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# Patient selection and training for home hemodialysis

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## Abstract

Patient selection and training is arguably the most important step toward building a successful home hemodialysis (HD) program. We present a step-by-step account of home HD training to guide providers who are developing home HD programs. Although home HD training is an important step in allowing patients to undergo dialysis in the home, there is a surprising lack of systematic research in this field. Innovations and research in this area will be pivotal in further promoting a higher acceptance rate of home HD as the renal replacement therapy of choice.

**Key words:** Home hemodialysis, hemodialysis, training, adult education

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## INTRODUCTION

Home hemodialysis (HD) has been associated with several clinical benefits compared with conventional thrice-weekly, in-center HD. To date, few resources have focused on the importance of patient selection, training, and education of a complex medical procedure such as home HD. In this module, we describe guiding principles for implementation of a home HD program with an emphasis on (i) patients' selection, assessments, and training and (ii) challenges of adult education. Future challenges in education research and the importance of quality assurance in home HD education delivery will also be discussed.

## PATIENT SELECTION FOR HOME HD

Guidance for patient selection has been provided by the National Institute for Health and Care Excellence<sup>1</sup> and the MATCH-D initiative.<sup>2</sup> Primarily, the patient should be physically and intellectually able and, most importantly, motivated to perform home HD and its related activities. As noted by others, most patients are medically suitable candidates for home HD.<sup>2,3</sup> Our own programs have enrolled patients with complex combinations of comorbidities and we have discovered that many of our patients do better with more frequent or longer treatments that are more easily implemented in the home setting.<sup>4</sup> Indications for and relative contraindications against home HD are listed in Table 1. At our centers, we have implemented, to various extents, a “home-dialysis-first” policy, which prioritizes proactive education to all patients with chronic kidney disease.<sup>5</sup> Policies such as these are important change agents and help healthcare professionals facilitate a clinical culture of promoting home dialysis to appropriate patients.

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**Table 1** Considerations for patient selection for home hemodialysis

## Potential candidates for home hemodialysis

- Patients who are able to physically and cognitively manage the tasks of care (or have a support person who can)
- Patients who are motivated and willing to learn the technique
- Patients who wish to continue to work or continue schooling
- Patients who have failed peritoneal dialysis and wish to continue therapy at home
- Patients with the following medical conditions:
  - Severe sleep apnea
  - Persistent hyperphosphatemia
  - Right heart failure
  - Uncontrolled ascites
  - Refractory volume overload
  - Difficult-to-control hypertension
  - Symptomatic hypotension, cramps, or nausea on conventional HD
  - Inadequate control of uremic symptoms on conventional HD
  - Excessive recovery time after conventional HD
- Women who are pregnant or planning to conceive

## Contraindications to home hemodialysis

- Unstable medical conditions (e.g., uncontrolled arrhythmia, seizure disorders)
- Lack of suitable vascular access
- Unstable behavioral problems (e.g., uncontrolled psychosis or anxiety, ongoing injection drug use, and alcohol abuse)
- Contraindication to anticoagulant use during dialysis
- Conditions that may cause abrupt loss of consciousness (e.g., severe and unstable intradialytic hypotension)

Adapted from Rioux et al.<sup>4</sup>

Optimal patient selection for home HD involves a balance between enthusiastic program recruitment and careful, shared decision-making to avoid recruiting patients who are either physically or mentally unsuitable for home HD and those who face insurmountable social challenges. As a starting point, home HD programs should aim to engage with and recruit all appropriate patients in their wider dialysis program who would be potentially capable of performing home HD and who would benefit from this therapy. Renal units that have a systematic practice in patient education and decision-making practices tend to have a significantly higher adoption rate toward independent dialysis<sup>6</sup> (see also the supplement article, “Systems to Cultivate Suitable Patients for Home Dialysis”). There are a number of tools to promote home HD to patients, which can be integrated into patient education programs (see also the supplement article, “Home Hemodialysis Needs YOU!”).

It is important for home HD programs to develop an explicit patient selection policy, which includes medical and social criteria for defining appropriate patients. A policy is crucial for driving program recruitment and also for the timely transition of patients to alternative modalities if and when home HD becomes inappropriate. For the patients, a policy makes explicit the requirements for

home HD and ensures they recognize that the therapy is more than simply a lifestyle choice.

It is ideal that an interdisciplinary team, which should include home dialysis nurses, technicians, and physicians, sees all interested patients (see the supplement article, “Workforce Development and Models of Care in Home Hemodialysis”).

Open discussions taking into consideration patient expectations and fears and the perspectives of care providers should be encouraged. Tests that assess hearing, vision, strength, and manual dexterity are helpful when evaluating patient suitability for home HD and results from these tests should be documented accordingly; however, alterations from the norm in the majority of these assessments should not be considered absolute deterrents for home HD.

Many of the initially perceived barriers to home HD can be overcome, often with the assistance of a care partner (see Table 2). A critical role for the interdisciplinary team is not only to identify patient barriers, but also solve them as well.

Another important issue to consider is that of nonadherence, which is a threat to patient safety as well as program credibility and longevity. Nonadherence in the setting of home dialysis is not well understood, although

**Table 2** Potential Barriers to Home HD and Possible Interventions

Factor	Possible Intervention
Unkempt/poor personal hygiene	Hygiene education, dialysis partner
Frail/nonambulatory/bedridden	Physiotherapy, occupational therapy, dialysis care partner
Illiterate	Pictures to train, return demonstrations to verify learning, tape recorders for patient reports
Hearing impaired	Light / vibration for alarms
Brain damage, dementia, or poor short-term memory	Dialysis care partner
No use of either hand	Dialysis care partner
Severely visually impaired or blind	Change to peritoneal dialysis, dialysis care partner
Reduced awareness/ability to report bodily symptoms	Dialysis care partner

Adapted from Schatell et al.<sup>2</sup>

there are some general observations that are relevant to patient selection. One red flag is the case of the “unwilling” patient. Patients who lack control over modality selection have worse outcomes, probably due to resistance to training and nonadherence to treatment.<sup>7,8</sup> Those who are less motivated, therefore, are likely to require extra training to successfully make the transition to home HD. Another key determinant of adherence is patient attentional and coping style. For patients undergoing a complex, self-directed home-based treatment such as home HD, a more vigilant and active coping style is asso-

ciated with more favorable adherence.<sup>9,10</sup> A general classification for nonadherence can be adapted to the home HD setting, and is shown in Table 3.<sup>11</sup> At-risk patients can still be trained, but they need to be managed carefully. This is one situation where support from health psychology is invaluable, especially during the selection process to identify at-risk patients, and also during the training period to mitigate the causal factors that underlie their predisposition.

Once there is agreement from the team that the patient is a suitable candidate and the patient himself has expressed interest in proceeding with home HD, a home inspection can then be scheduled.

For start-up home HD programs, appropriate selection of the first few patients is important to ensure a confident and successful training program in the future. These patients will, in general, be recruited from dialysis facilities and they should be highly motivated, have excellent social support, demonstrate a desire to learn, and most importantly, should have a good rapport with the wider clinical team. Successful home HD patients are a catalyst for program growth. Inviting patients to share their experience and stories to their dialysis peers either in person or by creating video footage is a powerful tool to improve uptake of home HD among others.

## TRAINING AND EDUCATION FOR HOME HD

### Adult learning and home HD

Teaching an adult to perform HD at home may be challenging and there is a paucity of published literature validating any specific training paradigm or program.

**Table 3** Risk Factors for Nonadherence, and Possible Interventions

Category	Examples	Possible Intervention
Procedure-related factors	Needle phobia	Health psychology, anesthetic cream
	Burden of schedule/tasks	Dialysis care partner
	Unpalatable physical effects of treatment	Change to extended hours or frequent hemodialysis
Psychosocial factors	Overwhelming situation/self-esteem issues	Health psychology
	Lack of trust in health professionals	Patient-to-patient peer support
	Unsupported home life	Social work, community house hemodialysis <sup>12</sup>
	Drug or alcohol abuse	Rehabilitation
Deliberate nonadherence	Depression, psychosis, or anxiety	Health psychology, psychiatry
	Attention-seeking	Health psychology, dialysis care partner
	“Infallible” attitude	Health psychology, patient contract
	Risk-taking behavior (eg, adolescents)	Health psychology, patient contract

Adapted from Bullington et al.<sup>11</sup>

The personnel involved in training and supporting the patients and their care partners are important to ensure success of a program. Home HD nurses should be skilled practitioners, typically having a sound practical knowledge of dialysis with at least 12 months experience in managing patients with chronic kidney disease. However, above all, nurses involved in training people for home HD must strongly believe that patients are capable of caring for themselves and have a passion to promote the benefits of home dialysis to their patients. They must enjoy teaching and understand the principles of adult learning and have the ability to invoke followership.

The principles of adult learning presume that adults are actively involved in the learning process and wish to be treated as equals to the teacher. The home dialysis learning process will benefit from having a staff that is informed of patients' and care partners' backgrounds, knowledge, and experience levels before these individuals enter the training program. A training program can then be tailored to allow patients to learn using styles and speeds with which they feel comfortable. Adults are motivated to learn things that they perceive will help them cope with real life issues; therefore, the ability to design active learning lessons that will help them to maintain their dialysis safety and long-term health are always best.

Adult learning is also motivated by a sense of self-esteem and it is important to establish a friendly and open atmosphere, ideally in an informal, relaxed environment. The input of patients and their care partners should be respected and encouraged and there should be frequent positive feedback given to patients as they progress through the training process.

Other unique considerations include the perceptions and reactions of the learners making errors—adults often blame themselves for their errors but do not always learn from their mistakes and make corrections accordingly. Finally, it is important to adapt to patients' different learning styles by using complementary visual, auditory, or kinesthetic techniques. Practically, a good start for any program is the use of training aids that are strong visually, with step-by-step photography to demonstrate the dialysis procedure with a minimal amount of text. These can be very easily developed and tailored for individual patient's needs by the enthusiastic HD dialysis training staff.

Depending on learning style, aids such as DVDs, slide presentations, and/or websites may also be useful for patients and their care partners to peruse at home and this approach has been used successfully in other settings.<sup>13,14</sup> Patients with very low literacy may benefit from the use of more elaborate audiovisual training aids (developed at low literacy levels).

## The training program

Typically, patients are trained at the main home HD facility (i.e., the home HD hub), although it is possible to train at a hospital or satellite HD unit or even in patients' own homes. No matter the venue, it is important to involve care partners early in the process of planning for home HD and in the training of patients. The objectives of the training program are to (i) provide the appropriate amount of information to ensure that the patient will be able to dialyze safely at home; (ii) to enable the patient to monitor and manage other elements of his or her chronic kidney disease, such as obtaining samples for laboratory work and maintaining appropriate nutrition and diet; and (iii) to help the patient and his or her care partner(s) cope with barriers and fears associated with home HD<sup>14</sup> (see also the supplement article, "Psychosocial Aspects in Home Hemodialysis: A Review"). During training, the patient will also receive technical education on the operations and maintenance of the water treatment system.

During training, the ideal nurse trainer-to-patient ratio is typically 1:1. An idealized schedule of training is described in Table 4, with weekly areas of focus and training objectives. In practice, however, training is individualized to address any identified learning barriers or risks for failure. The frequency and duration of actual HD training sessions are also variable, as shown in Table 5. Typically, approximately 6 weeks is necessary to complete training, although this training period tends to be shorter in counties with a low prevalence of patients who complete home HD, such as in the United States, and longer in countries with a higher prevalence of patients who complete home HD, such as in New Zealand. This may be related to the higher degree of patient selection in the United States (i.e., only the most capable and motivated patients undergo home HD) and the reduced availability of "low hanging fruit" for quick training in New Zealand, where training needs to accommodate a more educationally and medically diverse home HD patient population. Before training begins, dialysis professionals and patients should agree on and set an appropriate timeline for training, including incremental milestones that can be used to recognize difficulties in the training process and serve as markers of success.

At the end of each HD training session, there should be discussions with the patient to ensure that learning objectives have been met. Key points should be reiterated, as necessary, and patient understanding should be reaffirmed. At the end of training, the patient should be examined on his or her competency, usually through a written or some other formalized testing system (e.g., a

**Table 4** Weekly education and training for home hemodialysis (HD)

Training week	Education and training focus	Learning objectives
1	General operations of the dialysis unit Learn new vocabulary Proper hand washing technique Self-assessment (blood pressure, weight) Access care	Understand concepts behind HD Learn self-assessment
2	Introduction to dialysis manual Observation of the trainer doing tasks Interpretation of the concepts of self-assessment and dialysis	Set up the HD machine using the manual
3	Setup of the HD machine Equipment preparation Disconnect procedure Alarms management Self-cannulation	Set up the HD machine without using the manual
4	Perform tasks under the supervision of the trainer Alarms management Complications management Meet with technician to learn water management Recirculation procedure	Self-cannulation (may require additional time) Manage complications and alarms
5	Patient performing dialysis alone in absence of nurse	Achieve total independent self-care
6–8	Self-dialyze in the unit until ready for home HD Challenge with alarms and potential complications Formal examination	Complete independence Begin home HD

Adapted from Rioux et al.<sup>4</sup>

practical examination). In our programs, there are home visits made by training staff before and after training. They verify that the home is safe and suitable for home HD and ensure that setup and procedures used for training align with the particular physical arrangements that the patient has at home (e.g., placement of machinery in relation to patient, location of supplies, etc). Our programs also have home HD nurses present at the patient's home for the first treatment to alleviate patient anxiety and ensure proper techniques and procedures are used.

Various programs have adopted the use of simulation training in the context of nursing and medical education.<sup>15</sup> To date, there is a paucity of patient-based simulation education research data available, but some sort of patient-based simulation activity may be of interest and helpful to validate patients' readiness to launch home HD.

### Training failure

To understand the determinants of training failure, Schachter et al. conducted a retrospective cohort study including consecutive patients who began training for home HD at their facility between 2003 and 2011.<sup>16</sup> Of the

167 patients who started training for home HD, 32 were classified as "failure," a term which included any discontinuation of home HD during the first year. The most common reasons for training failure are listed in Table 6; the strongest predictors of "failure" were patients with concomitant diabetes and those living in rental housing.

### Vascular access training in home HD patients

The optimal form of vascular access is undetermined in home HD, but all forms (i.e., arteriovenous fistulas and grafts, central venous catheters) have been used. A detailed discussion of vascular access in the context of home HD is provided in the supplement article, "The Care and Keeping of Vascular Access for Home Hemodialysis Patients."

One of the biggest concerns of performing home HD is the fear of system disconnection. To this aim, multiple prevention and management strategies have been proposed, including the use of wetness detectors (situated proximal to the cannulation sites and/or on the floor), needle taping/fixing strategies, and single-needle

**Table 5** Training program parameters for home hemodialysis (HD)

Program*	Frequency of HD training sessions (per wk)	Number of training sessions required for completion	Training duration (wk)	Proportion of dialysis patients on home dialysis, nationally (2011) <sup>17</sup>	Proportion of dialysis patients on home HD, nationally (2011) <sup>17</sup>
Edmonton, Alberta Canada	4	~24	6	21	3.9
Monash, Victoria, Australia	3	18–24	6–8	27.6	8.8
Geelong, Victoria, Australia	4	16–24	4–6	27.6	8.8
Toronto, Ontario, Canada <sup>18</sup>	3	18–24	6–8	21	3.9
Los Angeles, CA, USA <sup>19</sup>	5	15–30	3–6	8.7	1.3
Helsinki, Finland <sup>20</sup>	4–5	10–34	2–8	22.8	4.2
Lynchburg, VA, USA <sup>21</sup>	5	25–30	5–6	8.7	1.3
Christchurch, New Zealand <sup>22</sup>	4	~43	8–12	51.4	18.2
Auckland, New Zealand	3–4	26–48	12–16	51.4	18.2
Frequent Hemodialysis Network trial group, USA/Canada <sup>23</sup>	3–5	11–59	3–12	3.1/21	1.3/3.9
Dublin, Republic of Ireland <sup>12,24</sup>	3–5	16–30	4–6	10.8	0.9
Kobe, Japan <sup>25</sup>	1–5	~45	8–28	3.2	0.1

\*Personal communications between July 17 and 21, 2014 with Robert Pauly (Edmonton, Alberta, Canada), Peter Kerr (Monash, Victoria, Australia), John Agar (Geelong, Victoria, Australia), Christopher Chan (Toronto, Ontario, Canada), Victoria Kumar (Los Angeles, CA, USA), Eero Honkanen (Helsinki, Finland), Virpi Rauta (Helsinki, Finland), Robert Lockridge (Lynchburg, VA, USA), David McGregor (Christchurch, New Zealand), and Mark Marshall (Auckland, New Zealand).

dialysis.<sup>5,18</sup> Clearly, further technical innovations are needed to improve the safety of vascular access use in home HD, although the cornerstone of patient safety will always be thorough education and training. Safety is discussed in greater detail in the supplement article, “Ensuring Patient Safety During Home HD.”

An equally important concern is the fear of cannulation itself. Different cannulation techniques have been advocated for home HD and are discussed in detail in the supplement article, “The Care and Keeping of Vascular Access for Home Hemodialysis Patients.” The provision of experienced home HD staff and a relaxed, informal, and supportive training environment will assist in alleviating some of the fears patients associate with cannulation. In addition, complementary use of psychotherapy and cognitive therapy to overcome needle phobia and introduction of breathing exercises have been used by patients in other contexts and may be applicable for those patients in home HD.

Central venous catheters are attractive alternatives in home HD because of the ease of use and lower potential for disconnection. Results from a study by Perl et al. showed that catheter survival is higher among home nocturnal HD patients compared with in-center HD patients,<sup>6</sup> which may be due, in part, to higher exposure to heparin. The incidence of catheter-related bacteremia was similar

**Table 6** Reasons for failure to graduate from home hemodialysis (HD) training

Rank	Reason	Proportion of patients (%)
1	Home is inappropriate or cannot be modified for home HD	17
2	Deterioration in medical status	13
2	Cannot cope with burden of home HD	13
2	Patient nonadherence	13
2	Failed training tests	13
3	Insurmountable language barrier	8
3	Inadequate family support	8
3	Imminent renal transplant, decided not to invest further in home HD training	8
3	Financial barriers	8
4	Patient anxiety/nervousness about home HD	4
4	Care partner anxiety about home HD for dependent patient	4
4	Inadequate manual dexterity	4
4	Insurmountable visual impairment	4

Adapted from Schachter et al.<sup>16</sup>

between patients undergoing home nocturnal HD and those patients undergoing in-center conventional HD,<sup>26</sup> however, central venous catheters have a higher rate of infectious complications than more permanent vascular access (i.e., arteriovenous fistulas and grafts).<sup>27</sup> Similar to arteriovenous access, several safety strategies have been advocated for patients using central venous catheters at home. For example, a number of centers support the use of perforated nonremovable central venous catheter caps (also known as closed-connector devices).

## BARRIERS TO HOME HD TRAINING

From the patient perspective, learning home HD is often accompanied by a great deal of anxiety.<sup>14</sup> It is reasonable to assume that all patients are confronted to some degree with multiple concerns, including personal lack of confidence, fear of experiencing a catastrophic event while they are on dialysis, fear of burdening family members with care, and apprehension over suboptimal care.<sup>28</sup> It is important to openly discuss and address concerns and these concerns are almost always surmountable with appropriate support.

Equally important, there are other potential barriers to the implementation of home HD. These barriers include the lack of center, physician, or nursing experience and deficiencies in the actual physical infrastructure for performing and training for home HD. Appropriate workforce development and infrastructure in the home HD hub becomes increasingly important with scaling and expansion of home HD programs, although more modest arrangements are often adequate for start-up or smaller programs (see the supplement articles, “The Home Hemodialysis Hub: Physical Infrastructure and Integrated Governance Structure” and “Workforce Development and Models of Care in Home Hemodialysis”).

Finally, poor education and planning regarding chronic kidney disease are important modifiable barriers to the adoption of nocturnal and wider home HD.<sup>29</sup> Effective cultivation of patients will improve home dialysis uptake in the predialysis stage, but also, in our experience, improve the receptiveness and engagement of patients during the training process (see the supplement article, “Systems to Cultivate Suitable Patients for Home Dialysis”).

## KEY PERFORMANCE INDICATORS FOR HOME HD TRAINING

As in every clinical process, the outcomes of home HD training should be measured. In our programs, these data

have been used in many ways. Documentation of training time and failure rates allow for appropriate planning and funding for growth of the program and more accurate estimates of training infrastructure requirements in the future. For trainers, individual metrics can be an indicator of their effectiveness and highlights the need for further support or oversight in their roles. For patients, analysis of training data may identify groups of patients with different training requirements, such as the need for more frequent training sessions or simply more of them. In some programs, the analysis of such data has offered insights into the most effective pairings between patients and trainers and allowed prospective allocation of patients to trainers who may better suit their learning style or cultural or sociodemographic needs. A variety of key performance indicators can be collected, such as those listed in Table 7. At a minimum, three process outcomes should be documented along with at least one clinical outcome.

## FUTURE STUDIES IN HOME HD EDUCATION

We present a step-by-step account of home HD training to guide providers who are developing home HD programs. Although home HD training is an important step in encouraging patients to consider undergoing dialysis in the home, there is a surprising lack of systematic research in this field. Innovations and research in this area will be pivotal in further promoting a higher acceptance rate of home HD as the renal replacement therapy of choice.

**Table 7** Key performance indicators for home hemodialysis training

Process outcomes
<ul style="list-style-type: none"> <li>• Training time</li> <li>• Training failure rate</li> <li>• Training nurse performance               <ul style="list-style-type: none"> <li>• Self-assessment</li> <li>• Patient satisfaction</li> <li>• 360° feedback</li> </ul> </li> </ul>
Clinical effectiveness measures
<ul style="list-style-type: none"> <li>• Program home hemodialysis technique survival</li> <li>• Patient “near misses” or frequency of intradialytic hypotension</li> <li>• Patient hospitalization rate</li> <li>• Patient adherence with treatments, clinical appointment attendance, and blood tests</li> <li>• Patient adherence with medication, phosphate control, and nutritional and fluid status parameters</li> </ul>

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