



## Complete Summary

---

### GUIDELINE TITLE

Guidance on the use of continuous subcutaneous insulin infusion for diabetes.

### BIBLIOGRAPHIC SOURCE(S)

National Institute for Clinical Excellence (NICE). Guidance on the use of continuous subcutaneous insulin infusion for diabetes. London (UK): National Institute for Clinical Excellence (NICE); 2003 Feb. 23 p. (Technology appraisal guidance; no. 57).

### GUIDELINE STATUS

This is the current release of the guideline.

## COMPLETE SUMMARY CONTENT

SCOPE  
METHODOLOGY - including Rating Scheme and Cost Analysis  
RECOMMENDATIONS  
EVIDENCE SUPPORTING THE RECOMMENDATIONS  
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS  
QUALIFYING STATEMENTS  
IMPLEMENTATION OF THE GUIDELINE  
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT  
CATEGORIES  
IDENTIFYING INFORMATION AND AVAILABILITY  
DISCLAIMER

## SCOPE

### DISEASE/CONDITION(S)

Type I diabetes

### GUIDELINE CATEGORY

Assessment of Therapeutic Effectiveness  
Management  
Treatment

### CLINICAL SPECIALTY

Endocrinology  
Family Practice

Internal Medicine  
Pediatrics

### **INTENDED USERS**

Advanced Practice Nurses  
Nurses  
Patients  
Physician Assistants  
Physicians

### **GUIDELINE OBJECTIVE(S)**

To examine the clinical and cost-effectiveness of continuous subcutaneous insulin infusion (CSII) using insulin pumps compared with multiple daily injections (MDI) for diabetes

### **TARGET POPULATION**

Adults with type I diabetes

### **INTERVENTIONS AND PRACTICES CONSIDERED**

Continuous subcutaneous insulin infusion (CSII)

### **MAJOR OUTCOMES CONSIDERED**

- Clinical effectiveness
  - Glycated haemoglobin
  - Insulin dose
  - Weight change
  - Cholesterol levels
  - Patient preference
  - Quality of life
  - Adverse effects
- Cost-effectiveness

## **METHODOLOGY**

### **METHODS USED TO COLLECT/SELECT EVIDENCE**

Hand-searches of Published Literature (Primary Sources)  
Hand-searches of Published Literature (Secondary Sources)  
Searches of Electronic Databases  
Searches of Unpublished Data

### **DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE**

**Note from the National Guideline Clearinghouse (NGC):** The National Institute for Health and Clinical Excellence (NICE) commissioned an independent

academic centre to perform a systematic literature review on the technology considered in this appraisal and prepare an assessment report. The assessment report for this technology appraisal was prepared by the Southampton Health Technology Assessments Centre. (See the "Availability of Companion Documents" field.)

A systematic review of the literature and an economic evaluation were undertaken.

### **Data Sources**

Electronic databases were searched, including the Cochrane Library, Medline, Embase, PubMed, Science Citation Index, Web of Science Proceedings, DARE and Health Technology Assessment (HTA) databases, PsychINFO, National Health Service (NHS) Economic Evaluation Database, EconLIT, and Health Management Information Consortium database. References of all retrieved articles were checked for relevant studies, and experts were contacted for advice and peer review, and to identify additional published and unpublished references. Manufacturer submissions to the National Institute of Clinical Excellence (NICE) were reviewed.

### **Study Selection**

Studies were included if they fulfilled the following criteria:

- Interventions: continuous subcutaneous insulin infusion (CSII) using insulin pumps compared with optimised multiple daily injections (MDI) (at least 3 injections per day)
- Participants: people with insulin-treated diabetes (Type 1 or Type 2). Newly diagnosed patients were excluded.
- Outcomes: glycated haemoglobin, insulin dose, weight change, cholesterol levels, patient preference, quality of life, adverse effects
- Design: Parallel randomised controlled trials (RCTs) and randomised and nonrandomized crossover studies with a minimum duration of 10 weeks on each treatment

Studies in non-English language or available only as abstracts were excluded from the main analysis.

Titles and summaries of studies being assessed for inclusion were checked by two reviewers. Full texts of selected studies were assessed for inclusion by one reviewer and checked by a second. Differences in opinion were resolved through discussion.

Sources of information, search terms, and a flow chart outlining the identification of studies are described in Appendix 2 of the Assessment Report (see the "Availability of Companion Documents" field).

## **NUMBER OF SOURCE DOCUMENTS**

Searching identified 20 studies comparing continuous subcutaneous insulin infusion (CSII) with multiple daily injections (MDI). These included eight parallel randomised controlled trials (RCTs), nine randomised crossover studies, and three non-random crossover studies. Fourteen studies included adults with Type 1 diabetes, four studies included pregnant women, and two studies included adolescents. The quality of reporting and methodology of the studies, many of which dated from many years ago, was often poor by today's standards, with just two studies having adequate randomisation and none reporting adequate allocation concealment.

Six further studies (one parallel RCT and five random crossover studies) were identified comparing analogue with soluble insulin in CSII. Randomisation and allocation concealment were adequate in the parallel RCT but not reported in the crossover studies.

No economic evaluations comparing CSII with optimised MDI were found.

## **METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE**

Expert Consensus

## **RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE**

Not applicable

## **METHODS USED TO ANALYZE THE EVIDENCE**

Meta-Analysis  
Systematic Review with Evidence Tables

## **DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

**Note from the National Guideline Clearinghouse (NGC):** The National Institute for Health and Clinical Excellence (NICE) commissioned an independent academic centre to perform a systematic literature review on the technology considered in this appraisal and prepare an assessment report. The assessment report for this technology appraisal was prepared by the Southampton Health Technology Assessments Centre. (See the "Availability of Companion Documents" field.)

### **Data Extraction and Quality Assessment**

Data extraction and quality assessment were undertaken by one reviewer and checked by a second reviewer, with any disagreement resolved through discussion. The quality of included studies was assessed in accordance with Cochrane Reviews Database (CRD) Report 4.

### **Data Synthesis**

Data on the clinical effectiveness of continuous subcutaneous insulin infusion (CSII) for diabetes were synthesised through a narrative review with full tabulation of results of all included studies, with meta-analysis performed where appropriate. Cost effectiveness analysis examined the marginal costs of CSII compared to multiple daily injections (MDI), and considered evidence on the marginal benefits such as improved control, adverse events, and quality of life.

## **METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Expert Consensus

## **DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS**

### **Considerations**

Technology appraisal recommendations are based on a review of clinical and economic evidence.

### **Technology Appraisal Process**

The National Institute for Health and Clinical Excellence (NICE) invites 'consultee' and 'commentator' organisations to take part in the appraisal process. Consultee organisations include national groups representing patients and carers, the bodies representing health professionals, and the manufacturers of the technology under review. Consultees are invited to submit evidence during the appraisal and to comment on the appraisal documents.

Commentator organisations include manufacturers of the products with which the technology is being compared, the National Health Service (NHS) Quality Improvement Scotland and research groups working in the area. They can comment on the evidence and other documents but are not asked to submit evidence themselves.

NICE then commissions an independent academic centre to review published evidence on the technology and prepare an 'assessment report'. Consultees and commentators are invited to comment on the report. The assessment report and the comments on it are then drawn together in a document called the evaluation report.

An independent Appraisal Committee then considers the evaluation report. It holds a meeting where it hears direct, spoken evidence from nominated clinical experts, patients and carers. The Committee uses all the evidence to make its first recommendations, in a document called the 'appraisal consultation document' (ACD). NICE sends all the consultees and commentators a copy of this document and posts it on the NICE website. Further comments are invited from everyone taking part.

When the Committee meets again it considers any comments submitted on the ACD; then it prepares its final recommendations in a document called the 'final appraisal determination' (FAD). This is submitted to NICE for approval.

Consultees have a chance to appeal against the final recommendations in the FAD. If there are no appeals, the final recommendations become the basis of the guidance that NICE issues.

### **Who is on the Appraisal Committee?**

NICE technology appraisal recommendations are prepared by an independent committee. This includes health professionals working in the NHS and people who are familiar with the issues affecting patients and carers. Although the Appraisal Committee seeks the views of organisations representing health professionals, patients, carers, manufacturers and government, its advice is independent of any vested interests.

### **RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

Not applicable

### **COST ANALYSIS**

No economic evaluation of insulin pumps was found in the literature.

The Assessment Group considered that too many assumptions were required for cost effectiveness to be measured in terms of cost per quality-adjusted life year gained (CQG). The approach taken was to look at the costs and consequences associated with multiple daily injections (MDI) therapy compared with continuous subcutaneous insulin infusion (CSII) therapy. The additional cost of CSII therapy compared with MDI therapy is estimated to be between 1100 and 1400 pounds sterling per year, depending on the type of pump and whether it lasts 4 or 8 years. These estimates were made allowing for cost offsets (comprising reduced insulin costs and lower medical costs for adverse events), estimated to be about £130 per year.

The two manufacturers also produced economic analyses. One manufacturer estimated a cost per quality-adjusted life year (QALY) of 8400 pounds sterling for CSII therapy against MDI therapy. Because of the absence of utility data comparing CSII and MDI therapies, the other manufacturer suggested how great a patient's utility gain would have to be to make CSII therapy cost effective compared with MDI therapy. It was estimated that utility gains of 8 to 25% and 3 to 8% would be needed to attain a cost per QALY of 10,000 and 30,000 pounds sterling, respectively.

### **METHOD OF GUIDELINE VALIDATION**

External Peer Review

### **DESCRIPTION OF METHOD OF GUIDELINE VALIDATION**

Consultee organizations from the following groups were invited to comment on the draft scope, Assessment Report and the Appraisal Consultation Document (ACD) and were provided with the opportunity to appeal against the Final Appraisal Determination.

- Manufacturer/sponsors
- Professional/specialist and patient/carer groups
- Commentator organisations (without the right of appeal)

In addition, individuals selected from clinical expert and patient advocate nominations from the professional/specialist and patient/carer groups were also invited to comment on the ACD.

## RECOMMENDATIONS

### MAJOR RECOMMENDATIONS

- Continuous subcutaneous insulin infusion (CSII or "insulin pump therapy") is recommended as an option for people with type 1 diabetes provided that:
  - Multiple-dose insulin (MDI) therapy (including, where appropriate, the use of insulin glargine) has failed; and
  - Those receiving the treatment have the commitment and competence to use the therapy effectively.
- People for whom MDI therapy has failed are considered to be those for whom it has been impossible to maintain a haemoglobin A<sub>1c</sub> level no greater than 7.5% (or 6.5% in the presence of microalbuminuria or adverse features of the metabolic syndrome) without disabling hypoglycaemia occurring, despite a high level of self care of their diabetes. "Disabling hypoglycaemia," for the purposes of this guidance, means the repeated and unpredictable occurrence of hypoglycaemia requiring third-party assistance that results in continuing anxiety about recurrence and is associated with significant adverse effect on quality of life.
- CSII therapy should be initiated only by a trained specialist team, which should normally comprise a physician with a specialist interest in insulin pump therapy, a diabetes specialist nurse, and a dietitian.
- All individuals beginning CSII therapy should be provided with specific training in its use. Ongoing support from a specialist team should be available, particularly in the period immediately following the initiation of CSII. It is recommended that specialist teams should agree a common core of advice appropriate for CSII users.
- The recommendations in this guidance are also applicable to children, adolescents, pre-pregnant and pregnant women for whom MDI therapy is deemed to have failed. Because of the risks of ketoacidosis to the fetus, pregnant or pre-pregnant women who switch to CSII therapy should do so only on the advice and under the care of a specialist team (defined above).
- CSII therapy is not recommended for people with type 2 diabetes who require insulin therapy.
- Established users of CSII therapy should have their insulin management reviewed by their specialist team so that a decision can be made about whether a trial of a switch to MDI incorporating insulin glargine would be appropriate.

### CLINICAL ALGORITHM(S)

None provided

## EVIDENCE SUPPORTING THE RECOMMENDATIONS

### TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence supporting the recommendations is not specifically stated.

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

- Appropriate use of continuous subcutaneous insulin infusion (CSII) therapy for diabetes
- CSII therapy may enable people with diabetes to have greater control over their condition, as well as lower anxiety about episodes of hypoglycaemia.

### POTENTIAL HARMS

Adverse events that may be associated with continuous subcutaneous insulin infusion (CSII) treatment include catheter site infection (which can be prevented by regular change of the infusion cannula and a high order of personal hygiene), blocked cannula tubing, and ketoacidosis due to lack of insulin in cases of pump malfunction.

## QUALIFYING STATEMENTS

### QUALIFYING STATEMENTS

This guidance represents the view of the Institute, 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. The guidance does not, however, 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.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

#### Implementation and Audit

- National Health Service (NHS) Trusts and consultants treating people with diabetes should review policies and practices regarding the treatment of people with diabetes to take account of the guidance (see the "Major Recommendations" field).
- The cost of ongoing consumables and, in due course, replacement pumps, should be funded by the NHS for established continuous subcutaneous insulin infusion (CSII) users for whom multiple daily injections (MDI) with insulin glargine is considered inappropriate or proves to be inadequate to maintain adequate glycaemic control (see the "Major Recommendations" field).

- Local guidelines or care pathways on the care of people with diabetes should incorporate the guidance (see the "Major Recommendations" field).
- Specialist teams who assume responsibility for initiating CSII should agree a common core of advice appropriate for CSII users in England and Wales.
- To measure compliance locally with the guidance, the following criteria can be used. Further details on suggestions for audit are presented in Appendix C of the original guideline document.
  - Insulin pump therapy (CSII) is considered as a treatment option for a person with type 1 diabetes for whom MDI therapy has failed, and who has the commitment and competence to use the CSII therapy effectively.
  - CSII is initiated only by a trained specialist team that comprises a physician with a specialist interest in insulin pump therapy, a diabetes specialist nurse and a dietitian.
  - A person beginning CSII therapy is provided with specific training in its use and has ongoing support from a specialist team, particularly in the period immediately following the initiation of CSII.
  - A person on CSII therapy is reviewed by his or her specialist team, who make a decision on whether it is appropriate for the person to undergo a trial of switching to MDI incorporating insulin glargine.
- Local clinical audits on the care of patients with diabetes also could include criteria for the management of diabetes based on the standards in the National Service Framework for Diabetes.

## **IMPLEMENTATION TOOLS**

Audit Criteria/Indicators  
 Foreign Language Translations  
 Patient Resources  
 Quick Reference Guides/Physician Guides

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

## **INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES**

### **IOM CARE NEED**

Living with Illness

### **IOM DOMAIN**

Effectiveness  
 Patient-centeredness

## **IDENTIFYING INFORMATION AND AVAILABILITY**

### **BIBLIOGRAPHIC SOURCE(S)**

National Institute for Clinical Excellence (NICE). Guidance on the use of continuous subcutaneous insulin infusion for diabetes. London (UK): National Institute for Clinical Excellence (NICE); 2003 Feb. 23 p. (Technology appraisal guidance; no. 57).

## **ADAPTATION**

Not applicable: The guideline was not adapted from another source.

## **DATE RELEASED**

2003 Feb

## **GUIDELINE DEVELOPER(S)**

National Institute for Health and Clinical Excellence (NICE) - National Government Agency [Non-U.S.]

## **SOURCE(S) OF FUNDING**

National Institute for Health and Clinical Excellence (NICE)

## **GUIDELINE COMMITTEE**

Appraisal Committee

## **COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE**

*Committee Members:* Professor R. L. Akehurst, Dean, School of Health Related Research, University of Sheffield; Dr Tom Aslan, General Practitioner, The Surgery, Stockwell, London; Professor David Barnett (*Chair*) Professor of Clinical Pharmacology, University of Leicester; Dr Sheila Bird, MRC Biostatistics Unit, Cambridge; Professor Rosamund Bryar, Professor of Community & Primary Care Nursing, St Bartholomew's School of Nursing & Midwifery; Professor Martin Buxton, Director of Health Economics Research Group, Brunel University; Dr Karl Claxton, Health Economist, University of York; Dr Richard Cookson, Senior Lecturer, Health Economics, School of Health Policy and Practice, University of East Anglia; Professor Sarah Cowley, Professor of Community Practice Development, King's College, London; Professor Terry Feest, Clinical Director & Consultant Nephrologist, Richard Bright Renal Unit, & Chairman of the UK Renal Registry; Professor Gary A Ford, Professor of Pharmacology of Old Age/Consultant Physician, Newcastle upon Tyne Hospitals NHS Trust; Mrs Sue Gallagher, Former Chief Executive, Merton, Sutton and Wandsworth Health Authority; Ms Bethan George, Interface Liaison Pharmacist, Tower Hamlets Primary Care Trust and St. Bartholomew's & The Royal London Hospital; Dr Trevor Gibbs, Head, Global Clinical Safety & Pharmacovigilance, GlaxoSmithKline; Mr John Goulston, Director of Finance, Barts & the London NHS Trust; Professor Philip Home, Professor of Diabetes Medicine, University of Newcastle upon Tyne; Dr Terry John, General Practitioner, The Firs, London; Mr Muntzer Mughal, Consultant Surgeon, Lancashire Teaching Hospitals NHS Trust; Mr James Partridge, Lay Representative, Chief Executive, Changing Faces; Mrs Kathryn Roberts, Nurse

Practitioner, Hattersley Health Centre, Hyde, Cheshire; Professor Philip Routledge, Professor of Clinical Pharmacology, University of Wales; Ms Anne Smith, Lay Representative; Trustee, Long Term Medical Conditions Alliance; Professor Andrew Stevens (*Vice-Chair*) Professor of Public Health, University of Birmingham; Dr Cathryn Thomas, General Practitioner & Senior Lecturer, Department of Primary Care and General Practice, University of Birmingham; Dr Norman Vetter, Reader, Department of Epidemiology, Statistics and Public Health, University of Wales College of Medicine; Dr David Winfield, Consultant Haematologist, Royal Hallamshire Hospital, University of Wales College of Medicine

## **FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST**

Committee members are asked to declare any interests in the technology to be appraised. If it is considered there is a conflict of interest, the member is excluded from participating further in that appraisal.

## **GUIDELINE STATUS**

This is the current release of the guideline.

## **GUIDELINE AVAILABILITY**

Electronic copies: Available in Portable Document Format (PDF) format from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).

## **AVAILABILITY OF COMPANION DOCUMENTS**

The following are available:

- Guidance on the use of continuous subcutaneous insulin infusion for diabetes. Quick reference guide. London (UK): National Institute for Health and Clinical Excellence (NICE); 2003 Feb. 2 p. (Technology appraisal 57). Available in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).
- Clinical and cost effectiveness of continuous subcutaneous insulin infusion for diabetes. Assessment report. NHS HTA Programme. 2002 Aug. 180 p. Available in Portable Document Format (PDF) from the [NICE Web site](#).

Print copies: Available from the National Health Service (NHS) Response Line 0870 1555 455. ref: N0195. 11 Strand, London, WC2N 5HR.

Additionally, Audit Criteria can be found in Appendix D of the [original guideline document](#).

## **PATIENT RESOURCES**

The following is available:

- Guidance on the use of continuous subcutaneous insulin infusion for diabetes. Information for the public. London (UK): National Institute for Health and Clinical Excellence (NICE); 2003 Feb. 2 p. (Technology appraisal 57).

Electronic copies: Available in English and Welsh in Portable Document Format (PDF) from the [National Institute for Health and Clinical Excellence \(NICE\) Web site](#).

Print copies: Available from the Department of Health Publications Order Line 0870 1555 455. ref: N0196. 11 Strand, London, WC2N 5HR.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

## **NGC STATUS**

This NGC summary was completed by ECRI on July 24, 2006.

The National Institute for Health and Clinical Excellence (NICE) has granted the National Guideline Clearinghouse (NGC) permission to include summaries of their Technology Appraisal guidance with the intention of disseminating and facilitating the implementation of that guidance. NICE has not verified this content to confirm that it accurately reflects the original NICE guidance and therefore no guarantees are given by NICE in this regard. All NICE technology appraisal guidance is prepared in relation to the National Health Service in England and Wales. NICE has not been involved in the development or adaptation of NICE guidance for use in any other country. The full versions of all NICE guidance can be found at [www.nice.org.uk](http://www.nice.org.uk).

## **COPYRIGHT STATEMENT**

This NGC summary is based on the original guideline, which is subject to the guideline developer's copyright restrictions.

## **DISCLAIMER**

### **NGC DISCLAIMER**

The National Guideline Clearinghouse™ (NGC) does not develop, produce, approve, or endorse the guidelines represented on this site.

All guidelines summarized by NGC and hosted on our site are produced under the auspices of medical specialty societies, relevant professional associations, public or private organizations, other government agencies, health care organizations or plans, and similar entities.

Guidelines represented on the NGC Web site are submitted by guideline developers, and are screened solely to determine that they meet the NGC

Inclusion Criteria which may be found at  
<http://www.guideline.gov/about/inclusion.aspx>.

NGC, AHRQ, and its contractor ECRI Institute make no warranties concerning the content or clinical efficacy or effectiveness of the clinical practice guidelines and related materials represented on this site. Moreover, the views and opinions of developers or authors of guidelines represented on this site do not necessarily state or reflect those of NGC, AHRQ, or its contractor ECRI Institute, and inclusion or hosting of guidelines in NGC may not be used for advertising or commercial endorsement purposes.

Readers with questions regarding guideline content are directed to contact the guideline developer.

© 1998-2008 National Guideline Clearinghouse

Date Modified: 9/15/2008

