Discrepancy between Linear Accelerator (LINAC) Assumptions and Methodology Calculation Steps

Agency Recommendation

Proposal:
Each methodology in the State Medical Facilities Plan (SMFP) includes the assumptions of the methodology and a description of the steps taken to calculate the inventory, utilization and need determinations. The assumptions provide a general framework for the steps. The steps describe how the methodology calculations are programmed into the relevant database to create the data tables in the SMFP.

There is a discrepancy between the assumptions, the description of the calculations in the steps, and the actual calculations in the database in the LINAC section of Chapter 15. Specifically, the calculations in the database reflect the assumptions of the LINAC methodology, but the narrative description of the methodology calculation steps does not reflect either the assumptions or the calculations in the database. The Agency proposes technical revisions to the description of the steps within the methodology to comport with the intent of the methodology as discussed below. The Agency does not propose substantive changes to the LINAC methodology.

Background Information:
Before the 2010 SMFP, the LINAC methodology narrative did not contain a detailed description of the calculation steps. See underlined text below:

2009 SMFP, Chapter 9 Excerpt

Basic Assumptions of the Methodology
In determining whether an additional linear accelerator is needed in a service area, three principal questions must be addressed:
1. Are the linear accelerators in existing radiation oncology centers performing greater than 6,750 procedures (ESTVs) per accelerator per year?
2. Is the population that lives in a radiation oncology service area sufficiently great to support the addition of another accelerator (population per accelerator greater than 120,000 - a figure suggested by the Inter-Society Council for Radiation Oncology)?
3. Does the patient origin data show that over 45 percent of the patients come from outside the service area?

Patient origin data is requested in order to establish service areas, and the vast majority of the facilities have responded with the patient origin data.

To examine the second and third questions, radiation oncology service areas are delineated, including in each area the counties that are closest to each radiation oncology program or cluster of programs. A cluster of programs is defined as all

of the programs in a single county. Two exceptions were employed in applying this method:

    a. Where patient origin data indicate a county's primary use of a program which is not the closest, the county is aligned with the radiation oncology area where most or a plurality of its citizens go for hospital care. Example: Alleghany to Forsyth.

    b. When a program is one that has a population too small to support it, the area for that program is combined with an adjacent area in which the smaller program's base county's patient origin data indicates that a sizable percentage of patients go to the adjacent programs. Example: (Haywood - Buncombe)

Data regarding each of the radiation oncology service areas of North Carolina were organized so as to examine each of the questions noted above.

Methodology for Determining Need
The methodology incorporates a geographic accessibility criterion (population base of 120,000), <u>a criterion aimed at assuring efficient use of megavoltage radiation facilities (when ESTV Procedures divided by 6,750 minus the number of present linear accelerators equals .25+),</u> and a patient origin criterion that when a service area has 45 percent or more of the patients coming from outside the service area. A need determination is generated when two of the three criteria are met within a service area.

The above narrative description of the methodology calculations formed the basis for programming of the original database. Beginning in 2010, the SMFP began to detail the calculation steps. **The text in the Basic Assumptions did not change.** Moreover, the 2010 SMFP LINAC narrative did not reflect any changes to the methodology. With the exception of removal of a redundant clause in Step 6 (in italics, below), the description of the steps has not changed since 2010. Criterion 3 is the relevant section (underlined).

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2010 SMFP, Chapter 9 Excerpt

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Methodology for Determining Need
The methodology incorporates a geographic accessibility criterion (population base of 120,000), a criterion aimed at assuring efficient use of megavoltage radiation facilities (when ESTV procedures divided by 6,750 minus the number of present linear accelerators equals .25+), and a patient origin criterion (when a service area has more than 45 percent of the patients coming from outside the service area). A need determination is generated when two of the three criteria are met within a service area.

The standard methodology used for determining need for linear accelerators is calculated as follows:

Criterion 1:

Step 1.   Using the 2009 North Carolina population estimate obtained from the North Carolina Office of State Budget and Management, sum the population estimates for counties that comprise each linear accelerator service area to determine the population for linear accelerator service areas.

Step 2.   For each linear accelerator service area, sum the number of operational linear accelerators acquired in accordance with G.S. 131E-175, et. seq., the number of approved linear accelerators not yet operational but for which a certificate of need has been awarded, and the linear accelerator need determinations from previous years.

Step 3.   Divide the service area population by the result of Step 2 to determine the population residing in the service area per linear accelerator. If the result is greater than or equal to 120,000 per linear accelerator, Criterion 1 is satisfied.

Criterion 2:

Step 4.   Using patient origin data reported on the 2009 Hospital License Renewal Applications and Linear Accelerator Registration and Inventory Forms for linear accelerators, for each service area, count the number of patients who were served on linear accelerators located in the service area, and who reside in a county outside the service area.

Step 5.   For each service area, divide the results of Step 4 by the total number of patients served on linear accelerators located in the service area. If more than 45 percent of total patients served on linear accelerators located in a service area reside outside the service area, then Criterion 2 is satisfied.

Criterion 3:

Step 6.   For each linear accelerator service area, sum the number of ESTV procedures performed on the linear accelerators located in the service area *as reported in each provider's 2009 Hospital License Renewal Application or Linear Accelerator Registration and Inventory Form.*

Step 7.   Divide the results of Step 6 by the number of linear accelerators in the service area which are counted in Step 2 to determine the average number of ESTV procedures performed per linear accelerator in each linear accelerator service area.

Step 8.   Divide the results of Step 7 by 6,750 ESTV procedures.

Step 9.   Subtract the number of linear accelerators in the service area counted in Step 2 from the results of Step 8. If the difference is greater than or equal to positive 0.25, Criterion 3 is satisfied.

Step 10. If any two of the above three criteria are satisfied in a linear accelerator service area, a need is determined for one additional linear accelerator in that service area.

The assumptions of the methodology and narrative description of the calculations from the 2009 SMFP produce the following calculations, using a service area with 2 LINACs and 8,566 total procedures (ESTVs) to illustrate.

$$\frac{8,566}{6,750} = 1.26$$

$$1.26 - 2 = -\mathbf{0.73}$$

Below are the calculations represented by Steps 6 – 9 beginning with the 2010 SMFP following (using the same example as above, 8,566 ESTVs and 2 LINACs):

Steps 6 and 7:
$$\frac{8,566}{2} = 4,283$$

Step 8:
$$\frac{4,283}{6,750} = 0.63$$

Step 9:
$$0.63 - 2 = -\mathbf{1.37}$$

The two results are markedly different. In addition, the calculations that follow the explicit steps make it more difficult for a service area to have a need determination because the result is smaller.

Recommendation:
Agency staff recommends changing the narrative description of the steps to reflect the calculations performed in the database to comport with the intent of the methodology. Below are the recommended edits to Criterion 3 in the LINAC methodology for the 2025 SMFP.

Criterion 3:

Step 6.   For each linear accelerator service area, sum the number of reported ESTV procedures performed on the linear accelerators located in the service area.

Step 7.   Divide the results of Step 6 by 6,750 ~~the number of linear accelerators in the service area which are counted in Step 2 to determine the average number of ESTV procedures performed per linear accelerator in each linear accelerator service area~~.

~~Step 8.   Divide the results of Step 7 by 6,750 ESTV procedures.~~

Step ~~9~~ 8:   Subtract the number of linear accelerators in the service area counted in Step 2 from the results of Step ~~8~~ 7. If the difference is greater than or equal to positive 0.25, Criterion 3 is satisfied *(Table 15C-5)*.

Step ~~10~~ 9: If any two of the above three criteria are satisfied in a linear accelerator service area, a need is determined for one additional linear accelerator in that service area.

Criterion 4:

Regardless of the results of Steps 1-~~9~~ 8 above, if a county has a population of 120,000 or more and there is not a linear accelerator counted in Step 2 for that county, a need is determined for one linear accelerator in that county. As a result, the county becomes a separate, new linear accelerator service area.

This recommendation does not change the methodology, but aligns the chapter narrative with the methodology assumptions and how the calculations have been done since the implementation of the LINAC methodology.