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Radiotherapy LINAC Breakdowns in Low- and Middle-Income Countries

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Access to Radiotherapy Linear Accelerators (LINACs) remains a significant challenge in Low and Middle-Income Countries (LMICs) for effective cancer treatment. The complexity of LINACs is further compounded in LMICs by environmental, socio-economic, and geographical factors, resulting in frequent breakdowns, with downtimes lasting from days to months. Recent studies have identified the Multi-Leaf Collimator (MLC) sub-system as having a disproportionate failure rate, especially in LMICs, which calls for re-evaluation. Through an analysis of Indonesian facilities, we provide insight into the causes of downtime and failure pathways for RT LINACs in LMICs. We also show that MLC accounts for 59% of all mechanical faults in LINACs, with downtime being 7 times longer in LMICs than in High-Income Countries (HICs). Further analysis of MLC leaf width demonstrates that narrow 5mm leaves contribute to $18.27 \pm 6.5\%$ of all breakdowns, while wider 10mm leaves make up $15.87 \pm 4.3\%$. These findings highlight the need to review the current generation of Radiotherapy LINACs and design future models that are more robust and suitable for all environments.

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