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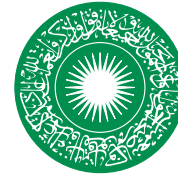
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AKU Research 2020





THE AGA KHAN UNIVERSITY

Contents

MESSAGES

- 2 President's message
- 3 Message from the academy

PREFACE

- 4 Rising to an unprecedented challenge

RESEARCH PROJECTS

- 7 AKU's typhoid vaccine study is first of its kind globally
- 8 AKU research informs national examination policy during COVID-19 disruption
- 11 Studies will help East African news media navigate the digital age
- 13 Uncovering the history of East Africa's Swahili Coast
- 16 AKU joins international network to identify and analyse new viruses
- 18 Novel insights into gut health and stunting in children

- 21 Educating parents on the power of play in early childhood development
- 25 Enhancing access to sustainable water supplies
- 26 AKU alerts government to HIV/AIDS outbreak in children
- 27 America and Islam in the age of Trump

RESEARCH ON COVID-19

- 30 Clinical trials test vaccines, therapeutics and more
- 33 Understanding the immune system's response to COVID-19
- 34 Study finds stress among Kenyan health workers
- 35 Expanding Pakistan's intensive care capacity for COVID-19
- 36 What is COVID-19's impact on maternal and child health?

- 38 Researching the role of genetics in SARS-CoV-2
- 39 Casual attitude to COVID-19 in Pakistan is cause for concern

UNIVERSITY UPDATES

- 42 AKU innovation delivers problem-solving technologies
- 44 New research centres will drive knowledge creation
- 46 Research facilities, oversight and ethics
- 48 High impact publications
- 52 Grants and publications

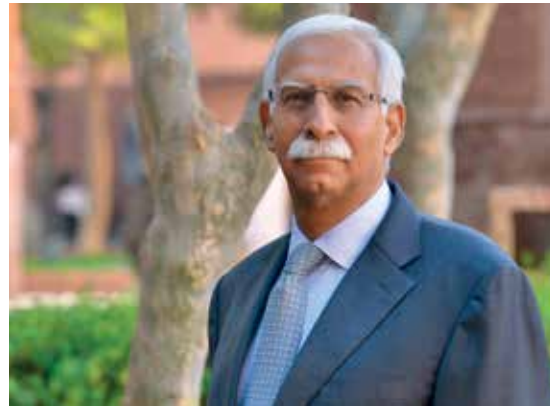
COVER CAPTION

AKU's Dr Asad Latif visits an intensive care unit at a public sector hospital in Pakistan's Sindh province.

CREDITS

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| President's message



Firoz Rasul
President and Chief Executive Officer

“The true sign of maturity and excellence in a university is its ability to contribute to the knowledge of mankind, in its own society and beyond.”

Those words were spoken by AKU’s founder and Chancellor, His Highness the Aga Khan, at our 2003 convocation. Seventeen years later – and in the midst of the COVID-19 pandemic – how does the University measure against the standard he articulated? Certainly AKU is generating far more knowledge today than ever before. Between 2015 and 2019, the number of research papers published by our faculty in peer-reviewed journals increased by more than 50 per cent. And our research productivity continued to increase through the first three quarters of 2020. We can also take pride in the fact that much of our work has been funded by or carried out in collaboration with globally renowned institutions such as the Bill & Melinda Gates Foundation, the World Health Organization, the University of Washington and the University of California, San Francisco.

Yet output data alone cannot capture the impact of our research and innovation on people’s lives. As the following pages make clear, numerous people across Asia and Africa are benefitting from our investigations. As of this writing, COVID-19 has infected nearly 60 million people and killed almost 1.4 million globally. AKU is working to deliver crucial insights into the novel coronavirus, and is participating in an array of international clinical trials to identify vaccines, treatments and tests that can help to halt the pandemic. Our researchers are also at the forefront of efforts to address an unprecedented outbreak of HIV/AIDS among children in Pakistan, to understand the biology of malnutrition, to identify emerging viruses and to help East Africa’s news media thrive in the digital age. In addition, they are producing cutting-edge scholarship in the humanities and social sciences that can help us to understand how centuries of cross-cultural interaction have shaped present-day identities.

In short, in keeping with our Chancellor’s vision, AKU is making important contributions to humanity’s storehouse of knowledge – contributions that are saving and changing lives, especially in low-income and marginalised communities.

But with the world facing its gravest public health crisis in recent memory, much remains to be done, and we cannot stand still. We must recognise that knowledge is constantly evolving, and that expanding the frontiers of understanding requires a spirit of restless inquiry. Therefore we will continue to strive to fulfill AKU’s potential as a research university, and to demonstrate the maturity and excellence our Chancellor intended.

| Message from the academy



It is our pleasure to report that AKU’s research continues to attract increasing support from a wide range of partners and funders located both within the countries we serve and in Europe and North America. The number of extramural grants the University received in 2019 represents an all-time high, and a nearly 50 per cent increase from just a few years ago. Meanwhile, the value of grants received in 2019 is 2.5 times higher than the figure five years ago. In total, the University attracted more than US\$ 150 million in research funding in 2015-2019.

As 2020 began, we were looking forward to seeing these figures grow – and with them, AKU’s contributions to addressing major challenges in a wide range of fields and in varying geographies. And despite the turmoil created by the COVID-19 pandemic, we are on track to attract more research funding in 2020 than in the previous year. Our largest grant, amounting to more than US\$ 6 million, came from Gavi, the Vaccine Alliance, and is supporting research to assess the impact of the introduction of typhoid conjugate vaccine in Pakistan. In a year defined by the pandemic, almost one-third of all grants the University submitted were related to research on the novel coronavirus. This reflects AKU’s health-related research prowess, but it also demonstrates our ability to rapidly pivot to address important new problems. Meanwhile, 2020 has been an especially productive year for our scholars outside the health sciences: though the year is not yet over at the time of this writing, AKU faculty have already published more peer-reviewed papers in the social sciences in 2020 than in all of 2019.

We are deeply grateful to all those who have supported AKU’s research efforts over the past year, including our institutional funders, individual donors, alumni, former staff and volunteers. And we wish to thank all our faculty and staff, who worked so hard and overcame so many obstacles to ensure that the University could continue to deliver innovative new research and scholarship amid challenging circumstances.

Dr Carl Amrhein, *Provost and Vice President, Academic*

Professor Anjum Halai, *Vice Provost and Dean, Faculty of Arts and Sciences*

Professor Fauziah Rabbani, *Associate Vice Provost, Research*

Dr Alex Awiti, *Vice Provost, East Africa*





Rising to an unprecedented challenge

The world has not seen an upheaval like the COVID-19 pandemic since the great influenza pandemic of 1918-1919. In the 11 months since the first few cases were detected in a localised outbreak in Wuhan, China, the novel coronavirus has spread to every country on earth and affected countless people.

Pakistan and Afghanistan were exposed to COVID-19 very early through pilgrims returning from Iran. Shortly thereafter, East Africa received travelers from Europe with the virus. Notwithstanding preventive measures and stringent official strategies, community transmission ensued.

In all geographies, the Aga Khan University's hospitals, health centres and laboratories had to rapidly transform to deal with a highly infectious illness and its consequences. This had to be done with staff and patient safety in mind, often amidst huge personal risks and difficulties in safe travel and transportation. Patient care had to shift to standards of care and personal protection hitherto unseen, and consultations had to move to virtual platforms, requiring

a major shift to deliver secure and effective communications. Meanwhile, faculty launched a massive effort to begin teaching students online.

The whole University family stood as one, with thousands of faculty and staff members making the personal sacrifices needed to mount an exemplary response. AKU's performance in such circumstances is a testament to the resilience of our greatest asset: our human resources.

In ordinary circumstances, research and scholarship would take a back seat to the daily challenge of clinical services and survival. Not so at AKU. The University developed one of the first online courses designed to rapidly

The AKU family stood as one, with faculty and staff making personal sacrifices to mount an exemplary response.

increase capacity for the provision of quality clinical care in intensive care settings. It also developed a widely recognised mobile-phone app to rapidly screen and triage suspected cases of COVID-19.

Faculty and students quickly pivoted, launching research efforts to address a range of challenges of immediate concern, such as basic epidemiology, risk-factor identification for prognosis and sophisticated sero-epidemiology studies to assess population immunity. Many of these competitive research projects were nationally or internationally funded, and many were collaborations with other researchers and institutions.

AKU also rapidly responded to government requests for advice in each of its key geographies, and participated in major global trials of therapeutic agents, including the Unity and Solidarity trials.

Faculty members undertook in-depth evaluations of the direct and indirect effects of COVID-19 on the health and nutrition of women and children

in South Asia, and also undertook an in-depth assessment of the epidemiological burden of disease in the Muslim world. Other projects are ongoing to assess mitigation strategies and efforts to rebuild resilience within health systems.

AKU faculty, staff and students have withstood the first wave of an unprecedented global challenge with aplomb, applying evidence-informed policies and pragmatically adapting to local realities.

The financial challenges that are inevitable in any organisation were met with a unique, equity-focused sharing of the burden. As we recover from this unique crisis, the research enterprise will move back to prioritising issues that have taken a back seat during the crisis. But we will not forget the lessons we have learned, and AKU will continue to address the challenges created by a once-in-a-century pandemic.

Professor Zulfikar Bhutta
Founding Director, AKU Institute for Global Health and Development





AKU's typhoid vaccine study is first of its kind globally



Amid an outbreak of drug-resistant typhoid, researchers evaluate the effectiveness of a new vaccine

AKU played a crucial role in addressing an outbreak of extensively drug-resistant typhoid in Sindh, and contributed to Pakistan's decision to become the first country in the world to use a new typhoid vaccine on a routine basis.

Now the University is conducting the world's first evaluation of the impact of the typhoid conjugate vaccine in a routine immunisation programme.

Caused by the bacterium *Salmonella typhi* and characterised by symptoms including fever and diarrhoea, typhoid afflicts 14 million people and kills roughly 220,000 every year, typically in poor communities in Asia and Africa that lack access to safe drinking water.

As the bacterium evolves to become extensively drug-resistant, it becomes an even greater threat because the risk of complications increases and treatment grows more difficult and expensive. Improved water and sanitation facilities play a key role in preventing new cases of typhoid, but they represent an expensive, long-term

fix. In the short-term, the only solution is a vaccine, which prevents people from catching typhoid in the first place.

"The vaccine represents the most cost-effective and rapid approach to preventing new cases of typhoid," said Associate Professor Farah Naz Qamar, principal investigator of the study, which is being funded by Gavi, an alliance of international organisations that works to increase vaccination rates, especially in poor countries.

To determine whether the vaccine has had an impact on antibiotic resistance and has helped decrease the number of typhoid cases, the study will analyse data on cases from hospitals across Sindh and Punjab over the three years

Increasing resistance to a range of antibiotics is making it more difficult and expensive to treat typhoid.

prior to the vaccine's introduction, comparing it to data on cases that have emerged up to three years after the launch of the immunisation campaign.

Researchers are also following a group of children who have received the vaccine to assess the duration of their immune response following administration of a single dose of the typhoid conjugate vaccine.

The study is expected to inform decisions on whether booster shots are needed to provide better and longer-lasting protection against the disease. The evaluation of the impact of the vaccine will provide crucial information for policymakers in other typhoid-endemic countries like Bangladesh and Nepal, which are considering introducing the vaccine.

Dr Qamar's co-investigators at AKU are Assistant Professor Sonia Qureshi, Assistant Professor Momin Kazi, Associate Professor Seema Irfan, Senior Instructor Tahir Yousafzai and Professor Asad Ali.



High-stakes exams, like the one shown in this pre-pandemic photo, did not take place in Pakistan in 2020 due to COVID-19.

AKU research informs national examination policy during COVID-19 disruption

Policymakers turned to AKU’s Examination Board when high-stakes exams were cancelled

Around the world, the COVID-19 pandemic has caused the cancellation of standardised examinations used for university admissions and promotion to higher grades, leading countries to adopt different methods for dealing with the consequences.

In Pakistan, the Aga Khan University Examination Board (AKU-EB) played a key role in formulating an evidence-based national policy used to address the fact that Secondary School Certificate (SSC) exams and Higher Secondary School Certificate (HSSC) exams were cancelled in order to limit the spread of the virus. SSC exams are taken in 9th and 10th grades and students’ scores are considered in admissions decisions by higher secondary schools. HSSC exams are taken in 11th and 12th grades and students’ scores are considered in university admissions decisions.

The Board’s involvement was the result of a request for assistance from Federal

Education Minister Shafqat Mahmood to AKU-EB Director Dr Shehzad Jeeva, who is also the chairman of the Inter Board Committee of Chairmen (IBCC), Federal Ministry of Education and Professional Training. Pakistan has 33 examination boards, each of which has the power to set examination policy. The IBCC exists to enable coordination among exam boards.

“The continuity of education of more than 4 million students across Pakistan was at stake,” Dr Jeeva said. “We were asked to create an evidence-based approach that could be uniformly applied by the country’s examination boards to prevent further disruption to students’ education. The goal was a solution based on the principles of fairness, equality and merit.”

AKU-EB’s assessment and operations teams studied data on the exam performance of 1 million students in grades 9-12 over four years. Their predictive psychometric statistical

analysis showed that for SSC qualifications (grades 9 and 10), the performance of grade 9 students in 2019 could be used to predict how they would have performed on the grade 10 exams cancelled in 2020. Similarly, for HSSC qualifications (grades 11 and 12), the performance of grade 11 students in 2019 could be used to predict how they would have performed on the grade 12 exams cancelled in 2020. In addition, there was strong statistical evidence that grade 10 and 12 students typically improve their performance by 3 per cent compared to their grade 9 and 11 scores. Therefore, it was recommended that an additional 3 per cent be added to scores of grade 10 and 12 students.

AKU-EB’s recommendation was unanimously approved by all relevant government agencies, including the Higher Education Commission; the coordinating body of all the country’s education ministers, the Inter Provincial Education Ministers Conference; and the federal body that brings together all

government departments to coordinate COVID-19 response, the National Command and Operation Centre.

The policy was rolled out across the nation in September 2020 and used to award exam scores and promote students across Pakistan.

AKU-EB’s technical expertise and leadership role in building support for a coordinated, transparent and fair solution that allowed the nation’s students to continue their education were acknowledged by Federal Education Minister Mahmood.

“The Federal Minister of Education was delighted with the outcome and to see a national-level policy recommendation receive such unanimous support,” Dr Jeeva said. “Other nations have struggled with controversies over results and promotion. The absence of these issues, including no reports of litigation in Pakistan, speaks to the strength of the evidence we were able to marshal.”



Studies will help East African news media navigate the digital age

AKU will highlight examples of successful innovation by the region's media outlets



A pair of studies by AKU's Graduate School of Media and Communications (GSMC) in Nairobi aims to help East Africa's news media navigate the changes brought by the internet, mobile phones and social media.

While the rise of digital media has wreaked havoc on older news organisations in many countries, the situation in East Africa has been less dire. For example, prior to the COVID-19 pandemic, Kenyan newspaper revenues had been growing modestly, and Kenya was one of just four countries in the world where newspaper revenues were expected to continue increasing over the next five years, according to a report by PricewaterhouseCoopers. Moreover, trust in news organisations in Kenya remains high by global standards.

Nevertheless, change is happening, and rapidly. Since 2014, radio's audience share in Kenya has plunged, although it remains the number one news source, according to a report by Reelforge and

TIFA Research. Meanwhile, with internet subscriptions having nearly tripled in five years, the percentage of people who get their news online via their mobile phones has greatly increased.

GSMC's State of the Media Report aims to be the most detailed publication of its kind, providing information on news organisations' audiences, finances and influence; professional and industry organisations; the legal and regulatory framework in which the media operates; the education and training of media professionals; and notable developments.

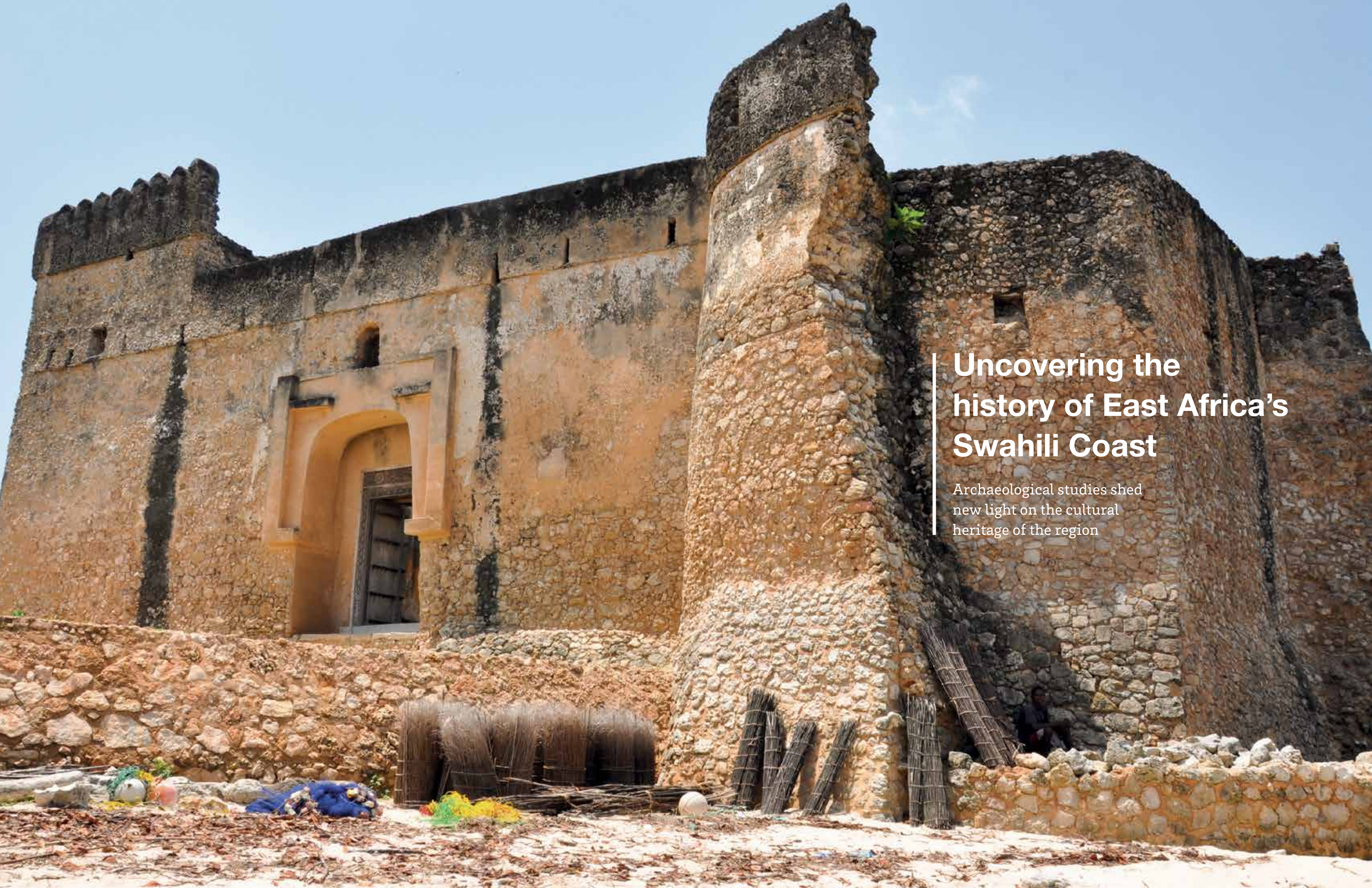
The tripling of internet subscriptions has greatly increased the percentage of people who get news via their mobile phones.

It will initially cover Kenya, but will eventually expand to cover neighbouring countries.

The School's Innovation for Media Viability Study will deliver insights that East African media organisations can use as they seek to achieve commercial success and deliver high-quality content in the digital age.

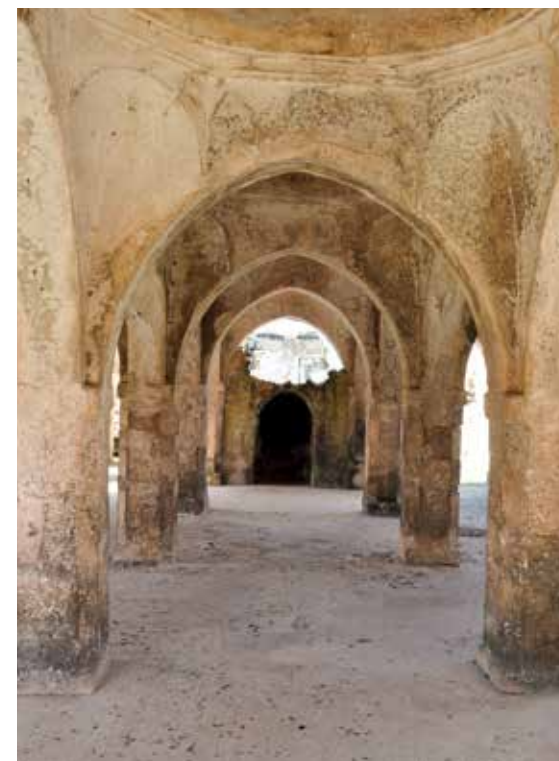
Researchers will conduct an online survey of journalists and executives at nearly 450 news organisations, as well as follow-up interviews. They will collect information on everything from the political challenges facing media outlets to examples of successful innovation with the potential for wider adoption.

Both projects are funded by KfW, the German development bank. The media viability study is being conducted in partnership with DW Akademie, the international media development division of Deutsche Welle, Germany's public international news agency.



Uncovering the history of East Africa's Swahili Coast

Archaeological studies shed
new light on the cultural
heritage of the region



Swahili cities were important nodes in a vast trading network connecting Africa to the Islamic world, India and China.

An expert in Islamic archaeology, Professor Stephane Pradines is delivering new insights into the history of the Swahili, the Indian Ocean and the Muslim world.

Prior to joining AKU's Institute for the Study of Muslim Civilisations in London in 2012, Pradines spent a decade at the French Institute in Cairo leading major excavations of the walls that surrounded the city during the Fatimid era. But his interest in the hundreds of ruins that dot coastal East Africa, and that date from the 11th century onwards, is longstanding. Those ruins are the remains of Swahili cities that were important nodes in a vast trading network that spanned the Indian Ocean and connected Africa to the heart of the Islamic world, as well as to India and China.

Long before the arrival of European explorers, cities such as Mombasa, Malindi and Kilwa exported gold, ivory, rock crystal and timber to the wider world. In return, they received ceramics, glass and – most consequentially – Islam. Out of these

exchanges was born the Swahili civilisation, a hybrid of African, Arab and Indo-Persian influences.

The archaeologists of the Swahili coast and adjacent islands has largely been shaped by scholars who were Africanists by training. Pradines' background gives him a different perspective, helping him to see what others have overlooked. For example, in their excavations of Dembeni, a wealthy city on the island of Mayotte that thrived from the 9th to the 12th centuries, Pradines and his team found numerous fragments of rock crystal.

This translucent form of quartz was highly valued in Baghdad, Cairo and elsewhere, where craftsmen carved it into vases and decorative objects.

While other archaeologists had noted such fragments in Dembeni, they speculated they were connected to the production of iron ore. But with his knowledge of Fatimid and Abbasid material culture, Pradines quickly recognised the rock crystal as such. He argues it was brought

from Madagascar to Dembeni, where it was traded for ceramics and other items before being shipped onward to the Middle East. Indeed, he suggests the rock crystal trade could be the source of much of Dembeni's wealth.

Dembeni is far from the only African site where Pradines has conducted excavations, having worked on a number of well-known ruins in Kenya and Tanzania, including Kilwa Kisiwani, site of the largest medieval-era mosque in Sub-Saharan Africa.

He has spent many days living in a tent on a beach with no running water, fending off mosquitoes and hacking away at vegetation to expose centuries-old stone ruins.

Pradines' latest project is on the Mafia archipelago off Tanzania. There, he is working with the World Monuments Fund to preserve the ruins of Kua, a medieval Swahili town, and to enable them to be safely developed as a tourist site that benefits the island's residents. Eventually, he hopes to see Kua included on the World Heritage List.



AKU joins international network to identify and analyse new viruses

Viruses know no boundaries. AKU is part of a global effort to identify emerging outbreaks

IRESSEF
Dakar, Senegal

FIOCRUZ
Rio De Janeiro, Brazil

KRISP
Durban, South Africa

Aga Khan University
Karachi, Pakistan

Chang Gung University
Taipei, Taiwan

AKU will be working to identify, understand and prevent potential pandemic viruses as part of a globe-spanning partnership supported by a five-year, US\$ 8.75 million grant from the U.S. National Institutes of Health's Centers for Research in Emerging Infectious Diseases.

Led by the University of Washington (USA), the UWARN partnership includes Rockefeller University (USA), FIOCRUZ (Brazil), IRESSEF (Senegal), KRISP (South Africa) and Chang Gung University (Taiwan), as well as AKU.

The centres will work to establish surveillance networks that can identify disease outbreaks at an early stage; develop tools for diagnosing emerging and re-emerging infectious diseases; and study the genetic make-up of viruses, as well as the body's immune response to viral diseases.

"Partners in the network will be constantly on the lookout for emerging viruses," said AKU Associate Professor Najeeha Talat Iqbal, the project's principal investigator in Pakistan. "When we find them, our goal will be to increase our knowledge of how they affect the body so that we can improve our recognition of signs of severe disease and develop therapies that can improve treatment outcomes."

Pakistan is a hotspot for vector-borne illnesses and has seen four outbreaks of infectious diseases, other than COVID-19, over the past decade.

AKU will use its countrywide network of laboratories to collect samples of emerging viruses for genetic analysis and enrol hospital patients in studies to monitor their response to treatment.

Public health researchers, basic scientists, infectious disease specialists and pathologists at AKU will be involved in the study.

Dr Iqbal's co-investigators are Associate Professor Farah Qamar, Assistant Professor Ali Faisal and Professor Erum Khan.



Novel insights into gut health and stunting in children

Partnerships with U.S. universities enable pioneering work in artificial intelligence and diagnostics

AKU researchers are conducting pioneering research into the causes of malnutrition and its inter-generational consequences, in partnership with faculty at the University of Virginia and imaging specialists at Massachusetts General Hospital, an affiliate of Harvard Medical School.

Environmental enteric dysfunction (EED) – often referred to as a neglected disease of poverty – is thought to be a leading cause of stunting in children in the developing world. EED hinders the gut’s ability to absorb essential nutrients, compromising children’s growth and leaving them vulnerable to a range of diseases. It is thought to be the result of chronic inflammation owing to continuous oral exposure to fecal matter

through contaminated food and water in communities that lack clean water.

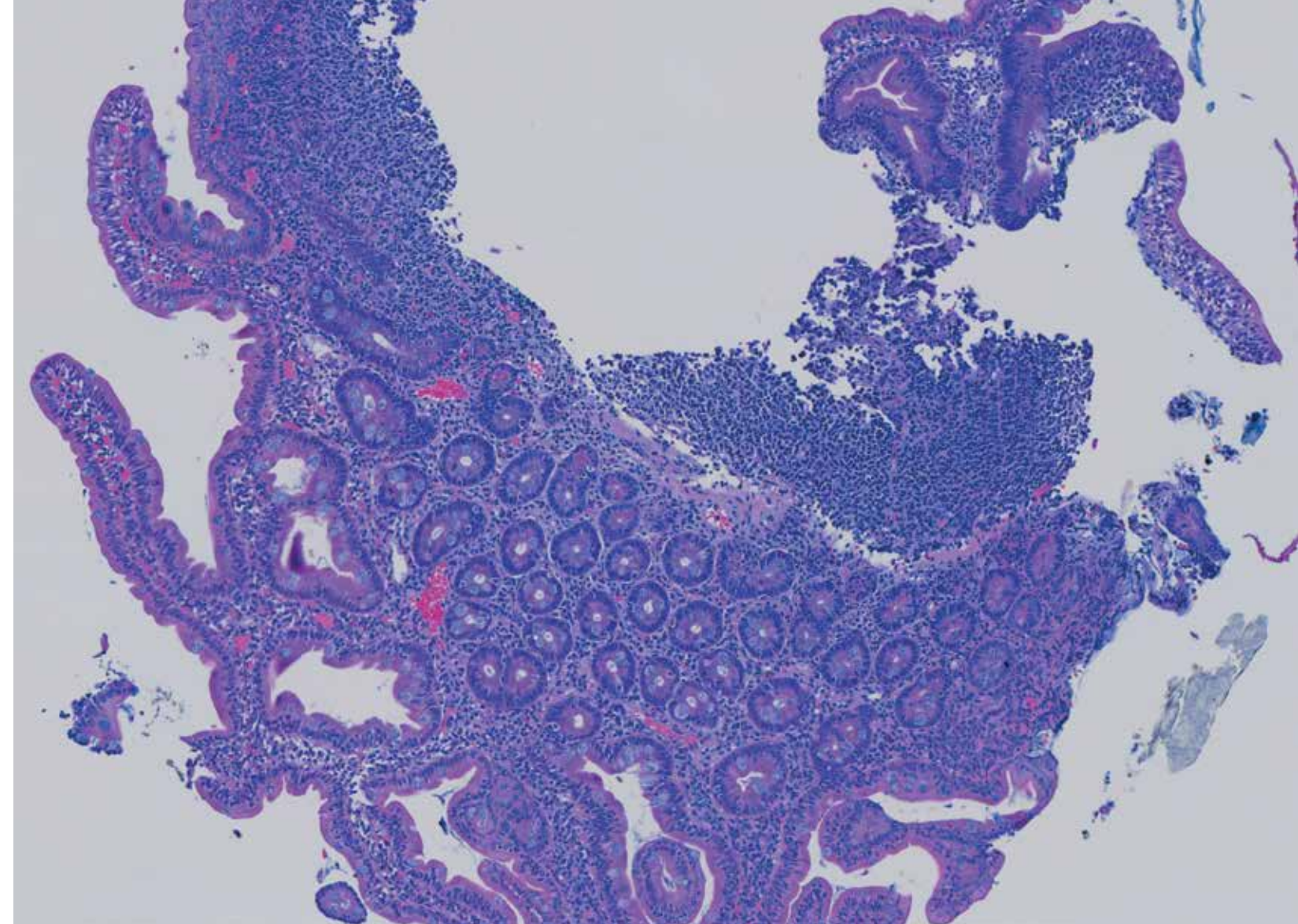
With funding from the Bill & Melinda Gates Foundation, Professor Asad Ali is working alongside University of Virginia Assistant Professor Sana Syed to harness the power of artificial intelligence to uncover patterns in biopsies of malnourished children’s guts.

Software the researchers developed uses the same principles as facial recognition technology to compare images of healthy intestines to those affected with EED.

The software learns to recognise patterns as it analyses more

images and eventually should be able to pinpoint the cellular-level differences that trigger the disorder.

Dr Ali and Dr Syed believe their work will generate insights that transform how doctors diagnose EED. At present, the only way to conclusively identify the disease is through a biopsy, an invasive and expensive procedure that requires sedating children in order to extract tissue samples from their intestines. Their goal is to identify a comprehensive set of screening biomarkers – chemical warning signs – that would enable clinicians to diagnose EED through a simple blood or urine test, and that could also be used to assess nutritional or pharmacological interventions aimed at reducing the effects of the disease.



Dr Ali is also testing a new device in partnership with Professor Gary Tearney of Harvard Medical School. It promises to give the first-ever insights into the gut health of pregnant women. Those insights could be used to improve the health and nutritional status of both pregnant women

The goal is to identify a comprehensive set of screening biomarkers that enable clinicians to diagnose EED through a simple blood or urine test.

and their babies, as malnourished mothers are much more likely to give birth to malnourished children.

Until now, assessing the gut health of expecting mothers was not possible because it was not possible to perform gut biopsies due to the risks involved in administering anaesthesia during pregnancy. Researchers will test a new trans-nasal scope that does not require patients to be anaesthetised. It consists of a slender tube that can be moved down the nose, through the throat to the gut. The tube contains a camera, a device that sends electrical pulses through the intestine to assess nutrient absorption capacity, a brush to collect tissue samples and cryobiopsy technology that freezes samples

to preserve them for analysis. The scope will be piloted on 150 pregnant women in the U.S. and Pakistan. Part of the trial will be conducted at AKU’s Matiari Research and Training Centre, which is located in an area where malnutrition is common, and where the University has earned the trust of residents over many years.

“Our ultimate goal is to take this technology to the doorsteps of the malnourished,” Dr Ali said. “This will enable us to easily assess the severity of malnutrition in women and children living in high-risk areas. In the long term, we hope to use this to test the success of different nutrition interventions by capturing before and after images of an individual’s intestine.”



Educating parents on the power of play in early childhood development

Providing children with a stimulating environment in their earliest years can benefit them throughout their lives



AKU plans to build an online hub for early childhood development that enhances access to technical resources and experts.



AKU's Institute for Human Development (IHD) is conducting a study designed to furnish information that can be used to expand programmes that encourage parents to play and communicate with their young children in ways that promote their intellectual, emotional and social development.

UNICEF's Care for Child Development (CCD) intervention package encourages "playful parenting" – an approach that sees parents communicate with their children even before they are able to speak, play developmentally appropriate games with them and encourage their questions and curiosity.

Under the Scaling Up Playful Parenting (SUPP) project, faculty will produce case studies of Care for Child Development programmes in Kenya, Tanzania, Uganda and Syria. The studies will be based on focus group discussions and individual interviews. Researchers will

also examine how CCD programmes can be adapted to meet the needs of parents and children in areas affected by conflict or a high burden of HIV/AIDS.

Preliminary investigations have revealed the existence of a wide range of standalone CCD programmes that are not integrated into government schemes and tend to be short-lived.

"Early childhood development interventions such as Care for Child Development represent one of the best ways to build strong, prosperous and stable societies," said IHD Director Amina Abubakar. "The findings of our study will help policymakers and practitioners to determine how best to go about educating parents on caregiving approaches that help children to fulfill their potential."

As part of the project, IHD is identifying individual programmes' gaps and

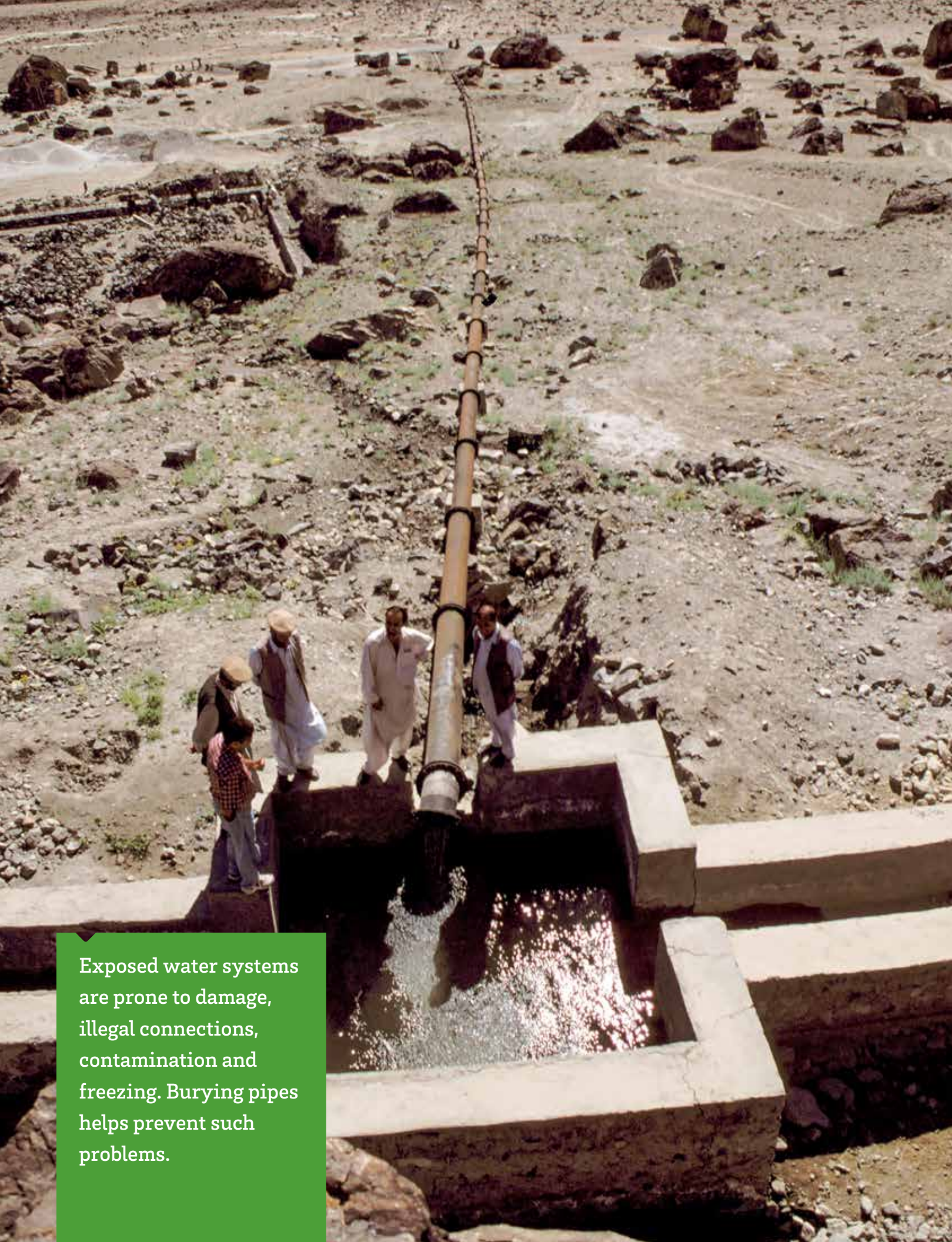
resource requirements, with a view to conducting capacity-building sessions for programme staff.

IHD's capacity-building experience in East Africa includes trainings on the Science of Early Childhood Development.

IHD will also help universities in Kenya and Zambia to integrate playful parenting and key child development topics into degree and professional development programmes.

In addition, the Institute plans to build an online hub for early childhood development that enhances access to technical resources and experts, thereby empowering practitioners to scale up initiatives wherever they may be.

SUPP is funded by UNICEF, the Lego Foundation and the Aga Khan Foundation.



Exposed water systems are prone to damage, illegal connections, contamination and freezing. Burying pipes helps prevent such problems.



Enhancing access to sustainable water supplies

Access to clean water and sanitation in the Global South is often hampered by the failure of governments to develop the necessary infrastructure. Even when governments do invest in infrastructure, it often deteriorates because users cannot or will not pay water tariffs.

Community-based water management (CBWM) attempts to solve the problem by mobilising community members to pay for and operate water infrastructure. In the mountainous Gilgit-Baltistan region of northern Pakistan, the Aga Khan Agency for Habitat (AKAH) has introduced CBWM in more than 400 rural communities totaling 100,000 households, through its Water and Sanitation Extension Programme (WASEP).

So far, CBWM appears to have worked well in rural areas with small and presumably tightly knit communities. AKAH is now scaling up WASEP to more urban areas in the region that have much larger and more transient populations and different social dynamics.

To determine if scaling-up is feasible, AKU's Institute for the Study of Muslim Civilisations (ISMC) in London has launched a study of WASEP

across Gilgit-Baltistan, including two large recent urban water schemes in Jutial and Danyore.

The study brings together researchers in economics, anthropology, geography, the environmental sciences and engineering from ISMC and Karakoram International University (KIU) in Gilgit, as well as engineers and development practitioners from AKAH. ISMC Associate Professor Jeff Tan, an economist who has published on water and infrastructure privatisation, is the project's principal investigator. Co-investigators are ISMC Professor Stephen Lyon and Professor Attaullah Shah of KIU.

Evidence for the study will be drawn from interviews with 1,200 households in more than 60 WASEP and non-WASEP control sites across Gilgit-Baltistan, along with focus group discussions, water quality testing and engineering audits.

The study focuses on the factors that influence the willingness of community members to make monetary and in-kind contributions to construct infrastructure, and to make monthly tariff payments. It will examine whether successful social mobilisation is

related to the size of a community, wider institutional support, religious affiliation, education levels and social structures. It will look into sources of conflict such as the passage of pipes over privately owned land and whether issues related to social status or sectarianism undermine social mobilisation within a community.

The study will also investigate how local terrain affects project management, and the extent to which women benefit from and contribute to social mobilisation and improved health and hygiene outcomes. "Sustainable water systems are at the heart of thriving communities," Tan said. "This study will generate valuable lessons on the social, economic, cultural and technical factors that govern the management of scarce water resources and enable local communities to improve their livelihoods."

The research team hopes that the lessons learned will be of interest not only to AKAH but to the Government of Gilgit-Baltistan and actors elsewhere in the developing world where access to water is a problem. The two-year project is funded by the British Academy's Urban Infrastructures of Well-Being programme.



AKU alerts government to HIV/AIDS outbreak in children

AKU researchers revealed how the disease spread using phylogenetic analysis

AKU has been at the forefront of the provincial, national and international response to an outbreak of HIV/AIDS that infected nearly 1,200 children in Larkana District, Sindh. The University was the first to alert officials of an outbreak, and has been advising government, providing patient care and training health workers, as well as publishing the most in-depth study of the outbreak to date, in *The Lancet Infectious Diseases*.

With funding from the World Health Organization, Associate Professor Syed Hani Abidi and colleagues studied the outbreak using phylogenetic analysis. They found that the HIV strains involved (known as CRF02_AG and A1) likely originated among people who inject drugs. Nationally, around 40 per cent of adult intravenous drug users have HIV/AIDS, and Larkana has a significant population of people who inject drugs.

Poor infection control practices in health facilities then allowed the strains circulating among drug users to be transmitted to children. While initial media reports implicated a single local

HIV-positive doctor in the outbreak, AKU researchers found multiple clusters within the outbreak, indicating a number of healthcare facilities contributed to the spread of the virus. That suggests that poor infection prevention practices are widespread.

Today, 98 per cent of the infected children are taking antiretroviral drugs and should be able to lead long and generally healthy lives. That is partly thanks to AKU. University staff assisted with screening the population, opening a new clinic for HIV-positive children, treating hundreds of patients in Larkana and training health professionals in managing patients with HIV/AIDS. Yet much remains to be done, according

Poor infection control practices in health facilities allowed strains of the virus to move from drug users to children.

to Associate Professor Fatima Mir, lead author of the *Lancet* article.

“It’s unconscionable that these children were infected,” Dr Mir said. “The government response to the outbreak has been commendable, but now we need to see a major effort to improve infection control in both the public and private sectors.”

Study co-investigators included Associate Professor Syed Faisal Mahmood and Associate Professor Rehana Siddiqui.



America and Islam in the age of Trump

Dean Lawrence Pintak’s latest book explores America’s complex relationship with the Muslim world

An award-winning, globe-trotting journalist and an accomplished academic with a PhD in Islamic Studies, Lawrence Pintak became Dean of AKU’s Graduate School of Media and Communications in Nairobi in mid-2020. His latest book is *America & Islam: Soundbites, Suicide Bombs and the Road to Donald Trump*. A finalist for the Religion News Association’s Awards for Religion Reporting Excellence, *America & Islam* offers a wide-ranging tour of America, the Muslim world and relations between the two in the age of Trump.

In his opening pages, Pintak analyses the context in which Trump’s Islamophobia found an audience. He discusses America’s long history of Middle East misadventures; the media’s willingness to hand Trump a megaphone in its quest for ratings and profits; the fact that Trump’s prejudices were echoed by well known Republicans; and the rise of ISIS, which helped to revive fears that had slowly dissipated in the years after Sept. 11, 2001.

It was against this backdrop that Trump found it possible to assert that “Islam hates us,” to conjure the spectre of crowds of Arab-Americans cheering the collapse of the World Trade Center and to call for a ban on Muslims entering America. Pintak quotes a law professor’s reaction to the Nov. 9 news of Trump’s election: “For Muslim Americans, 11/9 feels like 9/11 all over again: the aftermath is frightening.”

In the latter part of the book, Pintak seeks to supply the nuance missing from many discussions of Islam and extremism. He charts the diversity of Muslim belief, chronicles “how the West created radical Islam,” and clarifies the meaning of key terms ranging from Islamism to sharia. Turning from religion to politics, he probes the rivalry between Saudi Arabia and Iran, Turkey’s Ottoman dreams and the growth of Russian and Chinese influence from Islamabad to Damascus.

Finally, Pintak turns his gaze to the future, asking how Muslims’ interpretations of their faith might change in the years ahead. In Saudi

Arabia, he sees a “a huge constituency” for liberalisation. In Pakistan, he interviews artist-activists who aim to battle extremism with comic books. In Indonesia, he finds widespread support for Islam as “a living religion receptive to the modern world.” Indeed, he finds Muslims “from Lagos to Lahore...taking steps, large and small, to tame the extremist beast.” Returning to America, Pintak finds the country’s Muslims living in “an era of contradictions. Never had they been more under attack, but never had they been so accepted and outspokenly proud to be American.” He concludes on an optimistic note, citing a survey that found Americans have a more favourable view of Islam than ever before. Pintak gives newly elected U.S. Rep. Ilhan Omar the last word, quoting her defiant response to a critic who complained that “the floor of Congress is now going to look like an Islamic republic.”

“Well, sir,” Rep. Omar tweeted, “the floor of Congress is going to look like America...And you’re gonna have to just deal [with it].”

AKU's contributions to the global battle against COVID-19

The novel coronavirus is the biggest challenge facing the world today. In Asia and Africa, AKU is at the forefront of the effort to better understand the virus and its impact, prevent its spread and identify new ways to treat the infected.



Clinical trials test vaccines, therapeutics and more

In both Karachi and Nairobi, AKU is contributing to the global effort to identify safe and effective COVID-19 vaccines, treatments and diagnostic tests. Six clinical trials are underway or have concluded, five of which are international.



CanSino and Sanofi vaccines

As the world races to develop a COVID-19 vaccine, AKU is helping to evaluate CanSino Biologics' Ad5-nCoV vaccine in Pakistan. A phase III randomised, double-blind, placebo-controlled multi-country trial is assessing the vaccine's safety and immunogenicity (its ability to provoke an immune response that protects a vaccinated person against COVID-19). The vaccine will be administered to volunteers over the age of 18 who have no history of being infected by the virus. Other hospitals in Pakistan are part of the trial, which seeks to include 8,000-10,000 patients across the country. In Kenya, AKU will participate in a phase III trial of Sanofi's adjuvanted, recombinant protein-based vaccine. The randomised, double-blind, placebo-controlled, multi-country trial is expected to get underway by the end of 2020. Globally, it aims to enroll a total of more than 34,000 participants over the age of 18, including individuals who have been exposed to COVID-19 and individuals over the age of 65.

Tocilizumab

AKU's Clinical Research Unit (CRU) in Nairobi was part of a global, phase III clinical trial, EMPACTA, which studied whether a drug typically used to treat rheumatoid arthritis, tocilizumab, could safely prevent the onset of pneumonia in COVID-19 patients.

Pneumonia is one of COVID-19's most common serious complications, with patients often needing a ventilator to survive. The randomised, double-blind, placebo-controlled trial found that patients on the drug were 44 per cent less likely to require mechanical ventilation or lose their lives to the disease.

AKU was the only site in Africa outside of South Africa that participated in the trial.



Convalescent plasma therapy

Convalescent plasma therapy uses antibodies from individuals who have recovered from COVID-19 to treat patients who have severe or critical forms of the disease. While many countries have permitted its use, more data on its safety and efficacy is still required.

AKU is part of a Pakistan-based, multi-centre clinical trial to evaluate the therapy. Antibody-rich plasma from recovered COVID-19 patients at the Aga Khan University Hospital, Karachi, will be used to boost the immune system of individuals undergoing treatment at the hospital. Researchers will monitor each patient's response and assess the therapy's effectiveness through a range of clinical and laboratory tests.

Remdesivir

The World Health Organization's global Solidarity trial explored the potential of four drugs (remdesivir, hydroxychloroquine, lopinavir/ritonavir and interferon) to treat COVID-19 in hospitalised adult patients. AKU was one of nearly 400 research sites around the world chosen to investigate whether remdesivir, a drug used to treat Ebola, could help prevent deaths from the virus or reduce the severity of the disease. The trial found all four treatments to have little or no effect on overall mortality, initiation of ventilation or duration of hospital stay.



Hydroxychloroquine

AKU is the only centre in South Asia participating in the COPCOV trial, which is assessing whether taking hydroxychloroquine or chloroquine prophylactically prevents healthcare workers exposed to COVID-19 patients from contracting the disease. Sponsored by the University of Oxford and funded by the Bill & Melinda Gates Foundation and other organisations, the randomised, double-blind, placebo-controlled trial has been deemed to be of urgent public health importance by the UK's National Institute for Health Research's Clinical Research Network. Frontline healthcare workers at AKU are currently being enrolled into the trial.



Rapid antigen test

AKU is the only centre in Asia participating in a global, multi-centre clinical trial of a potentially quicker and more cost-effective COVID-19 diagnostic test, Abbott's Panbio rapid antigen test. The Panbio test can deliver results in as little as 30 minutes, compared to 12 hours or more for a PCR test. It assesses the reaction of a patient specimen to antibodies on a testing strip, avoiding the need to send samples to a laboratory for processing. The faster reporting of results can help to limit the spread of the virus.

"If this test proves to be as accurate as existing methods, then we'll have played a part in making available a COVID-19 test that is faster and also significantly cheaper than existing options," Professor Erum Khan said. "That would be good not just for Pakistan but for the entire world."



Researchers will explore how co-morbid infections affect the body's response to the novel coronavirus.

Understanding the immune system's response to COVID-19

AKU's study will track the immune response of 400 Kenyans

AKU is contributing to a two-year study in Kenya designed to illuminate the immune system's response to the novel coronavirus and aid in the development of vaccines and therapies.

"We're still very far from knowing how the immune system protects us from the virus," Associate Professor Shahin Sayed said. "It means that we can't explain why some patients recover with ease, and this limits our ability to predict who needs more aggressive treatment and who can be spared the toxicity and cost of intensive care."

Funded by the European and Developing Countries Clinical Trial Partnership, the study will enrol 400 individuals from Kenya who have been infected with COVID-19. Researchers will obtain clinical histories as well as blood and nasal swab samples when a person is first infected with SARS-CoV-2. Samples will also be collected at regular intervals over a two-year period.

This will enable researchers to assess the most important determinants in the immune system's response over time. Data will also be correlated

with the severity of illness to enable insights into the interplay between the virus and the immune response during the course of the illness.

The study promises to deliver insights into a range of questions, including how long antibodies protect a person, how different parts of the immune system communicate with one another to tackle the virus, which types of white blood cells are most effective in combating the virus, and what explains so-called cytokine storms and the respiratory distress they cause.

Researchers will also evaluate the effectiveness of antibody tests and other immunological assays, such as blood serum testing (serology), for detecting previous infection with SARS-CoV-2. As PCR testing is not always available and can deliver false negatives, mass serological testing could be used to determine the number of people previously exposed to SARS-CoV-2 in a given population. That would give a clearer picture of the overall spread of the virus. Potentially, this information could shape governments' COVID-19 management policies.

Serological tests will also be required for evaluating the effectiveness of vaccines.

In addition, the study will isolate monoclonal antibodies from COVID-19 survivors. These antibodies could help inform vaccine design and assist in the development of potential therapeutics.

While similar research is ongoing in other parts of the world, it is important to undertake such studies in Africa, where individuals may have concomitant infections such as tuberculosis, HIV/AIDS or malaria. The study aims to explore the impact of such co-morbid conditions on the immune system's response to SARS-CoV-2.

Led by the KEMRI-Wellcome Trust Research Programme, the study involves AKU, the Karolinska Institute, Karolinska University Hospital, Leiden University Medical Centre and Mabtech, a Swedish biotechnology company. Kilifi County Hospital and the Aga Khan Hospital in Mombasa are also participating.

Associate Professor Reena Shah and Professor Mansoor Saleh are co-investigators on the study.



Study finds stress among Kenyan health workers

Researchers launched a hotline so health professionals can get counselling

An online survey of Kenyan healthcare workers found nearly two-thirds may suffer from post-traumatic stress disorder, 25 per cent have symptoms of moderate to severe depression and 40 per cent consume harmful amounts of alcohol.

Conducted while COVID-19 was circulating in Asia and Europe but had yet to reach Kenya, the survey is the work of Lukoye Atwoli, Professor of Psychiatry and Dean of the Medical College, East Africa, as well as faculty and staff from Moi Teaching and Referral Hospital and Moi University School of Medicine. The survey also found that 15 per cent of respondents had moderate to severe anxiety and 20 per cent suffered clinically significant insomnia or were just below the threshold for clinically significant insomnia.

More than 950 healthcare workers out of 1,259 contacted filled out the survey, which consisted of standardised questionnaires such as the World Health Organization's Alcohol Use Disorder Identification Test (AUDIT)

and the PHQ-9 depression test. Almost 40 per cent of respondents were non-specialist doctors, while 16 per cent were specialist doctors, 20 per cent were nurses, 9 per cent were clinical officers, and the rest represented other health professions.

Given that Kenyan health workers were suffering from a high burden of mental distress prior to the arrival of COVID-19 in the country, Dr Atwoli and his collaborators decided to establish a hotline to provide mental health support to healthcare workers during

The survey found Kenyan health personnel were suffering from depression and other mental health issues even before the pandemic arrived.

the pandemic. With the assistance of various professional associations, they established a call centre in the headquarters of the National Nurses Association of Kenya staffed by clinical psychologists and counsellors.

The centre fielded calls from 30 healthcare workers in the first month of its existence. Data on the hotline's usage is being collected, and the researchers plan to conduct a survey after one year to gauge its impact. They also continue to analyse the responses to their initial survey, aiming to identify factors associated with mental distress among healthcare workers.



Expanding Pakistan's intensive care capacity for COVID-19

A nationwide study of critical care facilities informs efforts to strengthen the healthcare system

A survey of nearly 80 intensive care units (ICUs) across Pakistan conducted by AKU found that despite their success in obtaining beds and ventilators during the pandemic, many ICUs continue to lack crucial infrastructure and personnel. That could spell trouble if the country experiences a second wave of the COVID-19 pandemic, or an outbreak of another disease that strains ICU capacity.

"High-tech equipment is only a part of what makes a successful ICU," said AKU Associate Professor Asad Latif, who led the survey. "You also need trained staff, the right spaces to treat patients and systems to maintain quality."

The survey reported shortages of negative pressure isolation rooms, oxygen supplies, nurses and qualified critical care physicians. Many ICUs also lacked policies and protocols for patient care.

Dr Latif and his team consulted frameworks for health-systems

strengthening before designing a comprehensive survey to assess the quality and scope of facilities, staff, equipment and systems at ICUs across Pakistan.

"This survey points out the most critical gaps in our intensive care delivery," Dr Latif said. "While investing more money in the healthcare system is important, we also need to invest in building the capacity of staff and strengthening processes in order to raise the quality of care in our ICUs."

The assessment is part of the University's broader Tele-ICU initiative. Under agreements with the Government of Sindh and the federal Ministry of

Most intensive care units were short of infrastructure, trained personnel and policies for patient care.

Health, and with funding from the Bill & Melinda Gates Foundation and the Dawood Foundation, AKU is working towards building the capacity of healthcare workers across the country to care for COVID-19 patients.

Over 12,000 people have attended the University's online workshops on the use of personal protective equipment, and AKU's courses related to the care of COVID-19 patients have attracted more than 10,000 participants.

AKU has also established a hotline to provide teleconsultations to physicians treating COVID-19 patients, particularly focusing on government hospitals. To date, more than 500 frontline healthcare workers have called the hotline and consulted with AKU specialists.

At the signing of the agreement between AKU and the federal Ministry of Health, Dr Zafar Mirza, then the Prime Minister's special assistant on health, said the partnership "will contribute to the national effort to improve recoveries and save lives."



What is COVID-19's impact on maternal and child health?

Biorepositories will help researchers examine how COVID-19 affects pregnant women and their babies



To date, studies have generated conflicting findings on how COVID-19 affects pregnant women and their babies. AKU researchers in Nairobi and Karachi aim to shed new light on the subject.

In Nairobi, a team led by Professor Marleen Temmerman have been engaged in a major study of placental disorders (pregnancy hypertension, foetal growth restriction, etc.) in multiple African countries, using a biobank of samples collected from women throughout their pregnancy. The study, known as PRECISE, has now been expanded to investigate the impact of the novel coronavirus on pregnant women and their babies.

The team will conduct regular COVID testing on more than 1,000 pregnant women and 250 non-pregnant women, assess outcomes among those infected

and collect and analyse biological samples to determine whether and for how long SARS-CoV-2 is present in blood, urine, umbilical cord blood, amniotic fluid and other samples, as well as determine the presence of antibodies in cord blood and breast milk.

Their study involves women in Kenya, Uganda, Mozambique, Malawi and The Gambia. It will shed light on whether women infected with the virus are at a greater risk of pre-term births or pregnancy complications, and how pregnancy affects the progression of the disease in women.

"The novel nature of COVID-19 means there are many areas where we have no answers," said Dr Temmerman, Director of the Centre of Excellence in Women and Child Health, East Africa. "Our project will be one of the largest studies to date of these issues."

Dr Temmerman brings to the study decades of experience in studying HIV/AIDS in pregnant women.

In Pakistan, AKU Associate Professor Dr Fyezah Jehan and her team will be using the AMANHI biobank to understand the spread, severity and spectrum of COVID-19 in pregnant women and their newborns. The AMANHI biobank is part of a World Health Organization study of maternal and child health outcomes that spans eight countries in South Asia and Africa, with AKU being responsible for sample collection and analysis in Pakistan.

The biobank has enrolled more than 2,500 women and 2,300 children who live in the area of Ibrahim Hyderi in Karachi. The University has been providing low-cost primary care health services in the area for a number of years and has earned

the trust of the local community. Since approximately 10 per cent of the cohort is pregnant at any point in time, the AMANHI biobank is likely to be a valuable tool in understanding how COVID-19 affects maternal and child health in the area.

Researchers will contact women enrolled in the study to ascertain whether they have experienced symptoms of the disease. Samples

"The novel nature of COVID-19 means there are many areas where we have no answers. Our project will be one of the largest studies to date of these issues."

will also be collected from a cohort of pregnant women with COVID-19 until 42 days after birth to ascertain the course of the disease through pregnancy. COVID-19 antibody tests will be conducted on study participants to understand the burden of COVID-19 and to ascertain the immune system's response to the disease.

Indirect impacts of the pandemic

AKU researchers in Pakistan and Kenya are also examining the indirect impact of the pandemic on mother and child health.

In Pakistan, as part of the AMANHI project, researchers will be looking to understand how the pandemic has impacted nutrition, breastfeeding and immunisation of newborns.

Data will be compared with findings from other AMANHI countries to

shed light on the best strategies to prevent disruptions to essential services during pandemics.

In Kenya, Dr Temmerman and her fellow researchers will consult data from the Ministry of Health and from health facilities in Kilifi, Mombasa and Nairobi to assess trends in healthcare utilisation. They will also conduct interviews with service providers to assess the reasons for changes in health-seeking behaviour. This will aid researchers in understanding the pandemic's impact on antenatal and postnatal care, facility deliveries, family planning and adolescent health. As a member of a Ministry of Health working group that is looking at the delivery of essential health services during the pandemic, Dr Temmerman will present the study's findings to decision-makers to inform efforts to improve pandemic preparedness.



Researching the role of genetics in SARS-CoV-2

Why hasn't the virus been more deadly in Pakistan? Genetic analysis may deliver answers

Pakistan continues to experience a relatively low death rate from COVID-19 and a high proportion of mild or asymptomatic cases, contrary to the expectations of many experts. Professor Zahra Hasan and her team are working to understand why by examining the biology of both the virus and its human hosts.

“The nature of the pandemic here in Pakistan has given rise to a lot of speculation,” Hasan said. “Why hasn't it been worse? Is it because Pakistanis have a high level of immunity? Is it because our population is so young? We're working to deliver rigorous explanations by analysing the genetic makeup and diversity of SARS-CoV-2 strains.”

Hasan's team has conducted whole genomic sequencing of the virus and has identified four different families of strains that were circulating in Pakistan at the start of the pandemic.

They are analysing these strains alongside more current strains to

understand their variability and possible mutations in proteins – especially the spike protein or outer-coat proteins of the virus – that may cause different strains to be more infectious or deadly.

Biological differences between individuals can influence how they respond to viral infections. Researchers are studying genetic changes in blood samples gathered from mildly, moderately and critically ill COVID-19 patients at the Aga Khan University Hospital in Karachi to identify biomarkers that lead to unfavourable outcomes or protection from the virus.

They are also collaborating with researchers at Nova University Lisbon to explore the role of protective antibody responses in the progression of COVID-19 in patients.

“The fact that we have a high incidence of mild disease is very noteworthy,” Hasan said. “It opens up the possibility that we could help deliver answers to fundamental questions about the virus that have global implications.”

The research team was able to jumpstart COVID-19 research as their SARS-CoV-2 sequencing builds on previous pathogen genomics work conducted alongside Professor Rumina Hasan. Their COVID-19 immunity work builds on the department's ongoing research into tuberculosis and other infectious diseases.

The research team includes Rumina Hasan, Najia Ghanchi, Kiran Iqbal, Erum Khan, Asghar Nasir, Akbar Kanji and Safina Razzak from the Department of Pathology and Laboratory Medicine; Faisal Mahmood, Nosheen Nasir and Bushra Jamil from the Department of Medicine; Hani Abidi and Kulsoom Ghias from the Department of Biological and Biomedical Sciences; and Waqasuddin Khan from the Department of Paediatrics.

Research support has been provided by Health Security Partners in the United States, Pakistan's Higher Education Commission and AKU's University Research Council and Provost's Academic Priorities Fund.



Casual attitude to COVID-19 in Pakistan is cause for concern

Researchers found very different attitudes to the virus in Pakistan and Hong Kong

One in six Pakistani adults believes that they and their families are safe from COVID-19 even if they take no preventive measures, according to an online survey by AKU and The Chinese University of Hong Kong.

The survey was conducted in May 2020 and gathered responses from 1,406 Pakistanis and 1,715 Hong Kong residents. It found that Pakistanis were less concerned about COVID-19's complications and felt they were more likely to survive the virus than those surveyed in Hong Kong.

Forty-one per cent of Pakistanis rated COVID-19 symptoms as being severe or very severe, compared to 97 per cent of respondents in Hong Kong. Sixty-eight per cent of Pakistanis said they had a high or very high chance of surviving the disease against 36 per cent of respondents in Hong Kong.

Pakistanis were also less likely to seek out information on preventive measures and how to detect COVID-19 symptoms than their counterparts in Hong Kong.

“The relatively casual attitude of literate Pakistanis toward COVID-19 is concerning,” said AKU Professor and Associate Vice Provost for Research Fauziah Rabbani, the study's principal investigator.

Compared to Hong Kong residents, Pakistanis were more trusting of government information sources. Nearly eight out of ten Pakistanis rated government information as being reliable or very reliable compared with just 16 per cent of people in Hong Kong.

“In Hong Kong citizens took charge of the pandemic as they didn't trust

41% of Pakistanis rated COVID-19 symptoms as being severe or very severe, versus 97% of Hong Kong residents.

the government,” Dr Rabbani said. “Pakistanis are fortunate to have proactive government campaigns about mask use and physical distancing but have been relatively reluctant to adopt preventive measures.”

The survey also found evidence that Pakistani men and women responded to the pandemic differently. Despite a government-imposed lockdown, only 71 per cent of men said they avoided going out, compared to 87 per cent of women. Sixty-two per cent of women reported experiencing symptoms of anxiety, compared to 50 per cent of men. Men in Pakistan preferred to acquire information about the pandemic from their family and friends, while women viewed information from doctors as being more reliable. In both countries, three-quarters of respondents said they were avoiding going to hospitals or clinics.

Drs Adeel Abid, Hania Shahzad, Hyder Ali Khan, Suneel Piryani and Ms Areeba Raza Khan contributed to the study.



University updates

AKU continues to strive to achieve its mission of solving the developing world's most pressing problems by piloting and patenting new technologies, publishing groundbreaking studies in landmark journals, launching new centres for research and by continuing to invest in its infrastructure for knowledge generation.

AKU innovation delivers problem-solving technologies

Researchers have developed and patented several new technologies

The University's Technology Innovation Support Centre (TISC) works with faculty and staff to create new technologies that can help to solve a wide range of problems. The Centre has either led or facilitated the development of the following technologies.

Multipurpose scope

Despite significant technological advances, healthcare professionals continue to use multiple bulky and expensive devices to examine different parts of the human body. For example, dermoscopes, otoscopes, ophthalmoscopes, otolaryngoscopes and dental scopes are used for examining skin, ears, eyes, nose, throat, teeth and more. Traditional devices also lack the ability to capture and share images.

To overcome these problems, AKU has developed a scope with different end-points that attach to a mobile phone's camera. The probes turn the camera into a multipurpose scope that can be used to examine and

capture images of the skin, ears, eyes, throat, nose and oral cavity. An accompanying app uses artificial intelligence technology to analyse the images. The app also enables image sharing, which can help boost access to healthcare in remote areas where specialists are not easily accessible. The University has been issued a U.S. patent for this technology.

A clinical trial of the device is expected to begin by the end of 2020. Pilot studies will also be conducted in remote, rural regions of Central Asia.



Portable emergency ventilator

A portable, low-cost emergency ventilator developed by TISC is currently undergoing clinical trials. Unlike traditional bag-valve masks, which are manually pumped and can be difficult to use properly, the device is powered by a motor. Briefcase-sized, it is small enough for use in ambulances. It can also be used on hospital patients waiting for a traditional ventilator.



3D-printed nasal swabs

Nasal swabs are used to capture the sample needed to test individuals for COVID-19. 3D printing these swabs in Pakistan can help lower the cost of testing while supporting the country's ability to conduct large numbers of tests (Pakistan is currently reliant on imported nasal swabs, which are in high demand around the world). TISC is manufacturing swabs using the University's 3D printing facilities, and has completed a clinical trial which found that they are as safe, user-friendly and effective as existing swabs. AKU plans to seek regulatory approval that would allow it to market the swabs to other institutions in Pakistan.

CoronaCheck self-screening app

CoronaCheck is a mobile phone app that enables users to easily and safely evaluate whether they require a COVID-19 test by answering a series of questions regarding their health. CoronaCheck can help ensure that people who need testing get it, while also reducing unnecessary hospital visits and tests. The app is available to the public in Pakistan, Tajikistan, Tanzania, Kenya and Mozambique. It has helped more than 71,000 users.

UV-light disinfection device

The Aga Khan University Hospital, Nairobi, developed a device that uses ultraviolet light to disinfect spaces within the hospital, from offices to operating rooms. The Hospital uses the device on a regular basis.



Telemedicine mobile phone app

Elaj Asaan, or Easy Treatment, is a mobile phone teleconsultation app developed in collaboration with the Aga Khan Health Service, Pakistan (AKHS,P). It allows patients, including in rural areas, to consult a doctor without having to travel to a healthcare facility. The app also makes it possible to securely maintain and share medical records, allows patients to pay for services through the app and provides patients with the opportunity to provide feedback on their consultation. Available in Pakistan through AKHS,P, the application will also be launched in Kenya and Tanzania.

Patented tray to reduce surgical error

The misplacement of surgical instruments and medical supplies such as scissors and gauze during surgeries can lead to problems that endanger patient safety. The University has been issued a U.S. patent for a surgical tray that uses image processing technology to detect when instruments are removed from and placed back onto a tray, helping surgeons and support staff to keep track of vital equipment. A clinical trial to test the performance of the device will be launched soon.



New research centres will drive knowledge creation

The centres will advance knowledge regarding cancer, the brain, global health, emergency medicine, global surgery and more

Five new AKU research centres will deliver new knowledge in fields crucial to the health and well-being of the people of Asia and Africa.

Cancer Centre

Cancer cases in Sub-Saharan Africa are surging, as western diets and lifestyles become more common and life expectancy increases. AKU's new Cancer Centre in Nairobi aims to be a leader in the fight against the disease. It will combine innovative research with high-quality clinical care, train badly needed specialists and promote prevention and early detection.

Today, with Africa accounting for just 2 per cent of cancer clinical trials, doctors must prescribe cancer drugs that have never been rigorously tested in African populations. AKU will help to change that as one of the only institutions in Sub-Saharan Africa to meet U.S. Food and Drug Administration requirements for conducting clinical trials. The Centre will include a Centre for Women's Cancer, which will conduct research on cancers that are especially common among African women, such as triple-negative breast cancer. It will also be well positioned

to test novel therapies developed by AKU's Centre for Regenerative Medicine and Stem Cell Research.

The Centre is led by Founding Director Mansoor Saleh, who was previously Professor of Medicine and Pathology at the University of Alabama at Birmingham (UAB) and Director of the Phase I Programme of UAB's Comprehensive Cancer Center.

Institute for Global Health and Development

The Institute for Global Health and Development champions interdisciplinary research and cross-sectoral action on major global health challenges, and seeks to contribute to the achievement of health-related Sustainable Development Goals.

The Institute advances its mission through partnerships with its

AKU's cancer clinical trials will bring new treatments and hope to patients in East Africa.

sister agencies of the Aga Khan Development Network and leading organisations worldwide.

With extensive reach in South and Central Asia and Africa, the Institute comprises a network of leading scholars delivering research findings from state-of-the-art laboratories and extensive field sites in low-income urban and rural communities. Its efforts are focused on three areas within the broad context of health and health-related Sustainable Development Goals: climate change, urban development and health; gender inequality and health; and nutrition, food security and agriculture.

The Institute seeks to stimulate and elevate the scholarship around global health and development to tackle "wicked" problems affecting low- and middle-income countries.

Based in Karachi, the Institute is led by Founding Director Professor Zulfiqar Bhutta, a globally renowned, award-winning researcher in the field of maternal and child health, a member of the U.S. National Academy of Medicine and a Fellow of the Royal Society of the United Kingdom.



Centre of Excellence in Trauma and Emergencies

The primary goal of the Centre is to improve health outcomes for individuals and populations affected by trauma and emergencies, which account for more than half of the total burden of disease in low- and middle-income countries. Trauma and emergencies include motor vehicle crashes, humanitarian crises, disasters due to climate change and epidemics. Already, the Centre is leading a collaborative effort to train 10 million Pakistanis over 10 years in cardiopulmonary resuscitation and bleeding control, an initiative that could help to save numerous lives.

Research will be a core component of the work of the Centre, which aims to establish a data capture system in multiple hospitals in Pakistan, launch a trauma and emergency medicine research fellowship, and publish a growing number of articles each year. Based in Karachi, the Centre is led by Founding Director Junaid Razzak, the 2020 recipient of the Presidential Lifetime Achievement Award from the U.S.-based Society for Academic Emergency Medicine's Global Emergency Medicine Academy.

Centre for Global Surgery

An estimated 11 per cent of all deaths globally could be averted with timely access to surgical care. AKU's new Centre for Global Surgery will work to expand access to high-quality surgery in low-income countries by training healthcare professionals in rural areas, developing standards and guidelines for surgical personnel and facilities in low-resource settings and advocating for government policies that support increased access to surgery.

The Centre will engage in research that can inform efforts to improve surgical care in marginalised areas. Research projects may range from studies to determine surgical capacity in a given region to evaluations of interventions designed to improve surgical outcomes. Already, the Centre has undertaken a survey of hospitals across Pakistan that revealed there are multiple underappreciated challenges to the delivery of surgical care. The Centre is based in Karachi and is led by Associate Professor Sadaf Khan, an experienced general and colorectal surgeon who is also Associate Dean of Undergraduate Medical Education.

Brain and Mind Institute

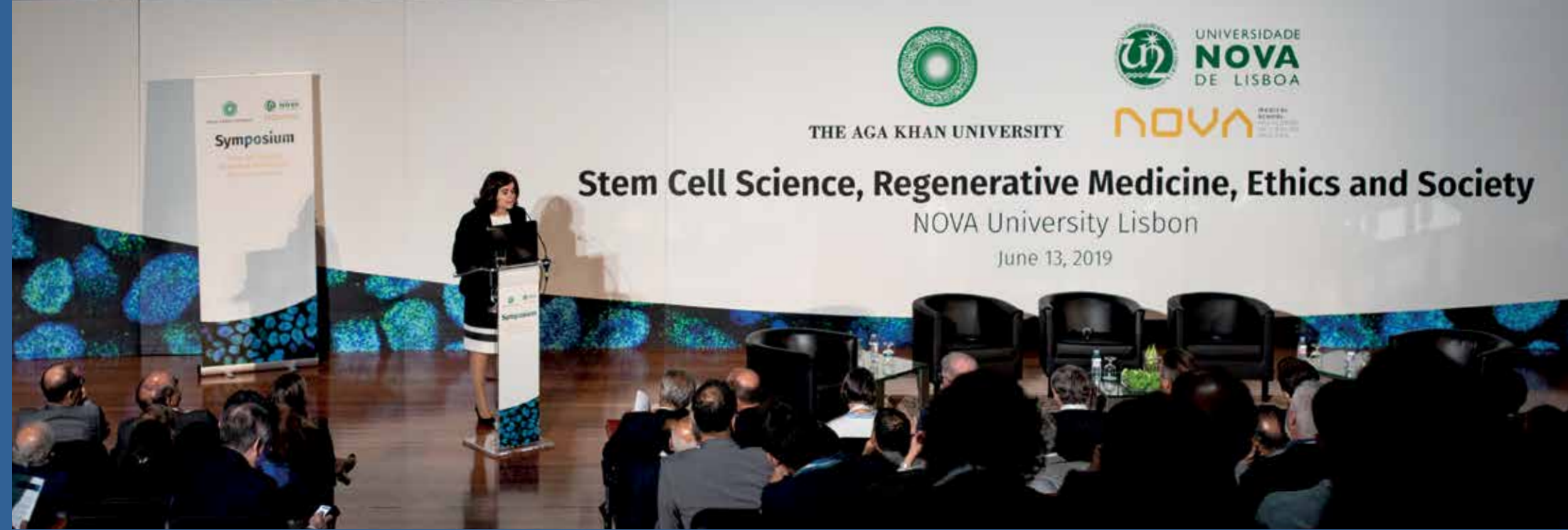
Mental illness has risen to the top of the list of threats to the people and communities served by AKU. Children and young people are especially vulnerable, with large proportions of the population already suffering the lifelong consequences of inaction.

The Brain and Mind Institute will take an interdisciplinary approach to improving mental health, with an emphasis on aiding high-risk populations, including children, youth and women.

Bridging the fields of medicine and nursing, public health, women's health, neuroscience, biology, psychiatry, psychology and the social sciences, the Institute will offer a platform for the study of a wide range of brain-related health conditions and the relationship between mental and physical illness.

Based in Nairobi, the Institute is led by Founding Director Zul Merali, who is Professor Emeritus at the University of Ottawa's Faculty of Medicine and Faculty of Social Sciences and was previously Founder and Scientific Director of the Canadian Depression Research and Intervention Network.

Research facilities, oversight and ethics



INSTITUTIONAL BIOSAFETY COMMITTEE

The Institutional Biosafety Committee (IBC) continues to work to ensure that the highest level of biosafety standards is followed. From January 2019 through September 2020, the Committee reviewed 237 project proposals and material transfer agreements. IBC also initiated a biosafety training programme for staff based on the American Society for Microbiology curriculum.

In response to the COVID-19 pandemic, IBC and the Research Office developed standard operating procedures that allowed laboratory and field activity to resume while protecting health and safety. As part of its efforts, IBC oversaw fit testing of N95 masks and training in donning and doffing of personal protective equipment. It also worked with the University Hospital pharmacy to manufacture a disinfectant for N-95 masks, as disinfectant was in short supply during the country-wide lock down in Pakistan.

SYMPOSIUM ON STEM CELL SCIENCE AND ETHICS

Stem cell research and regenerative medicine have the potential to alleviate suffering for millions of people, which is why AKU has established a Centre for Regenerative Medicine and Stem Cell Research at its Karachi campus with the support of the University of California, San Francisco. Yet these fields raise complex ethical challenges. To advance understanding of such issues in the context of a pluralistic world, the University organised a Symposium on Stem Cell Science, Regenerative Medicine, Ethics and Society together with NOVA University Lisbon in June 2019. The event featured leading scientists, ethicists, lawyers and scholars of religion from Europe, North America, the Middle East and Asia. Discussions covered experimental models of neurodegenerative diseases, bioethics in the context of Germany's Muslim minority, the rise of unproven stem cell therapies, human-animal chimeras and much more.

ANIMAL RESEARCH FACILITY

The Animal Research Facility on AKU's Stadium Road campus is fully functional and meets international standards for small animal research laboratories. At present, the facility is equipped to work on rabbits, guinea pigs, rats and mice; has individually ventilated cages for immune-deficient animals, as required for stem cell transplantation studies; and has a dedicated procedure room where anaesthesia and surgery can be performed. The University is seeking international accreditation of the facility.

The facility was closed during the first COVID-19 peak in Pakistan to minimise transmission risks as multiple animal species were reported to be susceptible to SARS-CoV-2. Standard procedures were developed for safe conduct of animal-based research and activities have since resumed. The Ethics Committee for Animal Care and Use and the Research Office organised a virtual training workshop on the Principles of Laboratory Animal Science in September 2020, which was well attended by participants from across Pakistan as well as Saudi Arabia and the US.

JUMA RESEARCH LABORATORY

Twenty-six projects are underway in the Juma Research Laboratory's Biosafety Level 2 lab. These involve research in the fields of immunohistochemistry, cell and molecular biology, bacteriology, virology, parasitology, genetics, cancer and tissue banking, with support from national and international grants. The Laboratory is also considering establishing a Biosafety Level 3 COVID-19 biorepository.

The Laboratory is now equipped with a state-of-the-art next generation sequencer, MiSeq, from Illumina. It is supported by technology for whole genome sequencing – a Qubit Fluorometer, Veriti Thermal Cycler, Palm Centrifuge and Vortex Genie. During lockdown, Laboratory staff continued working to properly maintain equipment and consumables and safeguard bio-samples. Once the lockdown eased, the Laboratory resumed normal operations in accordance with standard operating procedures.



High impact publications

NEW ENGLAND JOURNAL OF MEDICINE: RANDOMISED TRIAL OF AMOXICILLIN FOR PNEUMONIA IN PAKISTAN

A double-blind, randomized, placebo-controlled non-inferiority trial was conducted involving children at primary health care centers in low-income communities in Karachi, Pakistan. Children who were 2 to 59 months of age and who met WHO criteria for non-severe pneumonia with tachypnea were randomly assigned to a 3-day course of a suspension of amoxicillin (the active control) of 50 mg per milliliter or matched volume of placebo (the test regimen), according to WHO weight bands (500 mg every 12 hours for a weight of 4 to <10 kg, 1000 mg every 12 hours for a weight of 10 to <14 kg, or 1500 mg every 12 hours for a weight of 14 to <20 kg). The primary outcome was treatment failure during the 3-day course of amoxicillin or placebo. From November 9, 2014, through November 30, 2017, a total of 4002 children underwent randomization (1999 in the placebo group and 2003 in the amoxicillin group). The incidence of treatment failure was 4.9% among placebo recipients (95 of 1927 children) and 2.6% among amoxicillin recipients (51 of 1929 children, between-group difference 2.3 percentage points; 95% confidence interval [CI], 0.9 to 3.7). The presence of fever and wheeze predicted treatment failure. The number needed to treat to prevent one treatment failure



was 44 (95% CI, 31 to 80). One patient (<0.1%) in each group died. Relapse occurred in 40 children (2.2%) in the placebo group and in 58 children (3.1%) in the amoxicillin group. Among children younger than 5 years of age with non-severe pneumonia, the frequency of treatment failure was higher in the placebo group than in the amoxicillin group, a difference that did not meet the non-inferiority margin for placebo.

Fyezah Jehan, Imran Nisar, Salima Kerai, Benazir Balouch, Nick Brown, Najeeb Rahman, Arjumand Rizvi, Yasir Shafiq, and Anita K.M. Zaidi (2020). Randomised Trial of Amoxicillin for Pneumonia in Pakistan. New England Journal of Medicine 2020; 383:24-34.

FRONTIERS IN ONCOLOGY: LACK OF ANDROGEN RECEPTOR SELECTS FOR BASAL-LIKE PHENOTYPE

Androgen receptor (AR) has emerged as a significant favorable prognostic indicator in estrogen-receptor expressing (ER+) breast cancer (BCa). However, its clinical and biological relevance in triple negative breast cancer (TNBC) and association with cancer stem cell (CSC) markers remain ambiguous. We examined the immunohistochemical expression of AR in a cohort of stage I–III TNBC cases (n=197) with long-term clinical follow-up data (mean follow-up = 53.6 months). Significance of AR expression was correlated with prognostic biomarkers including cancer stem cell markers (CD44, CD24, and ALDH1), basal markers (CK5, CK14, and nestin), proliferation marker (ki-67), apoptotic marker (Bcl-2), and COX-2. Expression of CK5 and nestin was used for the categorization of TNBC into basal (TN, CK5+, and/or nestin+) and non-basal (TN, CK5–, and/or nestin–) phenotypes, and Kaplan–Meier curves were used for estimation of overall survival and breast cancer-specific survival (BCSS). Assessment of AR and



basal markers identified biologically and clinically distinct subgroups of TNBC. Expression of AR defined a low-risk TNBC subgroup associated with improved overall survival, whereas expression of basal markers (CK5 and nestin) identified a high-risk subgroup associated with adverse BCSS. Integration of immunohistochemical analysis of AR and basal biomarkers to the assessment of TNBC tumors is expected to improve the prognostication of an otherwise heterogeneous disease.

Nazia Riaz, Romana Idress, Sadia Habib and El-Nasir Lalani (2020). Lack of androgen receptor selects for basal-like phenotype and is a predictor of poor clinical outcome in non-metastatic triple negative breast cancer. Frontiers in Oncology 2020; 10:1083.

THE BMJ: COVID-19 RISK AND RESPONSES IN SOUTH ASIA

From what initially seemed like a localised outbreak in Hubei province of China in December 2019, it rapidly became clear that SARS-CoV-2 had pandemic potential. The number of deaths from COVID-19 in Italy now exceeds those reported from China, and the outbreak in Iran may have seeded cases in Pakistan and Afghanistan. The number of reported cases in South Asia remains relatively low, however, and the response patchy. By 24 March, authorities in the South Asian Association for Regional Cooperation (SAARC), which comprises India, Pakistan, Bangladesh, Nepal, Sri Lanka, Maldives, Bhutan, and Afghanistan, had reported just 1536 confirmed cases and 22 deaths. Although all countries took individual actions, it took the collective political leadership of SAARC almost two months to put aside political differences and meet to discuss the dangers to the region posed by COVID-19. The actions of individual countries in SAARC have varied. Although the potential economic and social consequences of such measures could be huge,

allowing the counterfactual reality of continued regular activities and mass congregations would be extremely unwise. Testing at scale is limited, focusing mainly on individuals arriving from affected countries and their immediate contacts. The only effective intervention implemented is that all countries in the region have drastically reduced or stopped air travel and imposed quarantine protocols on people arriving by road or air from countries with COVID-19 transmission. However, facilities for screening and quarantine remain limited and of questionable quality.

Zulfiqar A. Bhutta, Buddha Basnyat, Samir Saha, Ramanan Laxminarayan (2020). Covid-19 Risk and Responses in South Asia. British Medical Journal 2020; 368:m1190.

LANCET GLOBAL HEALTH: PERFORMANCE OF LATE PREGNANCY BIOMETRY FOR GESTATIONAL AGE DATING

This prospective, population-based, cohort study was done in three LMICs (Bangladesh, Pakistan, and Tanzania) participating in the WHO Alliance for Maternal and Newborn Health Improvement study. Women carrying a live singleton fetus dated by crown-rump length (CRL) measurements between 8+0-14+6 weeks of gestation, who were willing to return for two additional ultrasound scans, and who planned on delivering in the study area were enrolled in the study. Participants underwent ultrasonography at 24+0-29+6 weeks and at 30+0-36+6 weeks' gestation. Statistical modelling was done to develop new gestational age prediction formulas for third trimester ultrasonography in LMICs. With standard dating formulas, late pregnancy ultrasound at 24+0-29+6 weeks' gestation was accurate to within approximately plus or minus 2 weeks of the gold standard CRL measurement of gestational age, and late pregnancy ultrasound was accurate to within ± 3 weeks of the CRL measurement at 30+0-36+6 weeks' gestation. By use of a novel parsimonious model formula that combined TCD with femur length, gestational age at the 24+0-29+6-week ultrasound scan was estimated to within ± 10.5 days of the CRL measurement and estimated to within ± 15.1 days of the CRL

measurement at the 30+0-36+6-week ultrasound scan. Similar results were observed in infants who were small-for-gestational-age. Incorporation of TCD and the use of new formulas in late pregnancy ultrasound scans could improve the accuracy of gestational age estimation in both appropriate-for-gestational-age and small-for-gestational-age infants in LMICs. Validation of this new formula in other LMIC populations is needed to establish whether the accuracy of the late pregnancy ultrasound can be narrowed to within approximately 2 weeks.

The WHO Alliance for Maternal and Newborn Health Improvement Late Pregnancy Dating Study Group. Nasir et al. Performance of late pregnancy biometry for gestational age dating in low-income and middle-income countries: a prospective, multi-country, population-based cohort study from the WHO Alliance for Maternal and Newborn Health Improvement (AMANHI) Study Group. Lancet Global Health 2020; 8(4):e545-e554.

LANCET INFECTIOUS DISEASES: HIV INFECTION PREDOMINANTLY AFFECTING CHILDREN IN SINDH, PAKISTAN

In this cross-sectional study in April 2019, the outbreak response from the government, academia, and UN agencies in Larkana, Sindh, Pakistan was reviewed. For children who registered for HIV care, clinical history of previous injections and blood transfusions, HIV disease stage, hepatitis B and hepatitis C status, and CD4 count was abstracted from clinical records from Sindh AIDS Control Program HIV Clinic (Shaikh Zayed Children's Hospital, Larkana, Pakistan) and analysed using percentages, chi(2) tests, and weight-for-age Z scores. Between April 24, and July 15, 2019, 31 239 individuals underwent HIV testing, of whom 930 (3%) tested positive for HIV. Of these, 763 (82%) were younger than 16 years and 604 (79%) of these were aged 5 years and below. Estimated HIV prevalence was 3% overall; 7% (283 of 3803) in children aged 0-2 years, 6% (321 of 5412) in children aged 3-5 years, and 1% (148 of 11 251) in adults aged 16-49 years. Of the 591 children who registered for HIV care, 478 (81%) were 5 years or younger, 379 (64%) were boys, and 315 (53%) of 590 had a weight-for-age Z score of -3.2 . Prevalence of hepatitis B surface antigen was 8% (48 of 574) and hepatitis C antibody positivity was 3% (15 of 574). Of children whose mothers tested for HIV, only 39 (11%)

of 371 had HIV-positive mothers. Most children (404 [89%] of 453) reported multiple previous injections and 40 (9%) of 453 reported blood transfusions. The outbreak was heavily skewed towards children younger than 5 years, with a predominance of boys. Epidemiological and molecular studies are needed to understand the full extent of the outbreak and its drivers to guide HIV control strategies.

Mir, F., Mahmood, F., Siddiqui, A. R., Baqi, S., Abidi, S. H., et al. (2020). HIV infection predominantly affecting children in Sindh, Pakistan, 2019: a cross-sectional study of an outbreak. Lancet Infectious Diseases 2020; 20(3), 362-370.



BMJ GLOBAL HEALTH: GLOBAL STRATEGIES AND LOCAL IMPLEMENTATION OF HEALTH AND HEALTH-RELATED SDGS

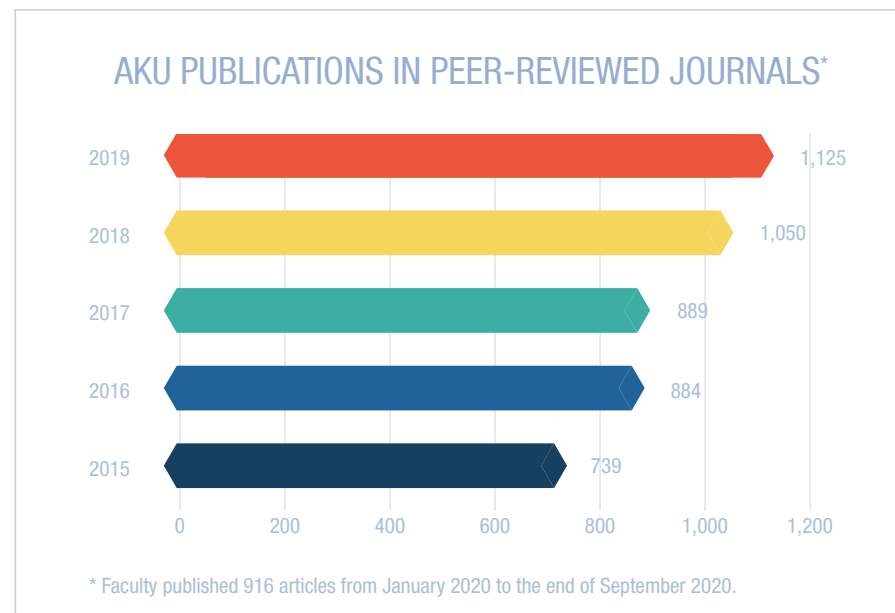
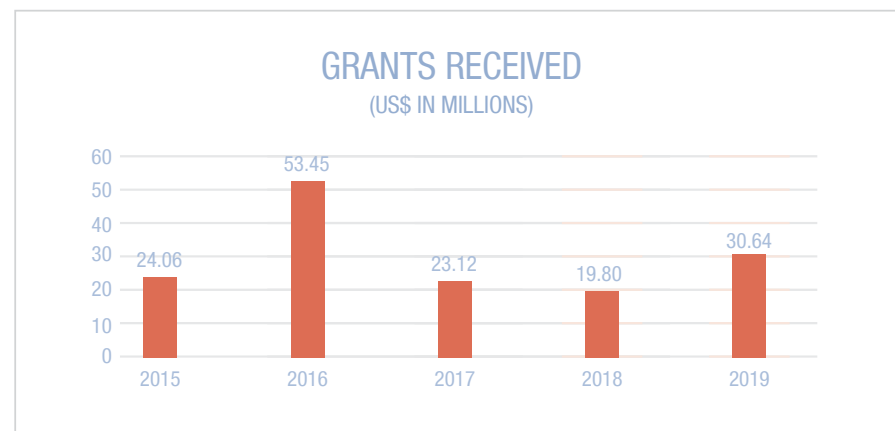
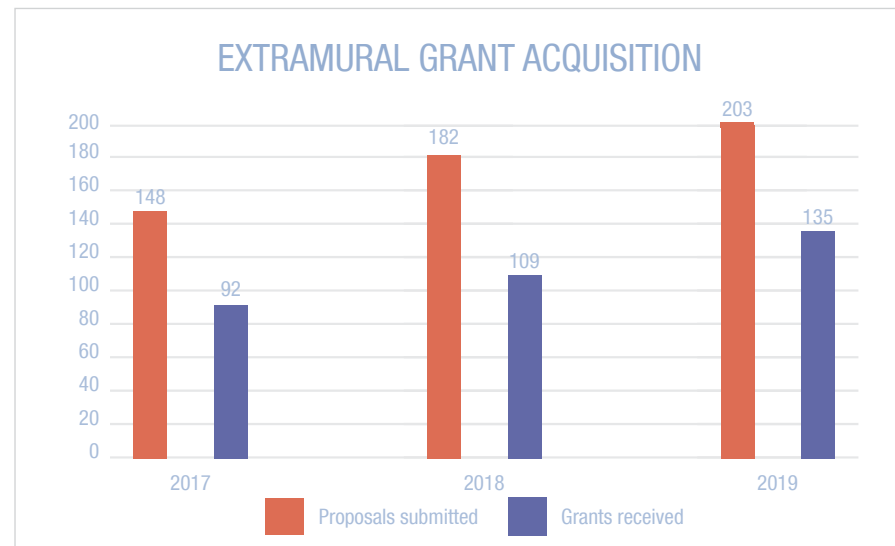
Evidence on early achievements, challenges and opportunities would help low-income and middle-income countries (LMICs) accelerate implementation of health and health-related sustainable development goals (HHSDGs). Consultative meetings were conducted during 2018-2019 that involved 15 countries across five regions to determine the status of implementation of HHSDGs. Almost 120 representatives from health and non-health sectors participated. The assessment relied on a multidomain analytical framework drawing on existing public health policy frameworks. During the first 5 years of the sustainable development goals (SDGs) era, participating LMICs from South and Central Asia, East Africa and Latin America demonstrated growing political commitment to HHSDGs, with augmentation of multisectoral institutional arrangements, strengthening of monitoring systems and engagement of development partners. On the other hand, there has been limited involvement of civic society representatives and academia, relatively few capacity development initiatives were in place, a well-crafted communication strategy was missing, and there is limited evidence of additional domestic financing for implementing HHSDGs. While the



momentum towards universal health coverage is notable, explicit linkages with non-health SDGs and integrated multisectoral implementation strategies are lacking. The study offers messages to LMICs that would allow for a full decade of accelerated implementation of HHSDGs, and points to the need for more implementation research in each domain and for testing interventions that are likely to work before scale-up.

Sameen Siddiqi, Wafa Aftab, Fahad Javaid Siddiqui, Luis Huicho, Roman Mogilevskii, Peter Friberg, Johanna Lindgren-Garcia, Sara Causevic, Anil Khamis, Mashal Murad Shah, Zulfiqar Ahmed Bhutta (2020). Global strategies and local implementation of health and health-related SDGs: lessons from consultation in countries across five regions. BMJ Global Health; 5:e002859.

Grants and publications





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Office of Research & Graduate Studies
research.office@aku.edu | www.aku.edu/research