

Characteristics of Lifestyle and Living Environment of Ger District Residents in Ulaanbaatar, Mongolia

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Abstract

Objectives: The population in Ulaanbaatar has been increasing, especially in the ger districts. Heavy reliance on coal for indoor heating and cooking amongst the ger residents contributed significantly to air pollution resulting in various health issues. Therefore, the purpose of this study was to analyze the health determinants influence by lifestyle and living environment of ger district residents.

Methods: Information about socioeconomic factors, behavioral patterns, and stove types were collected in 36 gers both in 2016 and 2018. The dataset was analyzed for their characteristics.

Results: The family structure of the observed ger residents had a positive impact on child and elderly care, and there were both positive and negative aspects on ger residents' health behavior. Perception on indoor air pollution seemed to have an impact on related health behaviors and issues. Dietary pattern was irregular and unbalanced where high consumption of meat amongst the ger residents was common. Our results indicated that household income was not associated with the types of stove used. The choice of ventilation and cooking on the stove did not increase the amount of fuel use significantly.

Conclusion: Additional effort is required to reduce the severity of indoor air pollution and related health behaviors of ger residents which contribute to indoor air pollution.

keywords: *Mongolian residence, ger district, health determinants, lifestyle, living environment*

Introduction

Ger district is formed as a result of increasing population of Ulaanbaatar. The number of migrants to Ulaanbaatar has increased since 2000 and this led to the increasing population living in Ulaanbaatar[1]. Better access to healthcare system, quality of education and greater job opportunities are some of the reasons responsible for the increase in the number of migrants in Ulaanbaatar. As most of the rural areas in Mongolia lack proper social services[2], one of the main problems arising from Ulaanbaatar's growing population is the insufficient supply of housings. According to Adding Capacity report, such housing deficit is a result of inward migration[3]. As such majority of people who have

moved to Ulaanbaatar formed what is now known as the "ger district."

Ger district covers approximately 60 percent of housing in Ulaanbaatar's population covering more than 9,701.03 ha area of the city[2]. Another problem caused by such increased population in the ger district is both indoor and outdoor air pollution. Due to contributing factors such as Mongolia's unique geographical characteristics, extremely cold weather, and heating, ger residents have a higher tendency of relying heavily on coal-burning stove for warmth[4]. Thus, causing Ulaanbaatar to be one of the cities with the worst air quality in the world[5].

There are two prominent dwelling types in the ger district: ger and detached house. The detached house

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is mostly built using either wood or brick. Ger is a Mongolian traditional house with the structure of rounded tent, and it consists of wooden skeleton covered with cloth and vinyl[6]. According to a study conducted from 2003 to 2004, out of 1994 households in the ger district, 19.9 percent was detached houses, 47.1 percent was gers, and the remaining 33 percent had both detached houses and gers[7]. In the ger district, families lived within a small fenced area called 'hashaa', and the size of land was restricted by law[2]. In terms of income level, amongst the extremely poor, 39 percent lived in gers, 39 percent lived in non-ger detached houses, and 22 percent lived in apartments[8]. Social determinants of health such as the living environment have a significant effect on health status and access to health services[9]. Since the ger district in Ulaanbaatar is one of the most populated areas in Mongolia[10], it needs to receive more attention, especially regarding its living condition. Therefore, the purpose of this study was to conduct a descriptive analysis on the lifestyle of Mongolians living in ger, especially with regard to their family structures and behavioral factors such as eating habits, sanitation, and use of fuels for heating and cooking.

Methods

This study was conducted on ger residents living in Ulaanbaatar, Mongolia. Observations were conducted in January 2016 and January 2018. In each year, 9 students participated in the field trip. The total number of gers visited was 72, each student was allocated to a ger where they spent most of their time (approximately from 9am to 6pm) observing daily routines of the residents, filling out survey questions for socioeconomic information, health status, and awareness on indoor air pollution.

Data were collected from three different sources mentioned below:

1) Observational log

Observational log comprised of four different parts. First part included general information about the household such as family members, structure of the ger, and the type of stove used. Second part was about the behavioral records, taken every 30 minutes from 9am to 6pm. Behavior included the amount and frequency of adding fuel, ventilation, indoor smoking, cleaning, cooking, eating, drinking,

number of times and the duration ger residents have left the ger, and number of visitors if there were any. The amount of fuel added was measured by an electronic scale each time residents added fuel in the stove. Third part was about dietary pattern of the ger residents, where the types of food stored were categorized and assessed according to the hygiene status. Specified records of the types and ingredients of the food consumed, number of family members dining together, the cooking methods, and the frequency of food intake were included as well. Last part had questions related to preventive medicine. This included questions about behavioral patterns that could affect ones' health status such as smoking, exercise, ventilation, drinking boiled water, and handwashing.

2) Perception survey

Perception survey also comprised of four parts. First part was about the socioeconomic characteristics such as gender, age, education, and occupation. On top of those questions, there were 4 additional questions about how long the ger residents have been living in the ger and if they have lived in any other types of housing. Second part asked about respondent's behavioral pattern with regard to smoking and drinking habits. Third part was about their perception which mainly focused on the indoor air pollution including other environmental problems such as water pollution, wastes disposal, and food contamination. Last part comprised of questions with regard to health status based on individual's medical symptoms and the duration of those medical symptoms lasted during the recent one year. Only part one was applicable to all family members while the rest of the parts required respondent's personal experience and perception. Perception survey had been recently included in 2018 study thus there were only 36 data available.

3) Daily reports

Daily reports were written by observers after every visit to the ger during the observation periods. The daily reports included not only the general information they have obtained via the observation but also observers' personal thoughts and feelings towards their visit to the ger. Information such as family members living in the same hashaa (fence) and characteristics of visitors was obtained and added as part of our dataset.

Based on the data collected, descriptive statistics was conducted to summarize and analyze the lifestyle and living environment focusing on the health determinants of the ger residents living in traditional ger. The comparison of mean and variance of income by stove type, and the amount of fuel use differentiating by the choice of ventilation were conducted using R, version 3.4.3.

Results

Characteristics of households

Table 1 presents characteristics of 72 gers included in this study. The most common type of family structure amongst the 72 gers were four members: parents with two of their children. The proportion of households having infant under 5 was 53 percent (38 out of 72 gers), and 36 percent (26 out of 72 gers) of the families had family members aged 60 years and above. With regard to the number of visitors, although it varied slightly from ger to ger, the most frequent time of visit was from 1 pm to 1:30 pm, followed by 12 pm to 1 pm. Excluding visitors who stayed less than five minutes, 2.1 people visited a ger per day on average and 25 percent (18 out of 72 gers) had no visitors. Most of the visitors were relatives or family members who lived within the same hashaa where there was mixed combination of houses such as a ger and a detached house or about two to three gers within a hashaa. Households having more than two gers within their hashaa were 42 percent (15 out of 36). Mostly, relatives and family members shared a hashaa while they lived in a separate ger or detached house. There were exceptions, however, 3 households observed in 2018 shared hashaa though they were not related. From

the 2018 survey, monthly average household income of 36 gers was 624,139 MNT (equivalent to approximately US\$256). The income level was widely distributed from the lowest being 180,000 MNT (US\$74) to the highest 2,500,000 MNT (US\$1,027). Such monthly average household income of 36 gers was lower than that of Ulaanbaatar (1,136,596 MNT) and the national average (936,187 MNT) of 2017[11].

Health issues

Throughout all the 72 observations conducted (from 9am to 6pm), none of the ger residents consumed alcohol during the day time. According to the interview conducted on ger residents, Mongolians tend to drink alcohol only on special occasions, such as Lunar New Year's Day, which is only about once or twice a year. Despite high-calorie red meat and dairy products being Mongolians main ingredients of their daily meal, most of the residents rarely exercised (only 1 percent of the ger residents exercised). One of the reasons for such low physical activity was also due to the cold weather. Ger residents mostly stayed indoors and watched TV, drank milk tea, and consumed snacks made of flour, such as biscuit. Although there were ger residents who often went out for grocery, shops were located only about five to ten minutes walking distance from their ger.

Out of 72 households, 21 households (29 percent) had smokers. Out of 21 smokers, 12 people (57 percent) smoked only outside. According to our survey results, more than half of the ger residents seemed to perceive that indoor smoking affected the

Table 1. Characteristics of the 72 households monitored

Survey factors	Data
Number of family members (Mean \pm SD)	4 \pm 1.8
Number of infants (Mean \pm SD)	0.8 \pm 0.9
Number of elderly (Mean \pm SD)	0.5 \pm 0.7
Number of visitors (Mean)	2.1 persons/day time
Visiting time (Median)	1:00 PM – 1:30 PM
Stove type (Traditional, New)	(35, 37)
Weight of coal (g/day time) (mean \pm SD)	6,882 \pm 4,010
Weight of wood (g/day time) (mean \pm SD)	624 \pm 1,860

indoor air quality. In addition, ger residents were aware of the severity of both indoor and outdoor air pollution. When the severity level was scored on a scale of 1 to 5 where 1 indicates ‘not severe at all’ and 5 indicates ‘much more severe’, the average score was 4.7 for outdoor air pollution and 3.0 for indoor air pollution. Although they were aware of the negative health impacts caused by air pollution, their perception towards indoor air pollution was less significant than their perception towards the outdoor air quality. Such behavioral pattern was also reflected in the ger residents’ choice of ventilation. The number of gers which was ventilated was 18 out of 72 gers (25 percent) and 33 percent (24 out of 72 gers) had family members with respiratory-related problems such as frequent coughing.

Table 2. Self-reported medical symptoms of 36 subsets (in 2018)

Medical Symptoms	Percentage (%)
Eye irritation / Poor visibility	42
Heart related disorders	39
Nose and throat Irritation	33
Breathing difficulty / Asthma	31
Depression	22
Skin problems / Allergies	17

The respondents of our perception survey were mostly women (69 percent, 25 out of 36) and the average age of the respondents was 48 years old. Respondent’s health status has been listed from highest to lowest as follows: 1) eye irritation/poor visibility; 2) heart related disorders; 3) nose and throat irritation; 4) breathing difficulty/asthma; 5) depression; 6) skin problems/allergies (Table 2).

Dietary patterns

1) Storage of food

According to our observational log, meat storage was the highest proportion (81 percent) followed by tea and beverages (72 percent). Most households possessed meat in 2018 (35 out of 36), but it was 64% in 2016 (23 out of 36). According to our 2018 observers’ report, only one particular household did not store any meat. An old lady was living alone and she usually skipped her meals. She bought her grocery at the nearest supermarket only when she

needed it. However, there was another elderly lady who also lived alone but cooked and had meals on a regular basis. On top of the red meat, dairy products were also commonly seen in the gers visited where, 64 percent of households (46 out of 72) possessed dairy products such as milk and curd (dried milk).

2) Dietary intake and pattern

Dietary intake and storage information in 72 gers is shown in Table 3. Meat took the highest proportion being 58 percent among main ingredients. The second highest was grain and vegetable, both being 38 percent, followed by noodles (33 percent). Potatoes took 32 percent but there were no sweet potatoes. Ger residents most commonly consumed noodles or rice soup with meat. The main ingredients were rice or noodles, beef, some vegetables (onions, carrots, garlics), and potatoes. Dumplings (29 percent), mostly made with lamb meat, was also one of the common daily meals for the ger residents. They usually had it with milk tea. Dairy products such as curd with biscuits were consumed in between meals. There was only one household that had eggs and fruits for their meal or snack. Other ingredients such as salt, garlics, ground pepper were mainly used for seasoning.

During the 9 hours of observation (from 9am to 6pm), 64 out of 72 households had at least a meal or snack. Out of 64 households, 44 households had lunch. Including meals and snacks, the average duration of meal time was 21 minutes. Based on the households that had meals or snacks, most of the ger residents (12 households) had their lunch, remaining households had their meals at varying hours, widely distributed from 9am to 5pm. From our observation, 36 percent of households had meal or snack with all of their family members together while 48 percent of the households ate with only some of their family members. The average number of family members who had their meals together was 2.5 people. Due to the limited amount of time given to observe, (from 9am to 6pm), it was difficult to observe all members of the family having a meal together. Moreover, breadwinners of the family were mostly out for work thus, we were not able to observe any of their dietary intake nor patterns.

Table 3. Food storage and intake of 72 gers

Category	Storage (%)	Intake frequency (%)	Detail
Meat	81	58	Beef, lamb, horse, goat, chicken
Tea/beverage	72	14	Black tea, milk tea, fruit tea, green tea, flower tea, sea buckthorn tea, juice, coke, coffee
Dairy	64	14	Milk, curd, butter, cheese, yogurt
Grain	60	38	Rice, flour, cereal, oat
Potato/sweet potato	54	32	Potato
Vegetable	54	38	Onion, carrot, garlic, cabbage, bell pepper, tomato, cucumber, eggplant
Etc.	44	18	Seasoning and sauce (salt, sugar, ground pepper, ginger, sea weed, curry powder, oil), bread, candy, biscuit, sausage
Dumpling	31	29	Lamb, beef, horse meat dumpling
Noodle	31	33	Flour noodle (pasta)
Egg	17	1	Egg
Fruit	15	1	Grape, mandarin, apple, banana, orange, peach, gooseberry, sea buckthorn, raisin

Hygiene

Hygiene status of 72 gers is shown in Table 4. From the observational logs, 81 percent (58 out of 72) of total households had indoor sink. Amongst those who had indoor sink, 91 percent (53 out of 58) had sinks connected to a water tank not a water pipe. Main source of water was from public tank or a well which was located within 5 to 10 minutes walking distance. Ger residents who had difficulty collecting water physically (ex. elderly, residents with disability), had their relatives living within the same hashaa to help them with household chores and collect water. Additional hygiene status was observed through 7 categories of questions in preventive medicine part of the observational log. The proportion of households that washed their hands before their meals was 28 percent (20 out of 72). Only 13 percent (9 out of 72) of the households brushed their teeth after their meal. Out of 72, 44 households (61 percent) used soap and 61 households (85 percent) boiled water before drinking. Only 5 observers (7 percent) indicated 'yes' to the question of whether there was mold on the floor or wall. There were 18 observers (25 percent) who answered that there was dust inside ger. With

regard to the question of the assessment of the overall hygiene status, 39 observers indicated 'good' which took up 54 percent.

On the third part of the observational log, observers made assessment about hygiene in three categories; 1) cleanliness of cooking and dining space (5 questions); 2) handling of the ingredients (5 questions); 3) individual hygiene (2 questions). Each question was answered based on a scale of 1 to 3, where 1 indicated poor, 2 indicated standard, and 3 indicated good (0 represented 'unavailable to observe'). The average score of 72 households in all category was 1.74, and the average scores of each category was 1.91, 1.58, and 1.72 in the order of 1), 2), and 3) respectively.

With regard to the personal hygiene, observers made assessment on hand cleanliness and their clothing when ger residents were cooking and having their meals. Although the average score of the personal hygiene was 1.72 out of 3, the proportion of 'poor' assessment (35 percent) was higher than 'good' (25 percent) and 'standard' (26 percent).

Table 4. Hygiene status of 72 gers

Survey factors	Proportion (%)
Possession of Indoor sink (Yes)	81
Washing of hands before meal (Yes)	28
Brushing teeth after meal (Yes)	13
Use of soap (Yes)	61
Drink boiled water (Yes)	85
Visible mold on the floor or wall (Yes)	7
Visible dust inside ger (Yes)	25
Overall hygiene status (Good, Bad)	(54, 46)
Cleanliness of cooking and dining space (Good, Standard, Poor, N/A)	(31, 34, 23, 12)
Handling of ingredients (Good, Standard, Poor, N/A)	(28, 22, 15, 35)
Personal hygiene (Good, Standard, Poor, N/A)	(26, 26, 35, 13)

Heating and cooking related issues

1) Stove type and income level

Types of stove used in 72 gers were observed. The number of new type of stove increased from 15 households in 2016 to 22 households in 2018. One of the probable reasons accounting for such increase could be due to lower price of the new stove via the subsidies provided by the Mongolian government. Under the assumption that households with higher income level would be more likely to have new type of stove, this study looked into the income level of households and the type of stove used (Figure 1).

Based on the results obtained from the perception survey in 2018, which included information about monthly average household income, it was unlikely to conclude that the income level did influence the type of stove used in general. The average monthly income of households using old stove type was 612,000 MNT, while households using new type of stove was 632,000 MNT. However, among households using new type of stove, there was one household with extremely high income (2,500,000 MNT) which was four times higher than the average

income of 36 households (624000MNT). To exclude the effect of extreme values on average value, 10 percent trimmed mean was calculated. The results varied when the trimmed and crude mean were compared. 10 percent trimmed mean of households using old stove type was 573,000 MNT which is higher than that of new type stove- 551, 000 MNT. Via t-test, we were able to tell that there was no significant difference between the means when income of households was compared by the types of stove used (under the significance level of 0.05).

2) Ventilation and fuel use

During the observation period of 2016 and 2018, coal was the main type of fuel (90 percent) followed by wood (8 percent). Only 2 households used dung as fuel among 72 households. For other types of fuel, 3 households used bean pods or nut shell, 2 households used paper or wood dust, and only 1 household used rubber to start off the fire.

According to the 2016 and 2018 observational log, 18 out of 72 households (25 percent) ventilated during the observation period. Under the assumption that the choice of ventilation is associated with the Ge of fuel used, households were divided into two groups: households that ventilated during the observation time and households that did not ventilate (Figure 1). The maximum amount of fuel used amongst those households that have ventilated was 16,126g per day, while it was 21,425g per day for those households that did not ventilate. Types of fuel include coal, wood, and animal dung. Both the mean and median value of the fuel used amongst the households that have ventilated (7,833g, 7,862g) were higher than those that did not ventilate (7,328g, 7,346g). T-test results showed that there was no significant difference in the means when the amount of fuel used was compared by the choice of ventilation (significant level = 0.05).

Cooking

A total of 58 households out of 72 (80 percent) cooked during the observation period. The frequency of cooking was highest from 1pm to 1:30pm, 27 households cooked during this period. The average duration of cooking was 1 hour and 13 minutes. Ger residents mainly used stove and induction range (or electronic pot) for cooking; 26 households (45 percent) used stove and 37 households (64 percent)

used either an induction range or electronic pot. Adding fuel for cooking took 11 percent (19 out of 152) out of total amount of fuel added, and 4 percent (20,590g out of 503,098g) of total amount of fuel use. Although ger residents' dependency on stove for cooking was high, it did not result in higher use of fuel due to cooking.

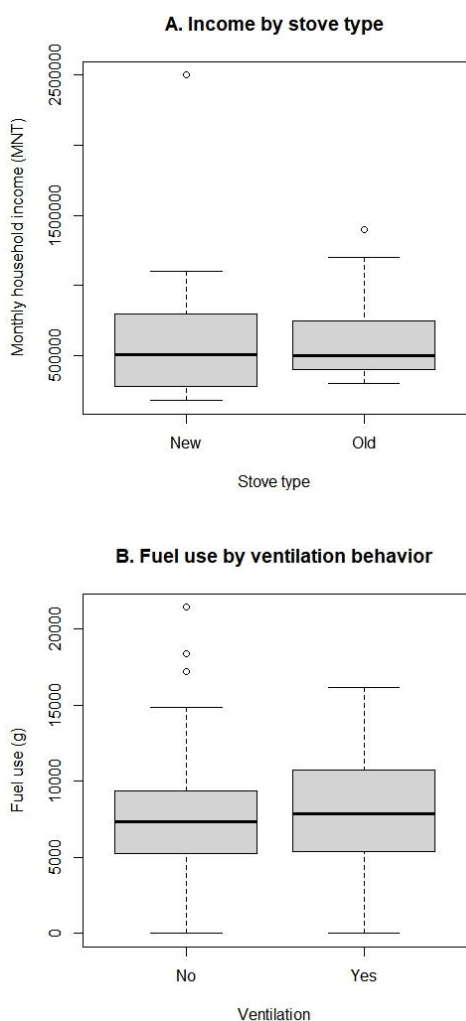


Figure 1. Income level by stove type(A) and amount of fuel use by choice of ventilation (B)

Discussion

Most of the Ger residents lived closely with their family members, taking care of their elderly member and children. Families living within the same hashaa visited each other's ger often. Such relations might

have a positive health effect on child and elderly care as parents of the children were about early to mid-20s and they needed someone to look after their children when they were out for work. Family members were supportive to each other helping out household chores.

Low consumption of alcohol and low level of physical activity were some of the characteristics of residents' health behavior. Greater attention needs to be paid on such low level of physical activity (lack of exercise) considering the result of dietary intake being highly dependent on red meat and dairy products and high prevalence of obesity rate in Mongolia[12-13]. Additional efforts to improve the level of physical activity amongst the residents are required. However, low consumption of alcohol has positive aspects in preventing chronic diseases that could otherwise be worsened by high alcohol consumption. This result was discordant with the average daily intake of alcohol in Mongolia reported by WHO (32.4g/day)[14]. Probable reason for this result is that most of the occupants were women and observation was conducted during the day time. Although cultural background and cold weather are some of the factors that contribute to such high level of alcohol consumption in Mongolia[15], this was not applicable to all of the ger residents who were part of our observation.

Traditional ger residents recognized the severity of air pollution and this was reflected in the 2018 perception survey results, where ger residents' perception towards environmental pollution were questioned. Such recognition towards air pollution was reflected in the behavioral pattern of choosing to smoke outdoor rather than indoor. However, with regard to the severity of indoor and outdoor air pollution, ger residents seemed to consider the indoor air pollution less severe than outdoor. This could also be seen in the choice of ventilation. Since indoor air pollution was perceived as less severe than outdoor, not many ger residents ventilated. Health effect of such perception and behavior might have led to high proportion of medical symptoms on eyes, heart, nose, and throat.

Red meat took the highest proportion in both food storage and intake, egg and fruit took the lowest proportion. However, there were some differences in the rank of proportion among other ingredients such as tea/beverage and dairy product. Since the

proportion of dietary intake was counted based on the main ingredients used for their meals, tea/beverage did not take high proportion compared to others. Even though vegetables and potatoes were second and third highest in the proportion of dietary intake, the rank itself may have limited implication as it did not represent the amount of the intake. In fact, when we observed the whole cooking process of ger residents, vegetables such as onions and potatoes were the essential ingredients of their main dish (mainly meat and noodles/rice soup). However, it was difficult to compare the exact amount of intake. Dietary patterns of the residents were irregular as they ger residents had their meals for 21 minutes on average showing wide variation of eating pattern from 9am to 5pm, rather than having meals at regular timings. Unbalanced diet with high consumption of red meat and irregular eating patterns can contribute to the high obesity rate and ultimately to high incidence rate of cardiovascular diseases.

In addition, the choice of taking shoes off inside the ger significantly impacted the hygiene status of each ger. For the assessment of hygiene, observers' additional comments were also considered as overall hygiene was widely varied from 'good' to 'poor.' The common factors used for assessing the overall hygiene status as 'good' or 'poor' was whether ger residents separated areas where outdoor shoes are allowed or not inside the ger. Even if they did not take off their shoes, some tried to wash the dust off when they came into the ger. Wearing the same set of shoes inside and outside of ger could worsen the indoor air quality as most roads in the ger district in Ulaanbaatar are unpaved. One of the dwellers who lived in both detached house and a ger shared his thoughts about the indoor air pollution of traditional ger. Within the same hashaa, his family move from one to another by the seasons (detached house during summer and ger during winter). According to observers' daily reports, one of the reasons why gers were more polluted than detached houses was due to the dust from the dust mainly coming from the shoe soles. When outdoor air pollution is severe, the pollutants tend to easily penetrate through dwellers' shoes. Lifestyle related to hygiene and indoor dust can cause health problems related to respiratory system and heart diseases. For these reasons, a small behavioral change such as taking shoes off inside the ger might lower the health risks of such diseases.

income level and types of stove used were not associated in our study. In fact, the Mongolian government implemented policies to provide monetary support for those who switched from old stove type to the new one until 2014. The aim of Mongolian government was to reduce the emission rate caused by the stove. As ger residents were highly dependent on stove for cooking, convenience for cooking when using the new type of stove was another important factor that needs to be considered. For example, the design of the new stove type is not suitable for putting a large pot on top of it. In addition, heating function and fuel efficiency were the most important factors to be considered during its usage in winter. From a survey results, the main problem with the new low-emission stove was that users had to start off a fire twice a day, and it was difficult to refuel[16]. Another main reason that users did not switch to new stove type was the financial burden. Even with subsidies, users had to pay additional US\$25, which can create financial burden (especially for the ger residents) as the monthly average income per households of ger residents in 2014 was 693,000 MNT (US\$289) including pensions and allowance[17]. Therefore, in order to encourage the ger residents to switch to the new low-emission stove, policies should consider not only monetary supports but also multi-dimensional aspects influencing ones' choice when switching to a new type of stove.

This study had limitation that the indoor air quality was not compared based on the ger residents' perception and behavioral pattern. This was because of the segmented study design within study group. Further study is needed to analyze air quality, perception, and behavioral pattern comprehensively. In addition, more information such as physical characteristics (weight, height) and basic health outcome (heart rate, blood pressure) should be supplemented on baseline characteristics of population for detailed analysis on health issues related to medical symptoms and hygiene status.

Conclusion

Lifestyle and living environment of ger district residents had both positive and negative aspects in terms of their health. Family structure and low consumption of alcohol had positive effects on caregiving and preventing alcohol related diseases. Lack

of exercise, unbalanced and irregular diet require implementation of new interventions to reduce the high prevalence of obesity in Mongolia. Perception on indoor air pollution seemed to have an impact on related health behaviors such as the choice of ventilation and smoking outdoor. With regard to hygiene, the number of times that ger residents washed their hands before meals and brushed their teeth after meals were low and wearing shoes inside ger indicated to be one of the main reasons for the presence of indoor dust inside the gers. Small behavioral changes such as taking shoes off and differentiating indoor and outdoor area can improve the hygiene status. Moreover, using new type of stove had no significant relationship with household income. In addition, the choice of ventilation and cooking on the stove did not increase the amount of fuel use significantly. Type of stove used could also be influenced by other factors such as the users' convenience when using the stove for heating and cooking.

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