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Title

Developing a readiness self-assessment tool for low- and middle-income countries establishing new radiotherapy services: a participant validation study

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Abstract

Purpose: Assessing low-and middle-income countries' (LMICs') readiness to establish a radiotherapy service is an important but empirically understudied concept. The purpose of this study is to develop and confirm a core set of readiness requirements and criteria that can be used to gauge LMICs preparedness to establish radiotherapy services.

Methods: Based on a systematic review and semi-structured expert interviews, a pool of requirements and criteria were generated. To confirm or disconfirm these items, we adopted a synthesised member checking process, also known as participant validation. A purposive sampling strategy was used to recruit radiotherapy experts. Items were sent via email. Each item was reviewed by participants. Qualitative comments were analysed thematically.

Findings: Seven of the 17 experts who participated in an earlier semi-structured interview contributed to this participant validation study. The final version of the readiness self-assessment tool for LMICs establishing new radiotherapy services contains 37 requirements mapped into four readiness domains, grouped under the following categories: commitment; cooperation; capacity; and catalyst. Among 23 criteria for commitment domain, participants reviewed 22 as relevant for inclusion. The cooperation requirements considered important, included: "strategic planning team", "stakeholder involvement" and a "technical assistance plan". Capacity requirements, which were endorsed included: "responsible project manager"; "availability of radiotherapy expertise"; and "training for initial core staff". Participants' feedbacks supported the inclusion of all the requirements and criteria related to catalyst.

Conclusion: The readiness self-assessment tool is a promising planning and evaluation tool for use by stakeholders interested in expanding access to radiotherapy services in LMICs.

Keywords: Radiotherapy, Readiness, Implementation, Low- and middle-income countries

Introduction

Achieving universal radiotherapy access is a global health concern. Health and cancer organisations and agencies such as International Atomic Energy Agency (IAEA), World Health Organisation (WHO) and Union for International Cancer Control (UICC) are working to ensure that radiotherapy services are more accessible and available to everyone who needs them (1-3). Improving access to radiotherapy services has largely developed in response to the increasing cancer burden in low- and middle-income countries (LMICs), accompanied by awareness and advocacy strategies. Globally, governments are being encouraged to commit resources to establish high-quality sustainable radiotherapy services to address the evolving cancer treatment and palliative care needs of their populations (4).

Radiotherapy is clinically indicated for more than half of all cancer cases, as either a treatment to cure, palliate and/or improve patients' quality of life. Improving cancer outcomes of working age people increases labour force participation (5). This indicates that, when successfully established, a radiotherapy service provides both health and economic benefits (5, 6). Similar to other health projects, when poorly implemented, the establishment of sub-optimal radiotherapy services can have negative impacts on cancer patients' outcomes, wastes scarce financial resources, damages industry integrity, and contributes to a population's mistrust (7, 8). Success of a new radiotherapy service is dependent upon being established on time, within budget and meeting all the various quality and safety requirements. Many new radiotherapy services fail because of poor stakeholder engagement, fatal construction flaw(s), procuring unsuitable equipment and not integrating maintenance into the project plan (9). In addition to these barriers, establishing new radiotherapy services in LMICs have been hindered by challenges such as the lack of political support, absence of radiotherapy expertise, ineffective project management, lack of radiation safety infrastructure and weak contract management (10, 11).

Assessing LMICs' readiness to establish radiotherapy services has become increasingly essential to governments, planners, coordinators and regulators so that they can better support investment decisions and planning priorities. Readiness refers to the state of being prepared to undertake the implementation of any development project (12). A readiness assessment can be conducted systematically using qualitative or quantitative indicators, or both (13). While quantitative readiness indicators can provide numerical snapshots of the preparedness, qualitative readiness indicators offer

insightful information necessary for understanding and defining the requirements for evidence-based monitoring and evaluation (13, 14). Both qualitative and quantitative readiness indicators are widely used as planning, self-assessment or managerial tools to identify progress, opportunities and barriers aimed at informed decision-making, accountability, learning, designing and selecting appropriate strategies to maximise achievement of results (15, 16).

Establishing a new radiotherapy service is a complex multiple stage process (4). However, the literature has not yet provided a validated readiness assessment tool that objectively assess an LMIC's preparedness to establish a radiotherapy service. The aim of this study is to develop and confirm a core set of readiness requirements and criteria that can be used to gauge LMICs preparedness to establish radiotherapy services.

Methods and analysis

Study design

A participant validation study was undertaken using a synthesised member checking qualitative technique (17). A participant validation was used to improve the trustworthiness of the content of the readiness self-assessment tool for LMICs establishing new radiotherapy services. The study design, data collection, analysis and reporting were conducted in accordance with well-recognised approaches for developing and validating tools (17-19). This study is part of a larger project approved by the Human Research Ethics Committee, University of Technology Sydney, and all participants had previously given a verbal informed consent to participate. Data collection for this phase of the project took place between July 2019 and October 2019.

Participants and setting

Expertise in radiotherapy establishment and sustainability is dependent on training, practical service delivery and/or experience with initiatives to improve access to radiotherapy at global, regional and/or national levels with organisations such as Union for International Cancer Control, International Atomic Energy Agency, Radiating Hope and International Cancer Expert Corps.

Radiotherapy experts including 11 radiation oncologists, three medical physicists, two radiation therapists and an administrator were eligible to participate in this study. These radiotherapy experts had elaborated the successful establishment of high-quality sustainable radiotherapy services in LMICs through a series of semi-structured interviews (20). Ten of the radiotherapy experts were working

permanently in LMICs, including Kenya, Ethiopia, Egypt, Brazil, Jordan, India, Nepal, Peru and Zambia. The remaining experts were permanently employed in four high-income countries, including Australia, Canada, USA and Qatar, but had been actively involved in establishing and/or improving radiotherapy services in LMICs.

Recruitment of participants

A purposive domain-based sampling strategy was adopted to recruit participants with a wide range of experience who could give insights that, collectively, would reduce the risk of construct underrepresentation within the readiness self-assessment tool for LMICs establishing new radiotherapy services. Recruitment was via direct email contact from one of the researchers (AD).

Data collection and procedure

The participant validation process is recognised as an essential technique for enabling researchers to refine their data interpretations and enhance credibility (17). The sections below detail the processes undertaken in completing the participant validation process and included: generating an initial list of item requirements; confirming item requirements; and refining item requirements.

Step one: Initial generation of the readiness item requirements

The first step of the participant validation process was to identify critical domains that can be used to describe readiness to establish new radiotherapy services in LMICs. Our starting point was establishing high-quality sustainable radiotherapy services is a complex process, which requires interconnected activities. To corroborate this view, we conducted a systematic review and a series of semi-structured interviews, identifying the facilitators and barriers to establishing high-quality sustainable radiotherapy services in LMICs (9, 20). The findings revealed that radiotherapy establishment readiness domains, can be grouped under the following four categories: commitment; cooperation; capacity; and catalyst. We defined each readiness domain for establishing high-quality sustainable radiotherapy services as follows:

1. Domain 1: 'Commitment', defined as an LMIC's willingness to put in place the necessary political, policy, funding and regulatory requirements to enable a new radiotherapy service to be established;
2. Domain 2: 'Cooperation', defined as the effective involvement of relevant international, national and local stakeholders in the planning, commissioning and operationalisation of a new radiotherapy service;

3. Domain 3: 'Capacity', defined as an LMIC's ability to translate commitment and cooperation to achieve sustainable results through effective and efficient management of the implementation process, a prepared workforce, maintenance, governance and information technology; and
4. Domain 4: 'Catalyst', defined as the potential for an LMIC to leverage off a new radiotherapy service to develop an integrated cancer care service.

Item requirements and associated criteria are used to assess a defined readiness domain (21). Based on the conceptual definition of each readiness domain, we generated a preliminary list of suitable item requirements and criteria of readiness based on our systematic review and the semi-structured interviews (9, 20). We generated 42 item requirements and 71 criteria that addressed the four readiness domains. The item requirements underwent iterative editing and consensus, review and proofreading processes by the research team (AD, TL, SA and JP) to clarify, and proof requirements for coverage and overlap prior to being sent to the radiotherapy experts for confirmation.

Step two: Experts' confirmation of the readiness items

This step aimed to have radiotherapy experts select, cross-check and confirm whether the requirements generated were appropriate and relevant to qualitatively assess readiness to establish a new radiotherapy service. Radiotherapy experts confirming their agreement with the generated requirements helped establish the requirements' relevance and representativeness of the topic being studied (22-24). Consensus was defined as the collective judgement and opinion of radiotherapy experts on the readiness item requirements and their associated criteria. Consensus implied general agreement, though not necessarily unanimity (25). The process of reaching consensus also meant that each radiotherapy expert was given the equal opportunity to correct errors, challenge or confirm accurate interpretations and influence the final decision on readiness item requirements and criteria (26, 27). Therefore, to achieve consensus, item requirements and criteria were framed in practically agreeable terms.

The literature is varied regarding the number of experts required to review and confirm generated items that should form the content of a tool (28). Sample size decisions are mostly based on the length and complexity of the tool (28). Nevertheless, some studies have recommended a range between six to 20 experts to help generate more information about the tool (28, 29). As described under the participant and setting section, 17 eligible radiotherapy experts received the survey document and information

sheet with the conceptual definition of each readiness domain, the associated item requirements and criteria. For the tasks, radiotherapy experts were asked if they agree with the readiness items by addressing the following statements:

1. If you think any of the item requirements already listed under the readiness domains should be removed, please place “R” as “Remove” in the inclusion column;
2. If you think any of the item requirements already listed under the readiness domains should be included but needs to be revised or modified in some way, please “M” as “Modify” in the inclusion column;
3. If you think any of the item requirements already listed under the readiness domains should be included without changes, please place “A” as “Accept” in the inclusion column.

In addition, radiotherapy experts had an option for a ‘no idea’. To evaluate the comprehensiveness of each readiness domain, experts were also asked to recommend other requirements that might have been omitted from the list, items that should be deleted because they are not consistent with the readiness domain and/or items that should be combined. This approach is consistent with the literature on tool development (30, 31).

A flexible response strategy was adopted that offered participants the option to complete the validation process over the telephone or submit the completed document electronically. Each radiotherapy expert was given two weeks to complete the survey. A follow-up email reminder prompting potential participants about the deadline to complete the survey was sent. If there was no response, it was considered a decline to participate. Participants completing and submitting the survey was considered as consent to cover all aspects of participation and use of the collected data.

Data analysis

The data from the participant validation process generated words of text, which were analysed qualitatively; hence, median score and interquartile range were not calculated (17). Qualitative comments from participants were imported into NVivo-12 for management, organisation and coding. Replicable and valid inferences from the texts were made through content analysis. Texts that were of interest to the analysis were systematically distinguished and comments from participants were read and re-read at several levels of word, sentence, paragraphs and whole to gain an understanding of the meaning. The researcher remained open to understanding the new, deleted or combined requirements

recommended by the participants without a pre-specified framework. Coded texts were grouped into categories reflecting readiness requirements. Areas of convergence and discrepancy among participants were identified through constant comparison, a qualitative data-analytic procedure whereby each finding and interpretation is compared with existing findings emerging from the data analysis (32). Regular feedback meetings were held with TL to share comments from participants, discuss and validate the refined requirements and criteria. Feedback is a common iterative consensus approach for supporting validity or trustworthiness by reflecting on the data (33).

Findings

Description of participants

A total of 17 invitations were distributed via email, with seven completions. Ten experts were unable to participate for the following reasons: no response after follow-ups (n=7) or other pressing work priorities (n=3), leaving a response rate of 41.2%. Majority of the participants (n=4) who completed the survey were females. Only one participant completed the survey via a telephone conversation, while the remaining completed and submitted it through email. Three participants were working permanently in Australia. The other participants were working in Jordan (n=1), India (n=1), Ethiopia (n=1) and Zambia (n=1). Five of the participants were radiation/clinical oncologists and two were radiation therapists.

Requirements and criteria identification and confirmation

Participants examined requirements and criteria for each of the four-readiness domains, categorised as: commitment; cooperation; capacity; and catalyst. Table 1 shows the item requirements that were sent to participants and their feedback. Majority of the feedback from participants were consistent, with minimal annotation.

Requirements and criteria for commitment. Among 23 criteria for commitment requirements, participants confirmed 22 as relevant for inclusion. Most participants indicated that two requirements “political window of opportunity” and “radiotherapy lobbying” convey advocacy messages to gain political commitment. Hence, they were merged into a single requirement “opportunities for advocacy”. Even though there was less agreement regarding the relevance of “stable political environment” as a requirement, it was included because a stable political environment was needed to attract long-term investment and gain the necessary technical support from the international community to develop radiotherapy.

Participants' favoured the requirement "access to basic infrastructure", confirming the important role of water, electricity and roads infrastructure for establishing a new radiotherapy service. The first and third criteria for the requirement "access to basic infrastructure" were reworded to include the phrases "has a plan to construct sewerage systems at the radiotherapy facility" and "with adequate onsite or nearby parking for staff, patients and their families, and enable goods to be delivered to the facility" respectively. Criteria for the four requirements "identified require information", "cancer control policy", "policy coherence" and "public statements by political leaders" were confirmed as important for inclusion because they concern avenues to engage policy to improve radiotherapy services. The requirement "identified require information" was reworded as "access to information" for clarity. Participants unanimously confirmed the need to identify an appropriate funding model, with a long-term budgetary commitment to establish and maintain the radiotherapy service. Based on participants comments, the word "maintenance" was introduced into the third criterion for the requirement "suitable funding model", which was changed to read "the LMIC and/or an external agency has identified a secure source(s) of funding for the development and maintenance/operational sustainability of the radiotherapy service". The requirement "commitment to universal health coverage" was considered critical in ensuring that patients and their families are protected from the financial burden associated with accessing a radiotherapy service. Three of the top-endorsed requirements - "membership status with IAEA", "legal and regulatory framework" and "independent LMIC-level regulator" - reflect the value attached to radiation protection and safety. There was general feedback to merge criteria within the radiation safety requirements.

Requirements and criteria for cooperation. Criteria for six of the seven original requirements linked to cooperation were confirmed relevant for inclusion. The requirement "trust relationship" was dropped as it was considered less relevant by most participants. Two requirements "identify and engage relevant stakeholders" and "stakeholder consensus-building" were merged and incorporated into the requirement "stakeholder involvement". Efforts to make information available and keep stakeholders informed about the radiotherapy development activities were critical to ensuring national and international stakeholders participate in the planning process. "Technical assistance plan" as a requirement was considered necessary to achieve coherent collaboration and teamwork. Several participants suggested the combination of two requirements "inclusive planning team" and "technical

working group” into a single requirement “strategic planning team” relating to coordination and overseeing the strategic planning of the new radiotherapy service.

Requirements and criteria for capacity. Participants confirmed criteria for 16 of the 17 original requirements related to capacity as relevant for inclusion. In relation to effective management capabilities to implement a radiotherapy service, participants confirmed the importance of creating a multidisciplinary implementation team, appointing a responsible project manager, securing suitable land and allocating resources for building construction process, equipment purchase, delivery and installation. Four requirements “training for initial core staff”, “training other supporting staff”, “staff succession plan” and “incentive systems” were focused on addressing local radiotherapy workforce development. In spite of the requirement “incentive systems” not reaching sufficient consensus, we included it because poor incentive was considered a major contributing factor to the brain drain in most LMICs. Minor typographical errors were corrected to improve readability. For example, “access to a suitable land” was reworded “access to suitable land”. Participants confirmed criteria for two requirements “governance and management structure” and “treatment guidelines, protocols and standard operating procedures” as critical to ensuring a high-quality of transparency and accountability. The implementation of simple and basic information systems was required to generate, compile, analyse and communicate health data. The second criterion for the requirement “generate, compile, analyse and communicate health data” was reworded to “the LMIC has well-trained information technologists to implement appropriate safeguards to protect patient data confidentiality”. Criteria for two requirements “service contract” and “spare parts” were endorsed, reflecting the importance of regular maintenance and repair.

Requirements and criteria for catalyst. There were relatively high endorsement of all five original requirements and 16 criteria related to catalyst domain. Participants confirmed that radiotherapy services can facilitate the harmonisation and integration of cancer service delivery by addressing three key requirements: “encouraging cancer control reform”; “promoting coordinated care”; and “promoting a multidisciplinary approach to care”. Also, participants confirmed the importance of orienting cancer care around patients and their families to address their broader needs. Most of the participants’ comments and keywords to improve catalyst domain were indicative of the need to clarify, insert missing information and elaborate criteria for the following requirements: “encourage cancer control reform”; “strengthen patient- and family-centred care”; and “encourage better outcomes through research”. For

instance, to accommodate the views of participants, we inserted the missing information “the need to implement cancer registry through partnerships” into the first criterion for the requirement “encourage better outcomes through research”. Similarly, the second criterion for the requirement “promote a multidisciplinary approach to care” was slightly reworded to clarify that establishing a radiotherapy service can be used “as a window of opportunity” for the development and implementation of oncology clinical practice guidelines.

Evaluating the comprehensiveness of requirements and criteria

Comprehensiveness was assessed based on the need for additional requirements and/or criteria required to make each readiness domains complete. None of the participants suggested an additional requirement. However, new criteria were developed by applying sentences that participants used in describing requirements. Table 2 presents the refined items and the nine additional criteria that emerged from participants’ comments, which included: five for commitment; two for cooperation; and two for capacity. For example, a new criterion “the LMIC acknowledges that unrestrictive customs and border laws are required for timely importation of spare parts” was created under the requirement “spare parts”.

Discussion

This study proposes a set of 37 requirements and 74 criteria that ought to be considered for inclusion in a readiness self-assessment tool for LMICs establishing new radiotherapy services. While there is no definite formula to promote the establishment of a successful radiotherapy service, the proposed readiness self-assessment tool is expected to generate processes that ought to be considered when LMICs are planning to establish new radiotherapy services. The readiness self-assessment tool for LMICs establishing new radiotherapy services focuses on providing practical guidance through four key readiness domains, grouped under the following categories: *‘commitment, cooperation, capacity and catalyst’*. Each readiness domain has a broad range of qualitative theme-based requirements that were confirmed by expert participants.

Commitment is a fundamental requisite for success in establishing a new radiotherapy service. Advocating for increased political commitment to improve access to quality and equitable radiotherapy services can be complex. Advocacy can bring about positive results when constructively applied in these circumstances. Exploiting windows of opportunity is vital to building and/or maintaining political

support for funding, policy and institutional commitments to establish a radiotherapy service. Funding a radiotherapy project in any LMIC can be challenging, so often, the suggestion is to secure a long-term budgetary commitment from diverse sources. It is critical to take into consideration public, private and/or philanthropic financial commitments in support of the radiotherapy project (9). An LMIC demonstrating institutional commitment, such as availability of legal and regulatory frameworks and an independent regulator to ensure radiation safety, protection, security and quality through collaboration with IAEA is a critical factor for establishing a radiotherapy service.

In establishing a new radiotherapy service, it is essential to consider stakeholder cooperation leading to a collective action. There are three cooperation requirements of importance for LMICs to consider: strategic planning team; stakeholder involvement; and technical assistance plan. A strategic planning team that recognises and appreciates the advantage of understanding the LMIC's current capacity helps align activities and available resources. It is imperative to place greater emphasis on identifying and involving relevant stakeholders to enrich the radiotherapy service development planning effort.

A successful radiotherapy service development involves careful consideration of the LMIC's capacity, as constraints on capacity exert a negative impact on radiotherapy services in LMICs (11). The confirmed capacity requirements to ensure successful radiotherapy development address implementation resources and activities, workforce development, regular maintenance, leadership, other essential and complementary services and information systems. The implementation plan should articulate equipment and personnel requirements, taking into consideration the cancer incidence and mortality profile. LMICs preparing to establish radiotherapy services should consider incentive systems and policies to reduce brain drain and develop local expertise.

LMICs must take advantage of radiotherapy services to improve access to integrated service and optimise all aspects of cancer control, including palliative care. Therefore, requirements of catalyst help to address the need for harmonisation of cancer care, the orientation of care around patients and their families and building research capacity. This study is part of a larger learning process, which has successfully highlighted relevant requirements and criteria. However, there are still gaps that require further field research to refine the understanding of the requirements and criteria and the conditions under which they are predictive and informative. The findings of this study could be used as a guide to help LMICs obtain objective information to address challenges related to establishing a new radiotherapy service by making well-informed decisions and aligning budgets. The findings are not

meant to be used as a checklist or substitute in-LMIC expert advice. Rather, we intend the tool be used to engage effectively in a range of collaborative discussions with diverse stakeholders to ensure a sustainable and cost-effective project.

Strengths and limitations

The strengths of this study include allowing a broader end-user engagement and participation (experience of both international and local experts) in generating and confirming requirements. This ensures that the assessment tool meets usability and practical needs of LMICs. The inclusive validation process allowed for the generation of new ideas and alternative explanations for a more comprehensive set of requirements and criteria. However, these items should be field-tested in a larger representative sample. The sample size was limited by the arduousness of participation given the large number of requirements and complexity of tasks.

Conclusion

Establishing a new radiotherapy service is a complex task and unplanned efforts can be expensive and futile. A readiness assessment is a step often omitted when establishing radiotherapy services in most LMICs. Investing a day or two stakeholders consultative workshop guided by the readiness self-assessment tool may guide decisions on resource allocations to achieve radiotherapy service implementation and sustainability goals.

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Availability of data and materials

Anonymised datasets analysed in the current study are available from the corresponding author on reasonable request.

Authors contributions

All authors contributed to manuscript writing, editing and final approval, including table design. AD, TL, SA and JP conceived the study. AD facilitated recruitment and data collection. Data analysis was performed by AD with consensus discussions with all authors. AD, TL, SA and JP performed iterative editing, review and proofreading of the requirements and criteria. VV assisted with interpretation of the findings. All authors reviewed the draft manuscript and provided approval to the final manuscript.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests

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Table 1: Original items, with global radiotherapy experts' feedback

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
Commitment	Stable and safe political environment	The LMIC has no ongoing civil war or political violence.	R	A	M	A	A	A	R	<i>"Delay in our radiotherapy projects are directly or indirectly related to unstable political situation. I would be happy if this is not excluded" – P6</i>
		The LMIC has government structures and processes defined by rules or laws to support policy-making and service planning.	R	A	M	A	A	A	A	
	Quality of basic infrastructure service	The LMIC has consistent supply of water and electricity over long periods.	A	A	M	A	A	A	A	<i>"Include sewerage too. I have been to some radiation therapy centres in LMICs where there are no toilets" – P3</i>
		The LMIC has a plan for backup power to keep the radiotherapy facility functioning.	A	A	A	A	A	A	A	
		The LMIC has good road and transport system to the radiotherapy facility site, with parking on-site.	M	M	M	A	A	A	M	<i>"I feel that roads and transport are important, parking could be nearby and not necessarily onsite" – P2</i>
	Political window of opportunity	An opportunity to advocate for the development of radiotherapy service is presented by a high-profile public figure being diagnosed with cancer who has had to seek therapy outside the LMIC.	A	R	A	A	M	A	A	
	Radiotherapy lobbying	Civil society organisations and influential individuals are building political interest in establishing radiotherapy service by collaboratively campaigning, advocating and/or lobbying.	A	A	A	A	A	A	A	
	Policy coherence	The Ministry responsible for Health has documents/policies that publicly acknowledge	A	A	A	A	A	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
		the need to strengthen cancer care, including radiotherapy services(s).								
	Cancer control policy	The LMIC has a Ministry approved comprehensive cancer control strategy that details the vision, values, directions, budget allocation and timelines to develop or enhance radiotherapy service.	A	A	A	A	A	A	A	
	Public statements by political leaders	Political leaders have made strong public statements supporting and endorsing the need to effectively and efficiently implement the components of the cancer control priorities as outlined in the cancer control plan.	M	M	A	A	A	A	A	<i>"It may not be possible to implement all elements of a national cancer control plan in one go...[but]...radiotherapy is effective if introduced within a comprehensive cancer control plan" – P1</i>
	Identified require information	The LMIC has access to reliable and accurate epidemiological data at the institutional or country level which can be used to determine the country's cancer profile as well as determine optimal equipment and facility siting plans.	A	A	M	A	A	A	M	<i>"Maybe say they must commit to creating a cancer registry" – P3</i>
	Suitable funding model	The LMIC has developed a detailed project plan for the development of the new radiotherapy service that identifies timelines, clear roles and responsibilities for all relevant stakeholders and project milestones.	A	A	A	A	A	A	A	
		The LMIC and/or an external agency has identified a secure source(s) of ongoing funding for the development of radiotherapy service.	A	A	A	A	M	A	A	
		The LMIC with assistance from an external agency has prepared budget document to help make case for long-term public, private,	A	A	A	A	M	A	A	<i>"Ensure that accessory replacement and maintenance cost are included" – P6</i>

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
		philanthropic or partnership financial commitments for the project.								
		The government, private partner and/or philanthropic organisations have obliged to financially support efforts in the LMIC to develop or enhance access to radiotherapy service.	A	A	A	A	M	A	A	
		The LMIC has identified and secured funding support for a scale-up implementation approach and ongoing operational sustainability of the service.	A	A	A	A	M	A	A	
	Committed to Universal Health Coverage	The LMIC has taken steps toward achieving universal health coverage by establishing a national health insurance program.	A	M	A	A	A	A	M	<i>"These two criteria on UHC could be combined" – P2</i>
		The LMIC has taken steps toward achieving universal health coverage by providing government subsidies for selected healthcare services.	A	M	A	A	A	A	M	
	Membership status with the International Atomic Energy Agency (IAEA)	The LMIC signed the 26 th October 1956 Statute within 90 days after it was opened for signature and became a member of IAEA.	A	M	A	A	A	A	A	
		The LMIC has deposited an instrument of acceptance of the Statute to become a member of IAEA.	A	M	A	A	A	A	A	
	Legal and regulatory framework	The LMIC has a legal and regulatory framework to safeguard the use of ionising radiation.	A	A	A	A	A	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
	Independent country-level regulator	The LMIC has created an independent regulator to inspect, authorise actions and enforce the legislation and regulations.	A	M	A	A	A	A	A	
		The LMIC has created an independent regulator to ensure compliance with international standards of radiation safety, security and protection.	A	M	A	A	A	A	A	
Cooperation	Inclusive planning team	The LMIC has formed a planning team with the right mix of skills, knowledge and experience to coordinate with relevant stakeholders and oversee the planning of the new radiotherapy service, such as carrying out the needs assessment and determining the feasibility of the radiotherapy project.	A	A	M	A	M	A	A	<i>"Maybe use the term 'strategic planning' so there is no confusion between it and radiation therapy planning" – P3</i>
	Technical working group	The LMIC has created a functional technical working group to support the planning team as a coordination and information-sharing group responsible for defining technical requirements and recommendations.	A	M	A	A	A	A	A	<i>"m not sure how this is completely separate from the inclusive planning team" – P2</i>
	Identify and engage relevant stakeholders	The LMIC has performed a stakeholder analysis to define, engage and gain better understanding of the range of ministries, institutions, organisations, professional bodies and individuals who have interest in and can influence the radiotherapy project.	A	A	A	A	R	A	A	
	Technical assistance plan	The LMIC has mapped international technical assistance programmes and invited the designated Agency or organisations to aid where further support is needed while avoiding duplications and conflicting advice.	A	A	A	A	A	A	A	
	Stakeholder involvement	The international agency or organisation providing technical assistance has involved	A	A	A	A	A	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
		relevant in-country stakeholders in broader consultations in defining specific needs, strategic plan and directions to ensure early buy-in of the planning process and local ownership of the new radiotherapy service.								
	Stakeholder consensus-building	The Agency working together with the LMIC have achieved consensus on the priority areas, such as equipment by circulating draft plan and providing opportunity for stakeholders to express their views on the radiotherapy plan.	M	M	A	A	A	A	A	
	Trust relationships	The LMIC has a good track record based on the previous history of working collaboratively with international development partners.	R	R	R	A	R	R	R	
Capacity	Multidisciplinary implementation team	The LMIC has formed a multidisciplinary implementation team to manage the building of the new radiotherapy facility once the radiotherapy plan has been approved at the ministerial level.	A	A	M	A	A	A	A	
	Responsible project manager	The LMIC has appointed an experienced project manager with technical and relevant contextual knowledge to help develop timelines and coordinate the implementation activities such as construction, equipment procurement, installation and timely training of staff.	A	A	A	A	A	A	A	
	Availability of radiotherapy expertise	The LMIC has relevant local radiotherapy expertise available or when unavailable locally the LMIC has recruited external experts such as clinicians (radiation oncologist and medical physicist), architects, building contractors and engineers to design, construct and commission the new radiotherapy facility in accordance with all regulatory requirements.	A	A	A	A	A	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
	Access to a suitable land	The LMIC has secured a suitable land, with space for future expansion.	M	M	M	A	A	A	A	
		The LMIC has successfully conducted environmental hazard assessment to address environmental issues such as flood and earthquakes.	A	A	M	A	A	A	A	<i>“Add engineering hazard assessment to mitigate natural disaster and construction engineering risks to the statement” – P3</i>
	Construction of the building	The LMIC has identified and secured the services of experience contractors to complete the building and bunker(s) for housing the radiotherapy equipment in a timely manner.	M	A	A	A	A	A	A	
	Equipment purchase, delivery and set-up	The LMIC has negotiated with a vendor for optimal equipment purchase, timely delivery and installation, with the necessary planning systems, simulation machine and dosimetry devices for monitoring dose equivalent.	A	A	M	A	A	A	A	<i>“Add oncology specific patient information management software and other accessory equipment to the statement” – P3</i>
		The LMIC has made arrangements for commissioning and licensing of the new radiotherapy service prior to the start of patient treatment.	A	A	A	A	A	A	A	
	Training for initial core staff	The LMIC has selected a dedicated team of health professionals and adequate arrangement made to train them to form the core workforce – radiation oncologists, radiation therapists and medical physicists.	A	M	M	A	A	A	A	
		The LMIC has requested for assistance from the IAEA to support placement of the candidates in suitable training sites while noting the importance of training on relevant equipment and relevant disease profiles.	A	M	M	A	A	A	A	
		The LMIC has a plan to ensure the training commenced immediately the radiotherapy	A	R	A	A	A	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
		project is approved to reduce delays or engaging services of expatriates.								
	Other supporting staff	The LMIC has appropriately identified and trained other supporting staff such as cancer care nurses, social workers and case managers or coordinators.	A	M	A	A	M	A	A	<i>“Add dieticians and occupational therapy services to the statement” – P5</i>
	Staff succession plan	The LMIC has a long-term strategic plan for building local training capacity to ensure the continuous development of radiotherapy workforce locally while addressing concerns about expected staff annual leave, retirement, change in jobs and brain drain due to overseas benefits.	A	A	M	A	A	A	A	
		The LMIC has knowledge of staffing needs and plan to participate in regional e-learning programmes to address staff knowledge and skill gaps.	A	A	M	A	A	A	A	
	Incentive systems	The LMIC has made arrangement for suitable financial and non-financial incentive systems, including appropriate salaries to motivate and retain staff.	R	R	M	A	M	A	A	<i>“In my experience lack of incentive is demotivating staff in reality” – P6</i>
	Service contract	The LMIC has a contractual service agreement for the purchased equipment to enable timely engineering support to minimise downtime.	A	A	A	A	A	A	A	<i>“In the longer term it might mean [training] local engineers or if critical mass is an issue, then a sub-regional network, such as West African engineers’ group who service multiple countries” – P1</i>
		The LMIC has arranged to select and train a team of in-house engineers as part of the procurement plan.	A	A	A	A	A	A	A	
	Spare parts	The LMIC has carefully negotiated with the vendor with a strong radiotherapy presence in	A	A	A	A	M	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
		the region to support the improvement of care, including availability of spare parts.								
		The LMIC has made arrangement to generate funds to support radiotherapy facilities in their efforts to maintain operation over the long-term period, including purchasing of spare and repair parts and replacement of obsolete equipment.	A	M	M	A	A	A	A	<i>"This can be built into fee scheduling for patient services in either a public or private setting" – P3</i>
	Governance and management structure	The LMIC has created an inclusive governance and management board plan for the new radiotherapy facility to ensure there is participation in higher level radiotherapy decision-making while properly managing the facility by providing leadership, financial governance, strategic direction, setting priorities for continuous improvement and clinical governance such as being accountable to patients and their families.	A	M	A	A	A	A	A	<i>"I would suggest a point here about radiotherapy articulating with other cancer services, such as surgery, medical oncology, diagnostics and palliative care" – P1</i>
	Treatment guidelines, protocols and standard operating procedures	The LMIC has developed or planning to develop radiotherapy guidelines, protocols and standard operating procedures which are required before the first patient treatment.	A	R	M	A	A	A	A	<i>"These may not be all completed before the 1st treatment but important to develop maybe 1st 12 months. – P2</i>
	Other essential health services	The new radiotherapy facility has other essential health services available, such as radiological, laboratory and nuclear medicine on-site or the LMIC has taken steps towards outsourcing such services from nearby health facilities.	A	A	A	A	A	A	A	
	Social support services	The LMIC and/or civil society organisations have programmes in place to provide social support services for patients, such as transport and accommodation assistance scheme.	A	A	M	A	A	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
	Generate, compile, analyse and communicate health data	The LMIC has appropriate health information system in place to collect clinical and non-clinical information in formats that meet the dissemination and communication needs of care providers, managers, patients and families to aid decision-making.	A	R	M	A	A	A	A	<i>"Ideal to have but perhaps not essential for first starting" – P2</i>
		The LMIC has adequately trained users in all levels to use the information technology.	A	R	A	A	A	A	A	
Catalyst	Encourage cancer control reform	The LMIC has plans to use the new radiotherapy service to persuade relevant stakeholders to think differently about cancer care.	A	R	M	A	A	A	A	<i>"This may be too broad" – P3</i>
		The LMIC has plans to use the new radiotherapy service to promote comprehensive service and optimise cancer prevention, diagnosis, treatment and palliative care outcomes.	A	A	M	A	A	A	A	<i>"As the new service consolidates and scales up the role of screening / early detection services will become more important" – P1</i>
		The LMIC has plans to use the new radiotherapy service to and sensitize policy-makers and health authorities to the growing burden of cancer and the importance of integrated cancer control strategies for managing it.	A	A	A	A	A	A	A	
	Promote coordinated care	The LMIC has plans to use the new radiotherapy service to upgrade information systems to improve coordination of care across providers, facilities and settings.	A	R	A	A	A	A	A	<i>"Ideal but not essential. Hard to cover all these aspects when resources are limited" – P2</i>
		The LMIC has plans to use the new radiotherapy service to develop patient referral pathways and registries to increase transition across specialists.	A	A	A	A	M	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
		The LMIC has plans to use the new radiotherapy service to develop nurse coordinators to support patients as they navigate the cancer care settings.	A	R	A	A	M	A	A	
	Promote a multidisciplinary approach to care	The LMIC has plans to use the new radiotherapy service to advocate for the promotion and implementation of multidisciplinary team management of cancer patients	A	A	A	A	A	A	A	
		The LMIC has plans to use the new radiotherapy service to develop and implement national cancer management guideline in collaboration with other specialities.	A	A	A	A	A	A	A	
	Strengthen patient- and family-centred care	The LMIC has plans to use the new radiotherapy service to provide patients and families access to basic information about cancer management and self-management support outside the healthcare setting through telephone or internet.	A	R	A	A	A	A	A	<i>"This could be managed by the nurse co-ordinators" – P3</i>
		The LMIC has plans to use the new radiotherapy service to develop educational and skill-building programmes for patients and families on the management of cancer.	A	R	A	A	A	A	A	
		The LMIC has plans to use the radiotherapy service to anticipate and better meet the needs of cancer patients (example, transport, accommodation and food is an incentive for low-income patients to adhere to treatment).	A	A	M	A	A	A	A	
		The LMIC has plans to use the new radiotherapy service to develop written materials to support self-management strategies.	A	R	M	A	A	A	A	

Domain	Requirements	Criteria	P1	P2	P3	P4	P5	P6	P7	Comment
		The LMIC has plans to use the new radiotherapy service to build stronger connection with the community to educate the community at large about the prevention of cancer.	A	R	R	A	A	A	A	<i>"I think radiotherapy services should not be used for widespread cancer prevention programmes" – P3</i>
	Encourage better outcomes through research	The LMIC has plans to use the new radiotherapy service to emphasise the importance of evidence-based cancer care.	A	R	M	A	A	A	A	
		The LMIC has plans to use the new radiotherapy service to support the conduct of local research to produce and demonstrate the cost-effectiveness of innovative care and strategies	A	A	A	A	A	A	A	
		The LMIC has plans to use the new radiotherapy service to establish international and regional collaborations where radiotherapy centres can exchange information, share expertise, policies and strategies to improve services.	A	A	A	A	A	A	A	

Legend: P = Participant; R = Remove; M = Modify; A = Accept; LMIC = Low- and middle-income country

Table 2: Final items that ought to be used to assess LMICs readiness to establish high-quality sustainable radiotherapy services

Domain	Requirements	Criteria
Commitment	Stable political environment	1. The LMIC has no ongoing civil war or political violence to divert attention and resource away from cancer treatment and care.
		2. The LMIC has government structures and processes defined by rules or laws to provide important support for policy-making and development of public infrastructure.
		3. AC: The LMIC has no international sanction imposed on it, so as not to impede the work of international radiation oncology volunteers and experts.
Quality of basic infrastructure service		4. The LMIC has made arrangement to ensure supply of water, electricity to the radiotherapy service centre and has a plan to construct sewerage systems at the radiotherapy service centre.
		5. The LMIC has a plan for backup power to keep the radiotherapy service functioning.
		6. The LMIC has road and transport system to the radiotherapy service site, with adequate onsite or nearby for staff, patients and their families, as well as enable goods to be delivered to the radiotherapy service centre.
		7. Champions have identified opportunities to advocate for the development of a radiotherapy service , such as a high-profile and influential public figure being diagnosed with cancer.
Opportunities for advocacy		8. Civil society organisations and influential individuals are building political interest in establishing radiotherapy service by collaboratively campaigning, advocating and/or lobbying.
		9. AC: The high-profile figure is a committed advocate and has the power to influence the decision to improve access to cancer treatment and care, including radiotherapy.
		10. The Ministry responsible for Health has documents/policies that publicly acknowledge the need to strengthen cancer care, including radiotherapy services(s).
Policy coherence		10. The Ministry responsible for Health has documents/policies that publicly acknowledge the need to strengthen cancer care, including radiotherapy services(s).
Cancer control policy		11. The LMIC has a Ministry approved comprehensive cancer control strategy that details the vision, values, directions, budget allocation and timelines to develop or enhance radiotherapy service.
		12. AC: The LMIC understands that radiotherapy is beneficial and effective when introduced within a national cancer control plan.
Public statements by political leaders		13. Political leaders have made strong public statements supporting and endorsing the need to align priorities and effectively implement the components as outlined in the cancer control plan in a prioritised manner.

Domain	Requirements	Criteria
Access to information		14. Preferably, the LMIC has access to reliable and accurate epidemiological data at the institutional or LMIC-level which can be used to determine the LMIC's cancer burden, thus enabling determination of optimal equipment, service siting and estimation of annual radiotherapy utilisation rate (demand for service).
		15. AC: The LMIC has access to global cancer data (GLOBOCAN) and has plans to establish a cancer registry through the support of International Agency for Research on Cancer (IARC) Global Initiative for Cancer Registry Development (GICR).
Suitable funding model		16. The LMIC has developed a detailed project plan for the development of the new radiotherapy service that identifies timelines, clear roles and responsibilities for all relevant stakeholders and project milestones.
		17. The LMIC and/or an external agency has identified a secure source(s) of funding for the development and maintenance/operational sustainability of the radiotherapy service.
		18. The LMIC with assistance from an external agency has prepared a budget document to help make a case for long-term public, private, philanthropic or partnership financial commitments to develop or enhance access to radiotherapy service.
		19. AC: The LMIC has completed a health economic analysis to help make a business case.
Commitment to Universal Health Coverage		20. The LMIC has taken steps toward achieving universal health coverage by establishing a national health insurance program or government subsidies for cancer treatment and care to help protect patients and their families from financial hardships associated with accessing radiotherapy
Membership status with the International Atomic Energy Agency (IAEA)		21. The LMIC signed the 26 th October 1956 Statute within 90 days after it was opened for signature or has deposited an instrument of acceptance of the Statute to become a member of IAEA.
Legal and regulatory framework		22. The LMIC has a legal and regulatory framework to safeguard the use of ionising radiation.
Independent LMIC-level regulator		23. The LMIC has created an independent regulator to: i) inspect, authorise actions and enforce the legislation and regulations; and ii) ensure compliance with international standards of radiation safety, security and protection.
Cooperation	Strategic planning team	24. The LMIC has formed a strategic planning team with the right mix of skills, knowledge and experience to coordinate with relevant stakeholders and oversee in detail specific strategic planning of the new radiotherapy service, such as carrying out the needs assessment and determining the feasibility of the radiotherapy project.
		25. Within the strategic planning team, the LMIC has created a functional technical working group to support as an information-sharing group responsible for defining technical requirements and recommendations.

Domain	Requirements	Criteria
		26. AC: Members of the radiotherapy project team have enabled a smooth articulation between radiotherapy and any existing cancer services in the LMIC.
	Stakeholder involvement	27. The LMIC has performed a stakeholder analysis to define, engage and gain a better understanding of the range of ministries, institutions, organisations, professional bodies and individuals who have interest in and can influence the radiotherapy project.
		28. The international agency or organisation providing technical assistance has involved relevant in-LMIC stakeholders in broader consultations in defining specific needs, strategic plan and directions to ensure early buy-in of the planning process and local ownership of the new radiotherapy service.
		29. The Agency working together with the LMIC have achieved consensus on the priority areas, such as equipment by undertaking due diligence, circulating draft plan and providing an opportunity for stakeholders to express their views on the radiotherapy plan.
	Technical assistance plan	30. The LMIC has mapped international technical assistance programmes and invited the designated Agency or organisations to aid where further support is needed while avoiding duplications and conflicting advice.
		31. AC: The extent and mechanisms for the technical assistance have been clearly defined by the LMIC and the international agency or organisation.
Capacity	Multidisciplinary implementation team	32. The LMIC has formed a multidisciplinary implementation team that is responsible for the day-to-day management of the building of the new radiotherapy service once the radiotherapy plan has been approved at the ministerial level.
	Responsible project manager	33. The LMIC has appointed an experienced project manager with technical and relevant contextual knowledge to help develop timelines and coordinate the implementation activities such as construction, equipment procurement, installation and timely training of staff.
	Availability of radiotherapy expertise	34. The LMIC has relevant local radiotherapy expertise available or when unavailable locally the LMIC has recruited external experts such as clinicians (radiation oncologist and medical physicist), architects, building contractors and engineers to design, construct and commission the new radiotherapy service in accordance with all regulatory requirements.
	Access to suitable land	35. The LMIC has secured suitable site for the radiotherapy service
		36. The LMIC has successfully conducted environmental and engineering hazard assessments to mitigate natural disaster and engineering risks.

Domain	Requirements	Criteria
	Construction of the building	37. The LMIC has identified and secured the services of experienced contractors to complete the building and bunker(s) for housing the radiotherapy equipment according to specifications and project timelines
	Equipment purchase, delivery and set-up	38. The LMIC has contracted a vendor for optimal equipment purchase (teletherapy and brachytherapy with applicators), timely delivery and installation, as well as oncology-specific patient information management software and other accessory equipment, such as planning systems, simulation machine, dosimetry devices and immobilisation devices.
		39. The LMIC has made arrangements for commissioning and licensing of the new radiotherapy service prior to the start of patient treatment.
	Training for initial core staff	40. The LMIC has identified candidates for radiotherapy leadership positions and arrangements have been made to train all staff to form the core workforce – radiation oncologists, radiation therapists and medical physicists.
		41. The LMIC has made arrangement for onsite vendor training and/or participation in an international mentorship programme for specific clinical education and training.
		42. The LMIC has a plan to ensure that immediate staff education and training are undertaken in centres with patient populations, equipment and training programmes relevant to the needs of the LMIC.
	Other supporting staff	43. The LMIC has appropriately identified and trained other supporting staff such as cancer care nurses, social workers, dieticians, occupational therapists, information technologists and case managers or coordinators.
	Staff succession plan	44. As part of a scale-up implementation strategy, the LMIC has a long-term strategic plan for building in-LMIC radiotherapy specific academic and clinical education capacity to ensure the continuous development of radiotherapy workforce locally while addressing concerns about expected staff annual leave, retirement, change in jobs and brain drain due to overseas benefits.
		45. The LMIC has knowledge of staffing needs and plans to articulate with regional professional networks and participate in regional e-learning programmes for continuous professional development to address staff knowledge and skill gaps.
	Incentive systems	46. The LMIC has made arrangement for suitable financial and non-financial incentive packages for staff, including appropriate salaries to motivate and retain staff.
	Service contract	47. The LMIC has a contractual service agreement for the purchased equipment to enable timely engineering support to minimise downtime.
		48. The LMIC has arranged to select and train a team of in-house engineers as part of the procurement plan.

Domain	Requirements	Criteria
	Spare parts	49. The LMIC has carefully negotiated with the vendor with a strong radiotherapy presence in the region to support the improvement of care, including the availability of spare parts and training of engineers.
		50. The LMIC has made arrangement to generate funds through service charges or government revenue to support the radiotherapy service maintenance over the long-term period, including purchasing of spare and repair parts and replacement of obsolete equipment.
		51. AC: The LMIC has created favourable trade and border legislation that encourage compliance and eliminate procedural barriers to medical goods across the border.
Governance and management structure		52. The LMIC has created an inclusive governance and management board plan for the new radiotherapy service to ensure there is participation in higher-level decision-making, strategic direction, financial and clinical governance, such as being accountable to patients and their families.
		53. AC: The LMIC has created a plan to ensure that the radiotherapy service articulates with other cancer services, such as diagnostics, medical oncology, and palliative care.
	Treatment guidelines, protocols and standard operating procedures	54. The LMIC has made arrangement to develop radiotherapy guidelines, protocols, standard operating procedures or has a plan to adopt international standards to guide the best practice of radiotherapy.
	Other essential health services	55. The new radiotherapy service has other essential health services available, such as radiological (computerized tomography [CT] scan, Magnetic Resonance Imaging [MRI] and ultrasound scan), laboratory and nuclear medicine on-site or the LMIC has taken steps towards outsourcing such services from nearby health services.
	Social support services	56. The LMIC and/or civil society organisations have programmes in place to provide social support services for patients, such as transport, accommodation assistance scheme, dietary support and information services.
	Generate, compile, analyse and communicate health data	57. The LMIC has a basic health information system in place to collect clinical and non-clinical information in formats that meet the dissemination and communication needs of care providers, managers, patients and families to aid decision-making.
		58. The LMIC has well-trained information technologists to implement appropriate safeguards to protect patient data confidentiality.
Catalyst	Encourage cancer control reform	59. The LMIC has identified that the new radiotherapy service will help the LMIC meets its cancer control goals and ready to act on an opportunity to improve equity in cancer control.

Domain	Requirements	Criteria
		60. The LMIC has plans to use the new radiotherapy service as a window of opportunity to promote and mobilise resources to develop a comprehensive service and optimise all aspect of cancer control (prevention, diagnosis, treatment and palliative care).
		61. The LMIC has plans to use the new radiotherapy service to and sensitize policy-makers and health authorities to the growing burden of cancer and the importance of integrated cancer control strategies for managing it.
	Promote coordinated care	62. If possible, the LMIC has plans to use the new radiotherapy service to upgrade information systems to improve coordination of care across providers, services and settings.
		63. The LMIC has plans to use the new radiotherapy and/or other services to develop patient referral pathways and registries to increase transition across specialists.
		64. Using nurse coordinators, the LMIC has plans to support patients as they navigate the complex cancer treatment and care pathway.
	Promote a multidisciplinary approach to care	65. The LMIC has plans to use the new radiotherapy service to advocate for the promotion and implementation of multidisciplinary team management of cancer patients.
		66. As a window of opportunity, the LMIC has plans to use the new radiotherapy service to facilitate the development and implementation of national cancer management guideline in collaboration with other specialities.
	Strengthen patient- and family-centred care	67. The LMIC has plans to use the new radiotherapy service to provide patients and families access to basic information about cancer management and self-management support outside the healthcare setting through nurse coordinators or the internet.
		68. The LMIC has plans to use the new radiotherapy service to develop educational and skill-building programmes for patients and families on the management of cancer.
		69. Through collaboration, the LMIC has plans to use the radiotherapy service to better meet the needs of cancer patients (example, transport, accommodation and food is an incentive for low-income patients to adhere to treatment).
		70. The LMIC has plans to use the new radiotherapy service to develop written and online patient education materials to support self-management strategies, which could be adopted by other LMICs.
		71. The LMIC has plans to use the new radiotherapy service to build a stronger connection with community organisations to promote awareness and use of radiotherapy.
	Encourage better outcomes through research	72. The LMIC has plans to use the new radiotherapy service to emphasise the importance of evidence-based cancer care and the need to implement cancer registry through partnerships.

Domain	Requirements	Criteria
		73. The LMIC has plans to use the new radiotherapy service to support the conduct of local research to produce and demonstrate the cost-effectiveness of innovative care and strategies
		74. The LMIC has plans to use the new radiotherapy service to establish international and regional collaborations where radiotherapy centres can exchange information, share expertise, policies and strategies to improve services.

Legend: AC = Additional criteria that emerged from experts' comments; Bold texts indicate major modifications to a requirement or criterion based on experts' comments; and LMIC = Low- and middle-income country