National Institute for Health and Clinical Excellence

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Peritoneal dialysis

Peritoneal dialysis in the treatment of stage 5 chronic kidney disease

NICE clinical guideline 125
Developed by the Centre for Clinical Practice at NICE

NICE clinical guideline 125
Kidney disease: peritoneal dialysis in the treatment of stage 5 chronic kidney disease

Ordering information
You can download the following documents from
www.nice.org.uk/guidance/CG125
A quick reference guide – a summary of the recommendations for healthcare professionals.

- 'Understanding NICE guidance' – a summary for patients and carers.
- The full guideline – all the recommendations, details of how they were developed, and reviews of the evidence they were based on.

For printed copies of the quick reference guide or 'Understanding NICE guidance', phone NICE publications on 0845 003 7783 or email publications@nice.org.uk and quote:

- N2600 (quick reference guide)
- N2601 ('Understanding NICE guidance').

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

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 summary of product characteristics of any drugs they are considering.

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Contents

Introduction

Peritoneal dialysis for patients with chronic kidney disease stage 5

At any one time in the UK, 400–800 people per million of the population need renal replacement in the form of dialysis. The prevalence of dialysis in the UK is highly age dependent – for adults aged 70–80 years it is between 1600 and 2000 people per million. Dialysis is needed to sustain life for patients with chronic kidney disease (CKD). For about 40% of adults on dialysis a kidney transplant is the treatment of choice; this percentage is higher in children. If patients do not have a kidney transplant, dialysis is needed for the rest of the patient's life.

Two main types of dialysis are available, haemodialysis and peritoneal dialysis. The main factors that determine what type of dialysis people with chronic kidney disease have are patient preferences about which treatment fits best within their lifestyle, availability of options within a service and clinical contraindications. Factors patients and carers may need to consider about peritoneal dialysis are: the ability to carry out dialysis themselves; the support services they need to carry out dialysis; integration of dialysis with work, school, hobbies, and social and family activities; opportunities to maintain social contacts; possible modifications to their home; the distance and time travelling to hospital; flexibility of daily treatment, diet and medication regimens; and possible changes to body image and physical activities because of dialysis access points.

Peritoneal dialysis can be delivered safely and effectively at home or at another location of the patient's choice. Patients administer it themselves although children, and some adults, might need help from their families or carers. Patients must have a clean and hygienic place to exchange dialysis fluid and/or set up dialysis delivery devices either to have dialysis throughout the day (continuous ambulatory peritoneal dialysis [CAPD]) or overnight while they are asleep (automated peritoneal dialysis [APD] and assisted automated

peritoneal dialysis [aAPD]). A small room or shed will be needed to store deliveries of dialysis fluid.

The proportion of people with chronic kidney disease (CKD) starting treatment on home- or hospital-based dialysis, and peritoneal or haemodialysis treatment, varies considerably. The proportion of people with chronic kidney disease using peritoneal dialysis ranges from 0–30% in adults, possibly because of variation in local practice and resources, and is as high as 56% in children.

There is currently no national guidance in England and Wales on supporting people to make informed decisions about renal replacement therapy, specifically peritoneal dialysis. Nor is there guidance on the role of aAPD in an integrated dialysis or renal replacement programme or individual patient pathway.

This short clinical guideline aims to improve the care of people with stage 5 CKD who need and want to receive dialysis, by making evidence-based recommendations on the role of peritoneal dialysis.

Who this guideline is for

This document is for healthcare professionals who support people with stage 5 CKD who need dialysis and other staff who care for people with stage 5 CKD who need renal replacement therapy (specifically peritoneal dialysis).

Patient-centred care

This guideline offers best practice advice on the care of adults, children and young people with stage 5 CKD.

Treatment and care should take into account patients' needs and preferences. People with CKD should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. If patients do not have the capacity to make decisions, healthcare professionals should follow the Department of Health's advice on consent (available from www.dh.gov.uk/consent) and the code of practice that accompanies the Mental Capacity Act (summary available from www.publicguardian.gov.uk). In Wales, healthcare professionals should follow advice on consent from the Welsh Assembly Government (available from www.wales.nhs.uk/consent).

If the patient is under 16, healthcare professionals should follow the guidelines in 'Seeking consent: working with children' (available from www.dh.gov.uk/consent).

Good communication between healthcare professionals and patients is essential. It should be supported by evidence-based written information tailored to the patient's needs. Treatment and care, and the information patients are given about it, should be culturally appropriate. It should also be accessible to people with additional needs such as physical, sensory or learning disabilities, and to people who do not speak or read English.

If the patient agrees, families and carers should have the opportunity to be involved in decisions about treatment and care.

Families and carers should also be given the information and support they need.

Care of young people in transition between paediatric and adult services should be planned and managed according to the best practice guidance

described in ‘Transition: getting it right for young people’ (available from www.dh.gov.uk).

Adult and paediatric healthcare teams should work jointly to provide assessment and services to young people with CKD. Diagnosis and management should be reviewed throughout the transition process, and to ensure continuity of care there should be clarity about who is the lead clinician.

1 Summary

1.1 List of all recommendations

Information and support

1.1.1 Offer patients with stage 5 chronic kidney disease (CKD) and their families and carers information and support in line with 'Chronic kidney disease' (NICE clinical guideline 73, 2008).

1.1.2 Offer patients and their families and carers oral and written information about pre-emptive transplant, dialysis, and conservative care to allow them to make informed decisions about their treatment.

1.1.3 To enable patients to make informed decisions, offer balanced and accurate information about all dialysis options. The information should include:

- a description of treatment modalities (assisted automated peritoneal dialysis [aAPD], automated peritoneal dialysis [APD], continuous ambulatory peritoneal dialysis [CAPD], and home or in-centre haemodialysis) including:
  - efficacy
  - risks
  - potential benefits, based on the person's prognosis
  - potential side effects and their severity
  - changing the modality of dialysis and the possible consequences (that is, the impact on the person's life or how this may affect future treatment or outcomes)
- a discussion about how treatment fits into people's lives, including:
  - the patient's and/or carer's ability to carry out and adjust the treatment themselves
  - integration with daily activities such as work, school, hobbies, family commitments and travel for work or leisure

- opportunities to maintain social interaction
- the impact on body image
- how the dialysis access point on the body may restrict physical activity
- if their home will need to be modified to accommodate treatment
- distance and time spent travelling for treatment
- flexibility of treatment regimen
- any additional support or services that might be needed from others.

1.1.4 Explain to patients and check they understand that CKD is a lifelong disease, and that during the course of renal replacement therapy they are likely to need to switch between treatment modalities depending on clinical or personal circumstances.

1.1.5 When providing information about treatment options, healthcare professionals should discuss and take into account any information the patient has obtained from other patients, families and carers and all other sources, and how this information has influenced their decision.

1.1.6 Make sure that healthcare professionals offering information have specialist knowledge about CKD and the necessary skills to support decision-making. This may include training in:

- using decision aids to help patients make decisions about their care and treatment
- presenting information to children in a form suitable for their developmental stage, such as play therapies.

1.1.7 Trained healthcare professionals (see recommendation 1.1.6) should be available to discuss the information provided both before and after the start of dialysis.

1.1.8 Offer all patients who have presented late, or started dialysis treatment urgently, an enhanced programme of information, at an appropriate time, that offers the same information and choices as those who present at an earlier stage of chronic kidney disease.

Choosing dialysis

1.1.9 Offer all people with stage 5 CKD a choice of peritoneal dialysis or haemodialysis, if appropriate, but consider peritoneal dialysis as the first choice of treatment modality for:

- children 2 years old or younger
- people with residual renal function
- adults without significant associated comorbidities.

1.1.10 When discussing choice of treatment modalities, healthcare professionals should take into account that people's priorities are not necessarily the same as their own clinical priorities.

1.1.11 Before starting peritoneal dialysis, offer all patients a choice, if appropriate, between CAPD and APD (or aAPD if necessary).

1.1.12 For children for whom peritoneal dialysis is appropriate, offer APD in preference to CAPD if they are on a liquid diet, especially if they have low residual renal function.

Switching treatment modalities

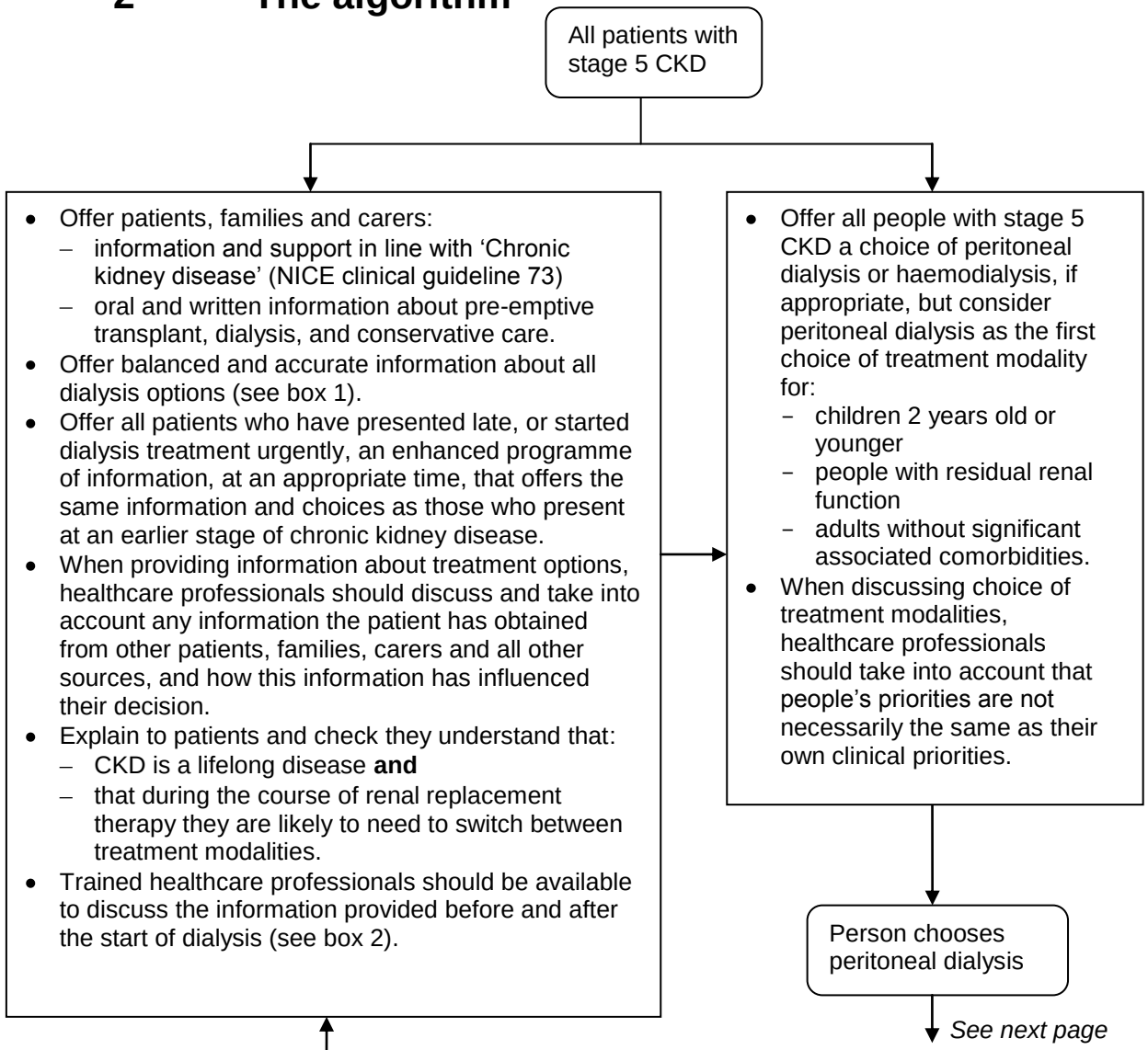
1.1.13 Do not routinely switch patients on peritoneal dialysis to a different treatment modality in anticipation of potential future complications such as encapsulating peritoneal sclerosis. However, healthcare professionals should monitor risk factors such as loss of ultrafiltration and discuss with patients regularly the efficacy of all aspects of their treatment.

1.1.14 Consider switching treatment modality if the patient, their family or carer asks.

1.1.15 When considering switching treatment modality, offer information on treatment options described in recommendations 1.1.1–1.1.8. This should also include how any decision to switch may affect future treatment options.

1.1.16 Switching between treatment modalities should be planned if possible.

2 The algorithm



Box 1 Information about dialysis options

- Offer a description of treatment modalities (assisted automated peritoneal dialysis [aAPD, automated peritoneal dialysis [APD], continuous ambulatory peritoneal dialysis [CAPD], and home or in-centre haemodialysis) including:
  - efficacy
  - risks
  - potential benefit, based on the person's prognosis
  - potential side effects and their severity
  - changing the modality of dialysis and the possible consequences.
- Discuss:
  - the patient's and/or carer's ability to carry out and adjust the treatment
  - integration with daily activities such as work, school, hobbies, family commitments and travel for work or leisure
  - opportunities to maintain social interaction
  - the impact on body image
  - how the dialysis access point on the body may restrict physical activity
  - if their home will need to be modified to accommodate treatment
  - distance and time spent travelling for treatment
  - flexibility of treatment regimen
  - any additional support or services that might be needed from others.

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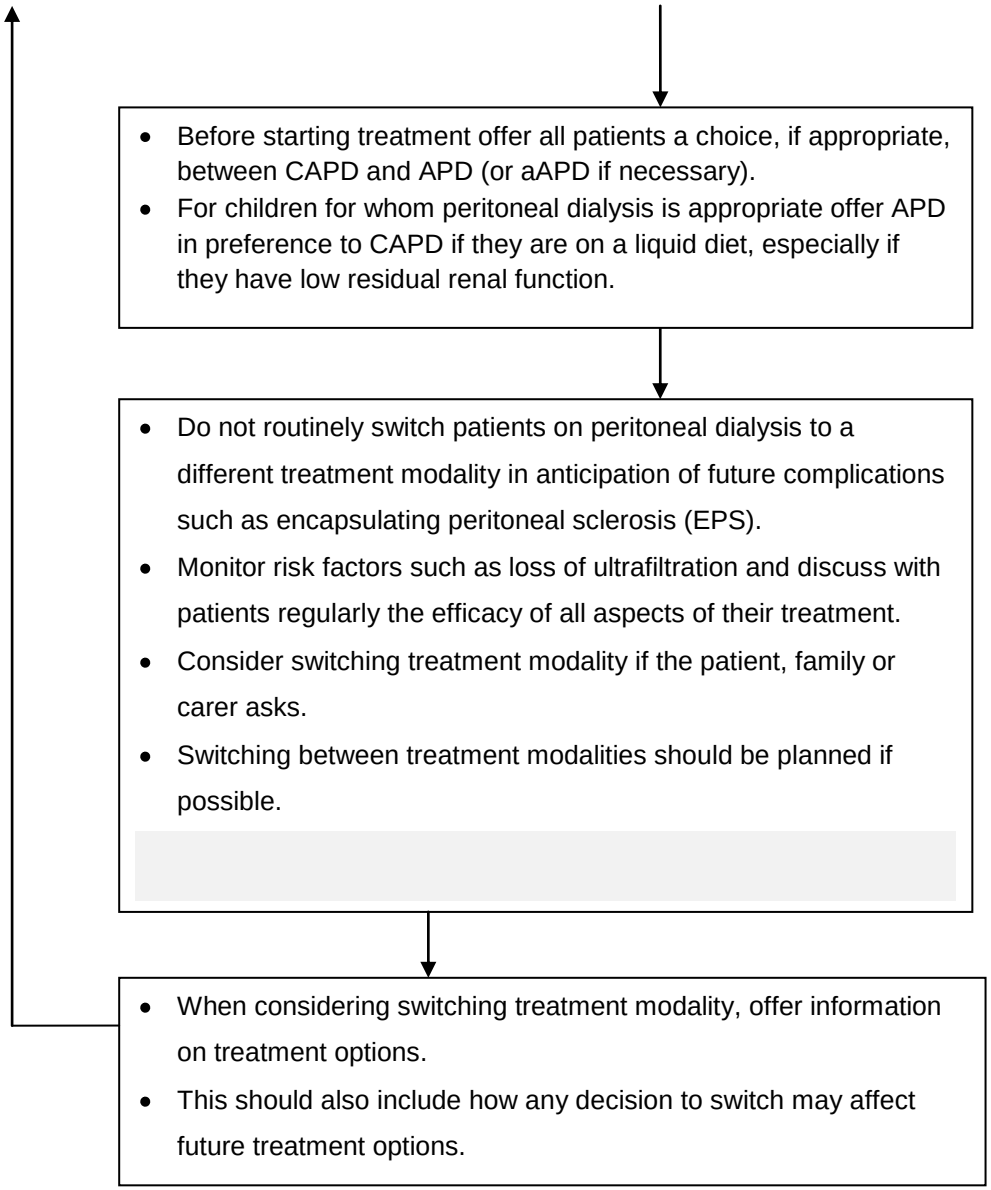

- Before starting treatment offer all patients a choice, if appropriate, between CAPD and APD (or aAPD if necessary).
- For children for whom peritoneal dialysis is appropriate offer APD in preference to CAPD if they are on a liquid diet, especially if they have low residual renal function.

- Do not routinely switch patients on peritoneal dialysis to a different treatment modality in anticipation of future complications such as encapsulating peritoneal sclerosis (EPS).
- Monitor risk factors such as loss of ultrafiltration and discuss with patients regularly the efficacy of all aspects of their treatment.
- Consider switching treatment modality if the patient, family or carer asks.
- Switching between treatment modalities should be planned if possible.

- When considering switching treatment modality, offer information on treatment options.
- This should also include how any decision to switch may affect future treatment options.

Box 2 Information providers

- Make sure that healthcare professionals offering information have specialist knowledge about CKD and the necessary skills to support decision-making. This may include training in:
  - using decision aids
  - presenting information to children in a form suitable for their developmental stage, such as play therapies.

3 How this guideline was developed

3.1 Introduction

‘Peritoneal dialysis: peritoneal dialysis in the treatment of stage 5 chronic kidney disease’ (NICE clinical guideline 125) is a NICE short clinical guideline. For a full explanation of how this type of guideline is developed, see 'The guidelines manual' (2009) at www.nice.org.uk/GuidelinesManual.

3.1.1 Outcomes

The Guideline Development Group agreed the following outcomes as relevant, and the importance of each outcome was agreed through informal consensus.

- Critical:
  - health-related quality of life
  - patient involvement and satisfaction
  - mortality (where reported, including deaths in the first 3 months of treatment)
  - preservation of renal function
  - technique failure or switch
  - resource use and costs including hospitalisation.
- Important:
  - adverse events
  - adequacy rates
  - staff attitude and skills
  - nutritional status.
- Minor:
  - anaemia.

The minimally important difference was agreed as a 10% difference in relative risk.

3.2 Information and support

3.2.1 First review question

What are the barriers and facilitators for peritoneal dialysis for:

- adults with stage 5 CKD
- children with stage 5 CKD
- families and carers of people with stage 5 CKD
- healthcare professionals who support patients and carers deciding on the type of dialysis (peritoneal dialysis or haemodialysis)?

Through understanding the barriers and facilitators to the use of peritoneal dialysis, the Guideline Development Group was able to draft recommendations on the information and support needs of patients and their families and carers to improve decision-making.

3.2.2 Evidence review

A total of 6183 articles were found by systematic searches, a further six systematic reviews were suggested by the Guideline Development Group (four of which had not been identified in the searches – Furr 1998; Kaptein et al. 2009; Morton et al. 2010b; Murray et al. 2009) and one further review was identified through background searching (Mason et al. 2008). Full text was ordered for 168 articles based on the title and abstract. Thirteen papers (Bass et al. 1999; de Paula et al. 2008a; de Paula et al. 2008b; Hislop and Lansing 1983; Lee et al. 2008; Mason et al. 2008; McLaughlin et al. 2008; Morton et al. 2010a; Morton et al. 2010b; Murray et al. 2009; Oliver et al. 2010; Portoles et al. 2009; Tong et al. 2008) met the eligibility criteria (see appendix A for review protocol and inclusion and exclusion criteria) and described the experience of decision-making when starting dialysis. Although many studies reported factors associated with the choice of dialysis, they were excluded because the focus was the experience of the patient, family or healthcare professional as explored using qualitative methods. However, some surveys evaluating patient-centred factors associated with the choice of dialysis are

included because the Guideline Development Group considered that they contributed important information.

GRADE assessment was adapted, and the following variables were considered: limitations, inconsistency and indirectness. Imprecision was rated as not relevant throughout because it does not apply to the type of evidence considered in this question. The following principles were applied to assess quality: a systematic review of qualitative studies started as high, and a single qualitative study started as moderate, with downgrading as appropriate.

Adults who need dialysis and families or carers

The evidence base describing barriers and facilitators for adults and their families or carers included two systematic reviews (Morton et al. 2010b; Murray et al. 2009) and five primary studies. Three of the primary studies were directly relevant (Lee et al. 2008; McLaughlin et al. 2008; Morton et al. 2010a), Two studies were identified as supporting evidence (Oliver et al. 2010; Portoles et al. 2009), but the GDG decided not to consider them any further.

Only the evidence considered to be directly relevant is summarised in the GRADE tables.

GRADE profile 1 Patient and carer perspective (adults)

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Patient and carer perspective (adults)							
1 Morton 2010	Systematic review	No serious limitations	No serious inconsistencies	No serious indirectness	Not relevant	Identified themes were: • confronting mortality • lack of choice • gaining knowledge of options • weighing alternatives Major factors influencing decision-making were: • peer influence • timing of information • maintaining the status quo	HIGH
1 Murray 2009	Systematic review	No serious limitations	No serious inconsistencies	No serious indirectness	Not relevant	Most frequent decisions were: • type of RRT • withholding or withdrawing of treatment • renal transplantation Reported information were: • condition management • social and lifestyle factors • general knowledge about	HIGH

						CKD, treatment options and renal transplant • lifestyle management • self-care • end-of-life planning • exposure to others' opinions and experiences. Patient-level factors influencing treatment decisions were: • interpersonal relationships • trust in providers • preservation of current well being, normality and quality of life • need for control • being personally responsible.	
3 Lee 2008 McLaughlin 2008 Morton 2010	Qualitative studies	Some serious limitations[a]	No serious inconsistencies	No serious indirectness	Not relevant	Identified themes were: • flexibility and independence or confinement • freedom and control or risk and subordination • self-care • feelings of insecurity or security • physical space and noise and home modification	LOW

						• maintenance of a normal life • lifestyle • social inclusion or family burden • convenience or time commitment • pre-dialysis information • involvement in choice of modality • effectiveness • simplicity • pain • access • impermanence.	

[a] It was not possible to synthesise these data, as was done in the high quality systematic reviews (downgraded one level).

Abbreviations: RRT, renal replacement therapy.

Children who need dialysis and parents, other family members or carers

The evidence base describing barriers and facilitators for children and their families or carers included one systematic review of the experiences of parents (Tong et al. 2008) and two primary studies (one with reports in two papers) (de Paula et al. 2008a; de Paula et al. 2008b; Hislop and Lansing 1983).

GRADE profile 2 Patient and carer perspective (children)

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Patient and carer perspective (children)							
1 Hislop 1983	Qualitative study	Some serious limitations[a]	Not assessable[b]	No serious indirectness	Not relevant	Children preferred different modalities of dialysis because of the impact on normal activities.	VERY LOW

[a] This study did not use true qualitative methods (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.

GRADE profile 3 Patient and carer perspective (parents)

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Carer perspective (children): parents of child or adolescent (aged 21 years or under) with CKD (any stage)							
1 Tong 2008	Systematic review	No serious limitations	No serious inconsistencies	No serious indirectness	Not relevant	Themes developed by the original researchers related to pre-dialysis were: • self-accusation and blame • depression and generalised anxiety • uncertainty around diagnosis • uncertainty for the child's future. Related to dialysis were: • emotional turmoil • uncertainty around prognosis • surrendering control of the child to clinical staff. Overall, main themes were: • intrapersonal issues • interpersonal issues • external issues.	HIGH

GRADE profile 4 Patient and family perspective (parents and other family members of children)

Quality assessment						Summary of findings	Quality
No. of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
Carer perspective (children): families of children with CKD on peritoneal dialysis							
1 de Paula 2008 (two reports from 1 study)	Qualitative study	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not relevant	Families, including siblings, reported changes and adaptations when the child was treated with peritoneal dialysis. Social supports were very meaningful and were varied; emotional, informational, instrumental, and appraisal. Such support was accessed through many and diverse sources, but should be accessible, and provide a 'depth' of support.	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.
[b] This study was not specifically related to decision making or initial support (downgraded one level).

Healthcare professionals who support patients and carers in the choice of dialysis modality

The evidence base for the perceptions of healthcare professionals on barriers and facilitators to peritoneal dialysis use included one primary study on the experience of healthcare professionals supporting or providing care to people who need dialysis (Bass et al. 1999).

GRADE profile 5 Healthcare professional perspective

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Healthcare professional perspective							
1 Bass 1999	Qualitative study	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not relevant	Healthcare professionals considered the following to be important factors related to decision making for dialysis: • access issues • choices • comorbidity • family relationships • financial concerns • freedom and energy • general issues about dialysis • general issues about HD • general issues about peritoneal dialysis • individual drive and control • job-related concerns • nutrition • patient education • physician bias • physician specialists and referral practices • provider bias • quality of life • referral policies • relationship with dialysis staff • relationship with peers • relationship with physicians	VERY LOW

						• reuse • scheduling and transportation for treatment • self-care • sex • social support • transplants • travel	

[a] Inconsistency was not assessable (downgraded one1 level) because it was reported in one1 study only.
[b] This was considered indirect because this was not the perspective of the patient or family, but the perceptions of the healthcare professionals.

3.2.3 Evidence statements

Adults and carers

3.2.3.1 *High-quality evidence (from one systematic review) found that the most frequent decisions cited in the literature were about the type of renal replacement therapy, withholding or withdrawing treatment, and renal transplantation (Murray et al. 2009).*

3.2.3.2 *High-quality evidence (from one systematic review) showed that confronting mortality, lack of choice, gaining knowledge about options, and weighing alternatives were important themes for adult patients and carers when making decisions about treatment (Morton et al. 2010b).*

3.2.3.3 *High-quality evidence (from one systematic review) found that patients wanted information on managing their condition, social and lifestyle factors, general knowledge about CKD, treatment options and renal transplant, lifestyle management, self care, and end-of-life planning. Patients were greatly influenced by exposure to others' (patient peers) opinions and experiences (Murray et al. 2009).*

3.2.3.4 *High-quality evidence (from one systematic review) identified the following as patient perceptions that influence treatment decisions: interpersonal relationships, trust in providers, preserving current wellbeing, normality and quality of life, the need for control, and being personally responsible (Murray et al. 2009).*

3.2.3.5 *High-quality evidence (from one systematic review) showed that major factors influencing decision-making by patients and carers were peer influence, the timing of information and duration over which it's given, and maintaining the status quo (Morton et al. 2010b).*

3.2.3.6 *Low-quality evidence (from three qualitative studies) showed that issues for patients, families and carers were flexibility and*

independence or confinement, freedom and control or risk and subordination, self care, feelings of insecurity or security, physical space and noise in the location of treatment delivery, home modification, maintaining a normal life, lifestyle, social inclusion or family burden, convenience or time commitment, pre-dialysis information, involvement in choosing dialysis, effectiveness, simplicity, pain, access for dialysis, and impermanence of the treatment and access (Lee et al. 2008; McLaughlin et al. 2008; Morton et al. 2010a).

Children and parents

3.2.3.7 Very-low-quality evidence (from one qualitative study) found that children preferred different types of dialysis because of the impact on normal activities (Hislop and Lansing 1983).

3.2.3.8 High-quality evidence (from one systematic review) showed that self-accusation and blame, depression and generalised anxiety, uncertainty around diagnosis, uncertainty around the child's future, emotional turmoil, uncertainty around prognosis and surrendering control of the child to clinical staff were issues at pre-dialysis and dialysis for parents of children and young people with CKD (Tong et al. 2008).

3.2.3.9 Very-low-quality evidence (from one qualitative study) found that families, including siblings, reported changes and adaptations when the child was treated with peritoneal dialysis. Social supports were very meaningful and were varied: type of supports were categorised as emotional, informational, instrumental, and appraisal. Such support was accessed through many and diverse sources, but it was generally thought that it should be accessible, and provide a 'depth' of support (de Paula et al. 2008a; de Paula et al. 2008b).

Healthcare professionals

3.2.3.10 *Very-low-quality evidence (from one qualitative study) showed that healthcare professionals perceived the following to be factors related to decision-making for dialysis (Bass et al. 1999):*

- *access issues for dialysis*
- *choices*
- *comorbidity*
- *family relationships*
- *financial concerns*
- *freedom and energy*
- *general issues about dialysis*
- *general issues about haemodialysis*
- *general issues about peritoneal dialysis*
- *individual drive and control*
- *job-related concerns*
- *nutrition*
- *patient education*
- *physician bias*
- *physician specialists and referral practices*
- *provider bias*
- *quality of life*
- *referral policies*
- *relationship with dialysis staff*
- *relationship with peers*
- *relationship with physicians*
- *reuse of equipment*
- *scheduling and transportation for treatment*
- *self care*
- *sex*
- *social support*
- *transplants*
- *travel.*

3.2.4 Health economic modelling

This was not considered to be a health economic question.

3.2.5 Evidence to recommendations

For most people the choice of dialysis is not clinically driven but is related to individual characteristics and preferences and the impact on their own and their families' lives. Kidney disease is a lifelong condition with varying modes of treatment, including dialysis and/or transplantation, with the option of conservative management if appropriate.

The disease is never 'cured', it is merely treated with these different therapies. It is therefore imperative that the choices offered and made are in line with what the patient needs and wants.

The Guideline Development Group noted that the decision about renal replacement therapy requires patients and professionals to consider this potential change to the patient's treatment regimen in advance of a deterioration in the patient's health. This requires effort by all parties to consider and discuss these treatment options over and above routine care practices, and to recognise that how the patient currently manages the impact of CKD on their life will change.

The evidence suggests that in most cases the dialysis choice depends more on how the dialysis treatment will fit into the patient's life rather than on clinical indicators. However, there are some patient groups for whom clinical considerations do have an impact on the choice of modality, and these are discussed below.

Overall, the Guideline Development Group noted the consistency of the evidence, particularly for the experience of adults when choosing the modality of dialysis. The factors identified as being important to patients were also consistent with the experience and perceptions of the Guideline Development Group.

However, there was significantly less evidence on the experience of children and their parents and families. However, the Guideline Development Group

considered that they could use experience from other areas of paediatric care to support the recommendations on decision-making in this group.

The Guideline Development Group agreed that information should be given proactively. Choosing dialysis is difficult and people, and their families, need help to collate all relevant information and tailor it to their needs. Supporting informed decision-making is not simply about providing information; if people are not able to use the information meaningfully, providing or repeating information alone will not help.

The approach to providing information to support informed decision-making should be structured and timely, including for those patients who have presented late or started dialysis treatment urgently. This is consistent with other initiatives to support people with kidney disease, for example the use of kidney care plans. The NICE guidelines on chronic kidney disease (www.nice.org.uk/guidance/CG73) also make recommendations on tailored education and information to be provided at appropriate times during the patient's journey.

There are significant challenges in providing information about choosing dialysis; there are many important factors and it can be difficult to understand how these will affect a person's daily life. The Guideline Development Group considered that these challenges could be addressed by encouraging the patient to think actively about those aspects of life that will change or stay the same as a result of the treatment choices. Also, because dialysis can be a long-term intervention and circumstances may change over time, a patient's values may also change, so information, evaluation of that information and the decisions about dialysis should be an ongoing process. This is also relevant to starting dialysis and information should be provided before dialysis is needed; that is, as part of the pre-dialysis education programmes.

Another key principle underpinning the recommendations is the need to give people enough information for them to make the right decision for them and their families, rather than the healthcare professional ruling out options before a full discussion of all appropriate choices. Healthcare professionals may have

different perceptions of what is important, and these may be valid (for example, if based on clinical factors). But this difference needs to be acknowledged and understood so that an informed decision can be reached.

The Guideline Development Group therefore made recommendations on the information and support that patients need to facilitate informed decision-making.

3.2.6 Second review question

What is the effectiveness of interventions (specifically education, decision-support tools and aids) to improve decisions about the initial choice of dialysis?

3.2.7 Evidence review

A total of 6183 articles were found by systematic searches, a further six systematic reviews were suggested by the Guideline Development Group (four of which were not identified in the searches: Furr 1998; Kaptein et al. 2009; Morton et al. 2010b; Murray et al. 2009) and one further review was identified through background searching (Mason et al. 2008). Full text was ordered for 168 articles based on the title and abstract. Two papers (Keshaviah 1997; Murray et al. 2009) evaluated the effectiveness of interventions to improve decision-making when starting dialysis. The following studies did not meet the eligibility criteria (see appendix 1 for review protocol and inclusion and exclusion criteria) and were not considered further: Furr (1998), Kaptein et al. (2009) and Keshaviah (1997).

Although the systematic reviews looked at interventions to improve decisions throughout the patient journey of CKD, only those studies that focused on choosing dialysis were considered for this review.

GRADE profile 6 Interventions to improve decision-making on choosing dialysis

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Health-related quality of life: depression and anxiety (adults)							
1 Mason 2008	Systematic review	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	A non-significant trend towards an increase in reported depression (p = ns) and anxiety (p = ns) was seen in the pre-dialysis education group compared with the control group.	LOW
Patient involvement and satisfaction: self-efficacy (training) and performing self-care (adults)							
1 Mason 2008	Systematic review	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	An increase in self-efficacy (p = 0.02) and performing self-care (p = 0.02) was seen in the pre-dialysis education group compared with the control group.	LOW
Patient involvement and satisfaction: social support (adults)							
1 Mason 2008	Systematic review	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	A non-significant trend towards an increase in social support (p = ns) was seen in the pre-dialysis education group compared with the control group.	LOW
Patient involvement and satisfaction: quality of decision making (adults)							
2 Mason 2008 Murray 2009	Systematic reviews	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	No studies were identified that assessed the effect of decision-support interventions on decision quality measures.	LOW
Mortality (where reported, deaths in first 3 months): median survival after starting dialysis and at 20 years (adults)							
1 Mason 2008	Systematic review	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[c]	After starting dialysis, the median survival was 8 months longer in the pre-dialysis education group (RR 1.35, 95% CI 1.02 to 1.8) compared with the	LOW

						control group. At 20 years, the median survival was 2.25 years longer in the pre-dialysis education group (RR 1.32, 95% CI 1.0 to 1.74) compared with the control group.	
Preservation of renal function (adults)							
2 Mason 2008 Murray 2009	Systematic reviews	Not reported as an outcome					…
Technique failure or switch (adults)							
2 Mason 2008 Murray 2009	Systematic reviews	Not reported as an outcome					…
Resource use and costs (inc. hospitalisation) (adults)							
2 Mason 2008 Murray 2009	Systematic reviews	Not reported as an outcome					…

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.
[b] Imprecision was not assessable (downgraded one level), and it was also noted that meta-analysis was not possible because of heterogeneity.
[c] Imprecise using 10% threshold (downgraded one level).
Abbreviations: ns, not statistically significant.

No other outcomes were reported.

3.2.8 Evidence statements

3.2.8.1 Low-quality evidence (from one systematic review) showed no difference in measures of depression and anxiety between adults who had undergone pre-dialysis education and those in the control group (Mason et al. 2008).

3.2.8.2 Low-quality evidence (from two systematic reviews) showed that efficacy for performing self care was increased in adults who had undergone pre-dialysis education compared with those in the control group (Mason et al. 2008). However, there was no increase in the level of social support between groups (Mason et al. 2008), and no studies reported the impact of decision-support interventions on measures of decision quality (Mason et al. 2008; Murray et al. 2009).

3.2.8.3 Low-quality evidence (from one systematic review) showed that the median survival (after starting dialysis and at 20 years' follow-up) was increased in adults who had undergone pre-dialysis education compared with those in the control group (Mason et al. 2008).

3.2.8.4 No studies were identified on the impact of pre-dialysis education or decision-support interventions on the other critical outcomes preserving renal function, technique failure or switch, resource use and costs including hospitalisation, or on the important outcomes of adverse events, adequacy rates, nutritional status or staff attitude and skills.

3.2.8.5 No studies were identified on the impact of interventions to improve decision-making in children and/or their families.

3.2.9 Health economic modelling

This was not considered to be a health economic question.

3.2.10 Evidence to recommendations

The Guideline Development Group noted the lack of evidence on interventions to improve decision-making for dialysis; however, it recognised that there is a large body of evidence on decision-making in general. The recommendations are therefore based on the reviewed evidence, specific to this topic, and the GDG's knowledge of generic decision-support interventions that were not reviewed in this guideline.

Specific interventions considered by the Guideline Development Group included play therapy for children and peer support. However, no evidence on them was identified. It was agreed that children need decision-making methods suitable for their age. Peer information giving was discussed in detail. Again, although there was no evidence, the Guideline Development Group considered that structured information from peers in a formal programme could be effective in improving patients' understanding of the impact of options. But if managed poorly it could negatively affect the decision-making process. If peer information is used, healthcare professionals should discuss this information with the patient and family and explore how the information has influenced their decision-making.

3.2.11 Recommendations

Recommendation 1.1.1

Offer patients with stage 5 chronic kidney disease (CKD) and their families and carers information and support in line with 'Chronic kidney disease' (NICE clinical guideline 73, 2008).

Recommendation 1.1.2

Offer patients and their families and carers oral and written information about pre-emptive transplant, dialysis, and conservative care to allow them to make informed decisions about their treatment.

Recommendation 1.1.3

To enable patients to make informed decisions, offer balanced and accurate information about all dialysis options. The information should include:

- a description of treatment modalities (assisted automated peritoneal dialysis [aAPD], automated peritoneal dialysis [APD], continuous ambulatory peritoneal dialysis [CAPD], and home or in-centre haemodialysis) including:
  - efficacy
  - risks
  - potential benefits, based on the person's prognosis
  - potential side effects and their severity
  - changing the modality of dialysis and the possible consequences (that is, the impact on the person's life or how this may affect future treatment or outcomes)
- a discussion about how treatment fits into people's lives, including:
  - the patient's and/or carer's ability to carry out and adjust the treatment themselves
  - integration with daily activities such as work, school, hobbies, family commitments and travel for work or leisure
  - opportunities to maintain social interaction
  - the impact on body image
  - how the dialysis access point on the body may restrict physical activity
  - if their home will need to be modified to accommodate treatment
  - distance and time spent travelling for treatment
  - flexibility of treatment regimen
  - any additional support or services that might be needed from others.

Recommendation 1.1.4

Explain to patients and check they understand that CKD is a lifelong disease,

and that during the course of renal replacement therapy they are likely to need to switch between treatment modalities depending on clinical or personal circumstances.

Recommendation 1.1.5

When providing information about treatment options, healthcare professionals should discuss and take into account any information the patient has obtained from other patients, families and carers and all other sources, and how this information has influenced their decision.

Recommendation 1.1.6

Make sure that healthcare professionals offering information have specialist knowledge about CKD and the necessary skills to support decision-making. This may include training in:

- using decision aids to help patients make decisions about their care and treatment
- presenting information to children in a form suitable for their developmental stage, such as play therapies.

Recommendation 1.1.7

Trained healthcare professionals (see recommendation 1.1.6) should be available to discuss the information provided both before and after the start of dialysis.

Recommendation 1.1.8

Offer all patients who have presented late or started dialysis treatment urgently an enhanced programme of information, at an appropriate time, that offers the same information and choices as those who present at an earlier stage of chronic kidney disease.

3.3 Modalities of dialysis: haemodialysis and peritoneal dialysis

3.3.1 Review question

What is the effectiveness of peritoneal dialysis compared with haemodialysis in people with stage 5 CKD who need dialysis?

3.3.2 Evidence review

A total of 5149 articles were found by systematic searches. Full text was ordered for 320 articles (comparing peritoneal dialysis with any other type of dialysis, including haemodialysis) based on the title and abstract. Only one primary study (Korevaar et al. 2003) met the eligibility criteria (for review protocol and inclusion and exclusion criteria, see appendix A) and evaluated the effectiveness of peritoneal dialysis compared with haemodialysis for adults with stage 5 CKD. A Cochrane systematic review was found that compared peritoneal dialysis with haemodialysis (Vale et al. 2004) and this included the one study identified in our reviews, so only the results from the primary study are presented.

No randomised controlled trial (RCT) evidence was found for children with stage 5 CKD.

Because of the lack of RCT evidence, the Guideline Development Group asked the technical team to search for publications from national renal registries that would provide further information on the outcomes agreed important for this guideline.

Systematic searches for registry data reported in published articles found 1672 articles. Full text was ordered for 261 articles based on the title and abstract. In addition, we looked for annual reports for those not identified by the searches; this included the 2008 annual report of the North American Pediatric Renal Trials and Collaborative Studies[1]. Of these publications, 53 papers met the eligibility criteria for registry publications; 42 evaluated the effectiveness of peritoneal dialysis or haemodialysis, either with comparative

[1] www.emmes.com/study/ped/annlrept/Annual%20Report%20-2008.pdf

analyses or single intervention reports for adults and children. We also re-checked studies identified for other questions (for example, switching) and included those that were relevant.

Table 1 summarises the included studies. See appendix A for more details.

Of the 42 studies, 11 included children (31 were adults alone); 25 reported outcomes for both peritoneal dialysis and haemodialysis, with 14 on peritoneal dialysis alone and 3 on haemodialysis alone.

For the GRADE assessment, registry studies were assessed as low-quality evidence, with downgrading as appropriate.

Table 1 Summary of studies of registry data for peritoneal dialysis and haemodialysis

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Ansell 2010 (Ansell et al. 2010)	UKRR	2008	To examine survival from the start of RRT, and among those patients alive at Jan 2008	6634	Adults receiving RRT	None
Barraclough 2010 (Barraclough et al. 2010)	ANZDATA	2003–2006	To examine the frequency, predictors, treatment, and clinical outcomes of polymicrobial peritonitis in peritoneal dialysis patients	324	Adults receiving peritoneal dialysis	None
Bordador 2010 (Bordador et al. 2010)	ANZDATA	2003–2007	To examine the frequency, predictors, treatment, and clinical outcomes of peritonitis in peritoneal dialysis paediatric patients	167	Children (younger than 18 years at initiation) receiving peritoneal dialysis	None
Dawnay 2010 (Dawnay et al. 2010)	UKRR	2008	To compare dialysis centre achievement of clinical performance measures for prevalent haemodialysis and peritoneal dialysis cohorts	20,099	Adults receiving dialysis on 31 December 2008	None
Evans 2010 (Evans et al. 2010)	RDPLF	2000–2007	To estimate the cumulative incidence of the outcome of the first incidence of peritonitis, taking into account competing risks	8559	Adults (16 and older) starting peritoneal dialysis	None
Fahim 2010 (Fahim et al. 2010)	ANZDATA	2003–2006	To examine the frequency, predictors, treatment, and clinical outcomes of culture-negative peritonitis in peritoneal dialysis patients	4675	Adults receiving peritoneal dialysis	None
Fluck 2010 (Fluck et al. 2010)	UKRR	2008–2009	To determine the prevalence of MRSA in people on dialysis	134	Patients receiving dialysis [assumed adults]	None

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Harper 2010 (Harper et al. 2010)	UKRR	2008–2009	To describe the pattern of blood pressure control in people on dialysis	19,263	Patients receiving dialysis [assumed adults]	None
Jarvis 2010 (Jarvis et al. 2010)	ANZDATA	2003–2006	To examine the frequency, predictors, treatment, and clinical outcomes of non-pseudomonas gram-negative peritonitis in peritoneal dialysis patients	4675	Adults receiving peritoneal dialysis	None
Lane 2010 (Lane et al. 2010)	IPPR	2001–2004	To report results related to peritoneal dialysis-associated peritonitis and factors associated with relapsing and non-relapsing peritonitis	392	Children (aged 1 month to 22 years) receiving long-term peritoneal dialysis	None
Richardson 2010 (Richardson et al. 2010)	UKRR	2008	To determine the extent to which the guidelines for anaemia management are being met	Not clear	Patients receiving dialysis [assumed adults] on 31 December 2008 and if on same modality for 3 months (for prevalence analysis)	Pre-emptive transplant
Williams 2010 (Williams et al. 2010)	UKRR	2008	To determine the extent to which the guidelines for the recommended dose of haemodialysis are being met	13,191 prevalent 2278 incident	Patients receiving dialysis [assumed adults] on 31 December 2008 and if on same modality for 3 months (for prevalence analysis)	Receiving other than haemodialysis three times per week
Brown 2009 (Brown et al. 2009)	SRR	2000–2007	To report the incidence of EPS in patients using peritoneal dialysis, and to characterise cases	1238	Adults starting peritoneal dialysis between 2000 and 2007	None
Johnson 2009 (Johnson et al. 2009)	ANZDATA	1995–2005	To evaluate the effects of dialysis modality on frequency, types, and causes of fatal infections	21,935	Adults with ESRD undergoing dialysis	None

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Kramer 2009 (Kramer et al. 2009)	ERA-EDTA	1997–2006	To provide information on the incidence, prevalence, and outcomes of RRT	Not clear	Patients undergoing RRT [assumed adults]	None
Macdonald 2009 (Macdonald et al. 2009)	ANZDATA	1963–2005	To investigate the effect of dialysis modality on likelihood, timing, and durability of recovery of dialysis-independent renal function	39,570	Patients with ESRD undergoing dialysis [assumed adults]	None
McDonald 2009 (McDonald et al. 2009)	ANZDATA	1991–2005	To compare mortality between modality of dialysis	25,287	Patients starting dialysis [assumed adults]	None
Roderick 2009 (Roderick et al. 2009)	UKRR	1997–2006	To compare the characteristics and survival of south Asian and black patients starting RRT	30,561	Patients starting RRT [assumed adults]	None
Sawhney 2009 (Sawhney et al. 2009)	SRR and BCPRA	2000–2005	To compare survival on dialysis, determine potential reasons for differences, and determine the relationship of GFR at dialysis start with survival	7299	Patients aged 18 years and older starting dialysis for established ESRD	None
Shigidi 2009 (Shigidi et al. 2009)	Qatar national data	2002–2006	To evaluate the demographics and outcome of ESKD patients on maintenance haemodialysis	278	Patients (adults and children) on maintenance haemodialysis for at least 3 months	None
Siva 2009 (Siva et al. 2009)	ANZDATA	2003–2006	To examine the frequency, predictors, treatment, and clinical outcomes of pseudomonas peritonitis in peritoneal dialysis patients	4675	Patients receiving peritoneal dialysis [assumed adults]	None

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
NAPRTCS2008 (North American Pediatric Renal Trials and Collaborative Studies 2009)	NAPRTCS	2008	To report the data registered through the NAPRTCS	6291 index dialysis	Children (younger than 21 years at initiation) receiving RRT	None
Arrieta 2008 (Arrieta et al. 2008)	SCN and ERA-ETNA	2005	To report on the status of dialysis and renal transplantation	4125 incident 903 prevalent	Patients receiving RRT [assumed adults]	None
Huang 2008 (Huang et al. 2008)	Taiwan Renal Registry	1995–2002	To estimate the survival and relative mortality rates by modality	45,280	Adults (20 and older) who survived first 90 days on dialysis (incident ESRD patients)	Multiple switches of modality; renal grafts.
Lim 2008 (Lim et al. 2008)	Malaysian National Renal Registry	1980–2006	To examine overall provision of dialysis, treatment rate, method, location and funding of treatment, patient characteristics, and outcomes	Not clear	Patients receiving dialysis [assumed adults]	None
Cala 2007 (Cala 2007)	CRRRT	2000–2004	To compare the outcomes of initial treatment with haemodialysis against initial treatment with peritoneal dialysis	Not clear	Patients (adults and children) receiving dialysis	None
Couchoud 2007 (Couchoud et al. 2007)	REIN	2002–2005	To study the clinical and laboratory indicators associated with the initial choice of treatment and with 2-year survival	3512	Adults (older than 75) starting dialysis	Diagnosis of acute renal failure

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Liem 2007 (Liem et al. 2007)	RENINE	1987–2002	To compare mortality between dialysis modalities	16,643	Adults (18 and older) starting dialysis	Younger than 18 years; more than one episode of renal function recovery or death following renal function recovery; pre-emptive transplant; centres treating fewer than 20 dialysis patients or fewer than 5 peritoneal dialysis patients; information not available
van Manen 2007 (van Manen et al. 2007)	ERA-EDTA	Range of dates	To quantify the confounding effects of comorbidities on survival	15,571	Patients on RRT [assumed adults]	None
Badve 2006 (Badve et al. 2006a)	ANZDATA	1991–2004	To compare survival, technique survival and peritonitis free survival in peritoneal dialysis after a failed transplant and after failed native kidneys	13,947 episodes of peritoneal dialysis in 11,979 patients	Adults and children on peritoneal dialysis	None
Kawanishi 2004 (Kawanishi et al. 2004)	National data from Japan	1999–2001	To assess the incidence, pathology and prognosis of EPS, and any association between peritoneal dialysis withdrawal and EPS	1958	Patients on peritoneal dialysis [assumed adults]	Centres treating 10 or fewer patients
Rinaldi 2004 (Rinaldi et al. 2004)	Italian Registry of Pediatric Chronic PD	1986–2000	To determine the rates of catheter complications	503	Children on peritoneal dialysis	None

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Jager 2003 (Jager et al. 2003)	ERA-EDTA	1985–1999	To describe trends in incidence, treatment and outcome of RRT in patients aged over 65 years	18,920	Adults (older than 65) on RRT	None
Kim 2003 (Kim et al. 2003)	Korean Society of Nephrology online registry	1985–2001	To describe the status of dialysis in Korea	23,057	Adults and children on dialysis	None
Heaf 2002 (Heaf et al. 2002a)	Danish Terminal Uremia register	1990–1999	To investigate the effect of dialysis modality on prognosis	4,921	Patients on dialysis [assumed adults]	None
Huisman 2002 (Huisman et al. 2002a)	RENINE	1994–1999	To determine rates of technique survival	Not clear	Patients on dialysis [assumed adults]	None
Rashid 2002 (Rashid 2002)	National data from Bangladesh	1986–1996	To report on RRT patients in Bangladesh	3186	Patients on RRT [assumed adults]	None
Abbott 2001 (Abbott and Agodoa 2001)	USRDS	1992–1997	To determine associations with septicaemia in patients on dialysis	327,993	Patients on dialysis [assumed adults]	None
Hoshii 2000 (Hoshii et al. 2000)	National data from Japan	1980–1997	To determine the incidence and characteristics of EPS in children on peritoneal dialysis	687	Children (15 years or younger) on peritoneal dialysis	Centres treating only one patient

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Ross 2000 (Ross et al. 2000)	Various	1980–1997	To determine survival in haemodialysis and peritoneal dialysis	137 studies	Patients on dialysis [assumed adults]	If no survival data (or not extractable), not primary studies, not in included language, or sub-groups of patients
Warady 2000 (Warady et al. 2000)	NAPRTCS	1992–1996	To describe the pattern of fungal peritonitis in children on peritoneal dialysis	1592	Children (younger than 21 years at initiation) receiving peritoneal dialysis	None

Abbreviations: EPS, encapsulating peritoneal sclerosis; ESKD, end-stage kidney disease; ESRD, end-stage renal disease; GFR, glomerular filtration rate; RRT, renal replacement therapy.

Registry abbreviations: ANZDATA, Australia and New Zealand Dialysis and Transplant Registry; BCPRA, British Columbia Renal Agency Registry; CRRRT, Croatian Registry for Renal Replacement Therapy; ERA-EDTA, European Renal Association - European Dialysis and Transplant Association ; IPPR, International Pediatric Peritonitis Registry; NAPRTCS, North American Pediatric Renal Trials and Collaborative Studies; RDPLF, French Language Peritoneal Dialysis Registry; REIN, French Renal Epidemiology and Information Network; RENINE, Dutch End Stage Renal Disease Registry; SCN , Spanish Society of Nephrology; SRR, Scottish Renal Registry; UKRR, UK Renal Registry; USRDS, US Renal Data System

GRADE profile 7 Effectiveness of peritoneal dialysis (CAPD and APD) compared with haemodialysis – health-related quality of life

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**Peritoneal dialysis (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
Peritoneal dialysis [CAPD and APD] vs HD (adults) **Health related quality of life: mean (sd) quality-adjusted life year (QALY) score in the first 2 years after the start of dialysis (0 to 100; with higher score better)**									
1 Korevaar 2003	RCT	Some serious limitations[a]	Not assessable[b]	No serious indirectness	Some serious imprecision[c]	54.0 (18.9)	59.1 (11.7)	Mean QALY score difference between PD and HD −3.1 (−16.1 to 9.9) after adjustment for age, comorbidity, and PKD Unadjusted −5.1 (−14.99 to 4.79)	VERY LOW

[a] External validity: The total required sample size was calculated to be 100 patients. After an inclusion period of more than 3 years, only 38 patients had been randomised. The trial was stopped early because of disappointing inclusion rates (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[c] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 8 Effectiveness of peritoneal dialysis (CAPD) compared with haemodialysis – health-related quality of life

Quality assessment						Summary of findings	Quality
No. of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
CAPD vs HD (adults) Health-related quality of life: Spitzer scale							
1 Lim 2008	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	Patients on CAPD reported higher median QoL scores compared with HD patients	VERY LOW
[a] Inconsistency was not assessable (downgraded one level) because it was reported in only one study. [b] Imprecision was not assessable because no statistics or confidence intervals were provided (downgraded one level).							

GRADE profile 9 Effectiveness of peritoneal dialysis compared with haemodialysis – patient involvement or satisfaction

Quality assessment						Summary of findings	Quality
No. of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
Patient involvement or satisfaction							
1 Korevaar 2003	RCT	Not reported as an outcome					…
42 See list of references	Reports from national registries						

GRADE profile 10 Effectiveness of peritoneal dialysis (CAPD and APD) compared with haemodialysis – mortality

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**Peritoneal dialysis (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
PD [CAPD and APD] vs HD (adults) Survival: death at 5 year follow-up									
1 Korevaar 2003	RCT	Some serious limitations[a]	Not assessable[b]	No serious indirectness	Some serious imprecision[c]	5/20 (25%)	9/18 (50%)	HR death in HD vs PD HR 3.6 (0.8 to 15.4) after adjustment for age, comorbidity, and PKD RR death 0.50 PD vs HD (0.21 to 1.22)	VERY LOW

[a] External validity: The total required sample size was calculated to be 100 patients. After an inclusion period of more than 3 years, only 38 patients had been randomised. The trial was stopped early because of disappointing inclusion rates (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in only one study.

[c] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 11 Effectiveness of peritoneal dialysis compared with haemodialysis – mortality

Quality assessment						Summary of findings	Quality
No of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
PD vs HD (adults and children) Survival							
1 Cala 2007	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[b]	Adjusted HR for survival in PD vs HD 1.5 (95% CI 1.1 to 1.9), after adjustment for age, gender, diabetes, and nephroangiosclerosis Adjusted HR for survival PD vs HD 1.58 (95% CI 1.10 to 2.27) for people without diabetes Adjusted HR for survival PD vs HD 1.26 (95% CI 0.83 to 1.91) for people with diabetes Adjusted HR for survival PD vs HD 1.96 (95% CI 1.29 to 2.99) for people < 65 years Adjusted HR for survival PD vs HD 1.07 (95% CI 0.75 to 1.53) for people ≥ 65 years	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in only one study.

[b] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 12 Effectiveness of peritoneal dialysis compared with haemodialysis – mortality

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD vs HD (adults) Survival							
16 See appendix 1 for list of studies	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[b]	See appendix 1 for full summary of survival data Adjusted HR for survival in PD vs HD 1.5 (95% CI 1.1 to 1.9), after adjustment for age, gender, diabetes, and nephroangiosclerosis Adjusted HR for survival PD vs HD 1.58 (95% CI 1.10 to 2.27) for people without diabetes Adjusted HR for survival PD vs HD 1.26 (95% CI 0.83 to 1.91) for people with diabetes Adjusted HR for survival PD vs HD 1.96 (95% CI 1.29 to 2.99) for people < 65 years Adjusted HR for survival PD vs HD 1.07 (95% CI 0.75 to 1.53) for people ≥ 65 years	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in only one study.

[b] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 13 Effectiveness of peritoneal dialysis– mortality

Quality assessment						Summary of findings	Quality
No of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
PD (adults and children) Survival							
1 Badve 2006	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Some serious imprecision[c]	Adjusted weighted HR for death in PD after transplant vs PD after failure of native kidneys 1.09 (95% CI 0.81 to 1.45), after adjustment for gender, age, race, comorbidities, BMI, smoking, time from commencement of RRT to PD, country of residence; 1.32 (95% CI 0.76 to 2.31), with addition of peritoneal transport status	VERY LOW
[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study. [b] The study was not a comparative evaluation (downgraded one level). [c] Imprecise based on 10% threshold (downgraded one level).							

GRADE profile 14 Effectiveness of peritoneal dialysis – mortality

Quality assessment						Summary of findings	Quality
No of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
PD (adults) Survival							
7 Barraclough 2010 Evans 2010	Report from national registry	No serious limitations	No serious inconsistency	Some serious indirectness[a]	Not assessable[b]	See appendix 1 for full summary of survival data Death occurred before the first peritonitis episode in 26.2% (2,243) Probability of experiencing death before a first	VERY LOW

Fahim 2010 Jarvis 2010 Brown 2009 Siva 2009 Kawanishi 2004						peritonitis episode was 29% at 5 yrs using competing risk methods 26 (57%) of people on PD with EPS died Mortality rate was 42% one year after diagnosis Median survival from diagnosis 180 days (range 1 to 1075, IQR 61 to 408) EPS related death 48 PD patients developed EPS during 4 yrs (incidence of 2.5% in 1,958 patients) with an overall mortality rate of 37.5% Incidence of EPS increased with duration of PD	
[a] Studies were not comparative evaluations (downgraded one level). [b] No confidence intervals were reported (downgraded one level).							

GRADE profile 15 Effectiveness of peritoneal dialysis – mortality

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD (children) Survival							
5 Bordador 2010 Lane 2010 Warady 2007	Report from national registry	No serious limitations	No serious inconsistency	Some serious indirectness[a]	Not assessable[b]	Peritonitis related death 0 2 patient deaths (4%) in the relapsing peritonitis group 3 patient deaths (0.7%) in the non-relapsing peritonitis group	VERY LOW

Hoshii 2000 Warady 2000						p = 0.17 EPS related death 11 PD patients developed EPS (1.6% in 678 patients) with an overall mortality rate of 27 Peritonitis related death Of 51 cases of fungal peritonitis in 51 children on PD, no related deaths were observed	

[a] Studies were not comparative evaluations (downgraded one level).

[b] No confidence intervals were reported (downgraded one level).

GRADE profile 16 Effectiveness of peritoneal dialysis – mortality

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
HD (adults and children) Survival							
1 Shigidi 2009	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	Mortality during 5 years 119 (43%) HD Estimated first year survival 84% and 53% of patients alive at end of the fifth year	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in only one study.

[b] The study was not a comparative evaluation (downgraded one level).

[c] No confidence intervals were reported (downgraded one level).

GRADE profile 17 Effectiveness of peritoneal dialysis – mortality and associated patient factors

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults) Survival							
7 Arrieta 2008 Cala 2007 Couchoud 2007 Heaf 2002 Huang 2008 Liem 2007 McDonald 2009	Report from national registry	No serious limitations	No serious inconsistency	No serious indirectness	Not assessable[a]	See appendix 1 for full summary of patient survival data Survival benefit of PD tended to be less in older adults and in adults with associated comorbidities such as diabetes and congestive heart failure.	LOW

[a] Confidence intervals not reported for all outcomes (downgraded one level).

GRADE profile 18 Effectiveness of peritoneal dialysis compared with haemodialysis – preservation of renal function

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Preservation of renal function (adults)							
1 Korevaar 2003	RCT	Not reported as an outcome					…
42 See list of references	Reports from national registries						

GRADE profile 19 Effectiveness of peritoneal dialysis (CAPD and APD) compared with haemodialysis – technique failure or switch

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**PD (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
PD [CAPD and APD] vs HD (adults) **Technique failure or switch: technique switch at 5 -year follow-up**									
1 Korevaar 2003	RCT	Some serious limitations[a]	Not assessable[b]	No serious indirectness	Some serious imprecision[c]	7/20 (35%)	2/18 (11%)	RR 3.15 PD vs HD (0.75 to 13.25)	VERY LOW

[a] External validity: The total sample size needed was calculated to be 100 patients. After an inclusion period of more than 3 years only 38 patients had been randomised. The trial was stopped early because of disappointing inclusion rates (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in only one study.

[c] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 20 Effectiveness of peritoneal dialysis compared with haemodialysis – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults and children) Technique failure or switch							
2 Cala 2007 Kim 2003	Report from national registry	No serious limitations	Some serious inconsistency[a]	No serious indirectness	Not assessable[b]	201 PD discontinued; recovery of renal function 3, transfer to HD 65, transplant 49, death 84 5 yr technique survival PD 68% (95% CI 65 to 70) 5 yr technique survival incident PD 60% (95% CI 54 to 65) 5 yr technique survival incident HD 42% (95% CI 40 to 44) p < 0.0001 Technique survival At 1 yr: 80.6% HD and 71.2% PD At 2 yr: 62.3% HD and 45.1% PD At 3 yr: 48.9% HD and 31.9% PD At 5 yr: 30.2% HD and 13.8% PD At 10 yr: 10.2% HD and 3.0% PD	VERY LOW

[a] Some inconsistent results were seen across the studies (see 5-year results) (downgraded one level).

[b] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 21 Effectiveness of peritoneal dialysis compared with haemodialysis – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults) Technique failure or switch							
5 Johnson 2009 Macdonald 2009 Couchoud 2007 Jager 2003 Huisman 2002	Report from national registry	No serious limitations	Some serious inconsistency[a]	No serious indirectness	Not assessable[b]	See appendix 1 for full summary of technique survival data Proportion who changed modality PD vs HD 8.5% vs 21.1% at 6 months; 27.9% vs 24.7% at 24 months; 63.6% vs 26.9% at 6 years. PD patients more likely to change at least once, but HD patients most likely to change within 6 months.	VERY LOW

[a] Some inconsistent results (see 5-year results) (downgraded one level).

[b] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 22 Effectiveness of peritoneal dialysis compared with haemodialysis – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (children) Technique failure or switch							
1 NAPRTCS 2009	Report from national registry	No serious limitations	Not assessablea	No serious indirectness	Not assessable[b]	Total changed modality of dialysis HD 490 PD 703 HD changed due to excessive infection 7.1% HD and 42.8% PD; choice 43.5% HD and 8.7% PD; access failure 13.5% HD and 8.1% PD; other medical 18.8% and 27.3% PD; and other/none 17.% HD and 13.1% PD Although time to termination is shorter for HD (relative to PD) courses initially (30.9% ± 1.1% versus 19.3% ± 0.7% at 6 months), by 36 months of follow-up PD courses have a higher percent of terminations than HD (85.5% ± 0.7% PD versus 80.1% ± 1.1% HD). If the reason for termination was that the patient was transplanted, then the relationship between PD and HD terminations is similar. However for patients who terminate their index dialysis to change modalities, HD patients experience most of their terminations in the first 6 months while PD patients appear to have a slow and steady increase in terminations over time.	VERY LOW

[a] Inconsistency not assessable (downgraded one level) because it was reported in only one study.

[b] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 23 Effectiveness of peritoneal dialysis – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD alone (adults and children) Technique failure or switch							
1 Badve 2006	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Some serious imprecision[c]	Adjusted weighted HR for technique failure in PD after transplant vs PD after failure of native kidneys 0.91 (95% CI 0.75 to 1.10), after adjustment for gender, age, race, comorbidities, BMI, smoking, time from commencement of RRT to PD, country of residence; 1.03 (95% CI 0.75 to 1.42), with addition of peritoneal transport status	VERY LOW

[a] Inconsistency not assessable (downgraded one level) because it was reported in only one study.

[b] The study was not a comparative evaluation (downgraded one level).

[c] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 24 Effectiveness of peritoneal dialysis – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD alone (adults) **Technique failure or switch**							
5 Barraclough 2010 Evans 2010 Fahim 2010 Jarvis 2010 Siva 2009 Kawanishi 2004	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	See appendix 1 for full summary of technique survival data Switch to HD occurred before the first peritonitis episode in 12.7% (1,090) Probability of switching to HD before a first peritonitis episode was 14% at 5 yrs using competing risk methods	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because many outcomes were reported in one study only.

[b] Studies were not comparative evaluations (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 25 Effectiveness of peritoneal dialysis – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD alone (children) Technique failure or switch							
5 Bordador 2010 Lane 2010 Warady 2007 Hoshii 2000 Warady 2000	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	See appendix 1 for full summary of technique survival data EPS-related switch 10 PD patients switched to HD because of EPS (91%); 2 children subsequently died	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because many outcomes were reported in one study only.

[b] Studies were not comparative evaluations (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

Abbreviations: EPS, encapsulating peritoneal sclerosis

GRADE profile 26 Effectiveness of peritoneal dialysis (CAPD and APD) compared with haemodialysis – resource use and costs

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**PD (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
PD [CAPD and APD] vs HD (adults) Resource use and costs inc hospitalisation									
1 Korevaar 2003	RCT	Not reported							

GRADE profile 27 Effectiveness of peritoneal dialysis compared with haemodialysis – resource use and costs

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults) Resource use and costs inc hospitalisation							
1 Abbott 2001	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[b]	Septicaemia-related hospital admissions OR 2.19 (95% CI 1.87 to 2.55) for multiple hospital admissions HD vs PD	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was one study only.

[b] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 28 Effectiveness of peritoneal dialysis – resource use and costs

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD alone (adults) **Resource use and costs inc hospitalisation**							
4 Barraclough 2010 Fahim 2010 Jarvis 2010 Siva 2009	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	Peritonitis related admissions 297 (83%) polymicrobial peritonitis 2,207 (68%) nonpolymicrobial peritonitis p < 0.001 262 (60%) culture −ve peritonitis 2,242 (71%) culture +ve peritonitis p < 0.001 679 (81%) NPGN peritonitis 1825 (66%) other organism peritonitis p < 0.001 150 (79%) Pseudomonas peritonitis 2354 (69%) non-Pseudomonas peritonitis p = 0.006	VERY LOW

a Inconsistency was not assessable (downgraded one level) because it was one study only.

b Studies were not comparative evaluations (downgraded one level).

c Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

Abbreviations: NPGN, Non-Pseudomonas gram negative

GRADE profile 29 Effectiveness of peritoneal dialysis– resource use and costs

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD alone (children) Resource use and costs inc hospitalisation							
1 Bordador 2010	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	Peritonitis-related admissions 86 (86%) overall 6 (100%) polymicrobial peritonitis 80 (85%) single organism peritonitis	VERY LOW

[a] Inconsistency not assessable (downgraded one level) because it was one study only.

[b] The study was not a comparative evaluation (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 30 Effectiveness of peritoneal dialysis (CAPD and APD) compared with haemodialysis – adverse events

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**PD (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
PD [CAPD and APD] vs HD (adults) Adverse events									
1 Korevaar 2003	RCT	Not reported							

GRADE profile 31 Effectiveness of peritoneal dialysis compared with haemodialysis – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults and children) Adverse events							
1 Kim 2003	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	Peritonitis 75.8% no peritonitis 11.6% 1 episode 5.7% 2 episodes 2.8% 3 episodes 4.1% > 3 episodes Exit site infections 84.2% no exit site infection in PD group	VERY LOW
a Inconsistency not assessable (downgraded one level) because it was one study only. b Confidence intervals only reported for some studies (and outcomes) (downgraded one level).							

GRADE profile 32 Effectiveness of peritoneal dialysis compared with haemodialysis – adverse events

Quality assessment						Summary of findings	Quality
No of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
PD and HD (adults) Adverse events							
2 Fluck 2010 Abbott 2001	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	MRSA 153 episodes of MRSA in 134 HD patients No episodes reported in PD patients (although one patient had previous CAPD treatment) Repeat episodes 123 (92%) experienced 1 episode 5 (4%) 2 episodes 4 (3%) 3 episodes (1%) 4 episodes Septicaemia OR 1.65 (95% CI 1.56 to 1.76) for septicaemia HD vs PD	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 33 Effectiveness of peritoneal dialysis compared with haemodialysis – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (children): Adverse events							
1 NAPRTCS 2008	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	**Peritonitis** During the first 30 days of PD, 426 (11.2%) patients had 1 peritonitis episode, and 49 patients had 2 episodes. Over the course of the study, 3,999 cases of peritonitis infection; 825 patients had 1 infection, 405 patients had 2 infections, 454 patients had 3 to 7 infections, and 49 patients had 8 or more infections. Annual rate of 0.67, or 1 episode every 18.0 months Overall, 38.7% of patients had at least one infection by 12 months; 52.2% had an infection by 24 months. **Exit-site infections** PD 8.8% at 1 month; 20.3% at 6 months; 20.1% at 12 months; 17.3% at 24 months; 18.0% at 36 months HD 8.8% at 1 month; 15.8% at 6 months; 13.01% at 12 months; 9.1% at 24 months; 7.4% at 36 months **Seizures** PD 3.6% at 1 month; 4.8% at 6 months; 3.3% at 12 months; 3.5% at 24 months; 2.4% at 36 months HD 4.3% at 1 month; 7.0% at 6 months; 5.6% at 12 months; 5.8% at 24 months; 4.7% at 36 months	VERY LOW

[a] Inconsistency not assessable (downgraded one level) because it was one study only.

[b] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 34 Effectiveness of peritoneal dialysis – adverse events

Quality assessment						Summary of findings	Quality
No of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
PD and HD (adults and children) Adverse events							
1 Badve 2006	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[b]	Adjusted weighted HR for peritonitis in PD after transplant vs PD after failure of native kidneys 0.92 (95% CI 0.72 to 1.16), after adjustment for gender, age, race, comorbidities, BMI, smoking, time from commencement of RRT to PD, country of residence; 0.88 (95% CI 0.60 to 1.30), with addition of peritoneal transport status	VERY LOW

[a] Inconsistency not assessable (downgraded one level) because it was one study only.
[b] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 35 Effectiveness of peritoneal dialysis – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD (adults) Adverse events							
7 Barraclough 2010 Evans 2010 Fahim 2010 Jarvis 2010 Brown 2009 Siva 2009 Kawanishi 2004	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	See appendix 1 for full summary of adverse event data First peritonitis episode occurred in 36.7% (3,137) Probability of experiencing a first peritonitis episode was just over 25% at 1yr, and 70% at 5 yrs using K-M methods; just under 25% at 1yr and 40% at 5yrs using competing risk methods	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.
[b] Studies were not comparative evaluations (downgraded one level).
[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 36 Effectiveness of peritoneal dialysis – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD (children**)** **Adverse events**							
6 Bordador 2010 Lane 2010 Warady 2007 Rinaldi 2004 Hoshii 2000 Warady 2000	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	See appendix 1 for full summary of adverse event data **Peritonitis** 100 episodes of peritonitis in 57 patients 0.71 episodes/pt-yr peritonitis 60% of infections started within 6 months of PD initiation **Relapse** 5 (5%) overall 0 (0%) polymicrobial peritonitis 5 (5%) single organism peritonitis **Recurrence** 7 (7%) overall 1 (17%) polymicrobial peritonitis 6 (6%) single organism peritonitis **Repeat episodes** 33 (58%) experienced 1 episode 14 (25%) 2 episodes 6 (11%) 3 episodes 4 (7%) 4 episodes or more	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] Studies were not comparative evaluations (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 37 Effectiveness of peritoneal dialysis (CAPD and APD) compared with haemodialysis – adequacy of dialysis

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**PD (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
PD [CAPD and APD] vs HD (adults) Adequacy rates									
1 Korevaar 2003	RCT	Not reported							

GRADE profile 38 Effectiveness of peritoneal dialysis compared with haemodialysis – adequacy of dialysis

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults and children) Adequacy rates							
1 Kim 2003	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	URR Mean URR 66.7% (sd?8.68) in HD	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] Confidence interval was not reported for outcomes – the measure of variance also not clear (downgraded one level).

GRADE profile 39 Effectiveness of peritoneal dialysis compared with haemodialysis – adequacy of dialysis

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults) Adequacy rates							
1 Harper 2010	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	**Blood pressure (mmHg)** Median SBP 129 HD and 138 PD Median DBP 68 HD and 80 PD **% BP <130/80mmHg** 46.8% (95%CI 45.9 to 47.8) HD 26.3% (95%CI 24.1 to 28.6) PD **% SBP <130mmHg** 50.3% (95%CI 49.3 to 51.2) HD 35.2% (95%CI 32.8 to 37.7) PD **% DBP <80mmHg** 78.1% (95%CI 77.3 to 78.8) HD 48.7% (95%CI 46.1 to 51.2) PD	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] Confidence interval was not reported for outcomes – the measure of variance also not clear (downgraded one level).

GRADE profile 40 Effectiveness of peritoneal dialysis compared with haemodialysis – adequacy of dialysis

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (children) Adequacy rates							
1 NAPRTCS 2009	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	Weekly Kt/V values PD: median at day 30 2.1, at 1 year 2.2, and at 2 years post-initiation, 2.3. HD: median at day 30 1.5, at 1 year 1.6, and at 2 years post-initiation, 1.6	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] Confidence interval was not reported for outcomes – the measure of variance also not clear (downgraded one level).

GRADE profile 41 Effectiveness of peritoneal dialysis – adequacy of dialysis

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
HD (adults and children) Adequacy rates							
1 Shigidi 2009	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	**URR** HD 83% had URR >65% in 2006; 68% in 2002	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] The study was not a comparative evaluation (downgraded one level).

[c] Confidence interval was not reported for outcomes – the measure of variance also not clear (downgraded one level).

GRADE profile 42 Effectiveness of peritoneal dialysis – adequacy of dialysis

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
HD (adults) **Adequacy rates**							
2 Williams 2010 Roderick 2009	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	See appendix 1 for full summary of adequacy rate data **URR (HD prevalence cohort)** Median URR 73% % achieving URR > 65% 83% **URR (HD incident cohort)** Median URR 65% **URR in 4th qtr after HD initiation** Mean 67.2% (sd 9.0) Caucasian; 69.2% (sd 9.0) South Asian; 65.9% (sd 8.4) Black; p < 0.0001 **SBP (mmHg) in 4th qtr after HD initiation** Mean 136 (sd 25) Caucasian; 138 (sd 27) South Asian; 142 (sd 28) Black; p = 0.0014 **DBP (mmHg) in 4th qtr after HD initiation** Mean 74 (sd 14 Caucasian; 76 (sd 14 South Asian; 78 (sd 15) Black; p < 0.0001	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] Studies were not comparative evaluations (downgraded one level).

[c] Confidence intervals were not reported for outcomes – the measure of variance also not clear (downgraded one level).

Abbreviations: URR, urea reduction ratio; HD, haemodialysis; sd, standard deviation; SBP, systolic blood pressure; DBP diastolic blood pressure.

GRADE profile 43 Effectiveness of peritoneal dialysis compared with haemodialysis – staff attitude and skills

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Staff attitude and skills							
1 Korevaar 2003	RCT	Not reported as an outcome					…
42 See list of references	Reports from national registries						

GRADE profile 44 Effectiveness of peritoneal dialysis (CAPD and APD) compared with haemodialysis – nutritional status

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**PD (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
PD [CAPD and APD] vs HD (adults) Nutritional status									
1 Korevaar 2003	RCT	Not reported							

GRADE profile 45 Effectiveness of peritoneal dialysis compared with haemodialysis – nutritional status

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults) Nutritional status							
1 Dawnay 2010	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	No serious imprecision	**Phosphate levels** HD mean 1.55mmol/l (sd 0.53); median 1.49 (lower quartile 1.20; upper quartile 1.84) PD mean 1.54mmol/l (sd 0.42); median 1.50 (lower quartile 1.25; upper quartile 1.79) **% phosphate 1.1–1.8mmol/l** HD 55.2%(95% CI 54.5 to 56.0) PD 64.1% (95% CI 62.5 to 65.7) **% phosphate <1.1mmol/l** HD 17.8 (95% CI 17.3 to 18.4) PD 12.3% (11.3 to 13.5) **% phosphate >1.8mmol/l** HD 26.9% (95% CI 26.3 to 27.6) PD 23.5% (95% CI 22.1 to 25.0) **Calcium phosphate product** HD 84% (95% CI 84 to 85) and PD 87% (95% CI 85 to 88) achieved the target of <4.8mmol^2/l^{2}l	LOW

[a] Inconsistency not assessable (downgraded one level) because outcomes were reported in one study only.

Abbreviations: sd, standard deviation; HD, haemodialysis; PD, peritoneal dialysis.

GRADE profile 46 Effectiveness of peritoneal dialysis compared with haemodialysis – anaemia

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**PD (CAPD and APD)**	**HD (in-centre)**	**Effect (95% CI)**	
PD [CAPD and APD] vs HD (adults) Anaemia									
1 Korevaar 2003	RCT	Not reported							

GRADE profile 47 Effectiveness of peritoneal dialysis compared with haemodialysis – anaemia

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults and children) Anaemia							
1 Kim 2003	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	**EPO use** Dose of EPO higher in HD than in PD	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] No details were reported (downgraded one level).

Abbreviations: EPO, erythropoietin.

GRADE profile 48 Effectiveness of peritoneal dialysis compared with haemodialysis – anaemia

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (adults) Anaemia							
1 Richardson 2010	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	**Haemoglobin levels** HD median 11.6 Hb g/dl (90% range 8.9 to 13.8; IQR 10.6 to 12.5); mean 11.5 (sd 1.6) PD median 11.7 Hb g/dl (90% range 9.1 to 14.1; IQR 10.8 to 12.6); mean 11.7 (sd 1.5) **% Hb ≥ 10 g/dl** HD 85% PD 89% **% Hb ≥ 11 g/dl** HD 66% PD 72% **Ferritin levels** HD median 436 ferritin µg/l (90% range 102 to 1079; IQR 289 to 622); PD median 246 ferritin µg/l (90% range 41 to 816; IQR 141 to 399); **% Ferritin ≥ 100 µg/l** HD 95.0% PD 83.9% **% Ferritin ≥ 800 µg/l** HD 12.2% (95% CI 11.7 to 12.7) PD 5.2% (95% CI 4.5 to 6.0) **ESA prescribing** HD % on ESA 90%; mean weekly dose 9,166 IU/week; median weekly dose 8,000 IU/week PD % on ESA 76%; mean weekly dose 6,302 IU/week; median weekly dose 4,000 IU/week	VERY LOW

						% with Hb < 10g/dl on ESA HD 95% PD 89% **% with Hb ≥ 10g/dl not on ESA** HD 8% PD 22%	

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] Confidence intervals only reported for some outcomes (downgraded one level).

Abbreviations: sd, standard deviation; HD, haemodialysis; PD, peritoneal dialysis; ESA, erythropoiesis-stimulating agent.

GRADE profile 49 Effectiveness of peritoneal dialysis compared with haemodialysis – anaemia

Quality assessment						**Summary of findings**	**Quality**
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
PD and HD (children) Anaemia							
1 NAPRTCS 2008	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	**Use of EPO** EPO use is lower initially for PD (86.9%) compared with HD (92.0%), by two years of dialysis therapy, EPO use is similar (94.8% for PD and 93.8% for HD).	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because outcomes were reported in one study only.

[b] No confidence intervals were reported (downgraded one level).

Abbreviations: EPO, erythropoietin

3.3.3 Evidence statements

Health-related quality of life

3.3.3.1 *There is no consistent evidence on the impact of different types of dialysis modalities (peritoneal dialysis or haemodialysis) on health-related quality of life.*

3.3.3.2 *Very-low-quality evidence (from one RCT) showed no difference in health-related quality of life in adults undergoing peritoneal dialysis (CAPD and APD) compared with those on haemodialysis (Korevaar et al. 2003). However, very-low-quality evidence from one national registry data showed that adults on CAPD tended to have a higher quality of life than those on haemodialysis (Lim et al. 2008).*

3.3.3.3 *No evidence on health-related quality of life in children was identified.*

Patient involvement and satisfaction

3.3.3.4 *No evidence on patient involvement and satisfaction was identified.*

Mortality

3.3.3.5 *Very-low-quality evidence (from one RCT and 17 national registries) showed a tendency for no difference in long-term mortality in adults and children undergoing peritoneal dialysis compared with those on haemodialysis. Where differences were seen (particularly in short-term mortality), they were associated with patient factors.*

3.3.3.6 *Survival on peritoneal dialysis tended to be better for adults younger than 55 years and for those without diabetes or other comorbidities, such as congestive heart failure (very-low-quality evidence from seven studies).*

3.3.3.7 *Low-quality evidence (from 12 national registries) showed similar rates of peritonitis-related deaths. Encapsulating peritoneal sclerosis (EPS) was very rare, but the incidence did increase over time.*

Preservation of renal function

3.3.3.8 No evidence on preservation of renal function was identified.

Technique failure or switch

3.3.3.9 Very-low-quality evidence (from one RCT and 20 national registries) showed that rates of dialysis failure or switch did not seem to differ between peritoneal dialysis and haemodialysis. However, reasons for switching differed by type of dialysis (for example as a result of different complications).

Resource use and costs

3.3.3.10 Very-low-quality evidence (from six national registries) showed that rates of hospital admissions did not appear to differ between peritoneal dialysis and haemodialysis. However, reasons for admissions differed by type of dialysis.

Adverse events

3.3.3.11 Very-low-quality evidence (from 18 national registries) showed that rates of adverse events did not appear to differ between peritoneal dialysis and haemodialysis. However, the type of adverse events differed by type of dialysis.

Adequacy rates

3.3.3.12 Adequacy rates were rarely reported in RCTs; when reported, rates were only for people on haemodialysis. The evidence that was available (very-low-quality evidence from six national registries) showed no clear difference between peritoneal dialysis and haemodialysis.

Staff attitude and skills

3.3.3.13 No evidence on staff attitude and skills was identified.

Nutritional status

3.3.3.14 Low-quality evidence (from one national registry) showed no significant difference in mean phosphate levels between people on

peritoneal dialysis and those on haemodialysis (Dawnay et al. 2010).

Anaemia

3.3.3.15 *Very-low-quality evidence (from three national registries) showed that erythropoietin use tended to be higher in people on haemodialysis, although this difference between types of dialysis may disappear over time.*

3.3.4 Health economic modelling

This question was considered a priority for health economic work. Instead of a straight comparison between peritoneal dialysis and haemodialysis, the analysis focused on comparing different service provisions between peritoneal dialysis and haemodialysis. A search was made for any appropriate studies. Five studies were identified that were considered suitable. These are outlined in the health economic appendix 2.

The paper by Kirby et al. (1996) indicates that haemodialysis was the most cost-effective treatment option (lower costs and more effective). However, the paper is relatively old and costing appears to be outdated. The other papers indicate that increasing the use of peritoneal dialysis is more cost effective. However, these papers are not UK based.

Therefore, a new economic analysis was produced. The model was based on previous models, specifically Kirby et al. (1996). A diagram of the model is presented in figure 1.

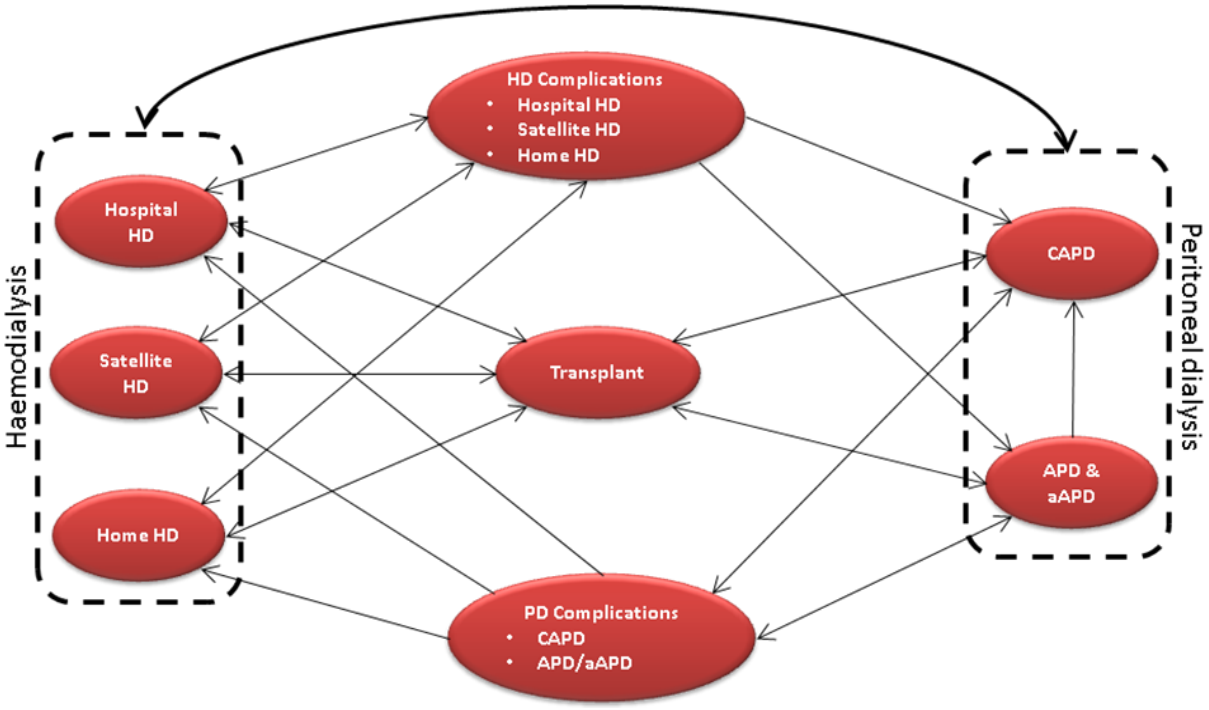

Figure 1 Model diagram

Transition probabilities were derived from the clinical review and from the renal registry and NHS blood and transplant report 2009. Cost data were obtained from Baboolal et al. (2009) and utilities from a meta-analysis by Liem et al. (2008). Costs from the payment by results working party were not used because they did not include additional costs such as treatment for adverse events. Full details are provided in appendix B.

The model examines several scenarios comparing hypothetical services providing a range of proportions of haemodialysis and peritoneal dialysis. The baseline is based on the average proportions of people starting dialysis from the renal registry report 2009.

Subset analysis 1 examines hypothetical centres based on amalgams of NHS trusts that are focused on providing one type of dialysis. Subset analysis 2 examines percentage increases over the baseline and subset analysis 3 examines absolute numbers starting on a treatment modality. The scenarios are outlined in table 2

Table 2 Scenarios examined in health economic analysis

	Hospital HD %	Sat HD %	Home HD %	CAPD %	APD %
Baseline	47	33	2	14	4
Subset analysis 1: centres providing predominantly one type of dialysis					
1: haemodialysis centred	28.5	67.5	0.5	2	1.5
2: peritoneal dialysis centred	8.5	49	9.5	20	13
Subset analysis 2: percentage increases over baseline					
25% increase in CAPD	45.25	31.25	2	17.5	4
50% increase in CAPD	43.5	29.5	2	21	4
25% increase in APD	46.5	32.5	2	14	5
50% increase in APD	46	32	2	14	6
25% increase in PD	44.8	30.8	2	17.5	5
50% increase in PD	42.5	28.5	2	21	6
80% increase in PD	39.8	25.8	2	25.2	7.2
Subset analysis 3:- increases in absolute numbers starting therapy					
30% start PD	40	28.1	2	23.3	6.7
40% start PD	34.1	23.9	2	31.1	8.9
50% start PD	28.2	19.8	2	38.9	11.1
60% start PD	22.3	15.7	2	46.7	13.3
70% start PD	16.5	11.6	2	54.4	15.6
80% start PD	10.6	7.4	2	62.2	17.8
90% start PD	4.7	3.3	2	70	20

Abbreviations: APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; HD, haemodialysis; PD, peritoneal dialysis; Sat HD, satellite haemodialysis.

Results

The deterministic and probabilistic results over 10 years are presented in tables 3 and 4.

Table 3 Base-case deterministic results

	Cost (£)	LYGs	QALYs	Incremental		ICER (£)	NMB (£)	
				Cost (£)	QALY		£20,000	£30,000
Baseline	130,234	5.78	3.77	-	-	-	-	-
HD centred	135,772	5.74	3.72	5539	−0.05	Dominated	-6534	−7032
PD centred	120,200	5.83	3.87	−10,034	0.10	Dominates	12,091	13,119
25% increase in CAPD	128,528	5.79	3.76	−1706	0.009	Dominates	1889	1980
50% increase in CAPD	126,869	5.81	3.78	−3365	0.018	Dominates	3731	3914
25% increase in APD	130,224	5.79	3.77	−9.35	0.003	Dominates	62	88
50% increase in APD	130,196	5.79	3.77	−38	0.005	Dominates	143	195
25% increase in PD	128,500	5.80	3.78	−1734	0.012	Dominates	1969	2087
50% increase in PD	126,757	5.81	3.79	−3476	0.024	Dominates	3948	4183
80% increase in PD	124,669	5.83	3.80	−5565	0.038	Dominates	6319	6697
30% start PD	125,669	5.83	3.80	−4565	0.035	Dominates	5266	5616
40% start PD	121,576	5.85	3.82	−8658	0.058	Dominates	9813	10,391
50% start PD	117,605	5.89	3.85	−12,628	0.084	Dominates	14,314	15,157
60% start PD	113,609	5.92	3.88	−16,625	0.111	Dominates	18,849	19,962
70% start PD	109,737	5.96	3.91	−20,496	0.142	Dominates	23,346	24,771
80% start PD	105,428	5.98	3.93	−24,806	0.168	Dominates	28,173	29,857
90% start PD	100,759	6.02	3.97	−29,474	0.205	Dominates	33,578	35,631

Abbreviations: APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; HD, haemodialysis; ICER, incremental cost effectiveness ratio; LYG, life years gained; NMB, net monetary benefit; PD, peritoneal dialysis; QALY, quality-adjusted life year; Sat HD, satellite haemodialysis.

Dominates: less expensive and more effective.

Dominated: more expensive and less effective.

Table 4 Base-case probabilistic results

	Cost (£)	LYGs	QALYs	Incremental		ICER (£)	NMB (£)	
				Cost (£)	QALY		£20,000	£30,000
Baseline	137,289	5.69	3.59	-	-	-	-	-
HD centred	143,551	5.64	3.53	6262	−0.056	Dominated	−7373	−7929
PD centred	126,280	5.74	3.70	−11,009	0.116	Dominates	13,327	14,486
25% Increase in CAPD	135,385	5.70	3.60	−1904	0.010	Dominates	2108	2209
50% increase in CAPD	133,536	5.71	3.61	−3753	0.02	Dominates	4160	4363
25% Increase in APD	137,298	5.69	3.59	9.34	0.003	3113	49	78
50% Increase in APD	137,285	5.69	3.59	−4.16	0.006	Dominates	120	178
25% Increase in PD	135,372	5.70	3.60	−1917	0.013	Dominates	2179	2310
50% Increase in PD	133,445	5.72	3.61	−3844	0.026	Dominates	4368	4629
80% Increase in PD	131,136	5.73	3.63	−6123	0.042	Dominates	6991	7411
30% start PD	132,235	5.73	3.63	−5054	0.038	Dominates	5822	6206
40% start PD	127,720	5.76	3.65	−9569	0.064	Dominates	10,853	11,495
50% start PD	123,332	5.79	3.68	−13,957	0.094	Dominates	15,831	16,768
60% start PD	118,916	5.82	3.71	−18,374	0.12	Dominates	20,847	22,084
70% start PD	114,629	5.86	3.75	−22,660	0.16	Dominates	25,819	27,398
80% start PD	109,869	5.89	3.78	−27,420	0.19	Dominates	31,170	33,044
90% start PD	104,681	5.92	3.82	−32,608	0.23	Dominates	37,189	39,480

Abbreviations: APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; HD, haemodialysis; ICER, incremental cost effectiveness ratio; LYG, life years gained; NMB, net monetary benefit; PD, peritoneal dialysis; QALY, quality-adjusted life year; Sat HD, satellite haemodialysis.

Dominates: less expensive and more effective.

Dominated: more expensive and less effective.

Table 5 outlines the results of cost effectiveness acceptability curves at £20,000 and £30,000 per quality-adjusted life year (QALY) thresholds.

Table 5 Cost-effectiveness acceptability results at £20,000 and £30,000 per QALY gained thresholds

	Probability of analysis being cost effective at cost per QALY thresholds	
Analysis	**£20,000 per QALY (%)**	**£30,000 per QALY (%)**
Baseline	-	-
Haemodialysis centred	13.4	14
Peritoneal dialysis centred	98	97.1
25% increase in CAPD	100	97.7
50% increase in CAPD	100	97.6
25% increase in APD	58.4	60.3
50% increase in APD	59.9	61.7
25% increase in peritoneal dialysis	99	96.2
50% increase in peritoneal dialysis	99	96.2
80% increase in peritoneal dialysis	99	96.3
30% start peritoneal dialysis	99.3	96.3
40% start peritoneal dialysis	99.4	96.2
50% start peritoneal dialysis	99.4	96.2
60% start peritoneal dialysis	99.4	96.2
70% start peritoneal dialysis	99.4	96.4
80% start peritoneal dialysis	99.4	96.4
90% start peritoneal dialysis	99.4	96.4
Abbreviations: APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; QALY, quality-adjusted life year.		

These results indicate that increasing the use of peritoneal dialysis is a cost-effective policy. Sensitivity analysis indicates that this is robust to changes in utilities, costs and assuming equivalence. The full sensitivity analysis is presented in appendix 2. Of note are the scatter plots of the simulations from the probabilistic analysis. One is reproduced in figure 2.

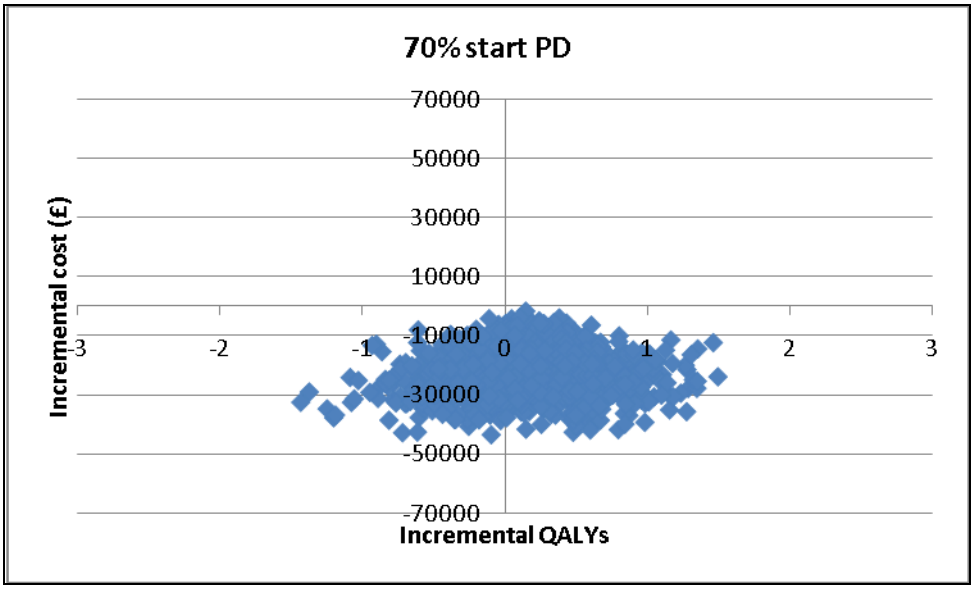

Figure 2 Scatter plot for starting 70% of people on peritoneal dialysis

The simulations are spread across the cost-effectiveness plane, most points are below the horizontal axis, suggesting it is likely to be cost saving. However, there is significant variation in terms of effectiveness. Therefore, to reduce uncertainty in the decision peritoneal dialysis should be targeted at those who could benefit most.

3.3.5 Evidence to recommendations

The Guideline Development Group agreed that overall there was no evidence of significant differences between the modalities for the critical outcomes; therefore recommendations were made allowing all patients the option of either peritoneal or haemodialysis. However, some patient factors (such as the absence of significant comorbidities) were associated with a short-term survival benefit with peritoneal dialysis. The Guideline Development Group therefore made recommendations, based on the evidence and their clinical expertise, on those patient groups in which peritoneal dialysis was likely to be the preferred option.

The Guideline Development Group noted the lack of evidence of the effect of dialysis modality on the preservation of renal function. Although this outcome was not reported in the reviewed evidence, the Guideline Development Group considered that the general clinical view is that residual renal function is preserved more effectively in peritoneal dialysis than in haemodialysis (Misra, V 2001; Moist 2000; Rottembourg et al. 1983). A recommendation was therefore made on the preferred use of peritoneal dialysis as the initial treatment modality in people with residual renal function.

The Guideline Development Group considered the health economic analysis that had been conducted. It noted that it was based on very poor data of clinical effectiveness and could not identify clinical data to differentiate between peritoneal or haemodialysis. It noted that the cost-effectiveness results indicate that increasing the proportion of people who start on peritoneal dialysis would result in cost savings to the NHS, with potential minor increases in health related quality of life. It noted from the sensitivity analyses that the results were robust to changes to survival estimates, quality of life estimates and alternative costing. The Guideline Development Group also noted that probabilistic sensitivity analysis suggested that the conclusions were associated with probabilities of being cost effective of more than 50% and close to 90%.

The Guideline Development Group noted that the cost savings were greater with CAPD than APD. However, it was mindful that the model could not differentiate between CAPD and APD in terms of clinical effectiveness and quality of life. Therefore, it was not possible to recommend one over the other. The Guideline Development Group concluded that, given the available information, increasing the use of peritoneal dialysis would be a cost-effective use of NHS resources.

The Guideline Development Group acknowledged that the analysis did not consider variation in home haemodialysis because of the absence during guideline development of appropriate data on effectiveness and costs. It was aware of potential future developments in technology, especially for home haemodialysis. It concluded that this should be an area for future work.

Therefore, based on this evidence and the related evidence on decision-making, the Guideline Development Group made the following recommendations on the use of peritoneal dialysis for people with stage 5 CKD.

3.3.6 Recommendations

Recommendation 1.1.9

Offer all people with stage 5 CKD a choice of peritoneal dialysis or haemodialysis, if appropriate, but consider peritoneal dialysis as the first choice of treatment modality for:

- children 2 years old or younger
- people with residual renal function
- adults without significant associated comorbidities.

Recommendation 1.1.10

When discussing choice of treatment modalities, healthcare professionals should take into account that people's priorities are not necessarily the same as their own clinical priorities.

3.4 Modalities of dialysis: CAPD, APD and assisted peritoneal dialysis

3.4.1 Review question

What is the effectiveness of different types of peritoneal dialysis in people with stage 5 CKD who need dialysis?

3.4.2 Evidence review

A total of 5149 articles were found by systematic searches. Full text was ordered for 320 articles (comparing peritoneal dialysis with any other modality of dialysis, including haemodialysis) based on the title and abstract. Only four papers from three studies (Bro et al. 1999; de Fijter et al. 1991; de Fijter et al. 1994; Iles-Smith et al. 1999) met the eligibility criteria (see appendix 1 for review protocol and inclusion and exclusion criteria) and evaluated the

effectiveness of different types of peritoneal dialysis for stage 5 CKD. The same three studies were also included in a systematic review (Rabindranath et al. 2007a; Rabindranath et al. 2007b) identified through our searches. The results of the systematic review based on the three included primary studies are presented below.

No RCT evidence was found for children with stage 5 CKD.

Because of the lack of RCT evidence, the Guideline Development Group asked the technical team to search for publications from national renal registries that would provide further information on the outcomes considered important for this guideline.

A total of 1672 articles were found by systematic searches focused on the retrieval of registry data reported in published articles. Full text was ordered for 261 articles based on the title and abstract. In addition, we looked for annual reports for those not identified through the searches; this included the 2008 North American Pediatric Renal Trials and Collaborative Studies annual report[2]. Of these publications, 53 papers met the eligibility criteria for registry publications; 11 evaluated the effectiveness of different types of peritoneal dialysis, either with comparative analyses or single intervention reports for adults and children. We also re-checked the studies identified for other questions (for example, switching) and included those that were relevant.

Table 6 summarises the included studies. See appendix 1 for more details.

Of these 11 studies, four included children (seven were adults alone); eight reported outcomes for both APD and CAPD, two for CAPD alone and one for APD alone.

For the GRADE assessment, registry studies were assessed as low-quality evidence, with downgrading as appropriate.

[2] www.emmes.com/study/ped/annlrept/Annual%20Report%20-2008.pdf

Table 6 Summary of studies of registry data for types of peritoneal dialysis

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Castrale 2010 (Castrale et al. 2010)	RDPLF	2000–2005	To provide information regarding the outcome of elderly patients treated with peritoneal dialysis	1,613	Older adults (75 or older at initiation) receiving peritoneal dialysis	Previous peritoneal dialysis, haemodialysis for more than 90 days, renal transplantation
Hooman 2009 (Hooman et al. 2009)	Iranian National Registry	1993–2006	To study the cause of death or termination of CAPD to improve survival and reduce complications	120	Children (younger than 14 years) on CAPD	None
NAPRTCS2008 (North American Pediatric Renal Trials and Collaborative Studies 2009)	NAPRTCS	2008	To report the data registered through the NAPRTCS	3224 on peritoneal dialysis	Children (younger than 21 years at initiation) receiving RRT	None
Badve 2008 (Badve et al. 2008)	ANZDATA	1999–2004	To compare patient survival and death-censored technique survival in patients treated with CAPD and APD	4128	Patients receiving peritoneal dialysis [assumed adults]	None
Verger 2007 (Verger et al. 2007)	RDPLF	2000–2004	To evaluate whether the type of home assistance influenced peritonitis rates	1624	Adults started on APD	If not treated in metropolitan area
Bakkaloglu 2005 (Bakkaloglu et al. 2005)	TUPEPD	1989–2002	To determine survival rates of children on peritoneal dialysis	514	Children on peritoneal dialysis	None

Study ID	Source of data	Date of data	Aim	Number of participants	Included	Excluded
Kavanagh 2004 (Kavanagh et al. 2004)	SRR	1999–2002	To determine differences in peritonitis between CAPD and APD	1205	Adults on peritoneal dialysis	None
Guo 2003 (Guo and Mujais 2003)	US incident cohorts (Baxter database; not clear if national, but considerable overlap with USRDS data)	1999–2001	To provide information on the status of patients and technique survival in cohorts of patients on peritoneal dialysis	32,135	Patients on peritoneal dialysis [assumed adults]	None
Fine 2002 (Fine et al. 2002)	NAPRCTS	1992–2002	To report the role of APD in children	2415	Children on peritoneal dialysis	None
Heaf 2002 (Heaf et al. 2002a)	Danish Terminal Uremia register	1990–1999	To investigate the effect of dialysis modality on prognosis	4921	Patients on dialysis [assumed adults]	None
Rashid 2002 (Rashid 2002)	National data from Bangladesh	1986–1996	To report on RRT patients in Bangladesh	3186	Patients on RRT [assumed adults]	None

Abbreviations: APD, automated peritoneal dialysis; CAPD, continuous ambulatory peritoneal dialysis; RRT, renal replacement therapy.

Registry abbreviations: ANZDATA, Australia and New Zealand Dialysis and Transplant Registry; NAPRTCS, North American Pediatric Renal Trials and Collaborative Studies; RDPLF; French Language Peritoneal Dialysis Registry; SRR, Scottish Renal Registry; TUPEPD, Turkish Pediatric PD.

GRADE profile 50 Effectiveness of APD compared with CAPD – health related quality of life

Quality assessment						Summary of findings			Quality
No of studies	**Design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) Health related quality of life: SF-36 at 24 months									
1 Bro 1999	RCT	Some serious limitations[a]	No serious inconsistency	No serious indirectness	Not assessable[b]	No difference in the changes of scores (SF-36) from start to end of the study was found between APD and CAPD patients.			LOW
APD vs CAPD (adults) Health related quality of life: mean Karnofsky score (sd) [range of scores: 10-100; better indicated by higher values] at 4 weeks and 24 months									
1 Iles-Smith 1999	RCT	Some serious limitations[c]	No serious inconsistency	No serious indirectness	Some serious imprecision[d]	Mean score (86.7) did not change	Small decline in mean score (−2.5, from 82.5 to 80) at week 4	Not calculable as sd not reported	LOW
1 de Fijter 1994	RCT					Mean 83 (sd 8)	Mean 77 (sd 7)	Mean difference 6.00 (0.00 to 12.00)	

[a] Study reported a high rate of dropout, and some baseline differences were seen (downgraded one level).

[b] Imprecision was not assessable (downgraded one level).

[c] One study reported high dropout rates (downgraded one level).

[d] Imprecise based on 10% threshold (downgraded one level), where assessable.

GRADE profile 51 Effectiveness of APD compared with CAPD – patient involvement and satisfaction

Quality assessment						Summary of findings			Quality
No of studies	**Design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) Patient involvement and satisfaction									
1 Bro 1999	RCT	Some serious limitations[a]	Not assessable[b]	No serious indirectness	Not assessable[c]	Significantly more time for work, family, and social activities was available for patients on APD compared with those on CAPD ($p < 0.0005$). Although the difference was not significant, there was a tendency for less physical and emotional discomfort caused by the dialysis fluid in the APD group. Sleep problems, on the other hand, tended to be more marked in the APD group.			VERY LOW

[a] Study reported a high rate of dropout, and some baseline differences were seen (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[c] No statistics were reported to assess imprecision (downgraded one level).

GRADE profile 52 Effectiveness of APD compared with CAPD – mortality

Quality assessment						Summary of findings			Quality
No of studies	**Design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) Survival: death at 4 weeks									
1 Iles-Smith 1999	RCT	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	No deaths reported in either group.			VERY LOW
APD vs CAPD (adults) Survival: death at 6 to 24 months									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[d]	No serious inconsistency	No serious indirectness	Some serious imprecision[e]	RR 1.49 (0.51 to 4.37)			LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] Both studies had very limited follow-up (downgraded one level).

[c] No confidence intervals were reported (downgraded one level).

[d] Studies reported high dropout rates (downgraded one level).

[e] Imprecise based on 10% threshold (downgraded one level), where assessable.

GRADE profile 53 Effectiveness of APD compared with CAPD – mortality

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (adults) Survival							
5 Castrale 2010 Badve 2008 Kavanagh 2004 Guo 2003 Heaf 2002	Report from national registry	No serious limitations	Some serious inconsistency[a]	No serious indirectness	Not assessable[b]	See appendix 1 for full summary of survival data Adjusted HR death 1.03 (95% CI 0.86 to 1.24) AutoPD vs CAPD [not clear what adjusted for] Peritonitis related death Of 594 cases of peritonitis in CAPD, 22 died (3.7%) Of 334 cases of peritonitis in APD, 3 died (0.9%) Survival First yr survival 78.48% (95%CI 77.62 to 79.33) CAPD; 87.24% (95%CI 86.74 to 87.74) APD p < 0.001 CAPD and APD had the same prognosis (survival curves) within 6 months.	VERY LOW

[a] Some inconsistent results were seen across the studies(downgraded one level).

[b] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 54 Effectiveness of APD compared with CAPD – mortality

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (children) Survival							
2 Hooman 2009 Bakkaloglu 2005	Report from national registry	No serious limitations	No serious inconsistency	No serious indirectness	Not assessable[a]	**Mean survival** 1.22 years (95% CI 0.91 to 1.53) RR death 3.25 (95% CI 1.82 to 5.79) for children aged under 24 months compared with those aged 24 months or over No other factors were significantly associated (illiteracy, failure to thrive, peritonitis, home location, sex, year of initiation) **Causes of death were:** infection (40%), pulmonary oedema or ineffective dialysis (29.1%), bowel perforation (5.4%) and undetermined (25.5%). Mean survival time in these patients was 2 years (95% CI 1.45 to 2.56) **Mortality rate** 55% from 1993 to 1997; 60% 1998 to 2001; 23% 2002 to 2006. Mortality was higher in children treated with CAPD before 2001 compared with current practice (RR 2.78; 95% CI 1.64 to 4.72) Survival 90% at 1 yr, 80% at 3 yrs, and 70% at 5 yrs No significant difference by PD modality (p = 0.342)	LOW
[a] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).							

GRADE profile 55 Effectiveness of peritoneal dialysis– mortality and associated patient factors

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (adults) Survival							
1 Guo 2003	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	1 year survival benefit of APD or CAPD tended to be less in older adults than younger adults and in adults with diabetes than those without diabetes.	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] The study was not a comparative evaluation of the two modalities (downgraded one level).

[c] No confidence intervals were reported for all outcomes (downgraded one level).

GRADE profile 56 Effectiveness of APD compared with CAPD – preservation of renal function

Quality assessment						Summary of findings			Quality
No of studies	**Design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) – Preservation of renal function: creatinine clearance (l/wk/1.73m^2) at end of study (4 weeks)									
1 Iles-Smith 1999	RCT	No serious limitations	Some serious inconsistency[a]	Some serious indirectness[b]	Not assessable[c]	Increase of mean creatinine clearance 17.5 (from 47.8 to 65.3).	Increase in mean creatinine clearance 2.3 (from 51.4 to 53.7).	Not calculable as sd not reported	VERY LOW
APD vs CAPD (adults) – Preservation of renal function: total creatinine clearance (l/wk/1.73m^2) at end of study (6 and 24 months)									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[d]	No serious inconsistency	No serious indirectness	Some serious imprecision[e]	Mean difference –3.87 (−18.95 to 11.21)			LOW
APD vs CAPD (adults) – Preservation of renal function: creatinine clearance (ml/min/1.73m^2) at end of study (6 and 24 months)									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[d]	No serious inconsistency	No serious indirectness	Some serious imprecision[e]	Mean difference −0.58 (−2.07 to 0.90)			LOW
APD vs CAPD (adults) – Preservation of renal function: urine volume (ml/day) at 6 months									
1 Bro 1999	RCT	Some serious limitations[d]	Some serious inconsistency[a]	No serious indirectness	Some serious imprecision[e]	Mean difference −212.00 (−791.98 to 367.98)			VERY LOW
APD vs CAPD (adults) – Preservation of renal function: P-creatinine (µmol/l) at 6 months									
1 Bro 1999	RCT	Some serious limitations[d]	Some serious inconsistency[a]	No serious indirectness	Some serious imprecision[e]	Mean difference 58.00 (−129.75 to 245.75)			VERY LOW
APD vs CAPD (adults) – Preservation of renal function: P-urea (mmol/l) at 6 months									
1 Bro 1999	RCT	Some serious limitations[d]	Some serious inconsistency[a]	No serious indirectness	Some serious imprecision[e]	Mean difference −1.00 (−5.45 to 3.45)			VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.
[b] The studies had very limited follow-up (downgraded one level).
[c] Confidence intervals were not reported(downgraded one level).
[d] The studies had high dropout rates (downgraded one level).
[e] Imprecise based on 10% threshold (downgraded one level), where assessable.

GRADE profile 57 Effectiveness of APD compared with CAPD – technique failure or switch

Quality assessment						Summary of findings			Quality
No of studies	Design	Limitations	Inconsistency	Indirectness	Imprecision	APD	CAPD	Effect (95% CI)	
APD vs CAPD (adults) Technique failure or switch: change to any other form of dialysis modality including other forms of PD									
3 Bro 1999 de Fijter 1994 Iles-Smith 1999	RCT	Some serious limitations[a]	No serious inconsistency	Some serious indirectness[b]	Some serious imprecision[c]	RR 0.50 (0.25 to 1.02)			VERY LOW
APD vs CAPD (adults) Technique failure or switch: change to HD									
3 Bro 1999 de Fijter 1994 Iles-Smith 1999	RCT	Some serious limitations[a]	No serious inconsistency	Some serious indirectness[b]	Some serious imprecision[c]	RR 0.45 (0.16 to 1.28)			VERY LOW

[a] The studies had high dropout rates (downgraded one level).

[b] These studies reported very limited follow up (downgraded one level) in one study.

[c] Imprecise based on 10% threshold (downgraded one level), where assessable.

GRADE profile 58 Effectiveness of APD compared with CAPD – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (adults) Technique failure or switch							
4 Castrale 2010 Badve 2008 Kavanagh 2004 Guo 2003	Report from national registry	No serious limitations	No serious inconsistency	No serious indirectness	Not assessable[a]	See appendix 1 for full summary of technique survival data Adjusted HR 1.36 (95% CI 0.95 to 1.95) for technique survival on AutoPD compared with CAPD (adjusted for centre as random effect) Adjusted HR technique survival 1.08 (95% CI 0.91 to 1.27) AutoPD vs CAPD Refractory peritonitis accounted for 42.4% of technique failures	LOW
[a] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).							

GRADE profile 59 Effectiveness of APD compared with CAPD – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (children) Technique failure or switch							
3 NAPRTCS 2008 Bakkaloglu 2005 Fine 2002	Report from national registry	No serious limitations	No serious inconsistency	No serious indirectness	Not assessable[a]	Terminations more likely due to change of modality in APD group (19.6%) than in CAPD group (13.2%); but time to termination was not significantly different between groups. Technique survival 95% at 1 yr, 82% at 3 yrs, and 69% at 5 yrs No significant difference by PD modality (p = 0.107) CAPD was the first PD modality for 476 (92.6%) patients, 142 of whom switched to APD during follow-up. At the end of follow-up 47.3% remained on PD 15.4% were transplanted, 13.2% switched to HD, and 16.7% died Technique survival 80.5% CAPD and 93.4% APD maintained the same modality of dialysis until termination or last reported visit (p = ns) Reasons for termination of modality Transplant: 54.4% CAPD and 44.7% APD (p = 0.0001) Change in modality: 11.7% CAPD and 15.3% APD (p = 0.13) No difference for all reasons (p = 0.04)	LOW
[a] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).							

GRADE profile 60 Effectiveness of APD compared with CAPD – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
CAPD alone (children) Technique failure or switch							
1 Hooman 2009	Report from national registry	No serious limitations	Some serious inconsistency[a]	Some serious indirectness[b]	Not assessable[c]	**Outcomes were:** recovery of renal function (6.7%), renal transplantation (8.3%), switch to HD (16.7%), still on CAPD (23.3%), death (43.3%), lost to follow-up (1.7%). **Reasons for termination of CAPD were:** persistent peritonitis (19.6%), catheter outflow failure (8.7%), generalised oedema or cardiomegaly (4.3%), bowel obstruction (1.1%), transplantation or recovery of renal function (47.8%). **Mean survival of first catheter** 8.16 months (95% CI 6.43 to 9.90). **Reasons for exchange** were: persistent peritonitis (37.5%), outflow failure (35.4%), catheter displacement (12.5%), and other (14.6%).	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] The study was not a comparative evaluation (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 61 Effectiveness of APD compared with CAPD – associated patient factors

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (adults) Technique survival							
1 Guo 2003	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	Technique survival of APD or CAPD tended to be less in older adults and in adults with diabetes.	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] The study was not comparative between the two modalities (downgraded one level).

[c] No confidence intervals were reported for all outcomes (downgraded one level).

GRADE profile 62 Effectiveness of APD compared with CAPD – resource use and costs

Quality assessment						Summary of findings			Quality
No of studies	**Design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) Resource use and costs inc hospitalisation: hospital admissions									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[a]	No serious inconsistency	Some serious indirectness[b]	Some serious imprecision[c]	RR 0.96 (0.43 to 2.17)			VERY LOW

[a] The studies had high drop out rates (downgraded one level).

[b] The studies had very limited follow-up (downgraded one level) in one study.

[c] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 63 Effectiveness of APD compared with CAPD – adverse events

Quality assessment						Summary of findings			Quality
No of studies	Design	Limitations	Inconsistency	Indirectness	Imprecision	APD	CAPD	Effect (95% CI)	
APD vs CAPD (adults) Adverse events: peritonitis									
3 Bro 1999 de Fijter 1994 Iles-Smith 1999	RCT	Some serious limitations[a]	No serious inconsistency	Some serious indirectness[b]	Some serious imprecision[c]	RR 0.75 (0.50 to 1.11)			VERY LOW
APD vs CAPD (adults) Adverse events: exit-site infections									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[a]	No serious inconsistency	No serious indirectness	Some serious imprecision[c]	RR 1.09 (0.56 to 2.13)			LOW
APD vs CAPD (adults) Adverse events: tunnel infections									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[a]	No serious inconsistency	No serious indirectness	Some serious imprecision[c]	RR 0.99 (0.15 to 6.49)			LOW
APD vs CAPD (adults) Adverse events: hernias									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[a]	No serious inconsistency	No serious indirectness	Some serious imprecision[c]	RR 1.26 (0.32 to 5.01)			LOW
APD vs CAPD (adults) Adverse events: PD fluid leaks									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[a]	No serious inconsistency	No serious indirectness	Some serious imprecision[c]	RR 1.06 (0.11 to 9.83)			LOW

APD vs CAPD (adults) **Adverse events: hydrothoraces**							
1 de Fijter 1994	RCT	Some serious limitations[a]	Some serious inconsistency[d]	No serious indirectness	Some serious imprecision[c]	RR 1.00 (0.06 to 15.45)	VERY LOW
APD vs CAPD (adults) **Adverse events: catheter removal due to all causes**							
1 de Fijter 1994	RCT	Some serious limitations[a]	Some serious inconsistency[d]	No serious indirectness	Some serious imprecision[c]	RR 0.64 (0.27 to 1.48)	VERY LOW
APD vs CAPD (adults) **Adverse events: catheter removal during peritonitis episodes**							
1 de Fijter 1994	RCT	Some serious limitations[a]	Some serious inconsistency[d]	No serious indirectness	Some serious imprecision[c]	RR 1.31 (0.31 to 5.46)	VERY LOW

[a] The studies reported high drop out rates (downgraded one level).

[b] Limited follow-up was evaluated in the studies(downgraded one level) in one study.

[c] Imprecise based on 10% threshold (downgraded one level).

[d] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.

GRADE profile 64 Effectiveness of APD compared with CAPD – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (adults) Adverse events							
2 Castrale 2010 Kavanagh 2004	Report from national registry	No serious limitations	No serious inconsistency	No serious indirectness	Not assessable[a]	Peritonitis Median survival free of peritonitis 32.1 months By age group, 75 to 79 years 29.4 months, 80 to 84 years 34.1 months, 85 to 89 years 37.7 months, and for >90 years 30.4 months. Unadjusted HR 0.89 (95% CI 0.74 to 1.08) for survival free of peritonitis aged 80 to 84 years, 0.81 (0.63 to 1.04) aged 85 to 89 years, and 0.91 (0.62 to 1.34) aged 90 years and over compared with 75 to 79 years Unadjusted HR 0.79 (95% CI 0.59 to 1.04) for survival free peritonitis on AutoPD compared with CAPD 928 cases of peritonitis in 1487 patient-years; an overall peritonitis rate of 1 episode every 19.2 months. Peritonitis rates for APD and CAPD were similar at one episode every 20.3 months and one episode every 18.6 months, respectively.	LOW
[a] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).							

GRADE profile 65 Effectiveness of APD compared with CAPD – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (children) Adverse events							
2 NAPRTCS 2008 Fine 2002	Report from national registry	No serious limitations	No serious inconsistency	No serious indirectness	Not assessable[a]	Peritonitis Peritonitis exposure in the CAPD group was significantly different to the APD group (p = 0.042) 50% of cases had the first peritonitis episode in CAPD patients by 16.6 months compared with 19.2 months for APD patients. At 1 year post initiation, 45.2% of CAPD patients had experienced peritonitis compared with 40.5% of APD patients. Access revisions 19.0% CAPD and 25.3% APD Due to peritonitis in 22% CAPD and 18% APD Peritonitis Peritonitis rate significantly better in APD compared with CAPD (p = 0.006) Median time to first episode 348 days CAPD and 472 days APD At 1 yr after initiation, 51% CAPD and 44% APD had 1 episode.	VERY LOW
[a] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).							

GRADE profile 66 Effectiveness of APD compared with CAPD – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
CAPD alone (adults) Adverse events							
1 Rashid 2002	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	**Peritonitis** 1 episode/16 pt months CAPD **Exit-site infection** 1 episode/16 pt months CAPD	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] The study was not a comparative evaluation (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 67 Effectiveness of APD compared with CAPD – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
CAPD alone (children) Adverse events							
1 Hooman 2009	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	Frequent surgical complications were: hernia in 25 (inguinal 15; umbilical 8; incisional 2) and leakage in 18 children. 14 had bleeding after surgery and hydrocele in 5.	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] The study was not a comparative evaluation (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 68 Effectiveness of APD compared with CAPD – adverse events

Quality assessment						Summary of findings	Quality
No of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
APD alone (adults) Adverse events							
1 Verger 2007	Report from national registry	No serious limitations	Not assessable[a]	Some serious indirectness[b]	Not assessable[c]	Overall, 1 episode of peritonitis every 34 months; 1 episode every 33 months for autonomous APD; 1 every 45 months for patients assisted at home by a family member; 1 every 36 months for patients assisted by a private nurse (p = 0.11) Probability of being peritonitis free at 24 months 59.3% (95% CI 55.8 to 62.9) for non-assisted patients; 54.4% (95% CI 45.7 to 63.1) for home nurse-assisted patients; 69.8% (95% CI 59.6 to 80.1) for home family-assisted patients Probability of being peritonitis free at 36 months 45.6% (95% CI 40.3 to 50.9) for non-assisted patients; 39.8% (95% CI 29.2 to 50.4) for home nurse-assisted patients;52.1% (95% CI 36.2 to 67.9) for home family-assisted patients Probability of being peritonitis free at 24 months 63.8% (95% CI 51.7 to 75.9) and at 36 months 50.8% (95% CI 34.2 to 67.5) for home nurse-assisted patients with home visits from the training centre; at 24 months42.4% (95% CI 28.9 to 55.9) and at 36 months 33.9% (95% CI 17.4 to 50.3) for home nurse-assisted patients without home visits from the training centre, p = 0.028	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] The study was not a comparative evaluation (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 69 Effectiveness of APD compared with CAPD – adequacy rates

Quality assessment						Summary of findings			Quality
No of studies	**Design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) Adequacy rate: weekly KtV at 4 weeks									
1 Iles-Smith 1999	RCT	Some serious limitations[a]	Not assessable[b]	No serious indirectness	Not assessable[c]	Increase of mean Kt/V 0.87 (from 1.68 to 2.55 l/ per week).	Increase in mean Kt/V 0.14 (from 1.66 to 1.8 l/ per week)	Not calculable as sd not reported	VERY LOW
APD vs CAPD (adults) Adequacy rate: weekly KtV at end of study (6 and 24 months)									
2 Bro 1999 de Fijter 1994	RCT	Some serious limitations[d]	No serious inconsistency	No serious indirectness	Some serious imprecision[e]	Mean difference 0.12 (−0.22 to 0.47)			LOW
APD vs CAPD (adults) Adequacy rate: systolic blood pressure (mmHg)									
1 Bro 1999	RCT	Some serious limitations[d]	Some serious inconsistency[b]	No serious indirectness	Some serious imprecision[e]	Mean difference 6.00 (−14.08 to 26.08)			VERY LOW
APD vs CAPD (adults) Adequacy rate: diastolic blood pressure (mmHg)									
1 Bro 1999	RCT	Some serious limitations[d]	Some serious inconsistency[b]	No serious indirectness	Some serious imprecision[e]	Mean difference 6.00 (−6.48 to 28.48)			VERY LOW

[a] The study reported a high rate of drop out, and some baseline differences (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.

[c] No confidence intervals were reported (downgraded one level).

[d] The study reported high drop out rates (downgraded one level).

[e] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 70 Effectiveness of APD compared with CAPD – adequacy rates

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
APD and CAPD (children) Adequacy rates							
1 NAPRTCS2008	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	Kt/V values Rates did not differ significantly for CAPD vs APD.	VERY LOW

[a] Inconsistency was not assessable (downgraded one level) because it was reported in one study.

[b] No information to assess imprecision was reported (downgraded one level).

GRADE profile 71 Effectiveness of APD compared with CAPD – staff attitude

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Staff attitude							
3 Bro 1999 de Fijter 1994 Iles-Smith 1999	RCT	Not reported as an outcome					…
11 See list of references	Report from national registries						

GRADE profile 72 Effectiveness of APD compared with CAPD – nutritional status

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) Nutritional status: P-phosphate (mmol/l) at 6 months									
1 Bro 1999	RCT	Some serious limitations[a]	Some serious inconsistency[b]	No serious indirectness	No serious imprecision	Mean difference 0.30 (0.02 to 0.58)			LOW
APD vs CAPD (adults) Nutritional status: P-ionised calcium (mmol/l) at 6 months									
1 Bro 1999	RCT	Some serious limitations[a]	Some serious inconsistency[b]	No serious indirectness	No serious imprecision	Mean difference 0.04 (–0.10 to 0.18)			LOW
APD vs CAPD (adults) Nutritional status: P-albumin (µmol/l) at 6 months									
1 Bro 1999	RCT	Some serious limitations[a]	Some serious inconsistency[b]	No serious indirectness	Some serious imprecision[c]	Mean difference −13.00 (−68.43 to 42.43)			VERY LOW
APD vs CAPD (adults) Nutritional status: Serum albumin and serum phosphate at 24 months									
1 de Fijter 1999	RCT	Some serious limitations[a]	Some serious inconsistency[b]	No serious indirectness	Some serious imprecision[d]	No difference seen between groups for serum albumin or serum phosphate at 24 months.			VERY LOW
APD vs CAPD (adults) Preservation of renal function: nutritional status at 6 months									
1 Bro 1999	RCT	Some serious limitations[a]	Some serious inconsistency[b]	No serious indirectness	Some serious imprecision[e]	Mean difference −0.30 (−0.85 to 0.25)			VERY LOW

[a] The study reported high drop out rates (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.

[c] Imprecise based on 10% threshold (downgraded one level).

[d] No confidence intervals were reported (downgraded one level).

[e] Imprecise based on 10% threshold (downgraded one level), where assessable.

GRADE profile 73 Effectiveness of APD compared with CAPD – anaemia

Quality assessment						Summary of findings			Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**	**APD**	**CAPD**	**Effect (95% CI)**	
APD vs CAPD (adults) **Anaemia: EPO use at 24 months**									
1 de Fijter 1999	RCT	Some serious limitations[a]	Some serious inconsistency[b]	No serious indirectness	Some serious imprecision[c]	No observed difference between the number of patients requiring EPO in the two groups.			VERY LOW

[a] The study reported high drop out rates (downgraded one level).

[b] Inconsistency was not assessable (downgraded one level) because it was reported in one study only.

[c] No confidence intervals were reported (downgraded one level).

3.4.3 Evidence statements

Health-related quality of life

3.4.3.1 *Low-quality evidence (from three RCTs) showed no difference in health-related quality of life in adults on APD compared with those on CAPD.*

3.4.3.2 *No evidence on health-related quality of life in children was identified.*

Patient involvement and satisfaction

3.4.3.3 *Very-low-quality evidence (from one RCT) found that adults on APD reported significantly more time for work, family and social activities than those on CAPD ($p < 0.0005$). Although the difference was not significant, there was a tendency for less physical and emotional discomfort caused by the dialysis fluid in the APD group. Sleep problems, on the other hand, tended to be more marked in the APD group.*

Mortality

3.4.3.4 *Low to very-low-quality evidence (from three RCTs and seven national registries) showed a tendency for no difference in mortality in adults and children on APD compared with those on CAPD. Where differences were seen, they were associated with patient factors.*

3.4.3.5 *Survival on APD and CAPD tended to be better for younger adults and for those without diabetes (very low quality evidence from one national registry) (Guo and Mujais 2003). There were no comparative data to suggest that there were any differences between the types of peritoneal dialysis.*

3.4.3.6 *Very-low-quality evidence (from one national registry) showed higher rates of mortality for adults older than 75 on assisted (family or nurse) peritoneal dialysis compared with unassisted peritoneal dialysis. There were similar rates of peritonitis, although rates*

tended to be higher in people unassisted or nurse-assisted than in those assisted by family members) (Castrale et al. 2010).

Preservation of renal function

3.4.3.7 Low to very-low-quality evidence (from two RCTs) showed no difference in preservation of renal function in APD or CAPD.

Technique failure or switch

3.4.3.8 Very-low-quality evidence (from three RCTs and seven national registries) showed that rates of dialysis failure or switch did not seem to differ between APD and CAPD. Where differences were seen, they were associated with patient factors.

3.4.3.9 Technique survival for APD and CAPD tended to be better for younger adults and for those without diabetes (very-low-quality evidence from one national registry) (Guo and Mujais 2003). There were no comparative data to suggest that there were any differences between the types of peritoneal dialysis.

Resource use and costs

3.4.3.10 Very-low-quality evidence (from two RCTs) showed that rates of hospital admissions did not seem to differ between APD and CAPD.

Adverse events

3.4.3.11 Very-low-quality evidence (from three RCTs and six national registries) showed that rates of adverse events did not appear to differ between APD and CAPD.

Adequacy rates

3.4.3.12 Low to very-low-quality evidence (from two RCTs and one national registry) showed no difference between APD and CAPD in dialysis adequacy.

Staff attitude and skills

3.4.3.13 No evidence on staff attitude and skills was identified.

Nutritional status

3.4.3.14 Very-low-quality evidence (from one RCT) showed no significant difference in measures of nutritional status between adults on APD and those on CAPD (Bro et al. 1999).

Anaemia

3.4.3.15 Very-low-quality evidence (from one RCT) showed that erythropoietin use did not differ between adults on APD and those on CAPD (de Fijter et al. 1991).

3.4.4 Health economic modelling

This was not considered to be a health economic question.

3.4.5 Evidence to recommendations

The Guideline Development Group agreed that overall there was no evidence of significant differences between the modalities for the critical outcomes.

The evidence on assisted peritoneal dialysis was considered to be of limited relevance to current practice in the UK. This was specifically because assisted peritoneal dialysis tended to be used only in those patients who were most frail (older, or with more health problems) and the organisation of care in the country where this was assessed (France) was not directly applicable to current practice in the UK.

Therefore, based on this evidence and the related evidence on decision-making, the Guideline Development Group considered that adults and children choosing peritoneal dialysis should have the choice of CAPD and APD, with aAPD as needed. However, based on clinical experience, there was one situation in which APD was recommended as the preferred option – for infants and children on a liquid diet.

3.4.6 Recommendations

Recommendation 1.1.11

Before starting peritoneal dialysis offer all patients a choice, if appropriate, between CAPD and APD (or aAPD if necessary).

Recommendation 1.1.12

For children for whom peritoneal dialysis is appropriate offer APD in preference to CAPD if they are on a liquid diet, especially if they have low residual renal function.

3.5 Sequences of treatment

3.5.1 Review question

What is the effectiveness of different sequences of treatment that include peritoneal dialysis in people with stage 5 CKD who need dialysis?

3.5.2 Evidence review

A total of 1669 articles were found by systematic searches. Full text papers were ordered for 50 articles (comparing sequences of treatment that include peritoneal dialysis) based on the title and abstract. Seven studies (Badve et al. 2006b; Guo and Mujais 2003; Heaf et al. 2002b; Huisman et al. 2002b; Jaar et al. 2009; Mujais and Story 2006; Rao et al. 2009) met the eligibility criteria (see appendix 1 for review protocol and inclusion and exclusion criteria) and evaluated the effectiveness of treatment sequences that include peritoneal dialysis. Different sequences were compared in the published studies. Only one study included children (Badve et al. 2006b).

As for the other reviews of dialysis in this guideline, because of the lack of RCT evidence, we included publications from national renal registries that would provide further information on the outcomes considered important for this guideline. We also re-checked the studies identified for other questions (for example, effectiveness of peritoneal dialysis) and included those that were relevant. Table 7 shows a summary of the studies that were included.

Table 7 Summary of included studies on treatment sequences

Study ID	Country	Source of data	Date of data	Aim	Number of participants	Included	Excluded	Dialysis sequence compared	Relevant outcomes reported
Badve 2006 (Badve et al. 2006b)	Australia and New Zealand	ANZDATA	1991–2004	To compare survival, technique survival and peritonitis-free survival in peritoneal dialysis after a failed transplant and after failed native kidneys	13,947 episodes of peritoneal dialysis in 11,979 patients	Adults and children on peritoneal dialysis	None	Peritoneal dialysis Transplant–peritoneal dialysis	Survival Technique failure or switch Peritonitis
Guo 2003 (Guo and Mujais 2003)	US	US incident cohorts (Baxter database; not clear if national, but considerable overlap with USRDS data)	1999–-2001	To provide information on the status of patients and technique survival in cohorts of patients on peritoneal dialysis	32,135	Patients on peritoneal dialysis [assumed adults]	None	Peritoneal dialysis Haemodialysis – peritoneal dialysis Transplant–peritoneal dialysis	Survival Technique survival
Heaf 2002 (Heaf et al. 2002b)	Denmark	Danish Terminal Uremia register	1990–-1999	To investigate the effect of dialysis modality on prognosis	4921	Patients on dialysis [assumed adults]	None	Peritoneal dialysis–haemodialysis Haemodialysis – peritoneal dialysis	Survival

Study ID	Country	Source of data	Date of data	Aim	Number of participants	Included	Excluded	Dialysis sequence compared	Relevant outcomes reported
Huisman 2002 (Huisman et al. 2002b)	Netherlands	RENINE	1994–1999	To determine rates of technique survival	Not clear	Patients on dialysis [assumed adults]	None	Haemodialysis Peritoneal dialysis–haemodialysis	Survival
Jaar 2009 (Jaar et al. 2009)	US	US CHOICE (Choices for Healthy Outcomes in Caring for ESRD - national prospective cohort)	1995–1998	To determine patient characteristics associated with risk of switching from peritoneal dialysis to HD and survival after switching	262	Adults (aged over 17 years) on peritoneal dialysis	None	Peritoneal dialysis Peritoneal dialysis–haemodialysis	Survival
Mujais 2006 (case–control) (Mujais and Story 2006)	US	US incident cohorts (Baxter database; not clear if national, but considerable overlap with USRDS data)	2000–2003	To provide information on the status of patients and technique survival in cohorts of patients on peritoneal dialysis	1464	Patients on peritoneal dialysis [assumed adults]	None	Peritoneal dialysis Haemodialysis – peritoneal dialysis Transplant–peritoneal dialysis	Survival Technique survival
Registry abbreviations: ANZDATA, Australia and New Zealand Dialysis and Transplant Registry; RENINE, Dutch End Stage Renal Disease Registry; USRDS, US Renal Data System.									

GRADE profile 74 Effectiveness of sequences and impact of switching – health-related quality of life

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Health-related quality of life							
6 See list of references	Report from national registries	Not reported as an outcome					…

GRADE profile 75 Effectiveness of sequences and impact of switching – patient involvement

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Patient involvement							
6 See list of references	Report from national registries	Not reported as an outcome					…

GRADE profile 76 Effectiveness of sequences and impact of switching – mortality

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Adults and children Survival							
1 Badve 2006	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[b]	Adjusted weighted HR for death in PD after transplant vs PD after failure of native kidneys 1.09 (95% CI 0.81 to 1.45), after adjustment for gender, age, race, comorbidities, BMI, smoking, time from commencement of RRT to PD, country of residence; 1.32 (95% CI 0.76 to 2.31), with addition of peritoneal transport status	VERY LOW
Adults Survival							
5 Guo 2003 Heaf 2002 Huisman 2002 Jaar 2009 Mujais 2006	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[c]	See appendix 1 for full summary of survival data 1yr survival new to PD 83.12%; 2yr 69.94%; 3yr 58.12% 1yr survival post transfer from HD 79.87%; 2yr 66.07%; 3yr 56.00% 1yr survival after failed transplant 91.42%; 2yr 82.71%; 3yr 74.65% Mortality rate 18.5 per 100 pt-yrs PD non-switchers 13.5 for PD switchers to HD RR 0.94 death (95% CI 0.51 to 1.73) switchers vs non-switchers	VERY LOW

[a] This sequence or comparison reported in one study only (downgraded one level).

[b] Imprecise based on 10% threshold (downgraded one level).

[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 77 Effectiveness of sequences and impact of switching – preservation of renal function

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Preservation of renal function							
6 See list of references	Report from national registries	Not reported as an outcome					…

GRADE profile 78 Effectiveness of sequences and impact of switching – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Adults and children Technique survival or switch							
1 Badve 2006	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[b]	Adjusted weighted HR for technique failure in PD after transplant vs PD after failure of native kidneys 0.91 (95% CI 0.75 to 1.10), after adjustment for gender, age, race, comorbidities, BMI, smoking, time from commencement of RRT to PD, country of residence; 1.03 (95% CI 0.75 to 1.42), with addition of peritoneal transport status	VERY LOW

[a] This sequence or comparison reported in one study only (downgraded one level).
[b] Imprecise based on 10% threshold (downgraded one level).

GRADE profile 79 Effectiveness of sequences and impact of switching – technique failure or switch

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Adults **Technique survival or switch**							
2 Guo 2003 Mujais 2006	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[b]	Transfer to HD similar across all groups, with transfer being highest in the first year of dialysis ($p < 0.0001$) Patients on PD transferred from HD appeared to have similar rates of transfer to HD to patients with a failed transplant (no p value or statistical analysis reported) 1 yr transfer to HD new to PD 19.60%; 2 yr 16.13%; 3 yr 15.75% 1 yr transfer to HD after transfer from HD 23.12%; 2 yr 17.33%; 3 yr 17.61% 1 yr PD transfer to HD after failed transplant 17.61%; 2 yr 21.37%; 3 yr 12.34% Technique survival was similar across all groups 1 yr technique survival new to PD 82.74%; 2 yr 69.03%; 3 yr 57.39%; 4 yr 52.08% 1 yr technique survival post transfer from HD 74.74%; 2 yr 64.55%; 3 yr 54.92%; 4 yr 48.72% 1 yr technique survival after failed transplant 77.21%; 2 yr 64.22%; 3 yr 53.72%; 4 yr 47.75% There were differences in the distribution of reasons for change across groups ($p < 0.007$), with fewer changes due to psychosocial reasons in the failed transplant group	VERY LOW

[a] This sequence or comparison reported in one study only (downgraded one level).

[b] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 80 Effectiveness of sequences and impact of switching – resource use and costs

Quality assessment						Summary of findings	Quality
No. of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Resource use and costs							
6 See list of references	Report from national registries	Not reported as an outcome					…

GRADE profile 81 Effectiveness of sequences and impact of switching – adverse events

Quality assessment						Summary of findings	Quality
No of studies	**Study design**	**Limitations**	**Inconsistency**	**Indirectness**	**Imprecision**		
Adults and children Adverse events							
1 Badve 2006	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Some serious imprecision[b]	Adjusted weighted HR for peritonitis in PD after transplant vs PD after failure of native kidneys 0.92 (95% CI 0.72 to 1.16), after adjustment for gender, age, race, comorbidities, BMI, smoking, time from commencement of RRT to PD, country of residence; 0.88 (95% CI 0.60 to 1.30), with addition of peritoneal transport status	VERY LOW
Adults Adverse events							
1 Guo 2003	Report from national registry	No serious limitations	Not assessable[a]	No serious indirectness	Not assessable[c]	Infections causing transfer to HD Patients transferring to PD after a failed transplant vs transferring to HD because of infection (p = ns) were higher than in those new to dialysis (approx 7.3% vs 4.9%; p = 0.05) and similar in those who had transferred from HD (approx 7.3% vs 5.9%)	VERY LOW

[a] This sequence or comparison reported in one study only (downgraded one level).
[b] Imprecise based on 10% threshold (downgraded one level).
[c] Confidence intervals only reported for some studies (and outcomes) (downgraded one level).

GRADE profile 82 Effectiveness of sequences and impact of switching – adequacy rates

Quality assessment						Summary of findings	Quality
No. of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
Adequacy rates							
6 See list of references	Report from national registries	Not reported as an outcome					…

GRADE profile 83 Effectiveness of sequences and impact of switching – staff attitude and skills

Quality assessment						Summary of findings	Quality
No. of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
Staff attitude							
6 See list of references	Report from national registries	Not reported as an outcome					…

GRADE profile 84 Effectiveness of sequences and impact of switching – nutritional status

Quality assessment						Summary of findings	Quality
No. of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
Nutritional status							
6 See list of references	Report from national registries	Not reported as an outcome					…

GRADE profile 85 Effectiveness of sequences and impact of switching – anaemia

Quality assessment						Summary of findings	Quality
No. of studies	Study design	Limitations	Inconsistency	Indirectness	Imprecision		
Anaemia							
6 See list of references	Report from national registries	Not reported as an outcome					…

3.5.3 Evidence statements

3.5.3.1 Overall, there was a lack of high-quality evidence on the effectiveness of sequences or the impact of switching.

3.5.3.2 No studies were identified on sequences or switching in children alone.

3.5.3.3 No studies reported the effect of different sequences on health-related quality of life, patient involvement, preserving renal function, resource use and costs, adequacy rates, staff attitude, nutritional status or anaemia.

Mortality

3.5.3.4 Overall, there was no clear evidence of different sequences having different mortality rates. Similarly there was no clear evidence for the impact of switching (very-low-quality evidence based on six national registries).

Dialysis survival or switch

3.5.3.5 Overall, there was no clear evidence of different sequences having different dialysis survival rates or rates of switching. Similarly there was no clear evidence for the impact of switching (very-low-quality evidence based on three national registries).

Adverse events

3.5.3.6 Overall, there was no clear evidence of different sequences having different rates of adverse events. Similarly there was no clear evidence for the impact of switching (very-low-quality evidence based on two national registries).

3.5.4 Health economic modelling

This was not considered to be a health economic question.

3.5.5 Evidence to recommendations

The Guideline Development Group recognised that duration of peritoneal dialysis is often used as a reason to switch treatment in anticipation of rare but significant adverse events, such as encapsulating peritoneal sclerosis (EPS; for example, in one study, the overall incidence of EPS in adults over the course of 4 years was 2.5%, and was lower in children at 1.6% in 5 years) (Hoshii et al. 2000; Kawanishi et al. 2004).

Although the duration of peritoneal dialysis is associated with the development of EPS, there is no evidence that people should be switched to prevent such adverse events. The Guideline Development Group considered that people should remain on the dialysis modality that is most effective and not switch unless there are clinical reasons to do so, such as progressive loss of solute transport or of ultrafiltration, or the patient or carers express a wish to switch.

Similarly, there was no conclusive evidence on the most effective sequence of treatments. However, there are clinical implications of sequencing; for example haemodialysis requires vascular access, so access for fistula formation is limited. Therefore, people who wish to switch should be aware of any implications this may have for future options, noting that people may have dialysis over many years. Where possible, switching should be a planned process.

Based on this evidence and the related evidence on effectiveness on choice of dialysis, the Guideline Development Group considered that adults and children should remain on the dialysis modality unless there are clear clinical reasons to switch, or the patient or carer expresses a wish to do so.

3.5.6 Recommendations

Recommendation 1.1.13

Do not routinely switch patients on peritoneal dialysis to a different treatment modality in anticipation of potential future complications such as encapsulating peritoneal sclerosis. However, healthcare professionals should monitor risk factors such as loss of ultrafiltration and discuss with patients regularly the efficacy of all aspects of their treatment.

Recommendation 1.1.14

Consider switching treatment modality if the patient, their family or carer asks.

Recommendation 1.1.15

When considering switching treatment modality, offer information on treatment options described in recommendations 1.1.1–1.1.8. This should also include how any decision to switch may affect future treatment options.

Recommendation 1.1.16

Switching between treatment modalities should be planned if possible.

4 Research recommendations

We have made the following recommendations for research, based on our review of evidence, to improve NICE guidance and patient care in the future.

4.1 Process of decision-making

How should the process of decision-making about the choice of dialysis modality, including peritoneal dialysis, be supported?

Why this is important

Various methods are used to support people making healthcare decisions through either formal or informal systems, but there was no evidence on which method is most effective in the choice of dialysis modality. Qualitative evidence showed that people were influenced by the experience of other patients. However, this also has the potential to harm informed

decision-making, because this information is very subjective and can discourage patients from making a decision informed by their own values.

Further research is needed on how decisions about the modality of dialysis can be supported. Methods might include how you could use peer support to make decisions based on the patient's own values, the use of a decision coach and the use of structured information for children. Research should also evaluate whether these methods vary in effectiveness at different stages of the pathway or for different decisions (for example, the start of dialysis or the decision to switch modality or not). The impact of the method or timing of information-giving on clinical outcomes should be assessed. Other outcomes should include whether the information given matched the actual experience of the patient after the decision was made.

4.2 Effectiveness of modality

What factors determine the effectiveness of any modality of dialysis, including peritoneal dialysis?

Why this is important

There are substantial barriers to using randomised controlled trials (RCTs) in research on dialysis modality. This is a particular challenge for dialysis in children because any UK study is unlikely to be adequately powered. Also, patient preference is such an important factor in the choice of modality that when RCTs have been set up recruitment targets have not been met, so results were uncertain and of limited value.

Qualitative evidence shows that that patients and healthcare professionals perceive many factors as influencing the effectiveness of dialysis. These include age (specifically age 65 years and older), level of support and family functioning (relationships, organisation, coping strategies and life events). However, there is little robust qualitative evidence in this area.

Further research is needed to identify factors that predict treatment success or failure. Outcomes should include clinical outcomes (including preservation of

renal function and rates of infection), dropout rates, psychosocial factors, quality of life, and adherence.

4.2.1 Treatment sequence

What is the most effective sequence of treatment?

Why this is important?

There is limited high-quality evidence on the effectiveness of different sequencing of modalities, and specifically on the impact of starting peritoneal dialysis in people with residual renal function. There is also limited high-quality evidence on when people should be switched to or from peritoneal dialysis.

Further research is needed on sequencing of treatment, including the optimal time for switching.

4.2.2 Nutritional status

Is there any significant difference in nutritional status between people on the different dialysis treatment modalities?

Why this is important

Undernutrition is a frequent finding in people with established renal failure (present in 30–40% of patients) and is associated with reduced survival. Conversely, weight gain, or regain, is common after starting peritoneal dialysis and is associated with a worsening lipid profile. Very high and low serum phosphate concentrations are also associated with poor outcomes.

Clinical interventions are currently used to try to correct both abnormal phosphate levels and malnutrition.

A rigorous study, using validated methods, is needed to compare the effects of haemodialysis and peritoneal dialysis on markers of nutritional status and phosphate control.

There is no single gold standard measure of nutritional status, so a panel of measurements should be used, reflecting the various aspects of protein–energy malnutrition. These outcome measurements should include subjective global assessment, assessment of dietary intake, anthropometric measures,

weight and body mass index, biochemical markers (including phosphate, calcium, serum creatinine and albumin), and estimation of dialysis adequacy and residual renal function.

4.2.3 Evaluating effectiveness

Which outcomes should be used in evaluating effectiveness?

Why this is important

Studies evaluating the effectiveness of different modalities report many different outcomes. However, it is not known which is the best measure to compare effectiveness between treatments.

Further research is needed to determine which outcomes are of most value to patients and healthcare professionals when deciding on dialysis modality.

5 Other versions of this guideline

This is the full guideline. It contains details of the methods and evidence used to develop the guideline. It is available from our website (www.nice.org.uk/guidance/CG125Guidance).

Quick reference guide

A quick reference guide for healthcare professionals is available from www.nice.org.uk/guidance/CG125QuickRefGuide

For printed copies, phone NICE publications on 0845 003 7783 or email publications@nice.org.uk (quote reference number N2600).

'Understanding NICE guidance'

A summary for patients and carers ('Understanding NICE guidance') is available from www.nice.org.uk/guidance/CG125PublicInfo

For printed copies, phone NICE publications on 0845 003 7783 or email publications@nice.org.uk (quote reference number N2601).

We encourage NHS and voluntary sector organisations to use text from this booklet in their own information about stage 5 CKD.

6 Related NICE guidance

Published

- Anaemia management in people with chronic kidney disease. NICE clinical guideline 114 (2011). Available from www.nice.org.uk/guidance/CG114
- Chronic kidney disease. NICE clinical guideline 73 (2008). Available from www.nice.org.uk/guidance/CG73
- Laparoscopic insertion of peritoneal dialysis catheter. NICE interventional procedure guidance 208 (2007). Available from www.nice.org.uk/guidance/IPG208
- Guidance on home compared with hospital haemodialysis for patients with end-stage renal failure. NICE technology appraisal guidance 48 (2002). Available from www.nice.org.uk/guidance/TA48

7 Updating the guideline

NICE clinical guidelines are updated so that recommendations take into account important new information. New evidence is checked 3 years after publication, and healthcare professionals and patients are asked for their views; we use this information to decide whether all or part of a guideline needs updating. If important new evidence is published at other times, we may decide to do a more rapid update of some recommendations. Please see our website for information about updating the guideline.

8 References, glossary and abbreviations

8.1 References

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8.2 Glossary

Term	Meaning
Conservative care	Full supportive treatment for those with advanced kidney failure who, in conjunction with carers and the clinical team, decide against starting dialysis
Peritoneal dialysis	A treatment for renal failure which uses the body's natural membrane in the peritoneal cavity to remove the build-up of toxins

8.3 Abbreviations

Abbreviation	Meaning
aAPD	Assisted automated peritoneal dialysis
APD	Automated peritoneal dialysis
CAPD	Continuous ambulatory peritoneal dialysis
CKD	Chronic kidney disease
EPS	Encapsulating peritoneal sclerosis

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9.2 The short clinical guidelines technical team

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9.5 The Guideline Review Panel

The Guideline Review Panel is an independent panel that oversees the development of the guideline and takes responsibility for monitoring adherence to NICE guideline development processes. In particular, the panel ensures that stakeholder comments have been adequately considered and responded to. The panel includes members from the following perspectives: primary care, secondary care, lay, public health and industry.

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9.6 Declarations of interest

A full list of all declarations of interest made by this Guideline Development Group is available on the NICE website (www.nice.org.uk).

9.7 Authorship and citation

Authorship of this document is attributed to the NICE Short Clinical Guidelines Technical Team and members of the Guideline Development Group under group authorship.

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