Policy

Clinical Guideline

Nurse Supervised Exercise Stress Test (EST) Clinical Guideline: for use in adult ACS risk stratification and testing for myocardial ischaemia

Policy developed by: Nurse Supervised EST Workgroup - supported by the Statewide Cardiology Clinical Network
Approved SA Health Safety & Quality Strategic Governance Committee on: 11 December 2012
Next review due: 30 June 2016

Summary Patients with chest pain for investigation constitute a large percentage of hospital admissions. An exercise stress test is a non-invasive procedure that can promote rapid evaluation of the presence of coronary artery disease and guide on-going management. Nurse supervised EST provision has the potential to improve access to services, promote timely patient assessment, enhance medical staff availability and reduce costs through decreased length of stay for patients on a low risk chest pain pathway.

In all instances of EST provision it is imperative that operators are appropriately trained and there is suitable critical care support in place to ensure safe practice and minimise organisational risk.

Keywords Cardiac procedure, Chest pain assessment, Exercise stress test, Treadmill testing, EST, Nurse Supervised Exercise Stress Test (EST) Clinical Guideline

Policy history Is this a new policy? **N**
Does this policy amend or update an existing policy? **Y**
Does this policy replace an existing policy? **N**
If so, which policies?

Applies to All Health Networks
CALHN, SALHN, NALHN, CHSALHN, WCHN, SAAS

Staff impact All Clinical, Medical, Nursing, Allied Health, Emergency

PDS reference CG097

Version control and change history

Version	Date from	Date to	Amendment
1.0	11/12/2012	31/12/2014	Original version
2.0	18/03/2014	30/10/2014	
3.0	31/10/14	current	At points 2, 6.2, 6.3, Appendix 2, Appendix 5.

Government of South Australia
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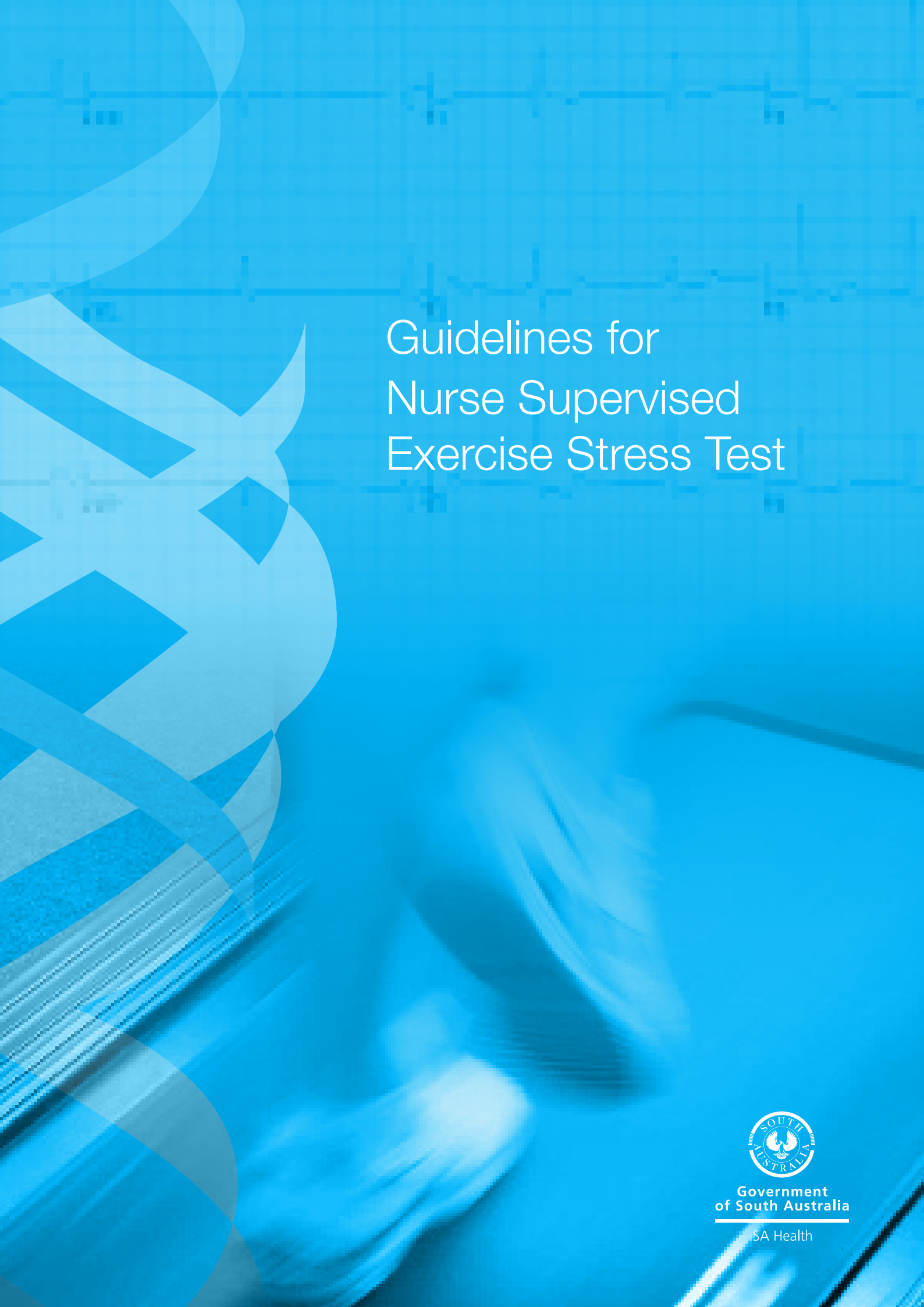
Guidelines for Nurse Supervised Exercise Stress Test



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STATEWIDE CARDIOLOGY CLINICAL NETWORK
Nurse Supervised EST Guidelines

Government of South Australia
SA Health

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Related document(s):	Nurse Supervised EST Training Package, Nurse Supervised EST Answer Template
Working group:	Dr Julian Vaile (Chair): Head of Cardiology Clinical Services - Department of Cardiovascular Medicine, Flinders Medical Centre, South Australia. Kate Pennington: Nurse Education Facilitator - Statewide Cardiology Clinical Network, Flinders Medical Centre, South Australia. Kay Johnston: Associate Clinical Services Coordinator - Cardiac Care Unit, Flinders Medical Centre, South Australia. Dr Angela Kucia: Lecturer in Nursing - School of Nursing and Midwifery, University of South Australia & Clinical Practice Consultant - Acute Cardiac Assessment, Lyell McEwin Hospital, South Australia. Michelle Munro: Nurse Education Facilitator - Statewide Cardiology Clinical Network, Lyell McEwin Hospital, South Australia. Don Olson: Clinical Service Consultant - Coronary Care Unit / A5, Royal Adelaide Hospital, South Australia. Deborah Wright: Clinical Practice Consultant - Acute Cardiac Assessment Service, Emergency Department, The Queen Elizabeth Hospital, South Australia
Peer review:	ESSA (Exercise and Sports Science Australia), February 2014

These guidelines have been developed in line with standards and guidelines published by the following organisations:

- Cardiac Society of Australia and New Zealand
- American College of Cardiology
- American Heart Association.

They are for use in assessment of low risk adult acute coronary syndrome (ACS) patients. The guidelines and associated training package describe minimum principles required of appropriately trained registered nurses to deliver an exercise stress test (EST) and complete provisional reporting in this setting without the need for direct medical supervision. Medical staff remain responsible for final reporting of EST results and ongoing patient management strategies.

Sites wishing to implement these guidelines should do so in line with local policy and governance procedures including, where appropriate, review and endorsement of advanced or extended scope of practice for nursing staff who participate in this procedure.

This guideline is accessible for download from the Cardiology Clinical Network page of the SA Health website:

http://www.sahealth.sa.gov.au/wps/wcm/connect/Public+Content/SA+Health+Internet/Health+reform/Clinical+networks/Cardiology+Clinical+-Network/Cardiology+Clinical+Network

The training package and resources developed to support use of these guidelines can be accessed by contacting the Cardiology Clinical Network, Network Development Manager - email: carolyn.astley@health.sa.gov.au

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NURSE SUPERVISED[1] EXERCISE STRESS TEST (EST) GUIDELINES: for use in adult ACS risk stratification and testing for myocardial ischaemia

For the purpose of this document, exercise testing is a cardiovascular stress test that uses treadmill exercise with electrocardiographic and blood pressure monitoring. Pharmacological stress and the use of imaging modalities are not incorporated in these guidelines. Also, exercise testing for indications other than acute coronary syndrome/myocardial ischaemia, is not addressed. The EST will be conducted in a hospital environment with appropriate critical care support services on site.

1. Environment

1.1 Exercise room must be located in an area where activation of an alarm/call system results in assistance from an additional 1-2 staff members in a timeframe of less than 2 minutes (assistance is not limited to MET staff).

1.2 Exercise room must be large enough to facilitate safe resuscitation and patient transfer as required.

1.3 Room should be air conditioned, ventilated, and have appropriate temperature control.

1.4 A telephone must be readily available to call for assistance as required. This is in addition to the presence of an emergency alarm system (refer point 3).

2. Personnel

2.1 For optimal patient safety in clinical exercise stress testing, two persons should be present in the exercise room during the test at all times: minimum requirements are one Primary Operator and one Assistant Personnel.

2.2 Primary Operator requirements – Registered Nurse (RN)/other suitably trained professional:

- currently accredited in Advanced Life Support (ALS) as per Australian Resuscitation Council guidelines,
- currently accredited in Nurse Supervised EST provision[2].

2.3 Assistant Personnel requirements – RN/Enrolled Nurse/other suitably trained professional:

- currently accredited in Basic Life Support (BLS),
- ability to obtain a high quality ECG trace,
- ability to recognise clinical deterioration that may occur during clinical exercise stress testing,
- familiarity with all relevant equipment in EST room and emergency procedures.

2.4 Medical officer requirements:

- must be appropriately qualified and registered to oversee EST provision,
- is ultimately responsible for EST provision and will provide final report,
- will assess patient to determine suitability for EST,
- must be readily available during EST for ECG interpretation as required and to assist with any untoward event or resuscitation measures.

3. Emergency Alarm

3.1 A suitable alarm system must be installed which facilitates appropriate emergency assistance within 2 minutes.

3.2 The alarm must be tested once a week.

3.3 Personnel must be familiar with planned responses as per their institution's emergency plan.

4. Exercise Equipment

The following equipment will be available within the exercise room:

- motorised treadmill with continuous 12-lead ECG capability
- sphygmomanometer
- emergency equipment (refer point 5).

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[1] Where EST is ordered by a medical officer (MO) and EST is conducted by EST accredited Registered Nurse (RN) without direct supervision from medical staff. Provisional EST report provided by EST RN is reviewed by the MO - MO generates final report and ongoing management strategies.

[2] A Nurse Supervised EST Training Package has been developed by the EST Working Group to support introduction and use of these guidelines.

5. Emergency Equipment

5.1 Full resuscitation equipment, including defibrillator and emergency trolley, must be in the exercise room.

5.2 Resuscitation equipment includes (but is not limited to):

- defibrillator and associated equipment
- oxygen and associated delivery equipment
- suction and associated equipment
- airway and hand ventilating assembly
- medication and administration equipment, including:
  - o Adrenaline
  - o Amiodarone
  - o Atropine
  - o Lignocaine
  - o Nitrates – short acting
  - o Salbutamol – aerosol or nebuliser
- equipment for inserting intravenous cannula.

5.3 All emergency equipment must be fully tested and functioning appropriately prior to commencement of any EST.

5.4 EST personnel must be familiar with location and appropriate use of emergency stop button on exercise treadmill.

6. Procedure

6.1 PATIENT ASSESSMENT

- Patient is assessed by medical officer (MO) as appropriate for EST and informed of procedure.
- The completion of a simple referral form by the requesting MO is recommended (refer Appendix 1 for example).
- Primary Operator RN to assess the following prior to commencing EST:
  - o Correct patient for correct procedure checked.
  - o Patient's medical history, relevant blood results, ECGs and current clinical status are examined for any absolute or relative contraindications to EST. Refer Appendix 2 for list of contraindications.
  - o Ensures comprehensive physical assessment has been undertaken and documented by medical officer prior to EST.
  - o Ensure patient's weight is compatible with treadmill manufacturer's recommendations and that patient has no mobility restrictions that will impede ability to exercise on treadmill.
  - o Check that medications have been administered/withheld as ordered.
  - o Ensure record of patient information/consent form is obtained (refer Appendix 3 for example per Cardiac Society of Australia and New Zealand).
  - o Check the patient understands their responsibilities during the procedure, is aware of reportable symptoms, and is able to communicate clearly with staff conducting EST.
  - o An interpreter is recommended if the patient has difficulty communicating with staff.

6.2 PATIENT PREPARATION & SET UP

- Patient is dressed in loose clothing/hospital gown that does not impede lead placement or quality of recording.
- Ensure patient is not wearing inappropriate footwear for the procedure.
- Patient information is entered in to EST equipment analyser.
- Protocol is selected as per medical officer's request. Appropriate protocol is chosen for the patient.
- Primary Operator RN is aware of patient's predicted exercise duration and predicted maximum heart rate for the EST.
- Patient's skin is prepared and electrodes attached in a manner that will optimise contact.
- Stress analyser leads are attached and strap applied to secure acquisition module to patient.
- ECG trace checked to ensure clear recording.

- Pre EST, check and clearly record patient's manual blood pressure (BP) and heart rate (HR) in lying and standing positions.
- Record patient's baseline resting ECGs in the lying and standing positions - limb leads on the torso (as located during EST). Clearly identify patient and lead position on each ECG to facilitate accurate comparison.
- Instruct and demonstrate to the patient how to walk on the treadmill.

6.3 CONDUCTING THE EST

- All ESTs will be symptom limited or maximal, whichever is sooner.
- Ask patient to stand on the treadmill belt.
- Warn patient re treadmil belt movement before starting test and 30 seconds before any change in stage, speed or incline.
- Commence EST in line with equipment requirements and programmed protocol.
- Patient is observed closely throughout the procedure:
  - The Primary Operator RN will maintain clear visibility of the patient, their ECG trace and sphygmomanometer readings throughout the EST.
  - ECG, HR & BP monitoring:
    - Continuous ECG monitoring throughout EST
    - BP recorded at no less than 3 minutely intervals, ensuring measurement within each stage of exercise.
    - Consideration should be given to checking manual BP if accuracy of automated BP reading is in doubt.
    - ECG & HR recorded during each stage of exercise and at no less than 3 minutely intervals.
    - ECG & HR recorded at peak exercise with BP recorded as soon as possible after clear ECG obtained.
    - ECG, HR & BP recorded at time of any abnormal signs or symptoms.
    - ECG & HR recorded immediately upon cessation of exercise with BP recorded as soon as possible after clear ECG obtained.
  - Additional measurements and documentation will be required in the presence of altered clinical circumstances.
- The Primary Operator RN may be required to modify EST delivery in line with patient's physical condition – all modifications are to be clearly documented.
- Other

  o Through close observation and appropriate questioning, the patient will be monitored for development of significant symptoms such as:
    - Angina, anginal equivalents, shortness of breath, presyncope, claudication, musculoskeletal discomfort.
    - Major symptoms which limit exercise will be identified and recorded. A Borg scale may be used (refer Appendix 4 for example).
- At completion of EST, assist patient to a chair/bed for recovery period.
  - ECG monitoring is continued for a minimum of 5 minutes post EST or longer if clinically indicated, i.e. until ECG returns to baseline and/or until significant symptoms have resolved.
  - ECG, HR and BP recorded at least twice within the first 5 minutes of recovery.
  - Continue to monitor the patient's vital signs until parameters have returned to near-baseline levels and patient is clinically stable.
  - Visual observation of the patient continues for not less than 10 minutes post cessation of EST.

6.4 CEASING THE EST

Refer Appendix 5 for a full list of EST end points in line with AHA standards.

It is acknowledged that the following indicators are for nurse supervised ESTs and that appropriately trained cardiology medical staff may conduct EST delivery outside of these limits.

- Indicators for ceasing the test include, but are not limited to:

- Achievement of 85% of maximum predicted heart rate which is sustained for a minimum of one minute, along with reaching ≥ 80% of predicted maximum workload (METs).
- Maximum duration is achieved.
- ST segment elevation and/or depression.
- Inappropriate BP responses.
- Heart rhythm disturbances.
- Ischaemic chest pain, shortness of breath, fatigue, presyncope, musculoskeletal discomfort.

• To cease the test, the treadmill is slowed or stopped - patient is informed of process prior to this occurring.

• Obtain clear ECG and HR readings directly on completion of exercise whilst patient is still standing on the treadmill. BP should be recorded as soon as practical after clear ECG obtained.

• Patient is then directed to rest on a chair or bed for recovery and completion of observations. Patient may be offered a drink at this time.

• If the medical officer is not in the room during the test, the presence and nature of any symptoms experienced during test (including test angina) should be verified at the conclusion of the test before the patient leaves. Any symptoms experienced by the patient should be resolved prior to leaving EST environment.

• Ensure patient is suitably rested and dressed prior to leaving EST environment.

7. Reporting and Documentation

• Reporting template/print out is completed by the EST Primary Operator immediately upon cessation of test. This becomes the provisional report.

• Provisional report (completed EST print out) is filed in patient's file/case notes, in line with site requirements.

• Once completed, the provisional report is reviewed as soon as is practical by the medical officer for validation, completion of the final report and ongoing recommendations.

• Documentation of provisional EST report by Primary Operator RN will include:

- demographic data, date of EST, reason for EST
- protocol used
- duration of exercise
- percentage of predicted heart rate achieved
- maximum workload achieved (in METs)
- resting and peak heart rate and blood pressure
- details of any abnormalities in heart rate, rhythm, blood pressure or physical response that occur during or after EST
- presence/absence of ST segment changes – specify direction and deviations in mm
- reason(s) for cessation of EST
- outline of any additional actions or interventions required during EST or recovery period
- recovery phase documentation of time taken for observations to return to near baseline values
- subjective interpretation
- objective interpretation.

8. Infection Control

• All ESTs will be conducted in line with standard precaution policies and procedures.

• All equipment used for EST provision will be cleaned after each use. Cleaning should be conducted in accordance with equipment manufacturers' recommendations and in line with relevant site infection control policies and procedures.

9. Safety

• All equipment will be serviced and maintained as per manufacturers' recommendations.

• Safe operating procedures should be adhered to as per site protocols.

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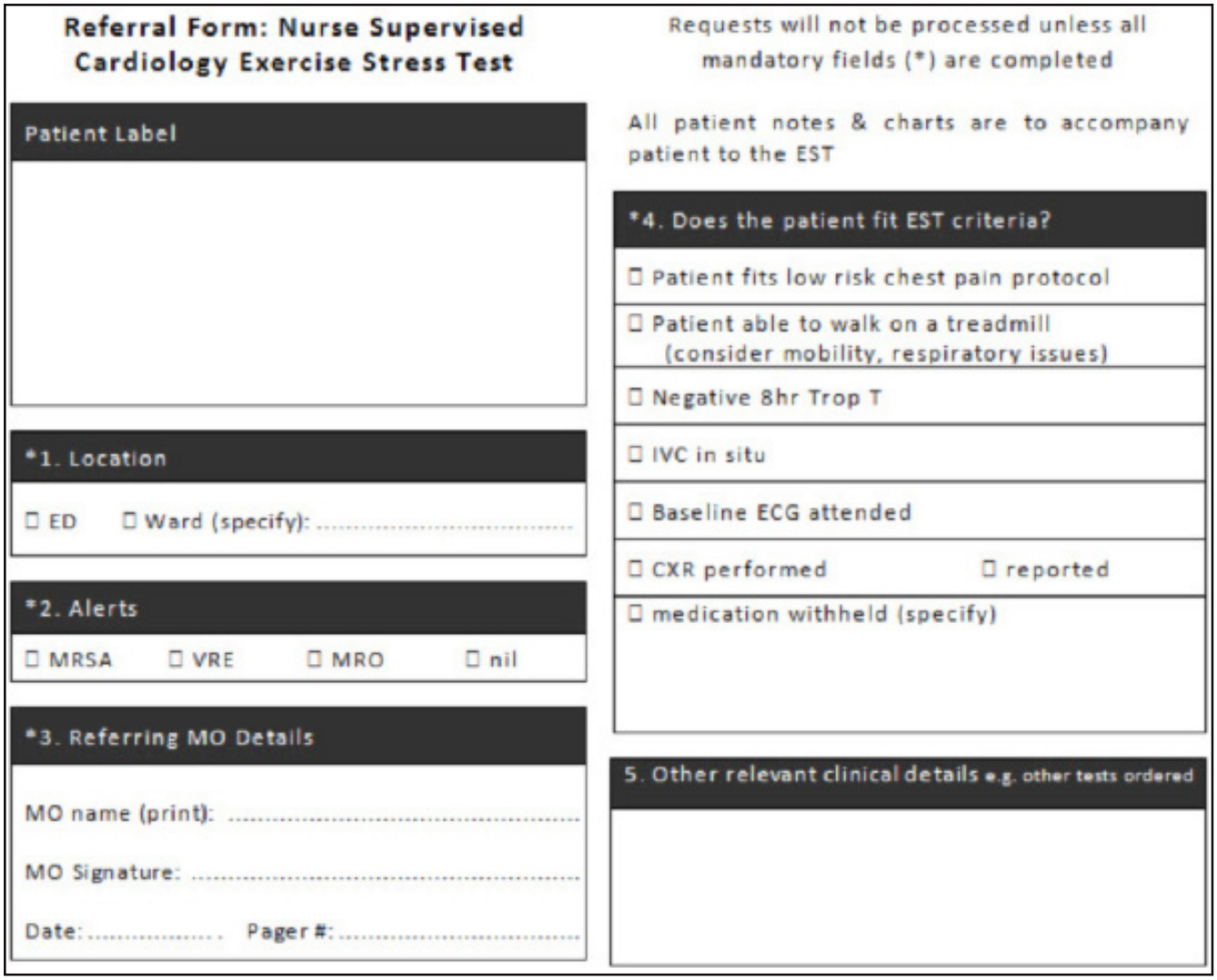
Appendix 1

EST request form

This form is provided as an example only and should be adapted to suit individual site needs.



Referral Form: Nurse Supervised Cardiology Exercise Stress Test

Requests will not be processed unless all mandatory fields (*) are completed

Patient Label

All patient notes & charts are to accompany patient to the EST

***1. Location**

☐ ED ☐ Ward (specify): .....

***2. Alerts**

☐ MRSA ☐ VRE ☐ MRO ☐ nil

***3. Referring MO Details**

MO name (print): .....

MO Signature: .....

Date: ..... Pager #: .....

***4. Does the patient fit EST criteria?**

☐ Patient fits low risk chest pain protocol

☐ Patient able to walk on a treadmill (consider mobility, respiratory issues)

☐ Negative 8hr Trop T

☐ IVC in situ

☐ Baseline ECG attended

☐ CXR performed ☐ reported

☐ medication withheld (specify)

5. Other relevant clinical details e.g. other tests ordered

Adapted and provided with permission from Flinders Medical Centre Cardiac Care Unit, South Australia, June 2011.

Appendix 2

Absolute and Relative Contraindications to Exercise Testing

Absolute contraindications

- Acute myocardial infarction (within 2 days)
- Ongoing unstable angina
- Uncontrolled cardiac arrhythmia with haemodynamic compromise
- Active endocarditis
- Symptomatic severe aortic stenosis
- Decompensated heart failure
- Acute pulmonary embolism or pulmonary infarction
- Deep vein thrombosis
- Acute myocarditis or pericarditis
- Acute aortic dissection
- Physical disability that precludes safe and adequate testing
- Severe pulmonary hypertension (PAP >60 mmHg or RV strain on ECG)
- Inability to obtain consent

Relative contraindications*

- Known obstructive left main coronary artery stenosis
- Moderate to severe aortic stenosis with uncertain relation to symptoms
- Tachyarrhythmias with uncontrolled ventricular rates
- Acquired advanced or complete heart block
- Hypertrophic obstructive cardiomyopathy with severe resting gradient
- Recent stroke or transient ischaemic attack
- Mental impairment with limited ability to cooperate
- Resting hypertension with systolic blood pressure >200 mm Hg and/or diastolic blood pressure >110 mm Hg
- Uncorrected medical conditions such as significant anaemia, important electrolyte imbalance, and hyperthyroidism
- Pulmonary hypertension (at levels lower than those described in absolute contraindications)

* Per ACC/AHA Practice Guidelines (Gibbons et al. 2002), relative contraindications can be superseded if benefits outweigh risks of exercise

Adapted from:

Fletcher GF, Ades PA, Kligfield P, Arena R, Balady GJ, Bittner VA, Coke LA, Fleg JL, Forman DE, Gerber TC, Gulati M, Madan K, Rhodes J, Thompson PD, Williams MA; on behalf of the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee of the Council on Clinical Cardiology, Council on Nutrition, Physical Activity and Metabolism, Council on Cardiovascular and Stroke Nursing, and Council on Epidemiology and Prevention 2013, 'Exercise standards for testing and training: a scientific statement from the American Heart Association', *Circulation*, vol. 128, no. 8, pp. 873-934. Viewed 13 March 2014, http://circ.ahajournals.org/content/128/8/873.full.pdf+html.

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Appendix 3

Patient information sheet

The following example has been adapted from recommendations provided by CSANZ guidelines (Freedman et al. 2010). Individual sites may choose to further modify this form in order to address site-specific needs.

When used, Nurse Supervised EST Guideline authors recommended retaining the completed form in the patient's file.

INFORMATION/CONSENT FROM FOR NURSE SUPERVISED TREADMILL EXERCISE TESTING

The purpose of the test: Exercise testing measures the performance and capacity of the heart, lungs and blood vessels. In many cases, the test is carried out to assist in making a diagnosis of coronary artery disease. Other uses of the test include evaluating a patient's capacity to undertake certain physical activities, the planning of an appropriate training program, assessment of prognosis in patients with heart disease and the effect of medical treatment, angioplasty or surgery on symptoms. Before being tested you will have been questioned and examined by a Doctor and a resting electrocardiogram will be recorded prior to performing exercise.

Testing consists of walking on a treadmill and the speed and gradient of the treadmill will be increased every three minutes. The test is eventually stopped if and when you develop symptoms such as fatigue, breathlessness, tired legs, chest pain or other symptoms. Throughout the test a Registered Nurse qualified in delivery of treadmill exercise testing will be present and your pulse, blood pressure and electrocardiogram will be monitored. If there is any change in any of these observations which concerns the Nurse, he or she may stop the test immediately. Your pulse, blood pressure and electrocardiogram will continue to be monitored for sometime after the test has been stopped.

If at any time during the test you are feeling unwell in any way, report the symptom immediately.

Risks: Clinical exercise stress testing is usually performed in patients with known or suspected coronary artery disease. While every effort is made to minimise the risks of the procedure, there is a small but definite risk of complications which you should be aware of. Be aware also that emergency equipment and trained personnel are available to deal with any complications that may arise.

Serious potential complications include the possibility of a major disturbance of heart rhythm requiring resuscitation, the development of heart failure or prolonged angina (heart pain), or the development of a heart attack. The risk of one of these occurring is approximately 2 or 3 in 10,000 tests. Unfortunately, there is also a very small risk of death occurring as a result of an exercise test. The chance of this in the average patient is approximately 1 in 10,000 although the risks both of complications and of death may be higher in patients who are already known to have severe coronary disease.

The staff recommending and performing the test are well aware of these risks and will have taken them into account as part of their assessment processes. Please feel free to discuss these issues prior to agreeing to undergo the exercise stress test.

Signed consent

Before proceeding with the test we need your signed consent. The signing of this form is voluntary and you are absolutely free to deny consent if you so desire. Before signing the consent form, please feel free to ask any questions you have about exercise stress testing and about any risks.

I have read this form and had the opportunity to ask questions. I understand the test which I will participate in and I have been made aware of the risks involved. I consent to participate in this stress test.

_____	_____
Signature of patient	Witness
_____	_____
Date	Date

Modified from Freedman B, and members of the Rehab, Exercise and Prevention Council 2010, 'Safety and performance guidelines for clinical exercise stress testing', Cardiac Society of Australia and New Zealand website, viewed 13 March 2014, http://www.csanz.edu.au/guidelines/investigations-and-procedures/.

Appendix 4

Rating of Perceived Exertion

Borg	Modified Borg
6	0 – nothing at all
7 – very, very light	0.5 – very, very weak
8	1 – very weak
9 – very light	2 – weak
10	3 – moderate
11 – fairly light	4 – somewhat strong
12	5 strong
13- somewhat hard	6
14	7 – very strong
15 – hard	8
16	9
17 – very hard	10 – very, very strong (almost maximum)
18	
19 – very, very hard	- maximum
20	

Myers J, Arena R, Franklin B, Pina I, Kraus WE, McInnis K and Balady GJ; on behalf of the American Heart Association Committee on Exercise, Cardiac Rehabilitation, and Prevention of the Council on Clinical Cardiology, the Council on Nutrition, Physical Activity, and Metabolism, and the Council on Cardiovascular Nursing 2009, 'Recommendations for clinical exercise laboratories: a scientific statement from the American Heart Association', *Circulation*, 2009, vol. 119, no. 24, pp. 3144-3161. Viewed 13 March 2014, http://circ.ahajournals.org/content/119/24/3144.full.

Appendix 5

Indications for Termination of Exercise Testing

Absolute Indications

- ST-segment elevation (>1.0mm) in leads without pre-existing Q waves because of prior MI (other than aVR, aVL, and V1)
- Drop in systolic blood pressure >10 mm Hg, despite an increase in workload, when accompanied by any other evidence of ischaemia
- Moderate to severe angina
- Central nervous system symptoms (e.g. ataxia, dizziness, near syncope)
- Signs of poor perfusion (cyanosis or pallor)
- Sustained ventricular tachycardia (VT) or other arrhythmia, including second- or third-degree atrioventricular (AV) block, that interferes with normal maintenance of cardiac output during exercise
- Technical difficulties in monitoring the ECG or systolic blood pressure
- Subject's request to stop

Relative Indications

- Marked ST displacement (horizontal or downsloping of >2 mm, measured 60 to 80 ms after the J point [the end of the QRS complex]) in a patient with suspected ischaemia
- Drop in systolic blood pressure >10 mm Hg (persistently below baseline) despite an increase in workload, in the absence of other evidence of ischaemia
- Increasing chest pain
- Fatigue, shortness of breath, wheezing, leg cramps, or claudication
- Arrhythmias other than sustained VT, including multifocal ectopy, ventricular triplets, supraventricular tachycardia, and bradyarrhythmias that have the potential to become more complex or to interfere with haemodynamic stability
- Exaggerated hypertensive response (systolic blood pressure >250 mm Hg or diastolic blood pressure >115 mm Hg)
- Development of bundle-branch block that cannot be immediately distinguished from VT.

Fletcher GF, Ades PA, Kligfield P, Arena R, Balady GJ, Bittner VA, Coke LA, Fleg JL, Forman DE, Gerber TC, Gulati M, Madan K, Rhodes J, Thompson PD, Williams MA; on behalf of the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee of the Council on Clinical Cardiology, Council on Nutrition, Physical Activity and Metabolism, Council on Cardiovascular and Stroke Nursing, and Council on Epidemiology and Prevention 2013, 'Exercise standards for testing and training: a scientific statement from the American Heart Association', *Circulation*, vol. 128, no. 8, pp. 873-934. Viewed 13 March 2014, http://circ.ahajournals.org/content/128/8/873.full.pdf+html.