Relocation of remote dwellers living with hemodialysis: a time trade-off survey

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ABSTRACT

Background. There has been little research exploring the experience and outcomes of dialysis therapy for people living in rural and remote communities. Remote residence location has previously been associated with excess mortality in hemodialysis (HD) patients, suggesting that relocation to a referral center might improve outcomes. It is unknown whether patients view this approach as acceptable.

Methods. We studied 121 remote-dwelling chronic HD patients using the time trade-off method applied to hypothetical scenarios.

Results. Participants indicated that they would trade a median of 6 years of life in their current location (including current social supports) (95% CI 2.25–7) for 10 years of life in a referral center without any of their existing social supports (meaning they would be willing to forgo 4 years of life to remain in their current residence location). When current social supports were assumed to continue in both locations, people were only willing to forego a median of 2 years of life (95% CI 1–4) to remain in their current residence location. Older participants were much less willing to accept relocation than younger participants; the median time trade-off associated with relocation and without social supports was 2 years for participants aged <50 years, 3 years for those aged 50–69.9 years and 9 years for those aged ≥70 years.

Conclusions. Hemodialysis patients currently living remotely were willing to forgo much of their remaining life expectancy rather than relocate—especially among older participants. These findings suggest that decisions about relocation should be accompanied by discussion of anticipated changes in quality of life and life expectancy.

Keywords: end-stage renal disease, health care services, hemodialysis, remote dwellers

BACKGROUND

There has been little research exploring the experience and outcomes of dialysis therapy for people living in rural and remote communities. In the DOPPS study with nearly 20 994 participants, longer travel time to dialysis was associated with a greater relative risk of death and significantly lower quality of life [1]. Similarly, hemodialysis (HD) patients who live further away from their nephrologist were found to have an increased risk of death compared with those who live closer, even after controlling for confounding variables [2]. One possible explanation for the excess risk of death among remote dwellers is that reduced access to nephrologists and other health services leads to lower quality of care [3]. This finding is worthy of further consideration because residence location is potentially modifiable.

Although patients can change their location of residence, moving is time-consuming, potentially costly and often disrupts employment and social and support networks [4]—which may be especially important among elderly or chronically ill individuals [5], such as those with kidney failure. These financial and social consequences could have a substantial negative influence on quality of life.

Nonetheless, assuming that the relation between residence location and excess mortality is causal, patients might be willing to relocate in exchange for longer life expectancy, even if it meant reduced quality of life. Using a utility measure, the Time Trade-Off, we used hypothetical clinical scenarios to ascertain (i) whether remote-dwelling HD patients would find relocation acceptable; and (ii) their strength of preference...
to avoid relocating closer to a referral center (with on-site nephrology support).

**MATERIALS AND METHODS**

**Participants**

Participants were recruited from the Northern Alberta Renal Program (NARP) from February 2010 to April 2012, specifically from remote dialysis units in Drayton Valley, Fort McMurray, Grand Prairie, Lloydminster, Peace River, Rocky Mountain House, Slave Lake, St. Paul, Stettler, Vegreville, Westlock and Wetaskiwin, Alberta (Figure 1). The remote dialysis units are managed as satellites of the in-center programs those in Edmonton, Red Deer, Calgary, Medicine Hat and Lethbridge. In contrast to patients treated in in-center dialysis units (who are seen in-person by a nephrologist between 1 and 3 times per week), patients in satellite dialysis units are managed by telephone, videoconference and occasional in-person visits.

English-speaking adults (≥18 years), within 8 weeks of commencing HD, were eligible for inclusion in the study provided that they indicated that they could understand the questions in the study survey. Written, informed consents were obtained. The University of Alberta research ethics board approved the study. The medical charts were reviewed for demographic information and medical history, and verified verbally with the participant.

**Survey**

The Time-Trade-Off Technique (TTO) is a health utility measure that involves an assessment of the preference of various health states. The individual is asked to choose between two health states, and the time frames are adjusted until they can no longer choose one option over another. We used the TTO to

**FIGURE 1:** Map of study sites. Edmonton, Red Deer, Calgary, Medicine Hat and Lethbridge are the five referral centers that patients would relocate to in the hypothetical scenarios.
determine participants’ relative preference for residence relocation versus remaining in their own home, following recent recommendations [6]. Advantages of the TTO include its direct linkage to the theoretical basis for utility measurement and that (compared with other methods such as the standard gamble) it is easily understood by respondents and can be completed within a reasonable time [7, 8]. Compared with other methods for evaluating health utility (such as disease-specific rating scales), the TTO may be more responsive to factors that are not related to health status [8]. This is a potential disadvantage for certain applications, but not for the current study, as we were interested in capturing the effect of non-health related factors such as social networks.

Analyses were aimed at determining how many months or years of life each participant was willing to trade for the opportunity to avoid relocation. The survey was administered during a face-to-face interview with a single research assistant, who used a pre-printed questionnaire as a guide. The research assistant asked each question in English and explained further when requested. The participants verbally answered the questions and the research assistant recorded the response on paper.

Each participant was asked to consider scenarios in which they would locate to the in-center unit that was closest to their current dialysis unit. Analyses were aimed at determining (i) utility for the current health state, where 1 represents perfect health and 0 represents death; and (ii) how many months or years of life each participant was willing to trade or forgo for the opportunity to avoid relocation. In general, comparator scenarios assumed 10 years of survival, similar to the median survival for nondiabetic patients with end-stage renal disease (ESRD) on dialysis.

As a warm-up task, we evaluated the participants’ perception of their current health (versus ‘excellent health’; Question 1 in Table 1). This question provides insight as to the respondents’ perceptions of the burden of illness associated with kidney failure, as well as familiarizing them with the time trade-off methodology. We then evaluated participants’ willingness to potentially increase life expectancy through more intensive medical care but without relocation (Question 2 in Table 1). We next assessed the relative merit of years of life spent in their current location versus the closest referral center (close to specialized medical care) where the participant’s existing social supports were not available (Question 3 in Table 1). To examine the perceived value of residence location per se, this scenario was repeated but specifying that their social supports would still be available in the new location (Question 4 in Table 1).

While most scenarios used a comparison survival of 10 years, a final question limited the horizon to 1 year in order to assess the possibility that time preference varied with shorter life expectancy. Worse-than-death states were not considered by our survey. Once an initial response was given, the research assistant adjusted the time frames in subsequent questions using the ‘ping-pong’ method [9], with steps of 1 year for questions 1–4 and 1 month for question 5. All participants appeared to understand the survey; we did not exclude participants for ‘non-trading’ behavior or apparent inconsistencies in results between questions.

### Distance to referral center

We calculated distance from the postal code of the participants’ residence to the closest referral center. We determined the geographic coordinates for each 6-digit postal code using the Statistics Canada Postal Code Conversion File (PCCF;
These coordinates were entered into ESRI ArcInfo 10.0 software (www.esri.com) to determine the shortest distance by road (in km) between the residence of each participant and the closest referral center.

**Statistical analyses**

All analyses were completed in Stata/MP 13.0 (www.stata.com). Descriptive statistics were reported as counts and percentages or medians and inter-quartile ranges or 95% empirical confidence intervals, as appropriate. The confidence intervals were bootstrapped using 1000 repetitions of sampling with replacement. Because the distributions of the response variables examined were non-Gaussian, means with standard deviation were not reported, and differences between subgroups were tested using the Kruskal–Wallis test and Fisher’s exact test. The following subgroups were explored as potential modifiers: age (<50, 50–69.9, ≥70 years), gender, diabetes, distance to closest referral center and number of comorbidities (0 or 1, 2 or 3, 4 or more). Distance was dichotomized at ≥150 km as per prior work [10]. In post hoc analyses, we used the Spearman Rank correlations and the Kruskal–Wallis test, as appropriate, to explore associations between distance as a continuous variable and the response variables.

**RESULTS**

We approached 192 remote-dwelling HD patients about participation in this study (Figure 2). Of these, 71 were excluded (48 due to lack of interest and 23 who were not eligible to participate). Characteristics of the 121 participants are shown in Table 2; the majority (51.2%) were between 50 and 69.9 years of age. Participants resided, on average, 120 km from the closest referral center. The characteristics of study participants were very similar to the underlying incident dialysis population in our health region [10], except that participants were less likely to have a history of heart failure (13 versus 32%) and peripheral vascular disease (24 versus 44%).

Not every participant answered all five of the survey questions; responses were missing from five to eight participants on each question (Table 3).

Overall, participants indicated that they would trade a median of 6 years of life in their current state of health for a median of 7 years of life in their current residence location. Participants indicated that they would trade a median of 8 years of life if they moved to a referral center, participants were only willing to trade a median of 6 years of life in their current location (including current social supports) (95% CI 5–9) for 10 years of life in a referral center.

Interestingly, not all participants were interested in closer medical follow-up even at their current location of residence: 20% indicated that they would prefer the status quo to weekly visits from their nephrologist. For this question, responses from participants aged >70 years were similar to those aged <50 years, with participants aged 50–70 displaying the highest demand for weekly nephrologist visits. Finally, in scenarios where life expectancy was assumed to be only 1 year if they moved to a referral center, participants were only willing to...
Table 3. Results of time trade-off analyses

<table>
<thead>
<tr>
<th>Question</th>
<th>a</th>
<th>b</th>
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<th>d</th>
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<tr>
<td>N 116</td>
<td>115</td>
<td>114</td>
<td>113</td>
<td>113</td>
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</tr>
<tr>
<td>Overall</td>
<td>Median 3 years</td>
<td>80.0%</td>
<td>Median 4 years</td>
<td>95% CI 3–7.75</td>
<td>Median 2 years</td>
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<tr>
<td>Age:</td>
<td></td>
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<tr>
<td>&lt;50 years</td>
<td>Median 2 years</td>
<td>69.0%</td>
<td>Median 2 years</td>
<td>95% CI 1–3</td>
<td>Median 0 years</td>
</tr>
<tr>
<td>50–69.9 years</td>
<td>Median 3 years</td>
<td>89.8%</td>
<td>Median 3 years</td>
<td>95% CI 2–4</td>
<td>Median 2 years</td>
</tr>
<tr>
<td>≥70 years</td>
<td>Median 5 years</td>
<td>70.4%</td>
<td>Median 9 years</td>
<td>95% CI 3–6.5</td>
<td>Median 9 years</td>
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<tr>
<td>Gender:</td>
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</tr>
<tr>
<td>Male</td>
<td>Median 3 years</td>
<td>80.3%</td>
<td>Median 4 years</td>
<td>95% CI 2.5–5</td>
<td>Median 4 years</td>
</tr>
<tr>
<td>Female</td>
<td>Median 2 years</td>
<td>79.3%</td>
<td>Median 5 years</td>
<td>95% CI 2–3</td>
<td>Median 2 years</td>
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<tr>
<td>Diabetes:</td>
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<tr>
<td>Yes</td>
<td>Median 3 years</td>
<td>82.8%</td>
<td>Median 4.5 years</td>
<td>95% CI 2–5</td>
<td>Median 3 years</td>
</tr>
<tr>
<td>No</td>
<td>Median 3 years</td>
<td>76.5%</td>
<td>Median 4 years</td>
<td>95% CI 2–4</td>
<td>Median 2 years</td>
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<tr>
<td>Distance to closest referral center:</td>
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<tr>
<td>≥150 km</td>
<td>Median 3 years</td>
<td>73.6%</td>
<td>Median 5.5 years</td>
<td>95% CI 2–5</td>
<td>Median 4 years</td>
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<tr>
<td>&lt;150 km</td>
<td>Median 2.5 years</td>
<td>85.5%</td>
<td>Median 3 years</td>
<td>95% CI 2–3.5</td>
<td>Median 1.5 years</td>
</tr>
<tr>
<td>Number of comorbidities:</td>
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<tr>
<td>0 or 1</td>
<td>Median 2 years</td>
<td>70.8%</td>
<td>Median 1 year</td>
<td>95% CI 2–3</td>
<td>Median 1 year</td>
</tr>
<tr>
<td>2 or 3</td>
<td>Median 3 years</td>
<td>82.3%</td>
<td>Median 6 years</td>
<td>95% CI 2–5</td>
<td>Median 2 years</td>
</tr>
<tr>
<td>4 or more</td>
<td>Median 3 years</td>
<td>82.8%</td>
<td>Median 4 years</td>
<td>95% CI 2–5</td>
<td>Median 4 years</td>
</tr>
</tbody>
</table>

If you had to choose between staying in your current location with your current health, the same medical care and same supports as you have now COMPARED WITH staying in your current location with your supports, having weekly kidney doctor visits and therefore improved health, more access to other specialist. Which would you choose? The proportion that chose

The presented medians and confidence intervals give the time that the participant is willing to trade.

For age categories, there was a trend towards participants who resided further away indicating larger trade-offs. In post hoc analyses, we calculated Spearman Rank correlations for Questions 1 and 2 or 3.

For participants aged <50 years, 3 years for those aged 50–69.9 years and 9 years for those aged ≥70 years. Put differently, participants aged ≥70 years indicated that they would value 1 year of life in their current location (with current supports) equally to 10 years of life in a referral center with or without their existing social supports. The number of comorbidities also modified the willingness of participants to relocate (Table 3): participants with more comorbidities were less willing to relocate than those with fewer. However, the differences across categories by comorbidity were less pronounced than those for age categories.

While distance (from the referral center) dichotomized at 150 km did not significantly modify preference for not relocating, there was a trend towards participants who resided further away indicating larger trade-offs. In post hoc analyses, we calculated Spearman Rank correlations for Questions 1 and 2 or 3.
3 through 5 (and performed a Kruskal–Wallis test for Question 2) and found that participants living further away at baseline were less willing to relocate than those living closer (Question 1 $p = 0.19$, $P = 0.047$; and Question 4 $p = 0.19$, $P = 0.048$).

All results were very similar in a sensitivity analysis that excluded the eight participants who had less than 8 weeks of dialysis experience (data not shown).

**DISCUSSION**

Hemodialysis is associated with poor quality of life; median utility among participants in our study was only 0.7, representing a substantial decrement compared with perfect health [11-14]. A key finding of our study was that most remote-dwelling HD patients place a high value on remaining in their current residence location—even when relocation to a referral center did not involve loss of existing social supports. Given that reduced access to social supports is an anticipated consequence of nearly all such relocations, it is notable that participants were willing to forgo 4 years of life to remain in their current residence location. A second key finding was the age-dependence of results: with younger participants placing a lower relative value on avoiding relocation and a higher relative value on longer life expectancy.

The link between remote or rural residence location and increased mortality among HD patients is based on observational data [2]. The relatively small magnitude of the apparent increase in relative risk (8-20%), the potential for residual confounding and the lack of trial data mean that causality is uncertain. Data from other studies support the potential benefits of aging in place (remaining in one’s own home or community in spite of potential changes in health and functioning in later life) [15]. These considerations together with the results of the current study argue strongly against a policy of routinely proposing relocation to remote-dwelling HD patients as a method of reducing mortality.

Our results may have broader implications for the common practice of transferring ill or failing patients from remote communities to receive HD in referral centers. The low tolerance for relocation (especially in the absence of social supports) reported by participants in our study suggests that this practice may not always be justified—especially for those aged $\geq$70 years. In fact, our findings likely support the increased use of peritoneal dialysis wherever possible for such patients—which might avoid the need for relocation to an area served by an in-center HD unit. Overall, our findings suggest that the potential benefits of relocation should be carefully explored with patients and their families, ideally using a decision aid. This may help patients to make a decision about relocation that is consistent with their values and preferences—and potentially to remain in their own communities even if this leads to lower access to care and/or shorter life expectancy. Further consideration could also be given to supporting people in rural and remote areas to remain in their home communities—perhaps on home dialysis if feasible [14]. Research evaluating the outcomes and cost-benefits of local clinics, home visits and telehealth initiatives could be considered.

Our study has some limitations that should be considered when interpreting results. First, it used hypothetical scenarios rather than real world situations to estimate people’s strength of preference for avoiding relocation. Although we used rigorous methods to perform our time trade-off analysis, the extent to which responses correspond to the true values and preferences of participants is uncertain. In addition, there are other methods for valuing utility [6, 16]; for assessing how residence location might have affected utility (e.g. conjoint analysis [17]); and for assessing quality of life (e.g. EQ-5D and SF-36) that could have been used—although it is uncertain whether any of these alternative methods would have affected our results concerning relocation. Second, all participants were drawn from a single large HD program in a Western Canadian province; there were no major differences between those who did and did not participate in the current study. Although the characteristics of participants were broadly similar to the overall Canadian HD population [18], our findings require validation in other patient populations and clinical settings. Third, approximately 20% of participants appeared to be non-traders, meaning that they were unwilling to make hypothetical choices that imply a change from their current circumstances. As recommended by guidelines, we included these individuals in our analyses. The proportion of non-trading participants approaches 60% in some populations [19], suggesting that these participants did not unduly affect our results. Finally, the default comparator for most scenarios implied a life expectancy of at least 10 years, which may be longer than the life expectancy of many HD patients. When life expectancy was explicitly limited to 1 year, while the majority of participants appeared to be less accepting of relocation, this trade-off was modified by age. Participants <50 years were more willing to relocate. Participants 50–70 years of age were less willing and the preference of participants aged >70 years did not change compared with the baseline scenario. This suggests that any assessment of preferences related to relocation may be most useful to patients if accompanied by a sensitive discussion of anticipated life expectancy.

In summary, in this study of remote-dwelling HD patients, we found people were willing to forgo a substantial number of years of life rather than relocate to a referral center—especially among older participants. These findings suggest that decisions about such relocation should be made in the context of a careful discussion of anticipated changes in quality of life and life expectancy.

**AUTHORS’ CONTRIBUTION**

M.T. conceived the study. M.T. and S.K. designed the time trade-off questions. M.T. and N.W. drafted the manuscript. N.W. performed the statistical analyses. All authors have made substantial contributions to the development of the manuscript, and have all been involved in revising it for important intellectual content and approved the final version.
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CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES


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