

Improving Cardiovascular Risk Assessment in Patients with Isolated LDL and Non-HDL Cholesterol Elevation Through Clinician Education: A Primary Care Quality Improvement Study

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Abstract

Original Research Article

Cardiovascular disease (CVD) remains a leading cause of morbidity and mortality worldwide, making early identification and modification of cardiovascular risk factors a priority in primary care. During routine clinical practice, patients with isolated elevations in low-density lipoprotein (LDL) cholesterol or non-high-density lipoprotein (non-HDL) cholesterol, despite normal total cholesterol levels, were identified as a potential group at risk of being overlooked for comprehensive cardiovascular risk assessment. This quality improvement study evaluated whether a targeted educational intervention could improve clinician recognition and interpretation of these lipid abnormalities and increase the appropriate use of QRISK3 as part of cardiovascular risk assessment. A retrospective audit was undertaken in an NHS general practice in England. Baseline practice and clinician knowledge were assessed through retrospective record review and an anonymous questionnaire completed by six clinicians. Following a structured educational session and practical decision-support crib sheets, an identical re-audit was undertaken one year later. Following the intervention, documented QRISK3 assessment improved from 5.6% to 88%, while clinicians reported greater confidence in interpreting complete lipid profiles. The findings suggest that a simple educational intervention can improve clinician adherence to cardiovascular risk assessment within routine primary care in cardiovascular risk assessment and may help reduce missed opportunities for primary prevention in primary care.

Keywords: Cardiovascular disease, QRISK3, LDL cholesterol, non-HDL cholesterol, cardiovascular risk assessment, primary care, quality improvement, lipid management.

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INTRODUCTION

Cardiovascular disease (CVD) remains one of the leading causes of morbidity and mortality worldwide, accounting for an estimated 17.9 million deaths annually and representing a substantial burden on healthcare systems worldwide (World Health Organization, 2021). In England, CVD accounts for approximately one in four deaths (Office for Health Improvement and Disparities, 2019) and remains a leading cause of premature mortality despite significant advances in prevention and treatment. Consequently, reducing cardiovascular risk through earlier identification and management of modifiable risk factors remains a major priority within primary care.

Comprehensive cardiovascular risk assessment enables clinicians to identify patients who may benefit from lifestyle modification and, where appropriate, lipid-

lowering therapy. The National Institute for Health and Care Excellence (NICE) recommends estimating 10-year cardiovascular risk using QRISK3 when undertaking cardiovascular risk assessment in adults without established cardiovascular disease, allowing treatment decisions to be guided by an individual's overall cardiovascular risk rather than isolated biochemical measurements (National Institute for Health and Care Excellence [NICE], 2023).

Assessment of the complete lipid profile forms an important component of cardiovascular risk evaluation. Although total cholesterol has traditionally been used as an initial marker of dyslipidaemia, current practice recognises the importance of interpreting low-density lipoprotein (LDL) cholesterol and non-high-density lipoprotein (non-HDL) cholesterol alongside the overall cardiovascular risk profile. The British Heart Foundation identifies healthy lipid concentrations as

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total cholesterol ≤ 5.0 mmol/L, LDL cholesterol ≤ 3.0 mmol/L and non-HDL cholesterol ≤ 4.0 mmol/L in healthy adults (British Heart Foundation, 2024). These values represent healthy reference ranges and support interpretation of lipid results; they should not be interpreted as independent treatment thresholds. Rather, abnormal lipid fractions should prompt clinicians to consider a patient's overall cardiovascular risk and undertake further assessment in accordance with NICE guidance.

Electronic health record (EHR) systems have become integral to modern primary care and have improved patient safety through automated alerts, clinical templates and decision-support tools (Carayon et al., 2020). However, EHR design may also influence clinician behaviour by directing attention towards visually highlighted results and electronic prompts. Within many laboratory reporting systems, abnormal total cholesterol values are more visually prominent than isolated abnormalities in LDL or non-HDL cholesterol. In busy clinical environments, this may inadvertently encourage clinicians to focus on highlighted laboratory abnormalities rather than systematically interpreting the complete lipid profile, potentially contributing to variation in cardiovascular risk assessment.

During routine clinical practice within our general practice, it was observed that patients with isolated elevations in LDL or non-HDL cholesterol, despite normal total cholesterol concentrations, did not consistently undergo documented QRISK3 assessment. Informal discussions with clinicians suggested that cardiovascular risk assessment was frequently prompted by abnormal total cholesterol values or electronic laboratory alerts rather than systematic interpretation of all lipid parameters. This raised the possibility that patients with isolated abnormalities in LDL or non-HDL cholesterol represented a subgroup at risk of being overlooked for comprehensive cardiovascular risk assessment.

Although NICE provides comprehensive guidance on cardiovascular risk assessment and lipid modification, there is limited published evidence examining whether isolated elevations in LDL or non-HDL cholesterol are consistently recognised within routine UK primary care or whether simple educational interventions can improve clinician recognition and interpretation of these lipid abnormalities. This project therefore sought to address a locally identified gap in clinical practice through a structured quality improvement intervention.

Aim

To improve clinician recognition and interpretation of isolated LDL and non-HDL cholesterol abnormalities and increase the appropriate use of QRISK3 as part of comprehensive cardiovascular risk assessment through a targeted educational intervention.

Objectives

The objectives of this quality improvement project were:

1. To determine the proportion of eligible patients with isolated elevations in LDL or non-HDL cholesterol who underwent documented QRISK3 cardiovascular risk assessment at baseline.
2. To evaluate clinician knowledge, confidence and current practice regarding interpretation of complete lipid profiles and cardiovascular risk assessment using an anonymous questionnaire.
3. To implement a targeted educational intervention comprising clinician teaching and practical decision-support resources to improve interpretation of lipid profiles and promote evidence-based cardiovascular risk assessment.
4. To assess the impact of the intervention by repeating the audit and clinician questionnaire using identical methodology one year later.
5. To evaluate whether improvements in clinician behaviour and documentation of QRISK3 assessment were sustained following the intervention.

MATERIALS AND METHODS

Study Design

A retrospective quality improvement study was undertaken in an NHS general practice in England with a registered practice population of approximately 10,500 patients. The project was registered locally as a quality improvement initiative and therefore did not require formal NHS Research Ethics Committee approval. The study aimed to evaluate and improve clinician recognition of isolated abnormalities in LDL and non-HDL cholesterol and increase appropriate use of QRISK3 as part of comprehensive cardiovascular risk assessment.

Clinical Standard

The project was based on recommendations from the National Institute for Health and Care Excellence (NICE) *cardiovascular disease: Risk Assessment and Reduction, Including Lipid Modification (NG238)*, which recommends assessment of overall cardiovascular risk using the QRISK3 risk prediction tool, originally developed and validated using UK primary care data (Hippisley-Cox et al., 2017) when undertaking primary prevention of cardiovascular disease. Although treatment decisions should be guided by overall cardiovascular risk rather than isolated lipid parameters, interpretation of the complete lipid profile remains an important component of cardiovascular risk assessment.

Patients were identified using LDL cholesterol ≥ 3.0 mmol/L and/or non-HDL cholesterol ≥ 4.0 mmol/L together with total cholesterol ≤ 5.0 mmol/L. These thresholds were selected using recognised healthy lipid reference values published by the British Heart

Foundation (British Heart Foundation, 2024) to identify patients with isolated lipid abnormalities for audit purposes. These values were used solely as pragmatic search criteria and were not interpreted as independent treatment thresholds or automatic indications for QRISK3 assessment. Instead, they were used to identify patients whose lipid profiles warranted further clinical review within the context of current NICE guidance (NICE, 2023).

Patient Identification

Eligible patients were identified using structured searches of the EMIS electronic health record system. Searches included adults aged over 40 years who had undergone lipid profile testing during the preceding three months.

Inclusion criteria

- Age over 40 years.
- LDL cholesterol ≥ 3.0 mmol/L and/or non-HDL cholesterol ≥ 4.0 mmol/L.
- Total cholesterol ≤ 5.0 mmol/L.
- Lipid profile performed within the previous three months.

Exclusion criteria

- Current lipid-lowering therapy.
- Established indication for secondary cardiovascular prevention.
- Patients outside the specified age range.
- Incomplete lipid profile data.

Baseline Audit

The baseline audit was conducted in May 2025. Electronic patient records were reviewed to determine whether eligible patients had undergone documented cardiovascular risk assessment using QRISK3 following identification of isolated LDL or non-HDL cholesterol abnormalities.

Data collected included:

- patient age;
- lipid profile results;
- documented QRISK3 assessment;
- evidence of cardiovascular risk discussion;

Clinician Questionnaire

An anonymous questionnaire was completed by all six clinicians working within the practice prior to the educational intervention.

The questionnaire explored five domains:

- clinician demographics and previous education;
- knowledge of QRISK3;
- interpretation of complete lipid profiles;
- current cardiovascular risk assessment practices;
- perceived barriers and facilitators to guideline implementation.

The questionnaire included a combination of multiple-choice and free-text questions to provide both quantitative and qualitative feedback regarding current clinical practice.

Educational Intervention

Following analysis of the baseline audit and questionnaire findings, a structured educational intervention was delivered to all clinicians.

The intervention consisted of:

- presentation of baseline audit findings;
- review of current NICE recommendations (NICE, 2023) regarding cardiovascular risk assessment;
- discussion of interpretation of complete lipid profiles;
- distribution of concise educational crib sheets summarising key learning points;
- group discussion addressing barriers identified through the clinician questionnaire.

The intervention focused on improving clinician recognition and interpretation of isolated LDL and non-HDL cholesterol abnormalities and encouraging appropriate use of QRISK3 within routine primary care consultations.

Re-Audit

A repeat audit was undertaken in June 2026, approximately one year after the educational intervention.

The same EMIS search strategy, inclusion criteria and exclusion criteria were used to identify eligible patients. An identical review of electronic patient records was performed to determine whether documented QRISK3 assessment had improved following implementation of the intervention.

Clinicians also completed the same anonymous questionnaire to evaluate changes in knowledge, confidence and self-reported clinical practice.

Data Analysis

As this project was designed as a local quality improvement initiative, descriptive analysis was undertaken. Results were summarised using frequencies and percentages to compare baseline and post-intervention findings.

RESULTS

Baseline Audit

A retrospective audit was undertaken in May 2025 using a structured EMIS search to identify patients aged over 40 years with isolated elevations in LDL cholesterol (≥ 3.0 mmol/L) and/or non-HDL cholesterol (≥ 4.0 mmol/L), normal total cholesterol (≤ 5.0 mmol/L), and no current lipid-lowering therapy.

Eighteen eligible patients were identified during the three-month audit period.

At baseline, only 1 of 18 patients (5.6%) had documented cardiovascular risk assessment using QRISK3 following identification of abnormal lipid

findings, while 17 patients (94.4%) had no documented QRISK3 assessment. This suggested that isolated abnormalities in LDL or non-HDL cholesterol were not consistently prompting comprehensive cardiovascular risk assessment within routine clinical practice.

Table 1: Baseline Audit Findings

Variable	Result
Practice population	Approximately 10,500
Audit period	Previous 3 months (May 2025)
Eligible patients identified	18
Patients with documented QRISK3 assessment	1 (5.6%)
Patients without documented QRISK3 assessment	17 (94.4%)
Clinicians completing questionnaire	6

Clinician Questionnaire

All six clinicians working within the practice completed the anonymous question baseline questionnaire (100% response rate).

The questionnaire assessed clinician knowledge and confidence regarding:

- interpretation of complete lipid profiles;
- use of QRISK3;
- current cardiovascular risk assessment practices;
- perceived barriers to implementation;
- facilitators for improving practice.

Baseline responses demonstrated variability in clinician knowledge and confidence. Although clinicians were familiar with QRISK3 as a cardiovascular risk assessment tool, questionnaire responses suggested uncertainty regarding interpretation of isolated LDL and non-HDL cholesterol abnormalities and when these findings should prompt consideration of comprehensive cardiovascular risk assessment. Several clinicians reported relying primarily on abnormal total cholesterol values or electronic laboratory prompts when deciding whether to undertake QRISK3 assessment. Commonly identified barriers included uncertainty regarding lipid interpretation, competing clinical priorities and reliance on electronic health record alerts.

Educational Intervention

The findings from the baseline audit and clinician questionnaire were presented during a structured educational session attended by all six clinicians.

The intervention included:

- presentation of audit findings;
- review of NICE recommendations for cardiovascular risk assessment;
- discussion of interpretation of complete lipid profiles;
- distribution of concise educational crib sheets;
- group discussion addressing barriers identified through the questionnaire.

The intervention aimed to improve recognition and interpretation of isolated LDL and non-HDL cholesterol abnormalities and encourage consistent use of QRISK3 as part of comprehensive cardiovascular risk assessment.

One-Year Re-Audit

A repeat audit was undertaken in June 2026 using the same EMIS search strategy and identical inclusion and exclusion criteria.

15 out of 17 eligible patients identified during the re-audit underwent documented QRISK3 cardiovascular risk assessment following identification of isolated LDL or non-HDL cholesterol abnormalities, representing an improvement from 5.6% at baseline to 88% following the intervention.

Repeat questionnaire responses demonstrated improved clinician confidence in interpreting complete lipid profiles and greater consistency in undertaking cardiovascular risk assessment. Clinicians also reported reduced reliance on isolated total cholesterol abnormalities and increased confidence in recognising patients who would benefit from further cardiovascular risk evaluation.

Table 2: Comparison of Baseline and Post-Intervention Findings

Outcome Measure	Baseline Audit	One-Year Re-Audit
Eligible patients	18	17*
Documented QRISK3 assessment	1 (5.6%)	15 (88%)
Clinicians completing questionnaire	6	6
Educational intervention delivered	No	Yes
Clinician confidence interpreting complete lipid profiles	Variable	Improved
Reliance on total cholesterol as primary trigger	Common	Reduced

*The same search methodology and eligibility criteria were applied during the one-year re-audit.

DISCUSSION

This quality improvement study demonstrated that a simple educational intervention supported by practical decision-support resources was associated with a substantial improvement in documented cardiovascular risk assessment within a primary care setting. Prior to the intervention, 17 of 18 eligible patients (94.4%) with isolated elevations in LDL or non-HDL cholesterol did not have a documented QRISK3 cardiovascular risk assessment despite abnormal lipid findings requiring further clinical consideration. Following clinician education and distribution of concise crib sheets, documented QRISK3 assessment increased from 5.6% to 88% and this improvement was sustained at one-year re-audit. These findings suggest that targeted education can improve consistency of cardiovascular risk assessment and reinforce evidence-based practice within routine primary care.

The principal finding of this study was not simply an increase in QRISK3 documentation, but the identification of a potential gap in the interpretation of lipid profiles during routine clinical practice. NICE recommends that cardiovascular risk assessment should be guided by an individual's overall cardiovascular risk using QRISK3 (Hippisley-Cox et al., 2017) rather than isolated biochemical parameters (National Institute for Health and Care Excellence [NICE], 2023). Our findings suggest that patients with isolated elevations in LDL or non-HDL cholesterol, despite normal total cholesterol, may represent a subgroup in whom opportunities for comprehensive cardiovascular risk assessment are more likely to be missed if clinicians rely predominantly on total cholesterol values or laboratory alerts.

One possible explanation for this finding is the increasing influence of electronic health record systems on clinical decision-making. Electronic health record (EHR) systems have become integral to modern primary care and routinely incorporate clinical decision-support tools, laboratory alerts and structured documentation to support clinical decision-making. However, they may also unintentionally influence clinician behaviour by drawing greater attention to visually highlighted laboratory abnormalities. During this project, clinician feedback suggested that abnormal total cholesterol values or electronic alerts were more likely to trigger cardiovascular risk assessment than isolated abnormalities in LDL or non-HDL cholesterol. This observation highlights an important human factors consideration: clinicians working within busy primary care environments may naturally prioritise visually prominent information when making clinical decisions (Mamede, S. *et al.*, 2013). Although this project was not designed to evaluate electronic health record usability, the findings suggest that optimisation of laboratory reporting systems may represent an additional opportunity to improve cardiovascular disease prevention.

The clinician questionnaire provided valuable insight into barriers affecting implementation of guideline-based practice. Baseline responses demonstrated variability in clinician confidence regarding interpretation of complete lipid profiles and when isolated LDL or non-HDL cholesterol abnormalities should prompt further cardiovascular risk evaluation. Following the educational intervention, clinicians reported greater confidence in interpreting lipid profiles and more consistent use of QRISK3 during routine consultations. These findings support previous evidence (Forsetlund *et al.*, 2009) that relatively simple educational interventions, combined with practical decision-support tools, can improve clinician adherence to evidence-based recommendations.

An important strength of this project was the assessment of sustainability. Sustainability is recognised as an important component of quality improvement reporting (Ogrinc et al., 2016). Many quality improvement initiatives demonstrate short-term improvements immediately following an intervention but fail to evaluate whether behavioural change is maintained over time. In this study, the re-audit was undertaken twelve months after the educational intervention using identical search criteria and methodology. The sustained improvement observed suggests that the intervention resulted in meaningful changes to routine clinical practice rather than a temporary increase in awareness.

This study has limitations. It was conducted within a single NHS general practice involving a relatively small number of clinicians and patients, which may limit the generalisability of the findings. The project evaluated documented QRISK3 assessment rather than long-term patient outcomes such as statin initiation or reduction in cardiovascular events. Furthermore, formal statistical analysis was not performed because the project was designed as a local quality improvement initiative with a small sample size. Questionnaire findings were based on clinician self-report and may therefore have been subject to response bias. Nevertheless, the intervention was straightforward, inexpensive and easily reproducible, making it feasible for implementation within other primary care practices.

Future quality improvement work should evaluate whether automated electronic prompts highlighting isolated LDL and non-HDL cholesterol abnormalities can further improve comprehensive cardiovascular risk assessment. Multi-centre studies involving larger patient populations would also help determine whether similar educational interventions produce comparable improvements across different primary care settings.

CONCLUSION

This quality improvement study demonstrated that a targeted educational intervention combined with practical decision-support resources significantly improved documented QRISK3 cardiovascular risk assessment in patients with isolated elevations in LDL or non-HDL cholesterol within a primary care setting.

The study also identified a potential systems issue whereby isolated abnormalities in LDL and non-HDL cholesterol may receive less clinical attention than abnormal total cholesterol values, potentially influencing opportunities for comprehensive cardiovascular risk assessment.

Improving recognition and interpretation of the complete lipid profile as part of comprehensive cardiovascular risk assessment represents a simple yet potentially impactful opportunity to enhance the prevention of cardiovascular disease within routine primary care practice.

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