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National Conference 2022

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It possible! You are needed indeed.

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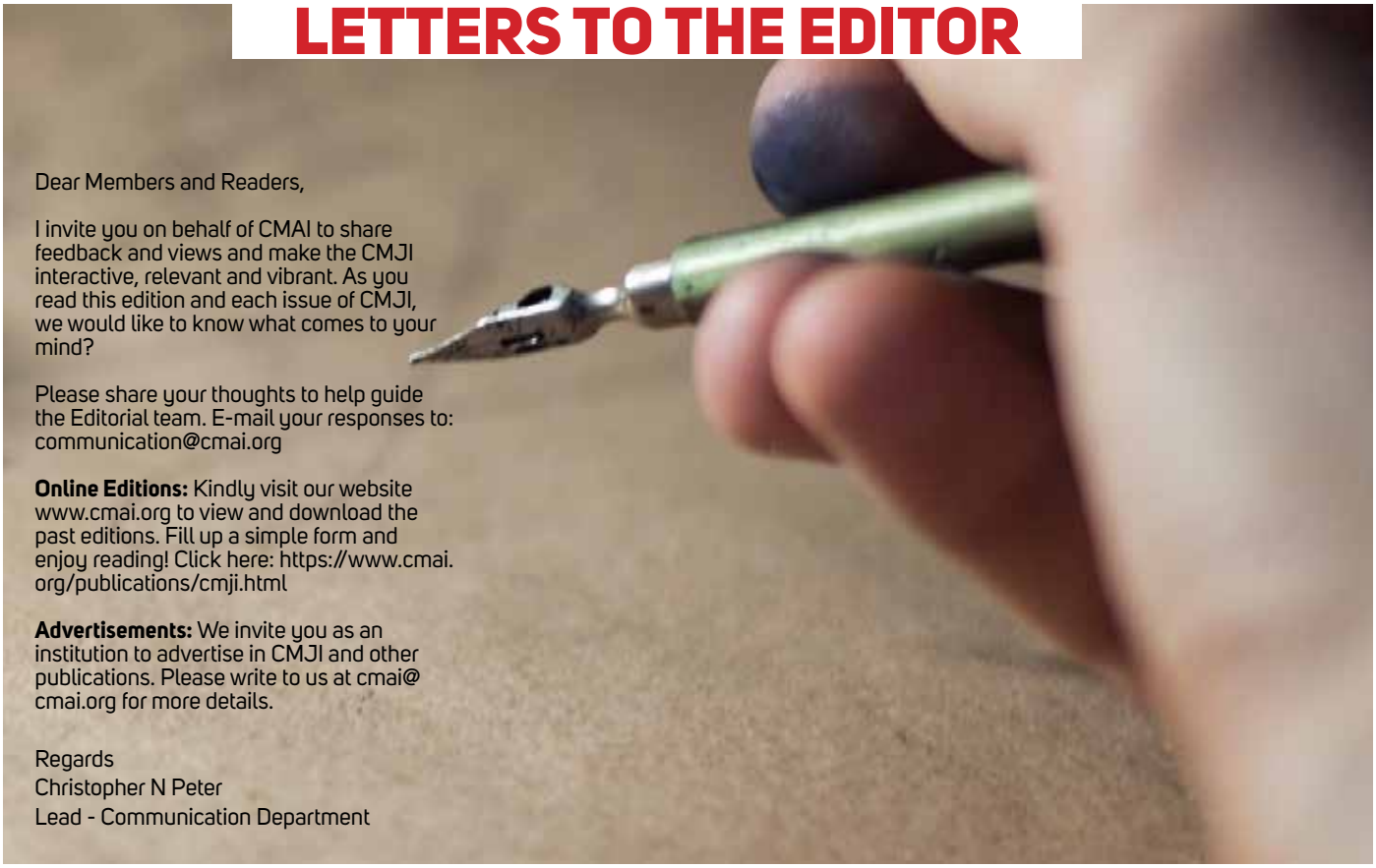
LETTERS TO THE EDITOR



Dear Members and Readers,

I invite you on behalf of CMAI to share feedback and views and make the CMJI interactive, relevant and vibrant. As you read this edition and each issue of CMJI, we would like to know what comes to your mind?

Please share your thoughts to help guide the Editorial team. E-mail your responses to: communication@cmai.org

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Regards
Christopher N Peter
Lead - Communication Department

GUIDELINES FOR AUTHORS & CONTRIBUTORS

SPECIAL ARTICLES: CMAI welcomes original articles on any topic relevant to CMAI membership - no plagiarism please.

- Articles must be not more than 1500 words.
- All articles must preferably be submitted in soft copy format. The soft copy can be sent by e-mail; alternatively it can be sent in a CD by post. Authors may please mention the source of all references: for e.g. in case of journals: Binswanger, Hans and Shaidur Khandker (1995), 'The Impact of Formal Finance on the Rural Economy in India', Journal of Development Studies, 32(2), December. pp 234-62 and in case of Books; Rutherford, Stuart (1997): 'Informal Financial Services in Dhaka's Slums' Jeoffrey Wood and Ifftah Sharif (eds), Who Needs Credit? Poverty and Finance in Bangladesh, Dhaka University Press, Dhaka.
- Articles submitted to CMAI should not have been simultaneously submitted to any other newspaper, journal or website for publication.
- Every effort is taken to process received articles at the earliest and these may be included in an issue where they are relevant.
- Articles accepted for publication can take up to six to eight months from the date of acceptance to appear in the CMJI. However, every effort is made to ensure early publication.
- The decision of the Editor is final and binding.

LETTERS

- Readers of CMJI are encouraged to send comments and suggestions (300-400 words) on published articles for the 'Letters to the Editor' column. All letters should have the writer's full name and postal address.

GENERAL GUIDELINES

- Authors are requested to provide full details for correspondence: postal and e-mail address and daytime phone numbers.
- Authors are requested to send the article in Microsoft Word format. Authors are encouraged to use UK English spellings.
- Contributors are requested to send articles that are complete in every respect, including references, as this facilitates quicker processing.
- All submissions will be acknowledged immediately on receipt with a reference number. Please quote this number when making enquiries.

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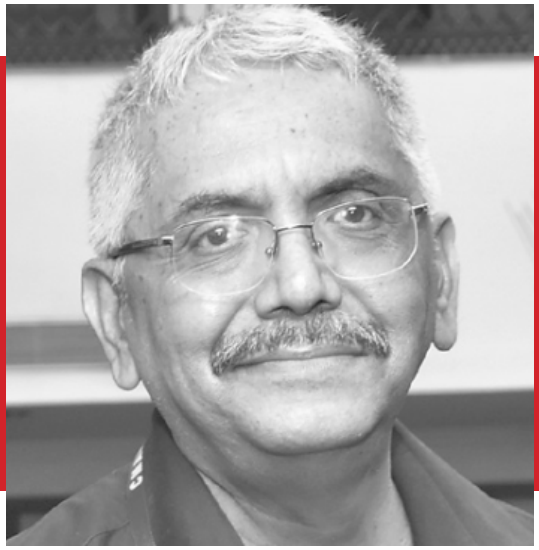
EDITORIAL



In the past edition Volume 36.4, we reported about the 46th Biennial Conference that was held virtually in 2021. In the midst of the prevailing challenges, new methods of technology and virtual gathering and interaction was adapted. However, we had planned to organize the prestigious Awards and Orations at a later date. The most important element in this being the Hope.

We are grateful to share with you a special edition that captures the Combined National Conference 2022. Along with that a spcial feature on Mental Health & Well-being of Children Amid COVID-19 by Bal Raksha Bharat.

This records our first in-person interaction post Covid-19, wherein various CMAI members across Sections; Administrators, Allied Health Professionals, Chaplains, Doctors and Nurses League were present. We realised that the opportunity of fellowship was greatly missed by our members, partners and staff across the nation.

In this edition the devotional shares with us on “How great things should be expected and attempted”. He writes that, “He is the same God who allowed COVID to change the course of church, same God who allowed for financial struggles, ministry struggles, academic struggles, criticism, all those precarious situations where you felt inadequate. He is the same God who says be strong, do not fear, and do it. Just do it.”

I had the privilige to be present for the event and witnessed how the Orators and Awardees expressed their pride of being associated with medical missions while sharing their testimonies and experiences. The energy in the halls and corridors was amazing. Each presentation communicated the great faihfulness of God displayed over the many years. This coming together of different sections of CMAI on one platform is undoubtedly a memorable experience.

The conference was held on 10th-12th November 2022 at New Delhi. The Orations included; 16th Jacob Chandy Oration 2022 and 5th Ms Aley Kuruvilla Oration 2022. The Awards included; Dr D W Mategaonkar Award and the Young Medical Missionary Award for the year 2022. We have shared excerpts and abridged versions, kinldy visit us on website for more details, videos and photographs.

We cherish the partnership and blessings of all our readers. Thank you. We invite you to write to Letters and Emails with feedback and ideas to help make CMJI a more meaningful and enjoyable journal. I look forward to hearing from you at communications@cmai.org

Best Wishes.

Dr Christopher D Moses | Editor - CMJI

JUST DO IT.

PASTOR JOY SINGH

After a lot of opposition from the church, William Carey finally set foot in India in 1793, with his family and a surgeon named John Thomas, hoping to present the gospel to Indians.

Little did he know what awaited him. Before long, his ministry partner John deserted him. Carey was forced to move his family repeatedly as he sought employment that could sustain them. Illness racked the family, and loneliness and regret set in: “I am in a strange land, no Christian friend, a large family, and nothing to supply their wants.” When Carey himself contracted malaria, and then his 5-year-old Peter died of dysentery, it became too much for his wife, Dorothy, whose mental health deteriorated rapidly. She suffered delusions, accusing Carey of adultery and threatening him with a knife. She eventually had to be confined to a room and physically restrained. Carey wrote, “This is indeed the valley of the shadow of death to me,”

Much like Carey, perhaps not with the same intensity, we stand at a precarious spot in front of a huge task with practically nothing in our favor. We get discouraged and disillusioned. These last two to three years of Pandemic has added unprecedented stress and unimaginable trauma. My wife and I returned from the US last year after being there for three years, and we saw a heaviness in everyone as if all were diagnosed with PTSD.

The question is how can I persevere when the odds are against us? How can I carry on when the mountainous task ahead of us seems insurmountable? Let’s look at it in our passage today, Haggai 2:1-9.

We will see two things in the passage: encouragement to persevere and assurance to provide.

Let me bring you up to speed with what’s happening in the background. About 15-16 years have passed since the exiles have returned to Jerusalem. In Ezra 3, we read that the foundation was laid two years after they came but the work stopped due to opposition. And it has been ten-twelve years that no one touched it. So, in chapter 1 God rebukes the Jews through Haggai to build his temple. By the end of chapter one they had started the work on temple. This brings us to our passage. Encouragement to persevere: Read vv.1-2!

Why is God asking these questions? About a month had passed since the work began. It seems that the magnanimity of the task viz. bringing all raw material, task-force, gold and silver, has gotten them discouraged and even fearful of God. Like Carey nothing is in their favor. Coupled with the lack of resources is the curse of the good old days. Some of them might have seen the Solomonic

temple or heard stories of its grandeur but all they see is a ghost of the glorious temple. So, the work has stopped again.

For us, we don't have a temple, we are not Israel, and our worship is not hindered by lack of a building. But the principles of "temple building" in the sense of larger mission and commission of God to build people, is still applicable. In the NT, church is God's temple. Paul says, we are the bricks and God dwells among us. TWR is not a church but you all are still actively involved in the temple building work. TWR is building God's temple by proclaiming the gospel. The fact is, it is hard and burdensome.

I have come from a different faith. When I first believed in Christ, all my friends and extended family deserted me. I did not know what to do. It was an onslaught of abuses, ostracization, and pain. I could not see beyond the mountain. The paIn was too much.

Some of you like me cannot see beyond the hill. Pandemic has thrown you some years behind. Let alone building the temple, our own lives seem out of sorts. Some of you are wondering on your own inadequacies and the task of ministry ahead. Discouragement has set in for the finish line is not in sight and the gloves have come undone.

Read v.4! He says be strong, be strong, and be strong. The indicative behind this imperative is God's abiding presence. Not just any name of God but Haggai invokes his warrior title—יהוה צבאות. The Lord of heavenly armies says to them be strong for I am with you. And then he commands them to not fear (v.5). This text echoes Deut 31:6 where the leadership baton is passed from Moses to Joshua as they prepare to cross over Jordan. Finally, their dream is about to come true. And Moses says to them in v.2 that I am not going to go with you. Imagine their disappointment. And Moses says to them be strong and do not fear, for the Lord your God is going with you.

They have come back to ruins of a glorious past. The same God who exiled them now assures them of his presence. Be strong and do not fear.

He is the same God who allowed COVID to change the course of church, same God who allowed for financial struggles, ministry struggles, academic struggles, criticism, all those precarious situations where you felt inadequate. He is the same God who says be strong, do not fear, and do it. Just do it (v.4).

We don't hear any complaint nor anyone whining but God knows that people will worry about the condition of the temple. That they will still mourn the good old temple. They will again give up. Anticipating all this, God encourages them to see what will be and not get bogged down by what is. He says four things in this unit—I will shake... (v.6); I will shake (v.7); I will fill (v.7); I will give peace (v.9). Five times in just four verses Haggai uses יהוה צבאות to emphasize God's power and his sovereignty. God will shake the creation and the people. The image of shaking is violent, like rattling a cage. And the result is nations bringing their precious things as tribute to this glorious king. And with the booty God will build his temple. No longer will they lack any raw material, any workforce. No longer will there be any criticism or opposition. For God will do it all by himself. And finally, God says you will have shalom. In that day you will have my shalom restored to you.

But for now, just do it. Build my temple no matter how insignificant, even if it is made with sticks and stones. Let my temple look like a child's drawing but just do it. I will perfect it, one day.

A grand temple was built by Herod and God's glory did fill the temple in Jesus. Jesus said greater than the temple is here. All the nations felt the reverberation as the gospel went out. But there awaits a greater shaking, a great fulfillment, a grander temple. Where we will have our shalom. Where we will not get discouraged, no criticism, no insurmountable tasks, no failures. Where every knee will bow and every tongue will confess. For now, just do it.

G. K. Chesterton once said, whatever is worth doing, it is worth doing badly. We can't save all. We can't be everything to everyone. We can't fix everything. But Just do it for God is with you and he will perfect his work.

Remember, we are called to faithfulness not perfection. In the midst of all his pain Carey says, "Well, I have God, and his word is sure." And then he says, "I rejoice that I am here notwithstanding; and God is here." After seven years of unimaginable pain, Carey leads one person to Christ. By the time Carey died, he had spent 41 years in India without a furlough. His mission could count only some 700 converts in a nation of millions, but he had laid an impressive foundation of Bible translations, education, and social reform.

His greatest legacy was in the worldwide missionary movement of the nineteenth century that he inspired. Missionaries like Adoniram Judson, Hudson Taylor, and David Livingstone, among thousands of others, were impressed not only by Carey's example, but by his words

"Expect great things; attempt great things."

Pastor Joy Singh, Delhi Bible Fellowship, Central Congregation, New Delhi

The Life and Times of Jacob Chandy and its Relevance Today

16TH JACOB CHANDY ORATION 2022

Dr. Jacob Chandy often hailed as the father of Neurosurgery in India was a practising Christian who also had the welfare of the Mission Hospitals in India close to his heart. Even when he dared to dream big, he never lost touch with reality or with the grass root level where patient care translated into excellence and where dedication meant meticulous work and consistency. He was a renowned Neurosurgeon, a visionary, and an Indian National who dreamed of a free India with Premier Indian Institutions of excellence and repute supported by well trained Indian nationals .

Ladies and Gentleman I deem it an honour to stand before you as his son and as a Neurosurgeon trained by his father's students, to deliver the Jacob Chandy Oration. It was only in 1997 that I began to understand the magnitude of my father's legacy. I was going through a difficult trough in my life when I reached a crossroad with two choices before me. One that would take me down an administrative path and the other, one that would allow me to grow with my chosen speciality. I was pleasantly surprised to receive a letter from a dear classmate of mine during this period and what was even more surprising was a note written by Dr Jacob Chandy way back in 1947 in the CMAI Journal two years before he joined Vellore! Some of you will recognise my friend's hand writing and name!. He was none other than your former General Secretary Dr C Thomas.

Born in 1910 in a small village in Kerala, he was nurtured in Church activities and theological discussions very early in life by his father. His grandfather and great grandfather were also-pastors of the Anglican Church.To get a good medical job in those days, one had to get into the Indian Medical Service like the Indian Civil Service or the Indian Revenue Service. His classmate and friend Dr P V Kurian persuaded him to come to Dhahran in Arabia, where they needed doctors for the new Oil Company, Aramco.

It was during his time with Dr Paul Harrison in Bahrain that Dr. Jacob Chandy learned that excellence at work in Medical Missionary Service comprised of dedicated service, meticulous research and prayerful living. He would never start Surgery without a prayer. Knife in hand , eyes closed and a silent prayer on his lips was a stance that the staff in the OR became used to. So much so, sometimes he would be lead to try medical intervention instead of laying a surgical incision. In many cases in hindsight, deferring surgery was the

right decision. The story circulating that Dr Chandy in some cases did not proceed with the scalp incision, but decided to wait and started the patient on medical treatment is completely true and it turned out to be the best decision. A good Surgeon is one who knows when not to operate or one who listens to his Masters voice.

Jacob Chandy joined the Christian Medical College on January first 1949 and started work on April the first. He was then 39 years old.

Aunt Ida referred to as Ida S by the senior staff in the fifties had retired by 1949 and was living at Hilltop in Kodaikanal and at the Big Bungalow at College Hill during the cooler months. In October of 1949, she dropped in to Dr Chandy's office at the Hospital to welcome him and to pray with him!

Dr Chandy established Neurology and Neurosurgery very quickly and he was able to draw staff from all over India to the Department. Dr Baldev Singh a physician interested in Neurology from Amritsar was the first one who joined the Department. Dr Chandy was inspired by the Montreal model where all the related sub specialities were under one roof including the basic science research departments. He was able to persuade Dr Bimal Bachawat to join as Chief of Neurochemistry and gave him lab space to start Neurochemistry research in the department. This resulted in sharing of data, knowledge, learning and research cross pollination to establish CMC quite rapidly as a premier Neuro-research organisation.

Dr Chandy served in multiple administrative roles during his stay in Vellore. In addition to being the Treasurer, he was also the Medical Superintendent, Deputy Director and Principal for eight years. During this period he had a significant part to play in the building of the Scudder Auditorium, the Carman Block the Sports Oval stands and two staff houses not forgetting all of the Neuro-Sciences infrastructure, built with extramural funds.

It is interesting to note that after Dr Chandy's retirement a Consultation was held, in fact, several Consultations were held, prompted I dare say by the doubters with experts both National and International in many fields, including potential donors to study and determine the future direction for CMC.

Of little faith, little did they know that the future direction has always been and will always be ordained by God and not by us mortals?

On his return to Kottayam he did not sit idle. He started his practise because as he said in his memoirs 'his patients were waiting for him'.

He went on to build a house and he arranged the marriages of my sister and my brother. He wanted to help his diocese and he became the Secretary of the Diocese and then the Director of the Medical Board when the Kodukulanji Hospital was built. He also spearheaded the establishment of a BSc Health Sciences course in the Kottayam University helped by Dr Abraham Joseph from CMC.

He continued to be a source of strength to the family and community until he passed away at the age of 97 just six months before the passing of his dear wife.

His three children were well established in their place of work and visited often and took care of them. They had seven grand children who were married when he was alive and most presented their grandparents with their great-grandchildren. Of the 14 grand children and their spouses 8 are doctors, 3 are CA's, 2 are business executives and one is a home maker.

God is no man's debtor. He is not blind, He is not deaf nor is He dumb. He looks down on His servants who trust Him implicitly , obey Him and faithfully trust Him despite the odds.

He rains His blessings down on them and theirs for generations in all the corners of the Earth they inhabit. He never fails. He cares. He loves. He protects.

We, like Dr. Jacob Chandy, Just have to Trust and Obey.

This article is extracted from the Oration Booklet circulated at the Combined National Conference 2022. For more details please visit www.cmai.org or write to communication@cmai.org

No Healing without Nursing

5TH MS ALEY KURUVILLA ORATION 2022

Standing amidst the luminaries of Nursing Professionals as well as eminent personalities of the CMAI who have significantly contributed to education, research and advancement of professional practice in various aspects of the healing ministry, I am privileged and deeply humbled to be given the opportunity to deliver the 5th Aley Kuruvilla Orasion of the CMAI.

While I was pondering on the theme for the Oration, I happened to come across the words of Billy Graham "God works through people to get His work done in the world including doctors and nurses". I find these words very apt for us in the healing ministry. We are blessed to be called to get God's work done through us, ministering to the sick and suffering entrusted into our hands for just a moment in time and we are expected to serve as faithful stewards of God's grace in various forms.

I pray that the good Lord, may permeate in and through us, His grace through our committed and continued service of healing as we envisage the ultimate purpose of God for humanity, that is, 'making a person whole'. This includes unbroken communion with him and wholeness of body, soul and spirit (I Thess 5:23)

I would like to deliver upon various aspects of Nursing in the healing ministry based on Biblical facts.

1. Nursing In Bible: The term nurse in the Bible implied a woman who fed and cared for infants and young children, unlike today's professional role. However, health care figured prominently in the life and teachings of Jesus. He healed the sick, cared for the poor and oppressed, sought out those whom society had rejected, and instructed His followers to go and do likewise. Health care - including the physical psychosocial, and spiritual dimensions-soon became the concern of the whole church (Shelly & Miller, 2006:244). In other words Jesus himself carried the figure of a nurse.

In them He is speaking to us individually, speaking as directly as if we could listen to His voice. It is in these promises that Christ communicates to us His grace and power. Received, assimilated, they are to be the strength of the character, the inspiration and sustenance of the life. Nothing else can have such healing power. Nothing besides can impart the courage and faith which give vital energy to the whole being Shelly & Miller (2006:244,256) laid out several characteristics of Christian nursing that stand out in the Scripture:

I. Nursing is a response to God's grace that flows from a dynamic personal relationship with God.

II. It is a ministry of the church and functions in the context of the body of Christ.

III. It recognizes the role of sin in the world created good, and it seeks to restore justice and righteousness.

IV. It views the person as created in the image of God.

V. It is demonstrated in compassionate care that is characterized by the fruit of the Spirit.

2. Relationship of Jesus to the Work of Nurses:

The gospel is to be presented, not as a lifeless theory, but as a living force to change the life." Four concepts common in nursing theory that influence and determine nursing practice are (1) the person (patient), (2) the environment, (3) health, and (4) nursing. Each of these concepts is usually defined and described by a nursing theorist, but the definitions and the relations among them may differ from one theory to another. Of the four concepts, the most important is that of the person.

3. Healing ministry in the Old Testament; Healing in The Exodus of Israel, Healing In The Psalms, The Healing Work Of The Cross Foretold (Isaiah 53)

4. Healing ministry in the New Testament

Jesus' healing, the focus is on Jesus' identity as Christ and his power to heal various ailments. Little or no reference is made towards the people who were healed. Yet, a closer look at these stories reveals that the sick person initiates the encounter by shouting, calling, touching or being at a strategic place to meet Jesus. Seemingly, all the healing stories start with the expression of pain and misery by the sick person. In addition, again, after Jesus' healing, the narrative returns to the jubilation by the restored person. Even after a private session and request by Jesus not to tell anyone, the clear and dramatic scene of celebration is clear from the previously sick person running back into the village, announcing his or her new healed condition. One cannot fail to hear the imaginary exclamation, 'I am healed!' 'I am healed!' 'I am healed!' Building upon Ernest van Eck and Andries van Aarde's suggestion that the healing stories deal with restoring the person to his or her role within the community or household, I propose the Shalom theory. In the Hebrew Bible, the term 'shalom' implies completeness, soundness, welfare and peace (Jdg 6:23).

The story in Mark 1:30–31 makes us ask – what happens to the household if the mother gets sick. The story concerning Peter's mother-in-law reminds us about how illness disrupts gender roles. Importantly, the news of her sickness may have been conveyed by Peter to Jesus after the synagogue event.

As an aside, the story reminds us that Peter was married; hence, his question to Jesus, asking, 'we left everything to follow you, what shall we gain from following you?' (Mk 10:28; Mt 19:27; Lk 18:28).

That the news of her sickness was told outside the domestic space signifies that her condition was concerning. John Pilch remarks that personalistic healthcare systems are dyadic, meaning that upon being sick and as a show of solidarity, relatives visit (Pilch 2000:65). As such, even relatives who reside far off would travel long distances to see sick family members in the villages.

Upon arriving at the household, Jesus went to where the patient lay in pain and proceeded to touch and lift her up, thereby restoring her. Anna Beavis comments that, within a personalistic worldview, healers are believed to possess powers that are contagious upon coming in touch with a sick person. In this story, the belief that powerful healers ooze with healing power is expressed through Jesus, who touched and lifted the woman to recovery (Beavis 2011:53).

Mark reports that she took up and served the guests, signifying that her healing restored shalom in two ways:

I. By being healed, she was restored to perform her gender role. From Mark's story, we can infer the psychological reaction of the woman and of the family members.

II. Her restoration retained the homestead space as a place for hospitality.

Nursing and healing are closely related. There is no healing without nursing, neither nursing without healing.

Healing might be seen from the different perspectives of life but they all work together hand in hand with nursing.

This article is extracted from the Oration Boolet circulated at the Combined National Conference 2022. For more details please visit www.cmai.org or write to Communication@cmai.org

Dr D W Mategaonkar Award 2022

MS K C ALEYAMMA

Ms K C Aleyamma is the recipient of the Dr D W Mategaonkar Award for 2022. We are honouring the life of a miracle worker who worked as a nurse and has saved lives everyday since 1971 at the Christian Fellowship Hospital, Oddanchatram. Ms Aleyamma is a dedicated mission worker in the healing ministry for our nation. She has set a good example with her simplicity amongst the nursing fraternity.

Born in 1941, Ms Aleyamma has studied nursing from Christian Medical College and Hospital, Vellore and School of Nursing, Madanapalli in Andhra Pradesh. She is a good teacher and with her hard working abilities in both clinical and community health has emerged as a beacon amongst the healthcare workers at the hospital.

As a woman of faith, Ms Aleyamma has stood the ground. She has faced many challenges and struggles, yet remained faithful to mission and her

people. Moving forward in faith and dedication as a teacher, she has remarkably transformed many lives. She is a role model for the young nurses of today.

Ms K C Aleyamma has excelled in multiple roles over a long career of devotion and service. A deserving champion of healing ministry that is reaching out to the underserved population of our nation. She has contributed to the Nursing profession in its growth and served the community for disease prevention and promotion of health and rehabilitation of the specially abled community.

CMAI is honoured to recognize Ms K C Aleyamma with the highly esteemed Dr D W Mategaonkar Award for 2022.

Dr D W Mategaonkar Award 2022

MR M A ABRAHAM

Mr M A Abraham is the recipient of the Dr D W Mategaonkar Award for 2022.

Mr Abraham's leadership and expertise have resulted in effective improvements for staff and organization alike at the Christian Fellowship Hospital, Oddanchatram. Since last 22 years, he has played a pivotal role as a healthcare leader and in establishing an organizational culture that enables and supports the healing ministry.

Mr Abraham, was initially working as the Office Superintendent and later with his efficieny, integrity and responsilibity trailts led him to lead as the Administrator of the hospital. Hes posseses God-given wisdom in dealing with people and challenging situations with an effective tact and discernment.

He has carried out his work with confidence while assertively dealing with varied kind of people at government offices, private organisations, church and the public.

Mr M A Abraham, lives a life of complete surrender to God in obedience to the call – Follow Me.

Along with that, better infrastructure, improved quality, patient care, staff safety, building new leaders & champions also displaying loyalty, grace, and servant heart are his greatest assets as the administrator of the hospital. He also regularly shares gospel and gives messages in churches and prayer groups.

Mr Abraham has excelled in multiple roles over a long career of devotion and service.

A deserving champion of healing ministry that is reaching out to the underserved population of our nation.

CMAI is honoured to recognize Mr M A Abraham with the highly esteemed Dr D W Mategaonkar Award for 2022.

Dr D W Mategaonkar Award 2022

DR BAHA HEBROM

In 1964, a young doctor born in Jharkhand, an MBBS from Tamil Nadu received her calling to take full charge and serve at a newly established hospital in Uttar Pradesh. Dr Baha Hembrom, thus began her work at Sundaram Chikitsalaya situated in rural Ballia District. Dr Baha completed her MBBS from CMC, Vellore and further qualification in Gynaecology & Obstetrics from Dublin in Ireland.

In retrospect, Dr Baha's journey as a medical missionary began with a burden for her own, the poor and needy people from the Santhal Pargana tribe from Pakur district in Jharkhand. She served among them at the Edith Jackson Fisher Memorial Hospital as a Medical Officer for over three years and then joined Sundaram Chikitsalaya.

Presently, Dr Baha with years of fostering care and compassion at the mission hospital is continuing to work as a Medical Superintendent in Sundaram Chikitsalaya. We marvel her strength, her dedication and commitment to the calling of healing ministry. Dr Hembrom has served with a determined heart as a doctor, administrator, manager and in multiple capacities despite very little help several times in her career at the hospital. Her farsighted work to build and strengthen the hospital has led to countless number of patients coming for healthcare from distant and rural locations.

Dedicated to building people, Dr Baha has been instrumental in bringing a balance by emphasizing the importance of education to the local rural population along with healthcare. She has provided opportunities for education to the young and forged a constructive path forward in efforts to improve wellbeing of her people.

Dr Baha is an active member of Methodist Church, Nagra and serves as a Treasurer. Also as a respected leader served on numerous committees and boards with visionary ideas, innovations and excellence in medical care.

An astute doctor, mentor, and a great public health worker, Dr Baha has excelled in multiple roles over a long career of devotion and service. A deserving champion of healing ministry that is reaching out to the underserved population of our nation.

CMAI is honoured to recognize Dr Baha Hembrom with the highly esteemed Dr D W Mategaonkar Award for 2022.

YOUNG MEDICAL MISSIONARY AWARD 2022

DR PRAKASH EMMANUEL GEORGE

In recognition of outstanding contribution to the Healing Ministry in rural India, CMAI presents Dr Prakash Emmanuel George the Young Medical Missionary Award for the year 2022.

Born in 1989, Dr Prakash, raised in a family of missionary doctors witnessed every day the greater impact of frontline healthcare workers. He responded to his higher calling and prepared himself to one day work with a mission hospital. He obtained his MBBS from Government Medical College in Anantpur and finally reached Christian Fellowship Hospital, Chagalamarri in Andhra Pradesh, where is presently working for the last seven years.

It is here he serves a rural population of around 1,00,000 with health, healing and wholeness.

Dr Prakash has pursued Fellowship in Emergency Medicine from Pushpagiri Medical College hospital, Thiruvalla, Kerala and MMed in Family Medicine from Christian Medical College, Vellore in 2018.

He has also completed IAPC CCEPC course in Palliative Care from Baptist Hospital, Bengaluru. He is known at this young age as a doctor for is ability to motivate staff members and works along them building their capabilities and nurturing relationships.

Preventive medicine, diet counselling and deep interest in Primary Care and Palliative Care have led Dr Prakash Emmanuel George to actively organise outreach programs and medical camps.

He is also involved in various church activities and in his involvement with the Marthoma church is working as treasurer of few mission fields in the Rayalseema region.

Dr Prakash is married to Dr Anith Sara Oommen an ENT Surgeon and has a son and a daughter.

16TH JACOB CHANDY ORATION 2022

// About the Oration //

In honour of the late Dr Jacob Chandy, a strong advocate of the Healing Ministry of the Church, a pioneering neurosurgeon and recipient of the Padma Bhushan Award, CMAI has instituted the Jacob Chandy Oration. The oration has a global outlook within the context of the developing world and is meant to inspire CMAI members, churches, partners and health professionals.

During the Biennial Year celebrations, an outstanding Christian leader is invited to deliver the oration, and through it, to challenge, raise issues and show new directions to the Healing Ministry work in India.

The Christian Medical Association of India is honoured that Dr. Mathew Jacob Chandy has consented to deliver the 16th Dr Jacob Chandy Oration, 2022. He obtained his medical degrees in Surgery and Neurosurgery from Madras University. Dr Chandy has been associated with the Neurosurgery department at CMC Vellore for over 20 years, deputed both abroad and at prestigious institutions in India. Presently, he is working at the Apollo KH Hospital in Vellore. In 2018, he received a Lifetime achievement Award by the Tamil Nadu Neuro Society.

// About the Orator //

Dr. Mathew Jacob Chandy is an established and highly skilled Neurosurgeon with nearly 50 years of experience in medicine. In the Indian healthcare community, he is well regarded for expertise and numerous accolades for his attention to quality in patient centric care. He obtained his medical degrees in Surgery and Neurosurgery from Madras University. Dr Chandy has been associated with the Neurosurgery department at CMC Vellore for over 20 years, deputed both abroad and at prestigious institutions in India. Presently, he is working at the Apollo KH Hospital in Vellore.

In addition to surgical practice, his association with Neurological Society of India, Montreal Neurological Institute, National Academy of Medical Sciences and many other professional societies display his skills and knowledge. In 2018, he received a Lifetime achievement Award by the Tamil Nadu Neuro Society. He has also received the Dr. Paul Horrison prize in Neurology and the Wilder Penfield Scholar amongst various other global awards and honors in India. Dr Chandy has been associated as a member in various committees, expert advisor with councils and boards. His scholarly contribution to publications, seminars, conferences, scientific papers and journals is almost endless.

Dr Mathew, today with decades of work is passionately driven by the relationships he has built with his patients, medical professionals and deep interest in building the next generation of neurosurgeons. Healing ministry endures with dedication of such medical professionals gathered by God and their faithful commitment to this nation.

5TH MS ALEY KURUVILLA ORATION 2022

// About the Oration //

CMAI has instituted the Ms Aley Kuruvilla Oration and is privileged to institute the 5th Ms Aley Kuruvilla Oration at the combined National Conference 2022 of CMAI. The contribution of legends like Ms Kuruvilla continues to inspire us. It is in recognition of her exemplary contribution to nursing education, service and thereby to the healing ministry that CMAI has instituted this oration. The oration has a global outlook within the context of the developing world and is meant to inspire CMAI members, churches, partners and health professionals.

At the 5th Aley Kuruvilla Oration 2022, it's our privilege to have, an outstanding Christian leader in community nursing and education, to deliver the oration and through it to challenge, raise issues and show new directions to the Healing ministry work in India.

Ms Lucky Warbah is serving as a Nurse Leader over 30 years in Shillong, Meghalaya. In 1993, she joined Dr. H. Gordon Roberts Hospital as a Nursing Tutor, leaving behind a rewarding Government job at the Civil Hospital in a response to her deep calling for missions. Ms Warbah with her M.Sc Nursing in Mental Health Nursing from College of Nursing, Christian Medical College, Vellore is the first nurse with a masters degree in Dr. H. Gordon Roberts Hospital, Shillong.

Ms Lucky Warbah is known for her determination and leadership capabilities working along with the team at Dr. H. Gordon Roberts Hospital. She has held dual charge as Principal of the School of Nursing and as Nursing Superintendent of the Hospital. Under her able leadership and visionary initiatives the hospital witnessed upgradation of its nursing school to a nursing college.

At present, Ms L Warbah is also the President of the Meghalaya Nursing Council and Adviser, Continuing Nursing Education of the Meghalaya Nursing Council. In this position, she had made significant contributions in the uplifting of the standard of nursing practice, research and education in the State of Meghalaya.

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DR D W MATEGAONKAR AWARD 2022

// About the Award //

The prestigious Dr D W Mategaonkar Award has been instituted by CMAI in memory of Dr D W Mategaonkar, in acknowledgement of his outstanding service and contribution to the Healing Ministry in India.

Dr D W Mategaonkar, born on 30 December 1928 at Pune, graduated in medicine from Christian Medical College at Vellore in 1957. Immediately after passing out from Vellore, he opted to work at the Christian Hospital at Chhatarpur in Madhya Pradesh and continued to work in different mission hospitals till 1987.

Dr Mategaonkar was conferred the Paul Harrison Award in 1974 by CMC Vellore in recognition of his outstanding contribution to community health in the Bundelkhand region. He was the President of the Madhya Pradesh Voluntary Health Association, a founder member of the Emmanuel Hospital Association and held important positions in the Church and health bodies. Active till the last, he died of cardiac arrest at a Youth Camp where he was the main speaker.

"To serve and not to be served" was always the guiding thought for Dr Mategaonkar. His exemplary life, matched by his humility and determination, was a source of inspiration to many, both in the Church and in hospitals. His obedience to the call, his strong faith and hope, enabled him to server the Lord in many different and creative ways.

The Dr D W Mategaonkar Award has been instituted in his memory to recognize and record the valuable and outstanding service of people who have contributed to the Healing Ministry in India in the spirit of Christ.

YOUNG MEDICAL MISSIONARY AWARD 2022

// About the Award //

The Young Medical Missionary Award has been instituted by CMAI in memory of Dr Prerit Thomas Jacob, in recognition of his contribution to the Healing Ministry in rural India.

Dr Prerit is the son of Dr Betty Chacko and Rev Ninan Chacko and the younger brother of Mr Arpit Jacob. He completed his MBBS from CMC Ludhiana in 2009 and worked in Evangelical Hospital, Khariar, Odisha for 2 years before joining CMC Vellore in 2011 for his MS General Surgery. On completing his post-graduation, he served in Khariar till his fatal accident on January 29, 2017. He was a versatile missionary doctor and never restricted himself to the field of general surgery but pitched in whenever he was needed, be it obstetrics and gynaecology, paediatrics, general medicine, psychiatry or orthopaedics. He was also trained in laparoscopy and had a special interest in paediatric surgery.

He had a deep love for his wife Shyla and 1 year old daughter Naomi. A beloved son and brother, a true and sincere friend, respectful and obedient to elders, with a lovely smile and an infectious sense of humor. Music was in his heart and his songs will always be remembered. He had a love for football, his favourite team being Liverpool Football Club.

A man of few words, but words, which have uplifted the discouraged, comforted the sorrowful, influenced his peers, loved the unloved and cared for the sick. Words which showed CHRIST LIVED IN HIM.

The Young Medical Missionary Award has been instituted in his memory to recognize and record the valuable, outstanding service of young people who have opted to serve in a mission hospital in rural India for more than 10 years and who are below 40 years of age.

Mental Health & Well-being of Children amid COVID-19

BAL RAKSHA BHARAT (SAVE THE CHILDREN)

The COVID-19 pandemic has brought disruptive lifestyle changes for families globally. During the last two years, pandemic-related disruptions such as government-imposed lockdowns, school closures and social distancing have been phasic, re-emerging and posing incremental challenges to children and adolescents, who have been readjusting their lives to the 'new normal' (Meade, 2021). Among children across China, India, Italy, Canada and United States of America, social isolation, concerns about health and safety, parental job loss and economic demands, adjusting to online classes, increased screen time and sedentary behaviour and decreased access to healthcare were major concerns during the multiple waves of the pandemic (Meherali et al., 2021; Nearchou et al., 2020).

Accumulating research shows that the pandemic- induced stress was experienced by all age groups; however, there has been a significant impact on the mental and physical health of children and adolescents. Worldwide, social isolation and loneliness were associated with high rates of depression and anxiety among children and adolescents during and after the cessation of risk mitigation measures (Loades et al., 2020).

Pandemic-related stress was experienced by children through key proximal factors such as parentalconflict, parental mental illness and socio-economic disadvantage (Meade, 2021). The impact has been manifold for children from socio-economically disadvantaged backgrounds, with an added influence of socio-political events across the globe (O'Brien et al., 2021). A comparison of prevalence rates of depression and anxiety in two longitudinal cohorts from United Kingdom showed almost doubling of rates of anxiety from 13 per cent to 24 per cent. Both anxiety and depression during the pandemic were greater among adolescents and young adults (<25 years of age), women, those with pre-existing mental/physical health conditions and individuals experiencing socioeconomic adversity (Kwong et al., 2021). Globally, from March 2020 to April 2021, close to one million children experienced the death of their primary caregivers, including at least one parent or custodial grandparent, pushing them into orphanhood (S. D. Hillis et al., 2021).

Impact on Mental Health and Psychosocial Well-being of Children

Onset of new mental health concerns owing to COVID-19

The mental health impact during the pandemic included anxiety and fear of COVID-19 infection, emotional distress on account of changing and uncertain circumstances, and symptoms of depression and Post Traumatic Stress Disorder (PTSD) (de Miranda et al., 2020). Across the studies reviewed, rates and nature of mental health concerns varied according to age.

• Preschool children (<6 years): Studies examining the impact of COVID-19 among preschool children report an increase in anxiety, clinginess to parents and worries about safety, as they had difficulty in understanding causality and overestimated threat (Vasileva et al., 2021). Parents also reported a decline in children's pro-social behaviours such as interaction with peers and play behaviours as compared to the pre- pandemic times (Linnavalli & Kalland, 2021). Symptoms of anxiety, depression, impulsivity and defiant behaviours were found to be elevated during the pandemic, however, a predictable family routine and outdoor play opportunities resulted in better mental health outcomes among preschoolers (Cordovil et al., 2021; Glynn et al., 2021).

• School-going children: Older children and early adolescents (6 – 15 years) also had a self- reported increase in anxiety and depressive symptoms compared to the pre-pandemic period. A study by (Shek et al., 2021) reports 10.4 percent clinically significant PTSD symptoms among school-going children, directly associated with pandemic-related stressors. Increased inattention, reassurance seeking and academic difficulties were other concerns among school-going children (Fitzpatrick et al., 2021).

• Older adolescents (16-18 years): Self-report of anxiety symptoms among adolescents ranged from 10.4% to 37.4%, and depressive symptoms ranged between 17.3% to 43.7%; overall depressive and anxiety symptoms were higher among adolescent girls compared to boys (Fitzpatrick et al., 2021; Zhou et al., 2020). Being a girl, studying in higher secondary classes, having a high number of COVID-19 positive cases in their locality, reduced sleep, academic stress in the form of increased study duration and higher quantity of homework were other factors associated with higher levels of depression and anxiety (Liu R et al., 2021). In a study by (Murata et al., 2021), adolescents reported new-onset depression (55%), anxiety (48%), and PTSD symptoms (45%), suicidal ideation or behaviour (38%) and intense grief reactions (58%) during the pandemic. Loneliness, social isolation and poor parent-child relationship were common predictors across all psychiatric outcomes among adolescent participants.

Worsening of pre-existing mental health conditions:

Children with pre-existing mental health conditions are a vulnerable subpopulation to develop new mental health concerns owing to the pandemic and suffer from worsening pre-existing psychiatric disorders. 'Loneliness' during the pandemic was found to be associated with depression and anxiety in children and young people with pre-existing mental health conditions. This highlights the role of social connections, especially for individuals with mental health issues. (Hards et al., 2022). The presence of pre- pandemic mental health concerns such as depression and anxiety was a significant predictor for excessive screen time amounting to internet/gaming addiction during the pandemic (Cost et al., 2022; Teng et al., 2021).

Various experiences during the pandemic such as social isolation, home confinement, family members suffering from COVID-19 infection, hospitalization of key family members, and in some cases, loss of a parent have been severely traumatic for children across the globe. In a study by Mensi and colleagues exploring PTSD in the context of COVID-19, 50 per cent of the Italian adolescent participants experienced COVID-19-related PTSD symptoms, and among them, 0.16 per cent experienced PTSD requiring mental health support and interventions. Adolescents with pre-existing mental health conditions experienced more severe PTSD symptoms in comparison to those without psychiatric conditions (Mensi et al., 2021). Another interesting finding reported by this study was that trauma and stress symptoms were not related to the impact of COVID-19 in their geographic region, personal or family history of COVID-19 infection. Increased focus on death and illness in mass media, adolescents' awareness and preoccupation about these themes, heightened threat perception, and increased family stress, especially among those with mental health conditions, could have contributed to high levels of trauma-related symptoms.

Perceived COVID-19-related threat positively correlated with PTSD symptoms, whereas positive youth developmental qualities such as emotional competence, resilience, caring family environment, spirituality, and continued connectedness with important social relationships were found to be associated with overall lesser PTSD symptoms (Mensi et al., 2021; Shek et al., 2021).

A study from Barcelona, assessing new-onset mental health concerns among children with pre-existing neurodevelopmental and common mental health conditions reported that children with Anxiety Disorder, Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD) demonstrated an increased frequency of self-harm and regressive behaviours (Lopez-Serrano et al., 2021). Children with ADHD demonstrated multiple difficulties based on the severity of ADHD symptoms and their age. Younger children(<6 years) with mild to moderate ADHD symptoms suffered increased boredom, temper tantrums and less enjoyment, while adolescents had difficulties in managing their emotional state and often displayed physical aggression. Lack of interest in productive engagement and increased boredom were higher among individuals with more severe ADHD, with some

children showing improvement during the lockdown (Melegari et al., 2021). Abrupt cessation of activities and environmental changes posed adaptation difficulties among children with ADHD. Perhaps, children with high severity of ADHD were protected from negative interactions and social demands during the lockdown, which could have contributed to the improvement.

Clinic-based studies on children and adolescents with Obsessive Compulsive Disorder (OCD) reported worsening of OCD symptoms during the pandemic, with concerns related to contamination and infections being predominant symptoms before and during the pandemic (Nissen et al., 2020; Tanir et al., 2020). Excessive preoccupation and increased media exposure related to COVID-19 were factors predicting the worsening of OCD.

Access to clinical services for individuals with eating disorders was a significant concern in Western countries. Studies focusing on adolescents with eating disorders reported mixed results with respect to improvement or deterioration of their condition.

In a study by (Schlegl et al., 2020), 70 per cent of adolescents reported worsening anxiety and depressive symptoms and an increase in fear about body weight and shape. Depressive and anxiety symptoms could have contributed to increased rumination about body weight and shape, and restriction of food intake could have served as a coping mechanism to deal with depression.

On the contrary, 73 per cent of the adolescents also maintained a stable weight during the pandemic. Increased time spent at home could have contributed to regular meal structure, parental supervision and support as well as increased self-care and relaxation, despite a potential increase in family conflicts. School closures, lesser social demands, improvements in family conflicts and relationships could have facilitated motivation towards recovery among adolescents with an eating disorder (Zeiler et al., 2021).

Outdoor restrictions paralleled by increased screen time.

With curtailed access to outdoor spaces, children engaged in digital media, spending increasing amounts of sedentary screen time, causing both direct and indirect impacts on their mental health. A study by Werling et al., 2021 reports 42 per cent increase in total media time in Switzerland, during the lockdown and media time was more among adolescents compared to children (Werling et al., 2021). While media use increased during lockdown among most children and adolescents, children with pre-existing ADHD had more difficulties in emotional regulation, executive function deficits, and reduced motivation to learn, with an increase in anxiety and depressive symptoms associated with screen time and content viewed online (Shuai et al., 2021). Studies have also reported an increase in media time among infants. Maternal anxiety and depressive symptoms and media time were found to be associated with mother's intention to offer screen time to children both before and during the pandemic (Pedrotti et al., 2022).

COVID-19-related information seeking on digital media was found to be associated with an increase in preventive and precautionary behaviours mediated by worry, in turn having a negative impact on mental health (Liu, 2020). Increased publishing of unverified and unreviewed information on digital media had a high propensity to misinform readers, especially adolescents, and was found to be associated with moderate to severe depressive and anxiety symptoms (Murata et al., 2021).

Children in street situations were one of the vulnerable subpopulations facing additional barriers to health and well-being during the COVID-19 pandemic. In 2003, UNICEF estimated that there were at least 100 million children in street situations in the world (Bellamy & UNICEF, 2002). A more recent survey by Bal Raksha Bharat reported a total of 2,02,765 children in street situations in ten Indian cities. Among the CiSS surveyed, 70 per cent were involved in child labour, one out of every four children suffered from hunger and every third child faced abuse (Spotlight on the Invisibles, n.d. 2019). Living on the margins of society, children in street situations are deprived of normative nurturing experiences and relationships, are exposed to multiple, and cumulative adverse childhood experiences and their rights are often violated and compromised. This was further compromised during the pandemic, with the sudden cessation of opportunities for livelihood (Pietkiewicz-Pareek, B. 2021)

Despite accumulating research on the mental health impact of the pandemic, there is a dearth of studies focusing on the marginalised and socio-economically disadvantaged children and youth, globally. Young people experiencing homelessness and living on the streets are at a high risk for negative health impacts as a result of community support services being withdrawn during the pandemic (O'Brien et al., 2021). A qualitative study assessing the experiences of homeless youth conducted in the United States interviewed 20 participants. The youth reported 'multiple losses'; loss of jobs and financial support for self and family, access to social and healthcare services, meaningful and important relationships, and loss of control over high risk behaviours such as substance abuse during the pandemic (Rew et al., 2021). 65 per cent of the participants reported exacerbation of mental health issues including increased anxiety and depression, and 25 per cent used substances to cope with the pandemic- induced stressful life events. Of the participants interviewed, 25% reported feelings of hopelessness and/or feeling overwhelmed with the changing circumstances such as loss of identification, moving locations and uncertainty, and 60 per cent reported difficulty in accessing and utilising services such as drop-in shelters, healthcare and hygiene products that were accessible pre-pandemic (Rew et al., 2021). Another study on urban street youth in Zimbabwe used 'story maps' as a novel participatory

methodology to understand the experiences of street youth during the pandemic and reported similar findings (Hunter et al., 2021). Unlike academic challenges reported by children and adolescents living with families, children in street situations had financial instability and multiple losses as their overarching concerns.

In general, children in street situations do not have a lot of structure in their lives. However, in a pandemic crisis, they may lose even the little structure and meaningful relationships they have. Adherence to social distancing measures is difficult and impractical given the harsh realities of the lives of children in street situations (Kawala et al., 2020). A study of children in street situations in the Republic of South Sudan reports that children are at risk of contracting COVID-19 infection and are at a higher risk of developing complications because of their unhygienic living conditions (Owen & d' Amour, 2021). On the one hand, given limited formal education, children in street situations have limited access to health information and are prone to be misinformed, while on the other, health literacy among mothers of children in street situations was reported to be effective in ensuring health safety behaviours (Tayo et al., 2021).

How did children cope with COVID-19?

Overall, it was noted that majority (80%) of the children, 'less often' used specific methods for coping, while only around 1/4th (20%) of the participants reported having effectively and 'more often' used certain strategies to cope with the pandemic-related stress. Children and adolescents have been using adaptive coping patterns more often than maladaptive patterns during the pandemic. More than one in two children used avoidant coping (52.7%) and problem focused coping (51.0%) often/more often, followed by emotions focussed coping (43.3%). Among the strategies used, most commonly used coping strategies were religious coping, acceptance, active coping, seeking informational support, positive reframing, planning, emotional support and self-distraction. Substance use was one of the least utilised coping mechanisms among children and adolescents. Most children (> 90%) have responded that they 'were not doing at all', the strategies related to venting, humour, behavioural disengagement, self-blame and substance use.

Informational support was available and utilized equally in rural and urban regions. There were no differences in how often children from rural and urban backgrounds utilised problem- focused coping patterns such as active coping, planning for their future, positive reframing of the adverse experience and seeking informational and emotional support. It is important to note that informational support was available and utilised by children from rural and urban backgrounds equally. This highlights the impact of massive nationwide efforts to implement pandemic-related safety measures and health education, which is of utmost importance to address misconceptions and misinformation. Also, 'religious coping' was most often reported by children from rural backgrounds (67% rural vs 40% among urban children).

Vulnerable children coped better than children living with their families

For the current study, only a few children from child care institutions and in street situations could be interviewed. However, the responses of this small number of children, who are living out of their family or in street situations with less support, provide meaningful insights on coping during adverse situations. Children in institutions, most often sought informational support (47% vs 24%), positive reframing (36% vs 23%), planning (54% vs 28%), religious coping (68% vs 40%) compared to children living with their families. The tendencies for problem- focussed coping could have also been possibly strengthened by their adverse childhood experiences, which could have resulted in institutionalisation in the first place.

Also, it is important to note that, children in institutions, more often sought/ utilised emotional support, venting, self-blame and avoidant coping patterns such as denial and disengagement compared to children living with families and in communities.

This calls for scaling up counselling and mental health support services, in addition to informational support in the institutions, to actively engage children in-house activities and support groups. 'Living with families' can provide more emotional support and resources to actively cope during the pandemic.

Decisions regarding reintegration with the family and ensuring community-based monitoring and continued support would be helpful in the case of institutionalised children. In addition to child protection mechanisms, access to mental healthcare support and services are essential to facilitate effective coping among children in street situation.

Extract and Key Findings from TRAC Report 2022 by Bal Raksha Bharat (Save the Children, India)

Reducing Stunting/Ensuring Growth in Children

DR BEULAH JAYAKUMAR

A global study that concluded in 2004 proved that children born anywhere in the world can grow to within a normal range, irrespective of race or ethnicity, if they are given appropriate nutrition and are raised in an environment free of illness. Stunting, therefore, is more an issue of nurture than it is of nature.

Anthropometric Indices

Stunting denotes low height for age and is expressed most commonly as the percentage of children under five years of age whose heights are at least 2 standard deviation scores (or Z scores) less than that of the reference population for the same age and gender.

Wasting denotes low weight for height and is expressed most commonly as the percentage of children under five years of age whose weights for height are at least 2 standard deviation scores (or Z scores) less than that of the reference population for the same age and gender.

Underweight denotes low weight for age and is expressed most commonly as the percentage of children under five years of age whose weights are 2 standard deviation scores (or Z scores) less than that of the reference population for the same age and gender.

Stunting indicates chronic malnutrition and is the result of continued exposure to a poor diet and/or infections. Wasting indicates acute malnutrition and is the result of a short period of exposure to severe food shortage, or severe illness. Stunting and wasting are the result of independent processes, but can occur concurrently in the same child.

Underweight is a composite measure and a synthesis of linear growth and body mass development. It does not help to distinguish between short children with adequate weight from tall, wasted children and thus makes interpretation complex.

There is consensus across the organization on the need to translate gains made in food security into improvements in child nutrition outcomes. “You see teams grasping, wanting to get a handle on child nutrition” says Ms. Sackett. “‘We have our (agricultural) yields up but we have high malnutrition’, they say. They hit a wall and don’t know what to do next”.

As stated above, key determinants to ensure growth and prevent stunting fall under two categories: One, intake of diet adequate in

growth-nutrients and two, reduced episodes of illness, especially diarrhea.

Nutrients required for growth (also called Type II nutrients) include protein, zinc, sulfur and magnesium . Greens and whole grains are rich sources of magnesium. But the most important category of food sources that provide all of these nutrients, and which are typically lacking from the diet of young children are animal source foods, especially red meat, seafood and small fish, rodents and insects (eaten whole) and nuts.

In addition to providing the above nutrients, animal-source protein is considered high-quality, and superior to plant-source protein (such as beans) because anti-nutrients such as phytates present in the latter prevent the absorption of other Type II nutrients listed above (as well as iron) that may be present in the rest of the meal. , Amaranth, which has high concentrations of zinc and magnesium also has high levels of phytates. Anti-nutrient content in beans and grains can be reduced by soaking, germination and malting.

It is also important for foods to be nutrient-dense because of the low capacity of the toddler's stomach and high requirement, relative to adults. Nutritionists consider animal-source foods as key non-fortified, nutrient-dense foods.

Exclusive breastfeeding fully meets the requirements of the above nutrients up to six months of age and continues as an important source thereafter.

Animal-source foods need to be included in infants' diets as early as 6-8 months of age, the time when growth faltering sets in. Infants' and young children's diets typically lack animal-source foods. The other means to improving intake of these nutrients is through fortified products such as fortified blended foods, micronutrient powders and lipid-based nutrient supplements.

It is not possible to implement these in small scale NGO programs, as they involve products and supply chains and also have issues of long-term sustainability.

Equally, if not more important than adequate nutrition, is the prevention of frequent episodes of illness, particularly diarrhea. WASH interventions in general and hand washing and improved sanitation in particular, help prevent these episodes.

Breastfeeding has a protective effect from diarrheal illness. Reduced episodes of diarrhea will result in better absorption of nutrients available in the meal, and thus the two pathways enhance each other.

Recent evidence suggests that low-grade gut infection caused by living in physical environments that are contaminated with feces (caused by open defecation) is strongly linked to stunting, without overt bouts of diarrhea and even with adequate intake of nutrients listed above .

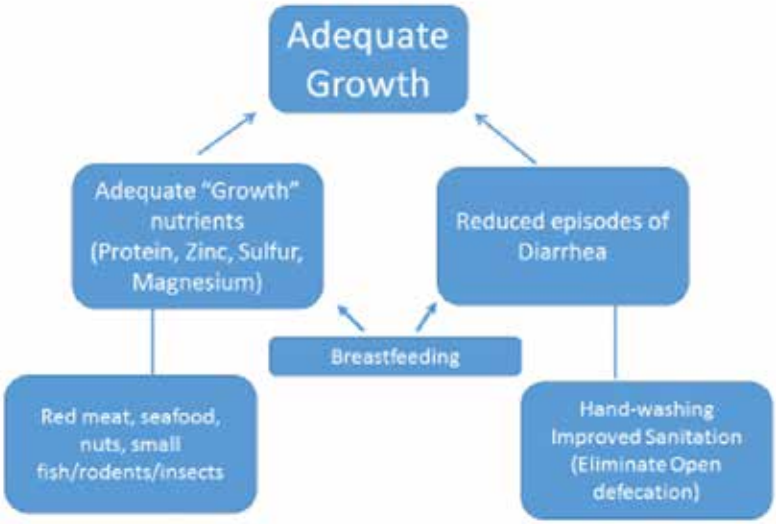
This is particularly true for the population-dense south Asian context but also applies to other locations with any level of open defecation.

It has been observed that there are more cellphones than toilets in India - part of the conundrum of impressive economic growth and high stunting. This association is so strong that sanitation is called "under nutrition's blind spot" and there have been calls to consider stunting separate from malnutrition, in order to underscore the influence illness has on growth.

The contribution of each of these two principal pathways, relative to each other, is not yet known. It is therefore essential that programs include activities that work on both.

Figure 1: Pathways for Optimal Growth

The above pathways provide indications as to why stunting continues to be very high in countries with significant economic growth and improving health indices such as Nicaragua and India.



As with interventions for reducing deaths, these two sets of interventions for ensuring growth are established by strong evidence. We know what works. Programs need to determine how to implement these interventions effectively in their respective contexts. In-depth formative work will be required in each program context to identify ways to include animal-source foods mentioned earlier in young infants' diets without significantly increasing opportunity costs such as women's workload.

Delivery strategies such as the PI community organization model will help programs in any context, to effectively address stunting in a way that enhances community ownership and sustainability.

WINDOW OF OPPORTUNITY

As is now widely recognized within the organization, the critical window of opportunity to intervene for ensuring both survival and growth is the first 1,000 days of life, from conception till the time the child is 2 years of age. While recent evidence suggests that some of the deleterious effects on growth can be reversed up to 5 years of age, the most long-lasting changes happen during the first 1,000 days. Rapid growth beyond 2 years of age increases the risk of fat-mass development and chronic disease in adult life. "How to promote linear growth without making children fatter?

Some clear options are promoting breastfeeding; high quality protein; zinc and, of course, focusing on the 1,000 days" says Dr. Cesar Victora, a renowned epidemiologist and the lead researcher of the 30-year COHORTS study . Focusing beyond the first 1,000 days could therefore lead to the unintended consequence of childhood obesity.

ADDRESSING STUNTING IN COMMUNITY PROGRAMS

Community development programs have a head start in addressing stunting in target populations as they are multi-sectoral in nature. Ensuring effective working linkages with agriculture/food security and livelihoods interventions is probably more relevant in reducing stunting than for any other development problem. However, the nature of interventions listed above point to some reasons why overall improvements in agricultural productivity or economic growth do not automatically translate into better child growth outcomes .

Programs need to continue to be multi-sectoral but include a deliberate focus on the first 1,000 days of life. Formative research should identify local, culturally acceptable "growth" foods – foods that are rich in high-quality protein and zinc; barriers to including them in young infants' diet; and barriers to changing WASH-related behaviors; agriculture and livelihoods interventions need to ensure that households have year-round access to those foods; gender equity issues need to be identified and addressed so that pregnant women and young infants receive the nutrition and care they require; WASH interventions need to ensure that entire communities have access to and use clean water, wash hands with soap, use latrines and eliminate open defecation, in order to effectively cut the transmission of diarrhea. Finally, behavior change interventions need to work with families to change household practices related to all the above interventions. Such comprehensive programs can expect stunting rates to reduce by about 1.8 percentage points every year .

ADDRESSING STUNTING IN PROGRAMS

Formative Research to identify:

- Locally available and culturally accepted "growth" foods

- Barriers to including them in infants' diet

- Barriers to hand-washing, latrine use

Agriculture Interventions to ensure:

- All households have year-round access to "growth" foods

WASH INTERVENTIONS TO ENSURE:

Entire communities have access to clean water, wash hands and use latrines

BEHAVIOR CHANGE/GENDER INTERVENTIONS TO:

- Work with families to change practices related to care during pregnancy, breastfeeding, feeding "growth" foods to infants, hand-washing and use of latrines

Focus on the first 1,000 days of life.

Dr Beulah Jayakumar

Public Health Consultant, New Delhi

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Same as #14

Do We Really Know Best?

DR TED LANKESTER

I WANT YOU TO THINK ABOUT THIS: DO WE REALLY KNOW BEST?

Who knows the most about what is happening in a village, or at the heart of an urban settlement?

Who often knows best about solutions which would help to solve those problems?

As doctors and health professionals we are brought up to think we know the best answers- about health, about evidence, about answers.

But do we always?

Who has not come across the wisdom of the villager, whether it's the ageless man or woman who has lived in the community and observed it for decades? Or the young entrepreneur, able to speak in person, or on social media, about ways to improve the health and wellbeing of their family or community?

When I worked for The Emmanuel Hospital Association in the Garhwal Himalayas, it was the villagers who first made this suggestion. ***"If you can't provide a doctor, hospital or ambulance for our village, perhaps you could train one or two of our own people on how to improve our health?"***

And who did they choose?

Wise compassionate women, already good mothers, and noted for their community spirit.

At the moment worldwide, there are millions of such men and women, ASHAs (Accredited Social Health Activists) or equivalents, helping to prevent and often cure illnesses in their own communities. And with the World Health Organization estimating the world is short of 15 million trained health professionals, Health workforce (who.int) how desperately the world needs Community Health Workers, with their informed knowledge amplified by community service.

TOP OF THE CLIFF

Are there enough of us there at the top? Preventing as many people as possible from falling off the cliff in the first place, rather than having to treat and cure so many when they land at the bottom?

How much are we involved, not only in the basic prevention of ill health, but in a wider remit of identifying the social determinants of health?

Before reading on, please remind yourself of the 17 Sustainable Development Goals. THE 17 GOALS | Sustainable Development (un.org) No 3 specifically on health comes quite naturally to us. Now look creatively at all the others. Can you see a single one which would not have a positive impact on health, if we helped to enabled it reach its goals? Even number 14, perhaps the

most obscure “Life in the Water” is relevant for a large number of those living in India where adequate fishing is essential for child (and adult) nutrition.

SCRIBBLED NOTES BECOMING A BOOK

I thank God I’m a doctor. I’ve been working in hospitals, health centers, clinics and communities for many years. Tomorrow I’m off to London to examine humanitarian aid workers and mission partners responding to their vocational calls to make our world a happier and healthier place. I love doing it.

But there is one thing I love even more: seeing this great combination. First a community able to identify and solve many of its problems. Second, skilled advisors accompanying and supporting them, such as nurses, teachers and doctors.

I drafted the first chapters on our book, now in its 4th edition, based on these principles. They had already been working well in our health programme. I started to scribble ideas when sitting on the backseat of our jeep, that is when not at the wheel on our remote mountain roads.

Since that time I have visited and worked with inspirational people from many nationalities, backgrounds and cultures. Together they have contributed a wide spectrum of further ideas, evidence and inspiration.

Here is my challenge, whether you read or don’t read this book. Become excited about this winning combination. Community wisdom in action plus evidence- based care and knowledge from your own health background. This is not a simple 1 plus 1 equals 2. It’s a number far greater than that, in proportion to the combined impact we help to bring.

TOGETHER NOT ALONE

I’ve often visited my old workplace in the hills since I and our family returned to England. But on one occasion I felt both glad and troubled. Glad that so many fine health programmes were starting or progressing. Troubled that most seemed to do this in isolation, often not working alongside or even relating to others doing similar things in adjacent areas. Many organisations all reinventing the wheel. A state government understandably puzzled by this plethora of civil society organisations. How could they relate to so many?

That same year, whilst seeing aid workers at my clinic in London from a wide range of NGOs, I noticed the equivalent happening.

Patient 1 “I’ve been working at community and hospital level in the north west of the African country I love”.

Patient 2 from a different NGO. “I’ve been working in the north west of the African country I love”.

“Oh you must know Patient one? I said. “No, I’ve never heard of his or her organisation”

Patient 3 from yet another NGO enters, quite coincidentally also working in the same area. “Oh you must know patient 1 or Patient 2?”. “No I’ve never heard about their work or their organisations”

A NEW NETWORK

I turned these two frustrations into nudges. My path miraculously overlapped with someone I had never met, a doctor working in Nepal for 10 years who had observed the very same thing. Together we co-founded Arukah Network, originally known as Community Health Global Network (CHGN).

The principles we’ve written about in the book, and being demonstrated through Arukah and other organisations too, can be extremely effective in both rural and urban settings. By working together in friendship and collaboration with like-minded individuals and organisations, and by listening, sharing our strengths and also our weaknesses, we can help to transform the health and wellbeing of vulnerable communities, neighbourhoods and families.

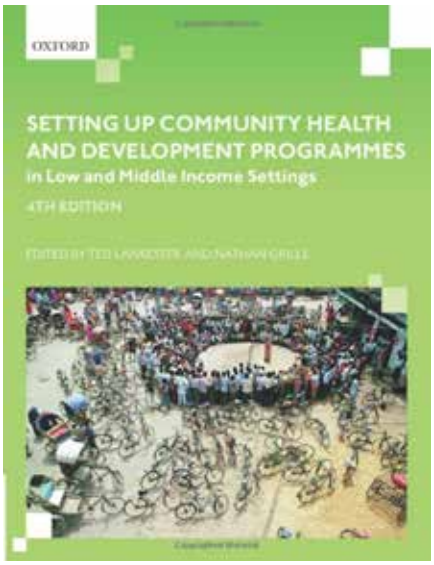
TWO FINAL SUGGESTIONS

In your busy life I invite you to consider reading this book or using it as a reference- as an actual book- yes! or on Kindle or via a Free Download.

And also to look at the Arukah Network website, to see how many of its principles can work out in practice in India- and globally. www.arukahnetwork.org

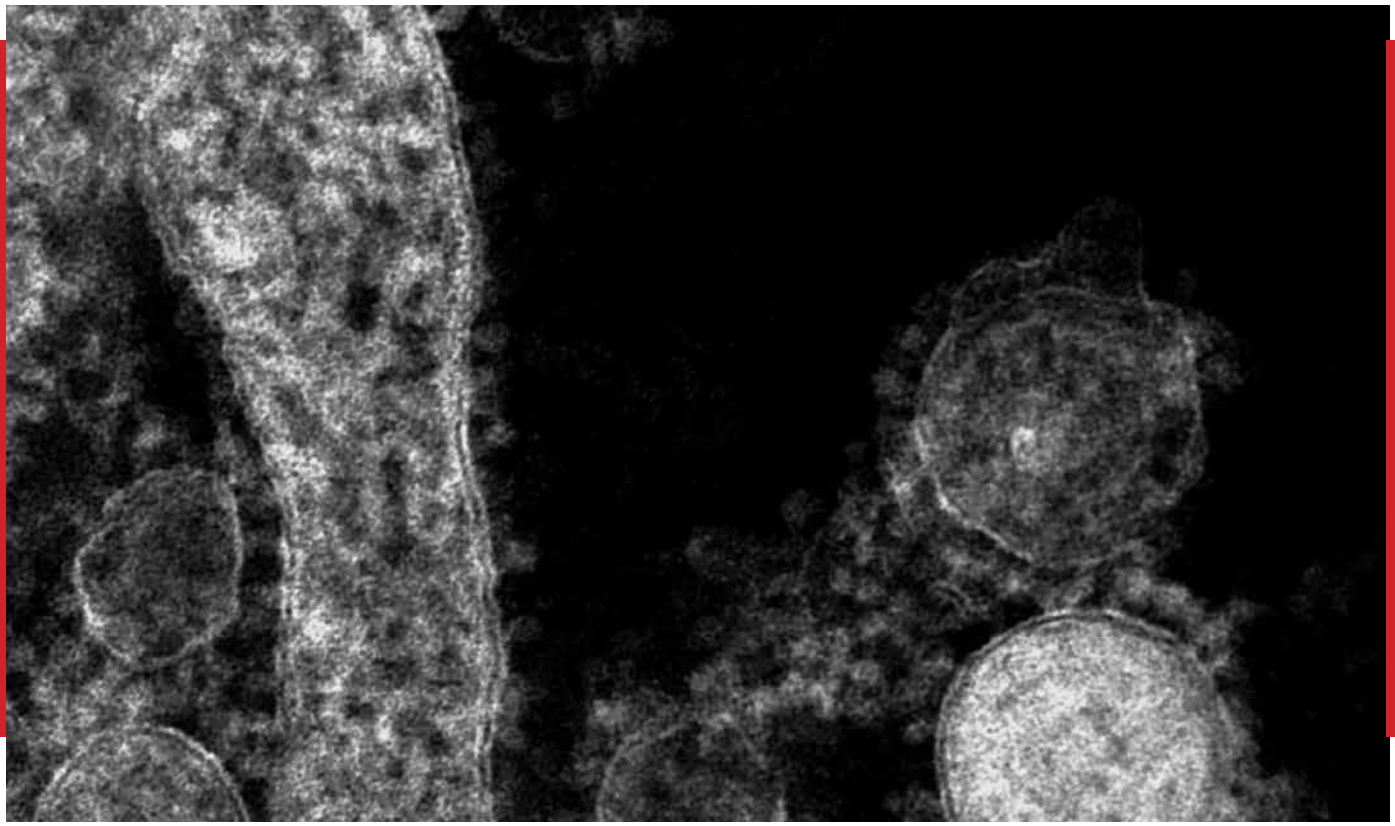
Above all I would value hearing your own ideas, thoughts and solutions which may be the best of all.

Dr Ted Lankester, Co-Founder and Co-Leader, Arukah Network



In its 28 chapters, this book gives details of how crucial areas need to be re-established and further developed at a community level.

Published in association with Arukah Network for Global Community Health. Available on Amazon and also on OUP as an E-Book



Dermatophyte Infections in Adults- Clinical Features and Management, Part 2

DR RENU GEORGE

Tinea pedis may present as:

i) itchy diffuse scaly patches on the soles referred to as the papulosquamous type (Fig. 10).

ii) itchy scaly or macerated patches in the toe webs (Fig. 11).

iii) vesicles and pustules.

iv macerated erosions and superficial ulcers which often have superadded Gram-negative bacterial infection.

Tinea unguium:

The nails become discolored, thickened and brittle. The nail plate may separate from the underlying nail bed which may become hyperkeratotic. Single or multiple nails may be involved.

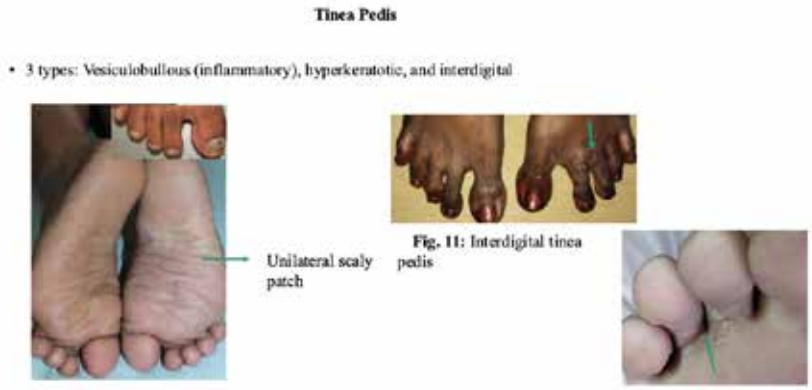


Fig. 10: Tinea pedis with unguium

Fig. 11: Interdigital tinea pedis

Box: 1 When to suspect a dermatophyte infection

Complications of dermatophyte infection

•Secondary infection- foot is a common site- lesions tend to be malodorous and macerated.

•Persistent itching/post tinea eczema or dryness.

•Tinea incognito: Misdiagnosis due to the local immunosuppressive effects which can alter the clinical features of dermatophyte infection (discussed above).

•Dermatophytid reactions: usually manifests as a vesicular reaction (pompholyx) distant from the primary infection.

•Exacerbation of lesions after starting treatment.

Differential Diagnosis

Common differential diagnosis of tinea corporis includes psoriasis (Fig. 12), granuloma annulare (Fig. 13), and eczema (Fig. 14) and occasionally tuberculoid leprosy.

Additionally, contact dermatitis and candidiasis should be considered in the differential diagnosis of tinea pedis.

Differential diagnosis of tinea unguium includes nail psoriasis, lichen planus and traumatic nail dystrophy.

Fig. 12: Psoriasis- silvery scales

Fig. 13: Granuloma annulare

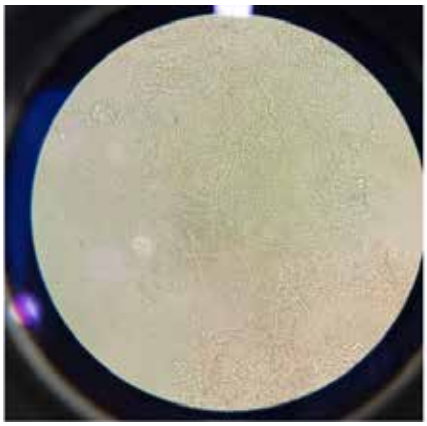
Fig. 14: Discoid eczema

Diagnosis

The diagnosis can be established by the history and physical findings. The most common laboratory test done is a KOH microscopy.

Wood's lamp examination and dermoscopy are useful for the diagnosis of tinea capitis.

10% KOH examination reveals septate hyphae (Fig. 15).



Treatment

The treatment of dermatophyte infection includes general measures, topical and systemic treatment.

General Measures

• Avoid sharing garments, towels, and sheets.
•Wash all the clothes in hot water, sun dry and iron inside out.
•Avoid close contact with other members of the family.
•Tinea pedis: avoid occlusive foot wear and sharing foot wear.
•Avoid tight fitting clothes.
•Avoid body contact sports.
•Advocate simultaneous Rx of all family members after physical examination.
•Examine nails of all patients for dermatophyte infection.

Topical antifungals:

Common topical antifungals available:

i) Azoles: Clotrimazole, miconazole, luliconazole, sertaconazole

ii) Allylamine: Terbinafine

iii) Others: Ciclopirox, amorolfine, tolnaftate, Whitfield's ointment

Indications:

1. In treatment naïve patients with 1-2 lesions.

2. Patients in whom systemic treatment is contraindicated and for those at risk for drug interactions.

3. Nail lacquer containing the active ingredient is indicated in patients with limited nail involvement.

Topical agents are used in combination with systemic antifungals for rapid mycological cure.

Preparations:

Topical antifungals are usually available as creams and ointments.

Other types of preparations available include:

Lacquers (mentioned above) are used for nail infection - Amorolfine, ciclopirox.

Shampoos - Ciclopirox and

ketoconazole are prescribed used for tinea capitis. Powders, soaps, and shampoos are not effective in eradication disease.

Powders dry the region and may be helpful in preventing recurrence of tinea cruris and tinea pedis.

Method of application:

"RULE OF TWO": Topical antifungals are applied twice a day (few exceptions), two centimeters beyond the margin for 2 weeks beyond the clinical clearance of the lesions.

Systemic antifungal therapy:

Tinea unguium (most cases), tinea capitis, and tinea barbae require systemic antifungal therapy due to poor penetration of topical agents into nail and hair. It is also indicated for widespread tinea infection, tinea manuum, tinea pedis, and in those with chronic or relapsing infection. Standard and modified regimes used in the current scenario for tinea corporis, cruris and faciei are shown in Table 1., common contraindications and standard lab monitoring tests are listed.

Table 1: Modified and standard systemic antifungal therapy for tinea corporis/cruris/faciei

Antifungal	Dose in adults*	Minimum Duration*	Standard regimen	Contraindication and monitoring
Griseofulvin	Naïve: 500 mg/day In chronic cases- 750-1000 mg/day	8 weeks 8 weeks	Microsize-500-1000 mg/day x 2-4 weeks Ultramicrosize-375-500 mg/day x 2-4 weeks	Pregnancy Porphyria, SLE Liver disease Long term Rx-CBC, LFT, Renal
Terbinafine	Naïve: 250 mg/day In chronic cases 250 mg bd/day	4 weeks 4 weeks	250 mg od 1-2 weeks Chronic cases- longer duration	Liver or renal disease Drug interactions Monitor LFT Long term Rx-CBC
Itraconazole	Naïve: 100 mg 1 or 2 capsules od In chronic cases: 200 mg/day	3 weeks 4 weeks	200 mg/day- 1 week Chronic cases- longer duration	Ventricular dysfunction-Proarrhythmic states Pregnancy Liver and renal disease Drug interactions Monitor: LFT
Fluconazole	Naïve: 50-100 mg/day 150-300mg/weekly In chronic cases 100 mg/day 150 mg thrice weekly	4 weeks 8 weeks 6 weeks 8 weeks	150- 200 mg once weekly- 2-4 weeks	Drug interactions Renal and liver disease Monitor LFT: prolonged course

Adapted from: Rengasamy M, Shenoy MM, Dogra S, Asokan N, Khurana A, Poojary S, Jayaraman J, Valia AR, Sardana K, Kolalapudi S, Marfatia Y, Rao P N, Bhat RM, Kura M, Pandhi D, Barua S, Kaushal V. Indian association of dermatologists, venereologists and leprologists (IADVL) task force against recalcitrant tinea (ITART) consensus on the management of glabrous tinea (INTACT). Indian Dermatol Online J 2020;11:502-19

Treatment of tinea pedis: Standard treatment

•Itraconazole: 200 mg bd x 1 week
•Terbinafine 250 mg od x 2 weeks
•Fluconazole: 150 mg once a week x 2-6 weeks
•Griseofulvin: 1000 mg (microsize) x 4-8 weeks/ 660-750 mg (ultramicrosize) x 4-8 weeks•Topical antifungals- Azoles, ciclopirox, terbinafine
•Whitfield's ointment- for thick scaly lesions (avoid in pregnancy)
•In malodorous cases – add an antibiotic which covers pseudomonas
•Prophylaxis: Antifungal powders
•Keep feet dry, use cotton socks, treat hyperhidrosis, use wicks in interdigital tinea

Special consideration in diabetics:

Itraconazole: Effective against dermatophytes and molds *Multiple drug interactions; hypoglycemia with sulfonylureas

Terbinafine: Effective against dermatophytes but less so against yeasts. Safer for those on OHAs

*List not complete

Treatment of tinea unguium:Treatment is not mandatory in all patients.

Indications for treatment:

1. History of cellulitis in those with ipsilateral tinea unguium.
2. Patients with diabetes, peripheral vascular disease, chronic edema, and immunosuppression, which are additional risk factors for cellulitis.
3. Patients with recurrent/relapsing tinea infection at other sites.
4. Symptomatic disease of the nails.

Systemic therapy:

- Itraconazole

1. Pulse therapy

Finger nail involvement- 200 mg twice daily for one week per month for two months. Toe nail involvement-200 mg twice daily for one week per month for 3 months

2.Continuous therapy: Finger nail involvement-200 mg per day for 6 weeks

Toe nail involvement- 200 mg per day for 12 weeks •Terbinafine

Finger nail infection- 250 mg per day for 6 weeks
Toe nail infection- 250 mg per day for 12 weeks

Topical therapy:

It is indicated for limited nail involvement- distal nail plate involvement of 1-3 nails.

The agents available are:

1. Amorolfine 5% nail lacquer applied once a week till clearance. Usually requires about 6 months of treatment.
2. Ciclopirox 8% nail lacquer applied once daily. Continue treatment till clearance or 48 months.

Treatment of dermatophyte infection in the elderly:

Indications for systemic therapy in the elderly:

•Tinea involving two or more areas
•Tinea unguium
• Repeated failure of treatments with different topical agents.

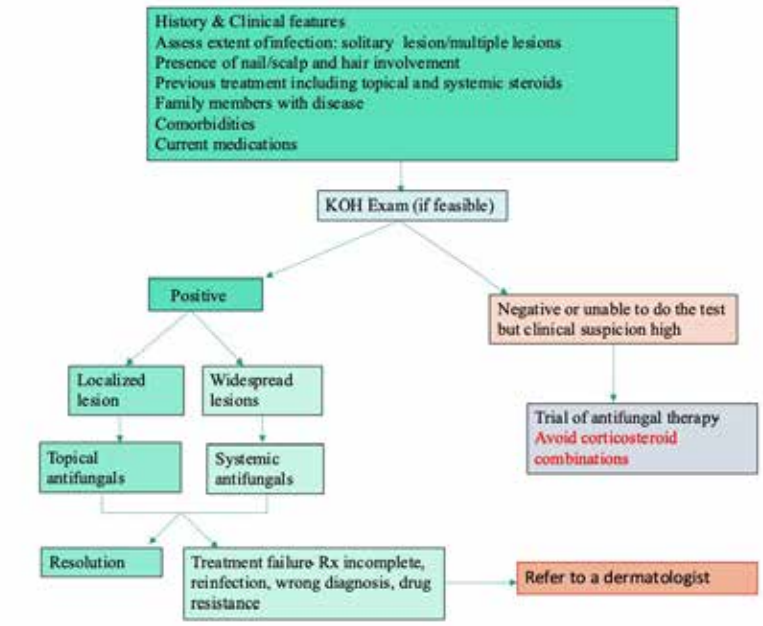
Choice of Rx: In view of polypharmacy and possible cardiac problems- preferred antifungals are terbinafine and griseofulvin along with topical agents.

Treatment of dermatophyte infection in pregnancy. Topical antifungals are preferred.

Summary:

The algorithmic management of dermatophyte infection of the skin is summarized is Box 2.

Box 2: Treatment algorithm



Dr Renu George, Consultant Dermatologist, Scudder Memorial Hospital, Ranipet

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Analysis Of An Arterial Blood Gas Report

DR GEORGE JOHN

INTRODUCTION:

An arterial blood gas (ABG) report is an important investigation in the evaluation of any critically ill patient. This article will focus on how to analyze it in practical terms. ABG machines have become more sophisticated over the years and the report spewed out gives a daunting list of parameters. Let us break it down to two basic groups:

Directly measured by the machine: PO2: partial pressure of oxygen in the sample | PCO2: partial pressure of carbon dioxide in the sample pH: the value representing the hydrogen ion concentration in the sample. The above are the basic parameters measured by all ABG machines

Derived (Calculated) values: These include many useful values but they are all calculated from the directly measured values. If the measured values are wrong, the derived ones will be also be in error. These include some or all of the following (or many more depending on the manufacturer):

Oxygen saturation A-a gradient

P/F ratio Bicarbonate: actual (calculated at actual pH and PCO2) standard (calculated at a PCO2 of 40mm Hg)

Base Excess: details later actual (also referred to as Base Excess Blood) and

standard (also referred to as Base Excess ECF)

Oxygen content

Some machines also give a direct measurement of oxygen saturation, carboxyhemoglobin and methemoglobin. However, this needs an additional measuring component known as a co-oximeter.

Additional parameters: As the machines become more sophisticated, additional values are available which are all directly measured: Hemoglobin Glucose Electrolytes: Sodium, potassium, calcium (ionized), chloride Others: lactate, creatinine, bilirubin.

Input parameters: Needs to be entered by the operator or read from a barcode

Patient ID: Name, hospital number etc.

At the very least, the FiO2 (fraction of inspired oxygen) being given to the patient must be fed into the machine. In some machines, the ventilator parameters (for ventilated patients) can also be entered.

CONCEPT OF NORMAL

It is important to understand the concept of normal in clinical usage before we understand the values in

an ABG printout. There are many ways in which a clinical normal can be defined. The following principles are important:

1. Biological normal is a range – not a single value. The normal height of an Indian woman is not one value but a range.

2. The range can be obtained in two ways

a. A population of "normal" individuals is taken and the parameter measured. The mean and standard deviation is calculated and a range of mean + 2 standard deviations is calculated to give the range. This is also referred to as reference range values and is included in the printout of many ABG machines

b. A group of individuals whose parameters are measured are followed up over a period of time and the outcomes of these people are observed. Those who suffer negative consequences as a result of some parameter values are referred to as having "abnormal" results. In other words, an abnormal value is one which impacts a person's life – either in terms of longevity (quantity, duration of life) or quality of life. For many parameters this involves a longitudinal follow up over time. In the case of ABG values, these are easy to determine because short term outcomes are easier to observe in the ICU setting. I shall refer to values which don't adversely impact the outcome of critically ill patients as clinically acceptable values.

The following are the ranges for the main ABG values:

Parameter	Reference Range	Clinically Acceptable Range
PaO2 (mm Hg)	60-90	60-120
PaCO2 (mm Hg)	35 – 45	30 – 50
pH	7.35 – 7.45	7.30 – 7.50
Bicarbonate (mmol/L or mEq/L)	24 – 28	24 – 28
Base Excess (mmol/L or mEq/L)	-2 to +2	-5 to +5

If you are writing an exam, please use the Reference Range concept of normal. If you are looking after patients in the ICU, you can use the clinically acceptable range because there are no deleterious effects in that range and trying to achieve parameters within a narrow rangecan have adverse consequences related to the therapeutic intervention.

OXYGENATION:

The first value to be looked at in an ABG report should be the PaO2. Many ABG reports printouts show pH and PaCO2 before PO2. I suggest you look at the PaO2 first because that is the most important parameter in the whole list. In a critically ill patient, the most important organ which needs to be protected is the BRAIN. Just as in a chess game, if the King is lost, the game is lost - irrespective of how many other pieces one may have, if the brain dies, there will be no personal meaningful recovery even if all the other organs in the body are functioning well and even if intensive care is continued indefinitely.

The brain critically needs oxygen for survival and inadequate oxygen for 3-5 minutes will result in significant irreversible brain damage. Hence the importance of PO2. It is also true that an acceptable PO2 alone will not ensure adequate brain oxygenation because the oxygen content (which depends on hemoglobin in addition to the oxygen saturation) and oxygen delivery (which depends on cardiac output) are also essential. However, in the presence of a low PO2, adequate hemoglobin and cardiac output will not ensure adequate oxygen delivery to the brain.

Hypoxia is defined as a PaO2 less than 60mm Hg on room air. If hypoxia is diagnosed, it is essential to act fast to ensure adequate oxygenation (increase inspired oxygen, ventilate the patient, change body position, clear secretions, increase PEEP as appropriate). Once adequacy of PaO2 is attained, one needs to know why the PaO2 is low. There could be two broad groups of causes.

a. Ventilatory Failure: Inadequate fresh gas reaching the lungs due to inability to move gas. This may be due to a number of reasons: deep coma, respiratory center injuries in the brain stem, spinal cord injuries, neuropathies affecting nerves to respiratory muscles, respiratory muscle involvement (fatigue or muscle disease), inability of chest to expand (chest wall injuries, pain, large pleural effusions) or large airway obstruction (mouth, pharynx, larynx, trachea).

b. Oxygenation Failure: There is fresh gas delivery to the alveoli but there is failure of oxygen to be adequately transferred to the blood due to a pulmonary parenchymal problem. This could be at the level of the small airways, alveoli or pulmonary circulation due to one or more of many pathological processes such as infections, inflammation (chemical, immune), fluid (overload or left heart failure), pulmonary fibrosis, vascular (pulmonary embolism, vasculitis).

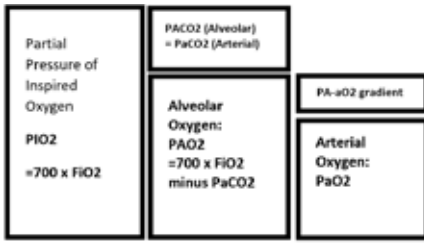
Distinguishing between the above two reasons can be achieved by calculating

a. Alveolar arterial Oxygen gradient (PA-aO2 for short).

b. P/F ratio: These are automatically calculated on most modern ABG machines. However, in order to get an insight into the concept here are the equations:

a. Alveolar arterial Oxygen gradient (PA-aO2 for short). The full formula to obtain the PAO2 (partial pressure of oxygen in the Alveoli, note upper case A) is: PAO2 = (PB – PH2O) x FiO2– PaCO2/RPB is atmospheric pressure PH2O is water vapor pressure at body temperature (about 47mm Hg). R is respiratory quotient, taken as 0.8. The component (PB – PH2O) x FiO2 gives the partial pressure of inspired oxygen (PIO2) The Alveolar carbon dioxide (PACO2) is taken as equal to arterial carbon dioxide (PaCO2) as carbon dioxide is highly diffusible and there is no significant gradient To use a simpler equation, if PB = 760mm Hg, (PB – H2O) = 713, rounded off to 700.If 0.8 is taken as 1.0, then the equation becomes PAO2 = (700 x FiO2) – PaCO2 The alveolar arterial gradient, is obtained by subtracting arterial PaO2 (PaO2 – note lower case a) PA-aO2 = (700 x FiO2) - PaCO2 – PaO2 = (700 x FiO2) – (PaO2 + PaCO2)

To look at it pictorially,



Example1: If PaO2 is 230 on FiO2 of 0.5, PaCO2 is 40, PA-a = (700 x 0.5) – (230 + 40) = 350 – 270 = 80

Example2: If PaO2 is 230, on FiO2 of 0.5, PaCO2 is 100, PA-a = (700 x 0.5) – (230 + 100) = 350 – 330 = 20

Using the shorter formula: The normal gradient depends on age of person (about 15 at the age of 20 years to about 35 at the age of 80 years), body position (less gradient in erect and prone positions as compared to supine) and on the FiO2 (gradient increases from 10-20mm Hg on room air to 60-70mm Hg on 100% oxygen). In the critically ill, a gradient less than 100mm Hg can be considered acceptable (indicating that the pulmonary parenchymal function is acceptable).

b. P/F ratio:This is simpler to calculate and is obtained by dividing the numerical value of PaO2 by the FiO2 (expressed as a fraction).

Example: If PaO2 is 200mm Hg and patient is on 50% oxygen, P/F ratio = 200/0.5 = 400.A value greater than 300 implies a clinically acceptable pulmonary parenchymal function.The difference between the two is that P/F ration does not consider PaCO2 in its calculation so hypoxia due to ventilatory failure will also show a ¬¬¬¬¬low P/F ratio (falsely indicating that the pulmonary parenchyma is abnormal). If the PaCO2 is not high (less than 50), the P/F ratio is good enough to use as an index of pulmonary parenchymal function. If PaCO2 is elevated, use the PA-a gradient, not the P/F ratio as a marker of pulmonary parenchymal dysfunction.

Hyperoxia:A high oxygen levels for prolonged periods is harmful as it enhances Reactive Oxygen Species (ROS) formation. ROS are reactive molecules formed through oxygen's electron receptivity (superoxide, peroxide, and hydroxyl anion). This can cause tissue damage and clinically cause coronary vasoconstriction after myocardial infarction, diffuse alveolar damage (ARDS) and inflammation.In addition, high oxygen in the alveoli can cause Denitrogenation, Absorption Atelectasis (DNAA). If pure oxygen is used, it is fully transferred to the blood in the alveolar capillaries and allows it to collapse. Nitrogen performs the important function of splinting alveoli and keeping it open.There are some differences in opinion regarding the acceptable ceiling (high level) for PaO2 (as no definitive studies are yet available) but in general, avoid values > 200mm Hg for long periods (>24 hours). It is advisable to keep it less than 150mm Hg as far as practically possible. However, 100% oxygen should be used in all patients during acute resuscitation for short periods of time.

At the conclusion of analyzing oxygenation, you should be able to state;1. Is PaO2 acceptable? 2. Is there pulmonary parenchymal dysfunction interfering with oxygenation?

ACID BASE STATUSThis is the second component of information available in an ABG report.

BASIC CONCEPTS: Neutral, Acid, Base: A solution is neutral if it contains equal concentrations of H+ (H3O+) and OH- ions.

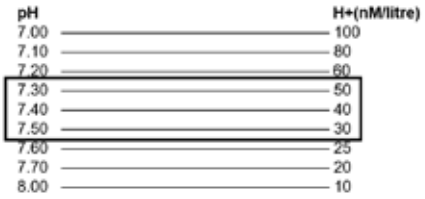
Acid (low pH): H+ (H3O+) > OH-
Base (high pH): H+ (H3O+) < OH-
The pH value is a measure of the hydrogen ion activity in a solution.

What is "normal" pH? Although the text book range of normal pH is 7.35-7.45, the human body can tolerate levels beyond this range for short periods without significant problems. In the ICU, a pH range of 7.30 – 7.50 is acceptable. In those with diabetic ketoacidosis, even those with a pH value of 7.0 recover with appropriate therapy (insulin, hydration, electrolyte correction) even without specific therapy for correction of the pH. Permissive hypercapnia (while allowing the pH to drop to 7.30) is recommended while ventilating patients with low tidal volumes in ARDS. Thus, the absolute value of the pH is, not by itself, an indication for correction of the pH. The severity of its effect on body dysfunction depends not only on the magnitude but also on the cause of the derangement and its reversibility. The relationship between H+ ion activity, PaCO2 and HCO3 can be seen expressed in the equation:

[H+] = 24 x (PaCO2 / HCO3) Note that the equation has H+ ion activity not pH. Considering a PaCO2 of 40mm Hg and HCO3 of 24mmol/L in the above equation, [H+] = 24 x (40/24) = 40nmol/L (nanomoles per liter)

To use the above equation, the values of H+ ion activity and corresponding pH in the human body needs to be calculated. It can be done using an online calculator or you remember the following three relationships:

pH	H+(nmol/L)
7.3	= 50
7.4	= 40
7.5	= 30



Since pH is on a logarithmic scale and H+ is on an arithmetic scale, doubling or halving H+ concentration is equivalent to subtracting or adding 0.3 to the pH (as log 2 = 0.3). As the pH rises, H+ falls and vice-versa, so use appropriately.

Examples: 1) pH 7.7 = 7.4 + 0.3; H+ for 7.4 = 40 hence for 7.7, H+ = 40/2 = 20nmol/L. 2)pH 7.2 = 7.5 - 0.3; H+ for 7.5 = 30 hence for 7.2, H+ = 30x2 = 60nmol/L.

DEFINITION OF TERMS: pH:Negative logarithm of the H+ ion activity.

ACID: A H+ ion donor
BASE: A H+ ion acceptor |
ACIDOSIS:An abnormal process which tends to lower the arterial pH.
ALKALOSIS:An abnormal process which tends to increase the

arterial pH. ACIDEMIA:Blood pH lower than acceptable range. ALKALEMIA:Blood pH higher than acceptable range.

Remember that the terms “acidosis” and “alkalosis” refers to processes which tend to change the pH. Whether the pH actually changes beyond the reference range depends on the severity of the process and any secondary disorders which may co-exist.

HYDRATION REACTION:

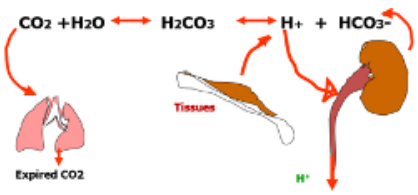
Instantaneous changes in the reversible reaction

$$CO_2 + H_2O \longleftrightarrow H_2CO_3 \longleftrightarrow H^+ + HCO_3^-$$

These changes are not due to compensation by the renal/ respiratory systems. It is a reversible reaction.

DEFENDING THE pH: COMPENSATORY MECHANISMS The pH has to be maintained within a specific range in the body in order for metabolic reactions catalyzed by enzymes to continue.

Buffer Systems: The first line of defense to resist a change in pH in the body is the buffer system. A buffer is a solution that resists a change in pH. There are many different buffer systems in the body, but the key one for understanding most acid-base disorders is the bicarbonate system present in the extracellular fluid. The importance is not because it is the most powerful but it is the most abundant and is regulatable by the respiratory and renal systems. It reflects the changes occurring in other buffer systems. As is for any buffer system, it consists of a weak acid (in this case carbonic acid, H2CO3) and its conjugate base (the bicarbonate ion, HCO3-) which exist in dynamic equilibrium.



Keep the above picture in mind while evaluating acid-base disorders. Disorders arising from a retention or excessive washout of carbon dioxide due to respiratory system dysfunction are known as RESPIRATORY disorders. If the disorder is not due to a RESPIRATORY cause it is known as a METABOLIC (or non-respiratory) disorder. Respiratory causes of changes in pH are due to an increase or decrease of the carbon dioxide but the non-respiratory (also called metabolic) abnormalities can be due to multiple causes -renal (retention of hydrogen ions, loss of bicarbonate), hepatic (failure to clear lactate), tissue (increased hydrogen ion production) or gut related (loss of hydrogen, chloride in vomiting or bicarbonate in diarrhea) problems. Compensatory responses refer to changes in function of the respiratory system (in a metabolic problem) or by the kidneys (in a respiratory problem) tending to return the pH to normal. The respiratory system does this by washing out or retaining carbon dioxide in response to metabolic disorders tending to alter the pH. This change occurs within minutes. The kidneys compensate for respiratory disorders by retaining/ producing bicarbonate or excreting H+. This response is slower than the respiratory response to metabolic disorders and occurs over days. A simple acid base abnormality is defined as that in which only a single disorder is responsible for the change in pH. Mixed acid-base disorders are those in which in which more than one disorder is present.

In the above diagram, note that the equation is a reversible one and can shift depending on the concentration of its components. A primary rise in CO2 (respiratory cause) will push the equation to the right and increase the H+ ions (acidosis) and increase the HCO3-. A primary drop in CO2 (respiratory) will shift the equation to the left and reduce H+ ions (alkalosis) and reduce HCO3.

A primary increase in H+ ions (metabolic acidosis) will push it to the left as more H+ combine with HCO3 (reduced level of HCO3) increasing carbonic acid (H2CO3) concentration which will dissociate to water and carbon dioxide (tending to raise PCO2).

A primary reduction in H+ ions (metabolic alkalosis) will push it to the right as less H+ combines with HCO3 resulting in decreasing carbonic acid (H2CO3) concentration which will tend to reduce its dissociation to carbon dioxide (reducing PCO2). Thus, a rise in bicarbonate can be due to a respiratory acidosis or a metabolic alkalosis and a reduction in bicarbonate can be due to a respiratory alkalosis or a metabolic acidosis.

COMPENSATORY responses refer to the changes actively brought about in PaCO2 or HCO3 by respiratory/renal function as a result of the primary dysfunction and tending to return the pH to normal. These changes are NOT classified as acidosis or alkalosis as they are part of the physiological response to maintain the pH. The respiratory response to metabolic disorders is quite rapid (within minutes) so the terms chronic metabolic acidosis/ alkalosis are not meaningful. In a respiratory problem, the renal compensation takes time (days) so the respiratory disorders are termed acute or chronic (usually >72 hours) depending on whether the renal compensation has had time to kick in. The differentiation between acute and chronic respiratory disorders is based on whether there is associated change in pH beyond the acceptable range. If the change in PaCO2 is associated with a change in pH, the disorder is an acute or an acute on chronic process. In a purely chronic process, the compensatory process brings the pH to just within the clinically acceptable range (7.30 - 7.50). In addition, since the term metabolic in this context does not refer to a single organ dysfunction, there can be combinations of metabolic acidosis plus alkalosis (renal failure and vomiting, which may bring pH to the normal range) or even double metabolic acidosis (renal failure and diarrhea).

Remember: 1. Compensatory changes do not fully normalise (bring pH to the middle of the range, unless the primary disorder is mild). 2. Compensatory changes NEVER cause an overshoot in the pH (overcompensate). 3. Mixed disorders can result in a normal pH

value. 4.The term acidosis/alkalosis with the adjectives metabolic/ respiratory are not final diagnoses but need to be explained in terms of physiological processes and clinical conditions. This involves correlating both clinical and laboratory information.

ANALYSING ACID BASE DISORDERS

In a real-world scenario, mixed disorders are commonly seen. A practical approach to the evaluation of acid base status is given in this section.

STEP 1: ALWAYS start with the clinical scenario: do you expect a primary respiratory or metabolic process in this scenario?

STEP 2: Is there a problem? DETECT the problem: Look at the pH, PaCO2 and HCO3 (or Base Excess). If any of these are outside the clinically acceptable range, there is a disorder. An abnormal PaCO2 or HCO3/Base Excess indicates that there is a disorder even if the pH is within the clinically acceptable range. A significant increase in the anion gap usually points to a metabolic acidosis.

STEP 3: Is the disorder SINGLE or MIXED: EXPLAIN the process:

If there is only one process causing a derangement of the acid base status it is a single disorder. The definition of a simple disturbance includes both the initial process and the compensatory mechanisms due to the initial disturbance. In a mixed disorder, there is simultaneous co-existence of two or more disorders. Inappropriateness (excess or inadequate) of the expected compensatory response indicates a mixed disorder.

This can be done for clinical purposes by using one of several possible approaches. In this article only the ones which can be easily applied by the bedside will be discussed: You can use any of the following rules;

1. Rule of thumb for metabolic disorders. The following “rules of thumb” for calculation are useful in evaluating a metabolic disorder: A) In a primary metabolic acidosis (when the primary event is a drop in HCO3 or accumulation of H+), the appropriate compensatory response is a drop in PaCO2 due to hyperventilation. The numerical value of the reduced PaCO2 should be within + 5 of the number formed by the 2 digits of the pH after the decimal point down to a PaCO2 of 10mm Hg. Usually, the PaCO2 does not go below 10mm Hg. B)

In a primary metabolic alkalosis (when the primary event is an increase in HCO3 or reduction of H+), the appropriate compensatory response is a rise in PaCO2 due to hypoventilation as the respiratory center is less stimulated when the CSF is alkaline.

The numerical value of the reduced PaCO2 should be within + 5 of the number formed by the 2 digits of the pH after the decimal point up to a pH of 7.60. Usually, the PaCO2 level due to a metabolic alkalosis does not go above 60mm Hg because hypoxia sets in and maintains the ventilatory effort.

If the PaCO2 is above 60mm Hg, look for other causes of hypoventilation – not just a compensatory response.

2. Base Excess rule:The Base Excess is a calculated value meant to represent the “metabolic” component just as PaCO2 represents the respiratory component. The terms Base Excess (actual) or Base Excess (blood) mean the same and refers to the Base Excess measured in the sample. However, as it was found empirically that this did not give a true reflection of the “metabolic” abnormality, the term standard Base Excess (or Base Excess-ECF) was introduced.

The discrepancy occurred because the pH buffering occurred throughout the extra cellular fluid (ECF). The standard bicarbonate (or Base Excess-ECF, assumes the hemoglobin is diluted in the entire ECF and recalculates the Base Excess.

The usual value taken is lower than the blood: Hb (5g%).

Note that the words “actual” and “standard” as applied to the Base Excess has a different connotation than when applied to bicarbonate.

To use the Base Excess rule, remember the following table:

ACID BASE DISTURBANCE	RULE FOR EXPECTED CHANGE
Acute Respiratory Acidosis/Alkalosis	▲▼ PaCO2 x 0 = ▲▼ BE
Chronic Respiratory Acidosis/Alkalosis	▲▼ PaCO2 x 0.4 = ▲▼BE
Metabolic Acidosis	▼ BE = ▼ PaCO2
Metabolic Alkalosis	▲ BE x 0.6 = ▲ PaCO2

To put it in words: In an acute respiratory acidosis/alkalosis, there is no expected change in base excess (multiplication by zero in above table). Since the problem is acute, the renal system has not had time to initiate compensatory changes. To determine whether it is acute or chronic evaluate the clinical scenario in conjunction with the pH. If the pH is within the clinically acceptable range with a PaCO2 beyond the clinically acceptable range, the disorder is chronic.

If pH is outside the clinically acceptable range with a PaCO2 beyond reference range limits, it can be acute, acute-on-chronic or a mixed disorder. In a chronic (the renal system has had time to compensate) respiratory acidosis/alkalosis, the increase in Base Excess should be 0.4 times (40% of) the rise in PaCO2 (primary change). If the change is less, there is a concomitant metabolic acidosis. If the change is more, there is concomitant metabolic alkalosis.

In a metabolic acidosis, the drop in PaCO2 must equal the drop in base excess (primary change). If there is more reduction, there is an associated respiratory alkalosis. If the reduction is less (or if there is an increase in PaCO2), there is concomitant respiratory acidosis.

In a clinical scenario, this lack of expected reduction or rise in PaCO2 could imply that the respiratory muscles cannot cope and could be fatiguing. If left without ventilatory support, it could lead to a respiratory arrest. In a metabolic alkalosis, the increase in PaCO2, should be equal to 0.6 times (60% of) the increase in Base Excess (primary change). If the increase is more, there is associated respiratory acidosis. If the increase is less, there is associated respiratory alkalosis.

Points to remember with above calculations;

1. the above formula for calculation is based on the change expected (delta values) – not absolute values.

2.think of the expected direction of compensatory change before calculation. 3. if the patient's previous values are available, use them to see the amount of change.

4.If previous values are not available, use the higher and lower values of the normal range: this gives the range within which the expected compensation should be present. Note: The expected values as a result of compensation nay be numerically slightly different depending on the method you use. Either method will give clinically relevant results. Remember, this is Biology, not Physics!

Delta Ratio	Conclusion
< 0.4	normal anion gap metabolic acidosis (**NAGMA**)
0.4 – 0.8	mixed normal and raised anion gap metabolic acidosis (**NAGMA + HAGM**
0.8 – 2.0	high anion gap metabolic acidosis (**HAGMA**)
More than 2	**HAGMA +** co-existent metabolic alkalosis/ chronic respiratory alkalosis (pre-existing high HCO3)

The anion "gap" is a misnomer and should be more accurately termed the "unmeasured anions". It exists because not all electrolytes are measured and is calculated as: AG = (Na + K) - (Cl + HCO3) Use the actual HCO3 for Anion Gap calculation not the standard HCO3.

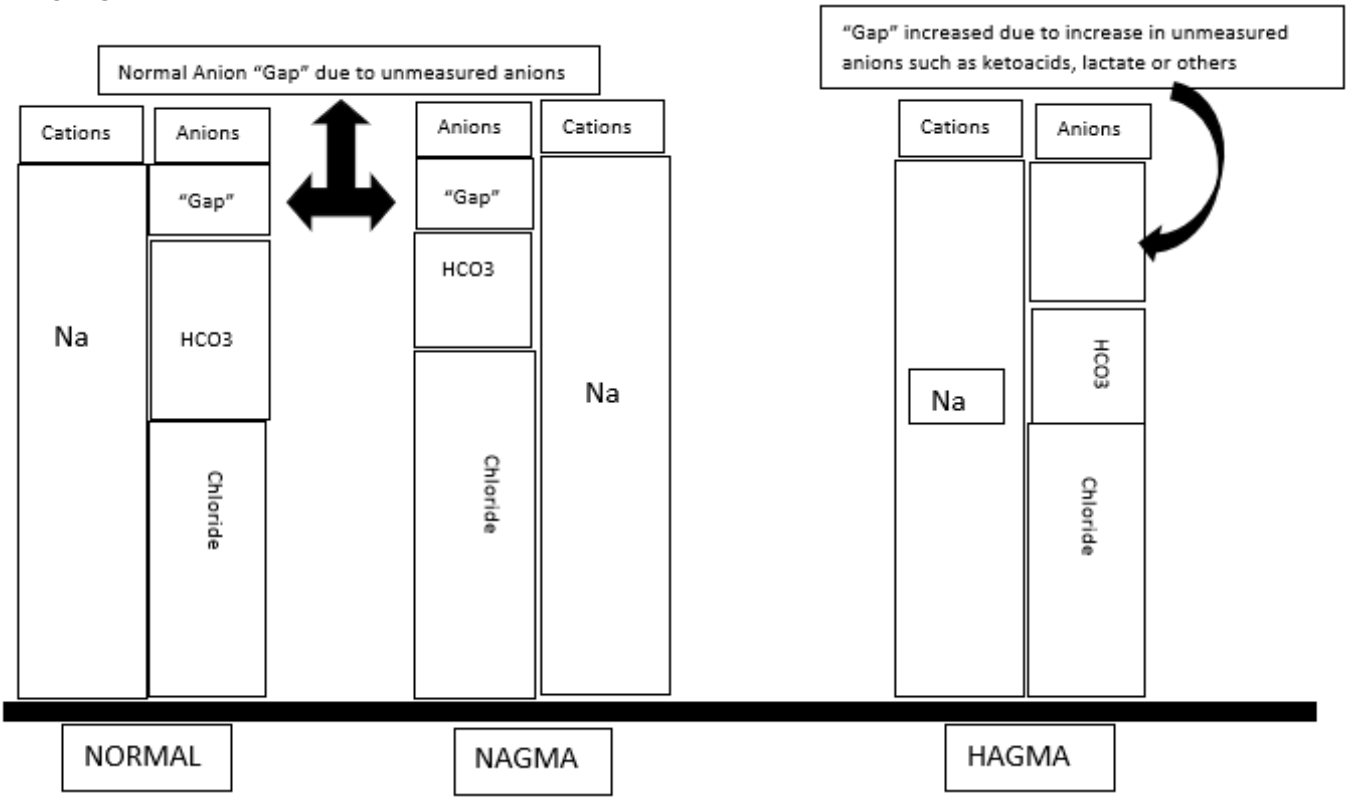
It has a value of 14 + 4 mmol/L if the above equation is used.The potassium may be omitted from the equation and then the Anion Gap has a reference range of 12 + 4 mmol/L.

In reality, there is no gap as the body is electroneutral. A change in one component will cause compensatory changes in other components so that electroneutrality is maintained. The anion gap also reflects the difference between the unmeasured cations and unmeasured anions. The value of the total unmeasured anions is about 23mmol/L and the value of the total unmeasured cations is about 6.5mmol/L thus giving the anion gap as 16.5mmol/L (Range = 10 to 18mmol/L). If the values of ions not included in the equation change, the apparent mathematical gap between the sum of the measured cations and sum of measured anions will also change.

Calculation of the AG is a useful approach to analyze metabolic acidosis. Metabolic acidosis caused by a loss of HCO3 or a gain in Chloride will cause a metabolic acidosis with no increase in the AG (NAGMA: normal anion gap metabolic acidosis). Metabolic acidosis caused by an increase in unmeasured anions (lactate, ketoacids, other metabolites, poisons) will result in a high anion gap metabolic acidosis (HAGMA).

An increase in the Anion Gap (>18 mmol/L) can occur with; a) increase in unmeasured anions: ketoacidosis, lactic acidosis, renal failure, some poisons, b) decrease in cations not in the equation: hypocalcemia, hypomagnesemia. A decreased or even negative Anion Gap (<10mmol/L) can occur with; a) decrease in unmeasured anions: hypoalbuminemia b) increase in measured chloride: this may be true or spurious (due to increased serum bromide, from consumption of cough medication: because bromide interferes with the automated analyzers measuring chloride and gives a false hyperchloremia).

ANION GAP



c) increase in unmeasured cations not in the equation: hypercalcemia, hypermagnesemia, lithium, increased IgG (a cationic protein) d) water excess causes a decrease by dilution.

It is also important to note that a high anion gap acidosis can be masked by a process tending to lower the anion gap. These are; (a). low serum albumin – for every 1g% reduction in serum albumin below 4g%, the anion gap drops by 2.5 – 3.0 mmol/L. (b). an increase in unmeasured cations. (c). normal renal function – a normal kidney can excrete the excess organic anions and replace them with chloride thus reducing the anion gap.

The delta Anion Gap: The anion gap allows for the differentiation of 2 groups of metabolic acidosis. Metabolic acidosis with a high AG is due to endogenously generated or exogenously administered acids: high anion gap metabolic acidosis (HAGMA) and metabolic acidosis with a normal AG is associated with the loss of HCO3 from the kidney or GI tract, or the failure of the renal tubules to excrete H+(NAGMA) normal anion gap metabolic acidosis. The delta/delta concept allows for the partitioning of metabolic acidosis into HAGMA and NAGMA or both which can occur concomitantly. As explained above, the concept behind delta/delta isbased on the assumption that for every increase in anion gap of 1 mmol/L above normal (12 mmol), serum HCO3 - will drop by an equal amount: The change in Anion Gap should be equal to change in HCO3: ΔAG = ΔHCO3 Delta Gap = ΔAG - ΔHCO3

The normal value for delta gap should be zero, and it should remain zero because, in HAGMA, the anion gap and bicarbonate change together (in opposite directions). As the AG rises, bicarbonate should fall equally if there is no other disorder. The delta gap will become more and more positive, if the bicarbonate is falling significantly less than the rising anion gap, reflecting an alkalosis. The delta gap will be very negative if the fall in bicarbonate is disproportionately greater than the decrease in anion gap: if there is acidosis unrelated to the increase in anion gap (co-existent NAGMA). The alternate method is to use the delta ratio Deltaratio=ΔAG/ΔHCO3=(Measured Anion Gap – 12) / (24 – HCO3).

Delta Ratio	Conclusion
< 0.4	normal anion gap metabolic acidosis (**NAGMA**)
0.4 – 0.8	mixed normal and raised anion gap metabolic acidosis (**NAGMA + HAGMA**
0.8 – 2.0	high anion gap metabolic acidosis (**HAGMA**)
More than 2	**HAGMA +** co-existent metabolic alkalosis/ chronic respiratory alkalosis (pre-existing high HCO3)

The last value of > 2 occurs in those who have a pre-existing higher than normal bicarbonate level. The HAGMA is reflected in the high anion gap, but because the initial bicarbonate was high, though it decreases, the fall will be reflected only as a small amount because a fixed value of 24 is subtracted from it. The numerator (AG) is a relatively large number but the denominator is a small number resulting in a high delta ratio (> 2). This implies HAGMA plus a pre-existing cause for a high bicarbonate (> 24): chronic respiratory acidosis or metabolic alkalosis.

The delta gap and ratios should not be applied blindly – keep a firm understanding of the physiology to understand what is going on. Blindly using the gap and ratio will result in wrong diagnosis if not backed by understanding the process.

BOSTON APPROACH: The above approach to calculate expected compensation is known as the Copenhagen (or European) approach. There is an alternate approach known as the Boston (or US) approach which has a set of equations to calculate the expected changes in HCO3 in compensation. In the interest of simplicity, it has not been discussed.

Standard bicarbonate method:

The actual and standard values of bicarbonate in an ABG printout are both calculated values. The standard bicarbonate is calculated to determine what the HCO3 would be if the PaCO2 were 40mm Hg. In other words, it is the bicarbonate value at a “normalised” PCO2 (thus any respiratory component causing the change in HCO3 is mathematically eliminated). If this value is lower than the clinically accepted bicarbonate range, there is an associated metabolic acidosis, if higher, there is a concomitant metabolic alkalosis. If it is within the clinically acceptable range, there is no metabolic component and the change is only due to an altered PaCO2. However, this is a calculated value and is not generally used for acid base evaluation. It is being mentioned for understanding the concept.

STEWART APPROACH:

Any discussion about analyzing Acid Base abnormalities is incomplete without mentioning the Stewart approach. It will not be discussed in detail either as those interested can read it in the section on Further Reading.

The Stewart approach offers additional insight into metabolic acid-base disorders. It reveals the role of Chloride in determining pH. It is based on the premise that the hydrogen ion concentration (pH) depends on the relative concentrations of multiple cations and anions. The full approach is difficult to use at the bedside but a simplified approach known as the Fencl-Stewart approach is useful. To put it in a nutshell, the approach uses the Strong Ion Difference (SID, difference between Na and Chloride concentrations) to evaluate the metabolic disorders. This is not the same as the Anion Gap.

The median difference between Na and Chloride is 35-37 mmol/L.

If the difference is less (due to low Na or high Cl) it drives more hydrogen ions to ionize (to maintain electroneutrality) thereby causing acidosis. You can think of this as the body maintaining electroneutrality by enabling more positive ions (H+) to be in solution.

If the difference is more (due to high Na or low Cl), it causes an alkalosis (reduces H+ ionization).

In summary, use the Stewart approach in a metabolic acidosis when the numbers don’t “gel” (look at the Na and Cl and calculate SID).

VENOUS BLOOD GAS (VBG):

Advantages of a VBG:

1. Decreased pain for the patient.

2. VBG sample can be drawn using the same venous line that is used to draw blood for other lab tests.

pH: The pH values closely mirror arterial values for several metabolic conditions, including diabetic ketoacidosis (DKA) and uremia. There is a close correlation between arterial and venous lactate levels.

PvCO2 A venous PCO2 above 45mm Hg predicts an arterial PCO2 above 50mm Hg. In addition, a difference in PaCO2 between arterial and central venous values of more that 6mm Hg indicates that the cardiac output is low.

PvO2: There is no correlation between arterial and venous values of PO2. However, a mixed venous (not peripheral venous but central venous sample) with an SvO2 (oxygen saturation) < 70% (corresponding to a PvO2 of about 35mm Hg) indicates that cardiac output is inadequate to meet tissue demands.

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FURTHER READING:

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