

COMMENTARY

The Role of Telemedicine in Addressing Access to Sexual and Reproductive Health Services in sub-Saharan Africa during the COVID-19 Pandemic

DOI: 10.29063/ajrh2020/v24i2s.8

Kolawole A. Oyediran¹, Olusesan A. Makinde^{2*}, and Olugbemiga Adelakin³

John Snow Inc., Arlington USA¹; Viable Knowledge Masters, Abuja, Nigeria²; UNFPA, Cairo, Egypt³

*For Correspondence: Email: sesmak@gmail.com

Abstract

The outbreak of COVID-19 threatens continued access to non-urgent healthcare including sexual and reproductive health (SRH) services. With the epicentre of the outbreak projected to shift to sub-Saharan Africa (SSA) after making significant impact in China, Europe, USA, and South America, it is necessary for countries in this region to begin to plan for how to tackle a rapid surge in cases. Health facilities are already being primed for increased presentation of COVID-19 cases. As countries prepare, they also need to consider how non-urgent services will not be interrupted. Estimates of a potential disruption in access to long and short acting contraceptives for up to 12 months will result in an additional 15 million unintended pregnancies and additional 28,000 maternal deaths. Thus, effort must be made to ensure that the gains made in SRH outcomes over several years are not lost. The potential of utilizing telemedicine to continue to offer healthcare services to the population for non-urgent care needs to be considered. It will not only provide for continued access to important services that can be delivered remotely but will reduce the risks of COVID-19 infection for both the client and the health workers. (*Afr J Reprod Health 2020 (Special Edition); 24[2]: 49-55*).

Keywords: Telemedicine, Internet, Universal Health Care, Outbreak, Communicable Diseases, Health Facilities

Résumé

L'épidémie de COVID-19 menace l'accès continu aux soins de santé non urgents, y compris les services de santé sexuelle et reproductive (SSR). L'épicentre de l'épidémie devant se déplacer vers l'Afrique subsaharienne (ASS) après avoir eu un impact significatif en Chine, en Europe, aux États-Unis et en Amérique du Sud, il est nécessaire que les pays de cette région commencent à planifier la manière de lutter contre surtension dans les cas. Les établissements de santé sont déjà préparés pour une présentation accrue des cas de COVID-19. Au fur et à mesure que les pays se préparent, ils doivent également se demander comment les services non urgents ne seront pas interrompus. Selon les estimations, une interruption potentielle de l'accès aux contraceptifs à action longue et courte durée pouvant aller jusqu'à 12 mois entraînera 15 millions de grossesses non désirées supplémentaires et 28 000 décès maternels supplémentaires. Ainsi, des efforts doivent être faits pour s'assurer que les gains réalisés en termes de résultats de SSR sur plusieurs années ne sont pas perdus. Le potentiel de l'utilisation de la télémédecine pour continuer à offrir des services de santé à la population pour des soins non urgents doit être pris en considération. Cela permettra non seulement un accès continu à des services importants qui peuvent être fournis à distance, mais réduira les risques d'infection au COVID-19 pour le client et les agents de santé. (*Afr J Reprod Health 2020 (Special Edition); 24[2]: 49-55*).

Mots-clés: Télémédecine, Internet, soins de santé universels, épidémie, maladies transmissibles, établissements de santé

Introduction

The World Health Organization (WHO) declared the novel coronavirus (COVID-19) outbreak a pandemic on 11th March 2020 after spreading to 114 countries since first detected in Wuhan, China in late 2019¹. With the continued spread of the disease and the interconnectedness between China and Africa due to business relations,² WHO

believes the next epicentre of the outbreak will be in sub-Saharan Africa (SSA), after making significant impact in Europe, USA and South America³. Since the first case of the virus in Africa was identified in Egypt on the 14th of February, the virus has now been diagnosed in 47 countries in the WHO AFRO region^{2,4}. As at the 11th of June, 2020, 147,635 confirmed cases and 3,564 deaths had been reported to the WHO⁴. Besides these

confirmed cases, it is believed that several undiagnosed cases abound, and counting of the dead has been faulted. For instance, the cause of several suspicious deaths in a city with known cases of the outbreak in Nigeria remains undetermined⁵. Four countries (South Africa, Nigeria, Algeria, and Ghana) account for more than 60% of the confirmed cases in Africa⁴. However, testing has been unequal across the region with South Africa and Ghana accounting for 46% of tests that had been conducted as of 7th May, 2020⁶. Many African countries rely on medical supplies from developed countries which are also battling the pandemic and limiting export of these diagnostic agents⁷.

Due to the infectivity of COVID-19, its mode of transmission (droplets and direct contact) and associated morbidity and mortality, countries have adopted social distancing, lockdowns, mask wearing, hand washing, and self or government imposed quarantine as strategies to curtail the continued spread of the disease^{8,9}. Unfortunately, more than a third of Africans lack access to water supply and nearly 60% of urban dwellers live in overcrowded slums, conditions that make hand washing and the other strategies laid out for the control of the disease difficult to achieve³. Most countries in SSA also have weak health systems, inadequate compliance with routine disease surveillance that can aid rapid detection, poor laboratory capacity, as well as scarcity of adequately skilled public health human resources and limited financial resources that can aid rapid response to the disease^{10,11}.

Although, the pandemic has focused global attention to the needs of those affected by the virus and other global health security challenges, it nevertheless exposes the weaknesses in country health systems, especially the infrastructural gaps in emergency situations. Health systems are being primed to care for those in need of support arising from the infection, with limited attention paid to other healthcare needs. Countries that are already hit with a large number of infections have focused on essential services, deprioritizing essential but non-emergency care in order to allow health workers attend to the needs of those affected by the outbreak. In addition, health facilities caring for patients infected with

COVID-19 virus could be an easy transmission site to uninfected persons requiring care for other ailments. Thus, to minimize in-person encounters during the COVID-19 pandemic, health care systems need to devise other mechanisms to maintain non-urgent healthcare services in the interim, which can be inadvertently neglected due to the outbreak response. This outbreak no doubt will impact Sexual and Reproductive Health (SRH) services such as counselling, dispensing of contraceptives and commodities, maternal and child health services, abortion and post-abortion care and Sexually Transmitted Infections (STIs) services, since they are mostly classified as non-life-threatening health services even though available evidence shows that these services are equally life-saving in the immediate, medium and long term. Childbirth as a proxy for SRH as an example - cannot be stopped for pandemics as has been observed with births recorded during the on-going COVID-19 outbreak.

The United Nations Population Fund (UNFPA) and partners recently highlighted that the pandemic threatens the achievement of global commitments to ending Female Genital Mutilation, Child Marriage, and other forms of gender-based violence depending on the duration of the on-going lockdowns¹². UNFPA further stated that the pandemic's "impact on acute care services in settings with under-resourced health systems is likely to be substantial" and called for the continued prioritization of essential core health services like maternal health services, and "other sexual and reproductive health care such as family planning, emergency contraception, treatment of sexually transmitted diseases, post-abortion care and where legal, safe abortion services to the full extent of the law, as components of available core health services"¹³. The potential consequences of non-delivery of these SRH services during lockdowns will include prolonged labour and home deliveries, unintended pregnancies and a rise in abortion and abortion-related complications. As a result, there is a high potential of increased maternal morbidity and mortality that could have been averted if SRH services were available to vulnerable women and girls. Riley and colleagues estimate that if SRH services were distorted for up to 12 months in low and middle income countries,

there will be an additional 48,558,000 women with an unmet need for modern contraceptives and 15,401,000 additional unintended pregnancies, resulting from a 10% decline in the use of short and long term contraceptives¹⁴. Similarly, there will be an additional 1,745,000 women experiencing major obstetric complications without care, additional 28,000 maternal deaths, 2,591,000 additional new-borns experiencing major complications and 168,000 additional new-born deaths arising from a 10% decline in service coverage of essential pregnancy-related and new-born care¹⁴.

The risks of nosocomial transmission of COVID-19 in health facilities would affect health care-seeking behavior of potential clients and the way health workers manage cases in the hospital. In addition, healthcare workers could be diverted from non-COVID-19 services to meet the urgent human resource needs of COVID-19 services. Thus, the delivery of health care requires new thinking on how to address these risks and ensure service delivery for SRH during this pandemic is not interrupted. Despite the adverse effects of the outbreak on the health system, policymakers and health managers could take the opportunity of the pandemic to strengthen existing but poorly developed and rarely utilized service delivery platforms to improve access to SRH. One of such opportunities lies in the use of telemedicine services to bridge the gap.

WHO defines telemedicine as “the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities”¹⁵. Telemedicine provides an opportunity to address access to certain healthcare services that would otherwise be disrupted by the pandemic. It’s use can be accentuated in sub-Saharan Africa (SSA) where people are likely to face additional consequences of limited access to SRH care, besides the previously existing low access rates prior to the outbreak^{16,17}. Telemedicine holds the

potential to expand access to counselling and life-saving consultation services even beyond this pandemic response. Yet, this channel of service delivery has been neglected for various reasons.

Telemedicine prior to COVID-19

Before the outbreak of COVID-19, remote service delivery by video conferencing had been rarely implemented for reproductive healthcare in SSA. However, the potential for its use in SRH service delivery has been documented across various countries in Europe and Asia. A project implemented in Europe utilized telemedicine services to consult with women with unwanted pregnancies and subsequently offered them medical termination of pregnancy by mailing the medication to them, before following them up remotely till they were fit¹⁸. Another study conducted in Nepal showed how telemedicine could be leveraged to reduce gender-based limitations of access to care¹⁹.

Many SSA countries are not new to telemedicine^{20,21}. With a rapidly growing population, poorly distributed health facilities and inadequate human resources,²² telemedicine became an option for service delivery about two decades ago²³. Telemedicine was suggested as a means to narrow the wide access to physicians in SSA because of their low numbers compared to the demand: doctor to population ratio in 31 SSA countries is fewer than 10 per 100,000 of the population compared to 370 in Italy and 380 in Norway for the same population²⁴. However, owing to various challenges including initial investment costs, on-going cost of internet access, and alternative approaches often preferred for the delivery of care especially physical presentation in health facilities, its potential was not maximized²⁵.

A meta-analysis of Telemedicine use and success in Africa which was published in 2013 found some level of use of telemedicine in South Africa and Ethiopia but limited use in Nigeria and Burkina Faso because of inadequate political support²⁰. Another study highlighted various projects in SSA including: transmission of biomedical images as done in Senegal and Mozambique, remote consultations in Ethiopia, knowledge sharing in Zambia, training and

continuous educational opportunities between researchers in Ghana with counterparts in UK and Switzerland, and remote diagnosis of conditions between clients in Congo and medical practitioners in Italy²³. Video Directly Observed Therapy to foster tuberculosis adherence has also been implemented in Uganda with satisfactory results among clients and health workers²⁶.

The outbreak of COVID-19 has however left healthcare managers with no other option than to be innovative in the provision of care. With the next epicentre projected to shift to SSA, African countries need to prepare for a massive presentation of cases and the consequent diversion of human and material resources to attend to this surge. Part of this will require planning for how millions of the population with the need for routine essential services will continue to receive care while health facilities are left to cater for those actively infected with the COVID-19 virus, to prevent nosocomial infections, and also to ensure that enough space is available to accommodate new cases of COVID-19 as the need arises.

Pros and cons of telemedicine

Telemedicine will remove the need for physical appearance in the health facilities for some ailments such as consultations for oral and barrier contraceptives, STI care and treatment, medical termination of pregnancies, routine and low risk pregnancy care, counselling services and other non-invasive services, thereby eliminating the risks of nosocomial transmission of COVID-19 virus to otherwise uninfected clients as well as increased protection for the health workers²⁷. However, it will not provide for issues such as childbirth, surgical termination of pregnancies and other invasive or life-threatening conditions. Telemedicine will also favour fewer health workers providing services across large geographic swathes thereby increasing access to those that may lose physical access to service because their neighbourhood health facilities have been designated to cater for COVID-19 infected clients, those unable to reach the health facilities as a result of government imposed lockdowns, or for other personal reasons which may include the fear of getting infected by COVID-19 in the health

facilities. Such interventions will help in reducing the potential unmet reproductive health needs during the outbreak which has been projected to be significant if nothing is done. It will also enable access to other reproductive health care services including hormonal contraception, medical abortions, and treatment and care for STIs. In addition, coverage of SRH services will be improved especially to rural and hard to reach communities that may not have had easy access to health facilities prior to the outbreak.

Other potential benefits of telemedicine are envisaged as countries increasingly adopt telemedicine during the outbreak. It can spur the government and health care administrators to begin to plan and implement centralized electronic medical record (EMR) systems which will be revolutionary beyond the COVID-19 outbreak. EMRs will further strengthen health data management and foster research. The adoption of telemedicine might also aid the uptake and integration of telemedicine into routine clinical practice; improve access to information; improve professional education and reduce health-care costs especially those associated with transportation.

Although, telemedicine may be a lifeline to address the acute crisis in SRH services that may result from this outbreak, significant barriers to its optimal implementation remain, many of which would require the intervention of policymakers and regulators, in collaboration with international and multilateral organizations to promptly address. Protocols to ensure that the quality of care offered through remote services is optimal may not be readily available and such needs to be quickly put in place. Another challenge to telemedicine is the issue of cost and access to internet services and specialized equipment. Many potential providers may not have ready access to specialized telemedicine equipment and internet services in several parts of SSA and this need to be addressed, possibly through government subsidies or grants. However, it is noteworthy that there has been tremendous improvement in internet bandwidth, transition to more day to day equipment for telemedicine services such as mobile phones, and reduction in

internet costs across countries since telemedicine was first introduced years ago²⁸.

According to a study by Pew Research, internet penetration in SSA has grown and is currently about 41% with many people accessing the internet through their mobile devices²⁸. The rapid proliferation of smart phones remains a major opportunity for providing telemedicine services in this region. Simple mobile applications such as WhatsApp have been deployed in providing telemedicine services in different parts of SSA and can be leveraged for SRH as COVID-19 pandemic restricts physical access to health facilities^{29,30}.

The cost of the healthcare services to be rendered by the health workers through telemedicine will still need to be paid for, especially as African healthcare markets are heavily dependent on fee-for-service payments. Healthcare providers wishing to offer such services may have to develop standard payment rates which can be made available on their websites. Also, local health insurance companies, like their counterparts in developed countries, need to urgently make provision for health insurance plans that will enable remote access to services for their enrollees in acute need during the pandemic. Traditional plans require the patient presenting physically for care in a health facility and this often necessitates completion of paper forms before the healthcare provider can receive their claims. Whilst still evolving, health insurance remains an available option that is used to pay for healthcare services in countries across the region and needs to advance with new developments in the COVID-19 pandemic.

Conclusion

Telemedicine has the potential to complement existing healthcare and service delivery channels for SRH as the COVID-19 outbreak rages and even beyond, addressing important service delivery shortfall that may arise from protective restriction of health facilities and unavailability of human resources. Healthcare managers and policymakers need to quickly act to put in place appropriate quality assurance processes before the eventual shift of the epicentre to Africa. The

quality assurance processes can include certification of healthcare providers with a publication of a list of such providers on a government or regulator's website in order to prevent quacks from taking advantage of this new channel of service delivery. Furthermore, guidelines may also specify the kinds of conditions that can be addressed remotely and those that still require some level of in-patient assessment and care. The devolution of service delivery will help reduce the indirect impact that COVID-19 has on SRH care and the associated morbidity and mortality that may arise from disruption of SRH services in SSA. Ultimately, it is expected that bringing this life-saving SRH service to those who need care in spite of the pandemic, will help avert the estimated 15 million unintended pregnancies among women and girls and other healthcare challenges during service disruptions occasioned by the COVID-19 pandemic, over a 12-month period¹². Besides the quality of healthcare, since healthcare information will be transmitted through these channels, it is necessary to agree on basic data protection principles that will ensure the privacy of the patient will be protected.

It is not the intention of the authors to claim that telemedicine would solve all the challenges currently affecting access to health care, especially SRH services in SSA, but it is believed that its adoption would mitigate the impact of COVID-19 disruptions by making these services available to the most vulnerable in some of the hardest-to-reach communities on the continent. To make this a sustainable endeavour even beyond the COVID-19 outbreak, there would be need for more active collaboration between healthcare providers in Africa and other parts of the world where the use of telemedicine is very well established²¹. Collaborations can include physicians in countries with high physician to population ratio or those from countries that have beaten the wave of the pandemic providing consultation services to those in need in SSA at this time. It may also involve knowledge transfer on contents of protocols and guidelines that can be deployed rapidly in such emergency situations for remote care. However, such collaborations created in this pandemic can serve as a means of on-going partnerships beyond the pandemic for

strengthening and fostering telemedicine services in areas where human resource skills are scarce.

Also, researchers in Africa would need to scale-up research works in telemedicine and continue to innovate towards options that would reduce the associated costs and infrastructural outlay required for optimal functioning of this service³¹. However, this will be a mid to longer term goal. In addition, research should be embedded in the deployment of telemedicine for this pandemic that can document patients' satisfaction and perceived quality of care as a means of evaluation of telemedicine in the pandemic but most importantly, to prepare telemedicine services as a strategy for addressing SRH service delivery shortfall in the future. Finally, international organizations, bilateral and multilateral organizations supporting the efforts of Governments in Africa on the provision of health services can facilitate the practice of telemedicine by including support for this approach as a key strategy in the delivery of development-oriented health interventions in the region.

Contribution of Authors

KAO, OAM and OA jointly conceived and developed the manuscript. All authors contributed significantly to all sections of the manuscript and approved the final version of the manuscript.

Declaration

The views and opinions expressed in this paper are the authors' alone and do not necessarily reflect those of the UNFPA, John Snow Inc or Viable Knowledge Masters.

References

- World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020. Geneva Switz. 2020.
- Gilbert M, Pullano G, Pinotti F, Valdano E, Poletto C, Boëlle P-Y, D'Ortenzio E, Yazdanpanah Y, Eholie SP, Altmann M, Gutierrez B, Kraemer MUG and Colizza V. Preparedness and vulnerability of African countries against importations of COVID-19: a modelling study. *Lancet Lond Engl* [Internet]. 2020 Feb 20 [cited 2020 May 12]; Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7159277/>
- BBC News. Africa could be next coronavirus epicentre – WHO. BBC News [Internet]. 2020 Apr 17 [cited 2020 May 12]; Available from: <https://www.bbc.com/news/world-africa-52323375>
- World Health Organization Regional Office for Africa. Coronavirus (COVID-19) [Internet]. WHO | Regional Office for Africa. [cited 2020 Jun 1]. Available from: <https://www.afro.who.int/health-topics/coronavirus-covid-19>
- Vanguard News. Kano mysterious deaths: Ekhomu rejects Presidential Task Force verdict [Internet]. Vanguard News. 2020 [cited 2020 May 12]. Available from: <https://www.vanguardngr.com/2020/05/kano-mysterious-deaths-ekhomu-rejects-presidential-task-force-verdict/>
- Hourelid K, Lewis D, McNeill R and Granados S. Virus exposes gaping holes in Africa's health systems [Internet]. Reuters. [cited 2020 May 12]. Available from: <https://graphics.reuters.com/HEALTH-CORONAVIRUS/AFRICA/yzdpxoqbdvx/>
- Wild S. African countries are struggling to access Covid-19 test reagents on the open market [Internet]. Quartz Africa. [cited 2020 May 12]. Available from: <https://qz.com/africa/1854277/african-countries-struggle-to-get-covid-19-test-reagents/>
- Musinguzi G and Asamoah BO. The Science of Social Distancing and Total Lock Down: Does it Work? Whom does it Benefit? *Electron J Gen Med*. 2020;17(6).
- Ma Q-X, Shan H, Zhang H-L, Li G-M, Yang R-M and Chen J-M. Potential utilities of mask-wearing and instant hand hygiene for fighting SARS-CoV-2. *J Med Virol*. 2020.
- Nkengasong JN and Mankoula W. Looming threat of COVID-19 infection in Africa: act collectively, and fast. *Lancet Lond Engl* [Internet]. 2020 Feb 27 [cited 2020 May 12]; Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7124371/>
- Makinde OA and Odimegwu CO. Compliance with disease surveillance and notification by private health providers in South-West Nigeria. *Pan Afr Med J* [Internet]. 2020 Apr 13 [cited 2020 Apr 13];35(114). Available from: <http://www.panafrican-med-journal.com/content/article/35/114/full/>
- UNFPA, Avenir Health, Johns Hopkins University (USA) and Victoria University (Australia). Impact of the COVID-19 Pandemic on Family Planning and Ending Gender-based Violence, Female Genital Mutilation and Child Marriage [Internet]. UNFPA; 2020 [cited 2020 May 7]. Available from: <https://www.unfpa.org/resources/impact-covid-19-pandemic-family-planning-and-ending-gender-based-violence-female-genital>
- UNFPA. COVID-19 Technical Brief for Maternity Services [Internet]. 2020 [cited 2020 May 7]. Available from:

- <https://www.unfpa.org/resources/covid-19-technical-brief-maternity-services>
14. Riley T, Sully E, Ahmed Z and Biddlecom A. Estimates of the Potential Impact of the COVID-19 Pandemic on Sexual and Reproductive Health in Low-and Middle-Income Countries. *Int Perspect Sex Reprod Health*. 2020; 46:73–76.
 15. World Health Organization. Telemedicine: opportunities and developments in member states. Report on the second global survey on eHealth. World Health Organization; 2010.
 16. Yao J, Murray AT and Agadjanian V. A geographical perspective on access to sexual and reproductive health care for women in rural Africa. *Soc Sci Med* 1982. 2013 Nov; 96:60–8.
 17. Okonofua F. Confronting the challenge of reproductive health in Africa: a textbook for students and development practitioners. Universal-Publishers; 2014.
 18. Gomperts RJ, Jelinska K, Davies S, Gemzell-Danielsson K and Kleiverda G. Using telemedicine for termination of pregnancy with mifepristone and misoprostol in settings where there is no access to safe services. *BJOG Int J Obstet Gynaecol*. 2008;115(9):1171–8.
 19. Parajuli R and Doneys P. Exploring the role of telemedicine in improving access to healthcare services by women and girls in rural Nepal. *Telemat Inform*. 2017 Nov 1;34(7):1166–76.
 20. Wamala DS and Augustine K. A meta-analysis of telemedicine success in Africa. *J Pathol Inform [Internet]*. 2013 May 30 [cited 2020 May 2];4. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3709418/>
 21. Mbarika VW. Is telemedicine the panacea for sub-Saharan Africa's medical nightmare? *Commun ACM*. 2004;47(7):21–24.
 22. Makinde OA, Sule A, Ayankogbe O and Boone D. Distribution of health facilities in Nigeria: Implications and options for Universal Health Coverage. *Int J Health Plann Manage*. 2018 Oct 1;33(4): e1179–92.
 23. Combi C, Pozzani G and Pozzi G. Telemedicine for Developing Countries. *Appl Clin Inform*. 2016 Nov 2;7(4):1025–50.
 24. Mars M and Erasmus L. Telemedicine can lower health care costs in Africa. *Innovate*. 2012; 7:32–33.
 25. Okoroafor IJ, Chukwunke FN, Ifebunandu N, Onyeka TC, Ekwueme CO and Agwuna KK. Telemedicine and biomedical care in Africa: Prospects and challenges. *Niger J Clin Pract*. 2017;20(1):1–5.
 26. Sekandi JN, Buregyeya E, Zalwango S, Dobbins KK, Atuyambe L, Nakkonde D, Turinawe J, Tucker EG, Olowookere S, Turyahabwe S and Garfein RS. Video directly observed therapy for supporting and monitoring adherence to tuberculosis treatment in Uganda: a pilot cohort study. *ERJ Open Res [Internet]*. 2020 Jan 1 [cited 2020 May 13];6(1). Available from: <https://openres.ersjournals.com/content/6/1/00175-2019>
 27. Hollander JE and Carr BG. Virtually Perfect? Telemedicine for Covid-19. *N Engl J Med*. 2020 Apr 30;382(18):1679–81.
 28. Silver L and Johnson C. Internet use growing across sub-Saharan Africa, but most are still offline [Internet]. Pew Research Center's Global Attitudes Project. 2018 [cited 2020 Feb 9]. Available from: <https://www.pewresearch.org/global/2018/10/09/internet-use-is-growing-across-much-of-sub-saharan-africa-but-most-are-still-offline/>
 29. Martinez R, Rogers AD, Numanoglu A and Rode H. The value of WhatsApp communication in paediatric burn care. *Burns*. 2018 Jun 1;44(4):947–55.
 30. Abusin S. Using WhatsApp Smartphone Application to Monitor INR in Patients on Warfarin: First Experience with 21 patients. 2019.
 31. Mbarika VW, Byrd TA and Raymond J. Growth of teledensity in least developed countries: Need for a mitigated euphoria. *J Glob Inf Manag JGIM*. 2002;10(2):14–27.