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Preferences for long-term care insurance in China: Results from a discrete choice experiment

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ABSTRACT

Rapid population aging has led countries to consider the introduction of long-term care insurance (LTCI) as an essential component of a comprehensive social health protection package. Limited evidence, however, exists on people's preferences for such insurance products, especially in countries where their availability is still restricted. Using a discrete choice experiment (DCE), we investigated preferences, willingness to pay, and heterogeneity in preferences for attributes of a social LTCI among community members in China. We adopted a multi-methods approach, combining information across different data sources to identify five DCE attributes: individual premium, benefit package, coverage ceiling, government subsidy for participants, and reimbursement of home-based care provided by family caregivers. We constructed our experiment using a D-efficient design and ran the DCE survey among 1067 community members in urban and rural areas in Shenyang and Dalian, Liaoning Province from Dec 2019 to Jan 2020. We relied on a panel mixed logit model to analyze the data. Our findings indicated that people had significantly higher preferences for the LTCI product with a higher coverage ceiling, a lower individual premium, a higher government subsidy, a reimbursement of home-based care provided by family caregivers, and an expansion of the benefit package to also include necessary daily assistance. The coverage ceiling was found to be the most important attribute, followed by the reimbursement of home-based care provided by family caregivers and the individual premium. Our findings also revealed that the area of residence, prior commercial insurance ownership, age, having children, and income were the factors that drove heterogeneity in preferences for LTCIs. These findings bear important policy implications, as they provide clear guidance on product design, enabling decision-makers to increase the attractiveness and sustainability of LTCI.

1. Introduction

Population aging is either affecting or will soon affect almost all countries. Worldwide, the share of the population aged 65 and above will nearly double from 9% (703 million) in 2019 to 16% (1.5 billion) in 2050 (United Nations, 2019). This rapid increase results in an urgent need for long-term care, since physical and cognitive functions decrease gradually with older age. Hence, identifying financing solutions for the provision of long-term care has become one of the most important policy concerns in many countries.

In low- and middle-income countries (LMICs), populations are aging at an extremely fast pace. By 2050, 80% of the population aged 65 and above will live in LMICs (United Nations, 2019). This phenomenon is especially visible in the largest middle-income country, China, where already in 2020 the proportion of people over 65 years old was 13%. This proportion is expected to rise to 27.9% by 2050, equivalent to 380 million people (China Development Research Foundation, 2020). Moreover, long-term care costs are substantially increasing in China, posing a great financial burden to the affected households. Without proper financial protection from long-term care costs, the affected households in this country have to pay out-of-pocket for these costs (Xu and Chen, 2019). Influenced by the miniaturization of family structures and the one-child policy, which was implemented in the 1970s, the traditional family-based caring system for the elderly is proving to be no longer sustainable (Feng et al., 2012). Hence, policy responses are needed to address increasing demands for long-term care in the country.

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In this regard, China's policy is oriented towards using the social insurance model to finance long-term care. In June 2016, the Ministry of Human Resources and Social Security issued a document "Guidance on Piloting the Long-term Care Insurance" and decided to pilot long-term care insurance (LTCI) in 15 cities (Ministry of Human Resources and Social Security, 2016). In May 2020, the Chinese government decided to expand the LTCI pilot to another 14 areas (National Healthcare Security Administration, 2020). The LTCIs in the first 15 pilot cities all rely on existing social health insurance schemes as the main financing channel (Zhu and Österle, 2019). This dependence on the funds of other social insurance schemes is convenient for gaining experience on implementing LTCI in China, but does not represent a sustainable funding channel. Similarly, due to constrained funding, the 15 pilot LTCI schemes can only provide a limited benefit package (Feng et al., 2020).

Expanding LTCI to the entire country requires the identification of sustainable sources of funding. Replicating the experience of many high-income countries, this process entails gradually increasing the premium and the benefit package of a dedicated LTCI product, independent of basic social health insurance coverage (Kato, 2018; Nadash et al., 2018). With specific reference to the latter point, China, like many other LMICs, needs to develop LTCI products whose key attributes, such as a premium and a benefit package, reflect the preferences of the community they target. These will make such LTCI products attractive to community members and hence increase the acceptability and sustainability of such products (Lambregts and Schut, 2020).

Surprisingly, however, we witness an extreme paucity of evidence in this regard. Worldwide, relevant empirical studies have mostly focused on how individual, household, or contextual factors influence the demand for private LTCI and have almost exclusively relied on LTCI enrollment data in the real market in high-income countries (Brown et al., 2012; Courbage and Roudaut, 2008; Lambregts and Schut, 2020; Li and Jensen, 2012; Lin and Prince, 2013; McGarry et al, 2014, 2018; Sloan and Norton, 1997; Tennyson and Yang, 2014; Van Houtven et al., 2015; Zhou-Richter et al., 2010). We could only identify five studies exploring individual preferences for attributes of LTCI using a discrete choice experiment (DCE) based in the US, Spain, Thailand, and Hong Kong (Akaichi et al., 2020; Allaire et al., 2016; Brau and Lippi Bruni, 2008; He et al., 2021; Chandoevwit and Wasi, 2020). Of these five studies, one concentrated on private LTCI; three used the type of insurance provider (private or public) as a defining attribute; only the study in Thailand focused specifically on preferences for publicly-provided LTCI. To the best of our knowledge, there is no published study exploring individual preferences for different attributes of LTCI in mainland China.

Our study aims at filling this gap in knowledge, using a DCE to assess individual preferences and willingness to pay (WTP) as well as heterogeneity in preferences for attributes of LTCI in China. Our study aims to generate evidence to inform policy formulation in China and to set an example for other LMICs interested in pursuing similar pathways to ensure long-term care coverage for their citizens.

2. Methodology

2.1. Conceptual framework

Globally, the demand for private LTCI has been very limited, and the uptake of LTCI is much lower than what the standard and basic insurance model would predict, based on expected utility theory (Lambregts and Schut, 2020). The existing literature has motivated this low uptake of LTCI in relation to supply-side imperfections and demand-side reasons (Lambregts and Schut, 2020; Brown et al., 2012; Brown and Finkelstein, 2009; Pauly, 1990; Ameriks et al., 2016). Supply-side imperfections result from the difficulties of insuring inter-temporal risk and the existence of adverse selection. The evidence for such imperfections is that the commonly purchased private LTCI has high average prices and limited benefits, i.e. the unattractive product features (Lambregts and Schut, 2020; Brown et al., 2012; Ameriks et al., 2016; Brown and Finkelstein, 2009). Demand-side reasons mainly include two aspects. On the one hand, individuals may underestimate the events with low probability and high loss that may happen in the long run or simply avoid considering the unpleasant risk of future disability (Lambregts and Schut, 2020; Brown et al., 2012; Brown and Finkelstein, 2009; Pauly, 1990). On the other hand, people may substitute private LTCI with government assistance (e.g. the Medicaid program), with financial transfers from their children, or with unpaid care provided by spouses or children (Lambregts and Schut, 2020; McGarry et al., 2018; Van Houtven et al., 2015; Brown et al., 2012; Zhou-Richter et al., 2010; Brown and Finkelstein, 2009; Pauly, 1990). Thus, in line with the conceptual model of purchasing health insurance (Berki and Ashcraft, 1980), we recognize that within a given context, the decision to purchase LTCI depends on two sets of factors: the design features of the insurance product (premiums, benefit package, etc.) and the characteristics of the decision unit (individual and household characteristics). Relying on DCE, we first explored how the design features of the insurance product influence people's preferences for LTCI, and then assessed how the interactions between the design features of the insurance product and the individual's characteristics influence respondents' preferences for such insurance.

2.2. Study setting

We conducted our study in rural and urban areas in Dalian and Shenyang, Liaoning Province. Liaoning is located in northeast China and has a population of approximately 43.5 million. Liaoning has 14 cities, Dalian and Shenyang being the most prosperous. Similar to other provinces in China, each city in Liaoning includes both rural and urban areas. As one of the three old industrial areas of the country, Liaoning used to be one of China's most prosperous provinces, but now its economic development ranks as average. Meanwhile, Liaoning is a province with one of the highest population aging rates in China. In 2017, 22.9% of the province population was aged 60 and above (Statistics Bureau of Liaoning Province, 2018).

Similarly to other parts of China, residents in Liaoning are covered by two social health insurance schemes, which offer coverage for routine preventive and curative health services: the Urban Employees Basic Medical Insurance (UEBMI, covering urban employees and financed by employers and employees), and Basic Medical Insurance for Urban and Rural Residents (BMIURR, covering the rural population and the urban unemployed and financed by government subsidy and individual premium). No LTCI has yet been rolled out in Liaoning, although one city, Panjin, has been selected as a pilot LTCI city starting in 2020. Liaoning residents, however, may already have some knowledge of LTCI due to media exposure.

Considering its rapidly aging population, Liaoning has long been constructing its long-term care system. Liaoning now includes 1079 long-term care facilities distributed across the entire province and has formed a well-functioning home-based and community-based care network in the urban areas of some prosperous cities, such as Shenyang and Dalian. Both initiatives were promoted and actively steered by the central government (Ministry of Civil Affairs of the People's Republic of China, 2019).

2.3. Development of DCE attributes and attribute levels

We developed the attributes for the DCE and the construction of the DCE scenarios sequentially. First, we used the Gilbert and Terrell (2005) social welfare policy analytical framework to conduct a literature review of DCE studies on LTCI and health insurance. DCE studies on health insurance were reviewed because LTCI and health insurance are closely related (OECD, 2020). Considering that all the reviewed DCE studies only involved three dimensions of the Gilbert and Terrell framework, we only used "how benefits are financed", "what benefits are offered", and

"how benefits are delivered" as our framework to summarize all potential attributes and attribute levels (Appendix Table 1). We did not include attributes to measure "who enjoys benefits", because this dimension captures a fundamental feature, normally defined a priori in the description of the product which precedes the actual DCE (Brau and Lippi Bruni, 2008; Chandoevwit and Wasi, 2020).

Second, we carried out a document analysis on China's national guidelines on LTCI and all the pilot LTCI policies from 2016 to 2019 (Shu and Wang, 2020; Wang et al, 2018b, 2018c). We also conducted a document analysis of the LTCI policies in Japan and Germany, the two major countries of the social LTCI model. Comparing the analysis of literature review and document analysis, we selected possible preliminary attributes that not only outline the Chinese LTCI, but also show the difference between current LTCI policies. The possible attributes included individual premium, government subsidy, premium payment method, benefit package, coverage ceiling and reimbursement rate, daily benefits, reimbursement of home-based care, and type of providers. Government subsidy was initially selected because among all pilot cities, almost half provided government subsidy, while the rest did not. Reimbursement of home-based care provided by family caregivers was initially selected because some pilot cities did not reimburse home-based care provided by family caregivers (the Japanese model (Kato, 2018)), while other pilot cities did (the German model (Nadash et al., 2018)).

Third, we conducted in-depth interviews with 11 policy makers and four academic experts to identify the final attributes, starting with the selection we made in step 2. In order to restrict the number of chosen attributes (Kjær, 2005), we excluded the premium payment method, referring to whether the individual premium for LTCI was paid in cash, or through individual medical saving accounts (money that is allocated from basic social health insurance to individuals to pay out-of-pocket medical expenditure), or deducted from salaries, because the panel of experts deemed that, considering participants spent on average less than 0.2% of their annual per capita disposable income on LTCI (Wang et al., 2018a; National Bureau of Statistics of China, 2020), the method of payment was not the key element deciding people's preferences on LTCI. We excluded daily benefits because experts considered that the design of "coverage ceiling and reimbursement rate" outperformed the design of daily benefits, even though a few pilot cities adopted the latter method. The national guidelines clearly recommended that the reimbursement rate of LTCI should be set at 70% and most pilot cities adopted the "70% reimbursement rate and certain level of coverage ceiling" to reimburse long-term care. We also excluded the type of providers as suggested by the experts because now almost all pilot cities cover services from home-based and community-based care providers and care facilities. This process resulted in the selection of the following five attributes: individual premium, benefit package, coverage ceiling, government subsidy for participants, and reimbursement of home-based care provided by family caregivers.

To make our hypothetical DCE scenarios realistic, we referred to the current options integrated in existing LTCI pilot policies to define the attribute levels for our LTCI. Specifically, we defined attribute levels as continuous for three attributes, i.e. individual premium, government subsidy, and coverage ceiling.

2.4. Experimental design

Once we had identified all attributes and relevant values, we constructed a D-efficient design using Ngene. Prior to the final DCE design, we constructed a design that was the same as our final design, assuming very small negative or positive prior parameters, whose signs were mainly estimated based on previous studies (Akaichi et al., 2020; Allaire et al., 2016; Brau and Lippi Bruni, 2008; Chandoevwit and Wasi, 2020). This design was piloted among 60 respondents with similar characteristics as the target population, but selected from a community in Dalian that was later not included in the formal data collection. To test internal consistency, we added a dominant choice set to each respondent in the pilot, in which one alternative was explicitly better than the other in terms of all attribute levels (Hensher et al., 2015). In the pilot, we aimed at generating prior parameters for the final design, confirming the appropriateness of every explanation in the questionnaire, an illustrative poster, and a video, and checking the easiness of the choice task. We found that all respondents passed the internal consistency test and had no cognitive difficulties in understanding the choice exercise.

Using the parameters derived from the pilot study, we constructed a D-efficient design in order to enhance the precision of the estimated parameters (Johnson et al., 2011). We used an unlabelled design with three choice alternatives comprising two LTCI packages and an opt-out option. Adding opt-out to the choice set was deemed necessary since in the national guidance LTCI was not determined as compulsory insurance and in some pilot cities the enrolment of LTCI was voluntary (Wang et al., 2018a). At the same time, forcing respondents to choose between two LTCI products can lead to over-estimation of utility for parameters (Hensher et al., 2015). The opt-out was explained to respondents as no LTCI insurance, represented by zero in all attributes in the dataset. Benefit package and reimbursement of home-based care provided by family caregivers were effects-coded to allow for the estimation of non-linear effects. Effects-coding avoids correlation between the constant term (representing opt-out) and the base levels, thus enabling the estimation of coefficients for all the attribute levels (Hensher et al., 2015). In addition, in our design, government subsidy was not related to individual premium and coverage ceiling.

In the final design, 24 choice sets were generated by Ngene and, based on the results from the pilot, no alternative dominated the other in each choice set. We therefore did not include the dominant alternative in the final design. The 24 choice sets were grouped into four blocks. Each block comprised six choice sets. Our design aimed at minimizing the D-error (measure of efficiency) of the multinomial (conditional) logistic model. The D-error of our final design was 0.0014.

2.5. Data collection

We obtained ethical approval from the biological and medical ethical committee of Dalian University of Technology, China. We collected our data from Dec 2019 to Jan 2020. The sample size of this study was calculated in relation to an S-error estimate of 252 (minimum sample per block) derived from the D-efficient design and thus led to a total sample of 1008 respondents that would have been sufficient to guarantee precision in the estimation of all model parameters (ChoiceMetrics, 2018). We used multistage stratified random sampling to select districts, streets, communities, and residential blocks. We first randomly selected two districts in urban and rural areas in each city and then randomly selected two streets in each district. Then, using probability proportional-to-size sampling, we randomly selected two to three communities in each district. In each community, we randomly selected five residential blocks. In each block, we selected approximately ten households. In order to improve the response rate and quality of the DCE interview, community staff (such as the staff responsible for civil affairs) assisted the research team in locating and visiting the sampled households to invite one member to the conference room in the community centre for the actual DCE. We calculated respondents' quota based on age, gender, and income to make the distributions thereof in our sample analogous to the general population in Dalian and Shenyang. In every community, we restricted our sample to those aged 20 to 75. The distribution of the sample closely matched a credible source of population data in Dalian and Shenyang (Dalian Municipal Statistics Bureau, 2019; Shenyang Municipal Statistics Bureau, 2019). Overall, 1067 of our sample size of 1106 respondents provided valid responses for the analysis, representing a response rate of 96.47%.

The selected respondents were randomly assigned to one block of choice sets. An equal number of respondents were assigned to each block. In each community, we first showed a short video to the

respondents, which introduced the definition of LTCI, the attributes, and attribute levels of LTCI in spoken Chinese. Then, around 10 trained interviewers (not community workers) conducted face-to-face interviews with the selected respondents. The interviewers helped respondents to understand the first DCE scenarios with the visual help of posters (Table 2, Appendix Fig. 1). Specifically, when addressing the first DCE scenarios, the interviewers explained, with support from notes, to the respondents that government subsidy and individual premium were non-related attributes in this study. LTCI was defined in the questionnaire, posters, and video as a social insurance that would reimburse care provided at home, within the community, or at care facilities and for people over 60 years of age, with poor health, and unable to fully take care of themselves due to frailty, illness, or accidents.

2.6. Analytical model and estimation procedure

The analysis of DCE data follows Random Utility Theory, which views the utility U_{ijs} that individual i obtained from a LTCI alternative j in choice set s as the addition of a systematic part and a random component part (Louviere, 2010):

$$U_{ijs} = V_{ijs} + \varepsilon_{ijs} = \beta' X_{ijs} + \varepsilon_{ijs} \quad (1)$$

where V_{ijs}, i.e. $\beta' X_{ijs}$, is the observable systematic part and ε_{ijs} is the unobservable random component part. X_{ijs} is a vector of the attributes of LTCI alternative j and$\beta$is a vector of the associated preference parameters. Under the assumption of utility maximization, individual i will choose alternative j that has the highest level of utility in choice set s (Hensher et al., 2015).

Within the conditional logit (CL) context, the random component, ε_{ijs}, is assumed to be an independently and identically distributed (IID) extreme value 1 random variate across alternatives and individuals. However, in reality, the ratio of the choice probabilities of any pair of alternatives may depend on the presence or absence of any other alternative, i.e. the violation of the assumption of the independence of irrelevant alternatives (IIA) (Louviere, 2010), which is behaviourally equivalent to the IID assumption (Kjær, 2005). In addition, in DCE studies, respondents usually have heterogeneous preferences. The mixed logit (ML) model relaxes the IIA assumption and accounts for preference heterogeneity. Therefore, the ML model is preferable to the CL model when DCE data do not conform with the IIA assumption and are with preference heterogeneity (Hensher et al., 2015).

Instead of assuming that $\beta$is fixed in formula 1, in the ML model, β_i is distributed with density $f(\beta_i|\beta, \theta*)$, where β is the mean of the preference of the attribute and $\theta*$ are the parameters of this distribution. One of the most common functional forms of β_i is normal distribution, mainly for its simplicity, with θ representing the standard deviation of preferences in the population (Hensher et al., 2015). Assuming β_i to be normally distributed in the ML model was also reasonable since in linear regression and logit model, $\widehat{\beta_i}$ can be assumed to be normally distributed and asymptotically normally distributed, respectively (Kennedy, 2008).

Our DCE data failed the Hausman test for the IIA ($p < 0.05$). This result was not surprising since the two LTCI options in our DCE were similar by nature, but different from the opt-out option. Therefore, we used panel ML to analyze preferences for attributes and attribute-levels

Table 2
Example of choice set.

Attributes	LTCI 1	LTCI 2	Neither
Individual premium	**550 RMB/year**	**100 RMB/year**	
Government subsidy	**0 RMB/year**	**60 RMB/year**	
Benefit package	**Basic + necessary daily assistance (e.g. preparing meals)**	**Basic**	
Coverage ceiling	**70% of total costs for items included in benefit package, no more than 4000 RMB/month**	**70% of total costs for items included in benefit package, no more than 1000 RMB/month**	
Reimbursement of home-based care	**professional staff +family caregivers**	**professional staff only**	
Which one do you prefer	○	○	○

Note: The LTCI fundraising totals equaled the sum of individual premium and government subsidy. e.g., in LTCI 1, The LTCI fundraising totals were 550 RMB/year, including 550 RMB/year of individual premium and 0 RMB/year of government subsidy; in LTCI 2, The LTCI fundraising totals were 160 RMB/year, including 100 RMB/year of individual premium and 60 RMB/year of government subsidy. The rest LTCI alternatives presented followed the same way.

Table 1
Characteristics of attributes and attribute levels.

Attributes	Attribute levels	Specific definition	Anticipated utility form	Priors from the pilot	Hypothesized signs
Benefit package	Basic	Basic daily care (e.g. bathing), medical (e.g. catheter care), and rehabilitation care (e.g. physical function training)	Non-linear	Reference	Reference
	Expanded 1	Same as Basic + necessary daily assistance (e.g. preparing meals, accompanying to medical treatment)		0.061	+
	Expanded 2	Same as Basic + providing necessary devices (e.g. wheelchairs) and adapting home environment (e.g. bed fence installation)		0.121	+
	Expanded 3	Same as basic + special care for the elderly with dementia (e.g. care for wandering behavior)		0.112	+
Coverage ceiling	1000 RMB/month 2000 RMB/month 3000 RMB/month 4000 RMB/month	Ceiling levels considering a reimbursement coverage equivalent to 70% of total costs for items included in benefit package	Linear	0.0002	+
Reimbursement of home-based care	professional staff only professional staff + family caregivers	Costs covered only for home-based care provided by professional staff Costs covered for home-based care provided by professional staff and family caregivers	Non-linear	Reference 0.190	Reference +
Government subsidy for participants	0 RMB/year 20 RMB/year 40 RMB/year 60 RMB/year	Government subsidy provided to those who were enrolled in this insurance	Linear	0.008	+
Individual premium	100 RMB/year 250 RMB/year 400 RMB/year 550 RMB/year	Individual premium actually paid	Linear	−0.002	–

of LTCI and heterogeneity in preferences for LTCI. Panel ML model accounts for the panel nature of DCE data (Hensher et al., 2015) as one respondent faces six choice sets in our DCE.

The utility function individual i obtained from a LTCI alternative j in choice set s was expressed as follows:

$$U_{ijs} = \beta_0 + \beta_{1i} benefit\ package\ expansion1_{ijs} + \beta_{2i} benefit\ package\ expansion2_{ijs} + \beta_{3i} benefit\ package\ expansion3_{ijs} + \beta_{4i} payment\ ceilling_{ijs} + \beta_{5i} family\ members\ providers_{ijs} + \beta_{6i}\ government\ subsidy_{ijs} + \beta_{7i} individual\ premium_{ijs} + \varepsilon_{ijs} \quad (2)$$

where β_0 is the parameter for the opt-out, β_{1i}-β_{7i} are the parameters for every attribute level for individual i and ε_{ijs} is the error term. The parameter of the opt-out was fixed, while all the rest assumed a random and normal distribution. We examined the theoretical validity of the estimated attributes in formula 2 by comparing their signs with the hypothesized signs (Table 1).

We further explored the interactions between the LTCI attribute and respondents' characteristics. Respondent characteristics were selected based on previous literature (Lambregts and Schut, 2020; McGarry et al., 2018; Van Houtven et al., 2015; Brown et al., 2012; Zhou-Richter et al., 2010; Brown and Finkelstein, 2009; Pauly, 1990) and included respondents' gender, age, education, area of residence, marital status, whether the respondent had children, per capita income, public health insurance, whether the respondent had ever bought any commercial insurance (any life, health, accident, etc. commercial insurance), whether the respondent had any chronic disease, and whether the respondent worried about long-term care when getting old. We then extended formula 2 with a series of interaction terms between respondents' characteristics and the attributed levels in which standard deviations were statistically significant ($p < 0.05$) (Hensher et al., 2015). We expected these interaction terms to influence preferences for attributes and attribute levels of LTCI as well. We used log likelihood ratio tests to compare goodness of fit between CL and panel ML without interactions, and the extended panel ML model with interactions. With interactions, the utility function individual i obtained from a LTCI alternative j in choice set s was expressed as follows:

$$U_{ijs} = \beta_0 + \beta_{1i} benefit\ package\ expansion1_{ijs} + \beta_{2i} benefit\ package\ expansion2_{ijs} + \ldots + \beta_{7i} individual\ premium_{ijs} + \beta_{8i}(area * benefit\ package\ add1_{ijs}) + \beta_{9i}(area * benefit\ package\ add2_{ijs}) + \ldots + +\beta_{67i}(worry\ about\ long-trem\ care * individual\ premium_{ijs}) + \varepsilon_{ijs} \quad (3)$$

where β_{8i}-β_{67i} are the parameters for the interaction terms between attribute levels and respondents' characteristics listed in Table 3. Only the variables that produced significant SDs in the first panel ML were deemed as the attribute levels associated with heterogeneity in preferences, i.e. the analysis of interaction in preferences was quite exploratory. We did not hypothesize the signs of interaction terms before data collection.

Meanwhile, we computed WTP space based on the basic panel ML model. WTP space generates more realistic values than those based on preference space, i.e. calculating the proportion of the negative coefficient of the non-monetary attribute to the coefficient of the monetary one (Hole and Kolstad, 2012). WTP space is expressed in RMB.

Additionally, we relied on the partial log likelihood estimation procedure, i.e. calculating the contribution of each attribute to the overall explanatory power of the ML model (log likelihood) to estimate the relative importance of the attributes of LTCI (Lancsar et al., 2007). All analyses were conducted in STATA. We used the mixlogit command for the panel ML model (Hole, 2007) and the mixlogitwtp command for WTP space (Hole, 2016). We used 500 Halton draws for all panel ML models.

Table 3
Socio economic interaction variables and respondents' basic characteristics.

Variable	Measurement	N	%
Area of residence	0 = Rural	456	42.74
	1 = Urban	611	57.26
Sex	0 = Male	387	36.27
	1 = Female	680	63.73
Age			
<35	1 = if age was in this range, 0 = if not	175	16.40
35-60	1 = if age was in this range, 0 = if not	553	51.83
≥60	1 = if age was in this range, 0 = if not	339	31.77
Education status	0 = Not received college or above education	692	64.59
	1 = Received college or above education	375	35.41
Marital status	0 = Single, divorced, or widowed	165	15.46
	1 = Married	902	84.54
Having children	0 = Respondent has no living children	192	17.99
	1 = Respondent has living children	875	82.01
Per capita monthly income	0 = Below or equal to average per capita income	667	62.51
	1 = Above average per capita income	400	37.49
Public health insurance	0 = BMIURR	509	47.70
	1 = UEBMI	558	52.30
Ever bought commercial insurance	0 = respondent has never bought commercial insurance	725	67.95
	1 = respondent has previously bought commercial insurance	342	32.05
Chronic conditions	0 = Respondent has no chronic conditions	805	75.45
	1 = Respondent has any chronic conditions	262	24.55
Worry about long-term care	0 = Respondent is not worried about future need for long term care	441	41.33
	1 = Respondent is worried about future need for long term care	626	58.67

3. Results

3.1. Descriptive statistics

Since each respondent faced six choice sets, surveying 1067 respondents resulted in 6402 choices. Out of the 6402 choices 3396 (53.05%) were counted for LTCI A, 2984 (46.61%) for LTCI B, and only 22 (0.34%) for the opt-out option.

Out of the total 1067 respondents, 57% were from urban areas, 64% were female, and 35% had received a higher education. Of all individuals surveyed, most were married (85%), had children (82%), and had no chronic diseases (75%). The respondents' mean age was 50 years, with only16% of all respondents being younger than 35. The average per capita income among respondents was 24,905.33RMB/year, and 37% of the respondents had per capita income above the average value. All the respondents were covered by public health insurance, with 52.30% being enrolled in UEBMI and the rest in BMIURR. Of all respondents, 32% had purchased commercial insurance at least once (Table 3).

3.2. Preference and WTP space

Table 4 shows the results of the basic panel ML model. All the coefficients of means of the attributes in the main effects panel ML model had the hypothesized sign. The Chi-Square test of the model's fitness showed that the basic panel ML model was statistically significant ($p < 0.05$). The intercept was statistically significant and was associated with a relatively higher negative coefficient, implying that respondents placed higher preferences on LTCI compared with opting out. Our results revealed that respondents had higher preferences for an LTCI scheme with a higher coverage ceiling, higher government subsidy, and reimbursement of home-based care provided by family caregivers. Compared with the basic package, respondents showed significantly higher preferences for the expanded package to which necessary daily assistance was added, but not for the other two packages. A premium

Table 4
Main effects panel ML model preference weights and WTP space.

	Preference estimates				WTP space			
	Coef		SD		Coef		SD	
Attribute and attribute levels	β	P	B	P	β	P	β	P
Benefit package								
Basic	Ref				Ref: WTP_{basic}[a]			
Expanded 1	0.151***	0.001	0.0046	0.975	94.722***	0.009	86.448	0.572
Expanded 2	0.047	0.305	0.3464***	<0.001	64.220	0.055	−100.502	0.166
Expanded 3	0.051	0.199	−0.0203	0.870	18.321	0.535	−28.538	0.548
Coverage ceiling	0.0005***	<0.001	−0.0005***	<0.001	0.345***	<0.001	0.310***	<0.001
Reimbursement of home-based care								
Professional staff only	Ref				Ref: $WTP_{no\ family\ caregivers}$[a]			
Professional staff + family caregivers	0.335***	<0.001	0.6625***	<0.001	241.012***	<0.001	−422.011***	<0.001
Government subsidy for participants	0.007***	<0.001	−0.0091***	<0.001	4.477***	<0.001	−5.178***	0.004
Individual premium	−0.001***	<0.001	0.0033***	<0.001	−6.752***	<0.001	0.895***	0.001
Opt-out	−4.912***	<0.001	–	–	−11383.540**	0.041	–	–
Number of observations	19206				19206			
Number of respondents	1067				1067			
Waldχ^2/LRχ^2	517.490				8553.520			
P>χ^2	<0.001				<0.001			
Akaike Information Criterion(AIC)	7992.425				8136.887			
Log pseudo-likelihood	−3981.213				−4053.443			

Significant at ***1%, **5%.
WTP space were in RMB. US $ 1 = 6.98 RMB.
[a] WTP_{basic} = -94.722-64.220-18.321 = −177.263, $WTP_{no\ family\ caregivers}$ = -241.012.

was significantly associated with a decrease in utility from LTCI (as indicated by a negative coefficient); respondents therefore preferred to contribute less to the LTCI scheme. The statistically significant SD estimates in the main effects panel ML model indicated the presence of inter-respondent heterogeneity in preferences across all attributes and attribute levels, except for the expanded benefit package 1 (when necessary daily assistance was added) and expanded benefit package 3 (when special care for the elderly with dementia was added). In addition, we also used a CL model to generate the preference estimates for LTCI (Appendix Table 2). A log likelihood ratio test further confirmed that the panel ML model performed better than a CL model ($p < 0.001$).

Based on the results of the partial log likelihood estimation, generated from the basic panel ML model, we calculated the relative importance of the various LTCI attributes. The coverage ceiling was found to have the highest influence on respondents' LTCI choices, followed by reimbursement of home-based care provided by family caregivers and an individual premium. These three attributes cumulatively contributed 94% to the overall explanatory power of respondents' choice made. Government subsidy and benefit package contributed the least to overall preferences for LTCI (Table 5).

For the non-linear variables with effects-coding, the base levels of utility coefficients are the negative sum of the other levels and the WTP from one level of an attribute to another is the difference in the corresponding coefficients (Balogh et al., 2016). Therefore, respondents were willing to pay 271.99 RMB ($WTP_{expanded1}$- WTP_{basic}) to enlarge the benefit package by necessary daily assistance, which accounted for 0.9% of their annual per capita disposable income (National Bureau of Statistics of China, 2020). They were inclined to pay 482.02 RMB ($WTP_{family\ caregivers}$ − $WTP_{no\ family\ caregivers}$) for the reimbursement of home-based care provided by family caregivers. When increasing government subsidy and coverage ceiling by 1 RMB, respondents would increase their contribution by 4.48 RMB and 0.35 RMB, respectively (Table 4).

3.3. Interaction effects

In the extended panel ML model, in addition to the two expanded packages that were statistically insignificant in the basic ML model, premium and government subsidy also became insignificant. In fact, only expanded benefit package 1 (when necessary daily assistance was added), coverage ceiling, and reimbursement of home-based care by family caregivers were the mean parameters that remained significant in the expanded model, while the standard deviations that were significant in the basic ML model remained significant in the expanded model.

The extended panel ML model showed that rural respondents had significantly higher preferences for the reimbursement of home-based care provided by family caregivers and a higher coverage ceiling than urban respondents. Those who have bought commercial insurance attached more importance to an LTCI scheme with an increased government subsidy and individual premium, while those who had children showed lower preferences for the expanded benefit package when providing necessary devices and adapting the home environment was added. Compared with those aged 35 to 60, respondents over 60 showed significantly higher preferences for the reimbursement of home-based care provided by family caregivers. Compared with those with lower per capita income, those with higher per capita income had significantly higher preferences for an LTCI scheme with an increased individual premium (Table 6).

Table 5
Relative importance scores.

Attribute	Log likelihood (attribute excluded)	Partial effect-change in loglikelihood	Relative effect-change in loglikelihood	Cumulative (%)	Order of importance
Coverage ceiling	−4373.848	−392.635	0.454	0.454	1
Reimbursement of home-based care	−4261.322	−280.109	0.324	0.778	2
Individual premium	−4120.112	−138.899	0.161	0.938	3
Government subsidy	−4012.974	−31.761	0.037	0.975	4
Benefit package	−4002.891	−21.678	0.025	1	5

Table 6
Heterogeneity analysis using panel mixed logit.

	Coef		SD	
Attribute and attribute levels	β	P	β	P
Benefit package				
Basic	Ref			
Expanded 1	0.159***	<0.001	−0.017	0.899
Expanded 2	0.318	0.091	−0.297***	0.003
Expanded 3	0.049	0.212	0.003	0.983
Coverage ceiling	0.001***	<0.001	0.001***	<0.001
Reimbursement of home-based care				
Professional staff only	Ref			
Professional staff + family caregivers	0.336**	0.021	0.655***	<0.001
Government subsidy for participants	0.005	0.277	−0.009***	<0.001
Individual premium	−0.001	0.380	0.003***	<0.001
Significant interaction terms [a]				
Resided in urban areas*Family caregivers	−0.177**	0.050		
Resided in urban areas*Coverage ceiling	−0.0002**	0.037		
Ever bought commercial insurance*Government subsidy	0.004**	0.043		
Ever bought commercial insurance*Individual premium	0.001**	0.017		
Having children*Expanded 2	−0.436***	<0.001		
Age>60*Family caregivers	0.138**	0.045		
Above average income*Individual premium	0.001***	0.001		
Opt-out	−4.956***	<0.001		
Number of observations	19206			
Number of respondents	1067			
LRχ^2	496.290			
P>χ^2	<0.001			
Akaike Information Criterion (AIC)	8003.631			
Log pseudo-likelihood	−3927.816			

Significant at ***1% and **5%.

[a] Since there were five attribute levels in the model with significant standard deviations (Table 4) and the dummies that were used to create the interaction terms were 12 (Table 3) then the total number of interaction terms were 60. It means that out of this 60, only 8 (about 13%) of the total interaction terms were statistically significant and hence included in Table 6. For lack of space, the remaining 52 interaction terms that were not statistically significant have been left out.

4. Discussion

This study makes an important contribution to the literature: it is one of the very first studies using DCE to explore preferences and WTP, as well as heterogeneity in preferences, for LTCI in a LMIC, and it is the first study in China. In line with prior evidence emerging from demand studies on LTCI (Wang et al., 2018c), our findings are indicative of a strong preference for LTCI, as less than 1% of the choices made were for the opted-out. Moreover, our study identified a coverage ceiling, reimbursement of home-based care provided by family caregivers, and an individual premium as the most important attributes driving respondents' preferences for LTCI.

First, we draw the reader's attention to the fact that a coverage ceiling was the most important attribute driving respondents' preferences for LTCI and that respondents expressed a clear preference for LTCI with higher coverage. These results are in line with previous DCE studies on LTCI (Akaichi et al., 2020; Allaire et al., 2016; Brau and Lippi Bruni, 2008; Chandoevwit and Wasi, 2020) and on health insurance (Abiiro et al., 2014; Obse et al., 2016; Vroomen and Zweifel, 2011). Furthermore, these results are consistent with a utility-maximization perspective, since coverage levels relate directly to one's expected gain from insurance and as such, can be expected to be the most important factor driving people's purchasing decisions. Our findings also indicate that rural respondents in particular expressed a marked preference for high coverage levels. This may be due to the fact that compared with urban residents, rural inhabitants are less able to cope with the financial burden incurred by needing long-term care (WHO, 2015), and they therefore favor LTCI schemes with higher coverage levels.

Second, we note that reimbursement of home-based care provided by family caregivers had the second highest influence on respondents' preferences. Interestingly, this preference was particularly marked among older respondents and respondents residing in rural areas. Our findings may be explained by the fact that, although accurate measures of how many elders are cared for in the home setting are not available, prior research has already suggested that due to socio-cultural norms and expectations, home-based care provided by family members is often a preferred long-term care option in China (Huang et al., 2011). Caring for the elderly has long been seen as a family responsibility since filial piety is one of the most important values in Chinese culture (Chou, 2011). It is also unsurprising that such a preference would be stronger both with older individuals, since they are closer than younger individuals to needing long-term care and are more attached to cultural traditions (Zhang et al., 2017), and with rural residents, who have poorer access to structured long-term care provision (Wu et al., 2016). Our findings suggest that to increase the attractiveness of LTCI and hence maintain its financial sustainability through continued enrollment, LTCI should be set to include reimbursement of home-based care provided by family caregivers. This may be especially important in rural settings, but also in large cities, such as Shenyang and Dalian, where people clearly indicate the wish to be able to choose between institutionalized and home-based long-term care. At the same time, however, measures should be set in place to monitor the quality of the care provided at home, since there is a risk that family members may receive reimbursement, but lack the capacity to provide the care needed by the elderly (Feasley, 1996).

Meanwhile, we found that an individual premium ranked third in influencing respondents' preferences for LTCI. A premium has previously been observed to be a key attribute in defining people's preferences for LTCI (Akaichi et al., 2020; Allaire et al., 2016; Brau and Lippi Bruni, 2008; Chandoevwit and Wasi, 2020) and health insurance schemes (Abiiro et al., 2014; Obse et al., 2016; Vroomen and Zweifel, 2011). In line with demand theory (Varian, 2009), as utility-maximizers, as individual premium increased, respondents' preferences for LTCI decreased. Moreover, we observed that those who have bought commercial insurance and those with higher income were more willing to purchase LTCI even at a higher premium. These findings align with prior studies examining demand for LTCI (Wang et al., 2018c; Brau and Lippi Bruni, 2008; Akaichi et al., 2020; Chandoevwit and Wasi, 2020) and suggest that access to higher disposable income increases people's capacity to pay and hence their predisposition to purchase insurance, just as much as increased awareness and first-hand experience with purchasing commercial insurance do. It is also plausible that individuals who have previously purchased any commercial insurance are more risk-averse and hence more willing to forgo a portion of their income today to avoid facing a potential financial risk at a later time (Outreville, 1998).

Fourth, we observed that government subsidy was another important LTCI attribute shaping respondents' preferences, especially among those who had previously purchased commercial insurance. As government subsidy increased by 1 RMB, respondents were willing to pay 4.48 RMB more for LTCI. Our findings resonate with previous observations in Thailand, where the government's decision to share a higher percentage of the caregiver cost was a key attribute in shaping people's preferences for LTCI (Chandoevwit and Wasi, 2020). Our results suggest that respondents prefer a higher government subsidy since this may be perceived as "welfare gains" or a discount when enrolling in LTCI. The findings also suggest that public subsidies are perceived to be of greater

value by those who, having purchased commercial insurance before, are aware of the cost of a full premium.

Last, our respondents expressed a clear preference for the benefit package including daily assistance, but did not attribute much value to the other more complex packages such as necessary devices, home environment adaptation, and special care for the elderly with dementia. To this regard, our findings differ from what has been observed in Thailand, where people also expressed a preference for the inclusion of home care products and devices (such as wheelchairs and disposable diapers) in LTCI packages (Chandoevwit and Wasi, 2020). Moreover, we observed that this preference for the benefit package including only daily assistance was more pronounced among respondents with children. Socio-cultural norms may help explain this finding, as the elderly often expect their adult children to provide for them, and to purchase the needed equipment in old age. Due to the one-child policy and widespread migration, the elderly usually live separately from their adult children in China. But monetary and non-monetary transfers between adult children and the elderly are very frequent (Lei et al., 2012). Building on these findings, we would recommend that in order to ensure affordable premiums and long-term financial sustainability, LTCI is first set up to cover relatively simple benefit packages, keeping in mind the possibility for later expansion. This strategy would replicate the policy development that has also characterized the last 20 years of social health insurance expansion in China (Dou et al., 2018).

4.1. Methodological considerations

As one of the very first studies examining preferences for LTCI, we adopted a series of strategies to enhance the credibility of our findings. First, we embedded our work in a Gilbert and Terrell (2005) social welfare policy analytical framework and combined literature and document review with in-depth interviews to identify relevant attributes that would specifically suit the Chinese context. Second, recognizing the cognitive burden imposed by DCE, we used both videos and posters to help respondents understand the definition of LTCI itself and its attributes. Third, we chose a panel ML approach as an analytical model, based on the nature of our data, which is the recommended way of analyzing DCE data (Hensher et al., 2015). All the attributes and attribute levels displayed the expected signs set a priori before we engaged in this study. This means that our study had good theoretical validity.

Nonetheless, this study still has a few limitations that need to be acknowledged. First, this study implemented a DCE in a province where LTCI had not yet been piloted, hence respondents are likely to have only limited knowledge of such an option acquired through exposure to national media. Second, given the limited number of significant interaction terms in our ML model, we recognize the possibility that variables not captured by our study might have been more suitable to explain heterogeneity in preferences. Third, we used a D-efficient design on the specification of a fixed effects CL model. Hence, it is possible that the exploration of panel ML might have affected the optimality of the D-efficient design. However, we consider that this effect would be minimal, since the results of the CL and panel ML models were very similar. Fourth, the sampling of this study was not a fully randomized design. However, we used quota sampling, stratified sampling, and proportional-to-size sampling to make our sample analogous to the general population. Fifth, it should be noticed that the relative importance of the attributes emerged based on the range of attribute levels included in this study. If the ranges of the levels for each attribute had been different, the relative importance of the attributes in the decision might have also been different. Sixth, we assumed β_{1i}-β_{7i} in the panel ML models with the most common distribution, i.e. normal distribution. If we had assumed β_{1i}-β_{7i} with other distributions (e.g. triangular distributions), the estimates might have been different. Seventh, in our study, the design of government subsidy was not related with individual premium or coverage ceiling. It is because when government subsidy had any impact on the individual premium or benefit of the choice presented, i.e., designing government subsidy, individual premium, and benefit as correlated attributes, then high levels of multi-collinearity would exist between them. Therefore, in line with a DCE study on crop insurance (Ye et al., 2017), we made government subsidy, individual premium, and benefit package as three independent attributes, which also shows the current status of LTCI in China (Wang et al., 2018a). In addition, we have also added the notes in the first scenario presented in the questionnaire explaining that government subsidy and individual premium were not related in this study. Considering that other social health insurances follow the same way of collecting individual premium under the condition of government providing some subsidy of participation (Dou et al., 2018) and with the help of the notes in the questionnaire, we believe that our respondents could understand that government subsidy and individual premium should be perceived separately in this study.

5. Conclusions

As one of the very first studies exploring preferences for LTCI in China, our findings indicate that in order to increase the attractiveness and sustainability of LTCI, future LTCI schemes should include a higher coverage ceiling, reimbursement of home-based care provided by family caregivers, a lower individual premium, higher government subsidy, and expansion of the benefit package by necessary daily assistance. Our results on WTP space for attributes and attribute levels could be applied in the initial design and future expansion of LTCI in China. The feasibility of implementing LTCI schemes that incorporate these features will need to be balanced against public health and financial considerations. This is essential to identify a product that meets people's preferences, takes into account population health needs and is financially viable. To reach such aim, our findings need to be complemented by further research exploring these issues.

Credit author statement

Qun Wang: Conceptualization, Methodology, Formal analysis, Writing – original draft; Gilbert Abotisem Abiiro: Methodology, Writing – review & editing; Jin Yang: Methodology, Data collection; Peng Li: Methodology, Data collection; Manuela De Allegri: Conceptualization, Methodology, Writing – review & editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2021.114104.

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