

PRACTITIONERS' GUIDANCE SERIES – XIII

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President's Remarks





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Editorial



I take great pleasure to place in your hands the thirteenth Practitioner series carrying the write ups on different unrelated conditions such as Anxiety spectrum disorders, Ageing and health, Choosing career in public health, and Myths and facts about antenatal malformations.

Dr C R Chandrashekar while discussing on **Anxiety spectrum disorders** has mentioned that it is a common experience to become anxious and fearful in day-to-day life situations. They are natural emotions and they bring about changes in different systems of the body. The cause for fear is known whereas it is unknown in anxiety. An inappropriate exaggeration to a given situation may cause severe distress in the individual. The causes/factors which lead to abnormal/pathological anxiety, the author has tried to explain on the basis of psychoanalytic, behavioural, existential, biologic and genetic theories. The anxiety disorders include phobia, panic disorder, generalized anxiety disorder, social anxiety disorder, agoraphobia, obsessive compulsive disorder, separation anxiety disorder and post-traumatic stress disorder. Dr Chandrashekar has discussed on how to overcome anxiety state and has suggested introspection, give up negative thinking, inferiority feelings, better use of available resources, get support from others and relaxation.

In the chapter on '**Ageing and health**' Dr **P S Shankar** has discussed that old age as the 'most difficult chapters in the great art of living'. As more and more people are destined to live into their eighties, it has necessitated them to cultivate the art of growing old gracefully, It is necessary to focus our attention towards their medical and health needs. Their spirit should not grow old. They should not feel that 'old age is an island surrounded by death'. Their mind has to be kept active, interested and useful. These things show a decline by inactivity and not by ageing. In advancing years many age-related disabilities begin to appear. Hence the aged require special medical attention. At the same time we must remember that 'there are no diseases of the aged, but simply diseases among the aged'.



Dr **Giridhar Babu and Yamuna** in the chapter on '**choosing a career in public health**' define public health as 'the art and science of preventing diseases, prolonging life and promoting health through organized efforts of society'. There is no public health at the community level without health at individual level. Primary health care professionals are the key personnel behind the idea of public health. Public health being inter-disciplinary intergrates and transcends many disciplines. Public health has been built on the concept of 'prevention is better than cure'. Public health activities are carried out as the research activities and survey in the community, nationally and internationally. The authors have discussed the reasons to choose public health as a career, which include job growth, job security, opportunity to perform a variety of roles, engagement with the community, national and global health. There is need to improve the training programmes in India. Public health cadre creation is essential to provide health promotion strategies.

Dr **Nandkishor Shinde** in his write up on '**Myths and facts about congenital malformations**', has mentioned that major congenital malformations that are not compatible with life are encountered in 2 to 3 per cent of all fetuses. The rate of foetal growth is maximum from 12th to 16th weeks of foetal life. The causes of congenital malformations are either genetic or environmental. Chromosomal abnormalities or mutation of genes may result in malformations. Foetal growth may be affected by the environmental factors such as drugs, chemicals, metabolic imbalances, infections and radiation. The author has stressed the need for antenatal screening and diagnosis facilitating proper antenatal counseling and proper care. Lethal malformation necessitates termination. Correctable lesions need surgical correction following delivery in a good centre.

The above four different topics have been described in detail to make the practitioner aware of the conditions they face in their clinical practice. By the study of the material found in this booklet, I am sure they will get the necessary knowledge of the conditions. It is hoped it will expand the horizons of their knowledge.

P. S. Shankar
Editor-in-Chief



Contents

Section : 1

ANXIETY SPECTRUM DISORDERS

Section : 2

AGEING AND HEALTH

Section: 3

CHOOSING A CAREER IN PUBLIC HEALTH

Section: 4

MYTHS AND FACTS ABOUT ANTENATAL



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ANXIETY SPECTRUM DISORDERS

Sectional Editor and Contributor

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ANXIETY SPECTRUM DISORDERS



Anxiety and Fear

All of us become anxious – fearful in the following situations.

1. When we are alone in darkness or in strange places or imaginary or real threats – danger.
2. When we meet strangers who appears to be rude, unfriendly and aggressive.
3. Participating in any competition.
4. When we have to take examinations, interviews.
5. When our work / performance is inspected or supervised by someone.
6. When we face dangerous pet / wild animals.
7. When we have to face angry parents, teachers, boss or any authority figure like police, strict officers.
8. When we have to travel alone for the first time either by train or air to a far of place.
9. When we have to go to other state / country.

ANXIETY SPECTRUM DISORDERS

10. When we have to take responsibilities with time limitations or resource limitations.
11. When we have to go to doctor, hospital, undergo painful investigations, surgery when we come to know that we are suffering from a serious / life threatening illness / ailment.
12. When we have to ride a vehicle in a busy traffic.
13. When we have to go or summoned by police or court.
14. When we have to go to graveyards / old dilapidated buildings where ghosts are believed to exist.
15. When we go to stage to perform and show our talents like singing / dancing / acting / mimicry / make speeches.
16. Life threatening disasters like floods, wild fire, cyclone, earthquake, collapse of a building, heavy rains with thunder and lightning.
17. When we experience bad omens or bad predictions and anticipate losses / bad events.
18. When we witness accidents, blood and injuries, dead bodies.
19. Violent mob, people fighting, loud sounds.
20. When we wake up with bad and violent dreams.
21. When we did not follow the social, legal or religious norms and feel guilty.
22. When we have to face death.

What are the changes that occur in our body and mind ?

1. Heart: Pulse and heart beats do increase with palpitation, blood circulation increases leading to feeling of warmth / feverishness, sweating, and blood pressure rises. Heart may skip a beat.
2. Lungs: Increased rate of respiration with shallow breathing, difficulties in breathing – shortness of breath, hyper – ventilation.
3. Brain and Mind: Decreased concentration, attention – distraction, inability to understand what we see hear or experience, confusion, wrong interpretations, illusions, poor learning and memory,

ANXIETY SPECTRUM DISORDERS

decreased ability to analyse, understand information or issues, take right decisions, find solutions or plan the actions, not able to use one's intelligence, feelings of apprehension, negative thinking, anticipate some more problems or difficulties, not able to relax, enjoy positive experience or sleep. Tremors of lips, hands, legs or whole body. Inability to talk and communicate properly, inability to write or put signature, physical and mental restlessness.

4. Sensory organs:

Eyes: Blurring and poor vision, misinterpretation, illusions

Ears: Poor hearing and wrong interpretations

Nose: Poor smell and wrong interpretations

Tongue: Poor / no taste, poor – inadequate movement leading to slurring of speech, stammering

Skin: Warm and dry skin, increased secretion of sweat and oil, goose skin, numbness and paraesthesia.

5. Digestive System: Mouth becomes dry, poor taste and appetite, difficulty to swallow, increased acidity, indigestion, constipation or loose motion.

6. Locomotor System: Stiff muscles, poor – coordination, pain in muscles and joints, slow movements.

7. Genitourinary System: Increased frequency and urgency to pass urine, poor or lack of erection of penis, dry vagina, inability to take part in sexual activities, lack of sexual desire and satisfaction.

8. Immune System: Decreased immunity

9. Endocrine System: Increased or decreased secretions of hormones.

Anxiety and Fear are natural emotions. In fear the cause is known and is easily identifiable. In Anxiety, cause is unknown and not easily identifiable. The past experiences, negative thinking, suppressed – unconscious issues, desires and thoughts are reported to be the cause of anxiety.

ANXIETY SPECTRUM DISORDERS

Anxiety and fear help us to protect ourselves. We take precautionary measures like avoiding objects, situations, people which are dangerous, plan how to face them, take the help of family, friends and colleagues to face them, increase our knowledge and skills.

Abnormal / Pathological Anxiety:

It is an inappropriate, exaggerated response to a given stimulus either in terms of intensity and duration. It forces an individual to run away or unnecessarily become defensive, disturbing his routine work by reducing his ability to cope with or fight against the danger. The severity may paralyse him and cause severe distress which makes him to feel totally helpless.

Causes / Factors which lead to Abnormal / Pathological anxiety:

a) Psychoanalytic theories:

Suppressed or repressed negative, unethical desires, painful experiences, anger – aggression, sexual needs and guilt which are in the subconscious mind, try to come back to conscious mind. This threat is said to be the cause of anxiety disorders.

b) Behavioural Theories:

Pathological anxiety is said to be a conditioned response to a specific stimulus. Seeing or being bitten by an insect or animal, the person perceives any insect / animal to be dangerous and develops phobia for insect / animal.

Patient suffering from anxiety disorders overestimate the degree of danger / harm in a given situation and also underestimates his ability to cope with that situation / danger.

Patient with panic disorder perceives bodily symptom like palpitation or giddiness as a sign of impending death and believe that he might die soon!

c) Existential Theories:

The individual feels a profound 'Nothingness' in his / her life and

ANXIETY SPECTRUM DISORDERS

anticipates death. He sees no meaning / inability to face the death. He may have doubts regarding his existence.

d) Biological Theories:

I Neurotransmitters:

- **Nor-epinephrine:** Poorly regulated nor – adrenergic system is said to cause anxiety. Studies have shown that in panic disorder, alpha - adrenergic agonist and alpha -2adrenergic antagonist lead to frequent and severe panic attacks.
- **Serotonin:** Serotonergic anti-depressant drugs like Clorimipramine and Buspirone reduce anxiety.
- **GABA** is said to play a role in the genesis of anxiety disorder.

ii. The Frontal Cerebral Cortex, temporal cortex are implicated in the production of anxiety disorders.

e) Genetic Theories:

Anxiety Disorder / Panic disorder can run in the families. Higher rate of illness is reported in first degree relatives.

Types of anxiety disorders

On an average 20% of people in any given community suffer from Anxiety Spectrum Disorders. Children, adolescents, elderly people, migrants people who live away from their families, people who work in very competitive, high risk jobs are more prone for anxiety disorders. Common types of anxiety spectrum disorders are:

1. Phobia
2. Panic Disorder
3. Generalised Anxiety Disorder
4. Social Anxiety Disorder
5. Agoraphobia
6. Obsessive Compulsive Disorder
7. Separation Anxiety Disorder
8. Post – Traumatic Stress Disorder

ANXIETY SPECTRUM DISORDERS

Phobia :

About 9% of the population suffer from Phobias. Phobia is an intense irrational fear with a specific object or situation. Because of intense fear, the individual tries to avoid the phobic object or situation. The signs and symptoms of fear are severe, causing severe distress to the individual. Most common objects / situations which causes phobia are:

- i. Insects and animals
- ii. Situations like height, cave, bridge, tunnel, lift, telephone booth, operation theatre, crowded bus.
- iii. Medical: Syringe, needle, blood, surgery, dental extraction, C.T. Scan, MRI, diseases
- iv. Water, heavy rains, thunder, lightning, fire.

Phobia is said to be a learnt behaviour and wrongly perceiving an object or situation as harmful and dangerous. Severe fear is aroused by a naturally frightening stimulus with a coincidental neutral stimulus. Later the neutral stimulus may arouse severe fear.

Agoraphobia:

Severe fear or panic attacks occur in places or situations from which escape may be difficult.

Example : Being outside the home alone.
Being in the middle of crowd.
Standing in a line or a que.
Being on a bridge, cave, lift
Travelling in a train, bus, aeroplane

Social Phobia:

Severe, persistent fear in social situations where the person is exposed to unfamiliar, strange people or possible scrutiny by people. The person may think that he may be humiliated commented or criticized. The person either avoids such social situations or feel very uncomfortable or even miserable. He may have panic attack.

ANXIETY SPECTRUM DISORDERS

Specific Phobias:

Animal Type: Insects and animals elicit phobia. This generally has onset in childhood.

Natural Environmental Type: Heights, waters, cliff, thunder. This also generally has onset in childhood.

Blood – Injection – Injury Type: Seeing blood, wound, and receiving an injury or have to undergo surgery or painful medical investigations.

Treatment

Medication, Psychotherapy – Counselling, Cognitive Behaviour Therapy are used in combination to treat phobias.

Medication:

Minor Tranquilisers and Anti-depressant drugs like SSRIS are used. Propranolol 40 -80mg, Lorazepam 1mg – 4mg, Buspirone (5 to 20mg), Escitalopram (10 to 30mg), Fluoxetine (20 to 60mg)

Medicine has to be continued for several weeks to several months. Medicines are generally safe. Possibility of addiction is minimum.

Psychotherapy – Counselling:

By talking to the patient he / she is made to understand the origin of phobia and how to manage the fear symptoms.

Desensitization: Patient is gradually made to expose himself to the phobic object or situation. Someone would be with him to reassure him that stimulus is not at all dangerous as he thinks. Graded and gradual exposure is the technique. Initially the person is asked to imagine the phobic object – later the phobic object is kept at a distance and gradually brought near and nearer. He is asked to relax and control the fear symptoms.

In Flooding technique, the patient is made to expose oneself to phobia object or situation and experience fear symptoms when he reaches the peak of fear, fear comes down.

General relaxation measures like yoga, meditation, deep breathing exercise, listening to music, help in reducing fear symptoms.

ANXIETY SPECTRUM DISORDERS

Panic Disorder:

The first panic attack is often spontaneous. It occurs all of a sudden. Sometimes panic attack may follow physical exertion, emotional trauma or emotional excitement. The attack consists of rapidly increasing symptoms like severe fear, a sense of impending death and doom. Patient may remain confused and have problem in focusing or concentration. The physical signs include tachycardia, palpitations, dyspnoea, sweating. Patient tries to leave that place and seek help for medical treatment. The attack usually lasts for 20 to 30 minutes. The patient may also experience depersonalization, depression. Patient may think that he may have heart attack, collapse, may go mad and behave abnormally breathing may stop and he may die.

Such patients may be brought to casualty section of a hospital or to the clinic as an emergency.

About 30% panic disorder patients may suffer from Depression and Suicidal ideas or even suicidal attempts. The patients may also report symptoms related to gastro intestinal system like I.B.S, dyspepsia, diarrhoea, constipation.

Certain phobia objects or situations can precipitate panic attacks.

Management:

Tricyclic antidepressant drugs like:

Imipramine Hcl: 50 to 150mg a day

Clomipramine Hcl: 75 to 150mg a day

SSRIs: Fluoxetine 20 to 60 mg

Sertraline 50 to 150mg

Benzodiazepines:

1. Clonazepam: 0.5mg to 2mg a day

2. Lorazepam: 1mg to 3mg a day

Duration of treatment: 8 to 12 months

ANXIETY SPECTRUM DISORDERS

Cognitive Behaviour Therapy:

Here the patient is trained to identify and alter the misinterpretations of bodily sensations and symptoms. He is told that these symptoms do not indicate impending death / disability. They are not life threatening.

General relaxation techniques also help.

Generalised Anxiety Disorder (GAD):

It includes the following symptoms:

- Excessive worry and anxiety which last for several days to 6 months. Patient fails to control the worry and anxiety. He reports:
 - Restlessness and feeling keyed up or on edge
 - Fatigue
 - Difficulty in concentration
 - Mind going blank
 - Irritability and anger
 - Muscle tension and pain
 - Sleep disturbances: difficulty to get sleep or wake up from sleep in the night.
- The worry causes significant distress, causes impairment in social, job or other day to day functioning.
- The worrying may be due to anything: Psychological, social, job, health, future, negative life events and experiences, finance, safety, past mistakes done etc.

Neurotransmitters:

GABA, Serotonin, Norepinephrine, Glutamate are believed to be associated with GAD.

Genetic factors: 25% of I degree relatives may be suffering from GAD.

Role of stress is also reported in GAD.

ANXIETY SPECTRUM DISORDERS

Treatment:

Medication:

Benzodiazepines: Clonazepam, Lorazepam, Propranolol, Buspirone

Tricyclic Antidepressant drugs like Imipramine, Amitriptyline

Psychotherapy, CBT, Relaxation Techniques, Yoga, Meditation, Pranayama, Music, simple religious activity like prayer, Japa (chanting the name of family deity).

Obsessive Compulsive Disorder



It is characterised by:

1. Repetitive and persistent thoughts, impulses or images which are intrusive, inappropriate, and meaningless causing marked anxiety or distress.
2. Repetitive behaviours like washing, checking, touching, uttering words silently, wanting reassurances / approvals by others.

The person recognises that these thoughts are his own; urges to carry on acts are his own urges, want to control but cannot control.

These obsessions and compulsions cause very marked distress by consuming lot of time and efforts which interfere with his daily routines, work, and social responsibilities.

ANXIETY SPECTRUM DISORDERS

Age of onset is usually in adolescence and young age. Male – female are equally affected. In India a subgroup of middle aged women getting OCD is reported.

4 common clinical presentations are reported

1. Washers
 2. Checkers
 3. Pure Obsessionals
 4. Obsessional slowness
- } Constitute 50% OCD

Washers usually have the fear of contamination with dirt, infections. Spend hours on washing cleaning.

Urges to smile, look at the genitals or other body parts of members of same or opposite sex are reported to be very embarrassing.

Getting sexual thoughts and images by looking at people or seeing God / Goddess photo or idols are also reported to be very disturbing.

Aggressive thoughts and impulses to spit, physically attack, push, harm, use sharp weapons, jumps from moving vehicle or from heights disturb the individual.

Checking compulsions – check the locks, switches, taps, electric appliances, writing, counting, doubts to do or not to do, which is right or which is wrong, to do things right now or later are equally disturbing.

Thus OCD can be very distressing to the individual and others causing severe disability. The patient spends majority of his time in obsessions and compulsions have no time to do routine work and day to day activities. Family members show anger and punish the patient believing that patient is deliberately doing these acts. They do not sympathise with the suffering of the patient.

Causes:

The neurotransmitters like Serotonin, Noradrenaline, and Dopamine are reported to be involved in OCD. There is sufficient evidence to suggest that OCD may be transmitted genetically.

The Psycho analytical theories of Sigmund Freud have no more relevance.

ANXIETY SPECTRUM DISORDERS

Treatment:

SSRIs are the drugs of choice to treat OCD.

1. Fluoxetine 20mg to 80mg a day
2. Sertraline 50mg to 200mg
3. Escitalopram 20mg to 50mg
4. Clomipramine 75mg to 250mg a day
5. Fluvoxamine 100mg – 200mg
6. Paroxetine 25mg to 50mg a day

Behaviour Therapy:

Exposure and Responsive Prevention (ERP)

For example: Patient is exposed to dirt or contamination, when he gets the urge to wash and clean, he is prevented from doing so. Initially anxiety symptoms mount up and over a period of time they subside. The therapist / a family member has to supervise the ERP and encourage the person to continue ERP till obsession / compulsion subside.

Post-Traumatic Stress Disorder

The person when gets exposed to a traumatic experience or life event like:

- Witnessed or was confronted with serious injury, a threat to physical safety of self or others.
- Witnessed sudden death due to accident / disaster / murder

Then onwards there is a recurrent, intrusive distressing recall of the event in terms of thoughts or images (flash back).

The same may be seen in dreams.

There may be intense emotional distress when the person sees the place / incident resembling the past trauma.

There may be persistent symptoms like:

- i. Sleep disturbances
- ii. Appetite disturbances
- iii. Poor concentration
- iv. Startle response with trivial stimuli

ANXIETY SPECTRUM DISORDERS

- v. Decreased efficiency. Social, occupational dysfunction
- vi. Multiple somatic symptoms
- vii. Abuse of alcohol / drugs

All symptoms may last for less than 3 months - Acute stress disorder
If symptoms last for more than 3 months, it is labelled as chronic stress disorder.

Treatment:

Medication: Minor Tranquilizers

Anti-depressant drugs

Psychotherapy with emotional support. The patient is encouraged to talk about the event and distress.

Relaxation – diversion activities.

The patient is encouraged to get busy in doing any activity of his / her choice which makes him comfortable: Religious, Spiritual, Social Service, Creative activities.

Substance induced Anxiety Disorder:

Symptoms of anxiety, panic attacks or obsessions occur during or within one month of alcohol, cannabis opiates. This can be part of intoxication or withdrawal.

Management includes:

Medication, deaddiction procedure and psychotherapy.

Management of Exam Fear AVOID EXAMINATION FEAR



ANXIETY SPECTRUM DISORDERS

Examination fear is common in students who appear for X, XII, CET, NEET or any other competitive exam. You have to help them to reduce the fear. "You are going to take SSLC or PUC or any examination. You are going to be cool. No anxiety, no fear should bother you."

What are the usual causes of examination fear?

- Thinking that your preparation is not adequate. You might have wasted your time in entertainment.
- You have difficulty in understanding a subject or a few subjects.
- Your memory is poor.
- You cannot write fast.
- There is a pressure and high expectation of getting 80+ marks and you have doubts about your capacity.
- You anticipate tough and difficult questions.
- You think that evaluation of your answer sheets may not be liberal.
- You think that your friends have studied well, revised many times and excel in the examination.
- You think that you may become sick neared to / during the examination.
- If you score less marks or fail; it is an insult to you. Parents may punish you.

Classmates may make fun of you.

- You are unlucky. Your stars are not good.
- You think that God is angry on you because you have committed a mistake.
- Somebody has done black magic on you and your family.
- Someone has predicted that you are going to fail.

ANXIETY SPECTRUM DISORDERS

Identify and avoid all the above negative thoughts. Do the following:

1. Adequate preparation to face the examination.
Read – Recall – Rehearsal – Revise and Repeat.
2. You have read all the chapters.
3. You have done well in preparatory and mock examinations.
4. You have done your best. You have made good and honest efforts.
5. You are going to do well. Result will be good only.
6. Get the blessings of parents, teachers and elders.
7. Offer simple and sincere prayers to god.
8. Take easily digestible food at regular intervals.
9. Sleep for six hours.
10. Consult a doctor if you have health problem. Be fit.
11. If you fail to recall some information do not panic. Revise and repeat.
12. Stop comparing yourself with others.

On the examination day:

- Get up. Take bath. Pray to God.
- Get the blessings of elders.
- Do quick revision (Do not try to recall).
- Have breakfast.
- Collect all the required materials to be taken to the examination. Carry three good pens.
- Start early and reach the examination hall half an hour before the scheduled time.
- Keep yourself calm. Be smiling.
- Wish your friends success.

ANXIETY SPECTRUM DISORDERS

- Do not discuss anything about the subject or probable questions.
- Go to toilet and urine.
- Enter the examination hall. Sit comfortably in your seat.
- Do deep breathing exercise and reassure yourself that you will do better. Pray God.
- When question paper is given to you simply read all the questions. See if there are options.

Divide the questions into three groups:

1st group: You know the answers.

You can write well.

2nd group: You can manage to write answers.

3rd group: You partially know the answers or do not know the answers.

Start answering questions which belong to group 1. Maintain the time targets. Lastly, you make attempts to answer the questions of group 3. Write legibly. Let there be space in between the lines.

Tie the answer sheets properly.

Once you come out of the examination hall do not discuss about answers. Don't try to find out what mistakes you did. Go home / hostel and relax. Go for a walk come back and prepare for the next day's subject.

Do not worry about the result. Wait for the result.

If you do not get the expected result, don't panic. See whether you have to apply for:

- a) Retotalling
- b) Re-evaluation

Or accept the result and plan accordingly with whatever marks you have obtained. Find out details about the course of interest and the college. You can get a seat. Join the course and study well.

ANXIETY SPECTRUM DISORDERS

How to overcome anxiety/fear?

1. **Introspection:** We should do introspection, know our assets and limitations. Assets will help us to improve our self – confidence and limitations help us to plan our strategy. Limitations should not bother us. If limitations cannot be improved, we should learn to accept and live with them.
2. **Give up negative thinking:** We should avoid negative thinking. We should not anticipate failures unnecessarily. We should not under-estimate our abilities. "Let me do my best. Let me make sincere effort. Things would be alright," should be our attitude.
3. **Give up inferiority feelings:** We should not compare ourselves with others. We need not excel others all the time. Our target should be, to work better and to achieve better than our own past work and achievements.
4. **Better use of available resources:** We have to look at our resources – time, men, money, materials and plan to make better use of them. There is no point in worrying about what we do not have. 'Stretch your legs according to the length of the mat.'
5. **Get support of others:** We should not have "Abhimanyu syndrome" that is, to succeed single-handed or to carry the entire burden on our shoulders. We should talk to others, involve and get their support to complete the task assigned to us. We have to request our family members, friends and colleagues to encourage us and not to simply criticise us.
6. **Relaxation:** Relaxation is the best medicine for anxiety and fear. We have to learn the art of relaxation. With anxiety and fear, fatigue sets in the body and mind, reducing their efficiency. Relaxation helps to remove the fatigue and bring back the efficiency.
 - i. Sleep for minimum six hours a day.
 - ii. Spend 45 to 60 minutes everyday in activities like listening to music, reading books, painting, gardening,

ANXIETY SPECTRUM DISORDERS

- playing with children or pets, sports, observing nature, yoga, meditation, pranayama etc.
- iii. Break the monotony while working or fulfilling a responsibility. Do some other activity for a while. Get up, stretch your body, walk a few steps, do simple breathing exercises (take a breath-in slowly and deeply and breath-out) in a relaxed sitting or lying posture for a few minutes.
 - iv. Share your difficulties, problems, frustrations with someone you love with respect.
 - v. See that your immediate environment is comfortable and aesthetically pleasing to you by keeping the place clean, tidy and attractive.
 - vi. Take easily digestible food, preferably fluid and semisolid food at regular intervals. Stop eating very high calorie diet like fried foods, ice-creams, chocolates, fatty meat.
 - vii. Have faith in God or some supernatural force. Offer prayers and request Him to give you the required abilities to complete your task. Do simple puja / worship, visit temple / mosque / church and always hope for the best.



AGEING AND HEALTH

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AGEING AND HEALTH

AGEING AND HEALTH

Healthy ageing in the changing world

Over the last century life expectancy has increased dramatically. The number of elderly is rising all over the world including India. The population of elderly persons in our country is increasing exponentially from 77 million at the beginning of last century to around 100 million now, forming 9 per cent of total population of the country. Thus the country has become a 'graying nation'. According to United Nations Population Fund, it has become a 'time bomb'

The report on 'An ageing World 2008' has highlighted that within 10 years older people will outnumber children, for the first time. It has forecasted that over the next 30 years, the number of over 65 years is expected to almost double from 506 million in 2008 to 1.3 billion, a leap from 7% of the World population to 14%.

The family plays a pivotal role in the care of its elderly. It should with the support from the Society and Government, shoulder its responsibility and make their life happy. The elderly persons are national asset who have contributed the growth of the Nation and development of the family. In advancing years, these persons find difficulty to generate income, and become increasingly vulnerable to illness and disability, and become dependent on their families. They should not be considered a burden. The Society must take pleasure in supporting them. We have to strive to make them show features of positive ageing. Successful ageing, then becomes giving to others with joy, and receiving it gratefully during needs.

The rapid strides in the medical science, has enabled a steady increase in human life expectancy. The implications are that ageing is becoming a matter of concern because of the rapidly growing number older persons putting enormous pressure on health care services. Our aim is to take care of them through separate clinics and hospitals

AGEING AND HEALTH

catering to the needs. If it is done with all seriousness the old age becomes a happy state in the life of every individual. Ageing as Betty Friedan has told, 'is not lost youth, but a new stage of opportunity and strength'.

Graying nation

Over the last century life expectancy has increased dramatically. The number of elderly is rising all over the world including India. The population of elderly persons in our country is increasing exponentially from 77 million at the beginning of last century to around 100 million now, forming 9 per cent of total population of the country. Thus the country has become a 'graying nation'.

The number of elderly persons is overtaking the number of the young resulting in a huge demographic shift threatening to overwhelm Nations with economic and social problems. The report on 'An ageing World 2008' has also highlighted that within 10 years older people will outnumber children, for the first time. It has forecasted that over the next 30 years, the number of over 65 years is expected to almost double from 506 million in 2008 to 1.3 billion, a leap from 7% of the World population to 14%.

Causes of ageing

There are many hypotheses that have tried to explain occurrence of ageing. They include genetic causes that may cause activation of genetic program in post-reproductive age, oxidative stress from accumulation of oxidants causing damage to DNA, protein and lipids and bringing about a decreased stress response, mitochondrial dysfunction from deletion of mitochondrial DNA with age causing an alteration in cell metabolism and adaptability to changes in the environment, hormonal deficiency from a decline and loss of circadian rhythm in their secretion, telomere shortening causing a decline in the ability of cells to replicate, deficiency in host defense bringing about an incompetency of immune system leading to an increased susceptibility to infections and environmental stress, and an inability to renew the dysfunctional cells leading to an accumulation of senescent cells.

AGEING AND HEALTH

Theories of ageing

Hypothesis	Mode of action
Genetic	Activation of genetic program in post-reproductive life
Oxidative stress	Accumulation of oxidative damage to DNA, protein and lipids decreasing stress response
Mitochondrial dysfunction	Deletion of mitochondrial DNA with age causing alteration in cell metabolism and adaptability to changes in the environment
Hormonal changes	Decline and loss of circadian rhythm in secretion of certain hormones leading the functional hormonal deficiency
Telomere shortening	Decline in the ability of the cells to replicate
Deficiency in host defense	Incompetency of immune system leading to vulnerability to infections and environmental stress
Accumulation of senescent cells	Loss of ability to renew the dysfunctional cells

AGEING AND HEALTH

Though no skill is needed to grow old, Henri Amiel has considered that, 'to grow old is the master-work of wisdom, and one of the most difficult chapters in the great art of living'. Today more and more people are destined to live into their eighties and it has necessitated them to gain the knowledge of growing old gracefully.

Graceful ageing

Graceful ageing can only occur in a healthy body. This statement probably answers the puzzle of restoration of youth. Healthy ageing requires an immune system that is working properly. It helps to prevent or slow the process of disease and regulates the speed of ageing process.

Ageing is looked from two sides. One side shows the chronological age and other the physiologic age. The chronologic age refers to how young or old a person is with reference to the calendar. The physiologic age refers to how young or old a person is relative to average chronological age. However when we make a comparison of a person's physiologic age with his chronologic age, the person may appear younger or older than his age in years. It must be known that nobody can control the years as they pass, but can control his physiologic ageing.

Elderly population comprises people who have given their best during their productive years to the Society and to the Nation. These people are still a part of our main stream which is being benefited by their experience. The elderly is living in a private Universe of physical weakness and mental decay. There is a great need to focus our attention towards their medical and health needs.

Focus on health needs

In the words of Victor Hugo, 'the misery of a child is interesting to a mother, the misery of a young man is interesting to a young woman, the misery of an old man is interesting to nobody'. The elderly is living in a private Universe of physical weakness and mental decay. The words of Jonathan Swift remind us that 'everyone desires to live long, but no one would be old'.

AGEING AND HEALTH

There is a great need to focus our attention towards their medical and health needs. The big number of geriatric population is increasing day by day; year after year. Goethe has said, 'no skill or art is needed to grow old, the trick is to endure it'. The physician has to strive not to put more wrinkles in their minds than their faces.

Adolphe Quetelet (1842) looking at different stages of man said, 'man is born, grows up and dies according to certain laws that have never been properly investigated, Vaillant, looking at the very complex concept of aging carrying different meanings to different people had formulated a multiple choice question on age in his book 'Aging well' and sought the answer:

1. decay and no one gets out of this world alive
2. things change, the more they stay the same
3. continued development right up to the moment of death
4. all the above

The correct answer, of course, is 'all the above'.

John F Kennedy remarked that 'a medical revolution has extended the life of our elder citizens without providing the dignity and security in those later years'. There is a great need to focus our attention towards their medical and health needs. The physician has to strive not to put more wrinkles in their minds than their face. The spirit should never grow old. They should 'not feel that old age is an island surrounded by death'. Their mind has to be kept active, interested and useful. These things show a decline by inactivity, not by aging. The lesson is that they should live, work, and learn something that they didn't know earlier.

According to a study of Adult Development carried out at Harvard University, people become mellowed with age. The features like forgiveness, gratitude, and compassion will lead to successful aging. The Study has given ingredients essential to successful living. It has said, 'old age can be both miserable and joyous. But the positive aging must reflect vital reactions to change, to disease and to conflict'. The goal is straightforward to achieve successful aging.

AGEING AND HEALTH

Since ageing appears to be the only available way to live a long time, and the number of geriatric population is on increase in the country, there is an urgency to address the health issues of this growing mass of population as a separate segment. In advancing years many age-related disabilities begin to appear. Mobility suffers, hearing gets impaired; there is gradual loss of eye sight and loss of memory. The immunity declines making elderly persons more vulnerable to infections. Diabetes, heart diseases, cancer, enlarged prostate, Parkinson's disease, and Alzheimer's disease make their appearance. Often there is fall making them bed-ridden. Hence the aged require special medical attention. At the same time we must remember that 'there are no diseases of the aged, but simply disease among the aged'.

Traditionally, the joint families in India used to care of its elderly. But in the recent decades the rapid urbanization, and an exodus of people from rural to urban areas and from urban areas to foreign land has resulted in dissolution of joint families and creation of 'empty nest syndrome'. Absence of extended family support and the support from the community, and the difficulty to continue earn their livelihood, the life of elderly has been put into great hardship.

National policy

The Government of India envisaged the National Policy on Older Persons (NPOP) that covers all aspects of the elderly, their health care, housing, financial security and protection against abuse. In that, elderly have been recognized as national resources, creating opportunities for their development. This Policy is yet to be implemented by all States and Union Territories of India.

The family plays a pivotal role in the care of its elderly. It should with the support from the Society and Government, shoulder its responsibility and make their life happy. The elderly persons are national asset who have contributed the growth of the Nation and development of the family. In advancing years, these persons find difficulty to generate income, and become increasingly vulnerable to illness and disability, and

AGEING AND HEALTH

become dependent on their families. They should not be considered a burden. The Society must take pleasure in supporting them. We have to strive to make them show features of positive ageing. Successful ageing, then becomes giving to others with joy, and receiving it gratefully during needs.

Decline in functions

The elderly exhibit a decline in functions of various organs and systems, along with alteration in the anatomical structure. In advancing years many age-related disabilities begin to appear. Mobility suffers, hearing gets impaired; there is gradual loss of eye sight and loss of memory. The nerve conduction becomes less rapid and the reflexes become slow. The immunity declines making elderly persons more vulnerable to infections. The elderly are susceptible to same diseases to which middle-aged suffer. Diabetes mellitus, ischaemic heart disease, cerebrovascular disease, cancer, enlarged prostate, Parkinson's disease, and Alzheimer's disease make their appearance. Often there are falls with fractures making them disabled and bed-ridden. The care of elderly has become complex. They have 'to live' rather than 'die from' chronic disorders of advancing age. This has necessitated for care by a comprehensive multidisciplinary approach.

The rapid strides in the medical science, has enabled a steady increase in human life expectancy. The implications are that ageing is becoming a matter of concern because of the rapidly growing number older persons putting enormous pressure on health care services. Benjamin Disraeli jokingly has said, 'youth is a blunder, manhood a struggle, old age a regret'. Our aim is to take care of them through separate clinics and hospitals catering to the needs. If it is done with all seriousness the old age becomes a happy state in the life of every individual.

Challenges of old age

It has been calculated that all mammals on earth have a life-span six time their skeletal maturity. This rule framed for animals should also apply to

AGEING AND HEALTH

man. Human beings reach their skeletal maturity at about age 20. On this basis human beings are expected to live, on an average to age of 120. Though the genetic blueprints allow them to live into the centenary of life, it does not happen. The average person barely reaches four times his or her skeletal maturity. The genetic expression does not allow that particular gene to keep the individuals alive as the diet, exercise, stress and other factors impair the genetic process.

As more and more of us are destined to live into our eighties, the challenge of old age has become more pressing than ever, and we need to decide from whom we have to gain that knowledge of living gracefully. As we go through life, we meet septuagenarians and octogenarians who offer us rare role models for growing old. To understand successful aging, we need to ask very old people about the road they have traveled. We all need models for how to live from retirement to past 80 with joy.

Majority of older people without brain disease, maintain a sense of modest well-being until the final months before they die. In the study of Adult Development at Harvard University, a 94-year old answered to a question 'what is the most important thing that makes you want to get out of bed in the morning?' he said, 'to live, to work, to learn something that I didn't know yesterday- to enjoy the precious moments with my wife'

Successful living

Age itself is a healing factor. It gives the ingredients essential to successful living. Old age can be both miserable and joyous. But that positive aging must reflect vital reactions to change, to disease and to conflict. There are many paths to successful aging and there will never be a right way to grow old. But the goal is straightforward. How can we make the journey past middle age gladly?

One can influence aging as much as one can influence disease prevention and other factors associated with fitness and health. Lynn Peters Adler who runs National Centenarian Awareness Project has found the following features have aided them to lead a long life with fitness and health.

AGEING AND HEALTH

1. positive but realistic attitude
2. A love of life
3. A sense of humour
4. Spirituality
5. Courage
6. A remarkable ability to accept the losses that come with age but not be stopped by them

It is worth remembering the words of Tryon Edwards that 'some men are born old, and some never seem so. If we keep well and cheerful we are always young, and at last die in youth, even when years would count us old'. The words of James Cricton-Browne remind us that 'there is no short-cut to longevity. To win it is the work of a life time, and the promotion of it is a branch of preventive medicine'.

American Gerontological Society in 1953 in its motto has said, 'Adding life to years, not just more years to life'. A successful living according to Vaillant, becomes 'learning to live with neither too much desire and adventure nor too much caution and self care'. As Abraham Lincoln has said, 'and in the end it's not the years in your life that count. It's the life in your years'.

Sirtuins and longevity

Ageing itself acts as an important risk factor for development of many of those disorders. People are in search of things that can keep them young. They include dietary regimens and exercise programs to achieve longevity. The medical science concerned with ageing has been able to identify genes and pathways that appear to control the process of ageing.

Sir2

While studying the simple laboratory organisms such as yeast, Leonard Guavente and colleagues, in mid 1990s found that when small amounts

AGEING AND HEALTH

of food is administered to them, it extended their life-span (1). The experiments with different sets of genes enabled them to recognize a certain type of gene when administered to them increased their life span and its withdrawal led to their death. The gene was named Silent Information Regulator two (Sir2). They are proteins possessing either histone deacetylase or mono-ribosyltransferase activity. They are essentially found in organisms from bacteria to humans.

The name Sir2 has come from yeast genes as 'silent mating type information regulator two', which is responsible for different cellular activities. Sirtuins have been implicated in influencing ageing and regulating transcription, apoptosis and stress resistance as well as energy efficiency and alertness during low calorie diet. Often they are referred to as 'longevity genes'. They can extend the life span in model organisms and mediate the salutary anti-ageing effects of a low-calorie diet.

Sirtuins

Sir2-related gene products (sirtuins) were able to extend the life-span in the nematodes (*Caenorhabditis elegans*), in the fruit fly (*Drosophila melanogaster*), and in mice (2, 3). Sirtuins exhibit nicotinamide adenine dinucleotide (NAD)-dependent lysine deacetylase activity, which is associated with the splitting of NAD during each deacetylation cycle (4). These genes suppress certain genes and repair DNA within the body. The process is referred to as 'gene silencing'. Sirtuins function by silencing the expression of certain other genes (5). This prevents wrong genes getting activated to disturb the function of the cells.

Sir2 is a protein decarboxylase that mediates transcriptional silencing at selected regions of the yeast genome, especially at the ribosomal DNA repeats, and extends its replicative life span (3). Sirtuins keep cells alive and healthy in face of stress by coordinating a variety of hormonal networks, regulatory proteins and other genes. Since then sirtuins have been shown to regulate longevity in lower organisms such as flies and worms (2).

AGEING AND HEALTH

Activity and functions

Mammals have seven sirtuin (SIRT1-7) orthologues that occupy different subcellular components. The sirtuins (SIRT1, 2, 3, 4, 5, and 6) exhibit NAD-dependent protein deacetylase activity (6). In addition, they regulate the circadian rhythm, metabolism, stress tolerance, and ageing (7). Sirtuins belong to the class III protein deacetylase family which are the only histone deacetylases (HDACs) that require NAD for their enzymatic activity. Owing to the characteristic NAD requirement for their enzymatic reaction, the activity of sirtuins is directly connected with the metabolic state in the cells.

SIRT4 and SIRT6 in addition exhibit ADP-ribosyltransferase activity. SIRT7 is found in nucleolus whose activity is undetermined. Sirtuins have been classified as per their succession of amino acids. They act on all cellular regulation in the same manner Sir2 behaves in yeast. The location, activity and functions of different sirtuins are as follows:

Class	Intracellular location	Activity	Function
SIRT1	Nucleus, cytoplasm	Deacetylase	Metabolism, inflammation
SIRT2	Cytoplasm	Deacetylase	Cell cycle, tumorigenesis
SIRT3	Nucleus, mitochondria	Deacetylase	metabolism
SIRT4	Mitochondria	ADP-ribosyl transferase deacetylase	Insulin secretion
SIRT5	Mitochondria	Deacetylation, demalonylation, desuccinylase	Ammonia toxification
SIRT6	Nucleus	ADP-ribosyltransferase, deacetylase,	DNA repair, metabolism TNF secretion
SIRT7	Nucleolus	Unknown	DNA transcription

AGEING AND HEALTH

Sirtuins are effective in protecting cells of human being from deterioration and in restituting injured cells.

SIRT1

SIRT1 in mammals is Sir2 orthologue and is found as a nuclear protein in most cells and takes part in deacetylation of the transcription factors and cofactors that participate in a variety of metabolic pathways. The transcriptional factors such as nuclear receptors, peroxisome proliferator-activated receptor (PPAR)-gamma coactivator 1 alpha (PGC-1 alpha) and forkhead box subgroup O (FOXO) are known to have important role in the energy metabolism (8). SIRT1 has an influence on the components of circadian clock and works in conjunction with AMP-kinase in limitation of energy expenditure. Further it regulates stress response by acting on p53, hypoxia-inducible factor 1 alpha and 2 alpha and heat-shock factor protein-1 (9). SIRT1 also modulates DNA repair and inflammation. Thus the activity of SIRT1 regulates metabolism and stress response (10).

Metabolism

The animal studies in rats have shown that SIRT1 could influence differentiation and fat accumulation in the adipose cell line and primary preadipocytes (11). A calorie-restriction diet increases biogenesis of muscle mitochondria (12). SIRT1 helps the activation of fatty acid oxidation. Along with PPAR-gamma SIRT1 increases insulin sensitivity (13). All these events are bound to slow down the rate of age-related decline.

SIRT1 promotes fat mobilization in white adipocytes by repressing PPAR-gamma (11). Deletion of hepatocyte-specific SIRT1 brings about an alteration in fatty acid metabolism and causes accumulation of fat in the liver (13). In the liver, SIRT1 appears to govern two pathways that exhibit opposing influences on gluconeogenesis. On one hand it may activate PGC-1alpha and FOXO1 to produce glucose (8). On the other hand the deacetylation and destabilization of the cyclic AMP

AGEING AND HEALTH

decreases the production of glucose via activator/coactivator exchange (14).

In calorie restriction, the relative influences of these pathways results in a mild increase in glucose production (10). SIRT1 along with SIRT6 repress the activity of the major proinflammatory transcription factor and nuclear factor and bring about an anti-inflammatory effect (15).

Cardiovascular system

SIRT1 is cardioprotective. It prevents angiotensin II-induced vascular smooth muscle cell hypertrophy in the cardia by downregulating the expression of the angiotensin-II type 1 receptor (ATI) (16). There is a decreased production of reactive oxygen species leading to an increased longevity of the mice (17) and it is mediated by increased levels of SIRT3. SIRT1 causes deacetylation and activation of endothelial nitric oxide synthase (eNOS) (12). Decreased oxidative stress inhibits oxidative stress-induced premature senescence of endothelial cells that may mitigate atherosclerosis (18). Calorie restriction has a favourable effect on cardiovascular system through SIRT1 that influences the functions of eNOS, and ATI.

SIRT1 regulates the fat and cholesterol homeostasis. It triggers oxidation of fatty acids in calorie restriction (13). It causes deacetylation and activation of the nuclear receptor liver X receptor (LXR), leading to up-regulation of the ATP-binding cassette transporter AI. It brings about reverse cholesterol transport (RCT) from peripheral tissues (19). In addition SIRT1 causes deacetylation and activation of the nuclear bile acid receptor farnesoid X receptor (FXR) leading to increase its dimerization (20). Activation of LXR and FXR by SIRT1 brings about an increased production of high-density lipoprotein (HDL) cholesterol. It facilitates cholesterol removal and regression of atherosclerosis.

SIRT1 plays an important role in regulation of hepatic lipid metabolism. The activation of LXR by SIRT1 gives impetus to the gene encoding the sterol regulatory element-binding protein 1 (SREBP1) in

AGEING AND HEALTH

liver to drive fat and cholesterol synthesis. This effect may be counteracted by an opposing action of SIRT1 through deacetylation of SRBEP1 and repression of its activity (21).

Neurodegenerative diseases

Increased longevity is associated with development of neurodegenerative diseases including Alzheimer's disease. An over-expression of SIRT1 in the brain is likely to cause suppression of production of toxic beta-amyloid peptide by activating the alpha secretase gene ADAM10, through deacetylation of its transcriptional activator, the retinoic acid receptor-beta and protect against the disease (22). In addition SIRT1 causes deacetylation of tau protein and bring about destabilization and reduction in tangles (23).

Mitochondrial sirtuin

SIRT3, 4, and 5 are examples of mitochondrial sirtuins that appear to mediate physiologic adaptation to reduced energy consumption. They bring about changes in the mitochondrial proteins that govern the metabolic pathways in energy deprivation. SIRT3 deacetylates long-chain acyl dehydrogenase involved in the oxidation of fatty acids. Thus SIRT3 deacetylates the components of the electron transport chain to make oxidative phosphorylation more efficient. It activates mitochondrial superoxide dismutase 2, isocitrate dehydrogenase 2 and components of the electron transport chain to suppress reactive oxygen species.

SIRT4 causes repression of the enzyme glutamate dehydrogenase (GDH) to regulate amino acid catabolism for energy (24). During calorie restriction there is a decline in the activity of SIRT4 facilitating glutamine to act as a fuel source for glucose synthesis in liver and as a stimulus for insulin secretion by beta cells of islets in the pancreas. SIRT5 causes deacetylation of carbomoyl-phosphate synthase (CPS1) enzyme to activate the urea cycle, facilitating the disposal of ammonia when amino acids are utilized as fuel sources

AGEING AND HEALTH

Activators of SIRT1

The studies on small-molecule activators of SIRT1 have been carried out (25). Resveratrol is a polyphenol antioxidant, and a possible SIRT1 activator, found in muscadine grapes, groundnuts, berries and cocoa beans. It is found in Japanese knotweed and has been in use for several decades in Japan and China for its anti-aging properties. It activates longevity genes. It activates deacetylation of peptidylsubstrates. A new class of chemically distinct classes of selective, synthetic SIRT1 activators has been identified. They possess higher potency than polyphenols. Both these compounds have the capability to increase the binding affinity of SIRT1 for the peptide substrates labeled with a chemical fluorophore group. Sirtuins are effective helping protect cells of human beings from damage and also help with restituting injured cells.

Adult vaccines

The success of immunization in children has reduced the incidence of vaccine-preventable infections. Influenza and pneumonia are commonly encountered in adults and elderly. In addition there is occurrence of infections like tetanus and lately recognized diphtheria, and pertussis, and herpes infrequently. Vaccinations can be effectively utilized to prevent these infections in adults. It implies that different vaccines are used to offer protection to the individuals throughout their life course. The waning immunity has to be augmented by vaccines. Persons with co-existing diseases are more susceptible to conditions like influenza and pneumonia and they are to be protected against those illnesses.

The vaccination program does not end with childhood. It is a continuous program where adolescents, adults and elderly are in need of certain vaccines to prevent the infections. Thus life course vaccination program is a cost-effective preventive strategy that has gained importance by drawing attention of public. Adult immunization is yet to be included in the National program (26).

AGEING AND HEALTH

Influenza

Influenza virus: Influenza is an acute, contagious viral disease. There are 3 basic types of virus named as A, B, and C that cause influenza. Circulating influenza type A and B virus are responsible for seasonal human influenza outbreaks/epidemics. Influenza virus is a rod shaped RNA virus having a lipid envelope. 2 glycoprotein spikes are found on its surface as haemagglutinin (HA), and neuroaminidase (NA). An infection results in the production of antibodies against these glycoproteins. Neutralising antibodies against HA offer protection against an infection

Influenza is caused predominantly by influenza A virus. The virus exhibits alteration from year-to-year because of an antigenic shift which results in a replacement of HA, and sometimes NA. These changes in the structure of the human virus result in widespread epidemics. There are 15 HAs and 9 NAs which are antigenically distinct resulting in different virus strains such as H1N1, H2N1, H1N2, etc. Such virus subtypes do not last for a long period of time. An antigenic drift brings about a mutation.

Flu vaccine: Flu vaccine was introduced in 1940s. A lasting immunity by the antibodies raised during infection/vaccination may be expected if there is no alteration in the structure of the virus. But this does not happen as the virus alters its structure year after year. Emergence of new strains make it necessary to produce new batch of vaccine each year, as antibodies elicited in one year lose their effectiveness in subsequent years. The scientists across the World are involved in tracking, analyzing and classifying the viral strains causing influenza. The results enable the World Health Organization (WHO) to select the strains for the vaccine in February each year for the upcoming season of influenza.

There is need to alter the vaccine due to continued antigenic drift of influenza virus. Vaccine has to be produced every year to include most current strains in circulation. It has to be administered annually to offer protection against prevailing strain of influenza virus. The manufacture of the vaccine begins only after isolation of the virus from different regions of the World. Due precautions have to be taken to produce a safe vaccine against any given variant of influenza virus.

AGEING AND HEALTH

- **Flu Pandemics:** World has witnessed many pandemics of flu during 20th century. The pandemics caused by H1N1, H5N1 strains of flu virus have exhibited capacity to invade lower respiratory tract and cause rapidly progressive pneumonia in healthy persons who are exhibiting absence of immunity against prevailing strain of flu virus.
- **Seasonal influenza:** The infection from seasonal influenza though is confined to upper respiratory tract, with features of fever, myalgia, rhinitis, severe disease can lead to pneumonia in elderly or in those with underlying chronic obstructive pulmonary disease (COPD).

Administration of vaccine: **There are 3 types of vaccines**

- 1. Trivalent inactivated influenza vaccine (TIV) administered intramuscularly
- 2. Live attenuated influenza vaccine (LAIV) administered as nasal spray between the ages 2 years and 49 years.
- 3. Quadrivalent flu vaccine for active immunization of adults 18 to 64 years of age

The effectiveness of vaccine is seen within 2 weeks following its administration. It depends on the extent of match between prevailing strain of virus and the strain of virus used in the preparation of vaccine. Vaccine against influenza is recommended annually for all adults. TIV (contains both A subtypes of virus and only one of the B subtype virus) is administered intramuscularly in the deltoid muscle. It is given once as a single dose of 0.5 ml available in prefilled syringe. The vaccination should be done during peak influenza activity in India. It is to be given before monsoon in April-May, or during winter in October especially in North India (27). Quadrivalent flu vaccine containing 2A virus strains-H1N1 and H3N2 and 2 B virus strains, can be given as a single injection from prefilled syringe in adults 18 to 64 years of age (28). LAIV is not recommended to pregnant women and immunocompromised persons

AGEING AND HEALTH

Indications:

- Adults exposed to a high risk for influenza and its complications, or living in close contact of persons at higher risk
- Persons with age above 50 years
- Women becoming pregnant during an influenza season
- Persons involved in health care activities
- Persons having chronic inflammatory diseases including asthma
- Persons suffering from cardiovascular (except hypertension), renal, hepatic, haematological, or metabolic disorders
- Persons having immunosuppressive disorders
- Haj pilgrims, people attending Kumbh mela

Streptococcal Pneumoniae

Streptococcus pneumoniae are found normally in human upper respiratory tract (URT). They have been considered as the single most important bacterial agent responsible for Pneumonia, otitis media, sinusitis, bronchitis, and invasive pneumococcal disease (bacteraemia, meningitis). Elderly patients are highly susceptible to the infection because of declining immunity. William Osler, more than a century ago, referred Pneumonia as 'the friend of aged'. In 2006, Finn and Jenkinson modified the statement as 'Old man's friend and children's foe'.

Vaccines:

Large number of Pneumococcal strains has become resistant to multiple antibiotics commonly used. An increased morbidity and mortality is associated with an invasive infection in individuals having an increased risk of acquiring the infection

Two types of vaccines are available to prevent pneumococcal infections, and they are;

1. Pneumococcal polysaccharide vaccine (PPV), and
2. Pneumococcal conjugate vaccine (PCV)

AGEING AND HEALTH

Pneumococcal disease: *Strep pneumoniae* accounts for 40% of illness. Major burden of the disease falls on elderly. A polysaccharide capsule which is an essential virulence factor surrounds *Streptococcus pneumoniae* organism. There are more than 90 capsular types, and some of them are frequently associated with the disease. The organism spreads from person-to-person by infected respiratory secretions.

Vulnerable segment:

The following situations make an individual vulnerable for Pneumococcal infection:

- Extremes of age
- Co-existing disorders such as Diabetes Mellitus, COPD, Bronchial asthma, nephrotic syndrome, hepatitis C, influenza
- Smokers
- Immunocompromised situations
- Impaired IgG synthesis, impaired phagocytosis, defective clearance of Pneumococci

Vaccines

1) 23-valent polysaccharide pneumococcal vaccine (PPV):

PPV contains 1,2,3,4,5,6b,7b,8,9V,10A,11A,12F,14,15B,17F,18C,19F,19A,20,22F,23F,33F serotypes. It is advocated for all adults aged >65 years and persons 2 years through 64 years with a long history of coexisting diseases/decreased resistance of the body to infections/long term steroid therapy, immunosuppressive agents, smokers, and asthmatics.

A tetravalent polysaccharide vaccine was prepared in 1945 against *Streptococcus pneumoniae*, and it was considered a land mark in the medical history. However, its usefulness was curtailed by the discovery of antibiotics. In 1970s 14-valent vaccine was introduced. It was further improved in 1983 as a 23-valent formulation, and it was found beneficial to elderly.

AGEING AND HEALTH

2) Pneumococcal conjugate vaccine (PCV): In 2000, PCV containing 7 most prevalent strains of Pneumococci, was produced as a heptavalent (cell membrane sugars 4, 6B, 9V, 14, 18C, 19F, 23F) vaccine where Pneumococci had been conjugated with a non-toxic recombinant variant of diphtheria toxin (Pevnar 7). Later a decavalent vaccine with 10 serotypes of Pneumococci was produced. In 2010 it was further modified into triskaivalent vaccine 13 (1,3,4,5,6B,7F,9V,14,18C,19F,23F) by conjugating to a carrier protein containing harmless variety of diphtheria toxin (Pevnar13).

Table 1: Differences between PPV and PCV vaccines

Features	PPV	PCV
T cell dependence	present	not present
Polysaccharide	capsular	conjugate
Antibody response	IgM	IgG
Affinity to antibodies	poor	marked
Presence of immune memory	not existing	Markedly present
Response to revaccination	decreased responsiveness because of depleted memory of B cells	exhibit faster, long-lasting secondary response due to presence of immune memory

Functional antibody response

A single dose of 13 valent conjugate vaccine in adults has demonstrated an antibody response comparable to or higher than the levels induced by polysaccharide vaccine. There is presence of similar opsonophagocytic activity and a T-cell dependent response eliciting immunological memory

AGEING AND HEALTH

New Approach

Conjugate vaccine has shown to effectively reduce pneumococcal disease in children, and it has paved a new approach to prevent pneumococcal disease in adults also. It is cost effective. The Community-acquired pneumococcal immunization trial (Capita) has shown the efficacy of PCV13 in adults aged 65 years or older in preventing first episode of serial pneumococcal disease (29).

Administration of vaccine

PCV 13 is advocated in adults aged 50 years or older to prevent pneumonia. The doctor and the patient have to decide about its administration. Polysaccharide vaccine can be given for all adults older than 65 years, and conjugate vaccine has shown to be superior. The indications are similar in both types of vaccine.

PCV 13 has to be administered intramuscularly in the deltoid region in a dose of 0.5 ml. It can be combined with influenza vaccine program at the same time and it has to be given separately. Alternatively PPV 23 can be administered either intramuscularly or subcutaneously in a dose of 0.5 ml only once.

Routine revaccination is not recommended for immunocompetent persons previously vaccinated with PPV. Revaccination may be needed for persons who exhibit an increased risk for Pneumococcal infection or those showing rapid decline in Pneumococcal antibody level provided that 5 years have elapsed since receiving the first dose.

Diphtheria

Diphtheria is a highly contagious infection of the throat. Though the infection is common during childhood, it can occur at any age. The condition is potentially fatal, and the lethal effects are due to the toxins liberated. The causative agent spreads through the infected droplets. A firm, fleshy-grey adherent membrane develops in the throat due to the infection. There is cervical lymphadenopathy. The toxin gets distributed haematogeneously and causes myocarditis, peripheral and cranial

AGEING AND HEALTH

neuropathy and renal failure. Diphtheria is a vaccine preventable disease. Routine immunisation is carried out in infancy and childhood.

Diphtheria vaccine

Loeffler discovered the causative agent of diphtheria, *Corynebacterium diphtheriae* in 1884. von Behring developed an antitoxin in 1890s and received the first Noble Prize in Medicine in 1901. He developed the first successful vaccine in 1913. Diphtheria vaccine contains a toxoid (a modified vaccine of diphtheria toxin). Adolescent vaccine contains a combination of small amount of diphtheria and tetanus toxoid (Td) which is modified to make them harmless and small amounts of purified components of pertussis acellular (ap) vaccine and aluminium salt (Tdap).

Vaccination

- Booster dose of diphtheria vaccine during 15-17 years of age
- all adults if they have not received booster dose of diphtheria vaccine in preceding 10 years

Recommendation

Diphtheria vaccine is useful in adults as the benefits of vaccine decrease with age without constant re-exposure. In adolescents /adults diphtheria toxoid combined with tetanus toxoid and pertussis acellular vaccine is given as a booster (Tdap)(30). Tdap vaccine is recommended on a single occasion in those who have completed a course of vaccine. The vaccine is also recommended to adults before planning pregnancy or for both parents as soon as possible at birth and to adults taking care of young children.

Pertussis

Pertussis or Whooping cough is a highly contagious infection of the respiratory tract. The causative agent *Bordetella pertussis* spreads through infected droplets and even by direct contact. It is a vaccine preventable disease and has been included in routine childhood vaccination program. It must be noted that immunization does not confer life-long immunity. Outbreaks of pertussis have been noted in

AGEING AND HEALTH

older children/adolescents exhibiting waning immunity. Booster dose of vaccine with an adult formulation is useful. The vaccine combined with diphtheria and tetanus toxoid is advocated for all women planning pregnancy, for both parents after delivery, for grand parents, and carers of children

Vaccine

After a successful immunization during infancy and childhood the fifth injection of pertussis vaccine is recommended during adolescence at the age of 15-17 years. The vaccine has lower concentration of pertussis antigens (ap) than found in childhood vaccine (aP). It successfully prevents them to become victims of whooping cough and a source of infection to infants.

Tetanus

Tetanus develops as a complication of wounds that have been contaminated by soil. The manifestations are produced by tetanospasmin, a neurotoxin secreted by *Clostridium tetanii*. The disease affects non-immunized or partially immunized persons, and the risk increases with age. The antibody levels are not in adequate amount to ensure protection in elderly persons. If the person has received the vaccination against tetanus within the past 10 years there is no need to give a booster in case of wounds or accident. Revaccination is recommended once in 10 years against tetanus.

Herpes Zoster

Herpes zoster is caused by varicella-zoster virus (VZV), which is also the causative agent of chickenpox. After recovery from chickenpox, the virus remains dormant in the dorsal root ganglion of sensory nerves from which they may get reactivated after many years to cause shingles. The risk increases after 60 years of age. Adults are given herpes zoster vaccine as a single dose of 0.65 ml subcutaneously in the deltoid region to prevent occurrence of herpes zoster and post-herpetic neuralgia (31). The vaccine contains live, attenuated varicella virus and is available as a lyophilized powder with a diluent. The vaccine should be administered

AGEING AND HEALTH

immediately after reconstitution to minimize loss of potency. Shingle vaccine is not recommended in the treatment of active shingles or post-herpetic neuralgia or genital herpes. The vaccine can be administered concurrently with other vaccines and it has to be stored in freezer (32).

The side effects of vaccine include erythema, pain and swelling. It is not advocated in those with a history of life threatening severe allergic reaction to gelatin or neomycin, and immunocompromised conditions.

Table 2: Indications and dose schedules of adult vaccines (33)

Vaccine	Indication	Dose schedule
Influenza	Adults, coexisting diseases like COPD, chronic kidney disease, diabetes,	TIV or Quadrivalent vaccine, single dose 0.5 ml IM annually
Pneumococcal	Adults, coexisting diabetes mellitus, COPD, bronchial asthma, smokers, immunocompromised conditions, influenza hepatitis C, nephrotic syndrome	0.5 ml IM/SC Efficacy persists for 5 years
Diphtheria, Pertussis, Tetanus,	All adults who did not have prior immunization	0.5 ml Tdap
Herpes zoster	Adults > 60 years of age	0.65 ml SC

References

1. Blender G, Guarente L. The Sir2 family of protein deacetylases Annu Rev Biochem 2004; 73; 417-35

AGEING AND HEALTH

2. Tissenbaum HA, Guarente L. Increased dosage of a sir-2 gene extends lifespan in *Caenorhabditis elegans*. *Nature* 2001: 410; 227-30
3. Rogins B, Helfand SI, Sir2 mediates longevity in the fly through a pathway related to calorie restriction. *Proc Natl Acad Sci USA*. 2004: 101; 15998-6003
4. Imai S, Armstrong CM, Kaeberlein M, Guarente L. transcriptional silencing and longevity protein, Sir2 is an NAD-dependent histone deacetylase *Nature* 2000: 403; 795-800
5. Kennedy BK, Gotta M, Sinclair DA, et al. Redistribution of silencing proteins from telomeres to the nucleolus is associated with extension of life span in *S cerevisiae*. *Cell* 1997: 89; 381-91
6. Milne JC, Denu JM. The Sirtuin family: therapeutic targets to treat diseases of aging. *Curr Opin Chem Biol* 2008; 12; 11-7
7. Asher G, Garfield D, Stratmann M, et al. SIRT1 regulates circadian clock gene expression through PER2 deacetylation. *Cell* 2008: 134; 317-28
8. Rodgers JT, Lerin C, Haas W, Gygi SP, Spiegelman BM, Puigserver P. Nutrient control of glucose homeostasis through a complex of PGC-1 alpha and SIRT1. *Nature* 2005: 434; 113-8
9. Nakagawa T, Guarente L. Sirtuins at a glance. *J Cell Sci* 2011: 124; 833-8
10. Guarente L. Sirtuins, aging, and Medicine. *N Engl J Med*. 2011: 364; 2235-44
11. Picard F, Kurtev M, Chung N, et al. Sirt1 promotes fat mobilization in white adipocytes by repressing PPAR-gamma. *Nature* 2004: 429; 771-6
12. Nisoli E, Tonello C, Cardile A, et al. Calorie restriction promotes mitochondrial biogenesis by inducing the expressions of eNOS. *Science* 2005: 310; 314-7
13. Purushotham A, Schug TT, Xu Q, Surapureddi S, Guo X. Hepatocyte specific deletion of SIRT1 alters fatty acid metabolism and results in hepatic steatosis and inflammation. *Cell Metab* 2009: 9; 327-38
14. Liu Y, Denin R, Chen D, et al. A fasting inducible switch modulates gluconeogenesis via activator/coactivator exchange. *Nature* 2008: 456; 269-73
15. Kawahara TI, Michishita E, Adler AS, et al. SIRT6 links histone H3 lysine 9 deacetylation to NF-kappa B-dependent gene expression and organismal life span. *Cell* 2009: 136; 62-74
16. Li L, Gao P, Zhang H, et al. SIRT1 inhibits angiotensin II-induced vascular smooth muscle cell hypertrophy. *Acta Biochim Biophys Sin (Shanghai)* 2011: 43; 103-9
17. Benigni A, Corna D, Zoja C, et al. Disruption of the Ang II type I receptor promotes longevity in mice. *Clin Invest* 2009: 119; 524-30

AGEING AND HEALTH

18. Ota H, Eto M, Kano MR, et al. Cilostazol inhibits oxidative stress-induced premature senescence via upregulation of Sirt1 in human endothelial cells. *Arterioscler Thromb Vasc Biol* 2008; 28; 1634-9
19. Li X, Zhang S, Blander G, Tse JG, Krieger M, Guarente L. SIRT1 deoxylates and positively regulates the nuclear receptor LXR. *Mol Cell* 2007; 28; 91-106
20. Kemper JK, Xiao Z, Ponugoti B, et al. FXR acetylation is normally dynamically regulated by p300 and SIRT1 but constitutively elevated in metabolic disease. *Cell Metab* 2009; 10; 392-404
21. Ponugoti B, Kim DH, Xiao Z, et al. SIRT1 deacetylases and inhibits SREBP-1C activity in regulation of hepatic lipid metabolism *J Biol Chem* 2010; 285; 33959-70
22. Donmez G, Wang D, Cohen DE, Guarente L. SIRT1 suppresses beta-amyloid neurodegeneration in models for Alzheimer's disease and amyotrophic lateral sclerosis. *EMBO J* 2007; 26; 3169-79
23. Min SW, Cho SH, Zhou Y, et al. Acetylation of tau inhibits its degradation and contributes to tauopathy. *Neuron* 2010; 67; 953-66
24. Haigis MC, Mostoslavsky R, Haigis KM, et al. SIRT4 inhibits glutamate dehydrogenase and opposes the effects of calorie restriction in pancreatic beta cells. *Cell* 2006; 126; 941-54
25. Alcain FJ, Villalba JM. Sirtuin activators. *Expert Opin Ther Pat* 2009; 19; 403-14
26. Bhattacharya PK, Murthi SV Adult immunization: Current scenario in India, in *Medicine Update*, Vol 28, Gupta P (Ed), Mumbai, Association of Physicians of India, 2018; 622-628
27. Sharma OP Relevance of adult immunization *Ind J Geriatr Care* 2018;7(1):9-19
28. WHO website on influenza vaccine viruses and reagents: <http://www.who.int/influenza/vaccines/virus/en/2018>
29. Bonten MJM, Huijts SM, Bolkenbaas M, et al Polysaccharide conjugate vaccine against pneumococcal pneumonia in adults *N Engl J Med* 2015;373: 1114-25
30. Hasselhorn HM, Nubling M, Tiller FW, Hofman MF. Diphtheria in adults. *Vaccine* 1998; 16; 70-5
31. Muruganathan A, Mathai D, Sharma SK (eds) Adult immunization, *J API* 2014: 1-270
32. Gagliardi AM, Andriolo, BN, Torloni MR, Soares BG *Cochrane Database Syst Rev* 2016; 3: CD008858. doi:10.1002/14651858.CD008858.pub3
33. Sharma OP, Shankar PS (eds) Vaccines at a Glance, New Delhi, Geriatric Society of India, 2014

CHOOSING A CAREER IN PUBLIC HEALTH

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INTRODUCTION

Health is "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity."¹⁽⁾ whereas, Public Health is defined as "the art and science of preventing disease, prolonging life, and promoting health through the organized efforts of society." There is no public health at the community level without health at individual level; both the concepts work hand in hand to serve the people. Promoting improved health and well-being of communities by strengthening integrated public health services and reducing inequalities emphasizes the overall vision of public health. Public health has an intersectoral and multisectoral approach in nature to promote health and prevent disease. Primary health care professionals are the key personnel behind the idea of public health.²⁽⁾ Scope of public health is multidimensional. The factors responsible for public health have been explained elegantly by Dahlgren-Whitehead 'rainbow model'. The model, developed by Göran Dahlgren and Margaret Whitehead in 1991 provides several factors at the individual, their environment and health. Individuals are placed at the centre, and surrounding them are the various layers of influences on health including individual lifestyle factors, community influences, living and working conditions, and more general social conditions.³⁽⁾



Fig-1: The Dahlgren-Whitehead rainbow model explaining determinants of health

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IMPORTANCE OF PUBLIC HEALTH

Public health is interdisciplinary. It integrates and transcends several disciplines. These include epidemiology, biostatistics, health management, demography, community health, environmental and occupational health, behavioral health, maternal and child health, mental health, health economics, and public policy among many others.

There is a popular phrase that "Prevention is better than cure." The backbone of public health is built on this concept. Preventive measures are always better to approach than curative care. It aids in prolonging life. Core areas of public health include protection, health promotion, and disease prevention. To fulfill these core activities, there should be good governance, advocacy, capacity building activities, information, and evaluation of the activities. Advances in public health contributed to the increase in life expectancy of individuals, reduction in maternal and child mortality, and reduction in infectious and Non-Communicable Diseases. Public health acts at the population level rather than at the individual level and influences policy formulation. Through the practice of public health, any health issues can be detected early and help in preventing the severity of disease through early management. Public health professionals always work for creating equity rather than equality. Information, Education, and Communication are integral in public health to reach lay community members. Health is a fundamental right of every individual, and hence public health covers all the population irrespective of their socio-economic status.(4)

Public health focuses on disease prevention but also for health promotion through organized action at a societal level.(5) Public health is a continually progressing field and assess the needs of the community population around the world. Public health initiatives such as family planning, immunization, clean air and water policies, motor vehicle safety measures have brought much more healthy life for all individuals in and around the world.(6)Public health continually works for the global health system strengthening.(7) Public health contributed to the medical

CHOOSING A CAREER IN PUBLIC HEALTH

practice by providing evidence-based findings and identifies effective interventions for better health outcome. It also assesses and identifies population needs for health care service and aids in decision making concerning health care. Cost-benefit and cost-effective analysis of any interventions will be known by public health.

Public health activities are carried out through research activities and survey in a community or at national and global level, where evidence-based findings will be gathered. Similarly, surveillance of the disease and outbreak investigation of the disease adds to evidence generation and disease prevention.

There are salient distinctions between public health and clinical health professions. Public health deals with health from a population perspective rather than a singular view at individual level. In contrast, clinical health care professionals deal with the health care issues most at individual level. A clinician typically assesses the symptoms, prescribe diagnostic tests, make the diagnosis, and prescribe the medicines or performs surgery. Whereas, public health approach deals with the entire city, state, or country and finds out the number of people with similar disease or symptoms or at risk. It works for reducing the exposure and prevent or control the disease burden at community level. It also checks for whether people with the illness have access to the health facility and getting necessary health care. Wider dimensions of public health such as health promotion, disease prevention, early diagnosis, and prompt treatment, disability limitation, rehabilitation enabled to reach every individual. In contrast to clinical care, Public health is the responsibility of all the sectors of society, health departments, coordinated efforts of multiple stakeholders such as NGOs, private sectors, Community, other areas of government, international organizations.

WHY A CAREER IN PUBLIC HEALTH?

There are multiple reasons for choosing public health as a career. These include job growth, job security, opportunity to perform a variety of roles, engagement with community, nation, and global health. Other

CHOOSING A CAREER IN PUBLIC HEALTH

reasons include a chance to travel, experiencing different cultures, learning new skills, dynamicity of the field, multidisciplinary approach, earn better salaries and leadership opportunity. Public health field is a right career choice for those interested in science; especially health care service and enjoy working with the Community. It is also an excellent choice for individuals who want to work with other professionals with collaborative skills to promote better health, interested in statistics, and demographic study.

The exponential growth of the population gradually increased the demand for public health professionals. A career in public health is of greater potential to doctors due to emerging nature of public health problems. These include pandemics of diseases, water and air pollution, bioterrorism, infectious, and Non-Communicable Disease burden and awareness regarding health. Public health professionals hence are in better demand to improve the health of local, national, and global communities. Thus, in this chapter, we presented the importance of public health, training options in public health, career options in public health, roles and responsibilities of public health professionals, the existing gap in the professionals, public health in India, public health and Sustainable Developmental Goals and way forward.

Table 1: Functions of public health professional

Functions of Public Health Professional	
Protecting people's health. * Promoting people's Health. * Restoring people's health. * Maintaining and improving health of people through – Collective action. – Social action.	* Programme addressing health needs of the population as a whole. Programmes emphasizing prevention not just cure. * Reducing the amount of disease, premature death and disease produced discomfort and disability in the population. * Promoting healthy life styles among the population. * Helping to create supportive environment for health

PUBLIC HEALTH TRAINING OPTIONS

Public health programs for medical doctors are grouped into two categories.

CHOOSING A CAREER IN PUBLIC HEALTH

- First route: These are through medical colleges by the program Doctor of Medicine (MD) and through National Board of Examinations (NBE) by postgraduate programs. MD programmes include MD – Social and Preventive Medicine/Community Medicine, PhD – Community Medicine, PhD – Hospital Administration, MD – Community Health Administration, MD – Tropical Medicine, MD – Hospital Administration, Master of Hospital Administration, Diploma in Public Health, Diploma in Community Medicine, Diploma in Hospital Administration, Diploma in Health Administration, Diploma in Health Education, Diploma in Industrial Health. Also, NBE includes Diplomate of National Board programs in Family Medicine, Social and Preventive Medicine, Health and Hospital Administration, Field Epidemiology, Maternal, and Child Health.(8)
- Second route: The second route includes other public health degrees. These include professional degrees of public health include Master of Public Health (MPH), Master of Science in Public Health, Master of Medical Science in Public Health, Doctor of Public Health, International Masters for Health Leadership. The specializations in these are available on various public health domains such as biostatistics, demography, occupational and environmental health, epidemiology, public health engineering, entomology, public health laboratory, health management/administration, health and hospital management/administration, Health economics, healthcare financing and health policy, Monitoring and evaluation, Public health nutrition, health promotion, public health law, Veterinary public health, Ethics, Maternal & child health.

Currently, doctors can choose the public health degrees by undergoing postgraduate courses in public health offered by recognized institutes of excellence. These include 1 year DPH, or 1 year

CHOOSING A CAREER IN PUBLIC HEALTH

postgraduate diploma in Public Health, 2 year MPH course, MSc (Public Health), or 3 years MD (Community Medicine), DNB (Community Medicine), MRC (Public Health), MPH (Honours), PhD in any discipline of Public health and other such courses will be recognized as relevant Public health degrees.(9)

Public health content areas for physician training includes biostatistics, Epidemiology, Environmental Health Sciences, Health services administration, Social and behavioral sciences, Informatics, Genomics, Communication, Cultural competence, Community based participatory research, Global Health, Policy and law, Ethics.

For a medical professional with interest in public health, for additional knowledge, certificate or master's degree in public health can be of a better choice. For busy professionals wanting to enroll in a public health program while working fulltime, online public health courses are available. For doctors with a master's degree in public health, interested in pursuing research by designing and implementing research studies; opting for doctorate programs in public health is an excellent career move.(10)

Public health courses in overseas countries are in great demand. These include Master's in Public Health, master's in health science, Masters in Behavioural Sciences, master's in advanced healthcare, Community Health, Masters in Medicine and Global Health, Masters in Public Health and Health Promotion, Healthcare Management, International Healthcare, Masters in Healthcare and Media Communications and online courses are available

A study in Cape Town found among MPH students; one fourth were physicians, they had more significant wish to undergo research training, acquire greater knowledge on health perspectives, to advance their career as researchers, policy makers. They strongly felt the need of undergraduate exposure to public health which may further increase uptake of public health training in advanced career."(11) A cross-sectional survey from South India found a limited preference for Community Medicine as a career choice.(12)

CHOOSING A CAREER IN PUBLIC HEALTH

Table-2: Find the Right Public Health Degree Program

Career Goals and Educational Needs	Certificate	Online	Master's	Doctorate
I am a doctor, but I have only a little formal education in public health. I would like to get additional knowledge, but I'm not sure I want to get a master's degree.				
Some of the jobs I'm interested only need a 2-year degree. However, I want the ability to get a degree if I change my mind.				
I want to work at improving the health of people around me. I'm not totally convinced of a particular career path, but I want to keep my options open and make sure that if I decide to get a graduate degree, I'll be ready.				
I have begun my career in public health, but I want to take it to the next level. I want to focus on the practice of improving public health, rather than teaching.				
I am currently a working in the medical field. I would like to enroll in a public health program, but I need to make sure I can still work fulltime and take classes when I have free time available, such as nights and weekends.				
I love research. My ultimate goal is to have a public health career where I get to analyze statistics and design research studies to figure out how to make people healthier.				

CHOOSING A CAREER IN PUBLIC HEALTH

CAREER OPTIONS IN PUBLIC HEALTH

One might choose medicine to make a difference or address societies health needs or help to improve quality of life or apply science to challenging problems or pursue opportunities for leadership. In Public health career, one can perform all these roles. Public health careers are available in a variety of settings such as local, state and national governments, regional and national health agencies and departments, private and public health-based organizations and foundations, nonprofit organizations, colleges and universities, insurance companies, faith-based organizations.

MPH graduates have the career opportunities in the broad areas such as health policy and management, Disease prevention and control, Health promotion, Occupational/environment health, Reproductive health, Oral health, Population health sciences, Public health laboratory, Public health/community health nurse, Entomology, Public health nutrition, Pharmaceuticals, Global health, Health insurance and finance, Hospitals, Academia and research institutes. (6)

Specific positions are available such as, policy advisor/policy analyst, public health physician, epidemiologist, surveillance officer, Monitoring and evaluation coordinator, data manager, statistician, health educator counsellor, mass medical coordinator, environmental scientist, public health/sanitary engineers, factoryinspectors, HIV/AIDS specialists and sexual/reproductive health counsellor. Other positions include demographer, entomologist, vector biologist, food inspector, drug inspector, jobs in food safety, pharmacovigilance, drug research, public health preparedness, surveillance, policy adviser, health economist, health insurance advisor. Public health specialist, hospital managers, Research officers, research associates. (13) A qualitative study to explore the views of postgraduates students of public health regarding their career choice elicited both positive and negative attitudes toward the public health discipline with more negative feedback. '(14) Hence the need for public health should be clearly understood by the

CHOOSING A CAREER IN PUBLIC HEALTH

similar discipline people, and then only the concept of public health can be reached to the public.

Public health professionals can work in the domains such as teaching and training, research, policy and programs and practice and serve in public and private sector as well.



Figure 2: Career opportunities for public health professionals in different sectors

Public health professional has career opportunity as according to subjects such as Epidemiology, biostatistics and data management, demography, health management, hospital management, environmental health, occupational health, social and behavioural sciences, health economics, health financing, nutrition, veterinary public health, entomology, public health engineering, health promotion, health communication, health

CHOOSING A CAREER IN PUBLIC HEALTH

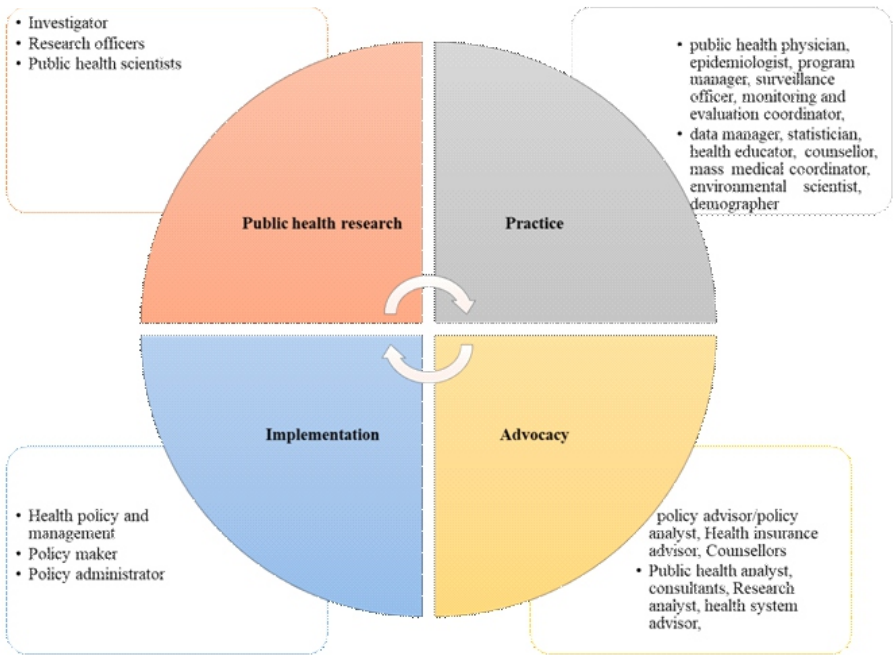
journalism, public health laws, disease-specific expertise, public health laboratory, health policy, ethics, Monitoring and evaluation, international and global health, oral health, family health. Also, in emerging areas such as Pharmaceuticals, Medical Insurance, Quality Management, Medical Tourism, Wellness, Clinical Research, Corporate Hospitals, Neutraceuticals, Devices, Health Technology, Consulting firms.

In the pharmaceutical sector, options include clinical research (epidemiological study, clinical trials, evidence generation), medical affairs (scientific engagement, product promotions, medical information, pharmacovigilance) and in public health (scientific meeting). Also, in clinical research as clinical operations, pharmacovigilance, medical writing, and data management. In health insurance such as life insurance companies, non-life insurance companies, specialists in health insurance companies. One can serve in disease modelling, meta-analysis, advanced statistical analysis, big data analytics, GIS, economic analysis, policy analysis, grant writing, etc. Can work in other entrepreneurship such as NGOs, preventive care setups, consultancy, etc.

National Health Policy 2017, provided special emphasis on public health management cadre. This policy proposed the creation of public health management cadre in all states based on public health or related disciplines, as entry criteria. The policy advocates an appropriate career structure and recruitment policy to attract young and talented multidisciplinary professionals. Policy considered both Medical and health professionals and professionals coming from diverse background to undergo public health management training. (15)

Skills needed for health professionals in the current century are communication, collaboration, critical thinking, creativity, problem-solving, innovative, thinking outside the box, self-reflection, leadership, proactiveness, decision making.

CHOOSING A CAREER IN PUBLIC HEALTH



OPPORTUNITIES IN PUBLIC HEALTH

There are three different divisions of public health, such as public health practice, advocacy, and research. In practice, professionals generally help the implementing agencies (Government and others) for addressing public health needs at the community levels.

The term “public health practice” is used to describe the core public health workforce who work in various areas of public health, including health improvement, health protection, and health and social care quality. They may work in the public, private and voluntary and community sectors. Although they work in different areas of public health, public health practitioners all contribute to public health outcomes and improving health and wellbeing. Public health practitioners work in many places and in many areas of public health. For example, they may support healthy lifestyle programmes, helping individuals and groups to stop smoking and take more exercise. To take

CHOOSING A CAREER IN PUBLIC HEALTH

another example, they may work on immunisation programmes and screening, based in local communities or in public health teams specialising in health protection. Some public health practitioners may play an important role in national and local health campaigns.

Advocacy is a key for overcoming major barriers to public health. The modern use of the term advocacy gained momentum from the Ottawa Charter on Health Promotion (a landmark definition of health promotion): “Political, economic, social, cultural, environmental, behavioral and biological factors can all favor health or be harmful to good health. Health promotion aims at making these conditions favorable through advocacy for health”. Advocacy has a key role in building and maintaining public health programs and is essential to shape the social and political climate.

Research in public health studies existing burden of mental health issues and risk factors as well as future associated conditions linked with mental health problems.

PUBLIC HEALTH PRACTICE AND ADVOCACY

Globally there is a wide gap in health professionals, and it is increasing further. As of 2012, there was 7.2million shortage of health care professionals, and it is projected to grow to 12.9 million by 2035. There are multiple challenges for these shortages, and they are a shortage of workforce, skill mix imbalance, mal-distribution of health workers, negative work environment, and inadequate knowledge among health workers. Health workforce consists of doctors, nursing and midwifery professionals, pharmacists, dentists, paramedical workers, grass-root level health workers, other health workers, and support staffs and more importantly, public health professionals in the medical and non-medical field.

A public health professional is a person educated in public health or a related discipline which is employed to improve health through a population focus. Public health has its applications in broader sectors due to its trans-disciplinary nature and approached. Therefore, it has

CHOOSING A CAREER IN PUBLIC HEALTH

expanded the role and scope and provides several work opportunities for public health professionals. Public health offers ample opportunities at different positions. Thus, public health is unique as a discovered discipline, which means that it is not a person's first profession but a choice embraced later in one's career.

There is an urgent need for public health professionals in India as the country is facing severe shortage of public health professionals. Estimates suggest India needs more than 10,000 public health professionals. An approximate estimate of 10,000 + for Government Sector, 2500 to 4000 for the NGO Sector and 1000 for the programs run by international agencies. If we categorize, vertically, at Central Level – 100, State Level – 600, District Level – 3000, Block Level – 10,000 public health professionals are required. There is no standard norms or benchmarks for public health professional's requirement in India. According to ASPH [US] benchmark of estimating public health workforce should be 220/1,00,000, hence India would require 26,40,000 public health professionals.

INTERNATIONAL ORGANIZATIONS

Graduates in public health can join government agencies such as World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), The National Institutes of Health (NIH), other government and private organizations such as Occupational Safety and Health Administration (OSHA), Food and Drug Administration (FDA), The Environmental Protection Agency (EPA), in nonprofit organizations such as American Red Cross, Planned Parenthood, The Allies for Health and Wellbeing, also in health care organization such as health care systems, hospitals, in educational institutions towards academic programme. Also have the opportunities in donor organization such as The United States Agency for International Development (USAID), Gates Foundation, World Bank, etc. Scope of public health courses also falls into National Rural Health Mission and Other Government Initiatives, health care analytics, big data, Geographical Information System (GIS), research,

CHOOSING A CAREER IN PUBLIC HEALTH

insurance sector, policy management, and administration. 1617(,) Highest paid career in public health care in the field of health and safety engineer, environmental scientists, healthcare administrator, biostatistician, epidemiologist and for doctorate holders.18() Within the public health sector, other specializations such as public health research, public health management, public health technology, public health nutrition, public health communication, health economics, and finance, etc. are of many essential and growing fields.

Huge career options in public health in other countries are available. These include positions of public health epidemiologist, public health analyst, health scientist, health education specialist, public health advisor, faculty in public health, program coordinator, consultants, research analyst, program associate, statistician, workforce and career development specialist, health systems advisor, research specialist, management and program analyst.

PUBLIC HEALTH JOBS IN GOVERNMENT

In India, after completion of pre-determined years of service in public health and acquiring a relevant postgraduate qualification in public health, promotion opportunities are available based on seniority. Every officer promoted should spend a month in "Induction Training" in Public health management. After completing at least three years at the block level, people with relevant postgraduate qualifications and based on performance can enter a list for District level Program Officers. Selection for program officers at the district level can be made from the seniority list maintained by departments. After completing at least three years as District level Program Officers (DLPO), an officer can be eligible to enter a list for promotion to Deputy Director (Public Health). Deputy Director (DDD, Public health) may be the new designation of District Health and Family Welfare officer. Deputy Director (Medical Services) can be the corresponding designation for District Surgeon. The number of positions of DD (Public health) can be consolidated based on the number of districts and those that are available at the state level. An officer with relevant postgraduate qualifications after completing at least 18 years of

CHOOSING A CAREER IN PUBLIC HEALTH

service can be chosen as Joint Director. Additional Director (Public Health) can be selected only among those from Joint Directors (Public health) who have spent at least 2 years as Joint Director. Director (public health) can be chosen only from among Additional directors (public health), who have spent at least one year as Additional Director.⁹⁾

HEALTH POLICY AND MANAGEMENT

Public health professionals trained in health policy and management have the employment opportunities in government health agencies like Centre for Disease Control (CDC), National Institutes of Health, union, state, and local health departments. They can also work in academic settings where one can serve, such as university health sciences centers or hospitals, or in the private sector, such as pharmaceutical companies, managed care organizations and other health finance organizations. According to experts in this field, health policy and management professionals must be thorough regarding resource allocation. Careers in the health administration's public sector usually require an MPH. In the private sector, a master's in health administration (MHA) or master's in business administration (MBA) are useful components of any health administrator's educational background. Health care administration performs tremendous responsibilities such as managing human resources, recruiting, hiring, and orienting new hires, planning, budgeting, etc. One should ensure that adequate revenue is maintained, expenses balanced, and staff must have access to the right equipment and supplies in sufficient quantity.

EPIDEMIOLOGIST

Epidemiology is the essential practice of public health and preventive medicine. Epidemiological studies provide the basis for preventive approaches in medicine and public health. Epidemiologists are called as "the disease detectives." They investigate the incidence of disease in a community. Other fields, such as environmental or occupational epidemiology, deal with problems from conditions of the global physical environment or in the workplace. There are different

CHOOSING A CAREER IN PUBLIC HEALTH

paths to the profession of epidemiology. Easier is a master's in public health with a specialization in epidemiology. Physicians, nurses, and others, such as nutritionists, who may also become epidemiologists by master's in public health, either before or after graduation from medical, nursing, or other professional schools. Even doctorate in epidemiology (Ph.D.) or public health (DrPH) with a concentration in epidemiology can be chosen.

MCH HEALTH OFFICER

The field of Maternal and Child Health (MCH) is one of the most significant opportunities for public health practitioners. Most of the resources are allocated in the ongoing public health programs are focused on MCH services. Other areas include Family planning, women's health, prenatal services, and management of high-risk pregnancy and infertility.

NUTRITION SPECIALIST

Food has a significant impact on health and well-being. Public health nutritionist educates communities about nutrition, promotes and implements the nutrition policy at the local, state, and federal government levels. One who enjoys interacting with people connects easily with others and believes that sharing knowledge will make a difference; then this field is highly valid. The required skills include an understanding of the sciences of nutrition and physiology and psychology.

HEALTH EDUCATOR

Public health educators (PHEs), modify the policies and environments as well as attitudes and behavior that affect health in a community. PHEs plan, design workshops, and forums work with community groups and serve a broad public health program. They conduct studies of public health education needs, evaluate the materials and methods used in applications, determine program effectiveness, improve the general health in communities, organize and address

CHOOSING A CAREER IN PUBLIC HEALTH

health-related issues such as pollution, drug abuse, nutrition, safety, and stress management. They provide health education materials such as fact sheets, pamphlets, and brochures for the easy understanding. Experts say they have the most significant impact in raising awareness, providing information, supporting and leading advocacy efforts, and sharing and augmenting skills. Public health educators work in other settings such as agencies, businesses, and schools to develop and deliver educational programs and provide counseling services.

COMMUNICATION SPECIALIST

Importance of effective public health communication is to encourage people to change certain attitudes, beliefs, or behaviors so that they adopt better health practices and ultimately improve their health. Highly useful channels for public health communication are interpersonal communications, print publications, electronic communications, and mass media. Interpersonal communication programs include training of counselors and providers and recruitment of local health advisors to conduct associated outreach activities.

STATE ENVIRONMENTALIST

The primary role of environmental health science (EHS) is to recognize and identify critical environmental exposures and risk factors which may adversely impact human health. Degree with MPH is highly beneficial as it provides multidisciplinary exposure and effective in management, epidemiology, and biostatistics. Also, a particular skill learnt, such as problem-solving, is highly necessary for this field. The environmental health practitioner may also choose other areas such as Toxicology to perform laboratory experiments on animals to assess certain environmental threats which may cause harm to the public.

PUBLIC HEALTH RESEARCH

Public health researchers aim to explore on the influence of the determinants of health, i.e. factors (genetic, environmental, social, etc.) which determine population health. The objective is to use this

CHOOSING A CAREER IN PUBLIC HEALTH

knowledge to propose interventions and policies, based on scientific evidence, to help improve health and well-being, and reduce health inequalities. In practical terms, public health researchers study population health, well-being, disability and loss of independence the determining factors for these statuses, whether biological, behavioral, social or environmental. In addition, they develop and assess interventions aiming to improve population health, prevent disease, and compensate for disabilities and loss of independence, innovations in terms of the organization of health services, social services and medical/social services.

Public health research is characterized by its multidisciplinary and cross-cutting approach. It draws on epidemiology, biostatistics, human and social sciences applied to health, biology, genetics, and toxicology. It usually requires the analysis of data on population samples, on varying scales, depending on the purpose of the research. There are several studies that a public health researcher conducts. Some of the studies are given below.

- Cohort studies: These involve monitoring a group of individuals sharing a number of common characteristics over time, so as to identify the occurrence of a health event of interest (disease or physical dysfunction). Individual monitoring evidences risk factors or protective factors for the health event studied.
- Case-control studies: These involve recruiting individuals presenting the health event of interest and control subjects not presenting this event. Data are collected on all participants in the two groups, with the aim of highlighting risk factors or protective factors for the health event studied.
- Cross-sectional studies: These observational studies serve to describe the characteristics and exposure concerning a population, at the time of recruitment into the study. These may be repeated over time, so as to compare the data obtained and thus analyze their changes over time.

CHOOSING A CAREER IN PUBLIC HEALTH

PUBLIC HEALTH IN INDIA

India has made substantial progress in provision of health services during the past century. The country has eradicated small pox, plague, and guinea worm infection, and polio transmission. In recent years, implementation of the National Rural Health Mission (NRHM), has demonstrated clear progress in terms of reducing Infant and maternal mortality. Nevertheless, several gaps remain, such as large rural-urban differences in health indicators and inter-state and regional disparities. Infant and maternal mortality, under-nutrition, has to manage dual burden of communicable as well as NCDs. These problems have been compounded by the lack of training in Public health as well as the lack of a public health cadre in the health workforce. There is a pressing need to understand and address the underlying reasons for these gaps. Hence, structural reforms are necessary, to ensure a better balance between preventive and curative public health priority and sustain swift and effective local responses to Health problems.

According to India's National Health Policy, India is committed to ensure the availability of adequate numbers of public health professionals. In reality, the current workforce lacks capacity (headcounts) and the competence (capability) to meet current public Health needs. The Indian Public Health Association (IPHA) has recommended the creation of a specialized cadre of Public Health managers to address the current public health challenges and to upgrade the status of public health services. The creation of a new public health cadre has the potential to result in an efficient public health management system delivered by teams of well-qualified and competent workers who are otherwise not burdened with providing treatment and care services. The good news is that the Government of India and several state Governments such as that of Karnataka are planning introduce a dedicated cadre of Public Health Professionals into their health workforce. Also, the Government of India has initiated the process of creating an all India cadre termed as Indian Medical Service, similar to that of Indian Administrative Service (IAS) and Indian Police Service

CHOOSING A CAREER IN PUBLIC HEALTH

(IPS). Currently, the centre has sought consultations from the state Governments for inputs. The proposed public health cadre can offer high quality training and appropriate career structure and recruitment policy to attract young and talented multi-disciplinary professionals committed to health promotion.

From our earlier review, we found that public health training program should provide core public health skills and competencies in the areas such as surveillance and health assessment. It also should have the ability to assess health evidence, contribute to public health strategy and policy and leadership and collaborative practice. Also, clear job roles and responsibilities for public health practitioners at each level need to be established. Public health once enrolled for the post; their responsibility is not only for public health alone, but also have significant influence on determining the broader determinants of health.

A common purpose of all public health institutions and their workforces should be linking the public health practice, policy, teaching, and research to the highest level possible. Hence what we require is a formal universal accreditation system, a new method of networking and mutual support, and creation of specialist public health cadre. Also requires inter-sectoral coordination among stakeholders and organizations, convergence among essential sectors and organizations can aid in the development of public health systems. Hence building such a network can strengthen the sharing of knowledge, roles, and responsibilities, and resources for comprehensive health development. This platform can enhance the existing system to contribute towards achieving the shared goals of Public Health in India.¹⁹⁽⁾

There are multiple opportunities for improving the public health system in India, as evidenced by earlier analysis. The Private health system in India is deregulated including reported dichotomy of consultation and diagnostic fees, which in turn adds on to an extra burden of expenditure on the common man which can be regulated by strict government rules. Implementing a system of scheduled annual or timely examinations for professional license renewal and continuing

CHOOSING A CAREER IN PUBLIC HEALTH

medical education programs (CMEs), which would be compulsory for the professionals to attend and participate in. Public health training and public health research, being two important aspects require immediate attention. There is a clear and definite need for establishing public health institute in every state, to focus and help in alleviating the varied challenges plaguing the regions. Management of the public health system must be done at the hands of a trained and professionally skilled workforce. A new service such as the "Indian Health Service" should be created with high priority, which should be equated to Indian Administrative Service (IAS) in terms of implementation powers' and economic structure.²⁰⁽⁾ This can be termed as Public Health Cadre, and can fill positions from Taluk level officers, District level officers, and State level officers. We recommend time-bound promotions of medical officers per published and updated typical seniority list, which is the basis for all service matters.²¹⁽⁾ In terms of human resource, it is an essential component of any public health system.

Progress on public health cadre in India are recommendation of training of the public health workforce by Health Survey and Development Committee, endorsement of the creation of an All India public health cadre by the High level expert group on Universal Health Coverage, establishment of public health cadres and their empowerment under the Public Health Act by the Steering committee, approve of an action point to strengthen public health cadres in states through innovative means by the Union Minister for Health, recommendation that adequately trained professionals hold senior leadership positions in public health by National Health Policy, proposal for establishment of Public Health cadre to expedite improvement in health in India at annual Conference of Indian Association of Preventive and Social Medicine.²²⁽⁾

In India, health service system necessitates that doctors trained in the technical, social, and managerial public health dimensions provide leadership to the system. They need to continuously supported by other people because of performing multiple tasks, to reduce the burden of non-clinical tasks, health management experts to fulfill the requirement administrative complexity.²³⁽⁾

CHOOSING A CAREER IN PUBLIC HEALTH

The concept of public health in India brought better health outcomes. Life expectancy India has increased from 64 to 68 years in a recent decade. The primary trend was seen in infectious diseases, focus given to prevention aspects, decrease neonatal mortality rates, tackling antimicrobial resistance, improvement in nutrition, use of digital health, stronger government accountability is seen in recent decades due to the public health interventions.²⁴⁽⁾

The public health care system in India is organized into primary, secondary, and tertiary levels. At the fundamental level, we have sub-centers and Primary Health Centres (PHCs). At the secondary level includes Community Health Centres (CHCs) and smaller Sub-District hospitals. At the tertiary level, there exists medical colleges and district hospitals and general hospitals.²⁵⁽⁾

PUBLIC HEALTH RESPONSIBILITY OF EVERY DOCTOR

All medical doctors play a role in the public health system and contribute to public health, but their roles and responsibilities vary. Every physicians or doctor need to work with staff nurses, Auxiliary Nurse Midwives (ANMs), laboratory workers, epidemiologists, dentists, veterinarians, environmental health specialists, health educators in a collaborative way to achieve the high-quality practice of public health. All medical doctors intersect with public health in the majority of the activities practiced. Some public health elements need to cover the doctor's practice. They have a significant role in public policymaking by sharing the experiences from disease prevention aspects. Doctors can also have careers in public health. They can choose it as an entire profession by specializing in any field of public health and or enter it as a change in specialty at some point in their career. They have a crucial role in identifying the areas which require both clinical health expertise and public health expertise. They should exhibit leadership qualities, especially in an emergency related to health. Ideally, they should perform Meta leadership.

Public health functions are grouped into five categories such as policy development; collecting and disseminating evidence for health

CHOOSING A CAREER IN PUBLIC HEALTH

policies, strategies and actions; prevention and control of disease; inter-sectoral response for better health; and human resource development and capacity building. 26) Medical practitioners have direct role in public health in terms of essential public health functions such as surveillance, Research and Control of Risks and Damages in Public Health, health promotion, Social Participation and Empowerment of Citizens in Health, Evaluation and Promotion of Equitable Access to Necessary Health Services, Ensuring the Quality of Personal and Population-Based Health Services. Training in public health can also help the physician to transition from clinical career to research, policymaking, management role, create effective health system by addressing the health needs of the population. "11()

WAY FORWARD

Key issues in global public health such as poverty, hunger and food security, health, education, gender equality, and women's empowerment, and water and sanitation are directly related to the concept of public health. A robust public health cadre, skilled workforce is must and urgently needed to achieve sustainable development goals by 2030. Specific interventions such as improving diet, iron supplementation, food and water supplementation, immunization, universal screening for disease, healthy lifestyle modification activities, health promotion activities achieve SDG targets. Public health workforce from the Community to global level should contribute to the highest level possible and work collaboratively, which makes successful attaining of SDGs as proposed.

Public health shouldn't be the last choice. Choice of choosing public health shouldn't be for the reason as it is easier to get the seat in public health courses compared to other higher degrees. Also, higher positions in national and international levels or government sector jobs are available choosing public health career. Of course, these are personal benefits of choosing public health career, but most importantly, positive attitudes towards public health discipline must be developed to work for the core aim of public health and achieve health goals and targets. A

CHOOSING A CAREER IN PUBLIC HEALTH

clinical specialist can investigate public health career at any point of time in his or her career since the preventive aspect of the disease is much more important than curative elements. Information in public health is generated through research activities. Research in public health is a highly focused area at present world where evidence is gathered for burning public health issues. Every doctor or clinical practitioners should contribute to public health activities along with their usual practice, whereas few can dedicate work in the field of only public health in an entire career.

There is a need to improve public health training programs in India. Initiatives need to be taken from public health institutions to overcome the shortage of public health professionals. There is a great need to strengthen the public health workforce in India as well as a strong urge for the career pathway for MPH graduates in the national public health infrastructure.²⁷⁾ Specific strategies need to be made to increase the number of faculty and career opportunities for public health professionals in India.²⁸⁾ For further promotional opportunities in the public health profession, the number of years spent in Public health education and research should be counted. Public health cadre creation is much more essential for developing world to provide health promotion strategies. Evidence-based public health is critical in the present world.

REFERENCES

1. WHO. WHO remains firmly committed to the principles set out in the preamble to the Constitution [cited 2019 August 26]. Available from: <https://www.who.int/about/who-we-are/constitution>
2. WHO. Public health services [cited 2019 July 25]. Available from: <http://www.euro.who.int/en/health-topics/Health-systems/public-health-services/public-health-services>.
3. Whitehead M, Dahlgren G. Concepts and principles for tackling social inequities in health: Levelling up Part 1. World Health Organization: Studies on social and economic determinants of population health. 2006; 2.
4. Birmingham city sohs. Why is Public Health so important? Available from: <https://www.bcu.ac.uk/health-sciences/about-us/school-blog/why-is-public-health-important>.
5. Kumar JR. Role of public health systems in the present health scenario: key challenges. Indian journal of public health. 2013;57(3):133.

CHOOSING A CAREER IN PUBLIC HEALTH

6. university W. What Is Public Health and Why Is It Important? . Available from: <https://.www.waldenu.edu/programs/health/resource/what-is-public-health-and-why-is-it-important>.
7. Bloland P, Simone P, Burkholder B, Slutsker L, De Cock KM. The role of public health institutions in global health system strengthening efforts: the US CDC's perspective. *PLoS medicine*. 2012;9(4):e1001199.
8. Tiwari R, Negandhi H, Zodpey S. Forecasting the future need and gaps in requirements for public health professionals in India up to 2026. *WHO South-East Asia Journal of Public Health*. 2019;8(1):56.
9. Babu GR. India's tryst with creation of public health cadre. *Annals of Tropical Medicine and Public Health*. 2011;4(2):143.
10. PUBLIC HEALTH DEGREES & CAREERS. How to Work in Public Health [cited 2019 August 13]. Available from: <https://.www.learnhowtobecome.org/medical-health-careers/public-health/>.
11. Zweigenthal VE, Marquez E, London L. Why do an MPH? Motivations and intentions of physicians undertaking postgraduate public health training at the University of Cape Town. *Global health action*. 2016;9(1):32735.
12. Kar SS, Ramalingam A, Premarajan K, Roy G. Do medical students prefer a career in community medicine? *International journal of preventive medicine*. 2014; 5(11):1468.
13. Sharma K, Zodpey S, Syed Z, Gaidhane A. Career opportunities for master of public health graduates in India. *Asia Pacific Journal of Health Management*. 2013;8(1):45.
14. Kumar R, Singh A, Gupta SN. Public health as a career option: postgraduate students perspective. *Red*. 2013;1(1).
15. National Health Policy 2017. In: Welfare MoHaF, editor.: Government of India; 2017.
16. Careers in Public Health: Career Scopes, Top Colleges and Salaries [updated November 30, 2018]. Available from: <https://.www.stoodnt.com/blog/public-health-careers/>.
17. Everything you need to know about MPH (Masters in Public Health) 2016 [cited 2019 August 15]. Available from: <https://medical.prepladder.com/dental/203-everything-you-need-to-know-about-mph-masters-in-public-health.html>.
18. Highest Paid Public Health Careers [cited 2019 August 15]. Available from: <https://.www.publichealthdegrees.org/highest-paid-public-health-jobs>.
19. Sathyanarayan T, Babu GR. Creating a public health cadre in India: the development of a framework for interprofessional and inter-sector collaboration. *Journal of interprofessional care*. 2011;25(4):308-10.
20. Babu GR. " Opportunities for improving public health system in India" analysis of current state of affairs and pointers for future. *Annals of Tropical Medicine and Public Health*. 2011;4(2):69.
21. Babu GR, Sathyanarayana T, Shapeti SS, Halagi P, Raveendra H. Creation of Public Health Cadre in Karnataka State, India. *Annals of Community Health*. 2014;2(2):4-14.
22. Kumar S, Bothra V, Mairembam DS. A dedicated public health cadre: Urgent and critical to

CHOOSING A CAREER IN PUBLIC HEALTH

- improve health in India. Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine. 2016;41(4):253.
23. Priya R, Chikersal A. Developing a public health cadre in 21 st century India: addressing gaps in technical, administrative and social dimensions of public health services. Indian journal of public health. 2013;57(4):219.
 24. Jain N. 7 ways public health in India has changed over the last decade 2018 [cited 2019 August 26]. Available from: <https://.www.path.org/articles/7-ways-public-health-india-has-changed/>.
 25. Chokshi M, Patil B, Khanna R, Neogi SB, Sharma J, Paul V, et al. Health systems in India. Journal of Perinatology. 2016;36(s3):S9.
 26. bank W. Public Health and World Bank Operations.
 27. Tiwari R, Negandhi H, Zodpey S. Current status of master of public health programmes in India: a scoping review. WHO South-East Asia journal of public health. 2018;7(1):29.
 28. Zodpey SP, Negandhi H, Yeravdekar R. Future directions for public health education reforms in India. Frontiers in public health. 2014;2:68.



MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

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MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

Introduction:

Major congenital malformations incompatible with life occur in 2-3% of all foetuses.¹ They are the cause of 20 – 30% of perinatal deaths.² Rate of body growth is greatest from 12th to 16th weeks of foetal life. Etiology of congenital malformations are primarily due to genetic or environmental factors. Malformations caused by genetic factors are secondary to chromosomal abnormalities or mutant genes. Environmental factors influencing foetal growth are drugs, environmental chemicals, maternal metabolic imbalance, infection, and radiation.³

Antenatal screening and diagnosis serves to increase the possibility of optimal care of the pregnancy in terms of antenatal care and referral for birth as required.

Timing of Antenatal visits:

First Visit: The first visit or registration of a pregnant woman for ante-natal clinic (ANC) should take place as soon as the pregnancy is suspected. Every woman in the reproductive age group should be encouraged to visit her health provider if she believes she is pregnant. Ideally, the first visit should take place within 12 weeks.

Second visit: Between 14 and 26 weeks

Third visit: Between 28 and 34 weeks

Fourth visit: Between 36 weeks and term.^{3,4}

Antenatal Screening and Diagnosis:

Many screening and diagnostic procedures (both non-invasive and invasive) are available. Techniques for screening fall into two groups:

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

a) **Non-invasive:** biochemical markers, isolation of foetal cells in maternal circulation, and ultrasound.

b) **Invasive:** amniocentesis, chorionic villi sampling, foetal blood and tissue sampling.

First-trimester prenatal screening:

During the first trimester of pregnancy, different serological components present variations, but only free Human chorionic gonadotropin (β -hCG) and Pregnancy-associated plasma protein-A (PAPP-A) were associated with the presence of a trisomy 21 and chromosomal anomalies. Other serological marker could be ADAM-12. During the first trimester of pregnancy many ultrasonographic markers of fetal aneuploidy were described, but the most used are nuchal translucency and nasal bone (NB).

Chorionic villus sampling (CVS) is invasive method that allows prenatal diagnosis in the first trimester of pregnancy, typically at 10–12 weeks of gestation. It is done through trans-abdominal or trans-cervical route, under ultrasound guidance. The samples obtained contain trophoblast cells (derived from fetus) and maternal decidua cells.^{3,4}

Second-trimester prenatal screening:

Second-trimester serum markers are represented by alpha-fetoprotein (aFP), human chorionic gonadotropin, unconjugated estriol (μ E3) and inhibin-A.

The serum markers used in second-trimester screening (aFP, μ E3 and inhibin-A) show minimal differences in trisomy 21 pregnancies and thus can't be used in first-trimester screening. The serum markers could be combined in different ways; however, the most commonly used tests are double test (association between aFP and hCG), triple test (association between aFP, μ E3 and hCG), and quadruple test (association between aFP, μ E3, hCG and Inhibin-A).

Amniocentesis is an invasive procedure performed from the 16th week of gestation and involves the trans-abdominal extraction of 10–20 ml of amniotic fluid, under ultrasound guidance.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

Cordocentesis is also an invasive method that consists of trans-abdominal or trans-vaginal puncture of the umbilical cord under ultrasound guidance in order to obtain small amounts of fetal blood. The method is performed after 20 weeks of pregnancy and has a reduced applicability in the diagnosis of chromosomal diseases. It is usually undertaken to diagnose fetal blood diseases.

During the second trimester of pregnancy different ultrasonographic markers could be identified, as well as major congenital anomalies. The most common markers in the second trimester are nuchal thickening, hyperechoic bowel, shortened extremities, renal pyelectasis, echogenic intracardiac foci (EIF) and choroid plexus cysts.

Ultrasound scanning is non-invasive, most affordable and low risk technique. The accuracy of ultrasound depends on the ultrasonographic skill, gestation age and type of malformation. 3-D Ultrasound ,4-D ultrasound displayed over time will display images in different orientation which improve accuracy in detecting structural malformation.

When ultrasound techniques became sufficiently powerful, many countries introduced a second trimester (Level 2) ultrasound screening test compulsory to detect these anomalies. The second trimester targeted scan is done between 18 and 20 weeks. The primary objective of this scan is to do a detailed anatomical evaluation of the fetus and to maximize the detection of anomalies that may be present at this stage. Alternate names for the study include **second trimester anatomy scan, fetal anomaly scan** or **targeted imaging for fetal anomalies (TIFFA)**.^{4,5}

Foetal malformations detected by Antenatal Ultra-sonography are Spina Bifida and hydrocephalus, CNS/Craniofacial, Abdominal wall defects, Oesophageal atresia, Duodenal atresia, Multiple pregnancy, Renal tract disease, Cystic lung diseases, Congenital diaphragmatic hernia, Bladder exostrophy, Cardiac defects, and Cleft lip/palate.

[Antenatal screening](#), particularly the use of routine mid-trimester ultrasound screening, has altered the diagnosis of major [congenital malformations](#). As a result, in many parts of the world it is now uncommon

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

for major malformations to be discovered at birth. Antenatal diagnosis potentially allows targeted diagnostic testing, planning of delivery, counseling and education of couples and earlier postnatal intervention for newborns with congenital malformations. However, antenatal diagnosis may identify severe abnormalities where treatment is unavailable, or unlikely to be successful, and where fetal or neonatal death is a likely outcome. Such cases are often referred to as 'lethal malformation'.

Obstetric markers for fetal congenital anomalies later in pregnancy include poly- and oligo-hydramnios, severe fetal growth restriction and fetal cardiac arrhythmias. In this subset of women the prevalence of fetal congenital anomalies approximates 40 to 60%.

Antenatal presentation and consequences of various fetal malformation are shown in table 1.³

Table 1. Presentation and consequences of fetal Malformations Fetal

Malformation	Fetal Presentation	Fetal/Neonatal Consequences
Posterior urethral valves	Hydronephrosis and Oligohydramnios	Renal dysplasia and renal insufficiency Pulmonary hypoplasia and respiratory insufficiency
Cystic adenomatoid malformation of the lung	Chest mass with mediastinal shift and hydrops	Pulmonary hypoplasia and respiratory insufficiency
Congenital diaphragmatic hernia	Herniated viscera in chest respiratory	Pulmonary hypoplasia and insufficiency
Twin–twin transfusion syndrome	Oligohydramnios and polyhydramnios	IUFD, heart failure, MLE
Acephalic-acardiac twin	IUFD	
Sacrococcygeal teratoma	High-output failure hydrops	IUFD, prematurity, hemorrhage
Complete heart block	Hydrops	IUFD
Fetal neck mass	Polyhydramnios	Inability to ventilate due to lack of airway

IUFD: intrauterine fetal death; MLE: multifocal leukoencephalomalacia

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

Antenatal Counselling:

Antenatal Diagnosis has four main purposes;

- 1) To inform and prepare parents for the birth of an affected infant;
- 2) To allow in utero treatment or delivery at a specialist centre for immediate postnatal treatment;
- 3) To allow termination of an affected fetus;
- 4) To provide information so that parents may choose between 1, 2 and 3.

Evidently, the goal of Antenatal Diagnosis is to help couples make an informed choice, one which they feel is best for themselves and their families.

In antenatal counseling clinic, detailed evaluation and open discussion with the family regarding possible outcome is done.

In antenatal surgical clinic information is provided to prospective parents about fetal outcome, possible interventions, appropriate setting of delivery, time and route of delivery, expected postnatal outcomes, prevention in subsequent pregnancies.^{6,7}

Management of Antenatal Malformations:

Management is an enormous challenge and different modes of management includes

1. Termination of pregnancy
2. Correction after term delivery
3. Cesarean delivery
4. Early Induced Delivery
5. Fetal intervention/ and therapy
6. Ex Utero Intrapartum Treatment (EXIT)

1. Termination of Pregnancy:

Termination of Pregnancy is advised in antenatal diagnosis for fetus with lethal malformation. The malformations in the fetus invariably lead to death, i.e., there is no effective treatment that will prevent death in the near future. Malformations most frequently described as 'lethal' conditions which are considered incompatible with life are Anencephaly

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

(Fig.1&2), Hydranencephaly, Holoprosencephaly, severe chromosomal anomalies like Trisomy 13, Bilateral Renal Agenesis, Infantile Polycystic Renal Disease, Metabolic disease like Tay Sachs disease, Lethal Bone Dysplasias (Fig. 3).

In India Medical Termination of Pregnancy(MTP) Law permits termination before 20 weeks. Hence early detection of malformation before 20 weeks is important for considering termination.

The diagnosis of Lethal Malformation would make no difference to take decisions about termination in jurisdictions that either do not permit termination on fetal grounds, or alternatively that allow access to termination for a broad range of fetal abnormalities.⁸

It is beyond the scope of this topic to provide a detailed discussion of the legal or ethical approach to abortion law. Nevertheless, it is not our intention to limit women's options. For jurisdictions that regard lethal malformation as a special case and wish to allow abortion in such cases, there are perhaps three possibilities. One possibility would be for lawmakers to create specific exceptions for conditions such as those listed above. A palliative approach to management during pregnancy, delivery, and post-natally may be ethically appropriate for foetuses with a very poor prognosis.^{8,9}

Ethical principles also put clinicians in a dilemma and pose a challenge in deciding whether or not to terminate the pregnancy. Some clinicians take the view that termination is morally unjustified while others advocate termination when the foetus is felt unlikely to survive.^{8,9}



Fig. 1. Anencephaly



Fig. 2: Anencephaly with open spine defect

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION



Fig, 3: Lethal Bone Dysplasias showing facial and limb skeletal dysplasia with Sirenomelia

2. Correction after term Delivery:

Malformations managed by correction after term delivery include Esophageal and Gastrointestinal atresias, cysts, duplications, Meconium ileus, small Omphalocele or Gastroschisis, unilateral Hydronephrosis, craniofacial, limb or chest wall deformities, small Cystic Hygromas, Teratomas, Mesoblastic nephromas, Neuroblastoma, cysts like Choledochal, Ovarian, Mesenteric, duplication, cystic lung malformations and without Hydrops and Diaphragmatic hernia without much lung hypoplasia.^{3,4}

3. Cesarean delivery:

Cesarean delivery is advised in large lesions, which interfere with normal delivery. Malformations that may require cesarean section are^{3,4}

- Conjoined twins
- Giant hydrocephalus, ruptured omphalocele/gastrochisis
- Severe hydrocephalus, large or unruptured meningomyelocele
- Large sacrococcygeal teratoma (Fig. 4) or cystic hygroma
- Malformations that may require preterm delivery in the presence of inadequate labour or fetal distress.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION



Fig, 4: Large lesion Sacrococcygeal teratoma

4. Early Induced Delivery:

Certain fetal malformation requires correction as early as it is diagnosed. Rational for early delivery differs for different anomalies but principle remains the same i.e. continued gestation has a progressive ill effect on the fetus.

Defects which may require induced preterm delivery for correction of EX Utero are⁴

- Obstructive hydronephrosis
- Obstructive hydrocephalus
- Gastroschisis or ruptured omphalocele
- Intestinal ischemia/necrosis secondary to volvulus, meconium ileus
- Immune hydrops fetalis
- Intrauterine growth retardation
- Arrhythmias (supraventricular tachycardia with failure)

5. Fetal Intervention/ and therapy:

Fetal intervention is usually done between 28 weeks to 32 weeks. During Fetal intervention, a hysterotomy is performed, and the fetus is partially removed to correct fetal malformation or trans-abdominal or trans-

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

vaginal endoscopic access to amniotic cavity and fetal intervention to correct fetal malformation done.^{10,11}

Fetal interventions done are:

-Twin-twin transfusion syndrome: [Laser Ablation of Vessels supplying the parasitic twin](#)

- Fetal bladder obstructions: Vesicoamniotic shunt, Fetoscopic valve ablation

-Drainage of hydrothorax or large CCAM

-Aortic or Pulmonary Valvuloplasty, Atrial Septostomy

-Congenital diaphragmatic hernia: Balloon tracheal occlusion (PLUG)

-Spina bifida: Fetoscopic closure of the malformation (MOMS Trial)

-Steroid therapy for CAH (Medical)

-Open fetal surgery is done in selected cases of congenital cystic adenomatous malformation of lung, Sacrococcygeal Teratoma, Menigomyelocele and obstructive hydronephrosis.

5. Ex Utero Intrapartum Treatment (EXIT):

Advised after 35 weeks of gestation in which during caesarean delivery uterine atony achieved while fetus is still on placental circulation. EXIT procedures offer the advantage of ensuring uteroplacental gas exchange while on placental support. The EXIT procedure helps surgeons to transform a potentially fatal neonatal emergency into a controlled environment to ensure a better outcome.¹²

TYPES OF EXIT PROCEDURES PERFORMED¹²

EXIT-TO-AIRWAY

- Cervical teratoma / lymphangioma
- Congenital High Airway Obstruction Syndrome (CHAOS)
- Micrognathia
- Chest masses

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

EXIT-to-Extra-Corporeal Membrane Oxygenation (ECMO)

- Congenital Diaphragmatic Hernia
- (CDH)
- Severe congenital heart defects

EXIT-to-Resection

- Congenital Pulmonary Airway Malformation of The Lung
- (CPAM)
- Bronchopulmonary Sequestrations (BPS)
- Mediastinal teratoma

1. CNS Anomalies:

Anencephaly, Hydranencephaly, Holoprosencephaly are lethal malformation need termination of pregnancy if detected before 20 weeks. if detected late after 24 week pregnancy has to continued till birth and after birth neonatal death is a likely outcome of these anomalies.^{3,4}

Hydrocephalus:

Hydrocephalus (figure 5) associated with severe abnormalities: Consider termination.

Isolated hydrocephalus:

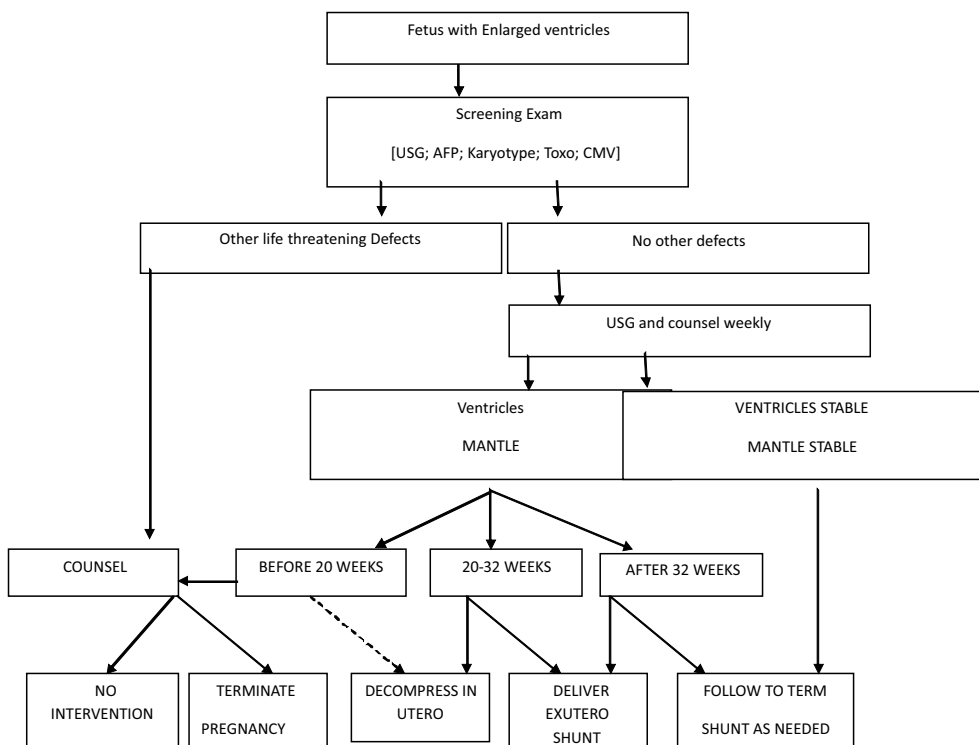
- Stable mild ventricular dilatation: observe till term.
- Progressive dilatation
 - Gestational age > 32 wks: delivery and shunting
 - Gestational age < 32 wks: consider for fetal therapy but in context of clinical trial.

Management of antenatally detected hydrocephalus is shown in flow-chart 1.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION



Fig. 5: Antenatal image showing dilated ventricle with thinned out brain parenchyma s/o hydrocephalus



Flow chart1: suggesting management of fetal hydrocephalus diagnosed with antenatal scanning.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

Spina bifida:

Spina bifida results from incomplete closure of bony element of spine posteriorly. Most common site is lumbo-sacral region. It can be open or closed, in open spina bifida (Fig. 6) always one should look for Hydrocephalus or other cranial anomalies.

Most cases are diagnosed either after the 24th week of gestation or they remain undiagnosed until after birth. When spina bifida is diagnosed before the 24th week of gestation the vast majority of parents opts for termination.^{3,4}

After birth detailed evaluation and early postnatal repair of neural tube defect is done.



Fig. 6: Open Spina bifida defect

2. Congenital lung lesions

Congenital Cystic Adenomatoid Malformation:

- a) Macrocystic lesions- Cyst > 5mm in diameter
- b) Microcystic- solid echogenic mass

Sequestrations: These are solid echogenic lesion with an anomalous systemic supply.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

These lesions treated with thoraco-amniotic shunt in fetal period if

- Evidence of early hydrops
- High risk of pulmonary hypoplasia (large lesion with mediastinal shift and < 24 weeks).

In fetuses with hydrops without intervention the mortality rate can be as high as 100%. Post intervention survival rates as high as 74% are reported.^{3,4,1} After birth detailed evaluation and early postnatal excision of lung lesions done.

Congenital Diaphragmatic Hernia:

In Fetal period Fetal Endoscopic Tracheal Occlusion (FETO) is indicated in High risk fetus (LHR < 1 or equivalent). 1.3 mm scope is used to place balloon in trachea. Balloon is placed at 26- 29 weeks. Balloon is deflated by USG guided puncture/ tracheoscopy at 34-36 weeks or by EXIT procedure. FETO helps in growth and maturation of lungs in fetal period. However definitive congenital diaphragmatic hernia repair done after birth.

3. Renal Anomalies

Fetal kidneys and urinary bladder filling can be visualised as early as 12-14 weeks of gestation. Abnormal renal morphology may not only be the result of urinary tract obstruction, it may also reflect abnormal development of the kidney itself, as is the case in multicystic dysplastic kidney.

Bilateral Renal Agenesis, multi-cystic dysplastic kidney, Infantile polycystic renal disease are lethal malformation need termination of pregnancy if detected before 20 weeks. if detected late after 24 week pregnancy has to continued till birth and after birth **neonatal death** is a likely outcome of these anomalies.^{3,4}

Lower Urinary Tract Obstruction (LUTO):

LUTO is an obstruction to the flow of urine from the fetal bladder. Various fetal anomalies causing lower urinary tract obstruction are posterior urethral valve, urethral atresia, ureterocele, and prune belly syndrome.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

Antenatal diagnosis of LUTO is done if fetus has Bilateral hydro-uretero-nephrosis, Enlarged bladder \pm dilated posterior urethra (Fig. 7), or Oligohydramnios.

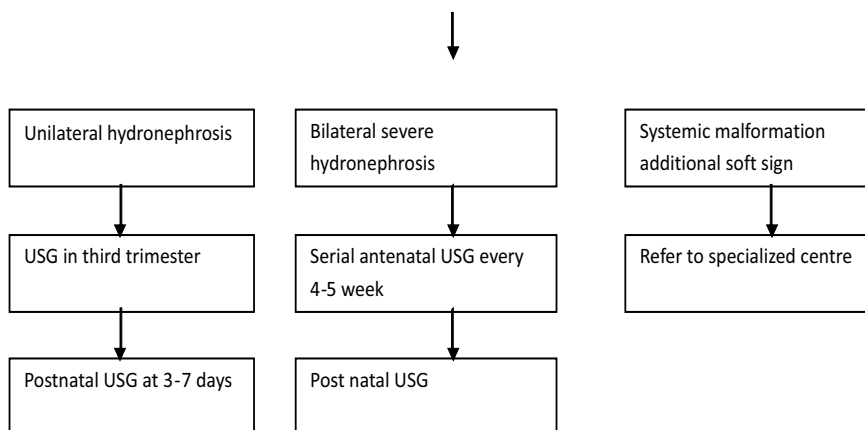
Fetal Vesico Amniotic Shunting or Fetal Cystoscope is done for lower urinary tract obstruction.^{10,11}

Management of antenatally detected hydronephrosis is as shown in flow chart 2 & 3.



Fig, 7: Ultrasonography showing Key-hole sign suggest lower urinary tract obstruction

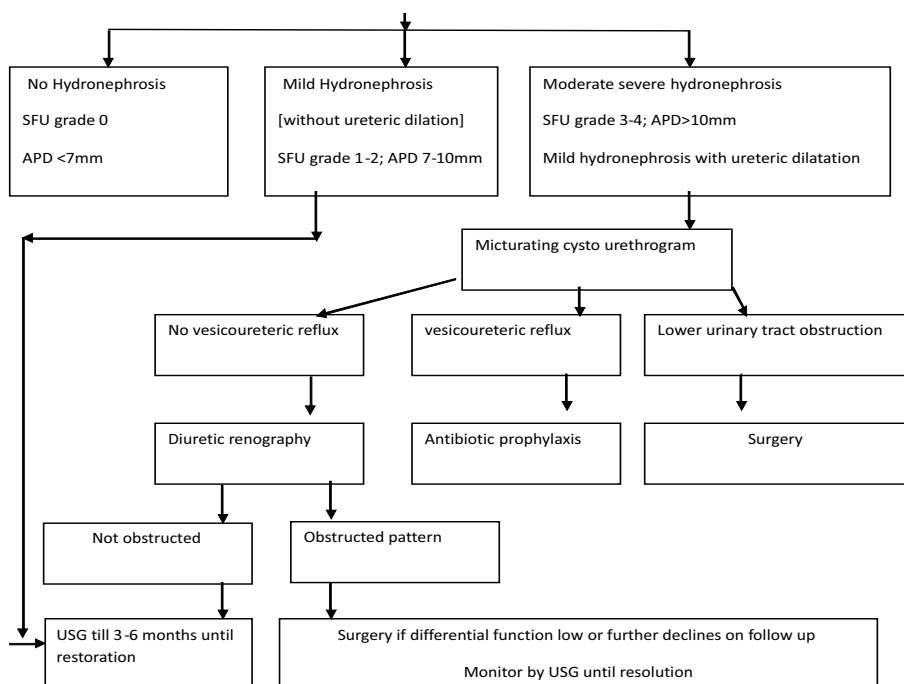
ANTENATAL HYDRONEPHROSIS



Flow chart 2: Suggesting management of antenatally detected hydronephrosis.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

Postnatal ultrasound Initial scan in first week, repeat at 4-6 weeks



Flow chart 3: suggesting postnatal management of antenatally detected hydronephrosis.

4. Antenatal Diagnosis and Management of Abdominal Wall Defects and Gastrointestinal anomalies

Accurate prenatal diagnosis is important for Gastroschisis (Fig. 8), Omphalocele (Fig. 9), Exstrophy/ Cloacal exstrophy, Anorectal malformation and bowel atresia (Fig. 10 & 11).

Gastroschisis and omphalocele are picked up by ultrasound scan done at 18-22 week of pregnancy. It must be noted that this is not the case for duodenal obstruction, which is usually detected as late as the third trimester of pregnancy.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

Gastroschisis and omphalocele are both abdominal wall defects. Gastroschisis is usually diagnosed as a simple anomaly for which perinatal outcome depends on the subsequent occurrence of intestinal complications. Omphalocele is clearly associated with other anomalies and numerical chromosomal abnormalities, such as trisomy 18 and 13.

Most of these anomalies are managed successfully after birth.^{3,4}



Fig. 8: Gastroschisis



Fig. 9: Omphalocele



Fig. 10. showing coiling of nasogastric tube in the upper oesophageal pouch in upper chest and a gasless abdomen suggesting pure oesophageal atresia

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION



Fig. 11: Intraoperative image showing Intestinal atresia.

Conclusion:

Antenatal counseling is essential component of antenatal care. Lethal malformation requires termination, before 20 weeks of gestation. Surgically correctable lesions are mostly dealt after delivery in appropriate centre.

References:

1. Garne E, Loane M, Dolk H, De Vigan, et al. Prenatal diagnosis of severe structural congenital malformations in Europe. *Ultrasound Obstet Gynecol.* 2005;25:6-11.
2. Munim S, Khuwaja S N. Accuracy of ultrasound in the diagnosis of congenital abnormalities. *JPMA.* 2006; 56(16):1-5.
3. Harrison M D, Michael R et al. *The Unborn Patient: The art and science of Fetal Therapy.* 3rd edn. Philadelphia: W B Saunders; 2001.
4. Bianchi D W, Crombleholme T M et al. *Fetology: Diagnosis and Management of fetal patient.* 2nd edn. New York. McGraw Hill; 2010.

MYTHS AND FACTS ABOUT ANTENATAL MALFORMATION

5. Luck CA. The value of routine ultrasound scanning at 19 weeks: a four year study of 8849 deliveries. *Br Med J.* 1992; 304:1474-8.
6. Lakhoo K. Fetal counselling for surgical conditions. *Early Hum Dev.* 2012; 88: 9-13.
7. Chervenak F, McCullough L B. Responsibly counselling women about the clinical management of pregnancies complicated by severe fetal anomalies. *J Med Ethics.* 2012; 38: 397-398.
8. McCaffrey M J. Lethality begets lethality. *J Perinatol.* 2011; 31 : 630-631.
9. Strong C. Fetal anomalies: ethical and legal considerations in screening, detection, and management. *Clin Perinatol.* 2003; 30: 113-126.
10. Masell K M, Badillo A. Advances in fetal surgery. *Ann Transl Med.* 2016 ;4(20):394.
11. Sala P, Prefumo F et al. Fetal Surgery: an overview. *Obstet Gynecol Surv.* 2014; 69(4):218-28.
12. Taghavi K, Beasley S. The ex utero intrapartum treatment (EXIT) procedure: application of a new therapeutic paradigm. *J Paediatr Child Health.* 2013;49(9):420-7.