Do not use CHD risk estimation tools because people with FH are already at a high risk of premature CHD

All patients with FH should be offered a referral to a lipidologist for confirmation diagnosis of familial hypercholesterolaemia (homozygous and heterozygous)

Start treatment with atorvastatin 10mg daily. Recheck fasting lipid levels after 3 months.

Consider prescribing a high-intensity statin (see appendix on statin intensity) to achieve a recommended reduction in LDL-C concentration of greater than 50% from baseline (that is, LDL-C concentration before treatment). Treatment should be titrated up and optimised.

Compliance with medication should be checked at every stage of management change.

Patients already on simvastatin and pravastatin who are benefitting from treatment should be allowed to continue to treatment.

Patients not able to tolerate one statin may benefit from a trial with another. Atorvastatin 10mg is first line, followed by simvastatin 10mg and then pravastatin 10mg (titrating to target dose of 40mg)

Patients unable to tolerate all generic statins (simvastatin, atorvastatin, pravastatin, rosuvastatin) should be referred back to a lipidologist

Rosuvastatin for FH may be considered in patients unable to tolerate sufficient dose of a cheaper generic statin to achieve 50% reduction in LDL cholesterol.

Ezetimibe is a monotherapy treatment option in patients truly intolerant to statins. Ezetimibe in combination with a statin is a limited treatment option following intensification of statins. (NICE TA385)

Most patients will be managed in primary care but re-referral back to the lipidologist is appropriate if LDL-c cannot be reduced by at least 50% or cascade screening has not been undertaken or diagnosis is in doubt.
1. **Diagnosis**

NICE makes a recommendation to systematically search primary care records for people who are at highest risk of FH as defined below:

- younger than 30 years, with a total cholesterol concentration greater than 7.5 mmol/l and
- 30 years or older, with a total cholesterol concentration greater than 9.0 mmol/l

For people with a personal or family history of premature coronary heart disease (an event before 60 years in an index individual or first-degree relative), but whose total cholesterol is unknown, offer to measure their total cholesterol.

- Suspect FH in adults who have total cholesterol concentrations greater than 7.5 mmol/l and/or in the presence of a personal or family history of premature coronary heart disease (an event before 60 years in an index individual or first-degree relative).
- The probability of FH increase with higher LDL-c. It is unusual for triglycerides to be significantly raised; if the triglycerides are raised, consider advice and guidance request or referral to a local lipid clinic to clarify diagnosis.
- Exclude secondary causes of hypercholesterolaemia before considering a diagnosis of FH, such as hypothyroidism.
- Use the **Simon Broome criteria** to make a diagnosis of FH.
- Absence of clinical signs (for example, tendon xanthomata) does not exclude a diagnosis of FH.
- To confirm a diagnosis of FH, take at least two measurements low-density lipoprotein cholesterol (LDL-c) concentration. Measurement of fasting lipid profiles is required and allows measurement of plasma triglyceride concentrations, which is important to exclude a mixed hyperlipidaemia.
- When considering a diagnosis of FH, always take a family history with particular reference to premature CVD. However, a family history may have confounders (e.g. adoption, non-paternity, early death from other causes) and its absence does not exclude the diagnosis.

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**Simon Broome diagnostic criteria for index individuals**

Diagnose a person with **definite** FH if they have:

- cholesterol concentrations as defined in table 1 and tendon xanthomas, or evidence of these signs in first- or second-degree relative
- Or DNA-based evidence of an LDL-c receptor mutation, familial defective apo B-100, or a PCSK9 mutation.

Diagnose a person with **possible** FH if they have cholesterol concentrations as defined in table 1 and at least one of the following:

- Family history of myocardial infarction: aged younger than 50 years in second-degree relative or aged younger than 60 years in first-degree relative.
- Family history of raised total cholesterol: greater than 7.5 mmol/l in adult first- or second-degree relative or greater than 6.7 mmol/l in child, brother or sister aged younger than 16 years.

**Table 1 Cholesterol levels to be used as diagnostic criteria for the index individual**

<table>
<thead>
<tr>
<th>Total cholesterol</th>
<th>LDL-c</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;6.7 mmol/l</td>
<td>&gt;4.0 mmol/l</td>
</tr>
<tr>
<td>&gt;7.5 mmol/l</td>
<td>&gt;4.9 mmol/l</td>
</tr>
</tbody>
</table>

1Levels either pre-treatment or highest on treatment
Identifying people with FH using cascade testing
Healthcare professionals should offer all people with FH a referral to a specialist with expertise in FH for confirmation of diagnosis and initiation of cascade testing.

2. Management

Before Starting
- Do not use coronary heart disease risk estimation tools (eg QRisk2) because people with FH are already at a high risk of premature coronary heart disease.
- A baseline resting ECG is recommended for adults.
- Regard lifestyle advice as a component of medical management and not as a substitute for lipid-modifying drug therapy. The five key elements are stopping smoking, diet, physical activity, weight management, and alcohol consumption.
- Inform patient that lipid-modifying drug treatment is life-long.

How to treat
- Start treatment with atorvastatin 10mg daily.
- NICE guideline on FH recommends aiming for a reduction in LDL-c concentration of greater than 50% from baseline. Where atorvastatin 10-20mg does not achieve this, increasing to atorvastatin 40-80 mg will be necessary for these patients.
- High intensity statins is the preferred local strategy to manage high LDL-C.
- Ezetimibe (Brown as per NICE TA385)
  - Ezetimibe monotherapy is a treatment option in patients contraindicated or unable to tolerate all statins.
  - Ezetimibe in combination with a statin is a limited treatment option following intensification of statins in patients where lipid level are not adequately controlled and changing from the initial statin (atorvastatin) is being considered.
- Treat these patients with blood pressure lowering medication (target BP <140/85 mmHg)
  - adults over 40 years of age with sustained systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg
  - adults 40 years of age or younger if they have sustained systolic BP ≥ 160 mmHg and/or diastolic BP ≥ 100 mmHg.
- When treatment fails to improve LDL-c always check compliance, revisit lifestyle modification advice, recheck for secondary causes of hyperlipidaemia and stop medications that are having no benefit (especially rosuvastatin or ezetimibe).

Intolerance to statin

Intolerance is defined as the presence of clinically significant adverse effects that are considered to represent an unacceptable risk to the patient or that may result in therapy being compromised. Adverse effects include evidence of new-onset muscle pain (often associated with levels of muscle enzymes in the blood indicative of muscle damage), significant gastrointestinal disturbance or alterations of liver function tests.

- Some patients intolerant of simvastatin and atorvastatin are able to tolerate pravastatin. Pravastatin although less potent in reducing LDL-c is still effective and remains a treatment option in some patients.
- Published data in a very small patient group supports infrequent dosing (i.e. less than once daily) of atorvastatin or rosuvastatin in patients otherwise intolerant of statins. The dosing of atorvastatin or rosuvastatin in this manner should only be initiated in a specialist lipid clinic but can then be continued in primary care.
Rosuvastatin (Brown 3rd line)

Rosuvastatin may be considered in patients with:

i. Complete intolerance of simvastatin, atorvastatin and pravastatin due to myalgia. Less than once daily dosing strategy may be adopted (which includes atorvastatin 10mg every other day). Rosuvastatin to be prescribed initially 5mg less than daily and titrated to 5mg daily if possible. Tolerance of higher doses is not likely but can be tried.

ii. Partial tolerance of other statins at low-moderate doses (simvastatin 40mg, pravastatin 40mg and atorvastatin 20mg max tolerated dose) but not reaching LDL-C target. In these patients it is appropriate to commence rosuvastatin with titration to maximum tolerated/ minimum necessary dose to achieve 50% reduction in LDL-c (dose range 5mg-40 mg daily).

- A start dose of 5 mg is recommended in patients >70 years. No other dose adjustment is necessary in relation to age.
- No dose adjustment is necessary in patients with mild to moderate renal impairment. The recommended start dose is 5 mg in patients with moderate renal impairment (creatinine clearance of <60 ml/min). The 40 mg dose is contraindicated in patients with moderate renal impairment and Asians. The use of rosuvastatin in patients with severe renal impairment (creatinine clearance of <30 ml/min) is contraindicated for all doses
- An assessment of renal function should be considered during routine follow-up of patients treated with a dose of 40 mg.

Other Specialist options for LDL- C control

- Bile acid sequestrants colestyramine but this is often not tolerated.
- Fibrates may be used in people intolerant of statin/ ezetimibe, only if triglycerides above normal, or on specialist advice. Patient should be re-assessed at 3 months and treatment discontinued if no improvement. Fenofibrate is the preferred choice. Ciprofibrate has been locally classified as BLACK as less cost effective.

PCSK9 inhibitors- alirocumab and evolocumab (JAPC classification RED)

NICE TA393 and TA394 recommends alirocumab and evolocumab as an option for treating primary hypercholesterolaemia or mixed dyslipidaemia in selected patients after statin/ ezetimibe treatment have been optimised. They are only recommended by lipid specialist and are supplied through hospital via homecare; GPs may be asked to prescribe statin in conjunction.

Ensure treatment is optimised before considering referral to lipid specialist for consideration of PCSK9 inhibitors.

<table>
<thead>
<tr>
<th>Low-density lipoprotein cholesterol concentrations above which alirocumab/evolocumab are recommended (NICE TA393/394)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Without CVD</strong></td>
</tr>
<tr>
<td>Primary heterozygous-familial hypercholesterolaemia</td>
</tr>
</tbody>
</table>
3. Follow up
- Patients should be reviewed annually for assessment of: lipids, concordance with treatment, control of other risk factors, new symptoms of cardiovascular disease and progress with family (cascade) testing.
- Most patients will be managed directly in primary care under the guidance of a lipidologist. Specialist re-referral is indicated if:
  - LDL-C cannot be reduced by at least 50% despite treatment optimisation in primary care
  - Cascade screening is necessary (all newly diagnosed cases of FH or cases in whom cascade screening has not been performed)
  - Diagnosis is in doubt (e.g. presence of raised plasma triglyceride concentrations)
  - Pregnancy is being considered.
  - SE compromising concordance with lipid modifying therapy
  - Unable to tolerate all generic statins

4. Special considerations

Women with familial hypercholesterolaemia
- Refer to a specialist lipid clinic if pregnancy being considered or if the woman is pregnant.

Children and young people
- Refer children and young people to a specialist with expertise in familial hypercholesterolaemia in this age group and in an appropriate setting. This would indicate a paediatrician with a metabolic clinic, rather than an adult lipid clinic.
- In children at risk of familial hypercholesterolaemia because of an affected parent, consider a DNA test by the age of 10 years if the family mutation is known; otherwise measure low density lipoprotein
- The Simon Broome criteria are NOT applicable to relatives of known FH carriers as the prior probability is high (50%). Use appropriate age and sex-related charts published by NICE.
- For children with FH treatment with a statin may be appropriate from the age of 10 years (where licensed), but should be initiated by a specialist following an individualised assessment
- Routinely monitor growth and pubertal development in children and young people.

References
- Identification and management of familial hypercholesterolaemia NICE Clinical Guideline 71, August 2008- updated November 2017
- NICE TA 385 Ezetimibe for treating primary heterozygous-familial and non-familial hypercholesterolaemia (February 2016)
- NICE TA 393/394 Alirocumab/Evolocumab for treating primary hypercholesterolaemia and mixed dyslipidaemia (June 2016)
- BMJ 2008; 337:509-10
- BMJ 2008; 337:a2423
- Ann Clin Biochem 2006;43:441-56
- Atherosclerosis 1999;142:105-12
- Lancet 2001;577-81
- JAMA 2004;292:331-7
- Atherosclerosis 1999;142:105-12
- Eur Heart J 2008; 2625-33
- Ann Pharmacotherapy. 2008; 42: 341
Treatment algorithm for FH

Diagnosis of FH using Simon Broome criteria (Adult TC > 7.5 mmol/L; LDL-c > 4.9 mmol/L)
Refer to lipid clinic for confirmation of diagnosis and initiation of cascade testing

Start **atorvastatin 10mg** daily on advice of lipid specialist
Lifestyle advice
**Aim for >50% reduction in LDL cholesterol**

Optimise lipid therapy if 50% **reduction** in LDH-c not achieved
- Titrate atorvastatin up to 80mg (see also p.4 advice on rosuvastatin)
- Consider ezetimibe in line with NICETEA385
  - monotherapy if contra-indicated or intolerant to statin or
  - in addition to statin if lipid level not adequately controlled and changing from the initial statin being considered
- Check compliance, revisit lifestyle advice, recheck for secondary causes, and stop medications that are having no benefit

Consider advice from lipid specialist to intensify lipid therapy if 50% reduction in LDH-c still not achieved.

Check **LDL** (fasting sample required) if 50% reduction still not achieved
LDL > 5.0 mmol/L (no cardiovascular disease*) or
LDL > 3.5 mmol/L (any cardiovascular disease*)
**On 2 or more samples 3 months apart**

- **Sub-optimal lipids but no treatment intensification currently advised.**
  - Optimize lifestyle and non-lipid risk factors
- **PCSK9 inhibitors may be indicated**
  - Refer to local lipid clinic

* defined as a history of any of the following: acute coronary syndrome (such as myocardial infarction or unstable angina requiring hospitalisation), coronary or other arterial revascularisation procedures, chronic heart disease, ischaemic stroke, peripheral arterial disease.
Systemically search primary care record to identify suspected FH; inclusion of DLCN criteria for diagnosis
November 2017 (NICE CG71 update)

Relax rosuvastatin use in primary care
May 2018

Add in fenofibrate is preferred choice of fibrates
May 2018

Updated by:
Derbyshire Medicines Management Clinical Effectiveness Team
In consultation with:
Dr Paul Masters (Consultant Chemical Pathologist, CRH & RDH)
Dr Roger Stanworth (Consultant in Diabetes & Endocrinology, RDH)

Appendix - statin intensity (as defined by NICE CG181)

| 20-30% | Low intensity |
| 30-40% | Medium intensity |
| Above 40% | High intensity |

<table>
<thead>
<tr>
<th>Drug</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>40</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluvastatin</td>
<td>21%</td>
<td>27%</td>
<td>33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pravastatin</td>
<td>20%</td>
<td>24%</td>
<td>29%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simvastatin</td>
<td>27%</td>
<td>32%</td>
<td>37%</td>
<td>42%</td>
<td></td>
</tr>
<tr>
<td>Atorvastatin</td>
<td>37%</td>
<td>43%</td>
<td>49%</td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Rosuvastatin</td>
<td>38%</td>
<td>43%</td>
<td>48%</td>
<td>53%</td>
<td></td>
</tr>
</tbody>
</table>

% = percentage reduction in LDL cholesterol

*Advice from the MHRA: there is an increased risk of myopathy associated with high-dose (80mg) simvastatin. This dose should only be considered in patients with severe hypercholesterolaemia and high risk of cardiovascular complications who have not achieved their treatment goals on lower doses, when the benefits are expected to outweigh the potential risks.