Start Small, Dream Big:
Multidisciplinary Interventions to Increase the Demand for Cardiac Imaging Studies and Consolidating a Cardiac Imaging Network.

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Background and Objectives

- Hospital Militar Central in Bogotá, Colombia is a University Hospital with about 357 beds and about 125.000 overall imaging Studies by 2018.
- Cardiac Imaging within the Radiology and Diagnostic Imaging Department
  - 1 Radiologist trained in Cardiac Imaging, 2 Technologists trained in Cardiac Imaging
  - Equipment: 1.5 Tesla MRI (GE Optima MR450W) and an 80-detector row CT Scanner (Toshiba Aquilion PRIME)

- **Despite human and technical resources, we percieved a low demand for Cardiac Imaging Studies.**
- The objectives of this Quality Initiative were:
  - Primary:
    - To double the demand for Cardiac Imaging Studies from 6 monthly Studies in March 2019 to at least 12 monthly Studies by March 2020 by means of a Cause-and-Effect analysis.
  - Secondary
    - To increase the number of physician referrers.
    - To stablish a network of physicians involved in Cardiac Imaging Studies at Hospital Militar Central.

Methods

- Quality Improvement Strategy:
  - Cause-and-Effect analysis [1] to identify potential causes for low demand (Figure 1).
  - Specific actions designed for every root cause (Figure 2).
  - Multidisciplinary interventions carried out according to time and resource availability.

- Study Design
  - Baseline: March 2019
  - Follow-up evaluation monthly between March 2019 and March 2020
    - Due to the COVID-19 pandemic we decided to stop the initiative and analyze data up to February 2020.

[1] Kruskal J et al. Quality Improvement in Radiology: Basic Principles and Tools Required to Achieve Success. RadioGraphics 2011; 31: 1499-1509

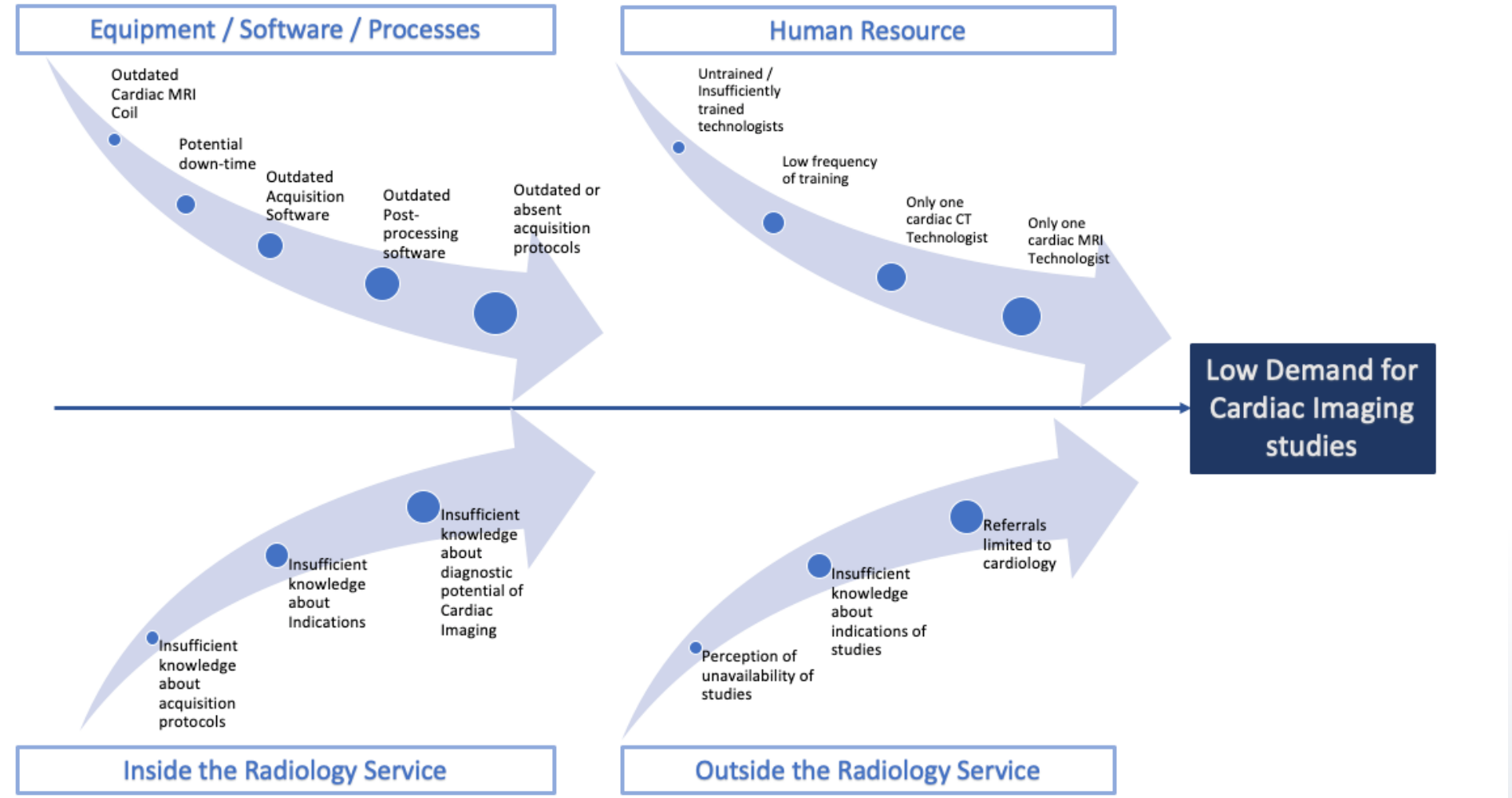


Figure 1. *Cause and Effect Analysis (Fishbone) Diagram*

- We found a total of 15 root causes grouped in 4 categories

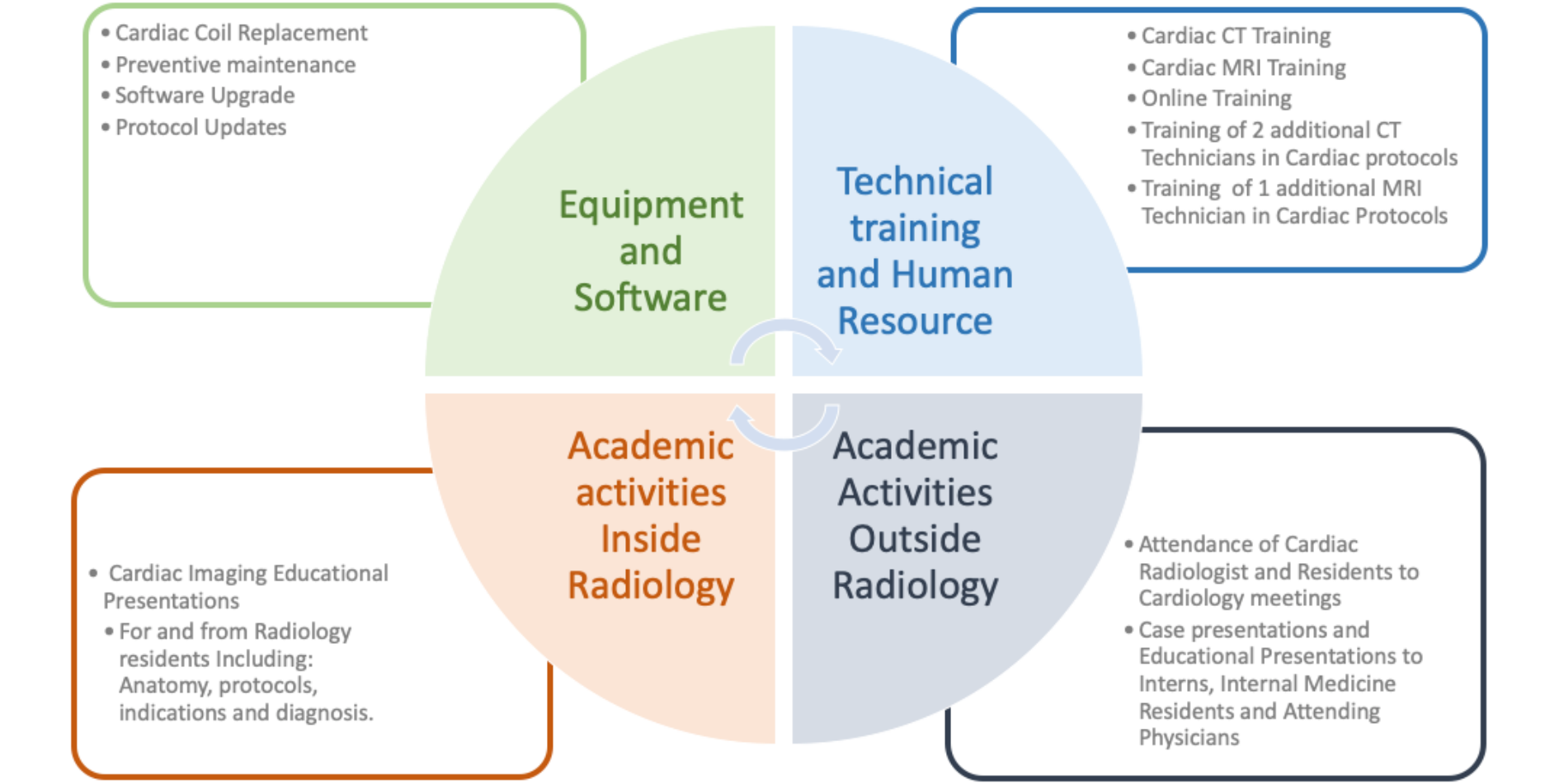


Figure 2. *Interventions chart*

- We designed specific multidisciplinary interventions targeting the root causes. During the initiative, a total of 81 actions were undertaken

Data Analysis

- Primary outcome is the demand generated: Monthly aggregate of referrals from physicians [2].
- Secondary Outcomes
  - Number of new referrers: Monthly aggregate of new referring physicians [2].
  - Total number of referrers: Accumulated aggregate of referring physicians [2].

- To assess the interventions we calculated the Effort Expended: Monthly aggregate of initiatives undertaken [2].

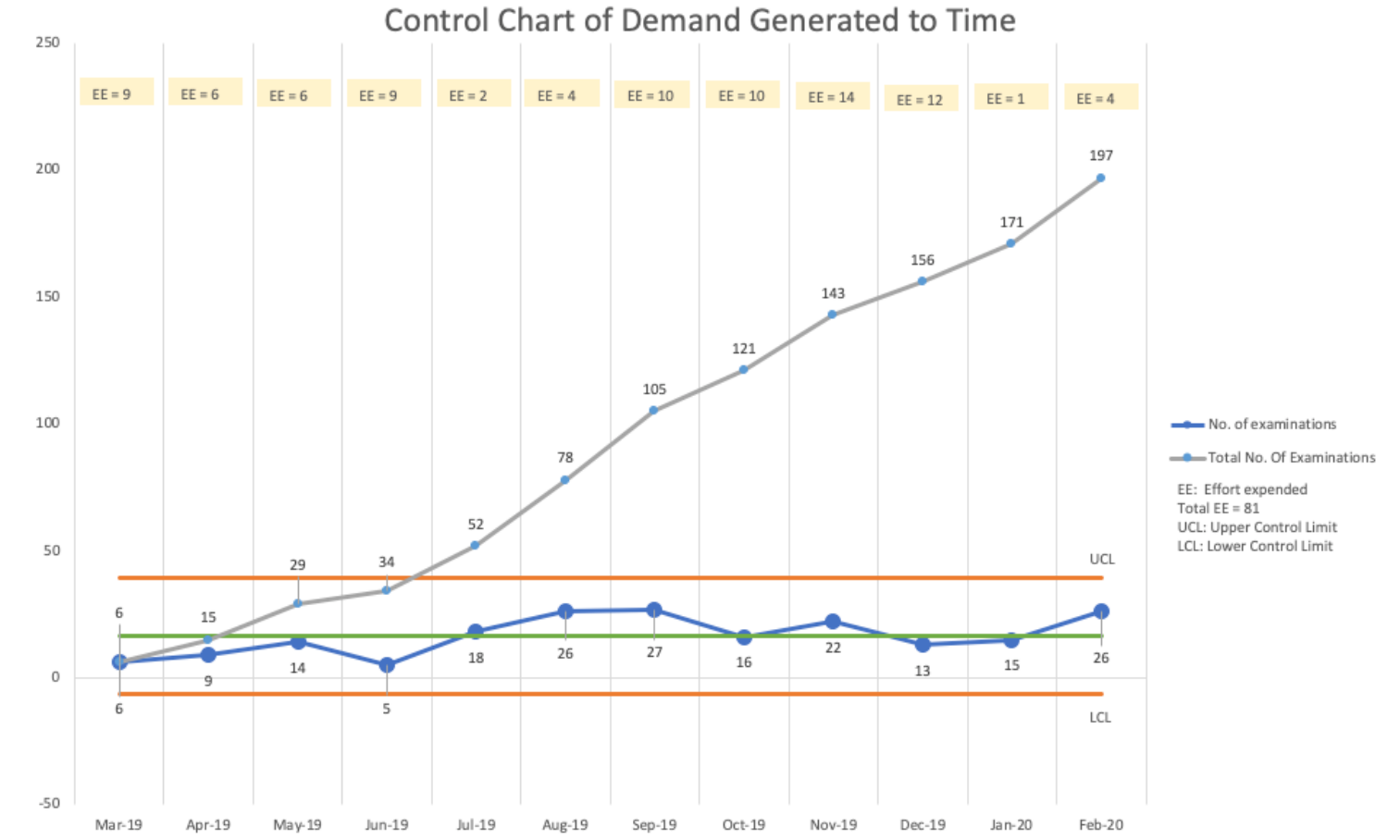
- Statistical analysis
  - Descriptive statistics represented in control charts [3] using Microsoft Excel for Mac 16.22
  - Social Network Analysis
    - Directed network graph analysis with Force Atlas distribution using Gephi 0.9.2 [4]
    - Nodes represent referrers and the cardiac radiologist.
    - The edges' direction indicates the referral direction.
    - Nodal size represents the degree (total number of interactions).

[2] Abujudeh et al. Key Performance Indicators for Measuring and Improving Radiology Department Performance. RadioGraphics 2010; 30:571-583

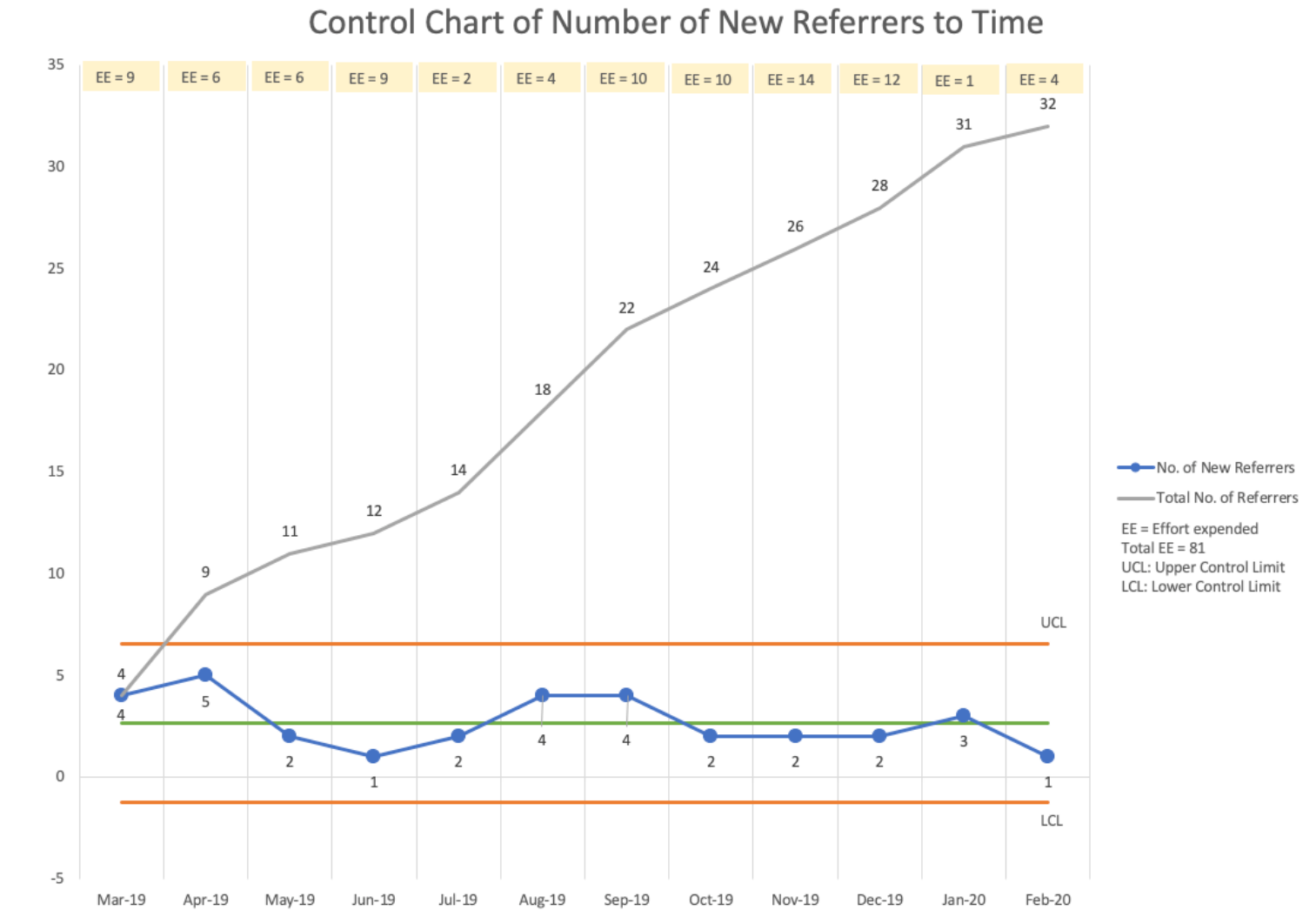
[3] Larson D et al. Guide to Effective Quality Improvement Reporting in Radiology. Radiology 2014; 271: 561 - 573

[4] Bastian M et al(2009). *Gephi: an open source software for exploring and manipulating networks.* International AAAI Conference on Weblogs and Social Media.

Results



- The demand generated increased from 6 studies in March 2019 to 26 studies in February 2020
- The objective of doubling the number of studies was achieved in 9 out of 11 months of the intervention.
- At the end of the intervention, the demand generated was 4.3 times that of baseline



- The total number of referrers increased from 4 referrers in March 2019 to 32 referrers in February 2020.
- The number of new referrers increased in 4 out of 11 months of the intervention.

- Each node represents a physician and the size of the node represents the number of interactions.
- The Cardiac Imaging Network at our institution includes a total of **33 physicians** from **15 specialties**.
- The radiologist has the highest number of interactions, followed by six cardiologists, one pulmonologist, two oncologists one emergency medicine physician and seven internists.
- The lowest number of physicians and interactions occurs among pediatric subspecialties.

Conclusions and Future Directions

- By means of a Cause-and-Effect analysis and multidisciplinary interventions the demand generated was doubled in 9 out of 11 months.
- Mutlidisciplinary Interventions are a promising strategy to increase the demand for studies, the number of referrers and stablishing a Cardiac Imaging Network.
- Based on the Network Analysis, we realized that the scope of cardiac imaging is wider than previously thought.
  - Further interventions should target pediatric specialties and adult specialties such as emergency medicine and internal medicine.
- Sustaining our results in the following months amidst the COVID-19 pandemic is a challenge for the future.