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Exploring the Needs of Elderly Care in China from Family Caregivers' Perspective via Machine Learning Approaches

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Abstract: With the rapid graying of China's population, ensuring and improving the quality of life for Chinese elderly people has become an urgent issue. This paper explores the needs of elderly people in China from the perspective of their caregivers by applying machine learning approach upon social media posts related to elderly care and subsequently put forward strategies with respect to data mining findings. We obtain more than thirty thousand texts from the Douban discussion group named "One-Child Parent Retirement Exchange"; Latent Dirichlet Allocation (LDA) model is employed to extract topic and words, to analyze and categorize text into relevant elderly care. This study then utilizes SnowNLP module upon previous outcome to appraise the emotional bias of the caregivers. Our finding points out that the essential needs of Chinese elderly people are mental health needs, information needs and intergenerational needs; the emotional bias of children in supporting their parents was generally negative. At the end, our paper subsequently suggests strategies to satisfy the primary elderly caring needs while at the same time alleviating caregivers' pressure.

Keywords: social media; text mining; ageing needs; intergenerational relationships



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1. Introduction

With 13.5% of its population or 191 million people aged 65 and over, China—the most populous country in the world [1]—is facing profound challenges in terms of caring for its elderly. It is projected that by 2025, the number of people over the age of 60 will reach around 300 million and could surpass 400 million by the end of 2035, respectively accounting for approximately 22% and 30% of the total population [2]. With the development of industrialization and urbanization, many young labor force began to move across provinces to find jobs, which led to the younger generation living in different places with their parents. Older parents in China are likely to be “empty nesters”, which means they live alone or with their spouses only with a lack of care and help. Effectively coping with the challenge of an aging population will have a profound impact on China's economic and social development. There are various elderly caring system models around the world. With filial piety as a tenet of traditional Chinese culture and core concept of Confucianism [3] and parent-child relationships at the heart of family relations in the East Asian cultural sphere [4], a home-based, family-centered, community-supported, institution-supplemented socialized elderly care system has gradually taken shape in China.

Although this unique elderly care solution is in line with China's social, cultural, and economic conditions, it is also publicly recognized that the family size in China has been shrinking since the official start of China's One-Child Policy in 1980, which means young generation carry a much heavier burden of family care than their parents did. Previous studies in context of elderly care issue categorize the roles of the family care service into two groups in terms of the subject and object of the service, namely the elderly person receiving care and the younger person providing care and afterward identify their distinct caregiving burden. From the perspective of the elderly care receivers, the family caregiving burden refers to the time, money and labor spent on meeting the daily needs of

the elderly and caring for them when they are ill, while from the perspective of the young caregiver, this refers to the psychological experience of stress, worry, anxiety, distress, etc., associated with providing care services [5,6]. Most previous studies on family caregiving have been conducted from the perspective of older people owing to the fact that it is the basis and foundation of the other perspective [7], yet we believe conducting research from care providers' perspective is also an indispensable part of the entire field of study, and discovering and satisfying the needs of elderly care providers can likewise greatly affect the construction and quality of the elderly care service.

In the past, fieldwork and analysis of specific databases are the mostly common utilized techniques in the field of user demand analysis. Presently, text mining methods have been proven to be powerful for this purpose. The information needs of online forums and discussion groups are being widely noticed. The vast corpus on the web has become data source for text analysis. Hot research topics range from top public opinion to basic activities such as food, clothing, housing and transport [8–10]. By mining and analyzing the large amount of corpus on the web, researchers can gain a more holistic understanding of the current state of affairs and scientifically predict future trends. Text mining often draws on natural language processing tools to structure text for further analysis. Natural language processing (NLP) is the process of helping computers understand natural language, combining linguistics and artificial intelligence, often using large data sets for topic refinement and sentiment detection. In Qian's [11] study, text mining approaches is employed to derive the health information needs of older people by analyzing text messages posted in forums. We consider it is highly feasible to use text mining technique to analyze the psychological and emotional status of young generation when caring their senior parents with advance in machine learning and natural language processing.

China's 14th Five-Year Plan reveals important plot for the development of the country's elderly care services system. Although exploring the needs of the elderly is a direct means to enhance the quality of elderly care, understanding dilemmas upon the children in caring for their elderly parents and alleviating their pressure to strengthen intergenerational relationships also plays an important role in improving care services.

The main contributions of this paper can be summarized as follows:

1. Our study explores elderly care needs in China from the perspective of direct caregivers by extracting texts published by registered users on the topic of elderly care and conducting thematic modelling and sentiment analysis.
2. Based on the demand obtained from text mining, this study proposes strategies to improve the quality of aged care services, aiming at offering a multidimensional perspective to improve the construction of elderly care service system in China.

The rest of this article is organized as follows: In Section 2, we describe the data processing process and the method used. In Section 3, we complete the data analysis and further divided the analysis results into three categories to explore the corresponding status quo and causes. In Section 4, we propose strategies based on the needs discovered. In Section 5, we summarize the possible future research and limitations.

2. Materials and Methods

This study uses text mining for exploratory analysis, including data collecting, data cleaning, data modelling and sentiment analysis. Figure 1 depicts the comprehensive research workflow.

2.1. Data Acquisition and Pre-Processing

Douban is a fun and popular interest-based Chinese social networking platform. According to monitoring data from Qianfan.tech [12], Douban has over 10 million monthly active users with a broad user age distribution. Users aged between 31 and 40 years old is the largest group accounting for 32.7 percent, 27.5 percent of users are aged between 25 to 30, while some post-70 users are presented as well.

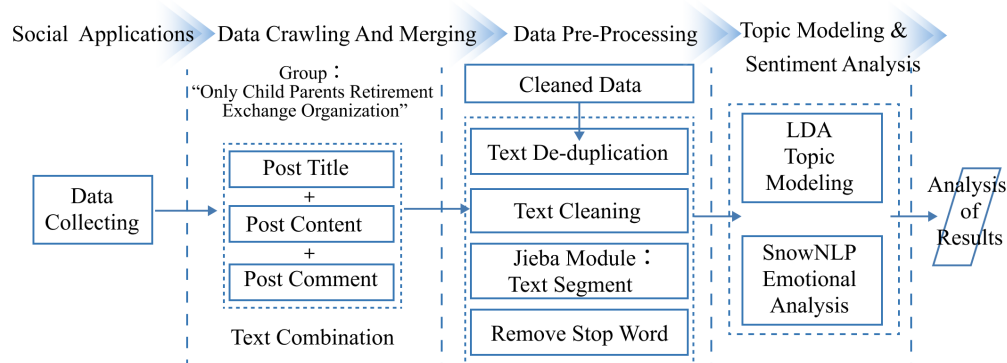


Figure 1. Research workflow (the data of this paper come from the Douban App).

Discussion groups related to the elderly care have been set up in recent years on topics such as retirement, use of smartphones, fraud prevention and age-appropriate modifications. Certain groups can host as many as 80,000 members. Most active users within those Douban groups are either care providers or supporters. By analyzing the texts of posts in those groups, we consider it possible to understand some of the dilemmas and psychological pressures faced by elderly care providers and hence indirectly obtain some of the potential needs of elderly people.

The Douban discussion group named “The Only-Child Senior Citizen Care Community” is chosen to serve as the data source due to its huge active user size (81,879 group members) and its copious number of posts with a comprehensive list of topics. We collected the title, content and comments of each post. Owing to the facts that the replies to the posts are full of low-feature short sentences and the LDA topic model was not effective in such scenario, it is essential to remove data duplicates and merge content of the three fields into one document. The data was cleaned using Excel to remove noisy data that was irrelevant to the topic, such as “delete”, “help”, “essence”, “as” and “topic”. Furthermore, Python programs are executed to perform more data preprocessing work. Common internet shorthand abbreviations are changed into matching text, for example, “lz” is replaced with “original poster”, “emo” was restored to “sad” etc. The meaningless spaces, blank lines and links were eliminated. All English letters are transformed to lowercase letters. The traditional Chinese characters were converted to simplified Chinese characters. Emojis in the data were deleted. The text shorter than 10 characters is deleted as well for more accurate result. The data was manually verified down the road and create a dataset of 3330 text. Jieba, a third-party Python library for Chinese word segmentation, was then used to split the text into words, with high frequency yet featureless words such as “mom”, “dad”, “time” and etc. were added to the HIT deactivation dictionary (which contains 746 Chinese deactivation words and can be used for Chinese corpus pre-processing), and finally the new deactivation words were removed by calling the HIT dictionary.

2.2. Emotional Analysis

Sentiment analysis is used to automatically derive the sentiment generated by messages posted on specific topics [13]. Presently there are three types of sentiment analysis approaches: lexicon and rule based approaches, traditional machine learning based approaches and deep learning based approaches [14]. The lexicon based approach uses sentiment words in a document, assigns a value to words and then determines the overall sentiment tendency of the document by weighting [15]. SnowNLP is a TextBlob-based Python library for Chinese natural language processing including various features like Chinese word segmentation, word annotation, sentiment analysis, text classification, pinyin conversion, traditional to simplified Chinese conversion, keywords extraction, summaries extraction, and sentence segmentation. It is designed explicitly to process Chinese contexts. Previous study [16,17] use SnowNLP to compute text sentiment on a popular topic comment on Weibo and demonstrate to be a feasible approach. The Python SnowNLP module

based on the naive Bayesian algorithm is employed in this study for training and prediction purpose. Current corpora and most of the data collected are feed to train the model, a small portion of collected data is used for model testing and validation, and finally sentiment detection is performed on the original text.

2.3. Latent Dirichlet Allocation (LDA) Model

A topic model is a statistical model that clusters the latent semantic structure of a dataset by unsupervised learning. In 1998, Salton and Buckley [18] proposed the TF-IDF model based on the term frequency for the data mining of large-scale document sets. Deerwester et al. [19] subsequently proposed the LSA (latent semantic analysis) model in 1989, which perfected the problem of document dimensions in the TF-IDF model. In 1999, Thomas Hofmann [20] proposed the PLSA (probabilistic latent semantic analysis) model. The disadvantage of the PLSA model is that it cannot generate new unknown documents, and with the increase of the number of documents, the over-fitting is easy to occur. In 2003 Blei et al. [21] proposed the LDA (latent Dirichlet allocation) model, due to it having stable parameters, not being affected by the number of documents, and having strong abilities in potential semantic mining and normalization learning, which makes LDA model better than PLSA in describing the relationship among documents, topics and words. As a three-level hierarchical Bayesian model widely used in text mining [10,11,16], LDA uses probability and classifies the content of a document with a specific probability for words to form a combination of topics with different classifications, and can be used as a generative probability model for discrete data sets such as text sets [22].

1. The words in the document obey a Poisson distribution.
2. Generate the topic distribution θ_m for the m th document by sampling from the Dirichlet distribution α .
3. Generate the topic $z_{m,n}$ for the n th word of the m th document by sampling from the polynomial of topics θ_m .
4. Generate the word distribution ϕ_k corresponding to the topic $z_{m,n}$ by sampling from the Dirichlet distribution β .
5. Finally generate the word $\omega_{m,n}$ by sampling from the polynomial distribution ϕ_k of words.

In Figure 2, α and β represent the Dirichlet prior parameters for each document topic distribution and topic word distribution, respectively. K is the number of topics. M is the number of documents, and N_m is the total number of words in the m th document. θ_m is the topic distribution under the m th document; ϕ_k is the word distribution under the k th topic; $z_{m,n}$ is the topic of the n th word in the m th document; and $\omega_{m,n}$ is the n th word in the m th document.

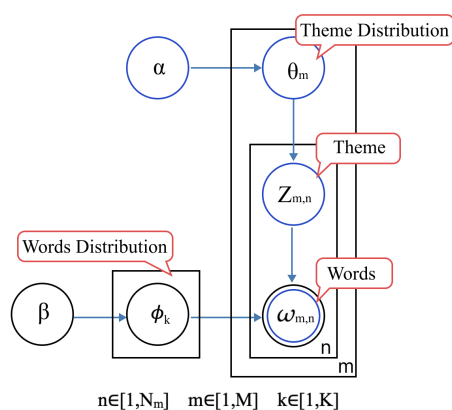


Figure 2. Latent Dirichlet allocation model representation.

2.4. Topic Extraction Based on the LDA Topic Model

Blei D M et al., proposed in 2003 that the degree of generalization of a topic model could be evaluated by calculating the perplexity, hence, to select the optimal number of topics. According to the literature on LDA models, the perplexity method is the standard method for the predictive power of LDA [23]. Quantitatively, lower topic similarity indicates larger distance between topic clusters and a better model, but excessive number of topics invoke overfitting results. In this study, the Scikit-learn library in Python was called for data processing and analysis. The `lda.perplexity()` function was first called to find the perplexity value, and the number of topics versus perplexity line graph is shown in Figure 3. It can be seen that as the number of topics increases, the perplexity tends to decrease, and there is a minimum inflection point at $k = 12$. Although the confusion value is at its lowest point at $k = 12$, the topics are over-fitted at this point. The `LatentDirichletAllocation()` function is called thereafter to model the LDA topics, where the number of topics $n_topics = 10$ and the maximum number of iterations $max_iter = 50$. max_df is set to 0.6 and min_df is set to 28 after several iterations. Finally, the `pyLDAvis()` function is executed to visualize the overall topic distribution.

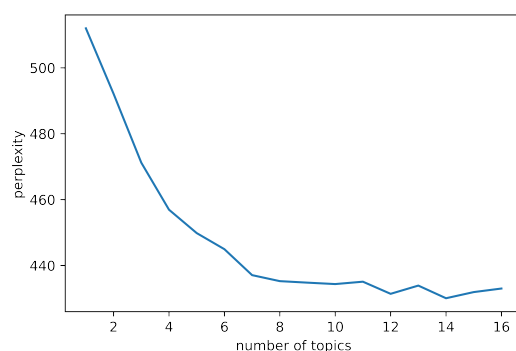


Figure 3. Line graph of theme count vs. confusion.

3. Results and Discussion

3.1. Sentiment Analysis

The training text used in this study is composed of the existing corpus plus an additional 100 positive texts and 100 negative texts randomly extracted from the data collected. The newly trained model then is feed with test set for validation and the result comes out with high accuracy, indicating the model has a good segmentation effect. Next, the entire data set (36,484 texts) collected is imported for sentiment analysis (the raw data were not combined in the same way as the data for topic analysis to avoid the combined text affecting the results). Sentiment scores ranged from 0 to 1. For scores less than 0.5, the sentiment is considered to be negative; if the score is larger than 0.5, the sentiment is concluded as positive. The closer the sentiment score is towards the extremum, the stronger the emotion is. The sentiment scores were visualized using seaborn and matplotlib. The sentiment analysis results are portrayed in Figure 4. As illustrated in graph, the overall sentiment of users in this discussion group tends to feel negative in context of elderly care support, which is in line with our observation of the discussion posts. Most of the Douban users in our discussion group have some unpleasant experience in caring for their elders and they go online for ideas, help or stress relief. From the content of the postings, some users express their negative feelings towards ageing issue, while many others offer advice, support, and encouragement, so there were also a certain number of texts falling into the neutral and positive areas.

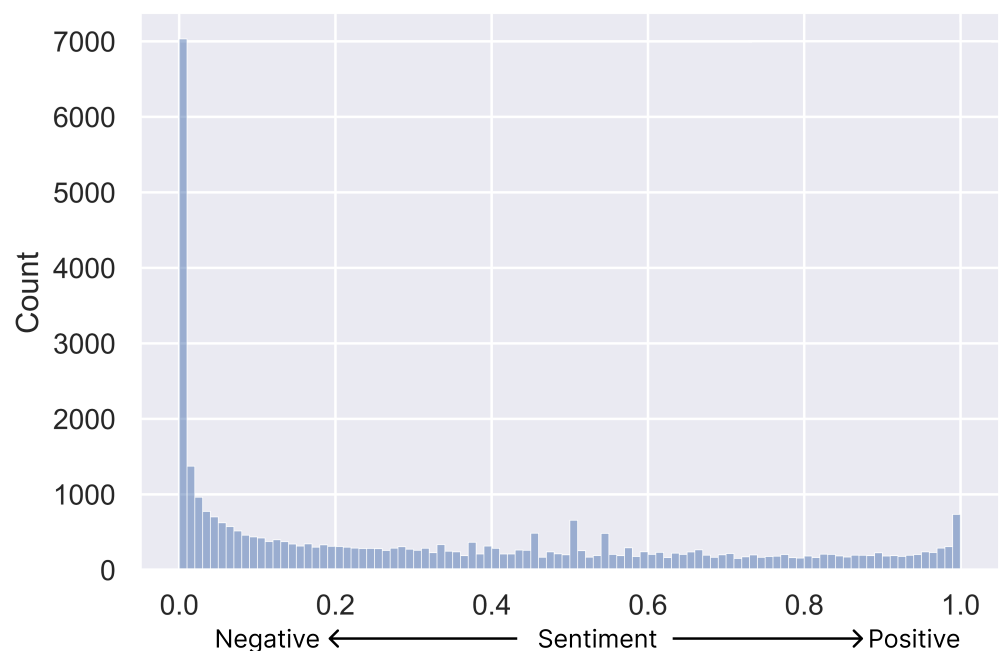


Figure 4. Emotional distribution.

3.2. Topic Clustering

The topic extraction work in this study is conducted by employing LDA model. Aiming to explore the needs and dilemmas of the elderly care services, the topics clustering results are analyzed and for each topic, the top 30 most frequent words of a particular theme are selected as the clustering results for that topic. The association between the topic and the words is adjusted by parameter λ . The closer the value of λ is to 1, the more relevant the frequent word is to the topic; on the other hand, if λ is closer to 0, the correlation between low-frequency words and the topic are higher. Repeatedly adjusting λ then observing the output word types, the value of λ is finally settled as 0.72. The result of topic clustering is composed by the top most frequent words occurring within each category of topics. The visual clustering effect map is plotted using pyLDAvis. The distance matrix is obtained by applying Jensen-Shannon scatter to calculate the distance between subjects. We then run a multidimensional scaling algorithm upon the distance matrix, marking each topic with a bubble and arranging them accordingly in a two-dimensional coordinate system. PC1 and PC2 are the horizontal axis and vertical axis of the two-dimensional coordinate system, respectively. The farther apart different topics are in the coordinate system, the greater the similarity difference between topics. Arrangement showing little or no overlap among the bubbles indicates a desirable number of topics. The distribution of topics for this study is presented in Figure 5.

Figure 5 points out the top three keywords are “children”, “career” and “hospital”. This reflects the fact that the adult generation are struggling to taking care of offspring, their individual development, as well as their ailing parents. As house prices continue to rise in recent years, high mortgages have left many young people financially ill-fated, while at the same time, the health conditions of their parents started deteriorating with aging, and along with it come family leave, medical insurance and hospital bills. As the “421” family model becomes mainstream in China, young generation are carrying an increasingly heavy burden of caring for their elders; therefore, “house”, “housing purchase”, “insurance”, “medical insurance” and “surgery” became trending discussion topics.

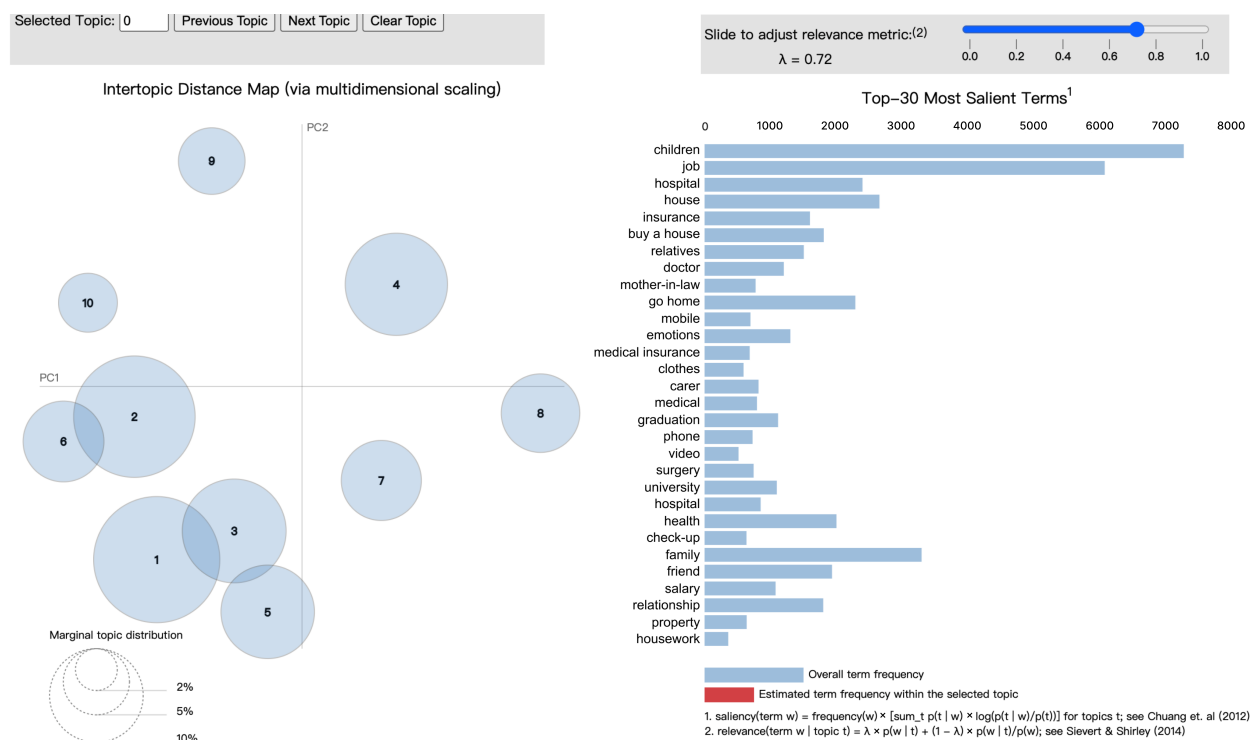


Figure 5. Visualization [24,25] of the distribution of topics.

The results of the topic clustering are listed in Table 1. It is noticeable that the information associated to elderly caring has characteristics of diversification, wide scope and multi-facet with numerous people involved. Such information can be classified into three aspects. The first one accounts for 11.4% of the all topics and is reflected in topic 6 and 10 which mainly discusses family relationships with non-immediate relatives and spouses. The second facet consist of topics 4, 7 and 8 (26.2%) and revolves around elderly health and medical care service including medical treatment accessibility, insurance, and the aged care institutions. Topics 1, 2, 3, 5 and 9 together constitute the last area, which focus on intergenerational conflicts with discussions relating to elderly entertaining activities, consumer issues and conflicts over daily chores. Representing 62.4% of the total, this one is the largest cluster probably because online social community users prefer to share their grievance and conflicts with aged parents in hope for advice and support.

3.2.1. Mental Health Needs

Topics 4, 7 and 8 are filled with concerns of adult children over the elderly health and medical care. Topic 4 discussed medical treatment for aged people. Among all the disease, cerebral infarction, cancer and diabetes are the most frequently mentioned ones. Words such as “follow-up checkup”, “annual physical” and “companion” are cited as well, meaning that group members have interest in treatment and post-surgery rehabilitation information. The keywords in Topic 7 are “industry”, “institution” and “community”, which reflect the feelings that adult children have for not being able to escort their parents to medical appointments due to work or distance and their wishes of finding good retirement homes for their parents. There are posts seeking auxiliary equipment suitable for semi-selfcare elderly, and many elderly care experts offers professional guidance. Core content in topic 8 is insurance. Questions such as how to pick the right type of insurance for an elderly person’s health conditions are popular, with medical insurance, accident insurance and life insurance being the most mentioned words.

Table 1. Distribution of thematic features.

Topic Categories	Percentage	The 15 Most Frequently Occurring Topic Terms under This Topic
1. Family relationships with non-immediate blood relatives and partners	Topic6 7.4%	relatives, red packet, relationship, sister, face, cousin, family, sister, cousin, gift, relationship, friend, child, university, room
	Topic10 4%	mother-in-law, clothes, father-in-law, housework, room, mother-in-law's house, in-laws, washing machine, kitchen, bedroom, angry, washing dishes, waste, air conditioning, daughter-in-law
2. Health and medical coverage	Topic4 11.9%	hospital, doctor, carer, surgery, body, check-up, hospitalisation, sick, brain attack, patient, cancer, discharge, symptoms, having surgery, diabetes
	Topic7 7.3%	work, community, institution, environment, company, industry, companionship, country, services, elderly family members, age, health, self-care, wages, young people
	Topic8 7%	insurance, medical insurance, medical, accident insurance, products, commercial, sickness insurance, pension insurance, cancer prevention, insurance companies, commercial insurance, major illness, rural, medical insurance, life insurance
3. Communication and intergenerational conflict	Topic1 18.2%	children, family, kids, brother, man, male, female, marriage, patriarchy, siblings, girls, childbirth, sister, female, pressure
	Topic2 16.8%	emotions, psychological, relationships, character, influence, children, care, spiritual, communication, temper, world, family, anger, mood, inner
	Topic3 12.3%	job, graduation, home, university, exam, study, pressure, school, salary, boyfriend, provincial capital, hometown, postgraduate, field, development
	Topic5 10%	house, buy a house, loan, property, investment, suite, obligation, name, deposit, house price, buy a car, buy a house, salary, law, lawyer
	Topic9 5.1%	Mobile, video, phone, home, friends, WeChat, playing mahjong, wedding, hair, chat, epidemic, elders, messages, hanging out, photos

Our finding shows that adult children are most concerned about their parents' physical health. Physical illnesses are more noticeable. Nowadays, it is quite common that family members live far away from each other, which makes it even harder for people to discover the psychological issue of their elders via video or voice communication. Topics 7 and 8 point out that presently elderly health support is still dominated by social support, such as services provided by the state, institutions, communities and insurance products. According to the WHO definition of health, health is not only the elimination of disease or infirmity, but also a state of complete physical, mental and social well-being. The WHO reports that the overall prevalence of depression in the elderly population is between 10% and 20% [26]. Depression also increases the risk of disability and suicide in aged people [27]. As technology are becoming increasingly interlinked with our daily lives, the anxiety and powerlessness of gray generation towards high technique products can affect their mental state. Their psychological issues and social adapting ability require attention too. It has been proven that social support (social insurance and elderly care services) and personal support (financial support and visits from children) can significantly improve the health of senior people [28]. Further improving social support and encouraging personal support have a positive influence on the overall psychological well-being of elderly generation.

Medical appointments and hospital ushering have also become a concern. Many hospitals now provide escorting services for physical checkups with professional nurses and health workers along to assist patients, but less attention has been paid to escorting

services for elderly outpatient [29]. In particular, the widely used self-service machines as well as various medical departments add inconveniences for elderly patients in registering, collecting medication and attending medical appointments. It would be beneficial to further boost professional personnel in nursing colleges, medical schools and hospitals and to enhance their skills with proper training and assessment. Volunteers should also be assigned to help senior patients with the use of self-service machines. This could not only create a positive experience for the elderly and their chaperone and also enhance the efficiency of medical procedure.

3.2.2. Information Needs

Top frequent words such as “mobile phone”, “video” and “WeChat” appearing in topic 9 reflect the need of the elderly to access information. The elderly in China are living in an era where different economic and social contexts, such as industrialization, informatization and urbanization, are dynamically evolving and integrating with each other. The complexity of information is unprecedented. A large proportion of Chinese elderly people are living in digital poverty, and they lack essential digital skills to understand, acquire, evaluate and utilize information. A few Douban posts talk about how they bought smartphones for their parents, but the parents use them as old age phones. Some elderly people are addicted to shopping in the live broadcast room or even online dating and suffer property and mental damage.

With the continuous development of intelligence technology and digital services, the elderly group has started to communicate and acquire information via mobile applications too. However, the development of new mobile Apps in terms of form and functionalities are not ageing-friendly, therefore are often troublesome for the aging generation whose physiological and cognitive abilities is progressively declining [30]. Moreover, the elderly usually cannot get help efficiently when they have trouble using new digital products. Their grown children, as their first-choice assistant, usually are not around and unable to offer help in a timely manner. In addition, judging from current information products, the construction of age-appropriate facilities in China is relatively underdeveloped and the support for digital life is insufficient. The European Union, Japan and the United States have all launched laws to guarantee the information needs of the elderly [31]. Although China has enacted several laws to protect the rights and interests of the people in different aspects of digital development, a more comprehensive legal policy is needed to ensure the information rights of the elderly at a macro level.

To provide digital services with quality, warmth and affection for the elderly, it is also necessary to further release ageing-friendly, “large-print” version mobile applications, especially those applications most frequently used by the elderly. Another crucial need is for the establishment of a sound regulatory system so that the elderly in China can conduct e-commercial activities comfortably and safely. Additionally, the community should regularly host workshops events and training seminars on smart technology, helping the elderly to bridge the “digital divide”.

3.2.3. Intergenerational Demand

Studies have shown that positive and harmonious intergenerational relationships can contribute to the psychological well-being of senior people [32,33]. Observation upon study cases of elderly European women confirms that positive emotional ties between older people and their adult children can add to life satisfaction [34,35]. Contrarywise, chaotic intergenerational relationships and intergenerational conflict impair people’s well-being and lead to depression [36]. Therefore, in terms of intergenerational needs, intergenerational conflict needs to be resolved in a timely manner so that older people can gain strength from intergenerational support and thus live a healthy aging life.

- (1) The conflict between high property prices and the desire to own a home

Young generation talk about grievance against their parents: the children hope the elderly could contribute to the purchase of a house but get rejected; young people could

not bear to live with their parents any longer; parents ask their children, who have little savings, to help with the mortgage.

For the Chinese people, a house is not only a place to live, but also a habitat for the soul. Nowadays, owning a home symbolizes wealth and status for young people and their families [37]. Studies have shown that with growing individualism [38], individuals care about personal privacy more than ever. Young people are eager to have their own private space. As intergenerational family relationships evolve, modern families are no longer build upon common interests. For each family member, his/her dependence on the family is getting lower and lower and this also leads to stronger personal consciousness. Furthermore, with the rise of women's awareness, women want to be house owners and feel accomplished and financially stable [38]. The term "investment" appearing frequently under this topic point toward the current speculative fever in house buying boom. It is difficult for today's young people to purchase a house on their own. Fan Gang, one of China's most prominent economists, put forward the "six wallets" concept for homeownership, vibrantly describing the phenomenon that a young couple and their parents and grandparents from both sides all contribute into the purchase of a house. Although emptying six wallets for house buying might strengthen family ties, it could lead to intergenerational conflict and economic risk in the long run [39]. It is vital to ensure stable house prices and launch some simultaneous-renting-and-buying policies to prevent the devaluation of assets from damaging intergenerational family relationships and guide young people towards rational home ownership.

(2) The intergenerational conflict between support responsibilities and individual development

As an important determinant of intergenerational support, the geographic proximity of parents and adult children affects the intergenerational relationships within family significantly. The nature of this sort of intergenerational conflict is the trade-off between filial responsibilities and individual development of grown children. High frequency words in topic 3 such as "work", "graduation" and "going back home" reflect such realistic life decisions. Some web users say that they have better opportunities overseas, yet the well-being of their parents are in need of support; others dispute with their elderly about ideal places to settle down: metropolis in their dream vs. hometown preferred by their parents; not to mention those that are distressed by the disagreement regarding career choices: the parents favored stable careers such as government officials while the children prefer to pursue dreams instead; additionally, grown children invite the elderly to live together in the city, but the deeply rooted parents would rather stay in their hometown.

Currently most seniors in China prefer home-based elderly care. A total of 90% of our gray generation live at home and are helped out by adult children besides spouses [40–42]. Children are morally and lawfully accountable to care for aging parents' spiritual needs as well as their physical needs. On the other hand, with the wide dissemination of the concept: "to live a life of one's own", each and every person desires to pursue individual autonomy and freedom, to seek individual independence and to be in complete charge of his/her life. Therefore, when personal development plan clash with family caregiving of aging parents, most people decide to go for the former [43]. Academic studies classify intergenerational living patterns into two categories: namely "separated but close" and "separate and faraway" [44,45]. In the first type of arrangement, adult children don't live with their parents but just a short distance away. Children can take care of the elderly in a timely and convenient manner while at the same time ensuring privacy of both parties. Conversation under this topic is dominated by the second living arrangement though, where family members reside geographically away from each, usually in different places or even different countries therefore it is problematic for children to meet the caring need of their elderly. Literature has demonstrated that robust intergenerational relationships help aging parent combat loneliness [46] and intergenerational emotional support can boost parents' cognitive health [47]. In addition, the first type can give the elderly parents more spiritual support [48]. We should actively promote the desirable "separated but

close” living arrangements, encourage intergenerational support, and launch society-based elderly caring services as supplement measurements.

(3) The intergenerational conflict regarding marriage and childbearing

It is indisputable that the birth rate in China has fallen. China now has the lowest fertility rate in the world. In context of offspring and marriage plan, discussion in Topic 1 reveals the distinct attitudes from multiple generations. On one hand, due to influences such as economic pressures, high care cost [49], education level [50] and changing attitudes towards marriage and childbearing [51], right-age population in China has weak willingness to get married or to give birth. More and more young adults choose late marriage, no marriage and infertility. Some studies have shown that only-children exhibit lower inclination to have babies than non-only-children [52]. Only-children receive all the parental attention and family resources during their growth [53–55], and that, in turn, exacerbates their preference of fewer births and better births. On the other hand, the elderly parents were born before the One-Child policy, and they yearn for family happiness with children and grandchildren around at home. The society needs to strengthen the construction of marriage and dating industry and forge a proper marriage and childbearing culture. More reproduction-encouraging policies based on full and scientific discussion should come out in the following years to alleviate young people’s worries and to promote a rebound in marriage intentions and fertility rates.

4. Conclusions and Recommendations

We obtain all the posts dated prior to 8 July 2022 in the Douban group “One-Child Alliance for Elderly Parents Caretaking”. Data analysis follows with the use of text mining methods. The issues and pressures facing grown children in caring their elderly are identified and classified. Sentimental scores are derived from systematical evaluation. Afterward, this study addresses the overall needs of elderly from three facets: mental health needs, information needs and intergenerational needs. Finally, suggestions are put forward to satisfying these elderly care needs correspondingly, aiming to improve the quality of life of aging generation.

4.1. Encourage Intergenerational Companionship and Support with a Focus on the Mental Health of the Elderly

Social forces should be supported and guided to participate in society-based elderly caring services. Community social workers and volunteers can hold mental health lectures and offer targeted psychological counselling for the elderly. Rich community life and activities, such as physical exercise and choral practice for aging group, can strengthen their physical health as well as their social connection. To promote filial piety, it is practical to grant adult children inhabiting with their parents with actual benefit such as tax reduction and utility tariffs. Local government and communities should keep launching new community-based caring projects. The “cross-generation cohabitation” pilot that appear recently is one promising example of such projects. This new form of cohabitation introduces young people to live in the homes of lonely elderly people and it is a win-win solution for both sides. Local government and communities play a crucial bridging role in building, regulating and supervising social elderly care system.

4.2. Encouraging Giving Back of Family Members and Safeguarding the Information Acquiring Needs of Older People

Family is the initial place for individuals to accept socialization and has significant impact upon individuals’ emotional needs and the stability of a society [56]. Research confirms that intergenerational assistance on high-tech digital media is more likely to improve digital information acquisition for elderly generation [57]. Young generation should actively and patiently assist the elderly to integrate into the new digital era in a gradual and encouraging manner. Teaching them the skills and features is just the first

step, it is more important to educate the gray generation to distinguish the authenticity of digital information.

4.3. Settling Intergenerational Family Conflicts and Maintaining Harmony among Generations

Our findings indicate that intergenerational disputes and grievances often occur around decisions related to house purchasing, individual development, marriage and childbearing plans. To solve the housing dilemma, the government should: (1) further release new policies to stabilize the real estate market and to avoid sharp fluctuation of housing prices; (2) promote simultaneous renting and purchasing strategy, and (3) refine housing aid plans targeting young people so that young people can resolve housing issues in ways other than buying. For the personal development issue, our proposal includes: (1) family medical leave should be encompassed into the Labor Law as one essential part of protection of labor rights and interests so that adult children who live far away from elderly parents can have plenty of time to be with them, (2) rally the community-based elderly care services and provide more assistances for the elderly who are in need of intergenerational support. As for the issue of marriage and childbirth plans, we put forward the following suggestions: to build a more comprehensive yet safer marriage and dating market and to offer various means in expanding social network and finding potential dates with robust supervision policies and procedures, to shape young people with a correct view of marriage and love while at the same time be respectful for individual willingness, establish a favorable and sturdy environment in terms of job stability, fertility planning, pregnancy protection and child rearing to enhance the fertility willingness of young generation.

5. Prospects and Limitations

Firstly, the dataset used in this study is originated from posts and articles in one discussion group on the Douban App. Given the powerful text processing ability of text mining, future research data could be collected from more relevant Douban discussion groups and even from similar social platforms such as Weibo, Zhihu and Little Red Book. Secondly, the timeframe for data collection in this study is established from 18 November 2019 to 6 July 2022. Integrating data collected over a broader timeframe or a defined period in future studies might depict dynamic evolution and valuable insights in this field of study. Furthermore, analyzing public opinions and comments on major events related to elderly care is another valuable attempt for future study. Furthermore, additional classification of the discussion participant with respect to their gender roles and geographic location could deliver more grounded propositions for practical implication.

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