

# Kidney paired donation and the unique challenges of kidney shipment in Canada

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## SUMMARY

Kidney paired donation (KPD) programs are an effort to bridge the disparity between kidney supply and demand. These programs combine several incompatible donor–recipient pairs in a national paired exchange database, thereby increasing the number of compatible matches. But KPD programs face unique challenges, particularly the large distances that often separate donors and recipients. Here we discuss key factors to consider when transitioning from a donor travelling model to a kidney shipment model in the Canadian context.

The kidney paired donation (KPD) program represents the most recent effort to bridge the disparity between kidney supply and demand and has led to improved numbers of transplants in recent years.<sup>1</sup> The KPD program combines several incompatible donor–recipient pairs together in a national paired exchange database, thereby increasing the number of compatible matches significantly. It also provides exposure to a larger national donor pool for highly sensitized recipients, thus maximizing opportunities to find a compatible match.<sup>1</sup>

While improving access to living donor kidneys, KPD programs also encounter unique challenges, in particular the large distances that often separate the donor and recipient. In addition to geographic distance, kidney shipment in Canada is challenged by several variables, such as a relative lack of commercial airlines, limited rail systems, frequent weather delays and congested provincial highways connecting major cities.

Two options have been considered to deal with this transportation dilemma. Either the donor travels to the recipient centre to donate their kidney (travelling donor model), or the kidney is shipped to the recipient centre (kidney shipment model). The majority of KPD programs worldwide use the kidney shipment model, as it provides many advantages, such as increased convenience for the donor who donates at a hospital closer to their home, thereby making support systems more available, while decreasing expenses involved in donor travel. Additionally, donor workup and surgery are performed by the same surgical team, improving continuity of care and minimizing additional testing costs.<sup>2</sup>

Historically, Canadian programs have used a travelling donor model, but owing to the challenges implicit with donor travel there has been renewed interest in evolving to a kidney-shipment model.<sup>3</sup> As the Canadian KPD program progresses toward kidney shipment as a means to improve organ exchange, it is vital that all transport options and scenarios be evaluated in detail to ensure an optimal, efficient and dynamic system. This is especially important in a country with a finite number of transport options, extreme weather conditions and transplant centres that stretch across 5 time zones. Several routes are possible for kidney shipment across Canada, including air, rail and road. Each form of transportation has advantages and drawbacks that vary depending on the distance travelled, availability of the mode of transport (e.g., flight or train

departure times) and, particularly in Canada, the unpredictability of extreme and quickly changing weather systems.

Overall, kidney shipment has the potential to lead to significant improvements to the Canadian KPD program. However, to optimize organ transport, use of all shipping options should be considered. In doing so, potential geographic and seasonal variables will be minimized, ensuring secure and efficient organ exchange. With this in mind, we provide a summary of potential considerations.

### *Use of all national air carriers should be mandated*

Use of all national air carriers would expand potential departure times, minimize delays and provide more connectivity between transplant cities. Currently Canada has 2 national air carriers, but only 1 (Air Canada) has an agreement to ship solid organs.

### *Utilization of rail transport*

Currently there is no agreement with a rail service in Canada for organ shipment. With more than 48 000 km of track, all Canadian cities harbouring transplant centres are well connected.<sup>4</sup> However, given the long interprovincial distances, rail shipment is realistic only for organ shipment within Ontario and Quebec. Rail shipment represents a predictable and efficient route for organ transport owing to its low delay/cancellation rates and the negligible impact of weather conditions on train travel.

### *Involvement of a third party logistical organization*

Involvement of a third party logistical organization would ensure optimal use of the multiple modes of transport for secure and efficient delivery of organs. Optimization of air transport is currently being explored in a pilot project between the Trillium Gift of Life Network and a private organization, Ornge.<sup>5</sup>

### *Donor nephrectomy start times*

Special planning of donor nephrectomy start times would be useful to avoid kidney shipment during high traffic hours. Delays in organ shipment due to highway congestion could also be avoided by using the train during high traffic times or in extreme weather conditions.

### *Dedicated evening transplant slating*

Negotiation of secure evening operative times for transplant centres would prevent delay of recipient surgeries due to

after-hours emergencies. This is especially important when kidneys are shipped from western to eastern time zones, which often puts the recipient start time outside of typical elective surgery hours.

### *Continued use of the travelling donor model in special circumstances*

Continued use of the travelling donor model in certain circumstances would prevent situations in which transport distance or delays may result in unacceptable cold ischemia times (CITs). For kidneys that are to be exchanged over long distances, especially if the donor is older, use of the travelling donor model may be indicated to avoid extended cold ischemic injury. The use of pulsatile hypothermic perfusion may be one solution for minimizing tissue injury in the face of prolonged hypothermic storage.

## CONCLUSION

The Canadian KPD program has proven to be successful over the past decade in helping expand transplant numbers and obtain kidneys for highly sensitized patients. Transition to a kidney shipment model is a logical next step, as it would provide many advantages over the travelling donor model and has been proven to be effective in several nations already using KPD. Canada's geography and population distribution may present several unique obstacles. Anticipation of the potential challenges and utilization of all routes of transport will help minimize the risk of extended and potentially harmful CITs while ensuring continued growth and functioning of the KPD program.

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