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Musculoskeletal (MSK) conditions are the highest contributors to disability worldwide<sup>1</sup>, with a third of the global population having to live with MSK pain. This leads in turn to mental ill health, loss of work and reduced ability to engage in social roles<sup>1</sup>. There has been a historic underestimation of the prevalence of MSK disorders in sub-Saharan Africa, but in fact the burden of this conditions is up to 2.5 times of that found in developed countries<sup>2,3</sup>. Whilst degenerative diseases are frequently seen<sup>4</sup>, a significant proportion of MSK disease is inflammatory, such as Rheumatoid Arthritis (RA), where prompt and appropriate treatment can prevent disability.

The prevalence of RA in Africa was recently estimated to be 0.42%, affecting 4.3 million people<sup>5</sup>. However, because of wide-spread under diagnosis, the true figure is likely to be considerably higher<sup>5</sup> and those patients who are diagnosed, are often treated sub-optimally with long and high doses of steroids, inadequate doses of disease modifying therapy and no access to biologic therapy<sup>6</sup>. Consequently, many live with high levels of disability and subsequent comorbidities that are potentially preventable<sup>7</sup>.

There are significant challenges to the provision of rheumatology healthcare in Africa. Accessing even basic healthcare is difficult in some parts of Africa, especially in rural communities and the lack of accurate data on disease prevalence makes governmental resource planning near impossible. Patients often travel long distances on poor transport infrastructure to consult with a general physician - let alone a specialist - and access investigations and medications. Such journeys are frequently impossible, as many patients are unable to leave their livelihoods for even short periods or afford the travel<sup>8</sup>. Limited rheumatology training means there are few, if any, rheumatologists in most sub-Saharan African countries. Indeed, less than 150 rheumatologists currently serve 1 billion people in sub-Saharan Africa, considerably less than the WHO recommended ratio of one per 100,000 population<sup>9</sup>. Consequently,

most patients are looked after by general physicians or even orthopaedic surgeons who are not equipped to prevent joint failure. A widespread lack of awareness of rheumatological conditions within the public and general physicians adds to these problems, with patients typically visiting local healers first and presenting to physicians late or not at all<sup>8</sup>. The average time to RA diagnosis in a private clinic in Lagos, Nigeria was reported as 63 months<sup>10</sup>. For those patients who do receive specialist care, there remains difficulties with patient education due to literacy rates, regional languages, the use of traditional medicines and cultural beliefs<sup>8</sup>. In addition, disease modifying therapies require regular blood monitoring which is not always practical in a low resource setting and biologic drugs come at a high cost, with significant risks of infection.

We believe digital technology could provide a critical tool to overcome the challenges faced in delivering rheumatology healthcare in Africa. The face of international research and training has already changed with advances in technology such as global web-based data sets and the development of effective e-Learning. Now, with the emergence of COVID-19 and the need to reduce face to face patient interaction, virtual patient care is set to become the new "norm".

The WHO has identified digital technologies as a vital resource to improve access to healthcare in Africa<sup>11</sup> and has developed an e-Health toolkit that sets out strategies for governments to implement e-Health<sup>12</sup>. There are already good examples of e-Health projects aimed at a wide range of specialists, community doctors and allied health professionals, which could easily be transferable to rheumatology. The digital infrastructure is increasingly available to support this strategy. Whilst currently only 57% of the population is over 14 years old<sup>13</sup>, as the fastest growing region, it is estimated that half of the population in sub-Saharan Africa will subscribe to mobile services by 2025 and 40% will have access to the internet<sup>14</sup>. Of those, the percentage who use smartphones and therefore can use "apps"

will grow from 39% in 2018 to 66% in 2025<sup>14</sup>. The benefit of mobile technologies lies in access. Barriers such as large geographical distance, high cost, ability to disseminate information and difficulties in adapting to local contexts can easily be overcome by virtual patient care<sup>15</sup>.

There is also a need for enhanced rheumatology specialist training in Africa. eLearning courses such as the EULAR online course have been successfully used to help train rheumatologists in Kenya, but the development of more Africa-specific and clinically relevant e-Learning would increase accessibility for trainees across the region. This year, in light of COVID-19, the annual EULAR congress is being delivered online. Although it remains to be seen how successful this will be, it represents an exciting opportunity for clinicians in Africa to attend international conferences and engage with the wider scientific community without the huge cost burden.

Telemedicine overcomes the geographical divide between patients and clinicians. Babyl, affiliated with Babylon health, provides video consultations to patients in Rwanda<sup>16</sup>. It has grown exponentially and in 2018 the Government of Rwanda, in partnership with the Bill and Melinda Gates Foundation, announced that they will give access to Babyl to the entire population. Similar applications have the potential to enable patients in rural areas to speak to specialist rheumatologists. Technology can also help provide specialist support to local general clinicians or allied health professionals. In Ghana, the Novartis Foundation and its partners have developed a system which connects frontline health workers to consultation centers in referral hospitals several hours away<sup>17</sup>. This has been so successful that it is being scaled up nationally. Virtual doctors, a UK based charity, links clinical officers in rural Zambia and Malawi with doctors in the UK who provide advice and education on individual cases<sup>18</sup>. Although not developed in the rheumatology community yet, there may be scope for international online multi-disciplinary meetings to discuss complex cases using video platforms. All these technologies mean that, even with low numbers of rheumatology specialists, their expertise can reach more patients.

Accessing and monitoring disease modifying therapy and biologics also presents a huge challenge. These specialist medications are often not included on the “national formulary” and are expensive to source from abroad<sup>19</sup>. Patients can travel long distances, only to find that the medicines they need are not in stock. In Uganda this has been overcome by the use of a system into which 27,000 government health workers report on medicine stock around the country<sup>20</sup>. In Ghana and Rwanda, “Zipline” uses drones to deliver blood and medications to remote clinics, ordered by an SMS or WhatsApp message<sup>21</sup>. Although still in their infancy, these initiatives are particularly promising for use in rheumatology as they allow individualised medication requests. Management of chronic conditions such as RA require patient engagement, long term follow up and

regular blood monitoring. WhatsApp, the most popular social app in Africa is widely available and a useful tool to share information, even with people who are illiterate by the use of audio notes. Rheumatologists in Senegal already use WhatsApp to communicate blood test results with their patients and the application was used by the British Broadcasting Corporation (BBC) in the Ebola crisis to share information with people in rural and quarantined areas<sup>22</sup>. Patient initiated follow up and symptom tracker applications have already been developed, allowing patients and clinicians to monitor and identify disease flares in a timely way and prevent the need for unnecessary consultations.

The true success of digital technology in supporting rheumatology care will depend on all elements of e-Health working together. There are potential problems of unclear healthcare system responsibilities, unreliable infrastructure and most of all in-ability to scale up these initiatives to create long-term sustainability. Well trained doctors and allied health professionals are vital to help deliver e-Health projects and, given the huge shortfall of rheumatologists currently, there is a long way to go before adequate manpower is on the ground.

In rheumatology we refer to the advent of biologics as a paradigm shift in the treatment of patients with RA. If implemented correctly, digital technology has the potential to deliver a similar paradigm shift in the provision of rheumatology to Africa and to transform and widen access to rheumatology specialist services.

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