

QUIC Coronary Plaque Quantification - Implementation Roadmap Whitepaper

1. Introduction:

The RSNA Quantitative Imaging Committee (QUIC) was formed in 2024 with the mission “to improve patient care, clinical research, and education by guiding and promoting implementation of quantitative imaging biomarkers.” QUIC builds on prior work of the Quantitative Imaging Biomarkers Alliance (QIBA), which primarily provided rigorous specifications (Profiles) for individual quantitative imaging biomarkers (QIB). The vision of QUIC is to move beyond QIBA Profiles to develop broader “Implementation Roadmaps” for collecting and distributing appropriate QIB information to all stakeholders on the information pipeline, including radiologists, referring physicians, patients, researchers, and the healthcare enterprise.

Coronary computed tomography angiography (CCTA) plaque quantification was one of the priority topics selected by QUIC. The QUIC Coronary Plaque Quantification workgroup developed a roadmap focused on automated quantification of coronary plaque for the purpose of risk stratification and guidance of treatment strategies. The purpose of this structured document is to describe the entire process for clinical implementation of coronary plaque quantification including motivation, stakeholders, drivers, challenges, and guidelines.

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2. Clinical Background:

Coronary plaque quantification software has emerged as an important adjunct to CCTA, enabling a more comprehensive assessment of coronary artery disease (CAD) than traditional visual interpretation alone. Historically, CCTA interpretation has focused primarily on identifying and grading luminal stenosis. However, numerous studies have demonstrated that the overall burden and composition of atherosclerotic plaque provide incremental prognostic information beyond the severity of coronary narrowing [1]. Quantitative plaque analysis allows objective measurement of total plaque burden,

plaque volume, and plaque composition, including calcified, non-calcified, and low-attenuation plaque components. High risk or adverse plaque characteristics may also be identified. By characterizing the full extent of atherosclerotic disease, quantitative analysis may provide clinicians with a more complete understanding of an individual patient's cardiovascular risk profile.

A major advantage of plaque quantification is its ability to identify patients who may be at elevated risk despite having non-obstructive coronary disease. Many major adverse cardiovascular events (MACE) occur in patients without severe stenosis, highlighting the limitations of assessing risk based solely on luminal narrowing [2]. Quantitative assessment of coronary plaque measures of atherosclerotic disease burden can also breakdown of biologically distinct calcified and non-calcified plaque volume and high-risk plaque characteristics to identify subclinical or early-stage disease which may be visually apparent but through quantification the ability to contextualization by age and sex becomes feasible. This additional information may improve risk stratification, allow a more personalized approach to medical therapy with disease burden and facilitate earlier initiation or intensification of preventive therapies, including lipid-lowering medications, antiinflammation, blood pressure management, and lifestyle interventions.

The use of plaque quantification software also improves the standardization and reproducibility of CCTA interpretation. Traditional plaque assessment is often dependent on visual estimation and may be subject to interobserver variability. Automated and artificial intelligence-enabled software platforms provide objective measurements using standardized algorithms, reducing variability between readers and across institutions[3]. Consistent quantification is particularly valuable for serial imaging studies, where small changes in plaque volume or composition may be difficult to reliably detect visually but may have important clinical implications. Serial imaging capability may permit clinicians to monitor disease progression or regression over time and evaluate the effectiveness of therapeutic interventions.

In addition to supporting individual patient care, quantitative plaque analysis has become an increasingly valuable tool in clinical research and population health initiatives. Objective measurements of plaque burden serve as reproducible imaging biomarkers that can be used to evaluate disease progression, compare treatment strategies, and assess the impact of novel therapies. Standardized plaque metrics facilitate multicenter collaborations and enable more meaningful comparisons across diverse patient populations. Furthermore, the growing availability of FDA-cleared plaque analysis software has enhanced confidence in the analytic validity and operational feasibility of these techniques.

As precision cardiovascular medicine continues to evolve, plaque quantification offers a means of moving beyond the binary assessment of obstructive versus non-obstructive CAD. By integrating quantitative measures of coronary atherosclerosis into routine CCTA interpretation, clinicians can better characterize disease severity, personalize treatment recommendations, and potentially improve long-term cardiovascular outcomes. Consequently, plaque quantification software is increasingly recognized as a

useful component of contemporary CCTA evaluation and cardiovascular risk assessment.

3. Motivation & state of evidence:

A substantial body of research supports the use of quantitative coronary plaque analysis as an important extension of CCTA. Large observational studies and prospective registries have consistently demonstrated that quantitative measures of atherosclerotic burden are independently associated with MACE. Metrics such as total plaque volume, total plaque burden, non-calcified plaque volume, and low-attenuation plaque burden have been shown to predict future myocardial infarction and cardiovascular mortality, even after accounting for traditional cardiovascular risk factors and the severity of coronary stenosis. Key evidence supporting these findings comes from the CONFIRM registry, the SCOT-HEART trial, and studies from the PARADIGM consortium, which demonstrated that plaque burden and plaque composition provide incremental prognostic value beyond stenosis assessment alone ([4] [5] [2]).

Research has also highlighted the importance of plaque composition in determining cardiovascular risk. High-risk plaque features identified on CCTA, including low-attenuation non-calcified plaque and positive remodeling, are associated with an increased likelihood of future coronary events. In the SCOT-HEART trial, low-attenuation plaque burden, pathophysiological related to lipid-rich and potentially vulnerable plaque, emerged as one of the strongest imaging predictors of subsequent myocardial infarction, surpassing stenosis severity alone in risk prediction. Similarly, Motoyama and colleagues demonstrated that high-risk CCTA plaque characteristics were associated with future acute coronary syndrome events. Quantitative plaque analysis enables objective and reproducible measurement of these features, facilitating more precise risk stratification than subjective visual assessment [6, 7].

Beyond risk prediction, quantitative plaque analysis has demonstrated usefulness for monitoring disease progression and treatment response. Serial CCTA studies from the PARADIGM registry showed that plaque burden and composition change over time and that aggressive lipid-lowering therapy is associated with slower plaque progression and more favorable plaque characteristics. These findings and other studies support the use of quantitative plaque metrics as potential serial imaging biomarkers for evaluating therapeutic effectiveness and tracking the natural history of coronary atherosclerosis [8] [9].

Importantly, the evidence supporting quantitative plaque assessment is not based on a single biomarker. Rather, it is derived from a collection of complementary measurements that characterize different aspects of coronary atherosclerosis. Among the most extensively validated metrics are total plaque burden, total plaque volume, and non-calcified plaque burden, all of which have demonstrated consistent associations with cardiovascular outcomes. More recent studies suggest that non-calcified and low-attenuation plaque may offer additional prognostic value. Consequently, current evidence favors a multi-marker approach in which plaque burden, plaque composition, plaque distribution, and high-risk plaque features are evaluated together [7, 10].

Observational data suggest that providing quantitative plaque metrics to clinicians alters their clinical decision making and is associated with reductions in low-density lipoprotein cholesterol (LDLc) [11, 12]. These data highlight the potential for plaque quantification to alter provider and patient management.

Taken together, the available evidence supports quantitative coronary plaque analysis as a clinically meaningful tool that enhances cardiovascular risk assessment beyond stenosis evaluation alone. Additional supportive data are rapidly emerging. By providing objective, reproducible measurements of both the extent and composition of coronary atherosclerosis, plaque quantification improves patient risk stratification, facilitates monitoring of disease progression, supports evaluation of treatment response, and provides robust imaging biomarkers for clinical research and precision cardiovascular medicine.

4. Current approach to coronary plaque quantification and interpretation:

In contemporary clinical practice, coronary plaque assessment is still predominantly based on *visual and semi-quantitative interpretation* of CCTA. Routine clinical interpretation continues to focus primarily on the presence, location, extent, and ordinal severity of atherosclerotic plaque as assessed by an experienced reader. The principal objective is to determine whether CAD is present and to adjudicate the severity of focal anatomical stenosis.

Plaque characterization is generally performed using a qualitative approach. Interpreters classify plaque as calcified, non-calcified, or mixed based on its visual appearance on CCTA. The distribution of plaque throughout the coronary tree is noted, and the degree of luminal narrowing is estimated visually or with basic measurement tools. Assessment is typically reported on a per-segment, per-vessel, and patient level, with an emphasis on identifying obstructive disease, commonly defined as luminal stenosis $\geq 50\%$ or $\geq 70\%$, depending on the clinical context. Although plaque burden is recognized as an important marker of risk, it is usually described descriptively as mild, moderate, or severe (figure 1) based on visualized semi-quantitative measures such as segment involvement score or visualized assessment of disease burden stratified by vessel in accordance with CAD-RADS 2.0 guidance[13].

Interpretation also includes evaluation for adverse or high risk plaque features that may indicate higher-risk atherosclerotic disease. Radiologists and cardiologists visually assess characteristics defined as low-attenuation plaque, positive remodeling, spotty calcification, and the napkin-ring sign. The presence of 2 or more features identify individuals who appear to be at higher risk. However, these plaque characteristics have not been shown to help discriminate against future culprit lesions. It is also unclear what is the incremental value in risk prediction compared to total plaque volume. Nevertheless, the identification of these high-risk features remains visual and somewhat dependent on reader expertise and experience, resulting in greater variability than fully quantitative approaches.

Clinical decision-making remains largely driven by stenosis severity and overall disease extent rather than detailed plaque composition metrics. Current reporting frameworks, including CAD-RADS 2.0, emphasize categorization of coronary disease according to the degree of luminal narrowing while also encouraging documentation of ordinal plaque burden and any high-risk plaque features. As a result, management recommendations are still primarily based on whether disease is absent, nonobstructive, or obstructive, with plaque characteristics serving as complementary information for risk stratification. As quantitative tools become more automated, validated, and widely accessible, they are expected to supplement—and potentially transform—this traditional interpretive paradigm.

The recent ACC consensus statement on Quantitative Coronary Plaque Analysis in Clinical Practice provides a framework for the potential adoption of AI enabled quantitative plaque tools to help inform refined risk stratification and a more personalized medical management strategy [14]. This document aligns with the recent ACC/AHA dyslipidemia guidelines which propose more personalized LDL targets based on the extent of plaque[15]. Along that line the concept of staging CAD based on total plaque volume is gaining clinical traction with decision making further refined by the prematurity of plaque (percentile) and amount of plaque non-calcified relative to the total plaque volume.

5. Specific Quantitative Imaging Biomarkers:

The following recommendations are based on current research evidence and medical society recommendations, particularly the 2023 RSNA QIBA Profile for Atherosclerosis Biomarkers by CTA[16], the 2024 SCCT Expert Consensus Document [17] and the ACC 2025 scientific statement[14]. Routine quantitative CCTA plaque analysis report should include patient-level and vessel-level biomarkers, while segment-level and individual plaque-level measurements should not be considered core reporting outputs. Patient- and vessel-level metrics provide the best balance between biological relevance, reproducibility, standardization across software platforms, and suitability for longitudinal follow-up and clinical trials. Vessel-based reporting preserves anatomical specificity while maintaining sufficient reproducibility for clinical and research applications.

At the patient level, the recommended quantitative biomarkers include total plaque volume (TPV, mm^3), total non-calcified plaque volume (NCPV, mm^3), total calcified plaque volume (CPV, mm^3), and total low-attenuation plaque volume (LAPV, mm^3). Total plaque volume is defined as the volumetric calculation of all plaque in a patient or vessel. Total non-calcified plaque volume is the volumetric calculation of non-calcified plaque. Thresholds for noncalcified and calcified can be derived from the scan, using fixed thresholds [17], or using adaptive thresholds for scan-specific contrast attenuation[18]. A fixed threshold approach measures total noncalcified plaque typically using <350 Hounsfield units (HU) and calcified plaque volume with a threshold of ≥ 350 HU. Low attenuation plaque volume is a subset of total non-calcified plaque volume and is usually defined as plaque measuring <30 HU. Figure 2 shows a generic example of a

software tool applying HU thresholds for detection and quantification of coronary plaque components.

The amount of coronary vessels analyzed is also an important biomarker and can be critical for comparative studies. However, indexed volumes to total coronary length or other measures are not recommended at this point given lack of scientific evidence around indexed biomarkers. Calculation of percent plaque volume or plaque burden (plaque volume divided by the vessel volume) is also not required, but it could be useful as an optional biomarker. Although nomenclature varies slightly in the literature, standardization of the terminology is recommended for clinical implementation of the technique.

At the vessel level, the recommended quantitative biomarkers are TPV, NCPV, CPV, and LAPV for each major epicardial coronary artery (left main, left anterior descending, left circumflex, and right coronary artery). Data on the length of the vessel analyzed and any excluded segments should be obtained. The remodeling index (unitless ratio) may also be calculated as a marker of adverse plaque characteristics.

We do not recommend segment-level or individual plaque-level measurements as primary outputs for plaque quantification analysis. Although these measurements may be useful in selected research applications, they are more susceptible to variability arising from image quality, plaque segmentation, threshold selection, and registration errors.

The previously mentioned QIBA, SCCT, and ACC documents in the topic emphasize the importance of standardized, reproducible measurements that can serve as robust biomarkers for serial assessment and inter-study comparisons. Therefore, patient-level and vessel-level plaque metrics should constitute the core quantitative reporting framework for CCTA plaque analysis.

Please refer to table 1 for a summary of the coronary plaque quantitative biomarkers and recommendation for clinical utilization.

Table 1. Recommended Quantitative CCTA Plaque Biomarkers for Routine Clinical Utilization

	Recommended Biomarker	Units	Recommendation	Rationale
Patient Level	Total Plaque Volume (TPV)	mm ³	Recommended	Global assessment of coronary atherosclerotic burden
	Total Non-Calcified Plaque Volume (NCPV)	mm ³	Recommended	Reflects potentially modifiable plaque burden

	Total Calcified Plaque Volume (CPV)	mm ³	Recommended	Quantifies chronic atherosclerotic disease burden
	Total Low-Attenuation Plaque Volume (LAPV)	mm ³	Recommended	Potential Marker of high-risk plaque phenotype
	Plaque Burden (Percent Plaque Volume)	%	Optional	Standardized measure of overall disease extent indexed to coronary size
Vessel Level	Total Plaque Volume (TPV)	mm ³	Recommended	Preserves anatomic localization while maintaining reproducibility
	Non-Calcified Plaque Volume (NCPV)	mm ³	Recommended	Characterizes vessel-specific plaque composition
	Calcified Plaque Volume (CPV)	mm ³	Recommended	Quantifies calcified disease within individual vessels
	Low-Attenuation Plaque Volume (LAPV)	mm ³	Recommended	Identifies adverse plaque characteristics
	Plaque Burden	%	Recommended	Enables vessel-specific disease assessment
	Remodeling Index*	Ratio	Optional	Marker of positive remodeling and adverse plaque phenotype
Segment Level	Segment-specific plaque measurements	Various	Not routinely recommended	Higher variability and lower reproducibility
Individual Plaque Level	Lesion-specific plaque measurements	Various	Not routinely recommended	Susceptible to segmentation and registration errors

6. Relevant RSNA QIBA profiles:

The RSNA QIBA profile pertaining to quantification of coronary atherosclerosis with CTA is entitled “Special Report on the Consensus QIBA Profile for Objective Analytical Validation of Non-calcified and High-risk Plaque and Other Biomarkers using Computed Tomography Angiography”. A summary of the document was published in 2024 in the Academic Radiology Journal [16], and the full QIBA profile is available at the RSNA QIBA webpage:

https://qibawiki.rsna.org/images/5/5b/Atherosclerosis_Biomarkers_Profile_2023Mar28.pdf

7. Standardized Protocols for Acquisition:

Quantification of coronary plaque is a challenging task due to the small size of coronary arteries and plaque components. To obtain the most accurate measurements possible, it is critical to use the highest spatial resolution that can be obtained on one’s system and to control the noise, which increases as the resolution increases and adds uncertainty to the measurements.

Many different scanner models are in use clinically, ranging from 4 cm 64-slice multi-detector row scanners to 16-cm wide detector scanners, dual-source systems, and more recently, photon-counting detector CT. In general, higher spatial resolution, temporal resolution and longitudinal coverage with each rotation improves image quality. Using the same CT model for comparison CCTA studies is ideal but can be difficult to achieve in practice due to upgrades to new scanner technologies. While standardizing scan and reconstruction parameters for a study is critical, it is difficult to achieve due to fundamental differences between scanner models and practice preferences.

The current QIBA profile for *Atherosclerosis Biomarkers by Computed Tomography Angiography (CTA)* provides specific requirements for the scanner and scanner performance that directly impact the selection of data acquisition parameters. For example, a rotation time of 400 msec or less and a total collimation width of 16 mm or greater are required. Other requirements focus on the characteristics of the reconstructed image, such as image noise.

8. Standardized Protocols for Image Generation:

The highest resolution is achieved using the smallest detector size available and by reconstructing with thin overlapping images using a very sharp reconstruction kernel.

The QIBA profile for *Atherosclerosis Biomarkers by Computed Tomography Angiography (CTA)* requires a nominal tomographic section thickness (detector size at isocenter along the longitudinal axis) of 0.75 mm or less and a reconstructed slice thickness of 1 mm or less. It also requires a pixel noise value in the reconstructed image of 30 HU or less.

While noise reduction using iterative reconstruction, deep-learning based reconstruction, or deep-learning based noise reduction helps to control the noise, these non-linear algorithms result in spatial resolution that varies with the dose level and the object contrast. Thus, while the iodine-enhance lumen and calcifications will likely retain

high spatial resolution with these approaches, low contrast plaque components such as fat and fibrous tissue will likely be represented with lower spatial resolution. Ongoing work in the field is seeking to find optimal settings to maximize plaque quantitation accuracy.

9. Extraction of QIB(s)- Current Software Options and Validation of Methods

There are a relatively small number of commercially available, FDA-cleared software packages that perform quantitative coronary plaque analysis from CCTA. While many CT workstations allow plaque visualization and stenosis measurements, far fewer provide automated or semi-automated quantitative measurements at the vessel-level and patient-level such as volumetric (mm³) or indexed volumetric measures including:

- Total plaque (TP) – volume (mm³)
- Plaque burden (%) – vessel specific as [total plaque area or volume/vessel area or volume]
- Non-calcified plaque (NCP) – volume, % volume, or % burden
- Calcified plaque (CP) – Agatston score, mass, volume, or % volume
- Low-attenuation plaque (LAP) - volume, % volume, or % burden
- Percent atheroma volume (%) – indexed for coronary vessel size as [TPV per vessel / total vessel volume]

Table 2 provides a summary of currently available FDA-cleared plaque measurement software tools. In addition to commercial software tools, there are a number of non-FDA-cleared packages used in research settings.

There are additional differences between software vendors to consider when selecting a system for clinical implementation. Some software solutions may be compatible only with certain CT imaging systems. Output devices and format may differ slightly between vendors; however, most supported output devices are CT workstations, PACS, and RIS using DICOM structured report and secondary capture. Deployment options may differ slightly such as a standalone computer, an add-on module to PACS, or a virtual machine with cloud based image transfer. Plaque quantitation software systems may also be an integrated product combined with AI-assisted detection.

Table 2. Compilation of available plaque measurement software.

A number of vendors are currently cleared by FDA, or have applications in process, to perform quantitative plaque analysis using CCTA images. The following information (in alphabetical order by vendor name) has been provided by the vendors and is not confidential.

Company	Product	FDA 510(k) Number	FDA Validation	Software Description	Typical outputs
APQ Health.com	Autoplaque 3.0	K212758	Expert readers	AI-based plaque quantification, central server	Total plaque volume, calcified/non-calcified plaque, low-attenuation plaque, remodelling index, percent atheroma volume, stenosis.
Careverse Technology Pte. Ltd.	Careverse CoronaryDoc	K251656	Expert readers	Fully-automated; Web-based software	Stenosis severity; vessel volume; lumen volume; total plaque volume; calcified plaque volume; non-calcified plaque volume; low-density non-calcified plaque volume.
Canon Medical Informatics, Inc.	CT SUREPlaque	K071331	FDA quantitative validation evidence not available	Semi-automated; Local or central server	Plaque volume; plaque burden; lumen area; wall area; calcified vs non-calcified plaque; remodeling.
Caristo Diagnostics Ltd	CaRi-Plaque	K242240	Expert readers	Semi-automated; Web-based software-only application	Total plaque burden; calcified plaque volume; total plaque volume; non-calcified plaque volume; low-density non-calcified plaque volume; remodelling index; maximum diameter stenosis; maximal area stenosis; vessel profile; lumen profile; vessel, plaque, and lumen segmentation
Circle Cardiovascular Imaging Inc	cvi42 Coronary Plaque	K251027	Expert Readers	Semi-automated; local software	Calcified plaque volume; non-calcified plaque volume; low-attenuation plaque volume; calcified plaque burden; non-calcified plaque burden; low-attenuation plaque burden; total plaque burden; remodelling index; diameter-based stenosis; area-based stenosis; lesion

					length; distance measurements (vessel, lesion, length).
Cleerly, Inc	Cleerly Plaque	K261210; K242338; K202280	Expert Readers	AI-based automated analysis, central server	Total plaque volume; calcified plaque volume; non-calcified plaque volume; low-attenuation plaque volume; vessel volume; lumen volume; percent atheroma volume; stenosis; remodelling index; coronary report.
Elucid Bioimaging, Inc.	PlaquelQ	K261855; K241524	Histopathology	Cloud-based software application	Total plaque volume; calcified plaque volume; non-calcified plaque; lipid-rich necrotic core; plaque burden; stenosis.
GE HealthCare	Advanced Vessel Analysis II; CardIQ Suite; CardIQ Xpress Pro; CardIQ Xpress Elite; CardIQ Xpress Reveal	K253770; K073138; K120910		Semi-automated, local machine	Plaque characterization and vessel analysis; quantitative plaque metrics vary by software version
Heartflow	Plaque Analysis	K213857; K250902	Expert Readers. IVUS	Semi-automated; central server	Total plaque volume; non-calcified plaque volume; calcified plaque volume; low-attenuation plaque volume; stenosis severity; total plaque percentile; plaque stage
Keya Medical Technology Co., Ltd.	DeepVessel Plaque (DVPlaque)	K260497	Expert Readers	Semi-automated; Web-based application	Vessel, plaque and lumen segmentation; total plaque volume; calcified plaque volume; non-calcified plaque volume; low-density non-calcified plaque volume; non-calcified plaque burden; low-density non-calcified plaque burden; calcified plaque burden; total plaque burden; diameter

					stenosis; minimal luminal diameter over lesion.
Medis Medical Imaging Systems	QAngio CT	K062386	Expert Readers. IVUS	Semi-automated, central server	Plaque characterization and vessel analysis.
Philips	CT Cardiac Plaque Assessment; AV Cardiac CT	K092747; K260169	Expert Readers	Semi-automated, local machine	Coronary artery centerline, major vessel labelling, lumen segmentation, stenosis, plaque assessment
Siemens Healthineers	syngo.via CT Coronary Analysis; syngo.CT Coronary Cockpit	K173637; K253786	Expert Readers	Semi-automated, local machine	Total plaque volume; calcified plaque volume; non-calcified plaque volume; low-density non-calcified plaque volume; remodeling index; stenosis;

There are additional differences between software vendors to consider when selecting a system for clinical implementation. Some software solutions may be compatible only with certain CT imaging systems. Output devices and format may differ slightly between vendors; however, most supported output devices are CT workstations, PACS, and RIS using DICOM structured report and secondary capture. Deployment options may differ slightly such as a standalone computer, virtual machine, or add-on module to PACS. Plaque quantitation software systems may also be an integrated product combined with AI-assisted detection.

Software validation activities follow the FDA guidance document, “Content of Premarket Submissions for Device Software Functions – Guidance for Industry and Food and Drug Administration Staff” Available at <https://www.fda.gov/media/153781/download>.

9. Data Workflow:

Informatics teams are critical for effectively implementing coronary artery plaque quantification into the clinical workflow. Ideally they integrate plaque quantification software tools into the clinical interpretation process and ensure seamless transfer of QIB data into structured radiology reports, the electronic health record (EHR), and downstream clinical decision support systems. Informatics teams should oversee system interoperability, user authentication, data security, software updates, and quality assurance to ensure reliable and reproducible quantitative measurements across clinical sites.

Vendors are key stakeholders in the implementation of quantitative plaque assessment. Their collaboration with, and understanding of, clinical teams, information technology departments, and imaging specialists can ensure software compatibility with institutional infrastructure and facilitate frictionless integration into existing clinical workflows. Vendor support is also important for software validation, version control, algorithm updates, cybersecurity, and maintenance of regulatory compliance. Conversely, vendors need to know the informatics protocols and requirements of healthcare systems for effective integration. This latter is an area where common standards, such as IHE (Integrating the Healthcare Enterprise) Profiles can be of immense help. However this requires adoption of the IHE Profile both the Vendor and the local informatics system. Often these standardized communication protocols are not available unless requested at purchase or during installation.

Plaque quantification applications are typically deployed within institutional firewalls or secure cloud environments that comply with applicable privacy and cybersecurity requirements. Communication between systems is generally performed using DICOM standards for image transfer and structured imaging objects, HL7 messaging for workflow coordination, and increasingly Fast Healthcare Interoperability Resources (FHIR)-based interfaces for integration with enterprise clinical information systems. Regardless of the application location, it is necessary to orchestrate the flow of information between the CT scanner, PACS, RIS, and vendor software.

Ideally following coronary CT angiography acquisition, reconstructed images are automatically routed from the scanner or PACS to the plaque analysis platform using predefined DICOM routing rules. Prior to plaque quantification, the software performs automated image preprocessing, which may include coronary artery extraction, centerline generation, lumen and vessel wall segmentation, motion correction, image quality assessment, and identification of coronary artery branches. Most commercially available platforms incorporate artificial intelligence and machine learning algorithms to automate these steps, although many retain semi-automated editing capabilities that allow users to modify vessel centerlines, lumen contours, vessel wall boundaries, or plaque segmentations. Automated quality-control algorithms may identify examinations with excessive motion artifact, severe image

noise, heavy coronary calcification, inadequate contrast opacification, or incomplete coronary visualization that could adversely affect quantitative measurements.

Following segmentation, the software identifies individual plaque lesions and quantifies plaque characteristics using either attenuation-based classification methods, histology-informed tissue characterization, or proprietary machine learning algorithms, depending on the software platform. Quantitative outputs commonly include patient- and vessel-level QIBs, including quantitative plaque volumes, percent plaque volume or plaque burden. Many platforms also identify high-risk plaque features and generate visual displays that include curved multiplanar reformations, cross-sectional vessel images, three-dimensional coronary artery renderings, and color-coded plaque maps.

Following analysis, quantitative results are transmitted back to the PACS and RIS, where they can be reviewed alongside the original CCTA images during image interpretation. Depending on the software platform, quantitative results may be stored as DICOM Structured Reports (DICOM SR), DICOM secondary capture images, encapsulated PDF reports, or proprietary structured data objects. Many institutions also map selected quantitative metrics into structured radiology reporting templates and enterprise data repositories, enabling incorporation into the finalized radiology report and facilitating clinical decision support, quality improvement initiatives, registry participation, and longitudinal outcome research.

Some plaque quantification software platforms reside directly on the CT scanner workstation or an on-premises image-processing workstation to allow local image analysis. Hybrid deployment models are also increasingly common, in which computationally intensive image processing is performed on secure vendor servers while quantitative results and annotated image series are returned to local enterprise imaging systems.

Regardless of the deployment architecture, successful implementation requires standardized acquisition protocols, reliable image routing, robust interoperability between imaging and information systems, quality-control procedures, and efficient integration into the radiologist's clinical workflow to minimize interpretation time while maximizing the clinical utility of quantitative plaque assessment.

10. Information on context of QIB for both general nature and specific exam: reliability, confidence intervals, and quality control:

A. Reliability and Confidence Intervals

Repeatability describes the agreement between measurements taken on the same subject over a short period of time using the same imaging methods, whereas

reproducibility describes the agreement between measurements taken on the same subject but with different imaging methods (e.g. different vendors, analysis software) [19]. These are critical component in a biomarker's technical performance capability, establishing the basis for the biomarker to diagnose, prognose, assess change over time, and monitor the effects of interventions.

The repeatability (RC) and reproducibility coefficients (RDC) are metrics used to describe a biomarker's precision. Differences between two serial measurements in the range of $-RDC_{0.95}$ to $+RDC_{0.95}$ are interpreted as differences expected due to measurement variability with some level of confidence (usually 95%), whereas differences outside the range are likely not due to measurement variability and might represent a biological change [20].

Repeatability and reproducibility can be assessed by comparing output from an initial and second scan run on the same subject usually a few days apart so that no biological change occurs between scans (i.e. test-retest design) using the same or different imaging methods at the two time points. Variability between repeat measurements on the same subject can be quantified by the within-subject standard deviation (wSD) or the within-subject coefficient of variation (wCV), from which the RC or RDC can be derived. Factors that may affect precision, such as the magnitude of the plaque burden, should be assessed and reported. A lower 95% confidence bound for the RDC allows one to understand the uncertainty in the precision estimate. A sample size of 35 subjects or more for the test-retest study typically provides a reliable estimate [21].

Meah et al [22] reported on the within-subject test-retest repeatability of plaque volumes among patients with multivessel disease. From their study of 20 patients, imaged twice within 2 weeks, the estimated RC was 495.7mm^3 for total plaque, 413.4mm^3 for non-calcified plaque, 205.2mm^3 for calcified plaque, and 13.1mm^3 for low-attenuation plaque.

There have been several studies looking into the inter-reader variability (i.e. one component of the total variability). Buckler et al[16] reported on the inter-reader standard deviation of several plaque morphology measurements, including plaque burden as 0.5. Meah et al report the inter-reader standard deviation for multivessel disease patients as 194mm^3 (~10%) for total plaque, 187mm^3 for non-calcified plaque (~11%), 24mm^3 for calcified plaque (~8%), and 4mm^3 for low-attenuation plaque (29%). Kim et al[23] reported much lower estimates of inter-reader variability of AI-assisted measurements of total plaque volume (CV=3.1%), calcified plaque volume (5.7%), and noncalcified plaque volume (3.9%), noting that the inter-reader variability increases with higher plaque volumes.

B. Quality Control

The measurements made for plaque analysis involve both the pixel value and pixel dimensions. Quality control for these parameters typically involves assessment of the CT number accuracy for known test objects and the accuracy of spatial measurements (e.g., in plane distance and slice thickness). These are standard measurements for scanner performance testing, which occurs at the time of installation, after a major repair, and on

a pre-determined schedule to comply with regulatory and accreditation requirements. Thus, a scanner that has been tested and approved for clinical use can be assumed to have adequately accurate CT numbers and spatial dimensions.

These quality controls tests, however, utilize relatively large test objects, on the order of several centimeters. The ability to accurately segment and measure small objects, such as coronary plaques, is dependent on the sharpness of the reconstruction algorithm and the presence or absence of edge enhancement features. Small (e.g., several millimeters) test objects (e.g., calcium hydroxyapatite cylinders) can be used to represent calcifications of known dimensions and density to confirm the ability to accurately measure calcified plaques. Other materials can be used to simulate non-calcified plaques.

However, simple test objects typically are not segmented correctly by automated software, which expects objects that look like coronary arteries. Thus, it is difficult to use simple test phantoms to assess automated segmentation and measurement tools. Ongoing work in the field seeks to use 3-D printed coronary arteries of known size and composition as test objects to assess the accuracy and reproducibility with which automated software tools can measure coronary plaques.

11. Standardize Protocol for Reporting:

Quantitative plaque analysis reports should include total coronary tree and vessel-level information. Recommended biomarkers for standardized reporting are TPV, total NCPV, total CPV, and total LAPV. NCPV, CPV and LAPV should be reported as an absolute volume and as a percentage of TPV. Length of coronary vessels analyzed should be disclosed. Any coronary segments excluded should be noted.

Additionally, the report should include similar vessel-level information for the left main, left anterior descending, left circumflex and right coronary arteries, preferably with representative images.

Vendor specific data should include name of software, image analysis mode and quality assessment, scanner /kVp information, and smallest coronary vessel diameter included (e.g. 2mm or 1.5mm).

Example of a basic report is seen on figure 3.

12. Interpreter qualifications:

Interpretation of quantitative coronary plaque analysis (QCPA) from CCTA requires advanced expertise beyond routine assessment of CT tomographic imaging and angiographic coronary stenosis. Physicians responsible for clinical interpretation should have formal training in cardiac CT, typically meeting Society of Cardiovascular Computed Tomography (SCCT), North American Society of Cardiovascular Imaging or American College of Radiology competency standards for independent CCTA interpretation. Such training provides the knowledge necessary to evaluate image quality, coronary anatomy, recognize technical artifacts, understand plaque segmentation methods, and appreciate the strengths and limitations of quantitative plaque software platforms.

Radiologists and cardiologists interpreting QCPA should be proficient in the characterization of coronary atherosclerosis, including the assessment of total plaque volume, calcified and non-calcified plaque burden, low-attenuation plaque, positive remodeling, and other high-risk plaque features associated with adverse cardiovascular outcomes. They must also be familiar with standardized reporting systems, such as CAD-RADS 2.0, and understand how quantitative plaque measurements complement traditional stenosis assessment in clinical decision-making and risk stratification.

In addition to technical and imaging expertise, interpreters must be able to integrate quantitative plaque findings with the patient's clinical history, cardiovascular risk factors, symptoms, and other imaging results. Although automated software can generate plaque metrics, physician oversight remains essential because measurement accuracy may be affected by image quality, motion artifacts, calcification, and software-related variability. Therefore, quantitative plaque analysis is best interpreted by cardiovascular imagers with dedicated training and experience in advanced cardiac CT, CAD disease evaluation, and quantitative image analysis.

13. List of stakeholders for implementation:

Successful implementation of quantitative coronary atherosclerosis assessment requires coordinated engagement across a broad, multidisciplinary network, with each stakeholder contributing essential expertise to guide protocol development and adoption.

A. Cardiac Imaging Experts

Cardiac imaging experts are integral to the integration of quantitative CCTA measures into clinical practice, and they are critical to demonstrating how quantitative metrics can enhance interpretation of CCTA findings. This is especially true when CCTA results are interpreted alongside complementary cardiac imaging modalities—such as functional assessments, echocardiography, or cardiac MRI—creating opportunities for experts' deep knowledge of cardiac anatomy, physiology, and multimodality imaging to contextualize quantitative plaque characterization and stenosis metrics. Their comprehensive understanding is essential for interpreting how quantitative outputs relate to clinically meaningful structural or functional changes (e.g., progression or stabilization of atherosclerotic plaque; imaging correlates that suggest alternative causes of chest pain or ischemia; or findings that may influence downstream management decisions, including preventive therapy selection or planning for revascularization).

B. Clinical Cardiologists

Clinical cardiologists are essential to integrating quantitative CCTA into patient care because of their central role in correlating imaging findings with symptoms, risk factors, comorbidities, and management decisions. Their expertise in evidence-based cardiovascular guidelines enables translation of qualitative and quantitative plaque measures into targeted clinical therapies, such as lipid-lowering or antiplatelet regimens

as well as referral for functional testing or revascularization. Quantitative assessment of CCTA provides objective metrics that refine risk stratification and support guideline-directed medical therapy, particularly in patients with non-obstructive or subclinical atherosclerosis where treatment has been variable. By guiding how quantitative imaging is incorporated into clinical pathways, cardiologists ensure that quantitative CCTA meaningfully informs personalized prevention and treatment strategies and promotes more consistent, evidence-aligned care.

C. PCPs

Primary care practitioners are often the first point of contact for primary prevention patients with cardiovascular risk factors, facilitating early identification, risk stratification, and ongoing management of at risk individuals. In these roles, they coordinate diagnostic evaluations (including specialty referrals) and support longitudinal follow-up as patients progress through preventive and therapeutic pathways. In rural and other resource-limited settings, primary care practitioners may play an outsized role in the assessment and management of cardiac risk. Accordingly, it is important that PCPs understand the clinical utility, interpretation, and limitations of quantitative information derived from CCTA, and that they are engaged in the development and dissemination of appropriate-use recommendations to guide clinical practice. “Add something about the language in the reports that could be interpreted by nonspecialists”

D. Imaging scientists

Imaging scientists are essential for ensuring that CCTA acquisition, processing, and quantitative analysis methods are robust, reproducible, and clinically meaningful. By partnering with cardiac imaging specialists and technologists, they help translate complex quantitative output into clinically useful cardiovascular risk assessment. Their expertise in algorithm development, workflow optimization, and validation maintains high data quality across scanners, sites, and software platforms. In addition, their expertise in training, quality assurance, and innovation supports reliable quantitative imaging workflows and the integration of emerging technologies, including advanced computational modeling, AI, and machine learning. Together, these contributions enable the effective clinical translation and sustained adoption of plaque quantification with CCTA.

E. Informaticists

Informaticists are essential to integrating CCTA outputs into PACS, electronic health records, and research databases, and to developing decision-support tools that align imaging results with evidence-based cardiovascular guidelines. Their involvement enables automated, reproducible workflows and structured reporting, ensuring that quantitative CCTA data are consistently captured and clinically actionable. By building reliable data pipelines and supporting advanced analytics, informaticists will help drive both the clinical adoption quantitative coronary imaging.

F. Technologists /physicists

Technologists serve as the operational backbone of the imaging workflow, ensuring consistency across scans, troubleshooting technical issues, and maintaining safety standards. Their precision in patient preparation, scanner calibration, and protocol adherence directly impacts image quality and the reliability of quantitative metrics. For these reasons, technologist engagement in implementation efforts is essential to generate reproducible and clinically actionable results. As frontline professionals, their insight and experiences are also essential to iteratively improve enhance workflow efficiency, optimize patient experience, and support clinical rollout.

G. Patient advocates

Patients, family caregivers, healthcare organizations, and advocacy groups play a key role in shaping the demand for and use of diagnostic and therapeutic approaches. Their perspectives throughout the development and implementation of new technologies are essential to ensure that quantitative coronary plaque CT methods are aligned with patient needs, support informed treatment choices, and broaden equitable access to care. Consistent involvement of patient advocates also helps strengthen education for clinicians, patients, and care partners about the value and limitations of quantitative CCTA–based plaque assessment, ultimately supporting shared decision-making and more patient-centered cardiovascular care.

H. Insurance providers

Insurance providers and other payers play a major role in determining access and reimbursement, ultimately shaping the affordability and availability of advanced cardiovascular imaging technologies. For this reason, it is important to clearly communicate how broader adoption of quantitative CCTA plaque analysis can enhance diagnostic precision, support more accurate therapeutic decisions (including initiating, intensifying, or discontinuing specific preventive therapies), and improve patient outcomes—while potentially lowering long-term healthcare costs associated with unmanaged or advanced coronary artery disease. Engagement of payers, alongside other key stakeholders, is also critical in establishing transparent and equitable coverage policies that ensure patients have timely access to quantitative coronary imaging when clinically appropriate.

I. Vendors

Vendors are essential to implementing quantitative CCTA, supplying scanner platforms, post-processing tools, and technical support, with quantitative software companies playing a central role in ensuring plaque measurements are accurate, reliable, and

compliant with regulatory requirements. Close collaboration among software developers, scanner manufacturers, and clinical teams supports interoperable tools that integrate smoothly into workflows, while ongoing training and product refinement enables dependable, scalable use of quantitative CCTA in routine care.

14. Regulatory considerations: FDA-approved biomarkers:

FDA regulatory oversight of quantitative plaque analysis on CCTA applies primarily to the software device and its intended use, rather than to individual biomarkers. FDA-cleared plaque analysis platforms are reviewed as medical devices, often through the 510(k) pathway, and must demonstrate that they can accurately and reliably quantify coronary atherosclerotic plaque from CCTA examinations.

The software may generate multiple quantitative outputs, including total plaque volume, calcified and non-calcified plaque volume, low-density plaque volume, plaque burden, and stenosis severity. These measurements are considered outputs of the FDA-cleared device and are included within the device's approved functionality.

Importantly, FDA 510k clearance does not necessarily mean that a specific biomarker threshold is independently validated as a predictor of clinical outcomes. Rather, the FDA evaluates the software's performance in generating these measurements, typically the correlation measurements to expert readers, and displaying them for clinical use. Any claims regarding prognosis, risk prediction, or treatment guidance require separate clinical evidence and must be supported within the device's labeling and intended-use statement.

15. Reimbursement considerations:

Reimbursement for CT coronary plaque quantification in the United States initially relied on Category III CPT codes (0623T–0626T), which were introduced to cover automated plaque quantification and characterization. These temporary codes reimbursed the technical and professional components of preparing the imaging data, performing AI-based analysis, and generating a final interpretive report. Payments were often determined by regional Medicare Administrative Contractors. Expanding clinical evidence and AI automation drove a broader adoption of plaque analysis as part of CCTA workflows. On January 1, 2026, the service transitioned to a permanent Category I CPT code, 75577, establishing national reimbursement rates and broadening payer acceptance. Medicare has finalized both Physician Fee Schedule and Hospital Outpatient Prospective Payment System reimbursement, with physician-office payments exceeding \$1,000 and hospital outpatient payments set at \$950.50. Major commercial insurers now also cover AI-enabled plaque analysis under the new Category I code, greatly expanding access.

CCTA plaque analysis is typically performed as an advanced assessment after a clinically indicated CCTA. Because it is considered an add-on service, coverage

generally depends on whether the underlying CCTA meets medical necessity requirements and has received any required prior authorization.

Many health plans, including government-sponsored programs, recognize AI-enabled quantitative plaque analysis as medically necessary when the following criteria are met: The patient has symptoms suggestive of coronary artery disease, such as stable chest pain or shortness of breath; The patient is considered low- to intermediate-risk for coronary artery disease.; A medically necessary CCTA has been completed and interpreted; The CCTA findings indicate intermediate-risk disease (e.g., mild to moderate plaque burden or CAD-RADS 1–3). Initial cardiac evaluation is negative or inconclusive for acute coronary syndrome.

Note that this test is not covered for routine screening or in asymptomatic individuals. Interestingly, CACS is also poorly reimbursed and is often paid out of pocket rather than with insurance coverage.

16. Workflow for Pre-approval and scheduling:

Prior authorization requirements vary by health plan. Some plans require pre-approval for both the CCTA and the plaque analysis service. Others require authorization only for the underlying CCTA. In certain cases, coverage may be available without separate authorization for the plaque analysis if clinical criteria are satisfied. Final coverage decisions depend on the patient's specific benefit plan and applicable utilization management policies.

As a general rule, there should be no need to schedule an additional patient appointment for the purpose of AI plaque quantification analysis. However, the order for the additional service must be submitted by the referring provider after the CCTA has been performed and results of the CTA, together of clinical presentation, meet criteria for the utilization of quantitative plaque analysis. It may be useful to have a support operational system within the imaging center to facilitate the ordering of the add on test, to create a new accession number attached to the quantitative analysis billing code, and to initiate insurance pre-approval request if required.

17. Potential timeline needed for implementation:

Implementing a quantitative CCTA plaque analysis service requires a structured approach that combines strategic planning, stakeholder engagement, technical integration, operational workflow development, and ongoing performance evaluation. Successful implementation depends on strong clinical leadership, institutional support, and collaboration across multiple departments.

The process begins with program development and business planning. An SBAR (Situation, Background, Assessment, Recommendation) communication framework can

facilitate discussions with leadership and key stakeholders. A comprehensive business plan should define the clinical rationale, anticipated patient volume, financial projections, reimbursement opportunities, and resource requirements. Securing institutional funding and executive sponsorship at an early stage helps establish the foundation for successful implementation. Identifying physician champions from both Cardiology and Radiology is also critical to driving clinical adoption.

A subsequent phase focuses on stakeholder engagement and program design. Effective implementation requires collaboration among administrators, billing and revenue cycle specialists, CT technologists, informatics and IT experts, as well as cardiologists and radiologists. Together, these teams establish governance structures, define patient eligibility criteria, develop referral pathways, and design standardized clinical and operational workflows. Early alignment among stakeholders helps ensure consistency and reduces barriers during deployment.

The next major step involves vendor selection, contracting, and technical integration. Organizations evaluate quantitative plaque analysis solutions based on clinical capabilities, workflow integration, regulatory compliance, and operational requirements. Technical teams then integrate the selected platform with existing imaging systems, electronic health records, image transfer workflows, and reporting tools. Comprehensive testing and validation are essential to confirm image quality, data transfer reliability, and reporting accuracy before clinical use.

Attention then shifts to billing, prior authorization, and staff education. Reimbursement strategies and payer requirements are reviewed to establish efficient authorization and billing processes. Scheduling, billing, and authorization personnel receive training on coverage criteria and documentation requirements. Physicians, technologists, and support staff are educated on patient selection, imaging protocols, ordering workflows, interpretation, and reporting standards. Standard operating procedures and reporting templates are finalized to support consistent clinical practice.

Prior to broad deployment, organizations often conduct a pilot implementation to assess workflow efficiency, turnaround times, provider adoption, and reimbursement performance. Lessons learned during the pilot are used to optimize processes and address operational challenges.

Following successful pilot testing, the service can be expanded to full clinical operations. Ongoing multidisciplinary oversight supports quality assurance, utilization monitoring, financial performance, and continuous improvement. Formal post-launch evaluations should be conducted to assess clinical utilization, operational effectiveness, provider satisfaction, reimbursement outcomes, and overall program sustainability. These evaluations help demonstrate the clinical and economic value of quantitative plaque analysis while identifying opportunities for further optimization and growth.

18. Gaps or barriers and potential solutions in technology, motivation and resources for implementation:

Technology/software: Certain technological barriers limit widespread acceptance and implementation of coronary plaque quantification in clinical practice. First, various CT parameters, including tube voltage, tube current, and kernel sharpness can influence quantification of plaque and its phenotypes [17]. Photon counting CCTA adds additional technologic complexity to these measurements. Routine CCTA protocols are not standardized across patients nor across vendors and this will affect initial plaque measurements as well as reproducibility if follow-up measurements are obtained. Second, increasing image noise may overestimate plaque measurements even when plaque is not present. As stated previously, optimizing patient and CCTA parameters that include highest resolution imaging and reconstruction parameters, such as iterative reconstruction techniques, may reduce noise while balancing radiation dose. Avoiding plaque analysis in CCTA scans without visible plaque may also be prudent. Overall, striving for consistent CT parameters and potentially standardizing protocols across vendors is a broad but a penultimate goal, especially for repeat measurements. Third, knowing whether adjustments for coronary size or evaluable length versus a simple volumetric analysis is required for standardization between patients or for risk stratification is unclear. Finally, patient risk categorization based on plaque volume, whether it be a continuous or threshold variable, varies across vendors is largely derived from expert opinion at present. Greater standardization of risk stratification thresholds across patient populations and vendors are ongoing and critical to inform patient prognosis and treatment options.

Clinician Adoption: Clinicians may be hesitant to adopt plaque quantification for several reasons. The Agatston coronary artery calcium scoring provides a widely available, easier, less expensive, reproducible and validated method for quantifying plaque. Recent studies suggest that there may be incremental benefit of advanced plaque analysis but more data are needed. Clinicians may question whether the incremental prognostic value of advanced plaque phenotyping justifies its cost and complexities for routine use. In addition, uncertainty persists regarding how best to incorporate plaque quantification data into clinical decision-making beyond qualitative plaque luminal stenosis assessment. At present, treatment recommendations based on plaque staging are largely derived from expert consensus rather than high-quality trial evidence. Accordingly, prospective clinical trials are needed to determine whether plaque quantification and phenotyping improve decision-making and clinical outcomes compared with standard CCTA reporting. Ongoing trials to address these limitations include SCOT HEART2 (ClinicalTrials.gov ID: NCT03920176), TRANSFORM (ClinicalTrials.gov ID: NCT06112418), and PARAMOUNT (ClinicalTrials.gov ID: NCT06713239).

Resources: While insurance coverage for plaque quantification is increasing, there is inconsistency across payers and regions and that may represent a barrier to broader adoption. Further research is also needed to evaluate the cost-effectiveness of plaque

quantification, both at baseline as well as repeated imaging, to support uniform reimbursement policies.

19. Future goals for the QUIC Cardiovascular Disease Group

The current roadmap represents an important initial step toward widespread clinical integration of quantitative coronary plaque assessment using CCTA. To support continued advancement of the field, the QUIC Group has identified several priority areas where further research, validation, and implementation efforts are warranted. These recommendations are intended to guide future work by the broader cardiovascular imaging community.

Implementation of Coronary Plaque Quantification in Clinical Practice: As quantitative plaque analysis becomes increasingly available, there is a need to better understand its adoption in routine clinical care. The QUIC Group recommends future investigations assessing variability in software platforms, analysis workflows, reporting practices, and clinical applications across institutions. Such efforts could also evaluate barriers and facilitators to implementation, including workflow integration, training requirements, reimbursement considerations, and standardization challenges. Improved understanding of current practice patterns may help inform future educational initiatives and implementation strategies.

Quantitative Plaque Imaging for Cardiovascular Risk Assessment: The QUIC Group recommends studies evaluating how quantitative plaque metrics, including total plaque burden, noncalcified plaque volume, low-attenuation plaque burden, and adverse plaque characteristics, can be incorporated into existing risk assessment frameworks. Additional work is needed to establish clinically meaningful thresholds and determine how these biomarkers may support more personalized approaches to preventive cardiovascular care.

Longitudinal Assessment of Atherosclerosis Progression and Treatment Response: Quantitative plaque imaging offers the potential to monitor changes in coronary atherosclerosis over time. Future research should explore the role of serial CCTA examinations in assessing plaque progression and regression, particularly in response to lipid-lowering therapies, lifestyle interventions, and emerging cardiovascular treatments. Further studies are needed to establish reproducible methodologies, define expected rates of disease progression, and identify imaging biomarkers that are most strongly associated with therapeutic response and clinical outcomes.

Standardization, Validation, and Clinical Impact: This QUIC roadmap is a step towards developing harmonization of acquisition protocols, plaque definitions, quantitative metrics, and reporting practices across institutions and software platforms. The QUIC Group recommends collaborative efforts to validate these measurements in diverse patient populations and clinical settings. In addition, future outcomes research should evaluate the impact of quantitative plaque information on clinical decision-making, preventive therapy utilization, patient outcomes, and healthcare value. Such evidence will be essential for supporting broader implementation and informing future clinical practice guidelines.

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Figures and Captions:

Figure 1. Curved reformation from CCTA shows examples of patients with different coronary plaque burden as described in the CAD-RADS 2 document. A. Mild burden with left anterior descending (LAD) lesion. B. Moderate burden with multiple areas of plaque in the LAD, left main coronary artery and proximal circumflex coronary artery. C. Severe burden with plaque in 3 different coronary vessels. Adapted from Cury RC, Leipsic J, Abbara S, et al. Radiol Cardiothorac Imaging. 2022 Sep 22;4(5):e220183[13].

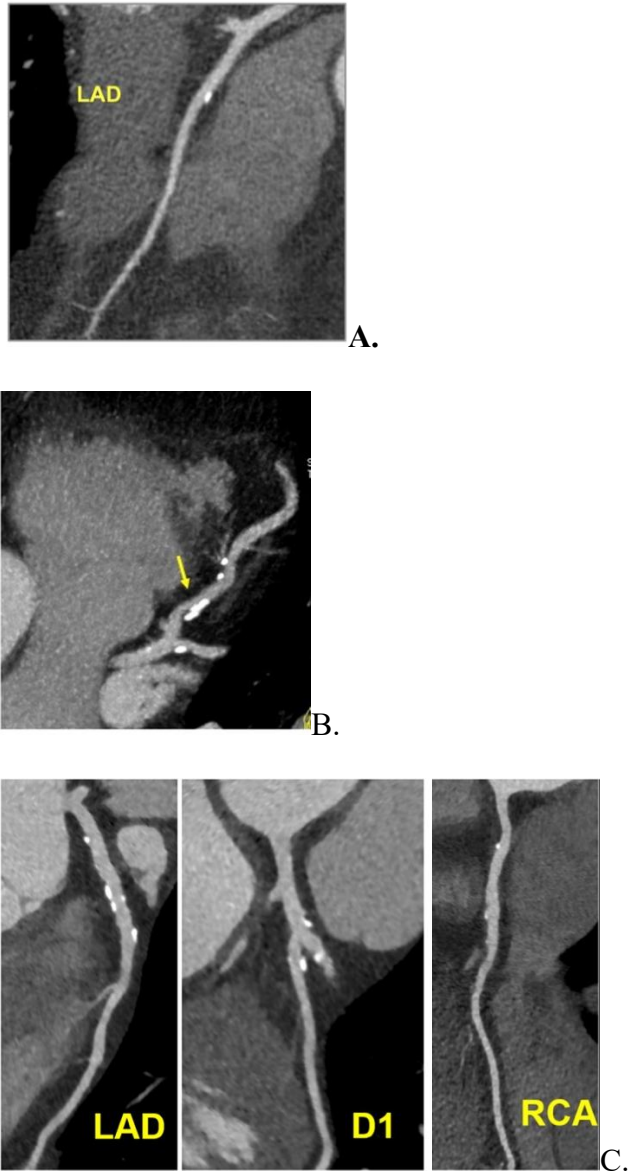


Figure 2. Example of software display showing straightened curved reformations of a coronary artery with segmentation of coronary artery plaque based on different CT density thresholds.

Adapted from Jukema RA, Blanke P, Khoo JK, et al. Radiol Cardiothorac Imaging, 2025. 7(5): p. e240568.

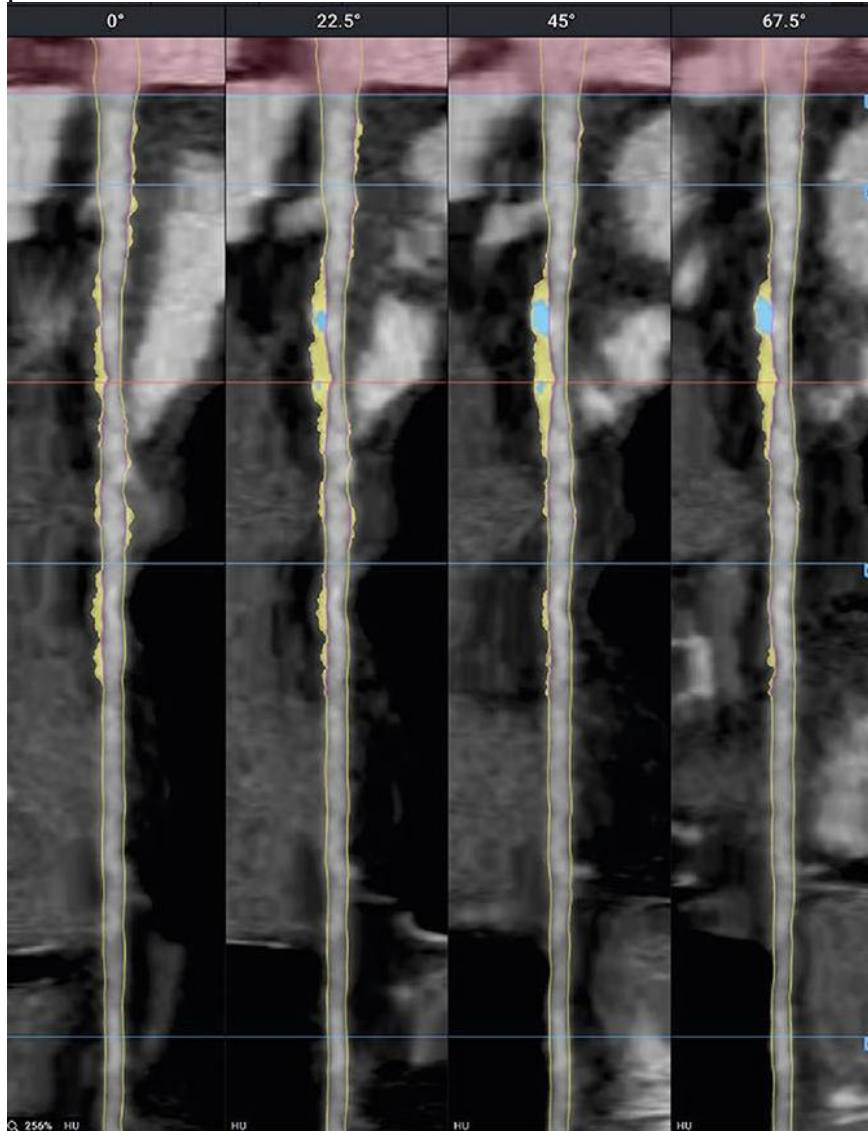


Figure 3. Example of a generic Standardized Coronary Atherosclerotic Plaque Quantification Report.

Patient: John Doe

Study Date: October 8, 2026

Analysis Information

Parameter	
Software Platform	Software name
Vendor	Vendor name
Analysis Mode	Fully Automated with Expert Review
Quality Assessment	High Quality
CT Scanner	320-row detector CT
Tube Voltage	100 kVp
Slice Thickness	0.5 mm
Reconstruction Kernel	Standard Cardiac
Minimum Vessel Diameter Included	≥ 2.0 mm
Numbers of segments excluded	3
Length of vessel analyzed	157mm

Overall Coronary Plaque Burden

Parameter	Volume (mm ³)	% of TPV
Total Plaque Volume (TPV)	685	100.0
Non-Calcified Plaque Volume (NCPV)	425	62.0
Calcified Plaque Volume (CPV)	235	34.3
Low-Attenuation Plaque Volume (LAPV)	25	3.6

Vessel-Level Plaque Distribution

Vessel	Total Plaque Volume	Non-Calcified Plaque	Calcified Plaque	Low-Attenuation Plaque
LM	35 mm ³ (5.1%)	25 mm ³ (3.6%)	10 mm ³ (1.5%)	2 mm ³ (0.3%)
LAD	360 mm ³ (52.6%)	240 mm ³ (35.0%)	105 mm ³ (15.3%)	15 mm ³ (2.2%)
LCX	135 mm ³ (19.7%)	90 mm ³ (13.1%)	40 mm ³ (5.8%)	4 mm ³ (0.6%)
RCA	155 mm ³ (22.6%)	70 mm ³ (10.2%)	80 mm ³ (11.7%)	4 mm ³ (0.6%)