

CASE REPORT

Long-term vulnerability of access to hemodialysis facilities in repopulated areas after the Fukushima Nuclear Disaster: a case report

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Abstract

In 2011, an earthquake and tsunami struck Japan, and these were followed by the Fukushima Daiichi nuclear power plant accident. The long-term impact on hemodialysis care access in rural areas after the disaster is unknown. Here we report on a 66-year-old male hemodialysis patient who was forced to evacuate and relocate multiple times to receive hemodialysis after the accident. While he returned to his hometown in 2012, all the available hemodialysis facilities had been placed in different districts. Therefore, the patient needed to cross a mountain to visit the hemodialysis facility. On a snowy day, the patient was unable to reach hemodialysis care in a timely manner. With community cooperation, a public ambulance successfully transferred the patient via a detour, taking 4 h to reach the hemodialysis facility. This case demonstrates that access to hemodialysis care in rural areas remains vulnerable even in the long term after a nuclear disaster.

INTRODUCTION

Ideally, access to health care should be equitable. Maintaining access to health care in resource-poor settings is a key issue [1]. Shortage of health care providers and facilities in rural areas is a universal issue around the world [2]. In rural areas, both

patient-specific and extrinsic factors—such as geographical distance, seasonal conditions and health care costs—can affect access to health care [3]. Of these factors, a nuclear disaster is one of the most complex situations.

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In March 2011, an earthquake and tsunami struck the north-eastern area of Japan, and these were followed by the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident. Futaba District is located in the coastal area of Fukushima Prefecture, and it was affected by all three disasters (Fig. 1). The subsequent impairment of health access was associated with the mandatory evacuation order [4]. Several health issues arose because of changes in lifestyles and social relationships [5]. Access to health care in the affected areas deteriorated because of a lack of health care facilities as well as an undersupply of physicians. Particularly significant was the lack of hemodialysis facilities, which are vital for patients with end-stage renal disease (ESRD) [6].

Immediately after the disaster, access to hemodialysis care was disrupted because of a shortage of medical staff, water shortages and blackouts [7]. Medical staff faced both a fear of irradiation and a shortage of necessary supplies, such as water, oxygen and oil for heaters, which resulted in the closure of hospitals in the surrounding areas [8]. Subsequently, access to hemodialysis around the evacuation zones was impaired because of increased demand from evacuees [6]. Moreover, evacuation was reported to increase the risk of chronic kidney disease [9]. Barriers to hemodialysis care in the short to medium term after the disaster have been reported; however, little information is available on the long-term impact of health care access for hemodialysis patients in rural areas after disasters. Here we report on a hemodialysis patient who relocated to places where hemodialysis was available on four occasions during the evacuation and repopulation process after the Fukushima Nuclear Disaster.

CASE REPORT

A 66-year-old male requiring hemodialysis care because of diabetic nephritis in Kawauchi Village was forced to relocate multiple times to receive hemodialysis after the FDNPP accident (Fig. 1). Before the disaster, as the only one clinic in Kawauchi

Village did not provide hemodialysis care [10], he regularly visited a hemodialysis facility in Tomioka Town (Fig. 1: Facility 1), located to the east of Kawauchi Village. However, he and his family evacuated immediately after the disaster, and he continued hemodialysis in Iwaki City (Fig. 1: Facility 2) on 12 March 2011. After receiving hemodialysis for a week there, he temporarily resettled to another prefecture (Facility 3). All hemodialysis patients needed to be transferred on 19 March 2011 because of a shortage of dialysis water [7]. After that transfer, the patient moved back to Fukushima Prefecture in May 2011, resettling in Koriyama City (Fig. 1: Facility 4).

Following recovery efforts, the Kawauchi Village Office declared it to be safe to return to the village given the low air radiation dose rate in January 2012. After careful consideration of his clinical and social background by dialysis doctors and public health nurses, the patient returned to the village in September 2012 and simultaneously started hemodialysis at the hospital in Ono Town (Fig. 1: Facility 5). While home therapy was considered, it was not undertaken because there were no doctors who could perform peritoneal dialysis or home hemodialysis. As the hospital is located 15 km from the center of Kawauchi Village, it usually takes one hour by road from the patient's residence to cross the mountainous areas. The journey takes twice as long as it did to the original facility (Facility 1).

In the winter of 2014, the patient was scheduled for his regular hemodialysis on a day of heavy snow; however, inadequate snow clearance from the road prevented him from visiting the hemodialysis facility using the hospital's shuttle service. Kawauchi Village officers were asked for help by the shuttle service staff, so they asked emergency medical services to transfer the hemodialysis patient to the hospital. With community cooperation, a public ambulance successfully transferred the patient via a detour, taking 4 h to reach the hemodialysis facility. During this journey to the hospital, close phone communication was maintained. On arrival, the patient fortunately presented with no symptoms indicative of uremia, and the results of a laboratory test showed no specific problems. The patient received hemodialysis care without any adverse events. As snow prevented the patient returning to his residence for four days, the hemodialysis center provided him with accommodation during that period. After this, the patient continued to visit the hospital periodically by crossing a mountain.

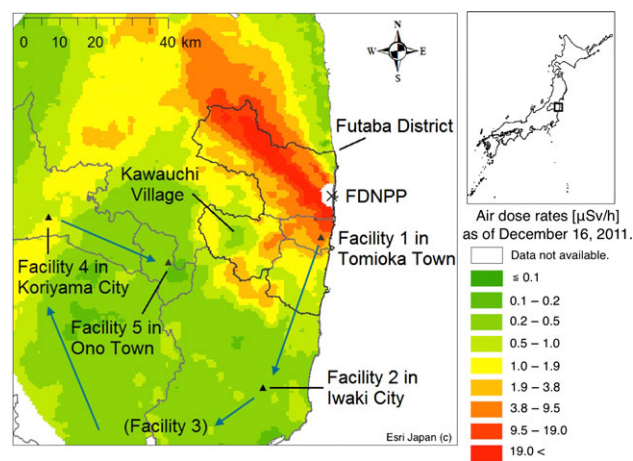


Figure 1: Geographical map of Fukushima Prefecture. The map is colored according to air dose rates at a height of 1 m above the ground as of 16 December 2011. The population of Futaba District was ~72 000 before the disaster, and almost all residents were forced to evacuate in the immediate aftermath of the FDNPP accident. While the Central Government of Japan gradually started to lift evacuation orders from September 2011, the current population of Futaba District remains at 11 000. Although there were two hemodialysis facilities in Futaba District prior to the disaster, both facilities were located in the evacuation zone as of March 2016 and have yet to resume operations. Source: Nuclear Regulation Authority, Geospatial Information Authority of Japan and Esri Japan.

DISCUSSION

This hemodialysis case highlights that access to health care in rural areas adjacent to the evacuation zones around the FDNPP remains suboptimal for a long term and remains vulnerable to extrinsic factors such as the heavy snow in this case.

Management of ESRD is challenging in rural areas long after the nuclear disaster. It has been reported that accessing alternative facilities for ESRD care would significantly increase rural patient travel time while having little impact on urban patients [11]. In this case, although there were two hemodialysis facilities in Futaba District before the disaster, these facilities were located in the mandatory evacuation zones and remained closed. Therefore, all the operating hemodialysis facilities were outside Futaba District. Nuclear disasters may cause persistent dysfunction of hemodialysis facilities because of a mandatory evacuation, as recovery from radioactive contamination takes a long time. Nuclear disasters could thus exacerbate the remoteness of rural areas in the long term.

Moreover, access to hemodialysis care is vulnerable to extrinsic factors even after this time. After the patient's return to Kawauchi Village, his visit to the hemodialysis facility was delayed by insufficient snow clearance from the road. While it has been reported that geographical factors affect access to screening facilities [3], to our knowledge, this is the first report suggesting that extrinsic factors could preclude timely access to ESRD care in rural areas. Importantly, this patient was successfully transferred, with cooperation among staff members of hemodialysis facilities, village officers and emergency medical services staff. In this respect, it would be helpful to establish a local registry to share clinical and social information on dialysis patients after a major disaster.

In conclusion, as access to hemodialysis facilities may remain vulnerable long after a nuclear disaster, community-level cooperation would be important to secure equitable health care access.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

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ETHICAL APPROVAL

This research meets the ethical guidelines and adheres to the Japan's local legal requirements. For this type of article, ethical review is not required.

CONSENT OF PUBLICATION

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

GUARANTOR

Y.N. accepted full responsibility for the work, had access to the data, and controlled the decision to publish.

AUTHORS' CONTRIBUTIONS

Y.N. conceived of the study and drafted the article. Y.O., M.T., A.O., T.S., T.M., N.Y. and F.F. conceived of the study, and participated in the design the study and coordination and helped to draft the article. All authors read and approved the final article.

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