The Elderly in The Context of Energy Poverty

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Abstract. While multiple papers under the category of energy have taken the ageing population into account, few have studied the well-being of the elderly specifically with depth. This paper reviews studies with regard to energy poverty, health and the elderly in recent years in order to highlight the profound relationship between the health of seniors and energy poverty which makes the elimination of energy poverty might be the key to achieving healthy ageing. The paper found energy poverty can influence the physical, mental and cognitive health of seniors mostly via poor housing conditions. When seniors live in regions where energy poverty is common, their conditions can be exacerbated by the lack of access to healthcare services of good quality and on time, especially during extreme weather. Regarding policies, there yet exist one that capable of solving the problem, and there still lacks a measure to monitor the well-being of older people more closely and directly. In the face of a series of challenges including the Covid-19 pandemic, the energy crisis induced by the Ukraine-Russia war and climate change, professionals in the field of public health and energy must collaborate for the welfare of the aged population in the future.

Keywords: Energy Poverty, Fuel Poverty, Healthy Ageing, Elderly, Thermal Comfort, Health.

1. Introduction

Energy plays an essential role in supporting basic human needs including maintaining indoor thermal comfort during harsh weather, and the adverse consequences of failing to do so are constantly associated with the topic of energy poverty, where health-related concerns are a major part of it. When households currently live in a state of domestic energy deprivation either due to the lack of monetary resources or secure access, the situation they faced is often defined as fuel poverty (FP) or energy poverty (EP) [1], which remains a global problem that exists in both developing and developed countries [2]. To date, the negative relationship between energy poverty and health has been found in many studies across different continents [3]. By impairing one's physical and mental health, inadequate housing is directly correlated with a higher mobility rate and a higher risk of mortality [4], amplified by poverty and climate change [5].

Certain types of individuals are more likely to suffer from the impact of EP and thus are considered to be vulnerable, and the elderly is one of them [6]. The elderly population is defined as people aged 65 and over [7]. Globally, it is the age group growing with the fastest speed [8], and the future with an ageing population is inevitable. According to data from World Population Prospects: the 2022 Revision, the percentage of the population aged over 65 is projected to almost double, from 10% in 2022 to 17% in 2050 [9]. Consequently, adaptions must be made to suit a growing older population in the long run. In terms of the health system, it is very likely for hospitals and nursing homes to only give services to bad cases due to limited capacity in the end [10]. With staying at home becoming the option for the retired, guaranteeing comfortable conditions in their house will be imperative. However, the well-being of aged people is often neglected or barely touched in the field of energy poverty. While multiple papers under the category of energy poverty have taken the elderly into account, few have studied the elderly specifically with depth. Therefore, this paper aims to fill in the gap.

This paper will first explore the correlation between energy and the well-being of seniors by reviewing relevant research in recent years. By focusing on literature regarding energy poverty, health, and aged people, the paper seeks to identify possible channels for the impact of energy poverty on aged people and the key challenges of conducting senior-specific studies. Finally, the last section will discuss whether advancing the improvement of EP might be a way to achieve healthy ageing from

the perspective of both the elderly themselves and the whole household. Suggestions regarding policymaking will be offered as well.

2. The elderly in the context of energy poverty and energy

2.1. Backgrounds

Ballesteros-Arjona et al. have concluded in their review that seeing energy poverty is such a "complex and multidimensional phenomenon in which the causes and consequences can vary according to the context under analysis", there just does not exist a universal definition for it [6]. The research on EP is diversified in terms of definitions, and one of the plausible explanations is the disparity of average living standards and growth levels in each country. In developing countries, most households' energy poverty borders around the accessibility of energy. Meanwhile, scholars in developed countries tend to focus on the affordability of energy. The powerfulness of these countries also allows them to pursue more sustainable energy usage in the residential sector, while some developing countries which have yet to achieve a considerable proportion of electricity accessibility do not have the ability to take it into agenda.

Similarly, there is also no single term of indicator for EP. Both subject and objective indicators have been applied in previous EP studies. Researchers calculate the former type by collecting the data via surveys [11-12]. As for the latter type, the most commonly seen indicators are those based on household energy expenditures such as Boardman's 10% and Hill's LIHC (Low-Income-High-Cost) [13]. Another frequently used standard for EP detection is the direct comparison between the level of pre-defined domestic energy service and the actual level achieved, like whether households are capable of maintaining a comfortable temperature in their main living room [13]. Recent EP literature tends to apply a multiple-indicator approach instead of a singular one [2, 3, 12, 14] as a previous study has suggested that it may lead to misinterpretation of the problem as well as cause vulnerable populations to be left out [13]. A considerable number of papers also chose to apply a multidimensional interpretation of the definition, where specific and more detailed energy needs such as cooking, lighting, laundry, education, and commuting are taken into account [15].

2.2. The lack of attention

However, although EP is a broad topic with great complexity, the aim of related studies is universally the same; A comprehensive understanding of the EP is fundamental for policymakers to mitigate the impact of EP on affected households and eventually solve the problem. EP is unevenly distributed among populations, following socio-economic factors [6]. As a result, vulnerable populations are often set as one of the foci of research, and the elderly is one of them [16]. But compared to other choices, they are far from popular. Jenkins et al. [17] have summarised 34 categories of the vulnerable from 155 EP research that related to EP inequality in their review published last year, where the popularity of the elderly only ranked 15th. Among 136 papers containing at least one social group of concern or enhanced vulnerability to EP inequality, 18 papers consist of older generations, and only 1 over 18 focuses on the group solely. In contrast, over 75% of papers selected by the review include the trait "poverty and economically marginalised", which was the most favourable one.

Reviews focusing on papers in terms of energy poverty and health, the most discussed aspect when the well-being of the elderly is concerned, also shows how unfavourable the elderly is. Ballesteros-Arjona et al. found out that over 73.7% of studies considered at least one axes of inequality, and age only has a ratio of 31.6% (with children, the elderly and age-without-an-age-group-in-particular all under this category) [7]. In another review conducted by Jessel et al., the time range set was between 1999-2019 [5], but citations that appeared in the section about the elderly only range from 2003 to 2011. Whilst the evidence mentioned cannot include all relevant papers in the field, considering their selection method does not involve any preference that might affect the percentage of papers whose

research focus includes the elderly, their data are hypothesized to be a result of random selection, thus capable of providing a revelation regarding EP with inequality to an extent.

In spite of health, aged people have also made a considerable number of appearances on the topic of energy when sustainable development is concerned due to the profound relationship between an ageing population and energy consumption. Whether an increasingly ageing population will lead to a higher energy consumption level (and thus higher carbon emissions) has arised controversies. On the one hand, a raise in the share of older people could cause more energy consumed as they typically spend longer time at home, and, by constantly needing to maintain a comfortable environment, they generate higher residential energy consumption [18]. Ageing will also contribute to higher old age dependency ratios (OADR) and create more energy consumption [19]. On the other hand, the reverse opinion states that because the elderly are more likely to have comparatively lower income and lower intensity of energy consumption, no concrete conclusion can be made. More importantly, an ageing population has a significant supply-side impact on reducing overall energy use in economic activities [20]. However, while discussions circling around ageing and energy consumption have their merits, the welfare of aged people (and thus retirement) is not within their focus. Therefore, although studies in the aspect have provided insights regarding the connection between an ageing population and energy consumption, research which extends the information to improve the well-being of the elderly is still lacking.

2.3. Previous findings

Plenty existed studies have investigated the correlation between individuals living in EP and their health conditions, and most of the intermediary effects can be applied to any group of people. Both physical and mental health effects have been reported in previous literature, adding cognitive health when the elderly are involved [21]. Evidence also shows that EP might exacerbate pre-existing conditions [4]. By living in inadequate housing conditions such as indoor air pollution [22], an indoor temperature too warm or too cold, dampness and mould, households are also put under multiple types of health risks.

Regarding indoor air pollution, adverse health outcomes often present themselves when households use solid fuels such as coal and wood for heating and cooking [15], which are commonly seen in the rural area with poor living conditions [23]. The anthropogenic emissions generated from using solid fuels may lead to more respiratory (i.e lung cancer and chronic obstructive pulmonary disease (COPD)) and/or cardiovascular disease (i.e stroke, ischaemic heart disease) and pre-mature death [24]. Similarly, households who are unable to either keep adequate warmth during cold winters or maintain adequate cooling during extremely warm summers (or both) may also suffer from respiratory and cardiovascular disease in the short and the long run [14]. The risk of mental health problems (like anxiety and depression [25]) for them is also higher, as the household may constantly trigger by mental stressors like financial stress, housing insecurity and chronic thermal discomfort, which has a direct impact on mental health [4, 26]. With respect to dampness and mould, those who have allergies and pre-existing conditions like asthma and COPD have a higher possibility of suffering from more intense reactions [27].

The elderly is considered to be especially vulnerable to these risks, compared with other types of people. The main reason is concluded to be that since the elderly spend most of their time at home, they receive a worse impact than those who are not [5, 28]. The two most stressed aspects are increased morbidity rate and higher mortality [4, 6]. In general, seniors are more likely to have existing conditions such as arthritis and rheumatism, which can be exacerbated by dampness and coldness resulting from EP. The group also possess a higher proportion of cardiovascular disease patients that can be triggered by inadequate temperature like cold stress, compared with other age groups [5]. Second, even without pre-existing conditions, the elderly are weaker in terms of immunisation and body circulation function with respect to younger people [10]. Therefore, an adequate indoor temperature is a must for seniors to be comfortable and healthy, and EP may impair

their ability to achieve the goal, thus leading to a string of household mayhem not only limited to health but also living standards [11].

The situations described above are especially severe when volatile weather (such as cold winter and extremely warm summer) is involved. As a result of ageing, the elderly may have difficulties dealing with the strong fluctuations of the temperature due to weakened physiological mechanisms [10]. Extreme weather has significant negative health impacts on the elderly for more reasons than physical frailty. As for coldness, access to health services might be hindered by cold winter. For instance, infrastructures like transport systems may be disrupted by snow and ice, causing hospital and domiciliary staff must spend a longer time to reach patients in need [29]. The elderly who already live in places that lack decent communication with health services due to EP might not get treatment in time. Similarly, extreme heat may also impair the functionality of hospitals and care services. In terms of structure, hospitals are designed to meet requirements like safety protocols restricting window openings, which may compromise thermal regulation and cause indoor discomfort. The possibly affected parties include patients, staff, medical equipment and medicines that need to store in a cool state [29]. In regions where EP is prevalent, the facilities are also more likely to encounter difficulties dealing with heat waves.

Specifically, aside from physical and mental illness, the elderly is often associated with cognitive health problems like dementia. World Health Organisation (WHO) reported over 20% of people aged 60 and over suffer from a mental or neurological disorder [30]. Currently, more than 55 million people live with dementia globally, with around 10 million new cases each year [31]. EP can have a significant influence on both mental and cognitive health directly and via affecting physical health, making it a imminent threat to healthy ageing [21]. A deteriorating cognitive health may also have detrimental effects on physical health. The capacities of the elderly to judge their own thermohygromentric comfort are sabotaged by the decrease in cognitive functions, eventually leading the elderly to be more easily subject to health risks [10].

However, while the elderly does seem to suffer more from EP, whether there is a causality between higher age and the state of energy poverty is controversial. Some researchers have found the elderly is one of the group of people who experiences EP at an above-average rate [4]. Also, the number of older people in one household seems to correlate with a higher risk of EP [32]. In contrast, some scholars argued that by controlling more factors such as income and household size, increasing in age may even associate with a lower probability of energy vulnerability [2].

It should be noted that households consisting of the elderly are diversified. Therefore, it is important to identify the real vulnerable group among the elderly to support older people in need. For instance, there exists research focusing on the elderly solely reporting that manual social class, social isolation and poor respiratory health showed the strongest association with self-reported cold home during winter [33]. Although the correlation between age and EP is rather unclear, it does not contradict the fact that the elderly has to face higher health risks should they live in EP compared with other age groups.

3. The paradox of policies

With respect to the concern for the welfare of the elderly and enjoyable retirement, governments worldwide have implemented policies that suit the need of the elderly in their countries to better achieve the aim of healthy ageing, and a majority of the policies aim to offer support in the aspect of health. This includes preventive measures, which by either finding the disease early (when the treatment is more effective) or preventing illnesses, have two significant advantages:

- Fewer risks for the elderly to experience unpleasant illness-related episodes
- Fewer risks for households that consist of the elderly in terms of financial stress regarding health expenditure

And rarely are these preventive measures implemented via the channel of EP, although some policies targeting EP do cover the elderly as they are considered to be vulnerable, coming from the

mindset of solving EP. Subsidising energy expenditure is one of the common ones, either in the long run and acts as a part of the pension, or in the short run to mitigate economic shocks. In the UK where the impact of EP is significant in winter, a part of the Pensioner Cost of Living Payment program funds the Winter Fuel Payment, which allows people aged 65 or over to collect subsidies for their energy bills [34]. Countries where winter is tough, like Germany, has also approved energy relief payment for pensioners, serving as a buffer for the elderly in the face of the recent energy crisis [35]. However, for several reasons, it is doubtful how effective and cost-efficient the policy would be.

First, while financial stress could be a major cause of EP, it does not only associate with a lower income level. For one, the lack of information access, especially in countries where the energy markets are not uniformly managed, may lead to EP. Consumers who received large energy bills may have made poor energy decisions due to limited education or difficulty in monitoring usage. In the case of the elderly, it is very likely that a considerable number of the elderly are struggling with energy-related decision-making [14], especially when they live alone. This also matches with previous studies which found social isolation to be a crucial factor for the elderly to live in the cold home during winter. Without assistance from other younger family members or professionals, even if there exist technologies with advanced information access, the elderly may not have the expertise to engage in them.

Other than information access, infrastructure could play an important role in causing EP. Particularly, in regions where the energy prices are relatively stable but EP still exists. Even though energy prices can fluctuate significantly in countries such as Australia, the US, the UK, and other European countries which operate in neoliberal economies. Some studies that have been conducted in these countries even applied energy price as an instrumental variable for EP, since it is a factor so closely related to EP [14, 25]. However, in countries where the energy markets are more centrally-managed, such as China, energy prices (despite being high with respect to some households with low income) are not an essential factor contributing to EP [36]. Given the continuous political well for welfare relating to domestic energy provision, China also operates a state-subsidy program for heating in cities in northern China, but it does not compensate for the disadvantage of a poor-built environment and rigid infrastructure. In the case of the elderly, this concerns not only the quality of the environment at home but also that of care homes and aged care facilities. The impacts of heat waves on the elderly are most noticeable when they are residents of such accommodations [37]. Subsidies to individuals are unlikely to help poor seniors to afford better care homes.

Second, even if financial stress is the key factor for the elderly (or the households that consist elderly) to live in EP (or energy-vulnerable state), subsidies will not change their monetary health condition fundamentally. For instance, when EP is concerned, households with elderly heads of household are generally linked with lower health status [38] and more use of health services and medication [39]. EP households that have older members also have higher causal chances of experiencing catastrophic health expenditure than those who are non-EP [11]. Even if financial support can help the elderly who are relatively healthy, the effect of the subsidy on EP regarding households heavily burdened by health expenditure is doubtful, and an uncomfortable indoor environment will only make the problem worse. In order to break the loop, long-term compensation for the elderly to pay their energy bill is still possible, and it might have smaller transaction costs compared with other non-monetary policies, but there lacks the research capable of proving it to be the most cost-efficient way to solve the problem associated with affordability when other channels are plausible.

Nevertheless, EP is a multidimensional and thus complicated problem: policies that are meant to be successful are not infallible. The capital city of China, Beijing, is equipped with Centralised District Heating (CDH) networks, which is a localised distribution that provides continuous heating at a fixed, subsidised rate when outdoor temperatures fall below 5℃ [36]. It is expected to fully eliminate energy insecurity related to thermal comfort as it provides secure access to heating without extra charge, but research conducted among households using CDH entirely suggests that there still exist households (around 10%) perceive themselves to be cold during the winter, which has also been

reported to be a common phenomenon present in formerly communist Central and Eastern European countries reliant on CDH [36]. In order to further increase our understanding regarding the possibility of advancing healthy ageing by the mitigation of EP, it is crucial for the authority to have a clearer picture of the well-being of the elderly. Yet, research on the well-being of the elderly is particularly faced with obstacles in terms of information collection:

- When the health of the elderly is involved in research, surveys are the most seen way of data collection, and often in relatively small ranges. Large ranges of surveys may take years to complete while at the same time costly.
- Direct subjective indicators collected via surveys could be biased due to political reasons
- Direct objective indicator regarding the well-being of the elderly is currently lacking
- Indirect objective indicators regarding the physical, mental and cognitive health of the elderly such as morbidity and mortality rate of diseases only offer a limited view of an older person's well-being and happiness

In the recent future, the turmoil in energy markets induced by the recent Ukraine-Russia war will bring more challenges to the economy that has yet to fully recover from the Covid-19 pandemic [40]. In the long run, weather can be even more erratic due to climate change. The elderly are confronted with serious threats of multiple health risks, thus making it the top priority for policymakers to have a better knowledge of the elderly before making long-term moves.

4. Conclusions

The problem of EP is deeply connected with health impacts, and the inequality in EP has also led to inequality in health. Specifically, due to the elderly being more affected once they are under the influence of EP, it calls for immediate attention and actions as an ageing population is inevitable. Previous studies in regard to healthy ageing in the field of public health and those concerning energy usage in the field of environment and economics have been in parallel lines, where it is possible, and should, be prompt to collaborate.

From the mindset of public health, EP could impose grave health damage on the elderly by impairing their physical, mental, and cognitive health. Housings that are unable to fulfil thermal comfort, food and water insecurity, and indoor air pollution will notably hamper healthy ageing. On the other hand, in order to achieve sustainable development where energy transition is required, the welfare of the vulnerable, including the elderly, must be considered. The view of health professionals could add critical components which might be neglected by economists in pursuing a just transition. The unity of understanding from both sides could show a new way for us to approach the core concerning the well-being of the elderly.

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