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Elderly mobility during the COVID-19 pandemic: A qualitative exploration in Kunming, China

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ABSTRACT

The outbreak of COVID-19 in China started at the end of December 2019. This led to a series of containment measurements to control the spread of COVID-19. Despite of the widely reported effects of these measures, inadequate attention has gone to their social impacts. The elderly, as one of the most susceptible populations, has experienced a considerable reduction in mobility.

This paper explores the role mobility played and how the social environment influenced elderly mobility in the first 2 months of the COVID-19 outbreak. We surveyed 186 families with a total of 248 elderly people in Kunming. The results show that mobility improves the quality of daily living, such as access to grocery shopping, maintenance of outdoor activities for health cultivation and preserving social networks even during the pandemic. Four themes relating to social environment emerged from the data as elements influencing elderly mobility during the pandemic: social pressure, practice of the virtue of Xiao, the social norm of respecting the aged and the impacts of technological advances. Among them, the virtue of Xiao enabled the elderly to stay in place in the early phase of COVID-19 by fulfilling their needs for daily necessities and social interactions, whilst being less technology-savvy further excluded them socially by restraining them from restoring mobility after the lifting of travel restrictions.

1. Introduction

The ongoing COVID-19 pandemic and the resulting containment interventions have aroused enormous attention in academic circles worldwide. There has been intense discussion of how and to what extent these measures have reduced the spread of COVID-19 (e.g., Flaxman et al., 2020; Gatto et al., 2020; Lau et al., 2020; Linka et al., 2020; Maier and Brockmann, 2020; Zhou et al., 2020), as well as their impacts on business (e.g., Donthu and Gustafsson, 2020; Fairlie, 2020; Hasanat et al., 2020), the economy (e.g., Andersen et al., 2020; Baker et al., 2020; Bauer and Weber, 2020; Kong and Prinz, 2020), and air quality (e.g., He et al., 2020; Menut et al., 2020; Singh and Chauhan, 2020). However, its impacts on mobility behaviour, which may influence society more persistently, have received much less attention in the current literature.

The elderly, as one of the most vulnerable populations, both in terms of coronavirus susceptibility and the mental health consequences of COVID-19 and related policy interventions such as social distancing (see Armitage and Nellums, 2020), has received timely academic attention (e.g., Banerjee, 2020; García-Fernández et al., 2020; Javed et al., 2020; Meng et al., 2020). Previous studies highlighted the importance of physical activities, which have been serving as an effective way to fight the mental and physical consequences of COVID-19 for the elderly (Jiménez-Pavón et al., 2020; Pitanga et al., 2020; van Tilburg et al., 2020). Since most of the physical activities took place outdoors, the elderly needed to be mobile at least within the community, yet the role of mobility in the elderly's daily life and elderly mobility issues during COVID-19 outbreak remained obscure.

Mobility, one's ability to move between different places independently and safely, declines with increasing age (Rantakokko et al., 2013). It is not only a prerequisite for maintaining functional

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independence, but also an essential element of quality of life for the elderly (e.g., Banister and Bowling, 2004; Metz, 2000; Schwanen and Páez, 2010; Tacken, 1998). Low levels of mobility put the elderly off social activities and consequently lead to a higher risk of loneliness and depression (e.g., Demura and Sato, 2003). It is therefore an important part of societal development in the transport domain to improve elderly mobility, which ensures their engagement in civic life, community activities and social interactions (e.g., Dickerson et al., 2007; Olawole and Aloba, 2014). However, governments have strongly discouraged elderly mobility since the outbreak of COVID-19. Despite the well-reported pandemic containment effects of mobility reduction, the impacts on the elderly's quality of life require further exploration.

To fill this void, this paper is set in the context of a wider set of social issues relating to elderly mobility. To explain the underlying causes of their persistence of mobility, this paper discusses the fundamental needs mobility serves in the elderly's daily life. Furthermore, it discusses how the social and cultural environment influenced the elderly's travel and other physical activity behaviours in the first 2 months of the nationwide outbreak of COVID-19 in China.

After there was an outbreak of a mysterious SARS-like virus among those who had been exposed to the Wuhan Huanan Wet Market in late December 2019 (Huang et al., 2020), the COVID-19 spread rapidly to all of the 31 provinces of China by the end of January 2020 (Baidu, 2020). In February, the number of confirmed cases had escalated from 14,380 to 79,824 in Mainland China, including 2870 deaths. The spread of COVID-19 then came under control—work resumption took place across China with an increase of 1730 confirmed cases in March. The initial success of containment of COVID-19 was largely attributable to a series of policies China's government implemented in the early phase of the pandemic (e.g., Chen et al., 2020; Salzberger et al., 2020).

After lockdowns and curfew laws went into practice in the centres of the outbreak such as Hubei Province and Wenzhou City (China Press, 2020; Kuo, 2020), many other local governments implemented restrictions to control the diffusion of COVID-19, such as village isolation (Song et al., 2020), travel restrictions (e.g., Chinazzi et al., 2020), community lockdowns (e.g., Pan et al., 2020), public transport shutdowns (Li et al., 2020), school closures and remote teaching (e.g., Bao, 2020) and the introduction of a smartphone-based health-tracking system (Wu et al., 2020).

This paper contributes to the existing literature in three aspects. Theoretically, it contributes to a more robust understanding of the role mobility plays in the elderly's daily life and how the social and cultural environment can influence it. Methodologically, it uses in-depth interview data to explore the needs and attitudes of the elderly, which informs researchers and practitioners to investigate the association between elderly mobility and social factors such as family interactions and new mobility services. Practically, it draws out policy implications for future pandemic containment interventions in China and beyond.

The remainder of the paper proceeds as follows. The next section introduces two bodies of literature: elderly mobility issues and the relationship between elderly mobility and the social and cultural environment, as well as the (anticipated) impacts of COVID-19 on mobility. Section 3 describes the methodology, including case selection, the recruiting process and information about the interviewees, and the process of interviews. In Section 4.1, we first report elder interviewees' travel and other physical activity behaviours and their attitudes towards containment interventions; then, we discuss the underlying causes of their mobility and resistance to travel restrictions. Section 4.2 sets out how the social and cultural environment may influence elderly mobility. In Section 5, we discuss how traditional Chinese culture enabled the elderly to stay in place by fulfilling their needs in the early phase of the COVID-19 outbreak and how smartphone-based new technologies further socially excluded the elderly. As such, this study provides new insights into the discussion of elderly mobility and technology-related transport inequity, which is still underexplored.

2. Literature review

To explore elderly mobility during the pandemic, this literature review focuses on previous studies on elderly mobility issues and the relevance of the living environment in elderly mobility during normal days to inform but not influence the qualitative data collection (see Dunne, 2011).

2.1. Elderly mobility issues

The maintenance of mobility is fundamental to active aging (World Health Organization, 2007). Decades of research indicated that a reduction in mobility has links with decreasing physiological adaptation to normal conditions and declining involvement in activities that provide interactions with the community and society, thus influencing quality of life for the elderly (e.g., Farquhar, 1995; Groessl et al., 2007; Yeom et al., 2008).

There are a number of conceptual frameworks that address the mobility issues of the elderly. Before the millennium, a special emphasis went on physical planning. Lawton and Nahemow (1973) developed a framework that considered the aging process as a continual adaption to the external environment and to changes in personal functioning. It therefore examined elderly mobility as one's ability to interact with the demands of the environment. Rowles (1983) viewed elderly individuals as situated in a dynamic sociospatial support system with distinctive geographical characteristics. Patla and Shumway-Cook (1999) proposed a conceptual framework for understanding elderly mobility within the community, and they identified eight critical dimensions that defined mobility as "the range of environmental contexts in which tasks can be safely carried out," namely ambient conditions, demands on attention, external physical loads, minimum walking distance, postural transitions, terrain characteristics, time constraints and traffic levels.

Webber et al. (2010) extended the understanding of elderly mobility to a wider range of aspects and proposed an interdisciplinary framework, cross-cutting evidence from geography, gerontology, medicine, planning, psychology and transport studies to interpret how mobility impairments may influence different life spaces. They also discussed the complex interactions between elderly mobility and its determinants. Nordbakke and Schwanen (2014) reviewed approaches to study well-being and developed a heuristic framework for examining its conceptualisation. The authors further displayed the potential links between mobility and well-being, which enriched the understanding of elderly mobility as a facilitator of being well.

Previous studies identified five determinants of elderly mobility, namely cognitive, financial, physical, psychosocial, and environmental factors. Cognitive factors include factors such memory and speed of processing, which is extremely important for elder mobility in car-dominant cultures such as the United States (e.g., Kerschner and Silverstein, 2018; Shoval et al., 2010). Individuals with low-efficacy beliefs were scared of being mobile, although they may be capable of driving and walking (Perkins et al., 2008). Older people with less financial burden could have access to various travel modes to maintain a higher level of mobility (e.g., Ipingbemi, 2010; Rosenbloom, 2004). Older people, including those who have never fallen, demonstrated fear of falling and hence restrained their intention to mobility (e.g., Friedman et al., 2002; Nascimento et al., 2018; Tinetti et al., 1990). Research revealed that the elderly sometimes restrict themselves from being mobile because of mental health issues such as depression (e.g., Dirik et al., 2006; Gayman et al., 2008). Although Mifsud et al. (2019) recently revealed that elderly mobility predominantly depends on people's intentions, which undergo influence from social pressures from specific groups, whilst transport infrastructure has an inconsequential effect on elderly mobility, a large body of empirical research has analysed the association between the environment and elderly mobility, which the next section elaborates.

2.2. Mobility and the living environment

In this section, we review the empirical contributions to the impacts of the living environment on elderly mobility organised into two broad themes: the intensively studied effects of the built environment and the much less talked-about social environment, such as social cohesion, social networks and cultural values.

Since driving is the most common travel mode among the elderly in the Global North, many studies have investigated driving behaviour and safe mobility for the elderly (e.g., Gelau et al., 2011; Mifsud et al., 2017; Ryan et al., 2015; Schmöcker et al., 2008). Although the elderly use public transport much less in such contexts, it is still fundamental to maintain their mobility, especially for those who do not drive (Shrestha et al., 2017). More importantly, elderly mobility in transit-oriented contexts largely depends upon public transport and active travel modes (Wong et al., 2018), whose interrelation with the built environment is more noteworthy. The built environment is an essential element of a variety of activities that the elderly need, want and commonly perform, such as access to affordable health care services (e.g., Cheng et al., 2020), access to urban green spaces and parks (e.g., Parra et al., 2010; Rojas et al., 2016) and access to shopping facilities (e.g., Ishikawa et al., 2016). Empirical studies have also identified pedestrian-friendly features of the neighbourhood that enhance elderly mobility, such as living in elderly-friendly communities (e.g., Alley et al., 2007), living in areas with a middle park area (e.g., Gómez et al., 2010), perceived security from crime (e.g., Lucchesi et al., 2020), the presence of pedestrian protection facilities (D'Orso and Migliore, 2020), the presence of recreational programmes (e.g., Fraga et al., 2011), the provision of leisure facilities within the residential environment (e.g., Fobker and Grotz, 2006) and volunteer opportunities (Gupta, 2018). Previous studies also brought out the association between elderly mobility and other factors within the physical planning dimension, such as residential density, street connectivity and land use patterns (e.g., Aditjandra et al., 2012; Chan et al., 2019; Li et al., 2005), but there remain controversies over the impacts of these factors. For example, Li et al. (2005) found that neighbourhoods with higher household density are more likely to encourage walking activity, whereas Olawole and Aloba (2014) showed that elderly people living in high residential density areas have lower levels of accessibility. This implies that some built environment factors may be context-sensitive and subject to different interpretations in different contexts, which requires further crystallisation.

Meanwhile, social and cultural environment factors, which are probably more context sensitive, have received much less attention in the current literature. Since the impacts of the nonphysical environment on elderly mobility are still underexplored, our review of the literature on social environment and mobility is not limited to the elderly. Based on a web-based survey of 110 residents in Malmö, Sweden and using a structural equation modelling technique, Ferreira et al. (2016) found that both spatial-physical and social-relational features of the neighbourhood influence walking intentions and behaviours. Using data from the Hamilton Active Living Study, Clark and Scott (2013) examined how four components of the social environment affect walking behaviour while controlling for physical environments and revealed the role of social cohesion and role models. The effects of relative deprivation on mobility are still under debate—some suggested that high levels of deprivation lead to mobility disability for the elderly (e.g., Fox et al., 2011), whereas Ogilvie et al. (2008) demonstrated that the environmental correlates of mobility are not generalisable between populations because those who have a low level of car ownership are less capable of making discretionary travel choices. There is a heated discussion on the relationship between social networks and activity-travel behaviour (for a review, see Kim, Rasouli, and Timmermans, 2018), with some merely considering it a source of explanation of activity-travel generation; however, except for a few studies focusing on social conformity, the wider influence of social environment has received much less examination.

So, the impacts of social environment on elderly mobility are still under scrutiny. Firstly, we still know little about how the elderly respond to external threat such as a pandemic in terms of mobility. Secondly, although there is widespread agreement that active travel is a way elderly people perform physical exercise, mobility can be more of a facilitator of other activities. However, mobility itself may play a more important role in older people's daily lives, and their mobility in the early phase of the COVID-19 outbreak may elucidate this. Thirdly, an in-depth exploration of how the social and cultural environment influenced elder mobility during the outbreak will enrich our understanding of the relationship between elderly mobility and the living environment.

3. Methodology

Since the social consequences of COVID-19 remain insufficiently explored and then only at the macro scale (Bonaccorsi et al., 2020), it is necessary to determine how and why the elderly respond to COVID-19 and its corresponding policy interventions, as well as their personal experiences, inner feelings, perceptions and cognitive processes during the tough time. A qualitative study for an initial exploration of the issue is therefore a prerequisite for undertaking larger quantitative studies by gaining meaningful indicative insights into the nature of elderly mobility issues, people's concerns about confinement policies and the interactions between social environment and elderly mobility (Maxwell, 2012).

3.1. The study area

The study took place in the city of Kunming, the capital of Yunnan Province in Southwest China. Kunming was the case for this study for three reasons.

(a) Kunming, as the third biggest city in Southwest China after Chengdu and Chongqing (see Fig. 1), is a typical Tier-2 city,[1] which shares similar economic, social, and spatial characteristics with other large Chinese cities. As of 2019, Kunming administrates seven urban districts, one county-level city, three counties, and three autonomous counties, with a total population of 6.95 million and an urban population of 5.11 million (Bureau of Statistics of Kunming, 2020). There were eight public nursing homes and 70 private nursing homes in Kunming by the end of 2019, providing 3156 and 15,400 positions, respectively. Since the majority of elderly people live at home due to the shortage of nursing facilities, especially affordable ones, this study only looked at people living at home.

(b) Kunming is a representative case in terms of both the seriousness of COVID-19 and the corresponding containment interventions. COVID-19 struck Yunnan at the end of January, with 187 reported confirmed cases, including two deaths to date (Baidu, 2020). In the first two weeks of the national outbreak, the authorities discouraged residents from engaging in social activities; shut down public transport; closed business zones, parks, schools, and universities; applied closed-off management to residential areas; and forbade rural residents from travelling to the city. Thereafter, starting in late February, a precision containment strategy began in response to the Central Committee's call for work resumption. The strategy involved a risk-based regulation,

[1] There is no official classification of Chinese cities. Multiple versions of classification exist, and economists, consultants, and businesses have used them. The consensus is that four cities belong to Tier 1 (Beijing, Shanghai, Guangzhou and Shenzhen) but Tier 2 is a rather vague category, usually including the capital cities of the provinces and some well-developed cities in East China, such as Suzhou and Tsingtao.

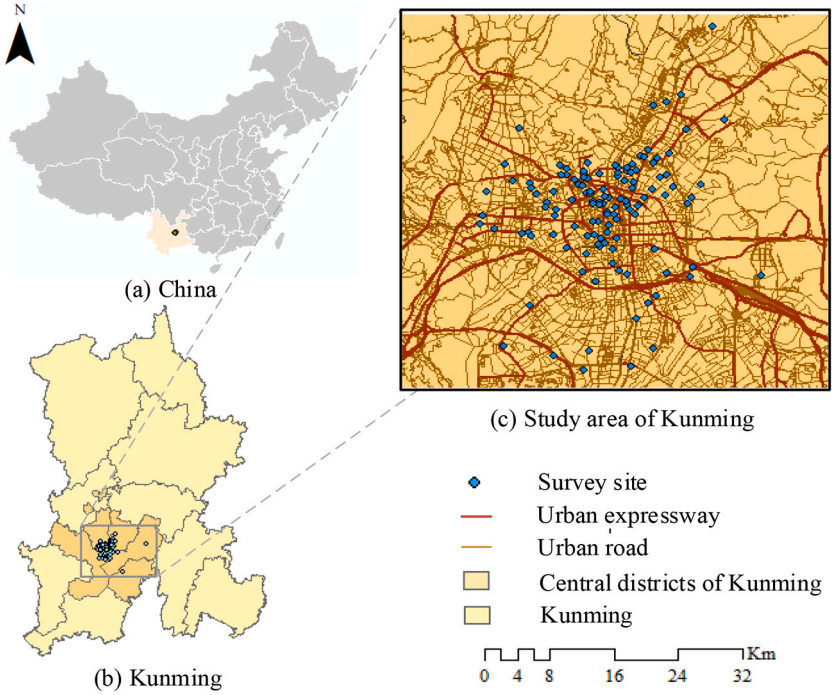

Fig. 1. The distribution of interviewees.

which lifted most of the restrictions on residents in low-risk regions (see Xinhua News, 2020) and implemented a smartphone-based health-tracking system after its roll-out in Shenzhen and Zhejiang Province (Mozur et al., 2020). In late February, most gated communities were open to visitors. The situation is similar to most other Chines cities, except for cities in Hubei Province and other centres of the outbreak, such as Wenzhou. Moreover, since there were various containment interventions without strict quarantine measures, the results of this study can shed light on a wider range of contexts beyond China.

(c) Yunnan province was one of the six provinces that reported no confirmed cases of SARS infection. Yunnan and Tibet were never shrouded in fear about SARS, as no suspected cases had arisen during the SARS pandemic (Ministry of Health, 2003). Therefore, we anticipated a more observable change in elderly mobility and their attitudes towards COVID-19 and containment measures.

3.2. *Recruiting process and information about the interviewees*

There were many problems in conducting face-to-face family interviews during the pandemic because Chinese people are generally unwilling to have long conversations with strangers and they saw face-to-face interactions as risky. Therefore, we adopted different approaches to reach diverse elderly groups.

The strategy for the first approach was to make the acquaintance of older people by walking and staying in the residential areas where they lived and talking with them informally. This approach was only useful in 16 gated communities because it is quite time-consuming and it was easier to reach older people after restrictions were lifted. The process started on 16th February, some three weeks after the nationwide outbreak of COVID-19. The process lasted for around 2 months and we interviewed the last family on 20th April. At first, it was only convenient to practice this approach in four residential areas because of the closed-off management in the early phase of COVID-19. The first interview took place after 4 days of short informal conversation and sometimes helping the interviewee to carry food home. The interviewer introduced the purpose of the study and was invited to her home for the interview. We approached 150 elderly people, and we recruited participants for 37 family interviews (123 participants in total) in this way.

We then asked the elderly people we approached in the aforementioned process to introduce their elderly relatives living in other residential areas to participate in our interviews. Although many participants warmheartedly helped the researchers to contact potential interviewees, the acceptance rate was low. We interviewed 62 families (192 participants) using this approach, and many of them had spousal connections with children of interviewees we recruited by the first approach.

We considered and carried out snowball sampling procedure to recruit interviewees, but it was extremely difficult to approach previous interviewees' acquaintances in this way. We only recruited nine family interviewees (25 participants) with this approach.

We recruited the other participants (78 families, 179 participants in total) at grocery shops, parks, plazas, and wet markets after travel restrictions were lifted. People in parks and plazas were easier to recruit as they were more willing to ask their spouses to come out and be interviewed when performing physical exercise. Since the researchers did not spend time making the acquaintance of these interviewees, most of the interviews with these participants took place outdoors.

Finally, a total of 186 families with 519 residents participated in family interviews. Among them, 248 were older than 65, 161 participants were aged between 40 and 64, and 110 participants were younger than 40. Since this study focuses on elderly mobility, only information about elderly interviewees is in Table 1. The distribution of elderly interviewees is in Fig. 1.

The recruiting approaches were undoubtedly biased because (a) the self-selection is impossible to circumvent in such qualitative explorations because of the voluntary participation principal; and (b) more importantly, it is extremely difficult to recruit interviewees to participate in such an interview-based study during the pandemic, especially when disadvantaged groups were the main focus of this study. The first strategy was initially used in communities where the authors own a property because other communities were difficult for the authors to enter; therefore, some participants selected from the first four communities had shared sociodemographic characteristics—retired university staff and officials. In fact, probably because of face-saving considerations, most interviewees we recruited from the second strategy

Table 1
Information about elderly interviewees.

Variable	Category	Number	Proportion/%
Gender	Male	115	46.4
	Female	133	53.6
Age	65–70	37	14.9
	70–75	69	27.8
	75–80	61	24.6
	80–85	47	19.0
	>85	34	13.7
Household size	1	6	2.4
	2	68	27.4
	3	82	33.1
	4	43	17.3
	>4	49	19.8
Housemaid	With housemaid	161	64.9
	Without housemaid	87	35.1
Type of community	Gated community	202	81.5
	Open community	46	18.5
Car ownership	Car free	221	89.1
	Car owner	27	10.9

(acquaintances of participants recruited by the first approach) were also from decent families (54 out of 62 families). Although participants recruited in public spaces were mostly in lower social positions, they were mentally healthy and generally quite optimistic. In other words, our recruiting process cannot really access those who seriously suffered from containment interventions, but, nonetheless, mobility issues clearly represented themselves in these relatively better-off elderly people's daily life during the pandemic, not to speak of their more disadvantaged counterparts.

3.3. Conducting and analysing family interviews

Family interviews took place in two different ways. 139 out of 186 interviews had two parts: group discussions between all the absent family members and short individual interviews with absent family members or, if all the family members could participate in the group discussion in a household of more than three, we interviewed at least one member (mostly younger ones) independently and that member did not participate in the discussion. This is because we anticipated a reluctance to discuss embarrassing experience in a conversation between family members, especially those who did not live with other family members before the COVID-19 outbreak. We preferred this form of interview because interactions between family members can be reflected through conversations. The other interviews took place independently with each family member. We also conducted these interviews outdoors when elderly interviewees were performing other activities.

To avoid asking biased questions, the interviewer only asked very general questions, for example, "How did you acquire food in the first 2 weeks of the outbreak?", "Why don't you use public transport now?", etc. A list of general interview questions is in Appendix 1.

Each family interview averaged about 55 min, ranging from 41 to 89 mins. Short individual interviews with absent family members averaged roughly 17 min, ranging from 7 to 23 min. Individual interviews with family members lasted an average of 24 min, ranging from 11 to 36 min. Complete transcripts of recordings were created and sent back to every focus group participant, but no feedback comments were received. The researchers translated all the transcripts into English in preparation for subsequent analysis. We adopted an inductive category development approach (Thomas, 2006), using the software package NVivo 11 to organise, code, categorise, and visualise the data. Liu and Liu conducted two rounds of coding independently. A line-by-line coding approach was adopted in first round of the open coding, and the word-by-word coding approach was adopted in the second round. The second round of open coding was conducted one month after the first round of coding to minimise the influence of the previous coding practice. To minimise the extent to which the meaning of content changed through translation, we used the Chinese versions of the transcripts in the first round of coding and the translated versions in the second round. The Kappa value was conducted using the Coder Comparison Queries of the NVivo for coding consistency in this study. The Kappa value for the first round of the coding was 0.74, which indicates a substantial consistency. The Kappa value for the second round was 0.87, which is almost perfectly consistent. All the authors read the transcriptions and three discussions on the themes between the co-authors and six experts from various fields.

We generated a list of 1896 codes ("nodes" in NVivo) in the open-coding stage, and then 58 theoretical codes ("parent nodes" in NVivo) were developed by weaving codes into themes. Due to the objective of this study, we used elderly mobility as the core to guide the selective coding. Finally, three themes about elderly mobility and four themes about social environment's impacts on elderly mobility emerged from this deep analysis: (a) behaviours, (b) attitudes towards restrictions, (c) needs for mobility, (d) social pressure, (e) Xiao, (f) the social norm of respecting the aged, and (g) the impacts of technological advances. Other themes were not used in this study, as they were not directly related to the selected core of the study "elderly mobility." Some outliers (37 codes) were not connected with any themes, but most of them are about some particular habits of the interviewees, such as playing basketball. In this framework, social pressure and the virtue of Xiao have close links with resistance to travel restrictions in the early phase of the outbreak, while challenged social norms and the impacts of technological advances influenced their mobility after travel restrictions were lifted. The coding and thematising process are in Fig. 2.

4. Results and discussion

This section introduces how older people in Kunming responded to travel restrictions and why they were so unexpectedly uncooperative in the early stage of the COVID-19 outbreak. Then it discusses the needs and attitudes of the elderly and the role of mobility in their life.

4.1. Resistance to travel restrictions

All the older people we interviewed before mid-March showed varying degrees of resistance to behaviour change, although most of them considerably reduced outdoor activities and social interactions. Sixty-seven out of 248 elderly interviewees accepted changes in daily life with unwillingness, confusion, and complaints. As one of the interviewees said:

> I moved to my son's house in Xishan (a suburban area) after the New Year's Eve Family Dinner. I planned to stay there for like 2 weeks, then suddenly, here comes the Coronavirus.… They (her sons) didn't allow me to go home. They frightened me, saying I can't survive this if I go back.… So, I stayed there for another 2 weeks. That's awful, very tedious. I have nothing to do and I have a lot of things to do back in my home.… I told them many times, 10 times at least, I want to go back to my home, but they said to me "don't be ridiculous." [Female, 91 years old, widowed, living with a housemaid, car-free].

Some were more stubborn and intensely opposed most of the COVID-19 policies, especially travel restrictions (86 out of 248 elderly interviewees). Interestingly, most of them (73 of 86) were older than 75. They persisted in performing physical activities outdoors, frequently in spite of their family members' concerns and persuasions.

Quite unexpectedly to the researchers, most of the interviewed older people (229 out of 248) routinely performed outdoor physical activities in the first month of the nationwide COVID-19 outbreak, whilst only three of the 110 interviewed young people went out regularly during that time. Undoubtedly, this is not because the interviewed older people collectively made irrational decisions or they did not recognise the threat of COVID-19. In fact, all of the interviewed older people

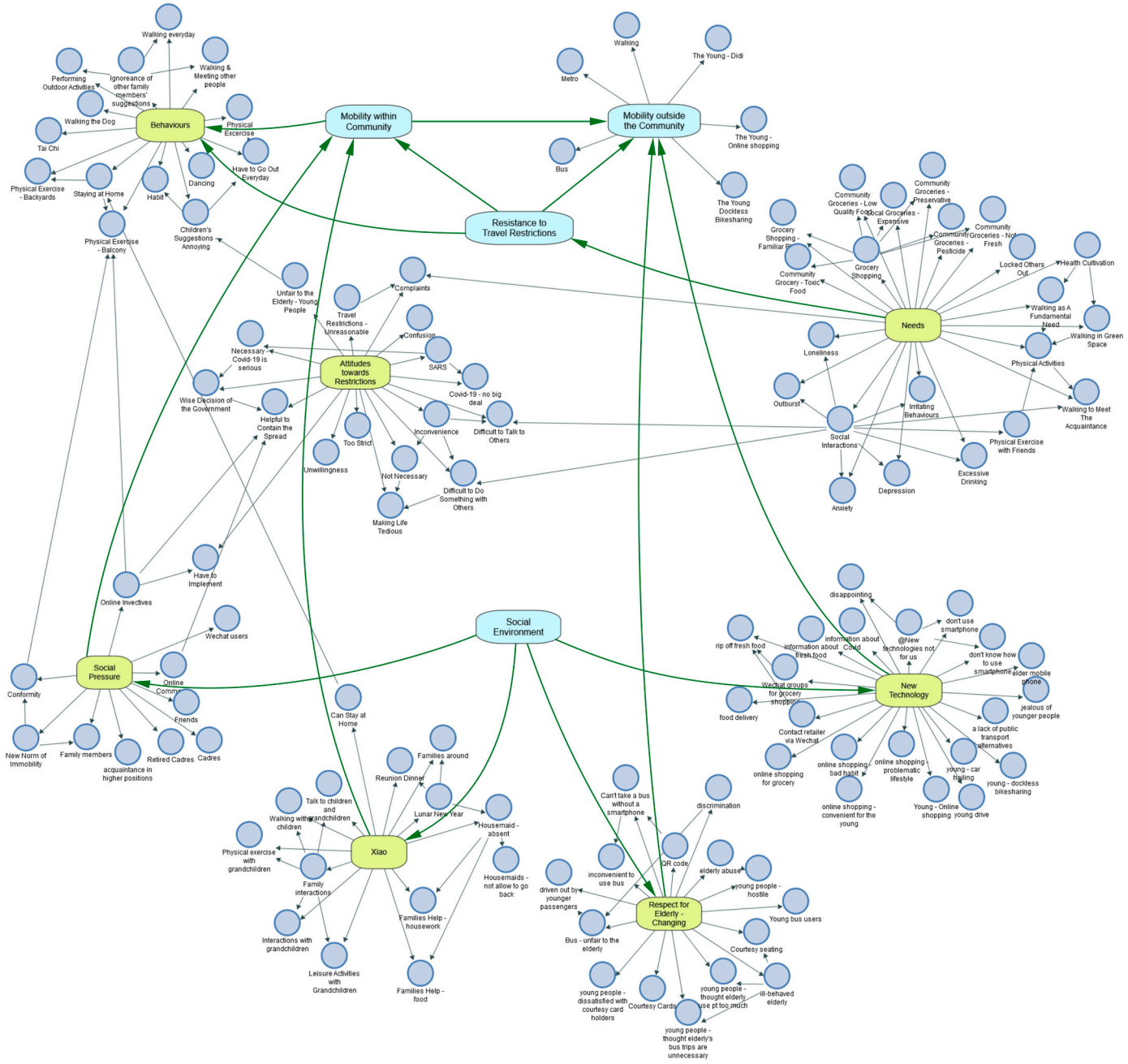

Fig. 2. Dynamic interactions between core topics.

acknowledged that they are the most susceptible population and many of them repeatedly declared that they had adopted various protective measures, even though they were ineffective in most cases. Therefore, it raised the question why the elderly, who were conventionally obedient to the Government due to their experience in the revolutionary era (see Gao et al., 2018), reacted to travel restrictions in such an insubordinate way.

4.2. Needs and attitudes

Although most of the elder interviewees thought the pandemic was life-threatening, some believed the seriousness of COVID-19 had been considerably exaggerated in the early days of the outbreak. Since COVID-19 was commonly reported as a SARS-like virus at that time (e.g., Cohen and Normile, 2020), they were quite optimistic about its spread because they believed the ultraviolet ray will kill the virus (52 reported when they were interviewed, and 153 said they thought so before).

Their attitudes towards COVID-19 changed dramatically when the reported confirmed cases climbed to 100 in 10 days (Health Commission of Yunnan Province, 2020). However, this attitudinal change did not lead to a perceptible change in older people's mobility—they still travelled, went shopping, and performed other outdoor activities in their most familiar ways. Despite the well-recognised risk of travel, older people were compelled to travel by some essential needs.

Grocery shopping is an indispensable part of older people's everyday life. In the first 2 months of the COVID-19 outbreak, older interviewees had experienced various degrees of difficulties in acquiring food. For those who lived in gated communities where entry and exit were strictly forbidden, older people had to acquire food from stores inside the community to which they "would never go for grocery shopping previously." Food in these stores was repeatedly described (by 236 elderly

interviewees for 1946 times in total) as "expensive but low-quality," "not fresh," "pesticide overused," "with preservatives," and sometimes more directly "toxic." Due to the widely reported food safety issues (e.g., Lam et al., 2013) and the tradition of health cultivation (e.g., Sun, 2015), eating healthily and safely is one of the most important life domains of the Chinese elderly (Liu and Grunert, 2020). Interestingly, 11 of the 12 elderly interviewees who did not mention food safety issues were those who were older than 85. It is probably because they did not do grocery shopping by themselves as they lived with their family or housemaids. Most of these interviewees travelled longer distances to familiar places to acquire food after lockdown restrictions were lifted, especially those younger ones (36 out of 37 people from the 65–70 category). Although some older interviewees were not influenced by the restriction, they had difficulties in access to food because public transport was shut down. As an interviewee complained:

> I do hope I can buy food nearby, although it might be expensive and … bad. But unfortunately, the nearest wet market is about 40 min' walk from home. There was a market near here, just around the corner. It was demolished about 15 years ago because of some cityscape transformation programme. The government said they would build another one, a better one somewhere else but … maybe they just hoodwinked us. It was not a big problem before. We get used to taking a bus to buy food in the Hongshan Market, but now it has become a very big problem for us. [Female, 76 years old, living with her husband, car-free].

Virtually all the elder interviewees deemed outdoor physical activity as the only way to achieve functional well-being, an important component of quality of life of Chinese older people (e.g., Lau et al., 1998). Since parks and gardens were temporarily closed to restrict the spread of COVID-19 and most interviewees considered public squares "particularly liable to infection," walking had become the most common form of physical exercise for elder interviewees (242 out of 248). The living environment had played a notable role in older people's walking experience during the pandemic. Walking and other physical exercises remained enjoyable for those who lived in communities within which accessible and attractive green spaces are available (71 out of 248). As one who lived on a university campus said:

> I went out and walked in the forest (in the campus) for around 1 h after breakfast every morning, and another half an hour after dinner, sometimes practised Tai Chi for a while.… Not so many people there, people outside were not allowed to come here now. All [the people I met] are retired people worked in this University.… Of course, it's not so convenient because you can't go out, but walking in the campus is good enough. I'm very satisfied. [Male, 73 years old, living with his wife, car-free].

Walking inside the community was acceptable to most of the people who lived in gated communities. Although the physical living environment may not have reached their expectations, they considered the lockdown restrictions during the initial phase of the COVID-19 pandemic "safeguarding the community from outside strangers" and hence providing them with a safe place for physical exercise. By contrast, those who lived in open communities repeatedly delineated barriers to walking (40 out of 248 people, mentioned 311 times in total). For example:

> It's difficult to do physical exercise now.… I used to walk and dance in the Yu Park every day, but now the park is closed.… [It's] impossible to walk outside. You can't do physical exercise on the pavement of a main road, can you?… The other roads are narrow and crowded, very close to other people. It's too dangerous. [Female, 67 years old, widowed, living with her son and daughter-in-law, car-free].

Since people cannot perform physical activities properly, these interviewees expressed discontent with a series of COVID-19 policies, including travel restrictions, community lockdowns, public transport shutdowns and public park closures. Many interviewees perceived these policies as more negatively influencing their daily life than the pandemic disease itself. This is not only because of the inseparable connection between walking and physical well-being, but also because walking offered most elderly interviewees the only opportunity for social interactions during the pandemic (209 out of 248 elderly interviewees). As a participant explained:

> At the beginning, our children can't visit us because of the community lockdown.… We can only see other people, meet other people, and talk to other people when we are out walking. [Female, 66 years old, living with her husband, car-free].

The need for social interactions, if not more important than other fundamental needs of the elderly, was the main underlying cause of complaints about COVID-19 policies. On the one hand, older people cannot effectively communicate with their acquaintances via telephone and social media apps, and therefore they were highly dependent on face-to-face conversations, which the Government and their loved ones strongly discouraged; on the other hand, social interactions among local residents were largely affected by travel restrictions and lockdowns—as the forms of outdoor physical activities became restricted, older people gradually lost their motivation to interact with other people during walking. Travel restrictions influenced the mental well-being of the elderly. For example:

> She [Female, 83 years old, widowed, living with a housemaid, car-free] had become more and more intolerable these days. Very irritable. She doesn't want to see me in the room all day but she doesn't allow me to go out either. … She has nowhere to go, she can't chat with other people like before. [Female, 44 years old, housemaid].

Despite the widely reported COVID-19-related mental health issues among the elderly population (e.g., Armitage and Nellums, 2020; Meng et al., 2020; Sepulveda-Loyola et al., 2020), the role of mobility reduction in the exacerbation of older people's mental well-being has not received sufficient exploration (see also Burtscher et al., 2020). However, the older interviewees not only perceived the reduction in mobility and social interactions relating to outdoor activities as the most dreadful consequence of COVID-19, but it was also repeatedly brought up to explain loneliness, depression, anxieties, changes in eating habits (such as excessive drinking), emotional outbursts and irritating behaviours of the elderly during the COVID-19 pandemic.

Elderly mobility goes beyond moving spatially. Elderly people remained mobile during the pandemic not only to access necessities and services spatially, but also, more importantly, because being mobile is a necessary and persistent part of elderly people's everyday lives. The in-depth study of older people's travel and physical activity behaviour and their attitudes towards COVID-19 policies during the initial stage of the coronavirus pandemic demonstrates the vital role of mobility in the generation and maintenance of older people's physical and mental well-being. Therefore, developing the content richness of elderly mobility requires further exploration of the relationship between older people's physical (in)activity and the wider social-cultural environment.

4.3. The social-cultural environment and elderly mobility

Although the initial interview design was more about exploring elderly people's daily activities and attitudes towards containment interventions during the COVID-19 pandemic, the impacts of the living environment emerged in an evolutionary way from the data. Unexpectedly, only a few older interviewees mentioned the extensively discussed built environment dimension, mostly related to access to parks and green space, and then only occasionally, whilst a wide range of social environment elements changed their mobility behaviour and

formed their attitudes towards government containment interventions.

4.3.1. Behaviour change under social pressure

Elderly physical activity behaviour underwent influence from pressure from their peers. Many elder interviewees gradually reduced their outdoor physical activities because of the people around them.

> I walked less and less. Many people I know do not come out that frequently.… I heard that young people say we are making trouble, they say we are messing up the country. [Male, 76 years old, widowed, living alone, car-free].

As the quote suggests, two kinds of social pressures had influenced elderly mobility during the pandemic. First, some older interviewees conformed to the social norm of immobility—they performed less outdoor activity because they believed their acquaintance who were in higher social positions travelled less; whilst a few interviewees, most of whom were retired cadres, interestingly, thought people who conformed to this new social norm had created a safer environment for walking. Also, elderly mobility reduced because others blamed older people for performing outdoor activities. According to many interviewees, the aging population was the target of online invectives which extensively reproached the elderly for their "ignorance," "irrationality," "selfishness," "lack of patriotism," "indifference to the pandemic," and "trouble making." Hence, those with access to social media apps significantly reduced their outdoor activities because of these accusations, some of whom even stopped walking and performed physical exercise on the balcony.

4.3.2. Xiao and immobility

Xiao, usually translated as filial piety (see Chan, 2004), is a Confucian virtue regulating the relationship between family members, which advocates humility and obedience to senior family members. As the core of Confucian ethics, Xiao and the traditional family culture played a vital role in helping the elderly to survive the early phase of COVID-19. Of 248 elderly interviewees, 92 moved to live with other family members in the first few weeks of the COVID-19 outbreak, especially those who were over 80 (53 out of 81). A total of 77 interviewees who were older than 80 lived with their families before their housemaids or hourly workers were allowed to enter the city. About half the elderly interviewees thought they were visited more frequently by their families after community lock-off management was lifted than in normal days.

Most of the interviewees started to see the threat of COVID-19 during the Chinese Lunar New Year, when children of older people returned to their home-towns to gather for the annual reunion dinner and to visit friends and relatives. Housemaids also went back to the rural areas before the New Year's Eve dinner before the state-owned media reported the COVID-19 outbreak (see Feng and Cheng, 2020). Therefore, older interviewees who lived with housemaids, especially widowed and divorced ones, were highly dependent upon their family members in the first few weeks of the pandemic. For example:

> I lived with my third son after New Year's Eve.… My housemaid went back home, and they (her children) told me she cannot come back because they (migrant workers) were not allowed to go out of the village.… It would be a big problem if they (her children and grandchildren) were not here. I can't live without them. The housemaid was not here, I'm too old to go out for grocery shopping, cooking, cleaning. If they were not here, I don't know what I could do. [Female, 94 years old, widowed, living alone, car-free].

Xiao and the traditional family culture enabled the elderly to be immobile when community lockdowns and public transport shutdowns made daily necessities extremely inaccessible to the elderly. On the one hand, elderly people could securely stay at home and perform outdoor activities for leisure and health cultivation purposes without worrying about food and housework, because they lived with their family members; on the other hand, interactions with their families considerably relieved their suffering from loneliness, depression, and anxiety due to COVID-19. It is noteworthy that many older interviewees perceived family interactions as a more effective way of depression alleviation than interactions with non-family members, even if they had received assistance from their former work unit, community, and/or neighbours. Since their emotional and social needs were largely fulfilled by family interactions, those who lived with their families travelled much less in the first few weeks of the COVID-19 outbreak.

The practice of Xiao was especially critical to the very old group, which had a higher degree of functional disabilities and was therefore highly dependent on assistance from others. Since most housemaids and hourly-workers they relied on for grocery shopping and housework in normal days were unable to return to the city from rural areas, they had to seek assistance from their children. Without the practice of Xiao, the very old group would have faced great survival challenges in the early phase of the outbreak.

Undoubtedly, COVID-19 policies such as community lockdowns may have met strong resistance and led to disastrous consequences without the virtue of Xiao and the traditional family culture when community assistance was absent. In other words, the virtue of Xiao and family interactions with the elderly in this special period contributed to grassroots governance and made it possible to implement a series of lockdowns and travel restrictions in the early phase of COVID-19.

4.3.3. The social norm of respecting the aged

It has been a longstanding tradition to respect the elderly in China. Since the Han dynasty,[2] government-issued laws have officially granted the aged an honourable social status (see Holzman, 1998) and advocated and rewarded behaviours relating to respecting the aged (e.g., Knapp, 2005). Courtesy seating has been allocated on public transport since the 90s and a free public transport card has been available to those who are older than 60 since 2007 in Kunming (Sohu, 2008). Although there were reports of sporadic incidences of conflicts between the elderly and younger people (e.g., Sohu, 2010), most citizens were giving precedence to the elderly in public spaces before the pandemic. However, unfriendly attitudes to and behaviours against the elderly emerged when elderly people attempted to take buses after public transport services were reopened. Consequently, the elderly was excluded from public transport services as they rarely considered public transport an available travel mode by mid-March. Many older interviewees (56 out of 248) expressed annoyance about being rebuked and humiliated by younger people after the public transport shutdown was lifted.

> That day, I wanted to take a bus then the driver asked me to scan the [QR] code. My mobile phone … is not a smart phone; it can't do that. … I told the driver, he asked me to get out. I thought that's unfair, so I argued with the driver. Then suddenly those passengers shouted at me and drove me out.… Although there are buses running outside now, we (elderly) are not allowed to use them. [Male, 77 years old, living with his wife, car-free].

This is an extreme case of elder abuse during COVID-19 in the transport domain. Many older interviewees reported similar but less oppressive experiences, which considerably discouraged their public transport use after the service lockdown was lifted. It was perceived as unfair to the elderly and many interviewees, including younger ones, called into question the reopening of public transport services.

Some older interviewees supposed that hostile behaviours towards the elderly during COVID-19 had emerged from younger public transport users' dissatisfaction with courtesy card holders for their immoderate use of public transport (see also Sina, 2020). According to older interviewees, younger people considered most of the public transport

[2] The second imperial dynasty of China (202 BCE–220 CE).

trips undertaken by the elderly unnecessary; therefore, others may think the elderly should not choose such a high-risk mode for seemingly unnecessary travel during COVID-19. Further, some older people appeared uncooperative when boarding the bus, mostly because of their unfamiliarity with smartphones, which has connections to widespread reports of shameful behaviours by the elderly (see Wei, 2014). In short, the COVID-19 pandemic intensified the dispute between elderly and others—public transport, on which most elderly depend, was perceived as extremely inconvenient and therefore unfair to older users, whilst other public transport users thought the elderly were more inconsiderate and ill-behaved during public transport trips.

In such circumstances, although most of the elderly interviewees lived in the city centre, where the spatial accessibility to public transport is very high, the elderly could not effectively use public transport without an elderly-friendly social environment. Partly due to this unfriendly social environment, the elderly was excluded from using public transport, thereby effectively restoring their mobility 6 months later then their younger counterparts (Liu et al., 2021).

4.3.4. *E-commerce, new mobility services and perceived inequities*

Compared to younger people, elderly mobility during the pandemic was particularly influenced by lifestyle change, especially e-commerce and new mobility services. Specifically, e-commerce enabled younger people to acquire daily necessities without travelling in the early days of COVID-19; and new mobility services, such as car hailing and dockless bike-sharing, had provided younger non-car owners with other public transport alternatives after the first few weeks of the nationwide COVID-19 outbreak. The negative impacts of COVID-19 and its corresponding policies on people's daily life were substantially alleviated due to technological advances; however, the elderly, who are generally less technology-savvy (e.g., Chaouali and Souiden, 2019; Pal et al., 2018), could hardly reap the benefits of these innovations.

Some older interviewees (31 out of 248) appeared resentful towards the convenience of new technologies younger people had been enjoying and expressed a sense of incompetence because they could not effectively use devices such as smartphones for shopping and travelling. An expectation of egalitarian outcomes of policies (Liu et al., 2019, 2020) manifested through their opinions about younger people. For example:

> He (her husband, 84 years old) was a professor in electronic engineering; he's extremely resistant to these, smartphones, other things, worse than me.… It's very disappointing for him that he did this for 40 years, but now he knows nothing.… My daughter, granddaughter ordered food (online) in the first 2 weeks [of the COVID-19 outbreak]. They delivered to our door; it's very convenient. They (her children) do that every day, [they can get] fresh vegetables and fruits. But we need to go out and buy food ourselves, low-quality food.… To do that you need a lot of accounts … online banking, about which we have no idea at all. [Female, 75 years old, living with her husband, car-free].

Most of the older interviewees were unfamiliar with online shopping before COVID-19. It was either perceived as an alternative way young people adopted for shopping or more commonly, a bad habit which they blamed their juniors for "buying useless stuff," "wasting money," and "being lazy." However, the elderly frequently mentioned (by 201 elderly interviewees, 877 times in total) inexperience with online shopping as the reason for inconvenience in the early phase of COVID-19. They had to take the risk of infection and walk to grocers to buy unacceptable food, whilst experienced online customers could avoid close contact with others by using fresh food delivery. In addition, other population groups used a variety of other smartphone-based channels to acquire food, such as contacting the retailer via WeChat and buying vegetable packages via WeChat groups. A few older interviewees displayed strong aversion towards online customers:

> It was extremely inconvenient for us because of them (online customers).… Because they can get food online easily, then it's just our problem. Nobody cares! We are old and useless; we can't buy good food because we are needy and picky. I know you people.… Those people ordered food from the local grocery shop; they picked the fresh ones. We walked there but can only buy the leftovers. [Male, 79 years old, living with his wife, car-free].

Similarly, many older interviewees thought the mobility of younger people was no longer restricted by COVID-19 after March, because public transport reopened and multiple new mobility services were available, whereas the elderly remained largely immobile.

> Work resumption was taking place days ago. It's not a problem for them: they can drive, they can use … Didi, very convenient. But it's still a big problem for us. We still can't travel further. We don't use cars, we don't know how to use Didi, and experts suggested we should not use public transport. [Female, 73 years old, living with her husband, car-free].

This partly explains why young interviewees rarely travelled in the first month of the nationwide outbreak of COVID-19. Also, young people can effectively communicate and interact with others via social media; therefore, they could largely fulfil their needs for social interactions online. However, the elderly cannot reap the benefits of technological advances and consequently they were unable to restore their mobility effectively after the lifting of travel restrictions.

5. Principal findings and general discussion

The narratives explored how the COVID-19 pandemic affected the elderly's mobility in their daily lives and the way by which the social environment influenced it during the pandemic. We studied these issues via a qualitative exploration based on in-depth family interviews. We found that most elderly interviewees remained mobile even in the very early phase of the COVID-19 outbreak when the government strongly discouraged outdoor activities. We identified four themes relating to social environment that influenced elderly mobility during the pandemic: social pressure, practice of the virtue of Xiao, the social norm of respecting the aged, and the impacts of technological advances. Our findings highlight an essential role of maintaining mobility in supporting the elderly's physiological and social needs during the pandemic. Going beyond existing studies, we revealed that the pandemic amplifies the impact of age-unfriendly social environments on elderly immobility.

Our findings on the elderly's voluntary persistence in being mobile during the pandemic were attributable to two major roles mobility plays in their daily life. Firstly, mobility is derived from the demand for acquiring daily necessities, especially for the elderly. Unlike younger people, who may eat in restaurants or order delivery food, maintaining mobility was of particular importance in the early phase of the pandemic for the elderly since they had to travel to acquire daily necessities, especially food from wet markets. This is in line with and elucidates the phenomenon that vulnerable groups reduced mobility much less than other groups during the COVID-19 pandemic (Fraiberger et al., 2020).

It is surprising to the researchers that elderly people rarely talked about accessibility to healthcare services, which has been a hotspot in the transport literature and is deemed as one of the key characteristics of elderly communities (e.g., Cheng et al., 2020; Neutens, 2015). This is probably because the elderly and their family members perceived visiting hospitals during the pandemic as risky; therefore, they avoided visiting hospitals for chronic diseases, which is definitely important for their quality of life but not an urgent need. Our results revealed that accessibility to healthy and safe food is also essential to the elderly. However, the elderly's accessibility to desired food has received inadequate attention in the transport field. Leaving out accessibility to food may misinform planners and policymakers of the importance of accessible wet markets during the urban renewal process, which may

consequently lead to long-distance travel for elderly people's food acquisition in normal days and inaccessibility to desired food during a public crisis such as the COVID-19 pandemic.

Mobility itself is an essential way for the elderly to engage in physical and social activities, thereby maintaining well-being and quality of life. The role of mobility as an activity by itself was apparently more important during the pandemic. After the outbreak of COVID-19, the closure of public spaces made walking one of the few alternatives for outdoor exercise for the elderly. Mobility also offered the only opportunity for many older people to interact with non-family members in the early phase of the COVID-19 outbreak. This was especially important for those who do not live with their children and grandchildren. Many older males did not undertake the responsibility of grocery shopping; therefore, they were eager to meet their acquaintances in the community and walk with them. In many cases, interviewees did not really need to chat with anyone—walking together with an acquaintance was already a great relief. The role of mobility served as an important, if not the only, part of social life for these elderly interviewees, which, as numerous studies have demonstrated (e.g., Lee and Ishii-Kuntz, 1987; Wang, 2016), is essential to elderly mental wellbeing. Conventionally, transport geographers focus on understanding the ease with which activities can be reached with the help of the transport system; however, our results suggest that being mobile, even without accessing any particular activity, is important to elderly people's quality of life. Therefore, improving community walkability can offer elderly people the opportunities to perform outdoor exercise, interact with other people and participate in social activities, which may promote active aging.

Together, the need for acquiring food by physically accessing local grocery stores, the need for functional wellbeing by walking, and the need for mental wellbeing by meeting their acquaintances and interacting with other people while walking brought about the resistance to travel restrictions in the early phase of the pandemic.

We found that four social environment themes, namely, social pressure, practice of the virtue of Xiao, the social norm of respecting the aged, and the impacts of technological advances, influenced elderly mobility during the pandemic. Social pressure refers to conformity that alleviated older people's resistance to travel restrictions in the early phase of COVID-19. Conformity is one of the few social influences that has been considered in research on activity-travel behaviour (e.g., Valentine, 1997); however, social pressure in this context is subject to quite different interpretations (see also Liu et al., 2019a). In short, elderly people were more likely to conform with those who were in higher social positions, such as retired cadres, while retired cadres hardly felt that they had imposed pressure for changes in behaviour. The social norm of respecting the aged was challenged during the pandemic. Many elderly interviewees experienced being insulted, shouted at, or driven out when attempting to use public transport after the restriction was lifted. Public transport was, therefore, not an alternative travel mode for many elderly interviewees one month after public transport service was reopened, and their mobility could not be restored, unlike other population groups. Previous studies on elderly satisfaction with public transport mainly focused on service aspects, such as the condition of stations and seat availability (e.g., Wong et al., 2017); however, as the results of this study revealed, a friendly environment to elderly public transport users also influences elderly mobility.

The practice of the virtue of Xiao and technological advances played a much more significant role in elderly mobility during the COVID-19 outbreak. The role of Xiao in present-day Asian countries has received extensive discussion in terms of long-term care (e.g., Chow, 1991; Zhan et al., 2011). However, familial care was more relevant to rural residents, whilst urban workers received support from sophisticated retirement benefits (see Luo and Zhan, 2012). In this study, we argue that the virtue of Xiao also plays a significant role in institutional care for the urban elderly. In the early phase of COVID-19, the virtue of Xiao enabled the elderly to stay in place and perform outdoor activities only for leisure and health cultivation purposes. They could fulfil their needs for social interactions effectively by performing activities together with their children and grandchildren, many of which they can never do with older acquaintances. Consequently, elderly interviewees who lived with other family members appeared less willing to walk and meet other people outside. Although they also complained about the pandemic and sometimes stated that they would like to go back to their own homes and live independently, they had no specific discontent towards travel restrictions. Members of the very old group were highly dependent on its families, and most of them received assistance from their children and grandchildren by moving to live with them in the early phase of the pandemic. Thus, they could survive COVID-19 without direct community assistance. It is conceivable that containment measures may face stronger resistance and bring about serious consequences if the elderly do not receive support from their families. The virtue of Xiao, therefore, contributes to grassroot governance when community assistance is absent. However, it is noteworthy that the practice of Xiao had such an impact because the reporting of the nationwide outbreak began during the Lunar New Year Holiday when people went home for reunion dinners; it is questionable whether the traditional family culture would have helped the elderly if the pandemic had started when their children were far away from home.

Technological advances did not seem to benefit the elderly. Instead, the elderly was involved in a technology-driven transport-related social exclusion during the pandemic. The elderly acquired food, travelled and communicated with others in the most traditional way. This was not perceived as a problem until the pandemic struck. The elderly, especially those who did not live with other family members, soon realised that they had to acquire low-quality and expensive food from community grocery shops by walking, whilst younger people had various ways to acquire fresh and less expensive food delivered using online platforms. After travel restrictions were lifted, younger people who did not own a car effectively restored their mobility via not only public transport, but also various smartphone-based new mobility services, such as dockless bike sharing and car hailing. In contrast, many elderly interviewees' mobility remains restricted, as they were unfamiliar with the smartphone-based health-tracking system and in turn, were afraid of taking a bus.

The findings of this study suggest that the pandemic has warped the time-space of urban transport systems. During the early phase of the pandemic, this presents itself as an absence of location-based activities. After the ease of mobility restrictions, it presents itself as networks and affordance that are unavailable to certain groups of people, such as the elderly. They either lacked the opportunities to benefit from online shopping and the associated logistical transport or suffered from transport-related social exclusion due to the smartphone-based health-tracking system which kept them away from using public transport.

This study could still be improved in a few ways. Firstly, the interviewees were mostly retired cadre members, retired employees of state-owned enterprises and public institutions living in the old town of Kunming. Therefore, the travel behaviour and attitudes of other elderly populations, such as older rural-urban migrants and older former rural *hukou* holders, may be different. Secondly, some behaviours may have been justified and interpreted in different ways by other family members during the family interview, which may not have reflected the real attitudes of the elderly interviewees. Thirdly, the implementation and analysis of qualitative interviews involves multiple subjective decisions. Although the interviews were coded by two researchers independently and the categorisation was discussed several times to minimise subjectivity, objectivity might be limited. Lastly, this is a qualitative study, which is useful for exploring and understanding the role mobility played during the first 2 months of the COVID-19 outbreak and how the social environment influenced elderly mobility, but the results of the study require further quantitative validation.

Authorship statement

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Appendix A. Appendix 1: General interview questions

Are you enjoying living with your families these days? Why?

Are you happy with the containment measures implemented in early February?

Are you happy with the containment measures now?

Did you do physical exercise outdoors? Why?

Do you think COVID-19 is a serious problem?

Do you think doing outdoor activities is dangerous?

Do you think these containment measures are necessary? Why?

Do you think these containment measures are successful?

How have these containment measures influenced your daily life?

How did you acquire food in the first 2 weeks of the outbreak?

How did you do physical exercise?

How do you feel living with your children?

What do you think about the containment policies (now, in late January)?

What do you think about the COVID-19 pandemic (now, in late January)?

What did you do today?

What did you do outdoors?

What did you usually do in the first 2 weeks (of the outbreak)?

What do you usually do with your families?

Why don't you use public transport now?

Why did you go out?

Why did you stay at home?

Why didn't you stay at home?

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