Review

Pharmacist's Use of Screening Tools to Estimate Risk of CVD: A Review of the Literature

Dónal Og O'Donovan [1], Stephen Byrne [1] and Laura J. Sahm [1,2,*]

[1] Pharmaceutical Care Research Group, School of Pharmacy, University College Cork, Cork 30, Ireland; E-Mails: donal.odonovan@ucc.ie (D.O.O.); Stephen.byrne@ucc.ie (S.B.)

[2] Department of Pharmacy, Mercy University Hospital, Grenville Place, Cork 30, Ireland

* Author to whom correspondence should be addressed; E-Mail: L.Sahm@ucc.ie; Tel.: +353-214-901-688; Fax: +353-214-901-656.

Abstract: To review pharmacist-led screening programmes for estimation of cardiovascular disease (CVD) risk using validated screening tools, studies were identified using a search of the following electronic databases: PubMed, EMBASE, Web of Knowledge and the Cochrane library databases. Each database was searched from inception to December 2011. The search terms used were: "cardiovascular disease", "screening", "risk estimation", "pharmacist" and "pharmacy". Titles, abstracts and full manuscripts were screened to determine eligibility. Inclusion criteria were: (i) Pharmacist-led CVD screening; and (ii) Use of validated screening tool or tools for CVD. From each included study information was collected on the following: Study author; year of publication; setting; inclusion and exclusion criteria; tools used and outcomes measured. Articles were grouped and independently verified to ensure they met with the inclusion criteria. Over 7,000 citations were found. Twenty full-length articles were retrieved for analysis, of which twelve were excluded, as they did not meet the inclusion criteria. The eight remaining articles were included in this literature review. Whilst pharmacists undertake screening in their own practice, this approach will only go so far. To have a population-health impact, pharmacists should be involved in proactive screening in a variety of settings.

Keywords: CVD; pharmacist; screening tools; review

1. Introduction

Cardiovascular disease (CVD) is currently the leading cause of death in the world [1]. At the beginning of the 20th century, CVD accounted for less than 10% of all global deaths, but by the year 2000, CVD was responsible for nearly half of all deaths in the developed world, and a quarter of deaths in the developing world [2]. Most recent World Health Organisation (WHO) figures estimate that CVD caused the death of 17.3 million people in 2008 [3]. This was the largest cause of death, representing 30% of all deaths that year. CVD is predicted to remain the number one cause of death globally for the foreseeable future [3].

The rationale for preventing CVD is straightforward: to reduce CVD events and prevent mortality due to CVD. Unfortunately the healthcare budget is a finite resource and although spending time and money on preventing CVD events is a very worthwhile use, highest priority goes to those who have already been diagnosed with CVD. Nonetheless there is enormous benefit in treating those people who are at risk of developing CVD [4].

Non-identification of this at-risk group can have serious consequences. It has been estimated that at least 25% of CVD patients have sudden cardiac death or non-fatal myocardial infarction (MI) without prior symptoms or knowledge of their existing CVD [5]. Studies have shown that many physicians rely on subjective methods to estimate risk of developing CVD [6,7], however these methods tend to underestimate the actual risk [8]. For this reason national guidelines recommend the use of validated and objective screening tools for estimation of CVD risk [9,10]. One of the advantages of having an objective screening tool is that it does not require medical training and can be applied by pharmacists (and other healthcare professionals). Several screening tools have been developed to measure risk of CVD, including Framingham, QRISK2, ASSIGN and SCORE [11–14]. The Framingham risk score (FRS) is the most widely used screening tool globally[12,15]. Although each screening tool ultimately measures risk of developing CVD, there are some differences in outcome, for instance SCORE measures risk of mortality due to CVD [16].

In recent years there have been many calls to broaden the role of the community pharmacist beyond the traditional product-orientated functions of dispensing and distributing medication, to include a greater role in public health [17]. A 2004 paper by van Mil *et al.* contains the following passage:

> "Pharmacists should move from behind the counter and start serving the public by providing care instead of pills only… The fact that pharmacists have an academic training and act as health care professionals puts a burden upon them to better serve the community than they currently do" [18].

The WHO have created a "seven-star concept", in which a pharmacist is described as a caregiver, communicator, decision-maker, teacher, lifelong learner, leader and manager and is thus perfectly positioned to carry out effective interventions [19]. One of the benefits of a pharmacist acting under the direction of this "seven-star" concept is that it will facilitate them to successfully carry out interventions which have been shown to improve the clinical outcomes of patients [20]. Intervention programmes involving the community pharmacist have been shown to be successful, and can generate benefits that are ten times greater than the costs [21].

Pharmacist-led interventions have been shown to be feasible in a number of areas relevant to CVD, such as:

- medication use [22];
- management of CVD [23,24];
- diabetes mellitus (DM) [25,26];
- hypertension [27,28]; and
- heart failure [29].

To date, however there are no systematic reviews that we are aware of, which document the pharmacist-led screening programmes for estimation of CVD risk. This review addresses this gap in the literature.

The aim of this systematic literature search was to review pharmacist-led screening programmes for estimation of CVD risk using validated screening tools, *i.e.*, where the pharmacist is the healthcare professional who conducts the screening. This was achieved by the following objectives:

- To examine the location of pharmacist-led CVD screening programmes.
- To record the screening tools used in pharmacist-led CVD screening programmes.
- To determine the prevalence, in the literature, of pharmacist-led CVD screening programmes.
- To determine the outcomes measured by pharmacists, both primary and secondary, during their screening services.

2. Experimental Section

A systematic review of the literature was conducted. Studies were identified using a search of the following electronic databases: PubMed, EMBASE, Web of Knowledge and the Cochrane library databases. Each database was searched from inception to December 2011. The search terms used were: "cardiovascular disease", "screening", "risk estimation", "pharmacist" and "pharmacy". Combinations of these search terms were used. Only original research articles in English and pertaining to humans were accepted. In addition, to capture any publications not found by the search strategy, references from retrieved studies were searched by hand for any relevant citations.

The primary researcher (Dónal Óg O'Donovan) screened titles, abstracts and full manuscripts to determine eligibility in this literature review. Inclusion criteria were:

- Pharmacist-led CVD screening (CVD risk estimates, as performed by pharmacists using a validated screening tool(s));
- Use of validated screening tool or tools for CVD.

Primary outcomes of interest for this review were CVD risk estimates, as performed by pharmacists using (a) validated screening tool(s). Secondary outcomes of interest were location of screening, screening tools used and other CVD risk factors measured (such as age, lipid profile, systolic blood pressure (SBP), diastolic blood pressure (DBP), High-Density Lipoprotein Cholesterol (HDL-C) levels, recruitment process and smoking status).

Data extraction was performed by the primary researcher. From each included study information was collected on the following:
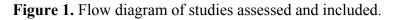
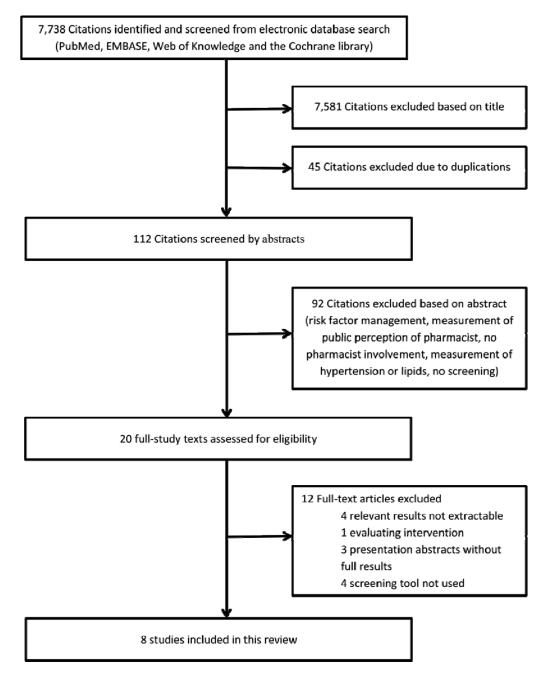- Study author;
- Year of publication;

- Setting and country where the study was conducted;
- Inclusion and exclusion criteria;
- Screening tool(s) used;
- Outcomes measured.

Articles were grouped in a Microsoft Excel® 2003 spreadsheet and were independently verified by all the researchers to ensure they met with the inclusion criteria.

3. Results and Discussion

Figure 1 describes how the studies were assessed for inclusion whilst Table 1 gives an overview of the characteristics of each of the included studies.

Figure 1. Flow diagram of studies assessed and included.

Table 1. Characteristics of included studies.

Source; Country	Setting	Recruitment	n	Inclusion Criteria	Exclusion Criteria	Screening Tool Used
Evans *et al.*, 2010 [30]; Canada	General Practitioner (GP) practice	referral	252	referral	severe psychiatric conditions, heart failure, terminal illness, pregnancy, lactation	10-year risk of cardiac death or non-fatal myocardial infarction (MI) based on Framingham risk score (FRS) tool recommended by Canadian Cardiovascular Society
Peterson *et al.*, 2010 [31]; Australia	Community pharmacy	opportunistic screening	640	minimum age 30 years	diagnosed hypertension, hyperlipidaemia or cardiovascular disease (CVD)	10-year cardiovascular risk calculated using a modified version of the New Zealand Cardiovascular Risk Calculator
Donyai *et al.*, 2009 [32]; UK	Community pharmacy	not clear	8,287	not clear	not clear	Framingham risk calculator for 10-year risk of Coronary Heart Disease (CHD)
De Oliveira Martins *et al.*, 2008 [33]; Portugal	Community pharmacy	opportunistic screening	1,043	age 40–65	cognitive impairment, inability to understand local language	10-year risk of fatal CVD calculated by SCORE model for low-risk regions
Taveira *et al.*, 2006 [24]; USA	Cardiovascular Risk Reduction Clinic	referral	355	referral	not clear	10-year risk of cardiac events as measured by Framingham Points Score
Liu *et al.*, 2008 [34]; USA	Union Hall for tradesmen	opportunistic screening	265	member of a trade union or dependent of member	not clear	Framingham risk calculator for 10-year risk of CHD
Olenak *et al.*, 2008 [35]; USA	Community pharmacy	opportunistic screening	86	minimum age 18	DM or diagnosed (CHD)	Framingham risk calculator for 10-year risk of CHD
Horgan *et al.*, 2010 [36]; USA	Community pharmacy	opportunistic screening	1,130	age 40–70	recently screened for CVD by General Practitioner (GP) or prescribed medication for existing CVD	Framingham risk calculator for 10-year risk of CHD

3.1. Recruitment

The inclusion criteria for each study in this review varied considerably. In five studies participants were recruited through opportunistic screening [31–33,35,36]. In some cases the screening service was advertised in both the pharmacy and in the local media. In one study the advertising was targeted to males at high risk of CVD [36]. For a further two studies, participants were referred for CVD screening [24,30]. For the remaining study [32] participant recruitment was not clear.

3.2. Inclusion Criteria

Similar to participant recruitment, inclusion criteria for the studies varied considerably. For both studies in which participants were referred by a doctor, the inclusion criteria were this referral [24,30]. For the paper by Liu *et al.* CVD risk screening was offered to members of unions and their dependents, and this was the only stated inclusion criterion [34]. In some cases screening was restricted to certain age groups, adults aged 40–70 years [36], adults aged 40–65 years [33], adults aged 30 years and over [31], and adults aged 18 years and over [35]. For the remaining study inclusion criteria were not stated [32].

3.3. Exclusion Criteria

Exclusion criteria were clearly defined for five studies. In many cases participants with a previous history of heart disease were excluded [30,31,35,36]. The study by Evans *et al.* [30] also excluded participants with severe psychiatric conditions, terminal illness, pregnancy and lactation. Participants diagnosed with DM were excluded in one study [36]. The study by de Oliveira Martins *et al.* [33] also excluded those with cognitive impairment and inability to speak the local language. Exclusion criteria were not defined for three studies included in the review [31,32,34].

3.4. Screening Tools Used

The most commonly used screening tool was the Framingham Screening tool. In total, six studies included in the review used a version of the Framingham Screening tool. Four studies used the Framingham Screening tool to estimate 10-year risk of coronary heart disease (CHD) [32,34,35,36]. Two studies included in this review used other versions of the Framingham screening tool. The study by Evans *et al.* [30] used a version of the Framingham screening tool for 10-year risk of cardiac death or non-fatal MI as recommended by the Canadian Cardiovascular Society. The study by Taveira *et al.* [24] used a measure of 10-year risk of cardiac events as measured by the Framingham Points Score. The remaining two studies used different screening tools to estimate risk of CVD. The study by Peterson *et al.* [31] was conducted in Australia and used a modified version of the New Zealand Risk Calculator for 10-year cardiovascular risk. Finally, the study by de Oliveira Martins *et al.* used the 10-year risk for fatal CVD calculated by the SCORE risk screening tool [33].

3.5. CVD Risk

The only outcome that was measured in all studies was CVD risk. Other outcomes measured varied between studies. This information is summarised in Table 2.

3.6. CVD Risk Estimate

Only five studies reported a mean (or median) value of CVD risk estimate for their entire study population [30,31,33,34,36]. These results are summarised in Table 3.The mean CVD risk ranged from 1.97 to 14.7 and reflects the outcome measure of the screening tool, which varied from CVD risk to fatal CVD.

The remaining studies did not report the mean CVD risk of the population. Instead the proportion of the study population that was at high risk of developing CVD was reported [32,34–36]. These results are given in Table 4. The study by Donyai *et al.* is not included in this table because it used different criteria to report the risk profile. That study reported that 65% of the population (*n* = 5,377) were at low risk of CVD (defined as <15% absolute risk of developing CHD over ten years). The remaining 35% of the population (*n* = 2,910) were at moderate to high risk of CVD (defined as >15% ten-year risk) [32].

3.7. Other Risk Factors Reported

The age profile of the population was described for only four of the studies, in which average age range varied from 53.7 to 62.0 years [30,33–35]. In total, six studies reported results concerning total cholesterol (TC). The results of five of these studies are shown in Table 5 [30,33–36]. Peterson *et al.* used different criteria to report results for the lipid profile. In this study it was reported that 21.3% of the population (*n* = 136) had a TC > 5.5 mmol/L [31]. Six studies also reported details of SBP in the study population [30,31,33–36]. The study by Peterson *et al.* did not report the mean SBP for the population, instead reporting that 30% of the study population (*n* = 192) had an SBP >140 mmHg [31]. No significant country-specific differences were found between the studies, and, therefore, this was not included as a variable.

In this review, eight studies were identified that showed the feasibility of pharmacists to screen for CVD. This compares very well with other work that has demonstrated the feasibility of other healthcare professionals to screen for CVD. There is a long track record of doctors screening for CVD, and all the major screening tools have been developed and validated using physicians [11,12,14,37,38]. It has also been shown that nurses can feasibly screen for CVD [39,40]. The variability in results reported makes it impossible to accurately compare screening results from pharmacists with results of other healthcare professionals.

The results of this study clearly demonstrate the potential value of pharmacists in identifying members of the population at risk of developing CVD. What is now needed is the proactive rather than reactive screening of members of the public by their pharmacist both in the pharmacy and other settings within the community. This is an opportunity for pharmacists to expand their role beyond the traditional functions mentioned earlier (dispensing and distributing medication) and playing a greater part in improving public health [17].

Pharmacists who move beyond the pharmacy setting could also increase uptake in those populations, which are marginalized or "hard to reach". Access-enhancing interventions can be defined as those which address the structural, financial and environmental barriers to screening *i.e.*, bringing the service to the public in mobile screening units, the location of mobile screening units, access to transport to screening units and access to translated materials [41]. This approach has been implemented in cancer screening programmes and could be a worthwhile development for cardiovascular disease.

Table 2. Outcomes measured in each study.

Source, year	CVD Risk	Age	Sex	SBP *	DBP*	TC *	TG *	LDL *	HDL *	TC:HDL *	BG *	Smoking status	BMI *
Evans *et al.*, 2010 [30]	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	
Peterson *et al.*, 2010 [31]	✓			✓		✓			✓		✓	✓	✓
Donyai *et al.*, 2009 [32]	✓		✓										
de Oliveira Martins *et al.*, 2008 [33]	✓	✓	✓	✓		✓							✓
Taveira *et al.*, 2006 [24]	✓												
Liu *et al.*, 2008 [34]	✓	✓	✓	✓	✓	✓		✓	✓			✓	
Olenak *et al.*, 2008 [35]	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Horgan *et al.*, 2010 [36]	✓		✓	✓	✓	✓							✓

* Key: CVD = cardiovascular disease; SBP = Systolic Blood pressure; DBP = Diastolic Blood pressure; TC = Total Cholesterol; TG = Triglycerides; LDL = Low density lipoprotein (cholesterol); HDL = High density lipoprotein (cholesterol); TC: total cholesterol; TC: HDL = ratio of TC to HDL; BG = Blood Glucose; BMI = Body Mass Index.

Table 3. CVD risk results reported.

Study	n	Mean CVD risk	Standard Deviation	Outcome measure of screening tool
Evans *et al.*, 2010 [30]	322	14.7	not reported	cardiac death or non-fatal myocardial infarction (MI)
Peterson *et al.*, 2010 [31]	640	9.5 (median)	not reported	CVD risk
De Oliveira Martins *et al.*, 2008 [33]	1043	1.94	2.69	fatal CVD
Liu *et al.*, 2008 [34]	265	10.9	9.1	CHD
Horgan *et al.*, 2010 [36]	1130	11.6	not reported	CHD

Table 4. CVD risk profile of study populations.

Study	n	Low Risk (<10%)	Medium Risk (10%–20%)	High Risk (>20%)
Liu *et al.*, 2008 [34]	226	119 (52.7%)	73 (32.3%)	34 (15.0%)
Olenak *et al.*, 2008 [35]	86	56 (65.1%)	23 (26.7%)	7 (8.1%)
Horgan *et al.*, 2010 [36]	1130	201 (17.8%)	353 (31.2%)	576 (51.0%)
Overall	1442	376 (26.1%)	449 (31.1%)	617 (42.8%)

Table 5. Outcomes measured in selected studies.

Study	n	Mean age (years)	SD	Mean TC (mmol/L)	SD	Mean SBP (mmHg)	SD	Recruitment
Evans *et al.*, 2010 [30]	332	62.0	NR	4.6	NR	135.9	NR	referred
de Oliveira Martins *et al.*, 2008 [33]	1043	53.7	NR	5.0	0.9	134.8	19.7	opportunistic
Liu *et al.*, 2008 [34]	265	57.7	12.1	5.3	1.0	142.8	19.2	opportunistic
Olenak *et al.*, 2008 [35]	86	59.0	14.2	NR	NR	134.1	15.8	opportunistic
Horgan *et al.*, 2010 [36]	1130	NR	NR	5.5	5.4–5.6 *	129.9	128.8–130.9 *	opportunistic

NR = not reported; * 95% Confidence Interval.

Two main factors have made it easier for pharmacists and other healthcare professionals to screen for CVD:

- The public availability of validated screening tools; and,
- The increasing availability of point-of-care testing (POCT) devices that can quickly and accurately measure cholesterol levels.

Many POCT devices currently in use differ in the results they are able to report. In many cases it is more expensive to assay for fractions of cholesterol such as HDL-C. Pharmacists can reduce costs by only testing for TC. This may inhibit the ability to use a valid screening tool. For instance, the Framingham, QRISK2 and ASSIGN screening tools all require both TC and HDL-C to screen for risk of CVD [12–14]. The SCORE screening tool can estimate risk of CVD using only TC [11]. By offering to assay full lipid profile the cost of the screening service will increase, which may reduce the number of people screened (because the cost of screening per person is increased) or reduce uptake (if the service is funded by patients). The ability of pharmacists to request laboratory testing of patient samples, which is currently not routinely possible, would be an important development and would overcome some of the challenges associated with POCT devices.

There were several limitations to this review. There were only eight papers identified as relevant and this will limit the generalisability of the findings. The inclusion of the Donyai *et al.* (2009) [32] paper is questionable as it only measured CVD risk and gender as compared to other studies measuring multiple outcomes. However, as this study met our inclusion criteria, it was eligible. There was no librarian involved in the literature search, which was conducted by one researcher. The researcher had been trained on literature searches, however, so this was not thought to adversely influence the results. Any ambiguity over a paper's suitability for inclusion in this review was resolved by discussion between all three researchers. It may have been productive to use other terms such as "risk calculation" as a search term, however the broad range of the search terms used meant it was thought to encapsulate all potentially relevant papers. References in retrieved papers were hand searched for other suitable papers. This review may not have captured all instances where a community pharmacist has screened

for CVD using a screening tool. It is likely that community pharmacists have engaged in this type of screening before but have not published the results in an academic journal.

As mentioned previously, different screening tools were used and reporting of results was not consistent between studies. This means that it is not possible to compare results between different studies and use the results to estimate risk of the greater population. Furthermore for the study by Evans *et al.* [30], the study population was broken up into three cohorts. This study examined the effect of a pharmacist intervention. For the purposes of this review all cohorts were pooled, and only baseline screenings were included.

Referral criteria were a source of bias in this literature review. In some cases patients were only enrolled in studies if they were referred for screening or were suspected to be at risk of developing CVD. This means that the patients in this study will have a higher risk of CVD than normal.

For future work it would be recommended that the results reported would be more consistent and comprehensive. The results should describe the overall CVD risk of the population, with a measure of centrality and variability. The results should also describe the proportion of the population at low, intermediate and high risk of developing CVD. Furthermore, each risk factor measured should be described appropriately to provide as much information as possible about the population screened. By describing the population's characteristics in more detail it will allow accurate comparisons between studies and also make it easier to identify any bias in each study, such as the age or gender balance of the study population being looked at.

4. Conclusions

In the studies reviewed between 2008 and 2010, over 12,000 people have had a CVD risk assessment performed by a pharmacist. The fact that other screening programmes are not robustly reported in the literature makes it impossible to calculate how many people may have benefitted from pharmacist CVD screening. Opportunistic and referral-based screenings are what most pharmacists do, but they thereby miss many patients. Proactive case finding is necessary for this to be population health-relevant. What is needed is to capture those patients who do not see their physician or those of whom the physician does not think to screen for CVD risk. That is where pharmacy-based cardiovascular risk assessments would be most useful from a population health point of view and where pharmacists could have the greatest effect in improving public health.

Conflicts of Interest

The authors declare no conflict of interest.

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