



Induced demand in kidney replacement therapy

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ABSTRACT

There are three notable aspects of the current kidney replacement therapy program. First, the number of patients on home dialysis has dropped substantially over the last decades. Second, the rate of transplantation has stabilized in recent years. Third, there is variation in referral rate for transplantation among hospitals. These trends are the result of overutilization of in-center dialysis and that demand for kidney replacement therapy is moderated by suppliers.

Current healthcare policy leads to overutilization of in-center dialysis and underutilization of home dialysis and transplantation. This overutilization is the result of supplier-induced demand and leads to suboptimal care for patients and excessive healthcare expenditures. The main drivers of this overutilization are the overcapacity of in-center dialysis beds and the high financial disincentives on empty dialysis beds. Policymakers should address this by reducing dialysis capacity and increasing the capacity of transplantation facilities.

This is the first attempt to address the overutilization and the nonalignment of supply and demand by looking at the capacity of in-center dialysis and the financial disincentives for physicians on empty in-center dialysis beds. In our analysis, we conclude that limiting the capacity of in-center dialysis beds is the most effective strategy to better align supply and demand, which will result in better patient outcomes and lower societal costs.

1. Introduction

Patients with end-stage kidney disease (ESKD) need kidney replacement therapy (KRT) to survive. There are four major types of KRT: hemodialysis (HD), peritoneal dialysis (PD), deceased donor kidney transplantation (DDKT), and living donor kidney transplantation (LDKT). Transplantation is a better treatment option for patients compared to the dialysis modalities in terms of quality of life and survival [1–3]. On top of that, transplantation is also less costly for society in the long run [4].

HD is typically carried out in dialysis centers, while PD is carried out at home. There is no significant difference in quality of life among the dialysis modalities [1]. However, studies suggest that PD and home hemodialysis allow greater flexibility for patients and result in better psychosocial outcomes [5]. Some studies also found a better survival and quality of life for patients undergoing home dialysis compared to in-center dialysis. However, it is unclear whether this is causative or a reflection of a healthier population selected for home dialysis [6]. Cost differences between in-center dialysis and the home dialysis modalities

vary significantly. There is evidence that home dialysis is the most economically efficient dialysis modality, also in terms of labor costs [7, 8]. In the Netherlands, costs of in-center dialysis are marginally higher than the costs of the home dialysis modalities, approximately €71,000 vs €67,000 [4].

Between the two transplantation modalities, LDKT is preferable to DDKT, as it provides better graft and patient survival [9]. LDKT is also substantial less costly for society than DDKT [4]. Moreover, patients living with a functioning donor kidney are more likely to be part of the labor force than dialysis patients [10]. Unfortunately, access to transplantation is accompanied with difficulties. There is a scarcity of deceased kidney donors worldwide. To qualify for a DDKT, a patient is typically put on a waitlist and the waiting time starts of the first day of dialysis. The average wait time is approximately 2–4 years in Europe [11]. As the supply of deceased kidney donors has shown to be constant over many decades, LDKT is the only transplant modality at this time to have a clear potential for growth [12].

Although superior in terms of outcomes, access to LDKT is not without difficulties [13]. The extent to which patients are supported by

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professionals in finding a living donor varies greatly. Obstacles to find a donor include a lack of knowledge about the treatment options and difficulty initiating a conversation to ask family and friends to donate their kidney [13,14]. In the last two decades, several successful initiatives have been undertaken to address these difficulties in access [15]. Most notably, home-based educational interventions have shown to increase the number of LDKTs [16,17]. Innovative allocation programs, such as kidney exchange programs, have increased the possibilities for patients to receive a donor kidney despite blood or tissue incompatibility [18,19]. Currently, so-called ‘HLA-incompatible’ and ‘ABO-incompatible’ direct transplantations are also possible [20].

Preemptive transplantation is a transplantation that is performed as the first treatment option for patients. Preemptive transplantation is associated with superior (graft) survival, as the lasting effects of health deterioration by dialysis are avoided [21]. For these reasons, the guidelines for nephrology state that the preferred treatment option for patients eligible for transplantation is a preemptive transplantation [22].

1.1. Problem definition

Although some treatment options have clear advantages over others, there are some problematic trends in the international kidney replacement therapy program. First, it is estimated that 40% of the ESKD-patients dependent on dialysis are eligible for home dialysis [23]. However, in many countries the proportion of patients on home dialysis is decreasing, while the utilization of in-center dialysis remains high [24]. Research on the perceived underutilization of home dialysis suggests that the choice of modalities is most likely physician-driven rather than patient-driven. Approximately 75% of incident HD-patients do not recall having home dialysis discussed at the time of initiating treatment, on the other hand, 33% of the incident home dialysis patients do not recall having HD discussed [25]. Indicating that initiating home dialysis is less often discussed with patient than in-center dialysis. Fig. 1 shows the center variation in percentage of home dialysis three months after the start of dialysis in the Netherlands.

Second, even though access to LDKT has improved in recent years, due to improved allocation programs and medical innovations, the LDKT-rate has either stabilized or declined slightly in many developed countries [27,28]. There are no apparent reasons for this trend. Third, although preemptive transplantation is the preferred treatment, there is

a large variability in the referral rate for preemptive transplantation [29]. For instance, in the Netherlands, the variation in referral rate among hospitals ranges between 0% and 40% of their incident patients, see Fig. 2 [26].

In this article, we argue that the decrease in the number of home dialysis patients, the stabilization of the LDKT-rate, and the variation in referral rates for preemptive transplantation are mainly the result of current healthcare policy. We argue that there is overutilization of in-center dialysis and that demand for KRT is moderated by suppliers. The overutilization is the result of overcapacity of in-center dialysis facilities and financial incentives. Consequently, current policy leads to suboptimal care for ESKD-patients and excessive healthcare expenditures. In this paper, we suggest policy changes that may improve care for patients.

2. Methods and materials

To justify these recommendations, we looked at international research on the utilization rates of kidney replacement therapies in countries with a developed healthcare system. Literature that focused on organizational, policy-related and economic aspects of access to dialysis and transplantation care was selected. To support our claims further, Dutch publicly available records were used. Data on incidence, prevalence and the number of dialysis centers were calculated using empirical data from the Dutch Renal Registry ‘Renine’. The Renine database contains information concerning all Dutch patients who underwent a non-experimental form of KRT. Data was analyzed using IBM-SPSS Statistics version 25 (SPSS Inc., Chicago). Findings were reported along the lines of the effects of capacity and financial aspects on the KRT-program.

3. Results

3.1. The role of capacity

In 1959, ‘Roemer’s Law’ was formulated, which states that a “bed built is a bed filled” [30]. This claim was supported by other studies that found compelling evidence for a positive relationship between bed availability and healthcare utilization rates [31,32]. This observation is linked to ‘supplier-induced demand’, which refers to the notion that hospitals fill their beds regardless of the underlying demand for hospital

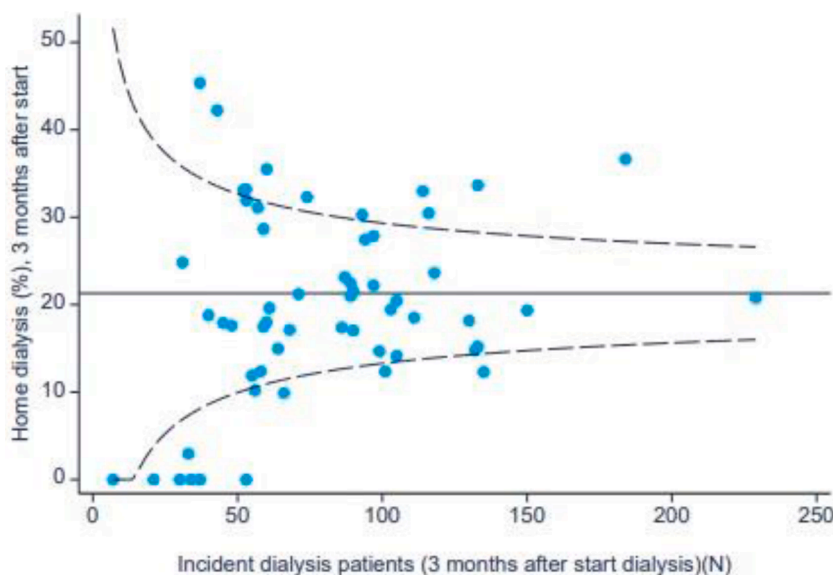


Fig. 1. Center variation in percentage home dialysis three months after start dialysis. Home dialysis includes peritoneal dialysis and home hemodialysis. Data is adjusted for age, sex, SES, and primary kidney disease categories. Inclusion period 2018–2020. Source: Nefrovisie [26].

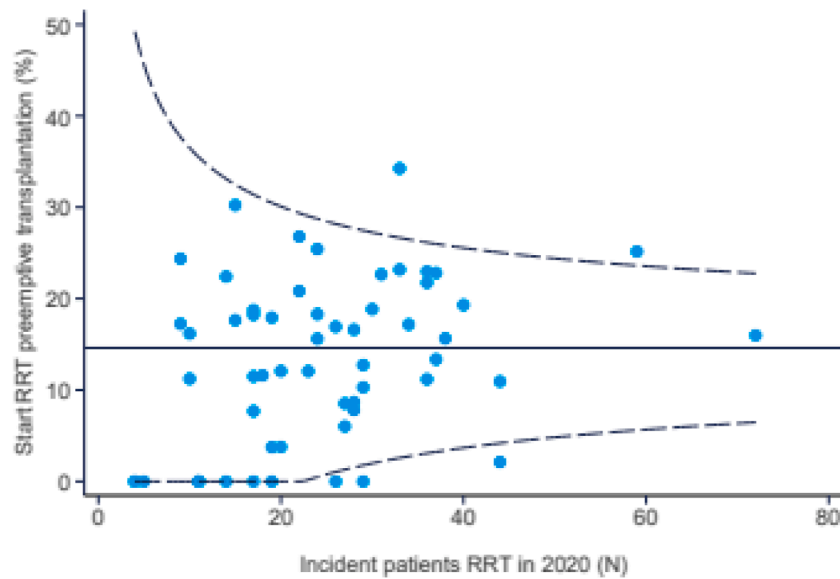


Fig. 2. Center variation in percentage preemptive transplantations in incident KRT-patients in 2020. Adjustments were performed for age, sex, SES, and primary kidney disease categories. Source: Nefrovisie [26].

care, i.e. that healthcare professionals do not always act as perfect agents for patients [33]. We argue that this mechanism is present in the current KRT-program, which has led to a decrease in the number of home dialysis patients, less attention to (preemptive) transplantation and lower referral rate.

3.1.1. Dialysis capacity

Dialysis capacity has already been linked to induced demand. A North-American study reported that a rapid increase in the number of in-center dialysis facilities creates incentives to keep operating at capacity and, consequently, reduces the number of patients on home dialysis [25]. A similar trend can be found in the Netherlands. In 2000, a policy regulation came into force which deregulated the construction of new dialysis centers [34]. The rationale behind this deregulation was to improve access to in-center dialysis, as a substantial number of the

patients had to travel a considerable distance to reach the nearest dialysis center. This was objectionable given that dialysis is a time-consuming, tiring and frequent treatment. This deregulation indeed improved access, as it led to a doubling of the number of dialysis centers, from approximately 50 in 2000 to more than 100 in 2017, while the incidence rate increased substantial less. This is visualized in Fig. 3.

Parallel to this rapid increase in dialysis centers, there was a decrease in patients undergoing home dialysis. In 2000, 30% of the dialysis patients underwent a form of home dialysis, while in 2012 this percentage was 19%, which stabilized thereafter. Initiatives were undertaken to reverse this trend, but so far these have been unsuccessful [35]. There does not seem to be an apparent reason for this decrease as there were no significant changes in financing, production or delivery of home dialysis in this period. One hypothesis is that patients were directed towards in-center dialysis to prevent empty beds, indicating the presence of

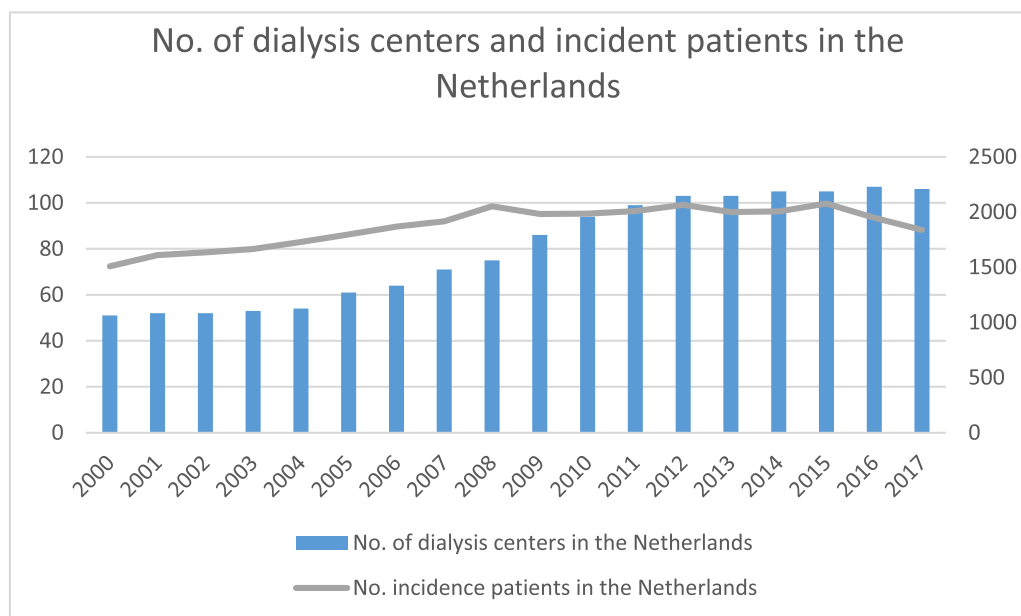


Fig. 3. The number of dialysis centers in the Netherlands (primary Y-axis), and the number of incident patients (secondary Y-axis). Source: Dutch Renal Registry ‘Renine’.

induced demand. Dutch Members of Parliament were aware of the trend, and expressed their concern, as it could endanger the freedom of treatment choice for patients, and a potential loss of quality of home dialysis care due to lower utilization [36].

The deregulation of the construction of new dialysis centers most likely led to a disproportionate increase in the utilization rate of in-center dialysis. One could argue that this has led to suboptimal care for patients. One solution to this induced demand is reducing the capacity of in-center dialysis. If an increase of dialysis beds resulted in overutilization, a decrease of capacity may lead to a lower utilization rate. Reducing (hospital) beds has proved to be an effective strategy to reduce overutilization in healthcare, as several European countries have cut down on the number of hospital beds in the past to reduce utilization of hospital care [37]. By reducing the capacity of in-center dialysis, nephrologists would be stimulated to look for alternatives beyond in-center dialysis, such as home-dialysis and (preemptive) transplantation.

Reducing capacity can be achieved in several ways by various actors. First, health insurers may restrict or stop reimbursement contracts with hospitals that have inadequate referral rates. This may entice hospitals to look at alternatives beyond in-center dialysis and consequently reduce their capacity. Reducing capacity may also be government-led, for instance, by introducing a so-called ‘certificate-of-needs’ regulation, which may help in aligning the supply and demand for KRT. Certificate-of-needs programs attempt to reduce the construction of unnecessary healthcare facilities and to limit the acquisition of costly equipment that provides little benefit for patients. Certificate-of-needs programs are associated with a significant reduction in healthcare capacity, up to 10% [38].

Some considerations should be taken into account when arguing for a decrease of the in-center dialysis capacity. For instance, it is expected that the global incidence of patients with ESKD is going to increase due to the aging population and accompanying comorbidities [39]. Although over the last decade the incidence rate in the Netherlands did not increase, it is not to say that this stability will continue in the future. Especially considering the negative impact of the COVID-19 pandemic on kidney care. In the Netherlands, there was a scarcity of ICU-beds which led to a substantial drop in the number of kidney transplantations. Consequentially, the waitlist for transplantation has increased. Moreover, infections with COVID-19 may result in kidney damage, which is especially troublesome for patients with kidney failure when infected [40]. The aging population and the aftermath of the pandemic may lead to an increase in the demand for dialysis beds. We therefore argue for a lower ratio of dialysis beds to incidence rate. Furthermore, travelling distance for patients to dialysis centers should be kept to a minimum, as the treatment is already time-consuming and burdensome for patients. Finally, one has to bear in mind that some patients prefer in-center dialysis to home dialysis. Reasons for this include that some patients (1) do not want to ‘hospitalize’ their home, (2) do not want to commit time required for training for home dialysis, and (3) prefer the social function of in-center dialysis [41]. These factors should be taken into account while reducing the capacity of in-center dialysis.

Recommendation:

- *The ratio of capacity of in-center dialysis to incidence rates should be lowered.*

3.1.2. Transplantation capacity

In the Netherlands, solely the eight university hospitals are allowed to perform transplantations. As a reduction of in-center dialysis will likely lead to an increase in the number of (preemptive) transplantation referrals, this could potentially be troublesome for the current KRT-program. Particularly because many transplant centers already have a waitlist for LDKT, a trend that started even before the COVID-19 pandemic. This suggests that the main scarcity problem for LDKT at

the moment is no longer the scarcity of willing kidney donors, but rather the capacity to transplant the available kidneys. This lack of transplant capacity is especially alarming, as it can be expected that the supply of kidney donors will further increase in the coming years [42]. Moreover, it can be expected that medical and allocation innovations will further increase the eligibility of patients and donors for transplantation, such as improved HLA- and ABO-incompatible transplantations, as well as improved exchange programs. All these developments are likely to lead to greater availability of kidneys for transplantation, and consequently, lead to an even longer waitlist for LDKT. For some patients this could result in missing out on a preemptive transplantation.

We therefore suggest to increase the total transplant capacity. Preferably, the capacity will be increased within the current transplant centers. Mainly because centralization of treatment of complex surgeries is associated with better quality of care and lower costs [43]. In the case that the transplant centers will not have sufficient opportunities to increase their capacity, large regional hospitals may be able and allowed to conduct transplantations.

Recommendation:

- *Capacity of transplant facilities should be increased.*

3.2. Financial aspects

One of the reasons why physicians induce demand is financial self-interest [44]. It is well established that physicians/hospital managers respond to financial incentives and are able to influence demand to adhere to these financial incentives [45]. It therefore makes sense to change incentives for physicians. For example, by incentivizing home dialysis and transplantation and/or to change payment methods for physicians. Below, we discuss possible changes for financial rewards.

3.2.1. Financial (dis)incentives

Reimbursement rates for the different dialysis modalities differ significantly across countries [46]. A recent study on dialysis reimbursement in 81 countries show that most healthcare systems favor the use of in-center dialysis. But even in countries where home dialysis is better reimbursed, the percentage of patients on home dialysis is low [47]. This is also the case for the Netherlands; most home dialysis modalities are better reimbursed than in-center dialysis, while the use of home dialysis is relatively low [4].

Incentivizing treatment options by increasing the financial rewards for physicians is an established strategy. This strategy is also used in the KRT-program to promote home dialysis. A literature review on whether financial incentives could increase the use of home dialysis shows effect, albeit limited [48]. This suggests that changing financial incentives alone will not always be sufficient and should be accompanied with other policy changes. Although the use of financial incentives has relatively limited effect, we still argue that behavior that follows the guidelines should be rewarded, and hence, referral for transplantation and home dialysis should be incentivized.

Financial disincentives may have a larger impact on the utilization of in-center dialysis than positive incentives. Empty dialysis beds are costly for nephrologists and hospitals. A survey among US nephrologists showed that a substantial portion of the nephrologists acknowledges the detrimental financial impact of transplantation on nephrologists’ practice as it leads to empty in-center dialysis beds [49]. This financial impact is also present in the Netherlands, as physicians are typically involved in independently organized per-specialty partnerships, the so-called ‘maatschap-structure’ [50]. Consequently, empty dialysis beds directly affect a physician’s income. A reduction in income is difficult to accept, even if the rationale of such a reduction is based on the best outcome for patients and society. ‘Prospect theory’ predicts that physicians respond to financial disincentives rather than to positive incentives, as the theory suggests that people have a strong aversion to loss [51]. This may explain the limited effects of incentivizing home dialysis

and transplantation. It seems therefore vital to diminish and/or contain the financial disincentives of redundant beds.

Reducing capacity of in-center dialysis may be an effective strategy to reduce the total financial disincentives of empty beds. Incentivizing referrals for transplantation and/or home dialysis may also influence physician behavior. Another strategy is to detach the physicians' income from redundant dialysis beds.

Recommendations:

- Incentivize preemptive transplantation and home dialysis.
- Remove disincentives of empty in-center dialysis beds.

3.2.2. Payment schemes

The interests of doctors and hospitals do not necessarily always align with the interests of patients and society [52]. It makes therefore sense to devise a payment system in such a way that the interests of physicians, patients and society are more aligned. In many countries, physicians are paid for every unit of healthcare they produce; the fee-for-service method. A fee-for-service payment system has been internationally associated with induced demand and overutilization of care [53]. Fee-for-service has also specifically been linked to overutilization of in-center dialysis. A study in the US showed that the transition from a capitation-based payment system to fee-for-service resulted in more patients undergoing in-center dialysis and fewer patients on home dialysis [54].

The Netherlands also has a type of fee-for-service payment system, although the Dutch government intends to replace this payment system with a salaried employment for physicians to reduce wrongly placed financial incentives. Indeed, salaried employment is associated with improved quality of care, while minimizing supplier-induced demand. However, it is also associated with reduced productivity [55]. Capitation-based payment may also be considered, as it is also associated with a reduction in supplier-induced demand, but it may result in rejecting or referring out the relative less healthy patients [56]. In kidney care this may lead to adverse effects for patients who are not eligible for transplantation or home dialysis.

Research on payment schemes for physicians to balance cost containment and quality of care is widespread, but the perfect scheme has not yet been found. Designing a system in which medical decisions are not affected by financial compensation is complex and there is no empirical evidence of an existing remuneration or payment scheme that is perfectly aligned with the interests of patients and society. Internationally, there is consensus that a blended payment scheme, with characteristics of fee-for-service with a salary or capitation component is the best way forward to contain costs while maintain quality and productivity [57].

Improving quality in healthcare may also be done by introducing a pay-for-performance (P4P) component to a payment scheme. A P4P-system rewards physicians on achieving certain clinical targets and quality goals. Ideally, a P4P-system is 'decoupled' from base payments and should be tailored to the specific setting of implementation [58]. In kidney care, one of the performance targets may be a minimal referral rate for transplantation or home dialysis, adjusted for patient-mix. This may incentivize the hospitals that have low referral rates to look beyond in-center dialysis. Although theoretically appealing, evidence of the effectiveness of a P4P-system is currently lacking. Empirical evidence is needed to confirm the effectiveness of P4P in kidney care.

Recommendations:

- Payment schemes for physicians should be devised in such a way that medical decisions are less affected by financial compensation.
- Empirical research should be conducted to confirm the effectiveness of a pay-for-performance component.

4. Discussion

In this paper, we argued that financial disincentives and over-capacity are the main causes for overutilization of in-center dialysis. It is well established that physicians respond to financial incentives, however, some may argue that alternative explanations for the overutilization of in-center dialysis exist beyond supplier-induced demand. Below, we will discuss some of these explanations.

4.1. Alternative explanations

Although physicians respond to financial incentives, they are bound by their intrinsic ethical restraints, such as the do-no harm principle. Research has shown that this is more important in the decision-making process for physicians than financial incentives [53]. This line of reasoning implies that some nephrologists are less aware of the harmful effects of dialysis, even though research has repeatedly shown that dialysis has a lasting detrimental effect on patients, even after a patient undergoes transplantation [59]. Physician education on the medical and psychosocial consequences of the different KRT-options can therefore help to improve the current KRT-program. Some studies indeed suggest that the underutilization of preemptive transplantation can be partly explained by a lack of knowledge on timely referral [60]. A study in the US suggests that nephrology trainees perceive low and moderate levels of preparedness for managing home dialysis [61]. A study in Europe also suggests that inadequate physician education is more likely to be the cause of low utilization than, for instance, patient-mix [62]. This would warrant improved physician educational programs.

Some scholars argue that supplier-induced demand is nothing more than using the available capacity to its limit. Physicians may believe this is the most appropriate thing to do as a healthcare professional, as not using available care can be seen as a waste [63]. This reasoning underlines that the overutilization is physician-driven, and one cannot rely on optimal utilization of current capacity by physicians. This does not just result in suboptimal care, but unrestricted use of resources in one healthcare sector will have consequences in other sectors. It is the society responsibility of healthcare professionals to take these considerations into account.

Alternatively, a more cynical explanation of the difference in utilization of in-center and home dialysis may exist. Some global listed companies make substantial profits on in-center dialysis, and have financial interests in promoting the use of in-center dialysis, while preventing the use of home dialysis. The magnitude of commercial forces likely differs between countries and healthcare systems. The role of these commercial interests in the overutilization of in-center dialysis should be investigated further.

4.2. Future research

Although we found indications for the presence of supplier-induced demand in the KRT-program, we did not present empirical evidence for these claims. More research on the relation between practice variation and financial incentives or payment schemes, would support the argument for supplier-induced demand greatly. Future research on the effect of a blended payment system and P4P-components to promote productivity and quality is also needed. From a policy perspective, it is important to determine how much the capacity of in-center dialysis should be reduced. In many countries, the incidence of patients with ESKD is increasing. Severely reducing the capacity may lead to unwanted results, as for a significant portion of the patients in-center dialysis is the only viable treatment option. Thus, reducing capacity of in-center dialysis should be done carefully.

5. Conclusion/Policy recommendations

Patients with ESKD do not always have equal access to all treatment

options. This inequality is accompanied with a decrease in life expectancy and quality of life for patients, and larger healthcare expenditures for society. We argued that the demand for in-center dialysis is lower than currently supplied, and that operating at an overcapacity is financially incentivized. From our analysis, we conclude that limiting the relative capacity of in-center dialysis beds is the most effective strategy to better align supply and demand. Eliminating financial disincentives of empty in-center dialysis beds should accompany such reduction. In parallel, transplantation capacity should be increased. As long as the remuneration system for care for ESKD is based on a fee-for-service for physicians and dialysis centers, reduction of the dialysis capacity and eliminating the financial incentives are the only health policies that could improve kidney care and reduce the unequal access of all treatment options.

Ethics approval

Ethical approval for this study was not required.

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Declaration of Competing Interest

There are no competing interests

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