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Empowering pharmacists working in primary care through a cardiovascular disease clinical management course: Impact on practice

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ABSTRACT

Introduction: Cardiovascular disease (CVD) is currently the leading cause of mortality and morbidity worldwide. A competent healthcare workforce working in primary care delivering disease management services efficiently is the cornerstone of well performing health systems, impacting patient outcomes positively. The aim of this study was to evaluate the effectiveness of a training course to support pharmacists working in General Practitioner (GP) practices; and to evaluate its impact on practice.

Methods: A before and after evaluation model was employed to assess the effectiveness of training resorting to a survey exploring self-confidence and knowledge on clinical management of three CVD topics: Atrial Fibrillation (AF), Hypertension and hyperlipidaemia. Before and after training data (immediate and retained after 6 months) were analysed at the Primary Care Network (PCN) and GP Practice level of the pharmacists who took part in the training sessions. Data were analysed in IBM SPSS v.29 resorting to paired samples *t*-test and Cohen's d for estimation of the effect size. Independent samples *t*-tests were performed for a sample group of PCNs and GP practices with and without training (comparator group).

Results: An improvement with large effect size was observed in pharmacists' self-confidence and knowledge related to the hypertension topic, suggesting potential practical benefit. For the topics of AF and hyperlipidaemia, pharmacists' confidence also increased with a large effect size, but for knowledge, the effect size of the increase was medium or small. Data suggests that pharmacists' practice has improved in both groups after 6 months, which suggests that it was not a sole result of the training.

Conclusions: This study provide evidence that the course improved pharmacists' knowledge and self-confidence, likely to contribute to performance in their clinical practice. Patients' clinical benefit is expected from pharmacists' improved capacity to effectively engage in medicines optimisation.

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Introduction

Cardiovascular disease (CVD) encompasses a range of long-term conditions affecting the heart and blood vessels. CVD prevention, detection and management, where applicable, remain a challenge for patients, caregivers, healthcare professionals and systems.[1,2]

According to the World Health Organization, CVD is the leading cause of death globally, taking an estimated 17.9 million lives each year, and accountable for an important proportion of premature mortality.[3] NCD premature mortality is considered an indicator of sustainable development (SDG3.4.1), with clear targets set against which countries' progress is monitored.[3] In the United Kingdom (UK), there are 7.6 million people living with CVD, and although mortality rates have been decreasing, it is estimated that the prevalence of CVD may increase due to an ageing population and improved survival rates.,[45]Therefore, CVD has been identified as a strategic priority in the UK National Health Service (NHS) long-term plan.[6]

For CVD management, as with any other condition, it is essential to consider that although primary healthcare should be at the centre of efficient health systems, as proposed in the Alma-Ata and subsequent Astana Declarations,[7,8] the patient moves along a pathway and appropriate care must be available and interlinked across it.[9]

There is diverse evidence of the pharmacists' contribution throughout this CVD patient care pathway, recognised and measured through their interventions.[10–13] Several studies have proven improvement in clinical and non-clinical outcomes for people living with CVD due to pharmacists' interventions in collaboration with other healthcare providers (e.g., physicians and nurses).[10,11,13]

Treating patients closer to home is also an aim reflected in the recently developed integrated care system (ICS) in England.[14] In England, primary healthcare is mostly delivered in GP (General Practitioner) practices.[15] A Primary Care Network (PCN) is a group of GP practices working closely together and providing integrated services to their local population.[16] A PCN pharmacist works across several GP practices in the same network, moving between different clinics to provide expertise. As an example, it is common for PCN pharmacists to work a few hours in one clinic and a few more hours in another, rotating their work. PCNs have national incentive schemes that intend to improve the quality of care provided, making PCN pharmacists accountable for a set of services (e.g., CVD prevention and management, structured medication reviews, etc) that aim to achieve pre-determined goals.[17,18] On the other hand, there are some pharmacists working full-time in a single clinic (practice-based pharmacists), having a focused action in managing medication for patients who are registered in that specific clinic. A practice-based pharmacist supports the smaller team, and their typical responsibilities include conducting general clinical medication reviews, chronic condition reviews, monitoring high-risk drugs, and handling daily medication queries from patients and the clinic team.[19] The engagement of pharmacists working in GP practices in the improvement of CVD management has proved to be a successful strategy.[20]

Lifelong learning is essential for the development of all healthcare professionals.[21] Long-term condition management as well as clinical assessment, examination and monitoring has already been identified as training needs by pharmacists working in GP practices.[22,23] Additionally, ensuring the quality of the clinical services currently provided, as well as new services demands for efficient continuous education and training methods that ensure competent delivery of specialised healthcare.[24] Previous studies have shown that perceived knowledge does not match real knowledge, and thus tools must be adapted to ensure that both perception and self-confidence is assessed but also capacity to deal with clinical case scenarios.[25] When it comes to learning methods and techniques, one size does not fit all and several studies point to a growing trend towards the use of online training, even though training that contains both components (online and face-to-face) has also shown good results..[2626] In a postgraduate context, it is common for training to be carried out in the workplace, often in a simulation context.[27] Education that includes reflective practice is also a growing trend, though it requires more effort from the student.[26]

Providing education and training is a cornerstone for an efficient workforce and a sustainable approach of managing long term conditions. Aiming to empower and improve the intervention of pharmacists working in GP practices in the management of CVD, a pharmacy team from St. Bartholomew's Hospital in London, supported by a research team based at the University of Lisbon, developed a virtual course on the CVD topics highlighted in the NHS Long term Plan - AF, hypertension and hyperlipidaemia. The aim of this study was to evaluate the effectiveness of a training course to support pharmacists working in GP practices; and to evaluate its impact on practice.

Methods

Scope of the initiative

This training initiative was developed upon request for wider adoption noting the success of a previous experience.[20] The goal was to facilitate the wider adoption by leveraging the pharmacy workforce in primary care settings. This was achieved through educating and training pharmacists working within primary care practices to ensure long-term retention of knowledge acquired and its translation into performance. Approval for the proposal to train and develop pharmacists in primary care was secured from both the funding primary care board and the hospital executive boards. Noting the direct lack of patient engagement, the study was exempt from ethics approval. It was registered as a service improvement with the Bart's Clinical Governance Board. As a quality improvement study, we have adopted the Squire checklist to report it.

Study design

A before and after study was developed to evaluate the association between the training and the knowledge and self-confidence gained. The retention of knowledge and confidence and the likely impact of the training on clinical outcomes was also explored by

selecting two time points post-event.

Population and sample

Invitations to attend the training events were sent in cascade through e-mail, by area leads to all primary care pharmacists working in the Northeast London (NEL), North Central London (NCL) and Mid and South Essex (MSE) areas. The courses were offered free of charge and no restrictions were set to all interested. There was no a priori sample size estimation as this was an exploratory practice-based evaluation.

Participants attended without receiving any incentives, driven solely by their personal interest in enhancing their skills and knowledge in CVD management and prevention.

Educational intervention

The pharmacy team at St. Bartholomew's Hospital in London, United Kingdom, supported by a research team based at the Faculty of Pharmacy, University of Lisbon, developed a learning course for pharmacists working in GP Practices in the NEL, NCL and MSE areas. This was a 3-module training course focused on the topics highlighted in the NHS Long term Plan, AF, hypertension, and hyperlipidaemia.

A virtual course was piloted first in 2021, subsequently refined aiming for continuous improvement and then implemented continually throughout 2022 and 2023. Following the pilot, the sessions took place one month apart: AF (November 2022), hyperlipidaemia (December 2022) and hypertension (January 2023). Each cardiovascular topic had only one training event except for AF which was composed of two complementary virtual events.

The structure of the educational intervention included a pre- and post-event communication, which entailed assessment surveys detailed below in the data collection tool subsection, and the synchronous training event. The educational structure was used for all training events. Each module had a duration of 1 to 1.5 h theory-based component given by an expert in each topic. Throughout the session, participants were given the opportunity to raise questions and comment on their own practice. Educational materials were approved by the Barts Heart Centre Board and were distributed to the participants after the session. The training was aligned with the learning objectives defined (Table A).

Data collection tool for assessing knowledge and self-confidence

Before each training event, pharmacists received an email with a mandatory survey to complete. The on-line survey included three sections: participant information, self-confidence assessment and baseline knowledge assessment (Appendix A).

The self-confidence assessment aimed to appraise pharmacists' level of confidence to perform clinical tasks in the scope of the addressed topic. Pharmacists were presented a clinical task, being asked to rank their level of confidence to perform it, on a scale of 1 to 4 (1- not confident, 2- satisfactory but not confident, 3- confident in some cases but would like more experience and 4- fully confident in most cases).

The knowledge assessment aimed to evaluate participants knowledge of the topic addressed. The assessment consisted of multiple-choice questions, some of them presented as clinical cases to be answered, with different levels of complexity.

After each training event, a follow-up email was sent to the participants to complete another on-line survey. The post-event survey was the same as the pre-event one, except for section 1 which only asked for the participants' first and last name so that the participant was identifiable. Upon filling out the post-event survey, pharmacists received a certificate of participation. The team used *Google forms* tool to develop the surveys and collect the data.

Indicators for assessing impact on practice

The CVDPREVENT database (https://www.cvdprevent.nhs.uk/data-explorer) was used to collect data that indicates the impact of the training sessions on practice, through specific indicators (Table B). The CVDPREVENT database indicators are aligned with the health national priorities and used to measure performance of commissioned services nationally. All data taken from the CVDPREVENT database is anonymous and does not allow pharmacists or patients to be identified. Baseline data (t0) and post-training, immediate (t1) and retained after 6 months (t2) were analysed at the PCN[16] and GP practice level of the pharmacists who took part in the training sessions, resorting to paired t-Students tests. Some PCN and Practices had missing values on the database, justified by the lack of reporting. These missing values were not included in the data analysis.

To ascertain the validity of the impact on practice outcomes, data was also gathered using the CVDPREVENT database, on the hypertension indicator from a random sample of 19 PCNs and 53 GP practices, within the same region of the UK, which did not employ any of the participating pharmacists (comparator group). These figures match the quantity of pharmacists' PCNs and GP practices that participated in the hypertension training. This analysis focused solely on the hypertension indicator, as its findings are indicative of broader trends across the remaining topics.

Data analysis

Data analysis was carried out utilizing IBM SPSS Statistics version 29.0 and included descriptive and bivariate analysis. Self-

confidence and knowledge scores were calculated by unweighted adding of all individual items.

Effect size was measured through Cohen's d using the sample standard deviation of the mean difference. Paired-samples *t*-tests were used to compare before and after event data, considering a 95% confidence interval. Additionally, independent samples t-tests were performed for the PCNs and GP practices samples with and without training, considering a 95% confidence interval.

As no significant changes were made to the project as a result of the pilot project carried out on the subject of AF in 2021, the results of the AF training events held in 2021 and 2022 were analysed jointly.

Results

A total of 107 pharmacists working in GP Practices attended the CVD course. From those, 58 answered the confidence and knowledge pre- and post-event surveys. The pharmacists who took part in the learning course worked in 34 different PCNs (Table C).

Data collected from the pre- and post-training event surveys applicable to the respective three modules (AF, hypertension, and hyperlipidaemia) indicates an increase in pharmacists' self-confidence to perform clinical tasks (Fig. A). The effect size, measured through Cohen's d, indicates a large effect: AF (d = 1.421), hypertension (d = 1.174) and Hyperlipidaemia (d = 1.317).

Also, results of the surveys show gains in knowledge with a large effect size when comparing before- and after-training event number of correct answers score for the hypertension topic (d = 1.302). For the remaining topics, effect sizes measured by Cohen's d were d = 0.623 (AF) and d = 0.415 (hyperlipidaemia) indicating a medium and small effect, respectively. Fig. B includes the results of the before- and after-training event knowledge assessment.

For the AF indicator, results show that the training course generated improved medicines optimisation practice in the PCNs where pharmacists who attended the training work. The effect size, measured by Cohen's d, indicate a large effect when comparing data before training and data in the two moments for extracting data after the training had been conducted (dt0/t1 = 1.161, dt0/t2 = 1.296). Similar findings were seen for the hypertension indicator, both at the PCN (dt0/t1 = 1.987, dt0/t2 = 0.899) and GP practice (dt0/t1 = 1.307) levels. A medium effect size of the improvement was noticed at GP practice level for AF, when comparing data before training and data in the two moments for extracting data after the training has been conducted (dt0/t1 = 0.725, dt0/t2 = 0.792), and for hypertension, when comparing data before training and data in the second moment after the training has been conducted (dt0/t2 = 0.776).

For hyperlipidaemia indicators, data showed that at PCN level, there was an improvement of medicines optimisation in practice with a large effect size, both for indicator 1 (dt0/t1 = 1.328, dt0/t2 = 0.872) and 2 (dt0/t1 = 1.700, dt0/t2 = 1.566). Also, at PCN level, for indicator 3, the improvement had only a medium effect size (dt0/t1 = 0.676, dt0/t2 = 0.655). At GP practice level, a large effect size was only seen for Indicator 2 (dt0/t1 = 0.918, dt0/t2 = 0.869), with indicator 1 (dt0/t1 = 0.016, dt0/t2 = 0.019) and 3 (dt0/t1 = 0.333, dt0/t2 = 0.298) showing a small effect size.

Table D include all data around impact of training in practice, both at PCN and GP practice levels.

The independent samples *t*-tests results (Table E) indicate that both groups (with and without training) were comparable at baseline. At the PCN level, both groups improved at 6 months, with a slight decrease at 12 months. However, the effect size was small across the three data collection points (dt0 = 0.059, dt1 = 0.127, dt2 = 0.368), with the comparator group having a slightly higher mean in performance of the hypertension topic in all three moments. For the GP Practices, the intervention group displayed a slightly higher mean performance maintained across the three measurement points, albeit with a small effect size (dt0 = 0.022, dt1 = 0.005, dt2 = 0.072).

Discussion

Our study suggests that the 3-module learning course focused on the topics highlighted in the NHS Long term Plan, AF, hypertension and hyperlipidaemia, targeting pharmacists working in England GP Practices led to improvements in pharmacists' knowledge and confidence, likely to contribute to improved performance, which should result in clinical benefit for patients.[28]

These findings support the ability of the developed course to reinforce pharmacists' competence in managing CVD. Healthcare professionals' education is a determining factor for change and improvement of the care provided to the population. The results of this study are in line with other similar studies that resorted to training events on CVD with the aim of improving pharmacist's knowledge and involvement in the management of these conditions.[29,30] A study where community pharmacists were tasked with initiating pharmacotherapy for lowering lipid levels and adjusting medication dosages, showed an increase in community pharmacists' knowledge following a 1-day dyslipidaemia-related training. The training was supported by a treatment protocol as well as clinical and communication tools. Knowledge was assessed using a comparative method before and after training by applying a questionnaire, similarly to our study.[29] Another study also conducted with community pharmacists showed that after a training program on hypertension management comprising a pre-reading manual, BP measurement workshop, and case studies, all participating pharmacists were competent in both the practical assessment of BP measurement and the written assessment. The study also qualitatively analysed the perspectives of the pharmacists who took part, which were relevant for improving the training programme.[30]

Although these studies are similar when it comes to assessing pharmacists' theoretical and practical knowledge after attending a training program, our study stands out for its innovative approach, as it assesses the clinical impact on patients through medicines optimisation.

Previous studies focusing on pharmacists working in GP practices had documented the positive impact of clinical activities on patients' clinical benefits.[10–13,20,31] However, knowledge needs to be updated in line with constantly evolving evidence and pharmacotherapy available. This study was set to evaluate if a training event could lead to improvements in knowledge and self-confidence

but more importantly if this improvement would effectively translate into pharmacists' performance related to medicines optimisation. Clinical Pharmacists contribute to medicines optimisation and to the selected clinical indicators in the UK since, at primary health care level, they have responsibilities in prescribing, conducting medication reviews, chronic condition management and prevention, monitoring high-risk drugs, and handling daily medication queries from patients and the clinic team. The analysis of the changes in clinical practice is a major strength of the study, even if results were not the expected. The process, however, is still believed to bring an added value to the body of evidence around assessment mechanisms used to evaluate learning events. This was only possible by having the ability to use practice-based indicators that are publicly available and monitored periodically.

In our study, the large effect size noted in the improvement of pharmacist's self-confidence and knowledge around the hypertension topic is consistent with the improvement of medicines optimisation in practice, both at PCN and GP practices level. However, the medium or small effect sizes noted for AF and hyperlipidaemia knowledge, respectively, were also associated with a smaller effect size on the practice indicators. This lead us to think there is more uncertainty and some degree of possibility that it may result from chance.[32] This lower level of certainty may suggest a possible mismatch between the training needs of the participating pharmacists and the content presented in the training event, or ultimately an inappropriate knowledge assessment. It is also possible that it stems from the challenge of effectively aligning the training content with the training needs of the pharmacists. The team engaged in developing the curricular content has vast experience in CVD management and is highly specialised in this area. However, AF and hyperlipidaemia training may benefit from further refinement. The limited sample size of this exploratory study is also likely to affect the meaningfulness of the effect size, even though this holds true for all three modules conducted.[33]

The short time elapsed between the baseline assessment and the delivery of the educational content allowed minimal opportunity to tailor the content to the training needs indicated in the survey responses, an aspect that should be improved in future events.

The study is not without limitations. The training events included the analysis of clinical cases. However, other formats could have been explored to diversify pharmacists' learning and enable them to progress and reach the highest level of Miller's Pyramid of clinical competence.[34] It is also worth acknowledging that this was an exploratory participatory evaluation which did not occur in a controlled environment and therefore we cannot guarantee that the impact on practice captured was not influenced by other factors (e.g., other training activities in which pharmacists have participated, change of procedures adopted by participating pharmacists at PCN/GP practice, existence of other national incentives for improved performance indicators) beyond the implementation of the CVD course, or even a mere result of chance.[32] Results from the independent samples *t*-tests suggest that are no differences in the performance of PCNs and GP Practices with pharmacists who received training and those without such training (comparator group). These data support the possibility that many other factors may have had an influence on the impact on practice data. Although only the hypertension indicator was analysed for the comparator group, the same outcome is likely for AF and hyperlipidaemia. Another limitation of the study is that although the correct answers were not given after the baseline survey and the pharmacists did not know that an exact same test would be administered at the end of the training session, no additional measures were taken to prevent the pharmacists from saving the survey questions.

To overcome some of the limitations pointed out, future studies could be designed in a more robust and controlled way, through for example a clinical trial, where we would be able to infer on causality and not merely association. In the future, this study could also be further replicated with community pharmacists and pharmacists working in tertiary care enabling and empowering the community structures for better management of chronic diseases among the population.

Another innovative aspect of this initiative concerns the close collaboration between healthcare professionals working in different sectors of care (primary and secondary) for the pursuit of national health goals on the CVD topics highlighted in the NHS Long term Plan.[6] The success of this collaboration resulted in increased self-confidence and knowledge of the pharmacists working in GP practices after attending the CVD management training events, which in turn, seems to have improved the practice of the participating pharmacists, with a potential impact on health outcomes of the communities served. Nevertheless, the health outcomes improved also in sites where the pharmacists did not participate in the training, which demonstrates a clear national effort to improve CVD indicators. While there is some uncertainty regarding the link between course participation and enhanced practice due to various influencing factors, the course potentially played a role in improving observed health outcomes by boosting pharmacists' confidence and knowledge.

Conclusions

The results of this study suggest that the CVD course improved pharmacist's knowledge and confidence to manage CVDs and may have influenced the pharmacists' performance in clinical practice, although other national-level incentives not related to the training could also have played a role in enhancing pharmacists' clinical performance. Training pharmacists working in GP practices to engage and intervene in the management of CVD is one of the steps to be extended for improved care and alignment with the priorities set out in the NHS Long Term Plan. We recommend that any future training events developed in any context are set up in a way that their impact on practice and at the patient level can be captured.

Financial disclosure

An unrestricted educational grant from AstraZeneca to the St. Bartholomew's Hospital enabled independent educational material development. AstraZeneca was not involved in educational content, and had no influence in materials used, which were the sole responsibility of the research team.

Contribution to literature

This study was set to evaluate if a training event could lead to improvements in knowledge and self-confidence but more importantly if this improvement would effectively translate into pharmacists' performance related to medicines optimisation, which is an innovative approach to the existent literature.

Author statement

All authors have contributed significantly to the manuscript, complying with authorship criteria, are aware of this submission and agree with it.

CRediT authorship contribution statement

L. Moura: Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing. **J. Chahal:** Conceptualization, Methodology, Investigation, Writing – review & editing. **F. Fernandez-Llimos:** Data curation, Formal analysis, Writing - review & editing. **F. Alves da Costa:** Conceptualization, Methodology, Writing – review & editing, Supervision. **S. Antoniou:** Conceptualization, Methodology, Resources, Writing – review & editing, Supervision.

Declaration of competing interest

None.

Appendix A. Structure of the pre-event survey

Section 1. Participant information
First and Last name
E-mail
Name of the GP practice or Primary Care Network you are predominantly working in?
How many years of pharmacy practice do you have?

- <2 years
- 2–5 years
- 6–10 years
- 11–15 years
- 16–20 years
- >20 years

How many years of practice managing people with cardiovascular diseases do you have?

- <2 years
- 2–5 years
- 6–10 years
- 11–15 years
- 16–20 years
- >20 years

Section 2. Self-confidence assessment
Please answer the question "How confident do you feel when you are performing the following task?" by rating your confidence to the following tasks, from 1 to 4, meaning:
1- Not confident;
2- Satisfactory but not confident
3- Confident in some cases but would like more experience;
4- Fully confident in most cases.

Atrial Fibrillation survey questions:
Q1. How confident do you feel about your ability to identify risk factors for developing AF?;
Q2. How confident do you feel in being able to identify AF signs and symptoms?;
Q3. How confident do you feel when you are measuring heart rate and rhythm by pulse palpation?;
Q4. How confident do you feel when you are using AF detection devices?;
Q5. How confident do you feel when you are identifying adverse drug reactions for anticoagulants in the management of AF?;
Q6. How confident do you feel when you are acting upon an anticoagulant missed or doubled dose?;
Q7. How confident do you feel when you are assessing stroke risk in AF patients (i.e., using CHA2DS2-VAScScore)?;

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(*continued*)

Q8. How confident do you feel when you are assessing risk factors for bleeding in AF patients (i.e., using HAS-BLED/ORBIT Score)?;
Q9. How confident do you feel in conducting a consultation with a person with AF around the management of AF?;
Q10. How confident do you feel if the need arises to switch a person with AF from one anticoagulant to another?;
Q11. How confident do you feel when you are reviewing anticoagulant therapy?;
Q12. How confident do you feel upon the following statement "I have access to the necessary sources of information to develop a convenient management plan for a person with AF"?;
Q13. How confident do you feel upon the following statement "I have someone (at my workplace) that can help me improve my expertise in managing AF (e.g., someone to whom I can address questions)"?

Hypertension survey questions:
Q1. How confident do you feel about your ability to identify risk factors for developing hypertension?;
Q2. How confident do you feel in being able to identify hypertension signs and symptoms?;
Q3. How confident do you feel in being able to measure blood pressure accurately?;
Q4. How confident do you feel when you are identifying adverse drug reactions in the management of hypertension?;
Q5. How confident do you feel in conducting a consultation with a person with hypertension?;
Q6. How confident do you feel if the need arises to switch/optimise a person's hypertension therapy?;
Q7. How confident do you feel when you are reviewing hypertension therapy?;
Q8. How confident do you feel upon the following statement "I have access to the necessary sources of information to develop a convenient management plan for a person with hypertension"?;
Q9. How confident do you feel upon the following statement "I have someone (at my workplace) that can help me improve my expertise in managing hypertension (e.g., someone to whom I can address questions)"?;

Hyperlipidaemia survey questions:
Q1. How confident do you feel about your ability to identify risk factors for developing atherosclerosis?
Q2. How confident do you feel interpreting cholesterol levels?
Q3. How confident do you feel when you are identifying adverse drug reactions for lipid lowering drugs in the management of high cholesterol levels?
Q4. How confident do you feel when you are acting upon a lipid lowering drug missed or doubled dose?;
Q5. How confident do you feel risk stratifying a patient based on the level of ischaemic risk?;
Q6. How confident do you feel in conducting a consultation with a person with high cholesterol levels?;
Q7. How confident do you feel when you are reviewing lipid lowering therapy?
Q8. How confident do you feel upon the following statement "I have access to the necessary sources of information to develop a convenient management plan for a person with hypercholesterolemia"?
Q9. How confident do you feel upon the following statement "I have someone (at my workplace) that can help me improve my expertise in managing hypercholesterolemia (e.g., someone to whom I can address questions)"?

Section 3. Baseline knowledge assessment

Number of questions varies from 10 to 12, depending on the training session: AF (12 questions), Hypertension and Hyperlipidaemia (10 questions).

Atrial Fibrillation survey questions:
Q1. Symptoms of AF include: [tick all that apply]

- Fatigue
- Chest pain
- Dyspnoea
- Rash
- All the above
- I don't know

Q2. Causes of AF include: [tick all that apply]

- Advancing Age;
- Obesity
- Anorexia
- Pericarditis
- Diabetes mellitus
- Rheumatism

(*continued on next page*)

(*continued*)

- I don't know

Q3. What is a "good" heart rate? [tick only one answer]

- 60–100 beats per min
- 70–110 beats per min
- 80–120 beats per min
- None of the above
- I don't know

Q4. Which of these is/are contraindication(s) for oral anticoagulation? [tick all that apply]

- Falls
- Age over 70 years
- Age over 80 years
- Previous GI bleed
- All of the above
- None of the above
- I don't know

Q5. What would you use to assess stroke risk in an AF patient? [tick all that apply]

- Own clinical judgment;
- CHADS2 score;
- CHADSVASc score;
- Don't know how to assess stroke risk
- Not part of my role

Q6. Which of these drugs has no interaction with NOACs? [tick all that apply]

- Gentamicin;
- Verapamil;
- Itraconazole
- Acetylsalicylic acid
- Simvastatin;
- Carbamazepine
- I don't know

Q7. What is/are the first priority in managing an asymptomatic patient with AF? [tick only one answer]

- Rate control;
- Rhythm control;
- BP/total cholesterol management;
- Stroke risk;
- Lifestyle issues;
- I don't know

Q8. In a patient with AF, after a gastrointestinal bleed who is now stable… [tick only one answer]

- *Re*-considering anticoagulation is the preferred option;
- Aspirin is the preferred option;
- No antithrombotic therapy should be given;
- I don't know which is the best therapeutic option

CASE-STUDY #1

A 71-year-old white female with a history of chronic non-valvular Atrial Fibrillation and mild congestive heart failure, currently controlled hypertension, has been evaluated by a cardiologist and found to be a suitable candidate for warfarin therapy.

Due to logistical barriers that make monitoring difficult and dietary variations, the patient has had difficulty controlling her INR (TTR 55%). Wide fluctuation in her INR has made her question continued warfarin therapy.

Because of her high risk for embolic stroke, her cardiologist is considering alternative forms of thromboprophylaxis for Stroke Prevention in Atrial Fibrillation (SPAF). She has a HAS-BLED SCORE of 2.

Q9. Which of the following therapeutic options do you consider the most appropriate for this patient? [tick only one answer]

- Keep patient on warfarin;
- Replace warfarin with aspirin;
- Replace warfarin with aspirin + clopidogrel;

(*continued on next page*)

(*continued*)

- Replace warfarin with a non-vitamin K oral anticoagulant (NOAC);
- I don't know

Case-study #2
A female patient has been diagnosed with non-valvular Atrial Fibrillation and was prescribed edoxaban 60 mg daily.

Q10. Which of the following parameter(s) do you consider important to check to be able to assess the appropriateness of the dosing regimen? [tick all that apply]

- Renal dysfunction;
- Comorbidities (heart failure, diabetes or hypertension);
- Concurrent medication
- Weight;
- Sex;
- Age;
- Other antithrombotics
- Liver dysfunction
- Bleeding risk
- Serum creatinine

Q11. The patient's history is as follows: PMH: Diabetes, Hypertension. Presenting complaint: palpitations (confirmed AF) and fatigue. Characteristics: Age 67 years; serum creatinine 123micromol/L; weight 74 kg; Height 5 ft., 7 in.; eGFR 52mLs/min. Which is the right daily frequency of intake and duration of therapy for this patient? [tick only one answer]

- 60 mg daily, – lifelong;
- 30 mg daily, lifelong;
- Twice daily 5 mg, – lifelong;
- I don't know

Q12. For the above lady, when would you monitor her renal function next? [tick only one answer]

- 1 month post initiation;
- 1–3 months post initiation;
- 3–6 months post initiation;
- 6–12 months post initiation.

Hypertension survey questions:

Q1. High blood pressure is a risk factor for

- Stroke;
- Kidney disease;
- Heart Failure;
- All of the above

Q2. Which of the following factors is not necessary to properly measure blood pressure?

- Correct posture of patient;
- Arm support and position;
- Wait 15 min before BP checking;
- Remove tight/restrictive clothing.

Q3. Medications and substances that can increase blood pressure include:

- Oral contraceptive pills;
- Immunosuppressive medications;
- Oral Antidiabetics;
- All of the above;
- Options A and B;
- Options A and C;
- Options B and C

Q4. Clinic blood pressure targets include:

- Clinic BP < 140/90 mmHg for people aged<80 years;
- Clinic BP < 140/90 mmHg for people aged>80 years;
- Clinic BP < 140/90 mmHg for people of all ages;
- None of the above

Q5. From the following statements regarding clinic blood pressure measurement in the first visit, which one is true?

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(*continued*)

- Should be measured in the left arm;
- Should be measured in the right arm;
- Should be measured in both arms;
- The arm chosen is not important;

Q6. From the following statements regarding clinic blood pressure measurement in the first visit, which one is false?

- Three BP measurements should be recorded;
- BP measurements should happen 1–2 min apart;
- Additional measurements may have to be performed in patients with arrhythmias;
- Having a full bladder does not interfere with the measurement;

Q7. When undertaking a 24 h ABPM, how many readings are required to be able to be successful during waking time hours?

- <5
- 5–13
- 14–20
- >20

CASE-STUDY #1
JL is a caucasian 56 year old man with no other comorbidities.
Q8. What is the first pharmacological option that you consider to implement to manage his hypertension?

- Angiotensin-converting enzyme (ACE) inhibitor;
- Angiotensin receptor blocker (ARB);
- Calcium channel blocker (CCB);
- Thiazide-like diuretic;

CASE-STUDY #2
MC is a 63-year-old african-caribbean woman with diagnosed type 2 diabetes.
Her clinic blood pressure measurement is 168/112 mmHg and QRISK is 12%.
Q9. Hypertension stage 1 is diagnosed if:

- Clinical BP average is between 135/85 and 149/94 mmHg for 3 months;
- Clinical BP average is 150/95 mmHg or more for 3 months;
- ABPM average is between 135/85 and 149/94 mmHg;
- HBPM average is 150/95 mmHg or more.

Q10. Besides lifestyle interventions, what is the first pharmacological option that you consider to implement to manage her hypertension?

- Angiotensin-converting enzyme (ACE) inhibitor/Angiotensin receptor blocker (ARB);
- Calcium channel blocker (CCB);
- Thiazide-like diuretic;
- Beta-blocker

Hyperlipidaemia survey questions:
Q1. Disorders known to adversely affect lipid profile include

- Alcohol abuse;
- Type 2 Diabetes;
- Inappropriate diet;
- Hypothyroidism;
- All of the above
- None of the above

Q2. The optimal serum HDL cholesterol is >1.0 mmol/L for both men and women

- True;
- False

Q3. Medications and substances that can increase lipids include:

- Oral contraceptives;
- Immunosuppressive medications;
- Antihypertensive agents;
- All of the above;
- Options A and B;
- Options A and C;

(*continued on next page*)

(*continued*)

- Options B and C

Q4. QRISK3 is a CVD risk software predictor. A low risk of having a CVD means than the QRISK is:

- <8%
- <10%
- <12%
- <15%
- Don't know/don't know what QRISK is.

Q5. Lifestyle modification is the first approach in all cases, except:

- 81 year-old person and QRISK 12%;
- 84 year-old person and QRISK 14%;
- Person with previous stroke;
- Person with type 2 diabetes and QRISK 12%;

Q6. After implementing primary prevention measures, how long should it be before the lipid profile is measured again?

- 3 months;
- 4 months;
- 6 months;
- 8 months.

Q7. Statins adverse effects may include:

- Headache;
- Myopathy;
- Rash;
- Gastro-intestinal symptoms;
- All of the above;
- None of the above

Q8. Ezetimibe 10 mg monotherapy can be a treatment option in case of statin intolerance.

- True
- False

CASE- STUDY #1

CL is a 67-year-old man with stable angina. He is currently receiving atorvastatin 80 mg daily with well controlled lipid levels He has been on atorvastatin for the a few months, and complains about muscle aches, but on this visit he states that his muscle pain has become more troublesome, to the extent that he wishes to come off the statin. He asks if there is nothing else he can take to control his cholesterol. On measuring his creatine kinase (CK) level, is was found to be 5 times the upper level of normal.

Q9. Of the options presented, which would be the first step to manage this patient?

- Reducing the dose of atorvastatin to 40 mg;
- Suspend treatment for 4–6 weeks;
- Substituting with an alternative statin;
- Switching to an alternative lipid lowering drug

CASE-STUDY #2

JD is a caucasian 53-year-old man who had a heart attack He is on atorvastatin 80 mg following alongside other cardiac medicines. His repeat lipids blood tests at 3 months after initiation is (TC 4.3, LDL 2.4, HDL 1.3, trig 1.30)

Q10. To optimise his lipid lowering therapy, which of the following options would you advise?

- Initiate Ezetimibe
- Initiate bempedoic acid
- Initiate Inclisiran
- Initiate PCSK9 Inhibitor
- Initiate any one of the above

Legend:

ABPM: Ambulatory blood pressure monitoring.
AF: Atrial Fibrillation.
ACE: Angiotensin-converting enzyme.
ARB: Angiotensin receptor blockers.
BP: Blood Pressure.
CCB: Calcium channel blockers.
CHA2DS2-VASc: Congestive heart failure or left ventricular dysfunction Hypertension, Age ≥ 75 (doubled), Diabetes, Stroke (doubled)-Vascular disease, Age 65–74, Sex category.
CK: Creatine Kinase.
CVD: Cardiovascular Disease.
eGFR: estimated glomerular filtration rate.

GP: General practitioner.
HAS-BLED: Hypertension, Abnormal Renal/Liver Function, Stroke, Bleeding History or Predisposition, Labile INR, Elderly, Drugs/Alcohol Concomitantly.
HBPM: Home blood pressure monitoring.
HDL: high-density lipoprotein.
INR: International Normalized Ratio.
LDL: low-density lipoprotein.
NOAC: Non-vitamin K oral anticoagulants.
ORBIT: Outcomes Registry for Better Informed Treatment of Atrial Fibrillation.
PCSK9: Proprotein Convertase Subtilisin/Kexin type 9.
QRISK: QRESEARCH cardiovascular risk algorithm.
SPAF: Stroke Prevention in Atrial Fibrillation.
TC: Total Cholesterol.
Trig: Triglycerides.
TTR: Time in therapeutic range.

Table A
Learning outcomes of the CVD training events.

Topic	Learning outcomes
Atrial Fibrillation	• List risk factors for developing AF • Describe the risk stratification tools involved in the management of AF • List the various treatment options • Describe the considerations for optimising anticoagulation in patients with AF and co-morbidities • List the considerations for supporting adherence to therapy
Hypertension	• List the risk factors for developing hypertension • Describe the role of renin angiotensin system in the pathophysiology of hypertension • Describe the non-pharmacological and pharmacological measures in managing hypertension • Describe the top tips in managing hypertension
Hyperlipidaemia	• Describe the importance of lipids in the pathophysiological process of atherosclerosis • Describe the risk stratification & assessment involved in CVD prevention & lipid management • Describe non-pharmacological and pharmacological measures in managing CVD prevention & lipid management

Legend:
AF: Atrial Fibrillation.
CVD: Cardiovascular Disease.

Table B
Data reporting periods for performance indicators used.

CVD topic	CVDPREVENT indicator	Data reporting period		
		t0	t1	t2
Atrial Fibrillation	Percentage of patients aged 18 and over with GP recorded atrial fibrillation and a record of a CHA2DS2-VASc score of 2 or more, who are currently treated with anticoagulation drug therapy (Proportion %) – AF indicator	2021 AF training March 2021 2022 AF training September 2022	March 2022 March 2023	June 2022 June 2023
Hypertension	Percentage of patients aged 18 and over, with GP recorded hypertension, in whom the last blood pressure reading (measured in the preceding 12 months) is below the age-appropriate treatment threshold (Proportion %) – Hypertension indicator	December 2022	March 2023	June 2023
Hyperlipidaemia	Percentage of patients aged 18 and over with no GP recorded CVD and a GP recorded QRISK score of 20% or more, on lipid lowering therapy (Proportion %) – Hyperlipidaemia indicator 1 Percentage of patients aged 18 and over, with GP recorded CVD (narrow definition), in whom the most recent blood cholesterol level (measured in the preceding 12 months) is non-HDL cholesterol <2.5 mmol/L or LDL-cholesterol <1.8 mmol/L (Proportion %) - Hyperlipidaemia indicator 2 Percentage of patients aged 18 and over with GP recorded CVD (narrow definition), who are currently treated with lipid lowering therapy (Proportion %) - Hyperlipidaemia indicator 3	September 2022	March 2023	June 2023

Legend:
AF: Atrial Fibrillation.
CHA2DS2-VASc: Congestive heart failure or left ventricular dysfunction Hypertension, Age ≥ 75 (doubled), Diabetes, Stroke (doubled)-Vascular disease, Age 65–74, Sex category.
CVD: Cardiovascular Disease.
GP: General practitioner.
HDL: high-density lipoprotein.
LDL: low-density lipoprotein.
QRISK: QRESEARCH cardiovascular risk algorithm.
t0: Date of extraction of results before training.

t1: Date of extraction of results immediate after training.
t2: Date of extracting results 6-months after training.

Table C
Participants' demographic and practice information.

Section 1. Participants demographic information		
Cardiovascular topic	Data description	Value
Clustered data from the three cardiovascular topics (Atrial Fibrillation, Hypertension and Hyperlipidaemia)	Number of participants	107
	Number of participants included in the analysis *(answered both pre and post event survey)*	58
	PCN[a]	34 different PCNs
	Years of pharmacy practice [a]	< 2 years: 17 (15.9%) 2–5 years: 30 (28.0%) 6–10 years: 20 (18.7%) 11–15 years: 11 (10.3%) 16–20 years: 7 (6.5%) >20 years: 22 (20.6%)
	Years of practice managing people with cardiovascular diseases [a]	< 2 years: 58 (54.2%) 2–5 years: 38 (35.5%) 6–10 years: 8 (7.5%) 11–15 years: 2 (1.9%) 16–20 years: 0 (0.0%) >20 years: 1 (0.9%)
Atrial Fibrillation (2021 and 2022)	Number of participants	58
	Number of participants included in the analysis *(answered both pre and post event survey)*	33
	PCN [a]	30 different PCNs
	Years of pharmacy practice [a]	< 2 years: 8 (13.8%) 2–5 years: 17 (29.3%) 6–10 years: 9 (15.5%) 11–15 years: 7 (12.1%) 16–20 years: 5 (8.6%) >20 years: 12 (20.7%)
	Years of practice managing people with cardiovascular diseases [a]	< 2 years: 32 (55.2%) 2–5 years: 21 (36.2%) 6–10 years: 4 (6.9%) 11–15 years: 1 (1.7%) 16–20 years: 0 (0.0%) >20 years: 0 (0.0%)
Hypertension	Number of participants	25
	Number of participants included in the analysis *(answered both pre and post event survey)*	10
	PCN [a]	19 different PCN's
	Years of pharmacy practice [a]	< 2 years: 6 (24.0%) 2–5 years: 6 (24.0%) 6–10 years: 3

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Table C (*continued*)

Section 1. Participants demographic information		
		(12.0%) 11–15 years: 3 (12.0%) 16–20 years: 2 (8.0%) >20 years: 5 (20.0%)
	Years of practice managing people with cardiovascular diseases [a]	< 2 years: 14 (56.0%) 2–5 years: 9 (36.0%) 6–10 years: 1 (4.0%) 11–15 years: 1 (4.0%) 16–20 years: 0 (0.0%) >20 years: 0 (0.0%)
Hyperlipidaemia	Number of participants	24
	Number of participants included in the analysis *(answered both pre and post event survey)*	15
	PCN [a]	18 different PCNs
	Years of pharmacy practice [a]	< 2 years: 3 (12.5%) 2–5 years: 7 (29.2%) 6–10 years: 8 (33.3%) 11–15 years: 1 (4.2%) 16–20 years: 0 (0.0%) >20 years: 5 (20.8%)
	Years of practice managing people with cardiovascular diseases [a]	< 2 years: 12 (50.0%) 2–5 years: 8 (33.3%) 6–10 years: 3 (12.5%) 11–15 years: 0 (0.0%) 16–20 years: 0 (0.0%) >20 years: 1 (4.2%)

Legend:
PCN: Primary Care Network.
[a] Data encompassing every pharmacist who took part in the sessions, regardless of whether they completed both surveys or not.

Table D
Impact of training in practice, measured by CVDPREVENT indicators.

CVD Indicator	PCN-level					GP Practice-level				
	M t0	M t1	M t2	d (t0/t1)	d (t0/t2)	M t0	M t1	M t2	d (t0/t1)	d (t0/t2)
AF	86.44	90.14	90.07	1.161	1.296	85.83	90.28	90.32	0.725	0.792
Hypertension	59.15	67.97	64.80	1.987	0.899	59.82	68.42	65.74	1.307	0.776
Hyperlipidaemia 1	64.45	67.10	66.34	1.328	0.872	62.00	62.13	62.15	0.016	0.019
Hyperlipidaemia 2	24.66	28.50	29.24	1.700	1.566	23.05	26.14	26.69	0.918	0.869
Hyperlipidaemia 3	82.62	84.16	84.10	0.676	0.655	81.65	82.76	82.70	0.333	0.298

Legend:
M: Mean performance score, measured as a percentage of patients meeting the quality indicator chosen (0−100).
d: Cohen's D.
t0: Date of extraction of results before training.
t1: Date of extraction of results immediate after training.
t2: Date of extracting results 6-months after training.

Table E
Independent samples t-tests results performed for the PCNs and GP practices samples with and without training, measured by CVDPREVENT indicator of hypertension.

	N	Mt0	Mt1	Mt2	dt0	dt1	dt2
PCNs with training	19	60.12	68.52	64.82	0.059	0.127	0.368
PCNs without training	19	60.45	69.10	66.19			
GP practices with training	53	60.81	69.12	65.79	0.022	0.005	0.072
GP practices without training	53	60.62	69.08	65.33			

Legend:
N: Number of PCNs/GP practices.
M: Mean performance score, measured as a percentage of patients meeting the quality indicator chosen (0–100).
d: Cohen's D.
t0: Date of extraction of results before training.
t1: Date of extraction of results immediate after training.
t2: Date of extracting results 6-months after training.

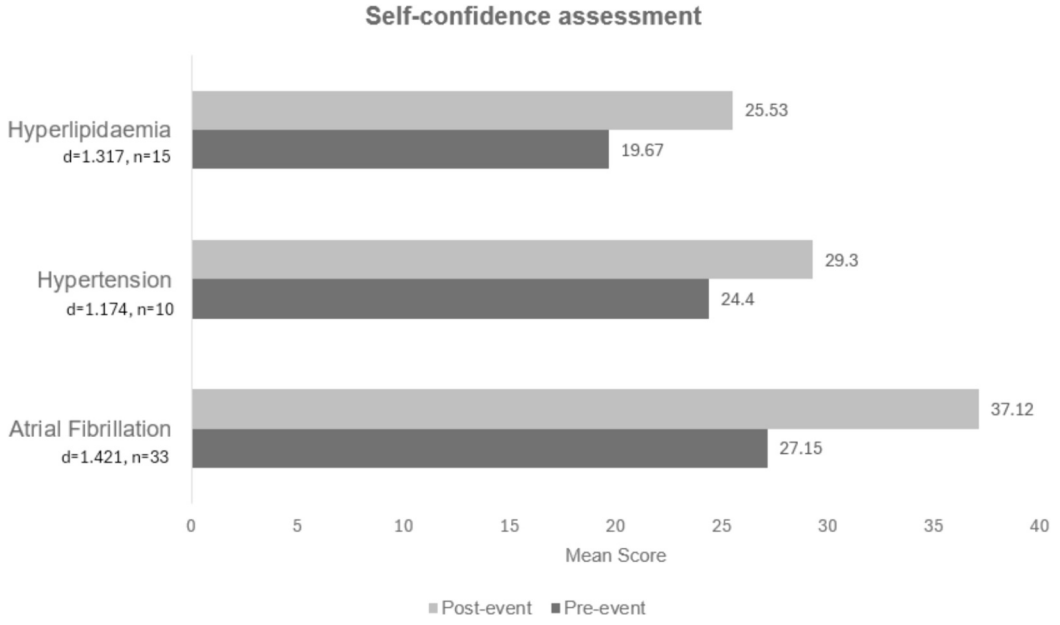

Fig. A. Results for the before and after self-confidence assessment.
Legend:
CVD: cardiovascular disease.
d: Cohen's d.
n: number of participants.

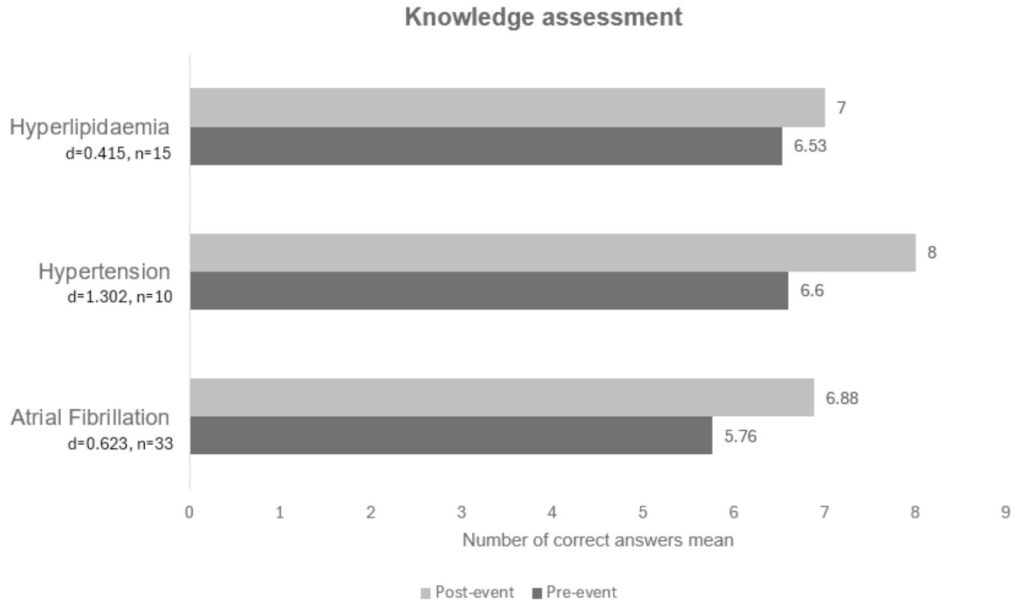

Fig. B. Results for the before and after knowledge assessment.
Legend:
CVD: cardiovascular disease.
d: Cohen's d.
n: number of participants.

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