

SDG 3: GOOD HEALTH AND WELL-BEING



ORIGINAL: ICTs have the potential to deliver benefits across the global healthcare ecosystem. Patients can contact health care services remotely regardless of their proximity to a healthcare centre. Health care workers can, for example, learn and prepare for disease outbreaks, identify patient symptoms, follow established treatment protocols, perform remote diagnostics, access expert support and so on. Big Data analytics can help produce snapshots, analyse trends, and make projections about disease outbreaks, health service usage, and patient knowledge, attitudes, and practices.

A SOUTH AFRICAN-SPECIFIC PERSPECTIVE:

HOW CAN INFORMATION AND COMMUNICATION TECHNOLOGIES HELP PROMOTE GOOD HEALTH AND WELLBEING FOR THE POOR IN SOUTH AFRICA?

1. Global use of ICT for Health and Wellbeing:

The Information and Communications Technology sector has always been a vital tool for the delivery of health services and the development of broad-spectrum wellbeing. This South African-specific perspective provides a very brief overview of the critical links between ICT and health/wellbeing, suggesting the problem statements that ICT4SDG3 will be designed to resolve. Internet hyperlinks to more detailed knowledge sources, which will be used to inform the development of specific strategies and implementation programmes in a reductionist, virtuous circle research and development mode, are provided. The following summarizes the key factors linking ICTs to the delivery of health and wellbeing services within the SDG3 challenges.

- 1.1. The non-electronic predecessors of today's high-tech ICTs, which ranged from drum beats, through fast human runners and horse assisted messengers, to various forms of mechanical semaphores, alerted whole nations, communities, and individuals of national and man-made disasters that threatened the health and wellbeing of individuals, communities and whole nations.
- 1.2. All variants of today's electronic communications have been used to seek and dispense medical assistance and support, to provide early warnings of natural and man-made disasters, and to contribute towards mitigation of those disasters. From the historical Morse Code SOS and May Day distress signals, through South Africa's emergency call numbers 10111, 10177, and 112 (mobile phones), to broadband Internet assisted online tools that enable calls for help and access to both curative and preventative information and knowledge for self-help, the role of ICT has always been central to the health and wellbeing sector.
- 1.3. The ICT-driven printed and electronic news media contains numerous case descriptions of emergency medical procedures undertaken or managed by remotely located specialist medical practitioners – emergency amputation of limbs in remote rural African locations guided by Europe-based specialists using mobile phone short message services (SMS) to deliver precise instructions on complex medical procedures that saved lives; telesurgery that combines robotics, high capacity and quality ICT networks, and remotely located surgeons undertaking complicated surgical procedures across oceans and continents.
- 1.4. Large-scale genome sequencing to combat viral outbreaks. For several years now, scientists have been able to sequence the genomes of newly discovered or still evolving new viruses, convert these genome sequences to digital data, and "email" the sequences to massive AI-driven DNA analytic computers to recreate the viruses and develop cost-effective vaccines. Example: [2013 – 10,000 Influenza Viruses sequenced and vaccines developed](#) in partnership with the [J. Craig Venter Institute](#), from a knowledge base of about 200 fully sequenced influenza genomes in 2005. Up to five million people severely affected with influenza may find life-saving relief from this development, a classic example of ICT4SDG3.
- 1.5. August 2017: Sophisticated medical diagnostic laboratory squeezed into a smartphone: [Handheld spectral analyser turns smartphone into diagnostic tool](#). "Powerful new apps are turning our phones into mobile medical clinics. Could this help solve the issue of rising healthcare costs?" ([Madhumita Murgia, Financial Times January 12, 2017](#)).
- 1.6. **Impact of The Fourth Industrial Revolution (4IR):** WEF 17: Future of the Digital Economy: Dr Liu Jiren, Chairman and CEO of Neusoft China describes "a Cloud Hospital": (a) Hospitals downsized to reduce costs; (b) Full AI-driven

integration of all health and wellbeing services – hospitals, the whole pharmaceutical industry, health insurance, diagnosis and clinical analyses; (c) health care and health service delivery moves from hospitals to homes; (d) Internet of Things (IoT) sensors link body functions and health threats directly to clinical laboratories and physicians; (e) relationships between doctor and patients fully personalized:

<https://www.youtube.com/watch?v=atM7Q8aPRb4>.

- 1.7. Natural Disasters: The 2004 Indian Ocean Tsunami: the first Internet mediated massive natural disaster: <http://unpan1.un.org/intradoc/groups/public/documents/apcity/unpan022464.pdf> | Successes and limitations of ICT usage during the 2004 Indian Ocean Tsunami are discussed fully in Finland's report available at <https://www.coe.int/t/dg4/majorhazards/ressources/virtuallibrary/materials/finland/dr3cvra.pdf>. This report provides an excellent example of international assistance and cooperation during natural and other massive disasters, saving lives and providing relief to survivors with the help of ICT. The health threats following mass fatalities in disasters such as these can be as devastating as the disasters themselves. Monitoring and control through ICT and related technologies has effectively reduced the extent and frequency of massive health pandemics (e.g. HIV, Ebola), preventing them from reaching the devastating proportions of the 14th century "Black Death" spanning most of Eurasia (see [South African "Health24" media warning of October 2017](#)).
- 1.8. **The destructive role of ICT in Health and Wellbeing:** Cybercrime, fake news, botnets, cyber bullying, Internet addiction, anomalous cyber activities, all with potential to trigger political instability, revolutions and civil/regional wars with immense reversals of health and wellbeing for whole nations, regions and individuals. The disruption of social order and political processes that such practices can lead to is discussed in numerous conferences and reports, including an excellent treatise in "*Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy (2016)*": <https://medium.com/@merrymou/widespread-mysterious-and-destructive-algorithms-cathy-oneil-at-microsoft-research-9c23609f168b>. An equally informative article has been published by Forbes in 2017: [What If Deep Learning Was Given Command Of A Botnet?](#), and "*Fake news in public health: what's the antidote?*" <https://croakey.org/fake-news-in-public-health-whats-the-antidote/>.

Many developing and developed nations have been plagued by fake news and related cyber-based misinformation that led to the rejection of modern curative medications in favour of less effective or wholly ineffective traditional medicines. Mass abuse of legal drugs as in the current [American opioid crisis](#) have in some cases been linked to online and traditional media misinformation by some major pharmaceutical companies. South Africa is not immune, fake news is a growing phenomenon that affects health and wellbeing (promotion of ineffective cures), and potentially health-threatening civil strife triggered by fake news disseminated through botnets.

2. The South African ICT4SDG3 Challenges:

Will all the above Health and Wellbeing related scientific advances "trickle-down" to South Africa's +30 million citizens living below the national poverty lines, and their children who number more than 60% of the national child population? The following briefly reviews a very short list of relevant literature and media coverage of South Africa's health and wellbeing crisis that afflicts 55% of the nation's population.

- 2.1. The [top five natural causes of death in South Africa](#) are listed as (1) Tuberculosis; (2) Diabetes; (3) Various forms of heart diseases; (4) Cerebrovascular diseases (strokes); (5) HIV. South Africa's 30+ million citizens living below the national poverty lines are especially at risk of death from these and more natural causes of death because of their poverty status, which deprives them from the same levels of health services available to their wealthier compatriots.
- 2.2. Poverty is South Africa's major health and wellbeing threat. This threat is discussed in [ICT4SDG1 \(No Poverty\)](#) and [ICT4SDG2 \(Zero Hunger\)](#). The impact on children's physical and mental health is profound: "*Chronic stress from growing up in poverty can physiologically impact children's brains, impairing their working memory and diminishing their ability to develop language, reading and problem-solving skills, reports a new Cornell study*"¹. There are no vaccines available for this health threat, the defeat of absolute poverty remains the only known remedy today.
- 2.3. 2 February 2018: News24: [Children continue to attend schools without safe sanitation, court hears](#) | 4 June 2018: [BBC News: South Africa's school pit latrine scandal: Why children are drowning](#) | 9 July 2018: Industry News, Water: [Opinion: Lack of sanitation in schools a deprivation of human rights](#). Poor sanitation is not restricted to

¹ Cornell University: 2009: <http://news.cornell.edu/stories/2009/04/poverty-changes-brain-reduces-childrens-learning> AND: <http://news.cornell.edu/stories/2016/12/kids-poverty-means-psychological-deficits-adults>

children drowning in pit latrines; the health threats of poor sanitation are well-known and well-understood, the challenge remains the spread of awareness and knowledge of these threats, and the means to reduce them.

- 2.4. 16 July 2018: HSRC BRICS Seminar [Presentation](#): Children 0 - 14 years constitute 30% of the population: More than 50% of these children live under the poverty line, actual and potential victims of malnutrition, stunting, wasting, underweight, overweight and obesity.
- 2.5. 29 May 2018: Hunger in SA: *"We sometimes go to bed on an empty stomach"*: Surveys show that there has been no shift in child malnutrition rates in South Africa since the 1990s despite social grants. Ntombizanele Mbuweni is a single parent and supports a family of five from one Child Support Grant (CSG) of ZAR 400 per month. She collects expired bread rolls from the nearest supermarket to help feed her family. ([Health 24 Report](#)).
- 2.6. 25 February 2014 – [The Citizen Report](#): An average of 23 shacks burn down in SA each day | 20 October 2018: One dead, 4,000 homeless as shack fire rages in Khayelitsha (Times Live [Report](#)). Homelessness adds to the trauma of home and possession losses that result from South Africa's frequent shack fires; it also leads to severe health and wellbeing reversals for individuals and whole communities.
- 2.7. 16 October 2018: Durban - It is expected that 13 million South Africans experience hunger in South Africa each day, yet a third of the world's food is waste – more than enough to eradicate world hunger. ([Report: IOL #WorldFoodDay](#)).
- 2.8. 2009/2010: **Saving Soweto** – an eight-part documentary series on Chris Hani Baragwanath Hospital, nominated as a finalist in the 2010 New York Festival's International Television and Film Awards. The series was directed and produced by Shareen Anderson (Fort Greene Filmworks) and Lisa Henry (Left Hand Films) for Al Jazeera, which broadcast the series worldwide in 2009. Part 1 presents gruelling insights about the trauma unit on a pay-day weekend - patients with gunshot, stab wounds and other life-threatening injuries are sent to wait outside because the emergency ward is too full to accommodate them all, other hospitals are full or closed. Many patients just die from their injuries without receiving medical attention. The series can be viewed and downloaded beginning with part 1 at <https://www.youtube.com/watch?v=CZjrSf3QG9k>.
- 2.9. **The Drugs and Substance Abuse**: [27 June 2018, Parent24](#): 80% of SA's male youth deaths are alcohol-related and drug consumption is twice the world norm | [9 November 2016, Soul City Institute for Social Justice](#) provides a valuable review of the literature on drug and substance abuse amongst youth and young women in South Africa: *"Substance abuse is a global challenge with detrimental effects on health, wealth and security of nations (UNODC, 2010). In South Africa drug abuse has been associated with crime, interpersonal violence, risky sexual behaviour (with accompanied increased risk of HIV acquisition and STI incidences), negative health of users and negative psychological impact to their families"* (Section 1: Introduction on page 4 of this Soul-City article).
"Substance dependency statistics show that drug consumption (cannabis, cocaine, and tik) in South Africa is twice the global average and second to none in Africa (UN World Drug Report, 2014). The average age of drug dependency in South Africa is 12 years and decreasing. South Africa is among the top 10 narcotics and alcohol abusers in the world" (see Page 8 of the Soul-City article).

This health and wellbeing national threat demands more than traditional health services and technological support tools. It is a serious social threat to South Africa's future which demands strong sociological intervention strategies, supported by enabling information/knowledge/learning platforms and communication networks best provided by affordable broadband ICTs.

- 2.10. **Violence against Women and Children**: https://www.huffingtonpost.co.za/jeanette-buis/violence-against-women-and-children-is-both-a-crisis-and-a-challenge_a_23193672/ : *"Ending the canker that is gender-based violence will require effort, commitment and endurance from the government, business and civil society"* (Jeanette Buis, Legal researcher) | *"Crime against Women in South Africa: An in-depth analysis of the Victims of Crime Survey data 2018"*: <http://www.statssa.gov.za/publications/Report-03-40-05/Report-03-40-05June2018.pdf> | Important data and figures have been prepared and published by the SA Medical Research Council (MRC), which reports that [40% of men assault their partners daily – and that three women in South Africa are killed by their intimate partner every day](#) | Opinion by Jade Tess Wiener, 18 June 2018: <https://www.politicsweb.co.za/opinion/violence-against-women>: *"Violence against women (I & II)"* | <http://www.oxfam.org.za/enough-is-enough-together-we-can-end-violence-against-women-and-children/>: ***"Enough is enough: Oxfam seeks to end violence against women and girls once and for all"*** – Oxfam South Africa 2017.

3. DISCUSSION: IMPROVING THE HEALTH AND WELLBEING OF THE EXCLUDED POOR THROUGH ICT.

3.1. A brief history of technology, health and wellbeing

Since the dawn of the human species some 300,000 years ago, humans have “invented” technological tools to survive and develop within often hostile environmental conditions, natural and manmade health and wellbeing reversals (including droughts and wars), and aggressive carnivores and viruses. Until about 300 BCE, humans shared information, knowledge, technological inventions (including pharmaceutical discoveries and inventions), and cultural and social practices that promoted human wellbeing freely, all in the interest of community.

“Humans evolved by sharing technology and culture: Our early ancestors, Homo sapiens, managed to evolve and journey across the earth by exchanging and improving their technology. Research from the University of Bergen shows that cultural interaction has been vital to the rise of humankind”.

[Humans evolved by sharing technology and culture](#)

Since its discovery in the early 1990s, Blombos Cave, about 300 kilometres east of Cape Town, South Africa, has yielded important new information on the behavioural evolution of the human species. The cave site was first excavated in 1991 and field work has been conducted there on a regular basis since 1997 – and is on-going. Blombos contains Middle Stone Age deposits currently dated at between 100,000 and 70,000 years, and a Later Stone Age sequence dated at between 2,000 and 300 years.

Adapting and evolving

“The pattern we are seeing is that when demographics change, people interact more. For example, we have found similar patterns engraved on ostrich eggshells in different sites. This shows that people were probably sharing symbolic material culture, at certain times but not at others” says [Dr Karen van Niekerk](#), a UiB researcher and co-author.

“This sharing of symbolic material culture and technology also tells us more about Homo sapiens’ journey from Africa, to Arabia and Europe. Contact between cultures has been vital to the survival and development of our common ancestors Homo sapiens. The more contact the groups had, the stronger their technology and culture became”.

3.2. The birth of Intellectual Property: Ownership of Ideas and Technology

Until circa 500 BCE, new discoveries, ideas and technological inventions were collectively owned by whole communities and nations. Then came the [dawn of intellectual property](#) (IP), the beginnings of the [“Tragedy of the Commons”](#) as it applies to technological advances and use. New laws and regulations were introduced that gave to the creators of new ideas and inventions, or dominant ICT operators, the exclusive rights to use or sell such ideas and inventions, e.g. the radiofrequency spectrum and the World Wide Web. The exclusion of vast populations of humanity from the benefits of technological advances began in earnest. The use of modern technologies, especially the deep-learning algorithms driving Artificial Intelligence (AI) machines, have enabled immense advances in the delivery of health and wellbeing services to humanity, but their “inventors” own exclusive rights of use (patents and IP), and the resulting products, services and outcomes come at a price:

[NiCoLA-B: A perfect employee](#)

NiCoLA-B (CoLAB is short for collaborative laboratory) is a drug-discovery robot that has recently joined the team at AstraZeneca’s Cambridge research centre.

It identifies and selects the best potential drugs as starting points for future medicine development so that AstraZeneca can use more complex assays and more difficult cell types to model diseases. It can test up to 300,000 compounds a day.

It uses soundwaves to move tiny droplets of potential drugs from storage tubes into miniature ‘wells’ on assay. Next, droplets of cells or biochemical solutions are added to the wells. NiCoLA-B then oversees interactions between contents of the wells, checking for potential activity that could indicate a promising new drug.

Experiments can last from an hour to many days, and NiCoLA-B must ‘remember’ to add reagents, change assay conditions and handle hundreds of plates, scheduling all of the stages of the experiment accurately and consistently.

The life-saving drugs “discovered” by NiCoLA-B are sold to health service providers, pharmaceutical distributors and the informed public. They are generally priced out of reach of the 30+ million South Africans living below the national poverty lines. The access barriers to technological advances include direct affordability of the medications developed from NiCoLA-B’s work; spatial and social distances between the poor who need them most and the diagnostic and drug supply sources; the information and knowledge distances that prevent the poor from knowing about the existence and utility of the medicines; and the isolation of South Africa’s children living in poverty in child-headed households and/or those without an informed working adult at home.

3.3. Impact of new technologies on unemployment, and therefore poverty

The automated design, manufacture, and distribution of the growing range of health-related artefacts and services adds yet another dimension to the plight of South Africa's 30+ million citizens living below the national poverty lines: many will lose their jobs as the 4IR-driven automation of work previously undertaken by humans expands. Independent analysts² estimate that up to 35% of jobs in South Africa will be at risk of automation within the next ten years. The South African Government³ recognises these challenges and seeks policy interventions to address them. Job losses of this magnitude will add to the already significant poverty-related health and wellbeing national challenges, some of which are discussed in section 2 of this document. How can the invaluable technological advances in the health and wellbeing sectors be positioned as "common goods" enjoyed by all, thus avoiding the "Tragedy of the Commons" effect that leads to the exclusion of vast populations from their benefits?

There are direct correlations between this discussion of ICT4SDG3 and those directly related to poverty and hunger discussed in [ICT4SDG1](#) and [ICT4SDG2](#). More correlations will emerge as the remaining SDGs are localized to the South African-specific environment, verifying yet again the interrelated complexity of the multidimensional characteristic of all Sustainable Development challenges as discussed briefly in [ICT4SDG](#).

4. Positioning ICTs for SDG3 support

Technology on its own cannot prevent or cure health reversals or improve human wellbeing. The proposed ICT4SDG3 strategy will merely build a platform for the following:

- 4.1. Improve the communication links between health professionals, all agencies and institutions set up to promote good health and wellbeing, and the citizens who live at the base of South Africa's development pyramid, largely excluded from most benefits of modern information, knowledge and services;
- 4.2. Present a new stream of income generation that will contribute towards the achievement of SDG1: "End poverty in all its forms everywhere", and SDG2: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture": SMME ownership and operations of SA-LANS creates new jobs. These jobs will have direct and major impacts on SDG3 delivery;
- 4.3. Provide an information and knowledge access platform that will enable the poor to access the information and knowledge they need, in formats that they can understand and use, to help themselves achieve most of the SDG3 goals and targets, especially those related to basic hygiene knowledge for the prevention and cure of health reversals;
- 4.4. Provide communication channels between socioeconomically marginalized South Africans and the experts and institutions set up to assist them through research, including statistical data collection, compilation and dissemination that supports SDG3 research and programme implementation;
- 4.5. Provide the Early Childhood Learning (ECD) platforms for socioeconomically marginalized children, so that they can acquire the critical thinking skills needed to survive and prosper in the increasingly hostile future, fraught with immense natural and manmade health and wellbeing threats;
- 4.6. Provide communications platforms for the delivery of all modern e-Health systems and services to the marginalized communities, and for the marginalized communities to know of the existence of these services, and how to access and use them for the benefit of themselves and their children;
- 4.7. Provide the information and knowledge access for all 17 SDGs, which are closely related and intricately intertwined with SDG3; Integrate all other ICT4SDG3 initiatives without destructive competition amongst them.

The Namibian example provided in the text box below suggests the potential for ICTs to improve the very significant and welcome community-based delivery of health services to socioeconomically and information/knowledge marginalized Namibian communities.

South Africa, a continental economic and technology leader, is ranked 4th most HIV-infected country in the world, after Swaziland (#1), Lesotho (#2) and Botswana (#3), followed closely by Namibia (#5). The Southern African Development Community (SADC) representing 14 of the 54 African countries, occupies the top nine global ranks in HIV prevalence. Can information and knowledge about HIV and other health threats, shared equitably amongst all South African citizens through initiatives such as SAKAN, help reduce this major health and wellbeing threat in South Africa and the region?

²Accenture Consulting report of February 2018: "Creating South Africa's Future Workforce":

https://www.accenture.com/t20180201t173907z_w_/za-en/acnmedia/PDF-70/Accenture-Creating-South-Africa-Future-Workforce.pdf?fla=en

³ Department of Science and Technology White Paper on Science, Technology and Innovation 2018:

https://www.gov.za/sites/default/files/41909_gon954.pdf

Namibia's success in the fight against HIV: [By Vauldi Carelse BBC Africa, Namibia, Dec. 2018](#)

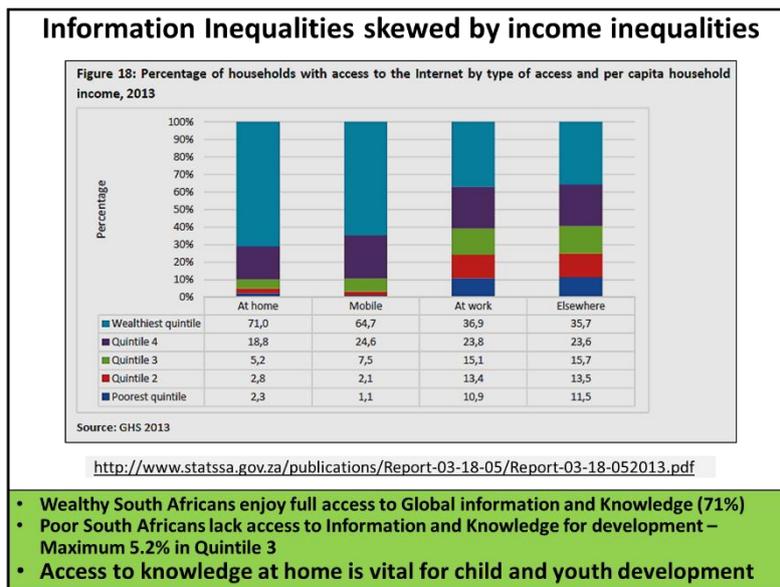
Data-driven Health Services Delivered by Foot: *“This is the front line in Namibia’s war against HIV, where a data-driven on-the-ground approach has helped it become one of the most successful countries in tackling its spread”.*

- Two [“Total Control of Epidemic”](#) (TCE, a national NGO) health workers have walked more than 3Km to visit a 79-year-old man, his wife, and their twin children, bearing a small plastic table and a cooler bag filled with ice packs and HIV tests;
- The rapid tests prove the 79-year-old man is HIV-negative, but his wife has been living with the virus for over a decade;
- The 79-year-old husband is referred to a hospital to which he must travel to obtain drugs that reduce the risk of contracting the virus from his partner who is HIV-positive by 90%;
- The next stop for the TCE workers is 12km away. These two health workers are part of a team of 200 serving a community of nearly 182,000;
- This vital community-centred “leg work” has mostly exceeded the targets of: 90% of people thought to be HIV-positive who know their status; 90% of people who know their status who are taking antiretroviral drugs; 90% of people who are taking the drugs who have an undetectable level of HIV.

The grinding leg work, built on community trust and respect, produces rewarding results for the health workers and community.

How much more rewarding would it be if they were in touch with their community, and their community in touch with them and the HIV preventative knowledge, through always on massively shared public access broadband communications networks instead of foot-delivered data? This is the SAKAN Vision, Mission and Objective.

If the SAKAN initiative can bridge the very significant knowledge divides between the “information and knowledge have’s” and the “information and knowledge have-nots” in South Africa, shaped as they are by the nation’s deep income AND knowledge inequalities as illustrated in the concluding chart below, then significant progress in the achievement of all SDG3 goals and targets will be made.



The data in the chart above is derived from the 2013 Household Survey undertaken by Statistics South Africa (STATS SA). Updating and improving the accuracy of vital data such as this using traditional household surveys, is extremely costly. Can the SAKAN initiative, as suggested in 4.4 above, reduce this cost for this and other equally important SDG indicators?

5. CONCLUSION: [ICT4SDG3](#)

This short summary outlines how ICTs can be positioned to help achieve the SDG3 objectives: *“Ensure healthy lives and promote well-being for all at all ages”*. The World Health Organization (WHO) lists [13 targets and 26 indicators](#) to meet this goal. Can the SAKAN communications platform, outlined briefly in <http://www.sakan.org.za/SAKANsolutions.html> and the linked references, be used to localize these SDG3 targets and indicators for the unique South African situation? Can the SAKAN model provide the vital communication links between people, and between people and an increasingly sophisticated array of technologies and machines, all in the interests of achieving the SDG3 challenges and targets? As shown in the outline, the model has served many of South Africa’s developed and developing country peers very well.