ต้นแบบหน่วยล้างไตเคลื่อนที่สำหรับผู้ป่วยโรคไตในชนบท กรณีศึกษาลำสนธิโมเดล จังหวัดลพบุรี

A Prototype for a Mobile Peritoneal Dialysis Unit, Case Study of Lamsonthi Model, Lopburi Province

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Abstract

Chronic kidney disease has been a major health problem in Thailand as confirmed by the growing number of patients every year in every region. Reports pointed out that poverty and difficult access to public hospitals are among factors that prevent underprivileged kidney disease patients in rural areas from receiving proper medical treatments. Frequent visits, at least twice-a-week, to the nearest haemodialysis center are not always affordable, while many dwellings do not meet hygienic standard for home treatments. A mobile peritoneal dialysis unit invention was then initiated by Lamsonthi Hospital, Lopburi, as a part of alternative services known as “Lamsonthi Model” in attempt to fill in service gaps and transform healthcare provisions to fit specific conditions in rural villages. Researched and designed by the Built Environment for Health research unit of Kasetsart University, the prototype was developed through participatory design process between designers, patients and multidisciplinary staffs from Lamsonthi Hospital to create an integrative design outcome responsive to sensitive conditions. With emphasis on affordability and movability, the final design proposed a budget foldable prototype that can be transported in a truck and installed at any location, and later movable to another place to service another patient in need. The unit accommodates wheelchair access and is equipped with sanitary and lighting systems. The post-occupancy assessment of the prototype installed for a 25-year-old male patient at his village home since September 2016 suggested that the unit is able to support required peritoneal dialysis procedures and deal with limitations of rural home environment for the medical treatments. While the prototype still needs further development on material weight and interior environmental comfort, the invention represents a convergence through multidisciplinary approaches to transform healthcare services and encourages awareness of the necessary collaborations between medical discipline and built environment. At the same time, it demonstrates an alternative community-based approach toward specific problems in healthcare that cannot be solved by the traditional system alone.

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Keywords
Built Environment
Participatory Design
Peritoneal Dialysis Treatment
Mobile Unit
Prototype

บทคัดย่อ

โรคไตเรื้อรังนับเป็นปัญหาสุขภาพหลักของประเทศไทย ดังเห็นได้จากสถิติผู้ป่วยต่อปีที่เพิ่มจำนวนขึ้นในทุกภูมิภาค จากการศึกษาพบว่าความยากจนและความลำบากในการเข้าถึงโรงพยาบาลเป็นปัญหาที่ทำให้ผู้ป่วยโรคไตด้อยโอกาสในชนบทไม่สามารถเข้ารับการรักษาที่เหมาะสมได้ ผู้ป่วยจำนวนหนึ่งต้องเดินทางไปยังศูนย์ล้างไตที่ใกล้ที่สุดอย่างน้อยอาทิตย์ละสองครั้ง ซึ่งมักไม่สามารถดูแลค่าใช้จ่ายในการเดินทางได้ อีกทั้งสภาพและรูปแบบของเรือนชนบทของผู้ป่วยอาจขาดสุขลักษณะตามมาตรฐานในการล้างไตด้วยตนเองที่บ้าน โรงพยาบาลลำสนธิ จังหวัดลพบุรี จึงได้เกิดแนวคิดของการสร้างหน่วยล้างไตเคลื่อนที่ ซึ่งเป็นส่วนหนึ่งของ “ลำสนธิโมเดล” เพื่อเสนอการบริการสุขภาพทางเลือกที่รองรับสภาพข้อจำกัดเฉพาะในพื้นที่ชุมชนชนบท ต้นแบบหน่วยล้างไตถูกค้นคว้าและพัฒนาการออกแบบโดยกลุ่มวิจัยสิ่งแวดล้อมสรรค์สร้างเพื่อสุขภาวะมหาวิทยาลัยเกษตรศาสตร์ ผ่านกระบวนการมีส่วนร่วมกับผู้ป่วย แพทย์และบุคลากรหลายสาขาวิชาชีพของโรงพยาบาลลำสนธิ เพื่อสร้างผลการออกแบบที่ตอบสนองเงื่อนไขต่าง ๆอย่างบูรณาการ แนวคิดการออกแบบหน่วยล้างไตมุ่งเน้นทางเลือกที่ราคาประหยัดและสามารถเคลื่อนย้ายได้ โดยเสนอรูปแบบที่สามารถพับได้เพื่อสะดวกต่อการขนส่ง สามารถติดตั้งที่บ้านหรือพื้นที่บริการผู้ป่วย และเคลื่อนย้ายส่งต่อไปบริการผู้ป่วยคนต่อไปในภายหลังได้ หน่วยล้างไตสามารถรองรับการเข้าถึงด้วยรถเข็นและติดตั้งระบบสุขาภิบาลและระบบไฟฟ้าที่พร้อมจะเชื่อมต่อกับพื้นที่ติดตั้ง จากการประเมินผลการใช้งานของต้นแบบหน่วยล้างไตเคลื่อนที่ที่ติดตั้งที่บ้านผู้ป่วยโรคไตเพศชายอายุ 25 ปี ตั้งแต่เดือนกันยายน 2559 พบว่าหน่วยล้างไตสามารถรองรับกระบวนการล้างไตทางช่องท้องด้วยตนเองและแก้ปัญหาข้อจำกัดของบ้านผู้ป่วยให้มีลักษณะเหมาะสมต่อการรักษา แม้ต้นแบบยังต้องการการพัฒนาต่อโดยเฉพาะน้ำหนักของวัสดุและสภาวะน่าสบายของสภาพแวดล้อมภายใน แต่การคิดค้นและพัฒนาการออกแบบหน่วยล้างไตนับว่าเป็นการแสดงการบูรณาการข้ามศาสตร์เพื่อปรับเปลี่ยนทิศทางการบริการสุขภาพและสร้างการตระหนักถึงความสำคัญของความร่วมมือกันระหว่างการแพทย์และการออกแบบสิ่งแวดล้อมสรรค์สร้าง และเป็นตัวอย่างของทางเลือกการบริการสุขภาพชุมชนที่อาจไม่สามารถแก้ปัญหาได้ด้วยระบบบริการทั่วไปเพียงอย่างเดียว

คำสำคัญ
สิ่งแวดล้อมสรรค์สร้าง
กระบวนการออกแบบอย่างมีส่วนร่วม
การล้างไตทางช่องท้อง
หน่วยบริการเคลื่อนที่
ต้นแบบ

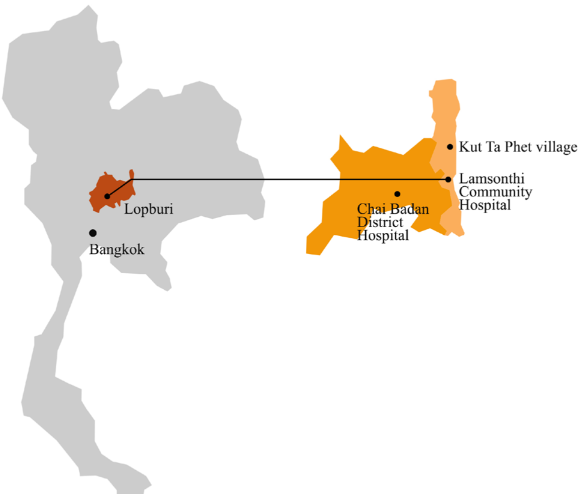
1. Situating the patient with kidney disease and healthcare policy in Thailand

Kidney disease is among major global health problems at present. Thailand is currently ranked third in Southeast Asian countries with the highest chronic kidney disease rate after Malaysia and Singapore. According to Thailand's Ministry of Public Health, approximately 8-million patients or 17.6 percent of the Thai population have been diagnosed with chronic kidney disease in 2016. Half of which are at stage 3-4 which requires peritoneal dialysis treatment at healthcare facilities. However, records and interviews with local medical staffs pointed out that several factors have prevented underprivileged kidney patients in rural areas from receiving proper medical treatments recommended by practitioners. Poverty and difficult accessibility make it complicated for twice-a-week visits, or everyday visit for the worst case, to the nearest hemodialysis center in a provincial hospital, which also involves hidden costs of time and transportation from remote villages. The Thai National Health Security Office then attempts to reduce costs of peritoneal dialysis per patient by encouraging patients to perform their own peritoneal dialysis at home. The dialysis process requires patients to filter their own blood by periodically injecting fluid into the abdominal cavity, which is later drained. Thus, nurses become key persons to train patients and family members to use the equipment that is provided free of charge under the Universal Healthcare Coverage scheme.[1] Meanwhile, patients who are treated by hemodialysis must pay one third of the total cost of treatment. Although it is argued that improper home treatments might lead to further costs, given the increased risk of infection and subsequent expenses associated with peritoneal dialysis, the proposed self-peritoneal dialysis treatment at home would help save transportation costs which poor patients might not afford.

Healthcare policies were employed in Thailand as major drivers to expand public healthcare facilities nationwide. There are currently 1,002 hospitals, covering over 90% of service area, and 9,826 sub-district health promoting hospitals, covering most sub-districts, under the care of the Ministry of Public Health (Wibulpolprasert, 2008). However, the infrastructure of the healthcare system expanded slowly due to the inadequate financial support by government budget. The problem of misdistribution of healthcare providers among rural and urban areas still continues, causing inequity in people's access to care. Stakeholders then seek to think outside the box to fill in gaps in medical service systems to provide optional services with better accessibility and customised solutions.

This paper aims to present the development of a mobile peritoneal dialysis unit which attempts to transform healthcare services, facilities and environmental conditions on human health in the rural village. Multidisciplinary design becomes a key in developing the unit under multiple reviews by a real patient and close supervision of various medical experts from a community hospital. This convergence of medicalization and architectural design represents multi-disciplinary approaches to transform and merge healthcare services and built environments (Borasi and Zardini, 2012), as well as suggests a strong association between well-being and the physical environment in which a person lives or receives healthcare services (Albert, 2010; Gesler et al., 2004; Rollins, 2004). At the same time, it provides a particular solution for the healthcare service which somehow cannot be solved by the normal healthcare system alone.

Lamsonthi district in Lopburi province, where Lamsonthi hospital is located, is chosen as the study area. 216 kilometers from Bangkok (see Figure 1), the district hospital has initiated and developed a community-based care system known as 'Lamsonthi Model' which attempts to reduce patients' revisit to the hospital and to overcome a shortfall of family caregivers for long-term patients. In this model, a coordinated health, long-term care and social care system has been established in collaboration with a care team with the Local Administrative Organisation (LOA) and a multi-disciplinary team of the hospital staffs including doctors, family nurses, palliative care nurses, psychologist, physiotherapist, occupational therapist, nutritionist, construction technician, as well as community caregivers. In the pilot projects, such care management and technical support are provided by Lomsonthi hospital and a community health center or a community health promotion hospitals.



(Source: The Author)

Figure 1. Location of Lamsonthi district

According to data collected by Chronic kidney disease clinic at Lamsonthi hospital, there are approximately 150 patients diagnosed with chronic kidney disease. It is estimated that 30-40 patients are at stage 1-3 whereas 16 and 14 patients reach stage 4 and 5 respectively which requires either haemodialysis treatment at the hospital or peritoneal dialysis treatment at home.[2] The peritoneal dialysis treatment normally has an annual cost of at least 250,000 Thai baht per patient, excluding other indirect expenses. Since most of the local patients have low income of 50,000-70,000 Thai baht annually, they have cannot afford frequent visit to even the nearest hospital due to insufficient cost of transportation and time. Moreover, various conditions of their current dwellings make it not always possible for modifications to meet standard of hygienic environment for home treatments.

(Source: The Author)

Figure 2. Care team visit a patient's home

Such conditions provoked Lamsonthi hospital team's ideas to create a prototype for a mobile peritoneal dialysis unit that not only transportable but reusable and transferrable when needed. The unit was developed as a part of the Action Design course, an elective module taught in the Bachelor of Architecture program at the Faculty of Architecture, Kasetsart University, Bangkok, during January-May 2016 in collaboration with Lamsonthi hospital and the Built Environment for Health research unit.

2. The mobile unit and multidisciplinary design process

The mobile peritoneal dialysis unit development was initiated by Lamsonthi hospital team through their learning experience during their patient's home improvement project for self-peritoneal dialysis treatment. When the patient passed away afterwards, the team realised downsides of the fixed model that could not be reused for other patients who also require a similar treatment at home. The medical team then attempted to work on another model for self-treatment, possibly reusable and transferable from patient to patient. Distributed by the Lamsonthi hospital, the unit therefore needs to be movable for a reinstallment at each patient's house, and should be returned to the hospital if the unit is no longer used. Moreover, affordability is another design concern. The unit should be built with basic, locally available materials. Such requirements became main criteria for this multidisciplinary project and a design brief to architecture students who participated in the design process.

(Source: The Author)

Figure 3. Participant A's house

(Source: The Author)

Figure 4. Students work on site with participant A

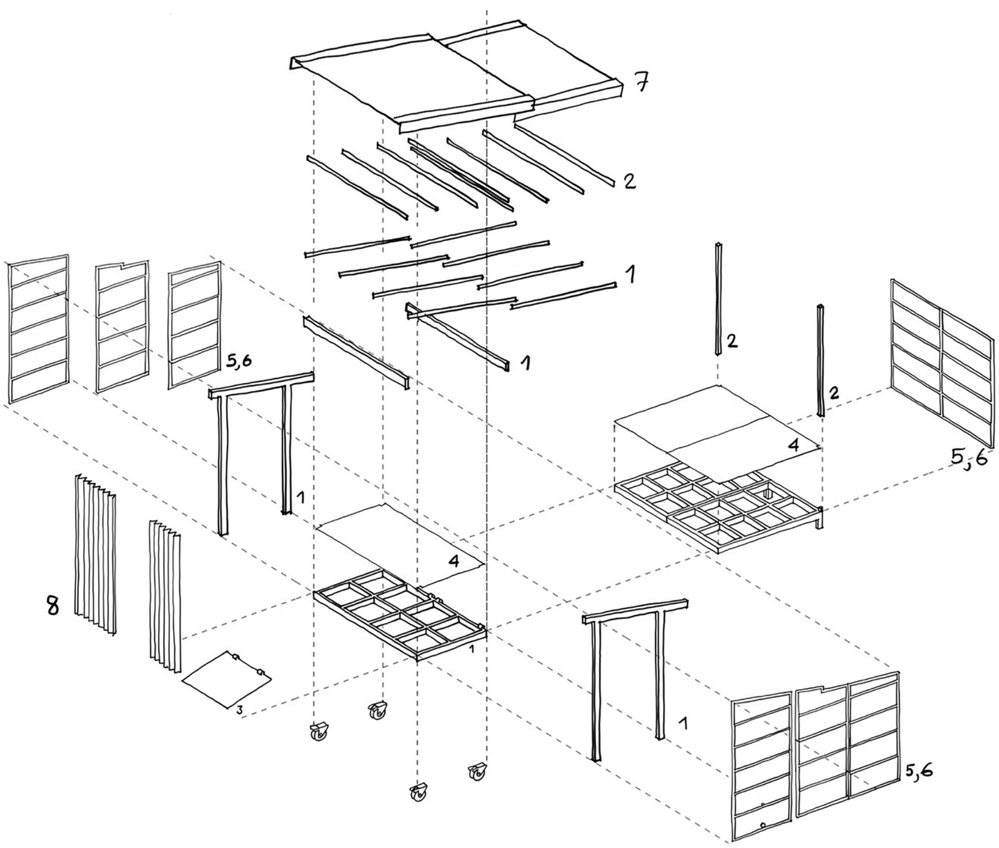
Participant A, the 70-year-old patient for whom the mobile unit was designed, had lived in his traditional two-storey house in a remote area of Lamsonthi district with a typical elevated floor and open plan on the ground. The house has no fence and is accessible from street at the front. Participant A was partially disabled and usually lived on upper floor, while he mainly relied on his caregiver, also his cousin, for everyday activities as he could not move through steep stairs. His house was initially renovated with Lamsonthi hospital's support in order to move him to live on the ground floor. He gradually practiced walking with a crutch on his own and mentally improved as he had more interactions with neighbors. However, participant A was diagnosed with kidney disease and first stage of Alzheimer disease. Self-peritoneal dialysis treatment installed at his house was needed for his case as he was unable to afford hemodialysis treatment at the hospital.

Through the participatory design process, the patient's behavior observation and interviews with the caregiver, physical therapists and medical team from Lamsonthi hospital were conducted to gather information and highlight their special needs. Architecture students developed a 1:1 layout plan for experiments with participant A in order to adjust the unit design to the appropriate size and layout. The architects' team exchanged knowledge with experts from Lamsonthi's team to advance their understanding of peritoneal dialysis treatment and caregiving for patients with special needs.

The first preliminary design of participant A's unit focused on affordability and movability. The smallest unit to accommodate a patient with wheelchair was designed. Nonetheless, the medical team suggested that the size of this mobile unit should be universal to accommodate both bed and seating for the peritoneal dialysis treatment depending on the health condition of each patient. The second design was larger to provide enough space for patients who are bed bound. The bigger unit, the heavier it is, which became an obstacle for movability. The design team then develop a manually foldable unit at an initial size of 1.20 x 2.40 meters, in order to be able to fit in a truck for the delivery. The unit is expandable to 2.40 x 3.00 meters as its maximum space (see Figure 5). The final design proposed a self-peritoneal dialysis unit to be attached to one side of participant A's room on the ground floor, so that he could access from inside, and to better control the hygienic environment. With a total weight of almost 750 kilograms, the unit is composed of 3 basic components with different uses of materials as follows (see Figure 6):

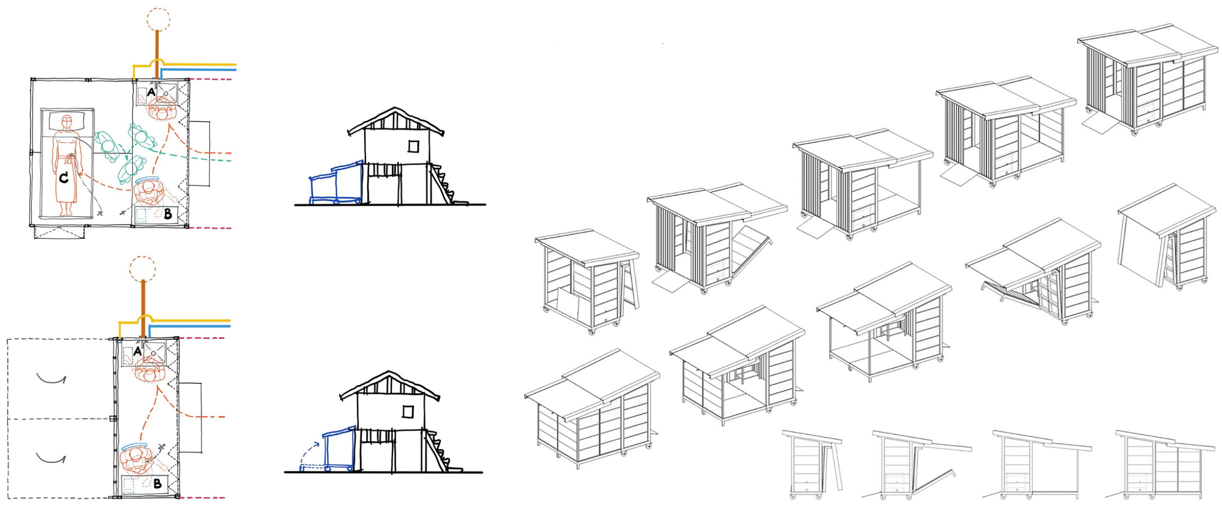
(Source: Author)

Figure 5. The unit prototype which can be manually folded and unfolded



(Source: Author)

Figure 6. Unit’s components



(Source: Author)

Figure 7. Spatial organisation of the unit and it is attached with existing house (Left) and Unit expansion (Right)

Structure:

1 - Carbon steel rectangular pipes (2 x 1 inches), (3 x 1.5 inches)

2 - Carbon steel square pipes (0.5 x 0.5 inches), (1.5 x 1.5 inches)

3 - Checker plate (3 millimeters)

4 - Fiber cement boards (16 millimeters)

Wall: 5 - Carbon steel square pipes (0.5 x 0.5 inches)

6 - Polycarbonate hollow sheet

Roof: 7 - Metal sheets

8 - Polyethylene sheets

Door and opening:

9 - Vinyl folding door, Aluminum sliding door, Polycarbonate window

The internal space planning of the unit follows the steps of Continuous Ambulatory Peritoneal Dialysis (CAPD) from 'A' to 'B' and 'B' to 'C', respectively (Nissenson & Fine, 2017). 'A' represents a hand washing area (a stainless steel sink and a lever handle stop valve). The sanitary and electrical system were provided by the patient's house. As shown in Figure 7, brown line and blue line indicate waste water line and tap water line, respectively. 'B' is a position of a shelf for the transfer sets which kept in 7 slots with different colors for daily use. This could remind the Alzheimer patients when to take their transfer sets for dialysis. 'C' is a resting area during peritoneal dialysis process. During the process, the caregiver is positioned in the middle of the unit while taking care of the patient. This allows a free space available for the caregiver to work conveniently. The vinyl folding door was installed due to its lightweight and capability to open wide. As mentioned, this peritoneal dialysis unit can be manually folded to a size of 1.20 x 2.40 m. in order to transfer to other patient houses or to fit in a limited space (see Figure 8). The total cost of unit construction is 55,000 baht.

3. From One Patient to Another

Unfortunately, participant A passed away before the prototype construction was completed. However, the finished mobile unit was transferred to participant B aged 25, another kidney disease patient who urgently needed peritoneal dialysis treatment, and installed in his residence in a nearby village, Baan Kud-Ta-Petch, in September 2017. This patient initially denied any treatment due to the estimated overall cost and the inconvenient access to local healthcare facility because of his usual work. The possibility to install the mobile unit at his house convinced him to agree on the recommended treatment and consequently aided his condition tremendously. This young patient requires self-peritoneal dialysis treatment four times a day: 6 AM., 12 PM., 6 PM., and 10 PM. Each treatment takes 40 minutes (see Figure 9). According to the patient, the provided unit is spacious and flexible enough for his routinely use during the day. He also sometimes stays overnight after the last treatment. However, the condition of his one-storey vernacular house is different from that of participant A which resulted in a few modifications of the initial design. First, setting up the unit outside his main house required a change of the door type and an addition of overhang to protect the unit from direct sunlight during the day. Second, stability needed to be improved on the base of the unit, and a paved foundation. Third, water, electric utilities and sanitary system were fully installed in order to connect to the main house.

The spatial organisation of the unit was adjusted by the patient and his relatives to suit his convenience and everyday routine. As he is able to deliver peritoneal dialysis treatment by himself, a folding table and a seat were placed as an area for peritoneal dialysis process, replacing the original storage shelf (see Figure 10). Instead, the bed was actually used as a storage space for transfer sets. A sliding door was installed to replace the vinyl folding door to provide better security and strength because the dialysis unit no longer directly attached to the house as in the original design.

(Source: Author)

Figure 8. Unit delivery and installation on site

(Source: Author)

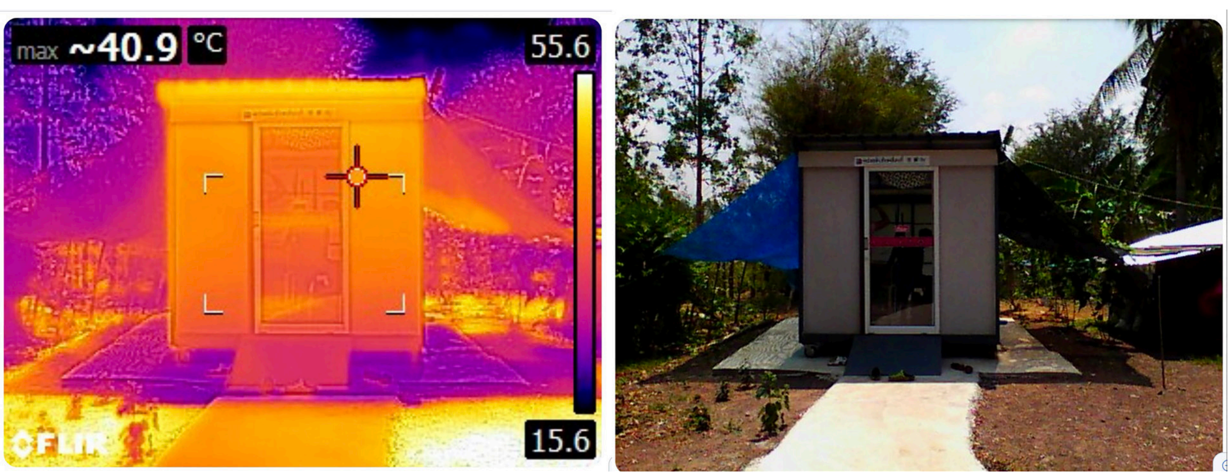
Figure 9. Peritoneal dialysis process in the unit by the patient

(Source: Author)

Figure 10. Interior space within the unit adjusted by the patience

After a 6-month occupancy, built environment for health researchers revisited the site and conducted a quick post-occupancy assessment of the peritoneal dialysis unit. It is found that the space provided within the unit is sufficient for the patient to use during the 40-minute dialysis. The unit performs as extra space for the patient to spend time in his daily life. For the environmental comfort examination, the temperature and relative humidity outside and inside the unit were recorded by a weather measurement equipment and a thermo gun. As can be seen from the test at 12-1pm, the average air temperature in the unit was 41-42 °C, and the average relative humidity was 53-56%. The external air temperature was at 36.5 °C, while the outside surface temperature of was 40-42 °C (see Figure 11). Moreover, the roof surface temperature was 53°C, while the temperature under PE ceiling insulation inside was at 48oC. According to the Olgyay bioclimatic chart, the temperature in the unit was excessively high compared to the comfort zone. This strongly suggests a further improvement of the unit by inserting insulation under roof surface and wall panels, as well as shading devices, to reduce the heat transfer. As the heat is a major concern, the appropriate properties of chosen materials must be considered in the development of the second prototype.

The installation process of the unit was also considered an issue to address. Due to limited budget and structure, the current unit is very heavy, making it difficult to be transferred and installed on site. The installation ground needs to be prepared to ensure a rigid foundation and smooth surface and prevent an effect on the wall assembly process. After installing the wall, it is necessary to use silicone caulk to seal wall materials and prevent wind and dust from outside getting into the unit. An aluminum sliding door is likely a stronger option for wind protection rather than the original vinyl door. The installation of the sanitary system should be separated from the patient house, while the electrical system can be connected to the existing system. These must be considered as basic criteria in developing the transfer and installation process of the second prototype.



(Source: Author)

Figure 11. Temperature within the unit during noon time tested by thermal gun

4. Observations and Discussions

(Source: Author)

Figure 12. The unit on site at present, adapted to suit the use of patience and its own context

The invention of the mobile peritoneal dialysis unit prototype could not have been executed and accomplished by a group of experts under a single umbrella of expertise alone (see Arnstein, 1969; Pateman, 1970; Sanoff, 2007). Instead, the long and complicated development process has been brought to completion significantly through multidisciplinary collaborations, principally between academic and professional personnel in healthcare and design. The healthcare collaborators from primary care unit included family physician, family nurse, palliative care nurse, psychologist, physiotherapist, occupational therapist, nutritionist, construction technician and community caregivers, while collaborators from design discipline consist of built environment for health researchers, architects and product designers. Additional stakeholders also included prospective patients, relatives or family caretakers, and community members who participated and shared feedback during the design development and implementation process. The collaborations involved applications of knowledge, information, opinions, experiences, and participation from a number of collaborators that have been raised, exchanged, discussed and negotiated through repeated back-and-forth reviews, tests and revisions in order to find an agreement for the most optimal solutions from different points of view of either side. The project was initiated by community hospital staffs who recognised real problems and limitations of underprivileged dependent patients due to budget and distance from actual situations during practice. The design scholar and professionals then carried out the needs and preliminary innovative idea by transforming them into physical design based on professional knowledge to handle the gap of regular health service. Participatory design and multidisciplinary collaborations enabled the holistic design of the mobile peritoneal dialysis unit that filled in the medical service margin, while avoiding possible mistakes and reduced practicality often caused by fragmented understandings and unbalanced theoretical interpretations from a single professional approach. By this, It should be noted that participatory design is a process in which the hopes and desires of all parties can be kept and negotiated in a constructed space that Schneekloth and Shibley (2000) called 'a dialogic space', whereby the knowledge of the professionals and the users are shared, disputed, negotiated and considered. In practice, by enabling the end-users to share the power of making decision, Till (2005, 2006) argues that the professionals still need to maintain their ability to envision. Therefore, negotiations between the designers and the users have become inevitable in the participatory design process. Not only was physical form of the unit invented, but mental and social aspects of the treatment were addressed. Integration of knowledge and issues in kidney disease, symptoms and conditions, treatment procedures, related equipment and systems, spatial arrangement, maintenance, material qualifications, construction cost, transportation, local context and social conditions have been taken into consideration in the design outcome. The process which required combined knowledge and experiences from diverse fields confirmed the benefit of multidisciplinary collaborations when it comes to health.

The unit invention provokes a reconsideration whether health innovations for patient care should be developed as prototypes or case-by-case designs. Prototypes usually employ one model or type of service as a universal design to serve a larger group of patients who share certain similar symptoms and necessary treatments. While main conditions are generalised and addressed, some minor or specific conditions might be omitted. Design can be developed as industrial products in a larger lot size to reduce production cost per unit. Therefore, a wider market group especially the middle-class with common health issues tends to attract health product development and often have priority to serve rather than smaller less-powerful product consumer whose urgency of health conditions and treatments may be equally critical. According to Wilkinson (1977), higher-income populations are likely to avoid environment and behaviors risky to health, and also have better access to healthcare. In contrast, the poorer people, the poorer lifestyles they are exposed to. When it comes to underprivileged patients with limitations of accessibility to services including budget and living distance to healthcare facilities, standard textbook solutions which are mostly adopted from western approaches may not fully fit the needs and constraints. Such marginal patients require different sets of care to serve different life assets and conditions, in particular social dimension. A major component of health as defined by World Health Organisation (WHO)[3] , social well-being specific for each context may also add up complications that shape specific solutions for each case.

Future healthcare requires comprehensive approaches to service and facilities capable to support a wide range of population in the society that fill in current gaps in healthcare provision. In addition to mainstream "standard" services, it should include alternative services responsive to specific constraints and conditions rarely addressed in general platform in the past. Through understandings in different needs and with creativity in service design, future healthcare should extend existing medical service boundary to unconventional health-promoting provisions based on sensitive criteria. As pointed out by the mobile peritoneal dialysis unit development, three components emerged as significant factors in healthcare accessibility and service design: budget, distance and stakeholders. Since budget is considered a major decision-making stimulator for underprivileged patients, cost-concerned alternatives tend to increase accessibility to well-being. Likewise, decentralised services provided in closer locations are preferred because living distance from healthcare facilities also mean transportation expenses that may not always be affordable for some families. In this case, mobility of equipment provided by the responsible community hospital is a more viable option than mobility of patients. The concept of easy-to-plug-in equipment to install in places in need is a possible option, but the local installation tends to limit the potential of the long-term treatment units to be reused only when the current patient passes away. In order to extend the use, healthcare delivery can also be arranged in the forms of "timeshare" communal equipment, utilities and facilities to share among members in the same or nearby villages. If not designed as a mobile unit that moves and stops to service each patient in a community, the treatment unit may alternatively be designed as a larger module to be installed at potential locations including a local primary care unit, a health promoting hospital, a community center or a designated location, such as close to the residence of a patient with severe health conditions. Under collaborations with local organisations, the medical benefit would no longer be specific to a single patient but the entire community. In order to support decentralized healthcare, the system of "trained community caregivers" or volunteers with necessary healthcare knowledge may be developed to merge the gap between medical personnel and social support network of the family and community.

5. Conclusion

Diverse health service approaches to address kidney disease problems in Thailand represent common medical situations that one single solution may not be able to entirely handle all sensitive factors directly and indirectly associated with health services. Lamsonthi Model, initiated and implemented by Lamsonthi Hospital in Thailand, demonstrates an alternative community-based care system to reduce hospital's service load and accommodate long-term patients with thorough understandings in specific requirements and conditions of local patients. The mobile peritoneal dialysis unit prototype was developed by Built Environment for Health and Well-being Research Unit and multi-disciplinary staffs of Lamsonthi Hospital as a non-traditional health service for frequently-overlooked underprivileged groups. In this case, well-being is formulated through a natural balance between constraints and built environment design rather than luxurious healthcare service by expensive treatments and the highest level of comfort. Self-care, cost-effective approaches with least commute to hospitals are prioritized in the physical and service design for low-income rural patients due to particular economic, social and environmental contexts. The unit's principal design criteria include mobility, accessibility, affordability and reusability, although the prototype construction and post-occupancy assessment suggested improvements in material selection, environmental comfort, transport and installation in the next models for better levels of comfort and convenience. However, the invention is able to adequately fulfill essential health requirements while minimizing negative service complications and paying more attention to healing power of social care. The mobile unit development also demonstrated multidisciplinary participatory collaborations, especially between health and design, which makes the design process and the final product sensible for both disciplines to achieve appropriate conditions of health and wellbeing.

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Remark

[1] Thailand's Universal Coverage Scheme (UCS) is a public health protection scheme, administered by the National Health Security Office (NHSO), which provides health care coverage to Thai citizens who are not covered by any other public health protection scheme. This scheme was a result of the reform of the Medical Welfare Scheme (MWS), a medical welfare scheme for indigent people, and the Health Card Scheme (HCS), a government subsidized voluntary health insurance for self-employed people. The UCS charged beneficiaries a co-payment of 30 Thai-baht visits, however this co-payment was abolished at the end of 2006. There are about 47 million people were registered under the scheme in 2006 (Wibulpolprasert, 2008).

[2] Chronic kidney nurse. (2018, March 26). Personal interview.

[3] The World Health Organization (WHO) defines health as "a complete state of physical, mental, and social well-being, and not merely the absence of disease or infirmity" (WHO 1948). WHO's definition specifically identifies social well-being as a third dimension of health. In doing so, it emphasizes the importance of positive social relationships. Having a social support network is positively associated with life stresses, self-esteem, and social relations. The social

aspects of health also extend beyond the individual level to include responsibility for the health of entire communities and populations. (World Health Organization 1948)

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