

# Myocardial infarction: cardiac rehabilitation and prevention of further cardiovascular disease

Clinical guideline

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[nice.org.uk/guidance/cg172](https://www.nice.org.uk/guidance/cg172)

## Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

## Contents

Introduction .....	5
Drug recommendations.....	6
Patient-centred care .....	7
Key priorities for implementation .....	8
Cardiac rehabilitation after an acute myocardial infarction (MI).....	8
Lifestyle changes after an MI .....	8
Drug therapy .....	8
Communication of diagnosis and advice .....	9
1 Recommendations .....	10
1.1 Cardiac rehabilitation after an acute myocardial infarction (MI).....	10
1.2 Lifestyle changes after an MI .....	14
1.3 Drug therapy.....	16
1.4 Coronary revascularisation after an MI .....	23
1.5 Selected patient subgroups .....	23
1.6 Communication of diagnosis and advice .....	23
2 Research recommendations .....	25
2.1 In people who have not undergone revascularisation after an MI, does clopidogrel and placebo have a better outcome than clopidogrel and aspirin? .....	25
2.2 Does continuing beta-blocker treatment beyond 1 year after an MI improve outcomes for people with normal left ventricular systolic function?.....	25
2.3 Is treatment with an oral anticoagulant, aspirin and clopidogrel preferable to treatment with an oral anticoagulant and clopidogrel in people who have had an MI, have an indication for oral anticoagulation and are treated either medically, by primary PCI or by coronary artery bypass grafting surgery? .....	26
2.4 What characteristics are associated with uptake and adherence to cardiac rehabilitation after an acute MI when rehabilitation is started early?.....	26
2.5 In people who have had a STEMI who undergo primary PCI with a bare-metal stent, and 4 weeks of aspirin and clopidogrel, is there an additional benefit to continuing clopidogrel for a further 11 months? 27	
3 Other information.....	28
3.1 Scope and how this guideline was developed.....	28
3.2 Related NICE guidance.....	28

4 The Guideline Development Group, National Collaborating Centre and NICE project team 2013.....	31
4.1 Guideline Development Group.....	31
4.2 National Clinical Guideline Centre.....	32
4.3 NICE project team.....	33
About this guideline .....	34
Update information.....	34
Recommendations from NICE clinical guideline 48 that have been amended.....	35
Strength of recommendations.....	36
Other versions of this guideline .....	37
Implementation .....	38
Changes after publication.....	38
Your responsibility.....	38
Copyright.....	38

This guideline replaces CG48.

This guideline partially replaces TA80.

This guideline is the basis of QS99 and QS167.

## Introduction

This guideline updates and replaces 'MI – secondary prevention' (NICE clinical guideline 48) and updates and replaces a recommendation from NICE technology appraisal guidance 80. The recommendations are labelled according to when they were originally published (see [About this guideline](#) for details).

Myocardial infarction (MI) is one of the most dramatic presentations of coronary artery disease. It is usually caused by blockage of a coronary artery producing tissue death and consequently the typical features of a heart attack: severe chest pain, changes on the electrocardiogram (ECG), and raised concentrations of proteins released from the dying heart tissue into the blood. MIs are divided into 2 types according to the changes they produce on the ECG:

- ST-segment elevation myocardial infarction (STEMI), which is generally caused by complete and persisting blockage of the artery
- non-ST-segment elevation myocardial infarction (NSTEMI), reflecting partial or intermittent blockage of the artery.

In England and Wales in 2011/12 more than 79,000 hospital admissions were caused by MI according to the Myocardial Ischaemia National Audit Project (MINAP). Of these, 41% were STEMI and 59% were NSTEMI. Twice as many men had MIs as women.

People who have had a STEMI or an NSTEMI benefit from treatment to reduce the risk of further MI or other manifestations of vascular disease. This is known as secondary prevention. Since the late 1990s MINAP has documented the reductions in mortality resulting from changes in acute treatment of MI and the application of secondary prevention measures. Although 30-day mortality was almost 13% for STEMI in 2003/04, it fell to 8% in 2011/12, with similar falls for NSTEMI.

The NICE guideline on the secondary prevention of MI (NICE clinical guideline 48) was published in 2007, offering comprehensive advice to prevent further MI and progression of vascular disease in those who had already had an MI, either recently or in the past (more than 12 months ago). Since

2007, there has been a major change in the management of acute MI, both STEMI and NSTEMI, although more dramatically the former. Primary percutaneous coronary intervention (PCI) has replaced thrombolysis in most cases of STEMI. This improvement in acute treatment may have an impact on the efficacy of secondary prevention, which is one of the reasons this update is needed.

Uptake of cardiac rehabilitation is still low, with only 44% of people starting an outpatient cardiac rehabilitation programme in England, Northern Ireland and Wales after an MI. People also wait an average of 53 days to start an outpatient rehabilitation programme. Interventions that may enhance uptake and adherence to cardiac rehabilitation programmes have been included in this 2013 update.

Drug therapy for secondary prevention is effectively applied nationally, but new findings on antithrombotic therapy, omega-3 fatty acid supplementation, angiotensin-converting enzyme (ACE) inhibitors and beta-blockers have also contributed to a need for this guideline to be updated.

### *Drug recommendations*

The guideline will assume that prescribers will use a drug's summary of product characteristics to inform decisions made with individual patients.

## Patient-centred care

This guideline offers best practice advice on the care of adults who have had a myocardial infarction.

Patients and healthcare professionals have rights and responsibilities as set out in the [NHS Constitution for England](#) – all NICE guidance is written to reflect these. Treatment and care should take into account individual needs and preferences. Patients should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. Healthcare professionals should follow the [Department of Health's advice on consent](#) (or, in Wales, [advice on consent from the Welsh Government](#)). If someone does not have capacity to make decisions, healthcare professionals should follow the [code of practice that accompanies the Mental Capacity Act](#) and the supplementary [code of practice on deprivation of liberty safeguards](#).

NICE has produced guidance on the components of good patient experience in adult NHS services. All healthcare professionals should follow the recommendations in [Patient experience in adult NHS services](#).

## Key priorities for implementation

The following recommendations have been identified as priorities for implementation. The full list of recommendations is in [section 1](#).

### *Cardiac rehabilitation after an acute myocardial infarction (MI)*

- Offer cardiac rehabilitation programmes designed to motivate people to attend and complete the programme. Explain the benefits of attending. [new 2013]
- Begin cardiac rehabilitation as soon as possible after admission and before discharge from hospital. Invite the person to a cardiac rehabilitation session which should start within 10 days of their discharge from hospital. [new 2013]

### *Lifestyle changes after an MI*

- Advise people to eat a Mediterranean-style diet (more bread, fruit, vegetables and fish; less meat; and replace butter and cheese with products based on plant oils). [2007]
- Advise people to be physically active for 20–30 minutes a day to the point of slight breathlessness. Advise people who are not active to this level to increase their activity in a gradual, step-by-step way, aiming to increase their exercise capacity. They should start at a level that is comfortable, and increase the duration and intensity of activity as they gain fitness. [2007]
- Advise all people who smoke to stop and offer assistance from a smoking cessation service in line with [Brief interventions and referral for smoking cessation](#) (NICE public health guidance 1). [2007]

### *Drug therapy*

- Offer all people who have had an acute MI treatment with the following drugs:
  - ACE (angiotensin-converting enzyme) inhibitor
  - dual antiplatelet therapy (aspirin plus a second antiplatelet agent)
  - beta-blocker
  - statin. [2007, amended 2013]



- Offer an assessment of left ventricular function to all people who have had an MI. [2013]
- Titrate the ACE inhibitor dose upwards at short intervals (for example, every 12–24 hours) before the person leaves hospital until the maximum tolerated or target dose is reached. If it is not possible to complete the titration during this time, it should be completed within 4–6 weeks of hospital discharge. [new 2013]
- Communicate plans for titrating beta-blockers up to the maximum tolerated or target dose – for example, in the discharge summary. [new 2013]

### *Communication of diagnosis and advice*

- After an acute MI, ensure that the following are part of every discharge summary:
  - confirmation of the diagnosis of acute MI
  - results of investigations
  - incomplete drug titrations
  - future management plans
  - advice on secondary prevention. [2007, amended 2013]

## 1 Recommendations

The following guidance is based on the best available evidence. The [full guideline](#) gives details of the methods and the evidence used to develop the guidance.

The wording used in the recommendations in this guideline (for example words such as 'offer' and 'consider') denotes the certainty with which the recommendation is made (the strength of the recommendation). See [About this guideline](#) for details.

### 1.1 *Cardiac rehabilitation after an acute myocardial infarction (MI)*

#### Comprehensive cardiac rehabilitation

- 1.1.1 All patients (regardless of their age) should be given advice about and offered a cardiac rehabilitation programme with an exercise component. [2007]
- 1.1.2 Cardiac rehabilitation programmes should provide a range of options, and patients should be encouraged to attend all those appropriate to their clinical needs. Patients should not be excluded from the entire programme if they choose not to attend certain components. [2007]
- 1.1.3 If a patient has cardiac or other clinical conditions that may worsen during exercise, these should be treated if possible before the patient is offered the exercise component of cardiac rehabilitation. For some patients, the exercise component may be adapted by an appropriately qualified healthcare professional. [2007]
- 1.1.4 Patients with left ventricular dysfunction who are stable can safely be offered the exercise component of cardiac rehabilitation. [2007]

#### Encouraging people to attend

- 1.1.5 Deliver cardiac rehabilitation in a non-judgemental, respectful and culturally sensitive manner. Consider employing bilingual peer educators or cardiac rehabilitation assistants who reflect the diversity of the local population. [new 2013]

- 1.1.6 Establish people's health beliefs and their specific illness perceptions before offering appropriate lifestyle advice and to encourage attendance to a cardiac rehabilitation programme. [new 2013]
- 1.1.7 Offer cardiac rehabilitation programmes designed to motivate people to attend and complete the programme. Explain the benefits of attending. [new 2013]
- 1.1.8 Discuss with the person any factors that might stop them attending a cardiac rehabilitation programme, such as transport difficulties. [new 2013]
- 1.1.9 Offer cardiac rehabilitation programmes in a choice of venues (including at the person's home, in hospital and in the community) and at a choice of times of day, for example, sessions outside of working hours. Explain the options available. [new 2013]
- 1.1.10 Provide a range of different types of exercise, as part of the cardiac rehabilitation programme, to meet the needs of people of all ages, or those with significant comorbidity. Do not exclude people from the whole programme if they choose not to attend specific components. [new 2013]
- 1.1.11 Offer single-sex cardiac rehabilitation programme classes if there is sufficient demand. [new 2013]
- 1.1.12 Enrol people who have had an MI in a system of structured care, ensuring that there are clear lines of responsibility for arranging the early initiation of cardiac rehabilitation. [new 2013]
- 1.1.13 Begin cardiac rehabilitation as soon as possible after admission and before discharge from hospital. Invite the person to a cardiac rehabilitation session which should start within 10 days of their discharge from hospital. [new 2013]
- 1.1.14 Contact people who do not start or do not continue to attend the cardiac rehabilitation programme with a further reminder, such as:
- a motivational letter
  - a prearranged visit from a member of the cardiac rehabilitation team
  - a telephone call

- a combination of the above. [new 2013]
- 1.1.15 Seek feedback from cardiac rehabilitation programme users and aim to use this feedback to increase the number of people starting and attending the programme. [new 2013]
- 1.1.16 Be aware of the wider health and social care needs of a person who has had an MI. Offer information and sources of help on:
- economic issues
  - welfare rights
  - housing and social support issues. [new 2013]
- 1.1.17 Make cardiac rehabilitation equally accessible and relevant to all people after an MI, particularly people from groups that are less likely to access this service. These include people from black and minority ethnic groups, older people, people from lower socioeconomic groups, women, people from rural communities, people with a learning disability and people with mental and physical health conditions. [2007, amended 2013]
- 1.1.18 Encourage all staff, including senior medical staff, involved in providing care for people after an MI, to actively promote cardiac rehabilitation. [2013]

## Health education and information needs

- 1.1.19 Comprehensive cardiac rehabilitation programmes should include health education and stress management components. [2007]
- 1.1.20 A home-based programme validated for patients who have had an MI (such as [The heart manual](#)) that incorporates education, exercise and stress management components with follow-ups by a trained facilitator may be used to provide comprehensive cardiac rehabilitation. [2007]
- 1.1.21 Take into account the physical and psychological status of the patient, the nature of their work and their work environment when giving advice on returning to work. [2007]

- 1.1.22 Be up to date with the latest Driver and Vehicle Licensing Agency (DVLA) guidelines. Regular updates are published on the [DVLA website](#). [2007]
- 1.1.23 After an MI without complications, people who wish to travel by air should seek advice from the [Civil Aviation Authority](#). People who have had a complicated MI need expert individual advice. [2007, amended 2013]
- 1.1.24 People who have had an MI who hold a pilot's licence should seek advice from the [Civil Aviation Authority](#). [2007]
- 1.1.25 Take into account the patient's physical and psychological status, as well as the type of activity planned when offering advice about the timing of returning to normal activities. [2007]
- 1.1.26 An estimate of the physical demand of a particular activity, and a comparison between activities, can be made using tables of metabolic equivalents (METs) of different activities (for further information please refer to the [Centers for Disease Control and Prevention website](#)). Advise patients how to use a perceived exertion scale to help monitor physiological demand. Patients who have had a complicated MI may need expert advice. [2007]
- 1.1.27 Advice on competitive sport may need expert assessment of function and risk, and is dependent on what sport is being discussed and the level of competitiveness. [2007]

## Psychological and social support

- 1.1.28 Offer stress management in the context of comprehensive cardiac rehabilitation. [2007]
- 1.1.29 Do not routinely offer complex psychological interventions such as cognitive behavioural therapy. [2007]
- 1.1.30 Involve partners or carers in the cardiac rehabilitation programme if the patient wishes. [2007]
- 1.1.31 For recommendations on the management of patients with clinical anxiety or depression, refer to [Anxiety](#) (NICE clinical guideline 113), [Depression in adults](#)

(NICE clinical guideline 90) and [Depression in adults with a chronic physical health problem](#) (NICE clinical guideline 91). [2007]

## Sexual activity

- 1.1.32 Reassure patients that after recovery from an MI, sexual activity presents no greater risk of triggering a subsequent MI than if they had never had an MI. [2007]
- 1.1.33 Advise patients who have made an uncomplicated recovery after their MI that they can resume sexual activity when they feel comfortable to do so, usually after about 4 weeks. [2007]
- 1.1.34 Raise the subject of sexual activity with patients within the context of cardiac rehabilitation and aftercare. [2007]
- 1.1.35 When treating erectile dysfunction, treatment with a PDE5 (phosphodiesterase type 5) inhibitor may be considered in men who have had an MI more than 6 months earlier and who are now stable. [2007]
- 1.1.36 PDE5 inhibitors must be avoided in patients treated with nitrates or nicorandil because this can lead to dangerously low blood pressure. [2007]

## 1.2 *Lifestyle changes after an MI*

### Changing diet

- 1.2.1 Advise people to eat a Mediterranean-style diet (more bread, fruit, vegetables and fish; less meat; and replace butter and cheese with products based on plant oils). [2007]
- 1.2.2 Do not routinely recommend eating oily fish for the sole purpose of preventing another MI. If people after an MI choose to consume oily fish, be aware that there is no evidence of harm, and fish may form part of a Mediterranean-style diet. [new 2013]
- 1.2.3 Do not offer or advise people to use the following to prevent another MI:
- omega-3 fatty acid capsules

- omega-3 fatty acid supplemented foods.

If people choose to take omega-3 fatty acid capsules or eat omega-3 fatty acid supplemented foods, be aware that there is no evidence of harm. [new 2013]

- 1.2.4 Advise people not to take supplements containing beta-carotene. Do not recommend antioxidant supplements (vitamin E and/or C) or folic acid to reduce cardiovascular risk. [2007]
- 1.2.5 Offer people an individual consultation to discuss diet, including their current eating habits, and advice on improving their diet. [2007]
- 1.2.6 Give people consistent dietary advice tailored to their needs. [2007]
- 1.2.7 Give people healthy eating advice that can be extended to the whole family. [2007]

## Alcohol consumption

- 1.2.8 Advise people who drink alcohol to keep weekly consumption within safe limits (no more than 21 units of alcohol per week for men, or 14 units per week for women) and to avoid binge drinking (more than 3 alcoholic drinks in 1–2 hours). [2007]

## Regular physical activity

- 1.2.9 Advise people to undertake regular physical activity sufficient to increase exercise capacity. [2007]
- 1.2.10 Advise people to be physically active for 20–30 minutes a day to the point of slight breathlessness. Advise people who are not active to this level to increase their activity in a gradual, step-by-step way, aiming to increase their exercise capacity. They should start at a level that is comfortable, and increase the duration and intensity of activity as they gain fitness. [2007]
- 1.2.11 Advice on physical activity should involve a discussion about current and past activity levels and preferences. The benefit of exercise may be enhanced by tailored advice from a suitably qualified professional. [2007]

## Smoking cessation

- 1.2.12 Advise all people who smoke to stop and offer assistance from a smoking cessation service in line with [Brief interventions and referral for smoking cessation](#) (NICE public health guidance 1). [2007]
- 1.2.13 All patients who smoke and who have expressed a desire to quit should be offered support and advice, and referral to an intensive support service (for example, the NHS Stop Smoking Services) in line with [Brief interventions and referral for smoking cessation](#) (NICE public health guidance 1). If a patient is unable or unwilling to accept a referral they should be offered pharmacotherapy in line with the recommendations in [Smoking cessation services](#) (NICE public health guidance 10). [2007]

## Weight management

- 1.2.14 After an MI, offer all patients who are overweight or obese advice and support to achieve and maintain a healthy weight in line with [Obesity](#) (NICE clinical guideline 43). [2007]

## 1.3 Drug therapy

- 1.3.1 Offer all people who have had an acute MI treatment with the following drugs:
- ACE (angiotensin-converting enzyme) inhibitor
  - dual antiplatelet therapy (aspirin plus a second antiplatelet agent)
  - beta-blocker
  - statin. [2007, amended 2013]
- 1.3.2 Ensure that a clear management plan is available to the person who has had an MI and is also sent to the GP, including:
- details and timing of any further drug titration
  - monitoring of blood pressure
  - monitoring of renal function. [new 2013]



- 1.3.3 Offer all people who have had an MI an assessment of bleeding risk at their follow-up appointment. [new 2013]
- 1.3.4 Offer an assessment of left ventricular function to all people who have had an MI. [2013]

## ACE inhibitors

- 1.3.5 Offer people who present acutely with an MI an ACE inhibitor as soon as they are haemodynamically stable. Continue the ACE inhibitor indefinitely. [new 2013]
- 1.3.6 Titrate the ACE inhibitor dose upwards at short intervals (for example, every 12–24 hours) before the person leaves hospital until the maximum tolerated or target dose is reached. If it is not possible to complete the titration during this time, it should be completed within 4–6 weeks of hospital discharge. [new 2013]
- 1.3.7 Do not offer combined treatment with an ACE inhibitor and an angiotensin II receptor blocker (ARB) to people after an MI, unless there are other reasons to use this combination. [new 2013]
- 1.3.8 Offer people after an MI who are intolerant to ACE inhibitors an ARB instead of an ACE inhibitor. [new 2013]
- 1.3.9 Renal function, serum electrolytes and blood pressure should be measured before starting an ACE inhibitor or ARB and again within 1 or 2 weeks of starting treatment. Patients should be monitored as appropriate as the dose is titrated upwards, until the maximum tolerated or target dose is reached, and then at least annually. More frequent monitoring may be needed in patients who are at increased risk of deterioration in renal function. Patients with chronic heart failure should be monitored in line with [Chronic heart failure](#) (NICE clinical guideline 108). [2007]
- 1.3.10 Offer an ACE inhibitor to people who have had an MI more than 12 months ago. Titrate to the maximum tolerated or target dose (over a 4–6-week period) and continue indefinitely. [new 2013]

- 1.3.11 Offer people who have had an MI more than 12 months ago and who are intolerant to ACE inhibitors an ARB instead of an ACE inhibitor. [new 2013]

### Antiplatelet therapy

- 1.3.12 Offer aspirin to all people after an MI and continue it indefinitely, unless they are aspirin intolerant or have an indication for anticoagulation. [2007, amended 2013]
- 1.3.13 Offer aspirin to people who have had an MI more than 12 months ago and continue it indefinitely. [new 2013]
- 1.3.14 For patients with aspirin hypersensitivity, clopidogrel monotherapy should be considered as an alternative treatment. [2007]
- 1.3.15 People with a history of dyspepsia should be considered for treatment in line with [Dyspepsia](#) (NICE clinical guideline 17). [2007, amended 2013]
- 1.3.16 After appropriate treatment, people with a history of aspirin-induced ulcer bleeding whose ulcers have healed and who are negative for *Helicobacter pylori* should be considered for treatment in line with [Dyspepsia](#) (NICE clinical guideline 17). [2007, amended 2013]

This guidance incorporates NICE technology appraisal guidance 236 on ticagrelor for the treatment of acute coronary syndromes. Guidance on prasugrel for the treatment of acute coronary syndromes has not been incorporated in this guidance because this technology appraisal is currently scheduled for update. For further information about this appraisal, see the [NICE website](#).

- 1.3.17 Ticagrelor in combination with low-dose aspirin is recommended for up to 12 months as a treatment option in adults with acute coronary syndromes (ACS) that is, people:
- with ST-segment-elevation myocardial infarction (STEMI) – defined as ST elevation or new left bundle branch block on electrocardiogram – that cardiologists intend to treat with primary percutaneous coronary intervention (PCI) or
  - with non-ST-segment-elevation myocardial infarction (NSTEMI).

This recommendation is from [Ticagrelor for the treatment of acute coronary syndromes](#) (NICE technology appraisal guidance 236). [new 2013]

1.3.18 Offer clopidogrel as a treatment option for up to 12 months to:

- people who have had an NSTEMI, regardless of treatment<sup>[1]</sup>
- people who have had a STEMI and received a bare-metal or drug-eluting stent. [new 2013]

1.3.19 Offer clopidogrel as a treatment option for at least 1 month and consider continuing for up to 12 months to:

- people who have had a STEMI and medical management with or without reperfusion treatment with a fibrinolytic agent. [new 2013]

1.3.20 Continue the second antiplatelet agent for up to 12 months in people who have had a STEMI and who received coronary artery bypass graft (CABG) surgery. [new 2013]

1.3.21 Offer clopidogrel instead of aspirin to people who also have other clinical vascular disease, in line with [Clopidogrel and modified-release dipyridamole for the prevention of occlusive vascular events](#) (NICE technology appraisal guidance 210), and who have:

- had an MI and stopped dual antiplatelet therapy or
- had an MI more than 12 months ago. [new 2013]

### ***Antiplatelet therapy in people with an indication for anticoagulation***

1.3.22 Take into account all of the following when thinking about treatment for people who have had an MI and who have an indication for anticoagulation:

- bleeding risk
- thromboembolic risk
- cardiovascular risk. [new 2013]

- 1.3.23 Unless there is a high risk of bleeding, continue anticoagulation and add aspirin to treatment in people who have had an MI who otherwise need anticoagulation and who:
- have had their condition managed medically or
  - have undergone balloon angioplasty or
  - have undergone CABG surgery. [new 2013]
- 1.3.24 Continue anticoagulation and add clopidogrel to treatment in people who have had an MI, who have undergone percutaneous coronary intervention (PCI) with bare-metal or drug-eluting stents and who otherwise need anticoagulation. [new 2013]
- 1.3.25 Offer clopidogrel with warfarin to people with a sensitivity to aspirin who otherwise need anticoagulation and aspirin and who have had an MI. [new 2013]
- 1.3.26 Do not routinely offer warfarin in combination with prasugrel or ticagrelor to people who need anticoagulation who have had an MI. [new 2013]
- 1.3.27 After 12 months since the MI, continue anticoagulation and take into consideration the need for ongoing antiplatelet therapy, taking into account all of the following:
- the indication for anticoagulation
  - thromboembolic risk
  - bleeding risk
  - cardiovascular risk
  - the person's wishes. [new 2013]
- 1.3.28 Do not add a new oral anticoagulant (rivaroxaban, apixaban or dabigatran) in combination with dual antiplatelet therapy in people who otherwise need anticoagulation, who have had an MI. [new 2013]

- 1.3.29 Consider using warfarin and discontinuing treatment with a new oral anticoagulant (rivaroxaban, apixaban or dabigatran) in people who otherwise need anticoagulation and who have had an MI, unless there is a specific clinical indication to continue it. [new 2013]

## Beta-blockers

- 1.3.30 Offer people a beta-blocker as soon as possible after an MI, when the person is haemodynamically stable. [new 2013]
- 1.3.31 Communicate plans for titrating beta-blockers up to the maximum tolerated or target dose – for example, in the discharge summary. [new 2013]
- 1.3.32 Continue a beta-blocker for at least 12 months after an MI in people without left ventricular systolic dysfunction or heart failure. [new 2013]
- 1.3.33 Continue a beta-blocker indefinitely in people with left ventricular systolic dysfunction. [new 2013]
- 1.3.34 Offer all people who have had an MI more than 12 months ago, who have left ventricular systolic dysfunction, a beta-blocker whether or not they have symptoms. For people with heart failure plus left ventricular dysfunction, manage the condition in line with [Chronic heart failure](#) (NICE clinical guideline 108). [new 2013]
- 1.3.35 Do not offer people without left ventricular systolic dysfunction or heart failure, who have had an MI more than 12 months ago, treatment with a beta-blocker unless there is an additional clinical indication for a beta-blocker. [new 2013]

## Calcium channel blockers

- 1.3.36 Do not routinely offer calcium channel blockers to reduce cardiovascular risk after an MI. [2007]
- 1.3.37 If beta-blockers are contraindicated or need to be discontinued, diltiazem or verapamil may be considered for secondary prevention in patients without pulmonary congestion or left ventricular systolic dysfunction. [2007]

- 1.3.38 For patients who are stable after an MI, calcium channel blockers may be used to treat hypertension and/or angina. For patients with heart failure, use amlodipine, and avoid verapamil, diltiazem and short-acting dihydropyridine agents in line with [Chronic heart failure](#) (NICE clinical guideline 108). [2007]

### Potassium channel activators

- 1.3.39 Do not offer nicorandil to reduce cardiovascular risk in patients after an MI. [2007]

### Aldosterone antagonists in patients with heart failure and left ventricular dysfunction

- 1.3.40 For patients who have had an acute MI and who have symptoms and/or signs of heart failure and left ventricular systolic dysfunction, initiate treatment with an aldosterone antagonist licensed for post-MI treatment within 3–14 days of the MI, preferably after ACE inhibitor therapy. [2007]
- 1.3.41 Patients who have recently had an acute MI and have clinical heart failure and left ventricular systolic dysfunction, but who are already being treated with an aldosterone antagonist for a concomitant condition (for example, chronic heart failure), should continue with the aldosterone antagonist or an alternative, licensed for early post-MI treatment. [2007]
- 1.3.42 For patients who have had a proven MI in the past and heart failure due to left ventricular systolic dysfunction, treatment with an aldosterone antagonist should be in line with [Chronic heart failure](#) (NICE clinical guideline 108). [2007]
- 1.3.43 Monitor renal function and serum potassium before and during treatment with an aldosterone antagonist. If hyperkalaemia is a problem, halve the dose of the aldosterone antagonist or stop the drug. [2007]

### Statins and other lipid lowering agents

- 1.3.44 Statin therapy is recommended for adults with clinical evidence of cardiovascular disease in line with [Statins for the prevention of cardiovascular events](#) (NICE technology appraisal guidance 94) and [Lipid modification](#) (NICE clinical guideline 67). [2007]

Recommendations about statins and other lipid lowering agents have been removed from the update of the guideline. Recommendations on the use of statins and other lipid lowering agents can be found in [Lipid modification](#) (NICE clinical guideline 67) and [Statins for the prevention of cardiovascular events](#) (NICE technology appraisal guidance 94).

## 1.4 *Coronary revascularisation after an MI*

1.4.1 Offer everyone who has had an MI a cardiological assessment to consider whether coronary revascularisation is appropriate. This should take into account comorbidity. [2007]

## 1.5 *Selected patient subgroups*

### Patients with hypertension

1.5.1 Treat hypertension in line with [Hypertension](#) (NICE clinical guideline 127). [2007, amended 2013]

### Patients with left ventricular systolic dysfunction

1.5.2 Patients who have left ventricular systolic dysfunction should be considered for an implantable cardioverter defibrillator in line with [Implantable cardioverter defibrillators for arrhythmias](#) (NICE technology appraisal guidance 95). [2007]

## 1.6 *Communication of diagnosis and advice*

1.6.1 After an acute MI, ensure that the following are part of every discharge summary:

- confirmation of the diagnosis of acute MI
- results of investigations
- incomplete drug titrations
- future management plans
- advice on secondary prevention. [2007, amended 2013]

1.6.2 Offer a copy of the discharge summary to the patient. [2007]

<sup>[1]</sup> This recommendation updates and replaces recommendation 1.3 in Clopidogrel in the treatment of non-ST-segment-elevation acute coronary syndrome (NICE technology appraisal guidance 80).



## 2 Research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future.

### 2.1 *In people who have not undergone revascularisation after an MI, does clopidogrel and placebo have a better outcome than clopidogrel and aspirin?*

#### Why this is important

Standard antiplatelet therapy after an MI consists of dual therapy (DAPT) with aspirin and clopidogrel, which produces better outcomes than aspirin alone. Research has demonstrated that new P2Y12 inhibitors improve on the outcomes with clopidogrel, when combined with aspirin, although bleeding and subsequently risk are increased.

Few studies have used P2Y12 inhibitors without aspirin. There are theoretical reasons why aspirin may detract from the vascular benefits of strong P2Y12 inhibitors. In addition, because clopidogrel alone produces at least the benefit of aspirin alone, it is possible that the supposed benefit of the combination of clopidogrel and aspirin over aspirin alone is due solely to the action of clopidogrel. Limited data on the use of clopidogrel alone in people with vascular diseases suggests the possibility that the addition of aspirin to clopidogrel gives little or no reduction in vascular event rate, at the cost of an increased risk of bleeding. A study of clopidogrel alone compared with clopidogrel and aspirin in people after MI would be valuable because of the potential preserved benefit and reduced risk of bleeding. This might lead to new strong P2Y12 inhibitors being assessed without concomitant aspirin.

### 2.2 *Does continuing beta-blocker treatment beyond 1 year after an MI improve outcomes for people with normal left ventricular systolic function?*

#### Why this is important

Recent cohort studies have suggested that continuing treatment with a beta-blocker beyond a year after an acute MI may not confer any benefit to the person in terms of reduced morbidity or mortality. This is particularly relevant given recent changes in acute management strategies. While beta-blockers are valuable in reducing mortality and morbidity for up to a year after an MI, they have side effects and represent an additional treatment burden to people who are already taking many other medications. However, there is also some suggestion that there are risks associated with withdrawal of beta-blockers in this population. The balance of risks and benefits of long-term

beta blockade has not been clearly determined, particularly in the context of modern acute treatment of MI.

### *2.3 Is treatment with an oral anticoagulant, aspirin and clopidogrel preferable to treatment with an oral anticoagulant and clopidogrel in people who have had an MI, have an indication for oral anticoagulation and are treated either medically, by primary PCI or by coronary artery bypass grafting surgery?*

#### **Why this is important**

Many people who have had an MI have indications for long-term treatment with both oral anticoagulants and combination antiplatelet drugs. Those with atrial fibrillation, mechanical heart valves or a history of pulmonary emboli are at high risk of stroke or thromboembolism and therefore need anticoagulation to prevent these events. It is well recognised that people receiving a combination of antiplatelet therapy and oral anticoagulation are at high risk of minor, major and fatal bleeding events. These outcomes are often recurrent and associated with hospitalisation, blood transfusion and interventional procedures. The evidence review found limited high-quality evidence to identify whether, in this population, treatment with triple therapy (an oral anticoagulant, plus dual antiplatelet therapy) or dual therapy (an oral anticoagulant plus clopidogrel) is more effective. The Guideline Development Group recognised that this question was important in an increasingly elderly population, who are more likely to have comorbidities and who are at a higher risk of bleeding.

### *2.4 What characteristics are associated with uptake and adherence to cardiac rehabilitation after an acute MI when rehabilitation is started early?*

#### **Why this is important**

There is wide variation across the UK in style, staffing and resources of cardiac rehabilitation programmes. Participation in cardiac rehabilitation after an acute MI significantly reduces mortality and improves quality of life. However, data from the 2012 Myocardial Infarction National Audit Project (MINAP) highlight that only 44% of all patients take part in cardiac rehabilitation after an MI. This falls far short of the National Service Framework for Coronary Heart Disease (2000) target of more than 85% of people discharged from hospital after an acute MI. National audit data also highlight that patients are waiting on average 53 days to start the exercise component (Phase III) after an acute MI. Early cardiac rehabilitation (defined as attendance at a cardiac rehabilitation orientation appointment within 10 days) significantly improves attendance and is also cost-saving through reduced incidence of unplanned cardiac re-admissions.

**2.5** *In people who have had a STEMI who undergo primary PCI with a bare-metal stent, and 4 weeks of aspirin and clopidogrel, is there an additional benefit to continuing clopidogrel for a further 11 months?*

**Why this is important**

There are no randomised controlled trials that provide data on long-term treatment with clopidogrel plus aspirin compared with aspirin alone in patients who are treated with primary PCI or medical therapy alone. Two large trials have provided data on short-term efficacy in medically treated STEMI patients (Commit/CCS-2 and Clarity – TIMI 28). In clinical practice, doctors extrapolate the data from patients with NSTEMI, in whom this problem has been studied in both medically and invasively managed patients, who receive clopidogrel for up to 12 months (CURE, PCI-CURE, CREDO) because of a reduction in composite endpoints including mortality. The risk of bleeding increases with dual antiplatelet therapy (aspirin with clopidogrel), but the majority of benefit might occur in the short-term reduction of fatal and non-fatal re-infarction, and a reduced risk of stent thrombosis in patients treated with PCI.

## 3 Other information

### 3.1 *Scope and how this guideline was developed*

NICE guidelines are developed in accordance with a [scope](#) that defines what the guideline will and will not cover.

#### How this guideline was developed

NICE commissioned the National Clinical Guideline Centre to develop this guideline. The Centre established a Guideline Development Group (see section 4), which reviewed the evidence and developed the recommendations.

The methods and processes for developing NICE clinical guidelines are described in [The guidelines manual](#).

### 3.2 *Related NICE guidance*

Details are correct at the time of publication of the guideline (November 2013). Further information is available on the [NICE website](#).

#### Published

##### *General*

- [Patient experience in adult NHS services](#). NICE clinical guideline 138 (2012).
- [Medicines adherence](#). NICE clinical guideline 76 (2009).

##### *Condition-specific*

- [Myocardial infarction with ST-segment-elevation \(STEMI\)](#). NICE clinical guideline 167 (2013).
- [Ticagrelor for the treatment of acute coronary syndromes](#). NICE technology appraisal guidance 236 (2011).
- [Hypertension](#). NICE clinical guideline 127 (2011).
- [Stable angina](#). NICE clinical guideline 126 (2011).
- [Generalised anxiety disorder and panic disorder \(with or without agoraphobia\) in adults](#). NICE clinical guideline 113 (2011).

- [Clopidogrel and modified-release dipyridamole from the prevention of occlusive vascular events \(review of technology appraisal guidance 90\)](#). NICE technology appraisal guidance 210 (2010).
- [Chronic heart failure](#). NICE clinical guideline 108 (2010).
- [Prevention of cardiovascular disease](#). NICE public health guidance 25 (2010).
- [Chest pain of recent onset](#). NICE clinical guideline 95 (2010).
- [Unstable angina and NSTEMI](#). NICE clinical guideline 94 (2010).
- [Depression in adults with a chronic physical health problem](#). NICE clinical guideline 91 (2009).
- [Depression in adults](#). NICE clinical guideline 90 (2009).
- [Prasugrel for the treatment of acute coronary syndromes with percutaneous coronary intervention](#). NICE technology appraisal guidance 182 (2009).
- [Familial hypercholesterolaemia](#). NICE clinical guideline 71 (2008).
- [Drug-eluting stents for the treatment of coronary artery disease \(part review of technology appraisal guidance 71\)](#). NICE technology appraisal guidance 152 (2008).
- [Lipid modification](#). NICE clinical guideline 67 (2008).
- [Smoking cessation services](#). NICE public health guidance 10 (2008).
- [Ezetimibe for the treatment of primary \(heterozygous familial and non-familial\) hypercholesterolemia](#). NICE technology appraisal guidance 132 (2007).
- [Obesity](#). NICE clinical guideline 43 (2006).
- [Brief interventions and referral for smoking cessation](#). NICE public health guidance 1 (2006).
- [Implantable cardioverter defibrillators for arrhythmias \(review of technology appraisal guidance 11\)](#). NICE technology appraisal guidance 95 (2006).
- [Statins for the prevention of cardiovascular events](#). NICE technology appraisal guidance 94 (2006).
- [Guidance on the use of coronary artery stents](#). NICE technology appraisal guidance 71 (2003).

## Under development

NICE is developing the following guidance (details available from the [NICE website](#)):

- [Lipid modification \(update\)](#). NICE clinical guideline. Publication expected July 2014.
- [Prasugrel with percutaneous coronary intervention for treating acute coronary syndrome \(review of technology appraisal guidance 182\)](#). NICE technology appraisal guidance. Publication expected August 2014.
- [Dyspepsia and gastro-oesophageal reflux disease](#). NICE clinical guideline. Publication date to be confirmed.
- [Rivaroxaban for the prevention of adverse outcomes in patients after the acute management of acute coronary syndrome](#). NICE technology appraisal guidance. Publication date to be confirmed.

## **4 The Guideline Development Group, National Collaborating Centre and NICE project team 2013**

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Editor

## About this guideline

NICE clinical guidelines are recommendations about the treatment and care of people with specific diseases and conditions in the NHS in England and Wales.

NICE guidelines are developed in accordance with a [scope](#) that defines what the guideline will and will not cover.

This guideline was developed by the National Clinical Guideline Centre, which is based at the Royal College of Physicians. The Centre worked with a Guideline Development Group, comprising healthcare professionals (including consultants, GPs and nurses), patients and carers, and technical staff, which reviewed the evidence and drafted the recommendations. The recommendations were finalised after public consultation.

The methods and processes for developing NICE clinical guidelines are described in [The guidelines manual](#).

## Update information

This guideline updates and replaces NICE clinical guideline 48 (published May 2007). NICE clinical guideline 48 replaced NICE inherited guideline A (2001).

Recommendation 1.3.18 updates and replaces recommendation 1.3 from 'Clopidogrel in the treatment of non-ST-segment-elevation acute coronary syndrome', NICE technology appraisal guidance 80.

Recommendations are marked as [new 2013], [2013], [2007] or [2007, amended 2013]:

- [new 2013] indicates that the evidence has been reviewed and the recommendation has been added or updated
- [2013] indicates that the evidence has been reviewed but no change has been made to the recommended action
- [2007] indicates that the evidence has not been reviewed since 2007
- [2007, amended 2013] indicates that the evidence has not been reviewed since 2007, but changes have been made to the recommendation wording that change the meaning (see below).

## Recommendations from NICE clinical guideline 48 that have been amended

Recommendations are labelled [2007, amended 2013] if the evidence has not been reviewed since 2007 but changes have been made to the recommendation wording that change the meaning.

Recommendation in NICE clinical guideline 48	Recommendation in current guideline	Reason for change
<p>After an MI without complications, patients can usually travel by air within 2–3 weeks. Patients who have had a complicated MI need expert individual advice. [1.2.3.5]</p>	<p>1.1.23 After an MI without complications, people who wish to travel by air should seek advice from the <a href="#">Civil Aviation Authority</a>. People who have had a complicated MI need expert individual advice. [2007, amended 2013]</p>	<p>This recommendation has been amended to reflect updated information on air travel after an MI from the Civil Aviation Authority.</p>
<p>All patients who have had an acute MI should be offered treatment with a combination of the following drugs:</p> <ul style="list-style-type: none"> <li>• ACE (angiotensin-converting enzyme) inhibitor</li> <li>• aspirin</li> <li>• beta-blocker</li> <li>• statin. [1.3.1.1]</li> </ul>	<p>1.3.1 Offer all people who have had an acute MI treatment with the following drugs:</p> <ul style="list-style-type: none"> <li>• ACE (angiotensin-converting enzyme) inhibitor</li> <li>• dual antiplatelet therapy (aspirin plus a second antiplatelet agent)</li> <li>• beta-blocker</li> <li>• statin. [2007, amended 2013]</li> </ul>	<p>This recommendation has been amended to reflect that dual antiplatelet therapy should be given to all patients after an MI (excluding those with contraindications).</p>

<p>Aspirin should be offered to all patients after an MI and should be continued indefinitely. [1.3.3.1]</p>	<p>1.3.12 Offer aspirin to all people after an MI and continue it indefinitely, unless they are aspirin intolerant or have an indication for anticoagulation. [2007, amended 2013]</p>	<p>This recommendation has been amended to include situations where aspirin would not be offered indefinitely.</p>
<p>After an acute MI, confirmation of the diagnosis of acute MI and results of investigations, future management plans and advice on secondary prevention should be part of every discharge summary. [1.6.1]</p>	<p>1.6.1 After an acute MI, ensure that the following are part of every discharge summary:</p> <ul style="list-style-type: none"> <li>• confirmation of the diagnosis of acute MI</li> <li>• results of investigations</li> <li>• incomplete drug titrations</li> <li>• future management plans</li> <li>• advice on secondary prevention. [2007, amended 2013]</li> </ul>	<p>This recommendation has been amended to reflect the importance of including details of any incomplete titrations in the discharge summary. This reflects new recommendations on titration of ACE inhibitors and beta-blockers included in the guideline update.</p>

### *Strength of recommendations*

Some recommendations can be made with more certainty than others. The Guideline Development Group makes a recommendation based on the trade-off between the benefits and harms of an intervention, taking into account the quality of the underpinning evidence. For some interventions, the Guideline Development Group is confident that, given the information it has looked at, most patients would choose the intervention. The wording used in the recommendations in this guideline denotes the certainty with which the recommendation is made (the strength of the recommendation).

For all recommendations, NICE expects that there is discussion with the patient about the risks and benefits of the interventions, and their values and preferences. This discussion aims to help them to reach a fully informed decision (see also [Patient-centred care](#)).

## **Interventions that must (or must not) be used**

We usually use 'must' or 'must not' only if there is a legal duty to apply the recommendation. Occasionally we use 'must' (or 'must not') if the consequences of not following the recommendation could be extremely serious or potentially life threatening.

## **Interventions that should (or should not) be used – a 'strong' recommendation**

We use 'offer' (and similar words such as 'refer' or 'advise') when we are confident that, for the vast majority of patients, an intervention will do more good than harm, and be cost effective. We use similar forms of words (for example, 'Do not offer...') when we are confident that an intervention will not be of benefit for most patients.

## **Interventions that could be used**

We use 'consider' when we are confident that an intervention will do more good than harm for most patients, and be cost effective, but other options may be similarly cost effective. The choice of intervention, and whether or not to have the intervention at all, is more likely to depend on the patient's values and preferences than for a strong recommendation, and so the healthcare professional should spend more time considering and discussing the options with the patient.

## **Recommendation wording in guideline updates**

NICE began using this approach to denote the strength of recommendations in guidelines that started development after publication of the 2009 version of 'The guidelines manual' (January 2009). This does not apply to any recommendations ending [2007] (see 'Update information' box above for details about how recommendations are labelled). In particular, for recommendations labelled [2007], the word 'consider' may not necessarily be used to denote the strength of the recommendation.

## ***Other versions of this guideline***

The full guideline, 'MI – secondary prevention: secondary prevention in primary and secondary care for patients following a myocardial infarction' contains details of the methods and evidence used to develop the guideline. It is published by the National Clinical Guideline Centre.

The recommendations from this guideline have been incorporated into a [NICE Pathway](#).

We have produced [information for the public](#) about this guideline.

## *Implementation*

[Implementation tools and resources](#) to help you put the guideline into practice are also available.

## *Changes after publication*

November 2013: minor maintenance

## *Your responsibility*

This guidance represents the view of NICE, which was arrived at after careful consideration of the evidence available. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. However, the guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer, and informed by the summaries of product characteristics of any drugs.

Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties.

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## Accreditation

