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## Broken machines or broken systems –The ugandan experience, on accessing/maintaining radiotherapy services, in low and middle-income countries

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**Introduction:** By 2020, about 70% of new cancer cases will occur in LMICs. According to DIRAC, 27 African countries have no radiotherapy and only 26 countries have. The expected number of new cancer cases in Africa in 2015 was 700,000. Over 50% of cancer patient's benefit from radiotherapy alone or in combination with surgery or chemotherapy, implying that over 350,000 would require radiotherapy. Common malignancies including cervical, head&neck, etc mainly presenting in advanced stages –are incurable without radiotherapy, especially in the absence of highly-specialized surgery and chemotherapy. Despite this enormous need, access to radiotherapy is inadequate for most cancer patients and machine down-time remains high. The Machines per Million Population (MMP), in LMICs range from 0.1-0.3, which is very low compared to developed countries (4.0–6.0).

### Case in point

Currently, Uganda has no functional external beam radiotherapy services. The single Cobalt-60 machine, installed at Mulago in 1995 stopped functioning beyond repair in March 2016, a feature that attracted international attention. The number of new cancer patients worked on this machine gradually increased from 292 in 1995 to 1920 in 2015; treating a total of 25,465 patients ( $\approx$  600,000 sessions) over the 21 year period. In comparison to a Linac, that can treat 312500 - 375000 sessions.

Efforts for the expansion of radiotherapy services in Uganda started as early as 2000. It was planned to have 2 more EBRT units at Mulago and 3 centres in regional hospitals. However, due to budgetary constraints, this expansion program was postponed every year until it was dropped. Plans for the replacement of the broken Cobalt unit started in 2005, three years after a major overhaul that included source exchange. The department made several consultations and expert missions were sought from IAEA:

(1) Assessment of Cobalt-60 machine and current capabilities in the Department by Jan Karl Hough December 2008

(2) Design and construction of a bunker for expansion of radiotherapy services by Frederic Johannes Lange, December, 2011

Despite all these recommendations, there were no tangible outcomes as far as expansion of radiotherapy services in the country. There were numerous administrative/managerial factors that hindered progress in radiotherapy, e.g.

(1) Between 2010 and 2011, the Mulago hospital administration identified a contractor to construct a new bunker, procure and install a new Cobalt-60 machine. However, before this process was completed, there was a change in administration in April 2011 that resulted in halting the process.

(2) Between 2011 and 2013 the new administration came up with a relocation plan of the department, worked on designs for the radiotherapy bunkers (2 EBRT/1 HDR and other auxiliary facilities). However, before the process was concluded, the department was transferred administratively to be under the Uganda Cancer Institute (UCI), in June 2013. This was in fulfilment of PACT recommendation, with the aim of creating an integrated cancer treatment centre. The UCI administration noted inaccuracies with the designs and the process was halted, however construction started in June 2016.

The above scenarios are characteristics of system breakdown, which in this context is a collapse of responsible authorities to perform, organise, maintain and support services following a fixed plan or set of rules. Government owned facilities are more affected than those that are privately owned. Irabor et al (2016) reported the stagnation of radiation oncology resources in Nigeria. It was reported that as of Jan 2016: only 2 of the 9 commissioned radiotherapy centres were functional, that 2 of the 5 linear accelerators installed in 2010 were

not functional and that there were fewer brachytherapy (HDR +LDR) units than in 2001. The blame was put on the Nigeria economic and political climate, lack of trained servicing engineers, procurement of equipment with minimal input from end users and no servicing contracts.

Johanna et al (2016) also reported on how the challenges of resourcefulness were affecting radiotherapy in the Philippines. The Kenya's main hospital has a functional Cobalt-60 unit where the source has not been replaced since its installation, over 17 years ago. The Zambia's only radiotherapy centre installed a Cobalt-60 unit in 2013 that is not yet utilised due to procurement mishaps –unfortunately the source is decaying.

Conclusions: Machine breakdown, downtime and decommissioning are some of the many events in a radiotherapy department. There is need for support for partnership and systems of care, more vigorous mechanisms to ensure that radiotherapy is part of planning for cancer care and control in LMICs. There are essential requirements that need much bigger budget, staff and mandate to ameliorate the numerous logistical complexities of acquiring and maintaining radiotherapy services. The lessons from Uganda and other LMICs emphasize the fact that it's not that machines break, but systems do.

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