study used a cross-sectional design. Registered nurses (RNs) provided data on forty-nine residents from three long-term facilities. Discomfort, agitation, level of disability in performing activities of daily living (ADL), and severity of dementia were measured by RNs who were well acquainted with the residents, using the Discomfort Scale for patients with Dementia of the Alzheimer Type, the Cohen-Mansfield Agitation Inventory, the ADL subscale of the Functional Autonomy Measurement System, and the Functional Assessment Staging, respectively. RNs were given two weeks to complete and return all scales (i.e., the Cohen-Mansfield Agitation Inventory was completed at the end of the two weeks and all other scales were answered during this period). Other descriptive variables were obtained from the residents' medical file or care plan.

Results: Hierarchical multiple regression analyses controlling for residents' characteristics (sex, severity of dementia, and disability) show that discomfort explains a significant share of the variance in overall agitation (28%, $p < 0.001$), non aggressive physical behavior (18%, $p < 0.01$) and verbally agitated behavior (30%, $p < 0.001$). No significant relationship is observed between discomfort and aggressive behavior but the power to detect this specific relationship was low.

Conclusions: Our findings provide further evidence of the association between discomfort and agitation in persons with dementia and reveal that this association is particularly strong for verbally agitated behavior and non aggressive physical behavior.

The history of falls and the association of the timed up and go test to falls and near-falls in older adults with hip osteoarthritis

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Background: Falling accounts for a significant number of hospital and long-term care admissions in older adults. Many adults with the combination of advancing age and functional decline associated with lower extremity osteoarthritis (OA), are at an even greater risk. The purpose of this study was to describe fall and near-fall history, location, circumstances and injuries from falls in a community-dwelling population of adults over aged 65 with hip OA and to determine the ability of the timed up and go test (TUG) to classify fallers and near-fallers.

Method: A retrospective observational study of 106 older men and women with hip pain for six months or longer, meeting a clinical criteria for the presence of hip OA at one or both hips. An interview for fall and near-fall history and administration of the TUG were administered on one occasion.

Results: Forty-five percent of the sample had at least one fall in the past year, seventy-seven percent reported occasional or frequent near-falls. The majority of falls occurred during ambulation and ascending or descending steps. Forty percent experienced an injury from the fall. The TUG was not associated with history of falls, but was associated with near-falls. Higher TUG scores occurred for those who were older, less mobile, and with greater number of co-morbidities.

Conclusion: A high percentage of older adults with hip OA experience falls and near-falls which may be attributed to gait impairments related to hip OA. The TUG could be a useful screening instrument to predict those who have frequent near-falls, and thus might be useful in predicting risk of future falls in this population.

Prevention of fall incidents in patients with a high risk of falling: design of a randomised

controlled trial with an economic evaluation of the effect of multidisciplinary transmurial care

Geeske Mee Peeters, Oscar J de Vries, Petra JM Elders, Saskia MF Pluijm, Lex M Bouter and Paul Lips

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Background: Annually, about 30% of the persons of 65 years and older falls at least once and 15% falls at least twice. Falls often result in serious injuries, such as fractures. Therefore, the prevention of accidental falls is necessary. The aim is to describe the design of a study that evaluates the efficacy and cost-effectiveness of a multidisciplinary assessment and treatment of multiple fall risk factors in independently living older persons with a high risk of falling.

Methods/Design: The study is designed as a randomised controlled trial (RCT) with an economic evaluation. Independently living persons of 65 years and older who recently experienced a fall are interviewed in their homes and screened for risk of recurrent falling using a validated fall risk profile. Persons at low risk of recurrent falling are excluded from the RCT. Persons who have a high risk of recurrent falling are blindly randomised into an intervention (n = 100) or usual care (n = 100) group. The intervention consists of a multidisciplinary assessment and treatment of multifactorial fall risk factors. The transmurial multidisciplinary approach entails close cooperation between geriatrician, primary care physician, physical therapist and occupational therapist and can be extended with other specialists if relevant. A fall calendar is used to record falls during one year of follow-up. Primary outcomes are time to first and second falls. Three, six and twelve months after the home visit, questionnaires for economic evaluation are completed. After one year, during a second home visit, the secondary outcome measures are reassessed and the adherence to the interventions is evaluated. Data will be analysed according to the intention-to-treat principle and also an on-treatment analysis will be performed.

Discussion: Strengths of this study are the selection of persons at high risk of recurrent falling followed by a multidisciplinary intervention, its transmurial character and the evaluation of adherence. If proven effective, implementation of our multidisciplinary assessment followed by treatment of fall risk factors will reduce the incidence of falls.

The Newcastle 85+ study: biological, clinical and psychosocial factors associated with healthy ageing: study protocol

Joanna Collerton, Karen Barrass, John Bond, Martin Eccles, Carol Jagger, Oliver James, Carmen Martin-Ruiz, Louise Robinson, Thomas von Zglinicki and Tom Kirkwood

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Background: The UK, like other developed countries, is experiencing a marked change in the age structure of its population characterised by increasing life expectancy and continuing growth in the older fraction of the population. There is remarkably little up-to-date information about the health of the *oldest old* (over 85 years), demographically the fastest growing section of the population. There is a need, from both a policy and scientific perspective, to describe in detail the health status of this population and the factors that influence individual health trajectories. For a very large proportion of medical conditions, age is the single largest risk factor. Gaining new knowledge about why aged cells and tissues are more vulnerable to pathology is likely to catalyse radical new insights and opportunities to intervene. The aims of the Newcastle 85+ Study are to expose the spectrum of health within an inception cohort of 800 85 year-olds; to examine health trajectories and outcomes as the cohort ages and their associations with underlying biological, medical and social factors; and to advance understanding of the biological nature of ageing.

Methods: A cohort of 800 85 year olds from Newcastle and North Tyneside will be recruited at baseline and followed until the last participant has died. Eligible individuals will be *all* those who turn 85 during the year 2006 (i.e. born in 1921) and who are registered with a Newcastle or North Tyneside general practice. Participants will be visited in their current residence (own home or institution) by a research nurse at baseline, 18 months and 36 months. The assessment protocol entails a detailed multi-dimensional health assessment together with review of general practice medical records. Participants will be flagged with the NHS Central Register to provide details of the date and cause of death.

Discussion: The Newcastle 85+ Study will address key questions about health and health-maintenance in the 85+ population, with a particular focus on quantitative assessment of factors underlying variability in health, and on the relationships between health, nutrition and

biological markers of the fundamental processes of ageing.

Oral health service utilization by elderly beneficiaries of the Mexican Institute of Social Security in Mexico city

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Background: The aging population poses a challenge to Mexican health services. The aim of this study is to describe recent oral health services utilization and its association with socio-demographic characteristics and co-morbidity in Mexican Social Security beneficiaries 60 years and older.

Methods: A sample of 700 individuals aged 60+ years was randomly chosen from the databases of the Mexican Institute of Social Security (IMSS). These participants resided in the southwest of Mexico City and made up the final sample of a cohort study for identifying risk factors for root caries in elderly patients. Sociodemographic variables, presence of cognitive decline, depression, morbidity, medication consumption, and utilization of as well as reasons for seeking oral health services within the past 12 months were collected through a questionnaire. Clinical oral assessments were carried out to determine coronal and root caries experience.

Results: The sample consisted of 698 individuals aged 71.6 years on average, of whom 68.3% were women. 374 participants (53.6%) had made use of oral health services within the past 12 months. 81% of those who used oral health services sought private medical care, 12.8% sought social security services, and 6.2% public health services. 99.7% had experienced coronal caries and 44.0% root caries. Female sex (OR=2.0), 6 years' schooling or less (OR=1.4), and caries experience in more than 22 teeth (OR=0.6) are factors associated with the utilization of these services.

Conclusions: About half the elderly beneficiaries of social security have made use of oral health services within the past 12 months, and many of them have to use private services. Being a woman, having little schooling, and low caries experience are factors associated with the use of these services.

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Abstract

Yoo KH, Norwood VF, Chevalier RL. Regulation of Aging (Abstract). *Nature*1995; 65:82-91

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