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Contact-Fraud Victimization among Urban Seniors: An Analysis of Multilevel Influencing Factors

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Abstract: Fraud crime against seniors has become a serious social problem both at home and abroad. While most of the relevant research focuses on non-contact fraud against seniors, a few studies attend to contact fraud targeted at seniors. By constructing a theoretical framework of "environment–activity–fraud victimization" based on the integration of multiple theories, this study conducts a multilevel logit analysis of contact-fraud victimization among urban seniors in the downtown area of Guangzhou at the individual and neighborhood levels. The results show that contact-fraud victimization among urban seniors is influenced by individual-level factors and neighborhood-level factors, and that individual-level factors play a more significant role. More specifically, seniors with higher education levels and lower levels of self-control are more likely to experience contact-fraud victimization, while seniors who are older and healthier, and have higher household income are significantly less likely to experience contact-fraud victimization. Further, higher levels of collective efficacy and better living environments in the neighborhood significantly reduce the probability of contact-fraud victimization among urban seniors, while the percentage of the migrant population, the percentage of the aging population, and developed traffic environments significantly increase the probability of seniors experiencing contact fraud. This study confirms the feasibility of examining contact-fraud victimization among urban seniors based on the integration of theories, and enriches the research results of crime geography in terms of contact-fraud victimization among urban seniors.

Keywords: Guangzhou; senior citizens; contact fraud; multilevel influencing factors

1. Introduction

As the seventh national census in China shows, the percentage of the senior population aged 60 and over in China is reaching 18.7%, and that of those over the age of 65 is reaching 13.5%. China is about to become a moderately aging society [1]. In the report of the 19th National Congress of the Communist Party of China, it is written that to cope with the aging population, a policy system and social environment that support, care for, and respect seniors should be created. Actively responding to the aging of the population will be a long-term strategic task for the country. Fraud crime against seniors has become a serious social problem both at home and abroad, and fraud crime has become the most likely form of crime to be experienced by seniors [2–4]. Seniors are more vulnerable than other demographic groups [5], and likely suffer from greater economic losses [6]. As their age increases, seniors are more likely to experience fraud crime [7,8]. Seniors living in senior aggregated communities and urban areas has a higher probability of being deceived [9,10]. In addition to causing significant economic losses to seniors, fraud crimes can also cause

them to suffer serious physical and mental health problems [11,12]. Paying attention to the fraud victimization experienced by urban seniors has become an important issue in the aging era.

Fraud crimes in existing research are often divided into two categories, contact fraud and non-contact fraud, according to whether the perpetrator and the victim have direct face-to-face contact [4]. Some studies have analyzed the relative occurrence probability of non-contact fraud from the perspective of gender differences, and found that individuals experiencing non-contact fraud are influenced by factors at the individual and neighborhood level [13], but the experience of fraud crimes in the senior group has not been explored. There are many ways in which senior people are deceived. Contact fraud can be perpetrated through promotional activities [14], the purchase of health care products, and mortgage loans [15], and includes emotional deception [16] and superstition deception [17]. Non-contact fraud can be perpetrated through remote shopping [18–20], and includes false lotteries [8], identity theft [21], and false debt collection [10]. Most of the existing results focus on non-contact fraud encountered by seniors, and rarely mention the contact fraud experienced by this group. In China, the experience of contact fraud by seniors is also a severe social problem. According to a recent survey of urban China, the probability of experiencing contact fraud among seniors is as high as 10.87%, although it is lower than the probability of experiencing non-contact fraud crime (16.9%) [22]. However, it is still much higher than the probability of being cheated in general among seniors in Western countries (5.6%) [23]. Fraudsters often take advantage of the emotional needs of seniors, establish connections with them, and gain their recognition and trust, which eventually puts seniors at risk of being defrauded. After realizing that they have been deceived, seniors not only experience property losses, but also suffer from a more serious mental blow as a result of non-contact fraud [24]. Unfortunately, there are still few research results on contact-fraud victimization among seniors. Thus, there is an urgent need to enrich and improve this line of research.

Prior research on fraud victimization among seniors is mostly based on multidisciplinary backgrounds, which include economics [25], sociology [26], psychology, and criminology [6], and draws on routine activity theory [17], lifestyle theory, and low self-control theory [20] to discuss the influencing factors of fraud victimization. It is shown that the factors affecting the deception of seniors are multi-faceted, including not only individual factors but also social and geographical environments. There have been rich research results at the individual level, which mainly focus on the demographic and economic attributes, psychological characteristics, and behavioral characteristics of senior victims. Specifically, age [7], sex, occupation, education level [27], physical health [28], income level, etc. are important factors that have an impact on victimization [29]. Furthermore, factors such as psychological loneliness [30], social support [31], fear of aging [3], cognitive level [32], and vulnerability [24] also affect the likelihood of being deceived. Moreover, investment preference [33], affinity personality [34], surfing the Internet for a long time, answering unfamiliar calls, going out for leisure and shopping, purchasing health care products, and other daily activities [20] increase the probability of encountering offenders, thereby increasing the risk of being deceived. By comparison, less research has been conducted at the neighborhood level. While there has been discussion about the distributions of aging populations, locations of neighborhoods (e.g., whether they are close to urban centers), and social integration, the influence of social and built environments has been less explored.

Existing research indicates that it is feasible to study the spatial distribution and influencing factors of fraud victimization based on the perspective of crime geography. The built environment (such as real estate, the length of road, etc.) and social environment (such as aging population, migrant population, household income, etc.) have a significant impact on the spatial distribution of fraud victimization [13,29,35]. In addition, social control, as a key factor in examining social solidarity at the neighborhood level, is often used to explain the influence of legal and official government agencies (such as police, courts, etc.), morality, and social institutions (such as family, neighbors, peers, etc.). The former is often referred

to as formal control, and the latter as informal control. Meanwhile, semi-formal control, represented by grass-roots social organizations in China, such as neighborhood committees, also has an impact on the occurrence of neighborhood crimes [36]. Collective efficacy, as a form of informal control, is also often used to explain the impact of neighborhood cohesion on neighborhood crimes. As an important dimension to measure the social environment of a neighborhood, social control plays a significant role in curbing crimes in a region. The more obvious social control is, the higher the cost and risk for criminals to commit crimes becomes, and the less inclined individuals are to commit crimes in these areas. At the same time, the stronger the social control, the stronger the interactions between residents and between residents and managers, and the easier it is to find potential crimes in a given neighborhood. Existing research has demonstrated that collective efficacy and formal control have a significant impact on curbing the victimization risk for burglary victims [37]. While the impact of social control elements on neighborhood crimes has been well studied [38], it is rarely examined in the field of senior fraud victimization research.

To fill the gap in the research into the relationship between crime geography and the occurrence of contact-fraud victimization among urban seniors, this paper builds a multilevel logit model at the individual and neighborhood levels to analyze contact-fraud victimization among individual urban seniors in the downtown area of Guangzhou, a megacity with an aging population. The results can not only deepen the research on the mechanism of contact-fraud victimization among seniors in the field of crime geography, but it can also provide scientific support for the prevention and control of particular fraud crimes.

2. Conceptual Framework

Prior research on fraud victimization mostly attended to victims and studied the influencing factors at the individual level. The results verified the applicability of routine activity theory, lifestyle theory, and low self-control theory in explaining fraud victimization [37,38]. It was shown that seniors experiencing contact fraud are not only affected by individual socioeconomic attributes and behaviors with low social control, but also by the social and built environments of the neighborhoods where they live. This paper aims to study how factors at the individual level and neighborhood level interact and influence contact-fraud victimization among seniors. Based on the integration of multiple theories, a conceptual framework of "environment–activity–fraud victimization" was constructed (Figure 1).
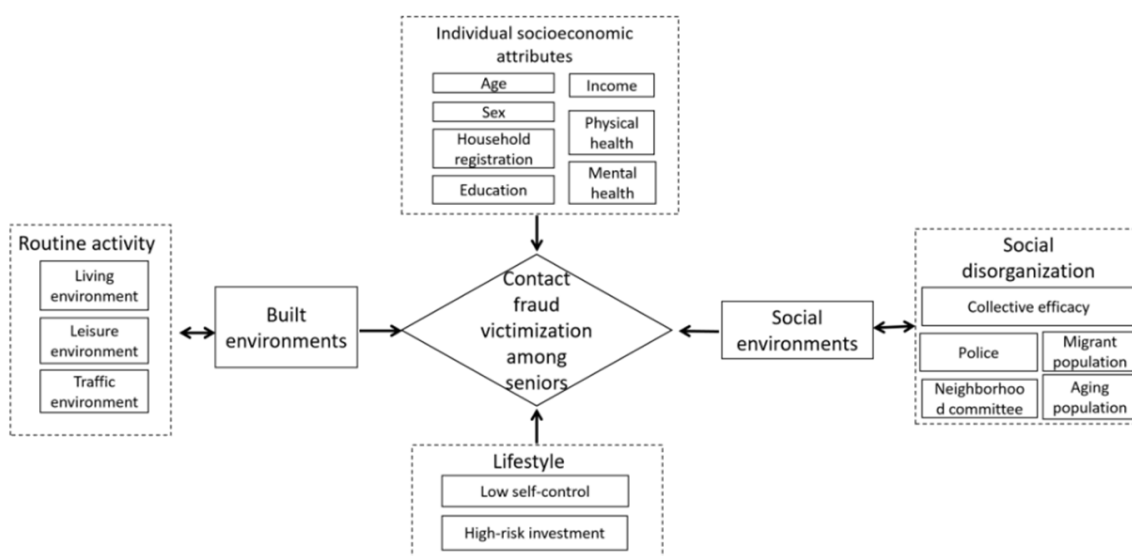

Figure 1. The conceptual framework.

Routine activity theory is an important part of the new opportunity theory in environmental criminology. The theory aims to emphasize that societal changes lead to changes in crime opportunities, and that the uneven distribution of crime opportunities results in a variation in the spatiotemporal distribution of criminal activities. In recent years, more attention has been paid to victims' micro-level behaviors, making routine activity theory overlap with lifestyle theory and become a veritable victimization theory [39]. The daily activity locations of residents are also attractors and/or generators for criminals, encouraging criminals to find suitable crime targets [40]. The daily activity space of seniors is specific in the sense that seniors have almost no work-related activities, but the frequency of their shopping and leisure activities does not decrease significantly [41]. To categorize factors of environments where daily activities are conducted, some studies divide them into residential and outdoor activities [41], while other studies divide them into three categories, including residence, work, and activity environments. Drawing on the second classification method, this paper selects the elements of seniors' daily activity space, mainly around three dimensions: living environment, leisure environment, and traffic environment. Living environment mainly refers to the type of building near where the senior lives. Leisure environment mainly refers to the supply of places where the senior often goes for leisure. Traffic environment mainly refers to the accessibility of the senior's activity paths.

Social disorganization theory maintains a far-reaching influence in terms of promoting the development of crime geography. This theory extends the research perspective to the macro-level attributes of crime occurrence, neighborhood environment, opening up new research agenda in crime geography. Scholars have tested this theory in different geographic spaces, taking into account a series of factors, such as population size, unemployment, income, household, neighborly relationship, and urbanization level [42]. For social environment, this theory considers not only population composition and economic structure, but also social control efforts, including formal control, informal control (collective efficacy), and semi-formal control, among others [38]. Based on this theory, this paper aims to examine how the degree of social disorder influences seniors' exposure to contact fraud in their neighborhood.

Lifestyle theory attends to the micro-level characteristics of the victim himself/herself that account for the cause of crimes. It is an important perspective to explain victimization at the micro-level through the exposure behaviors caused by low self-control in the victim's lifestyle [43]. Susceptibility to deception has become a key area of concern for scholars. Low self-control, high-exposure lifestyle, and other theories have gradually been applied to fraud research, and the results are becoming increasingly rich [44]. Based on this theory, this paper aims to analyze whether going out, low self-control, and high-risk investment have a significant effect on seniors' exposure to fraud crimes.

In sum, there are many theories that contribute to fraud victimization research, but each theory has its limitations, and is inevitably biased in its application. Increasingly, research synthesizes multiple theories to systematically study criminal victimization, and this has received rich results. By integrating routine activity theory, social disorganization theory, and lifestyle theory, this paper constructs a theoretical framework of "environment-activity-fraud victimization", to conduct an in-depth analysis of contact-fraud victimization among urban seniors. First, based on the micro-level perspective, variation in experiencing contact-fraud crime among seniors with different socioeconomic characteristics and lifestyles is analyzed. Second, based on the macro-level perspective, variation in experiences of contact-fraud crime among seniors who live in different built and social environments is analyzed. Third, the influence of two levels of factors on contact-fraud victimization are compared and discussed.

3. Data Source and Research Method

3.1. Study Area

Big cities and megacities in China are always the areas in which aging populations are concentrated. It is of great practical significance to study the social problems relating

to aging in big cities from the perspective of geography. As a megacity with an aging population, Guangzhou has a distinct circle-and-fan-shaped spatial distribution of its aging population, with the urban center being the most significant aging area [45]. This study selects central urban areas as the research area, including Yuexiu, Haizhu, Tianhe, Liwan, Baiyun, and Huangpu districts.

Due to the vast territory of Guangzhou, it is impossible to achieve full coverage of every neighborhood. The method we used to classify neighborhoods is called social area cluster analysis, which is usually based on census data [46]. It includes two steps: factor analysis, to extract principal components; and, then, hierarchical clustering. For example, to examine the fine-scale socio-spatial structure of Nanjing, China, Wu et al. (2014) used data from the fifth census to extract eight components and then clustered the neighborhoods in into seven types of social area, named by according to key components. Each type of social area was assumed to have a similar social structure and features [47]. However, it needs to be pointed out that the name of a social area only reflected the main features of the neighborhoods.

By referring to social area cluster analysis in prior studies [48], relevant indicators in the sixth census data of Guangzhou were used to extract principal components and then conduct a cluster analysis. After repeated screening, a total of 40 indicators in 10 categories, which were household registration, age, educational background, occupation, year house was built, rent, housing property, and size of house, were selected and used to perform orthogonal twiddle factor analysis. The results showed that the Kaiser–Meyer–Olkin (KMO) value for factor analysis was 0.726 (larger than 0.7), and the approximate chi-square value on the Bartlett sphericity test was 125,421.746, which was significant at the 0.001 level. Combined with the explained total variance and gravel plot, according to the principle that the eigenvalue is greater than 1, nine principal components were extracted, and the cumulative variance contributed 78.8%. Next, the hierarchical clustering method was applied with these nine principal components, and seven types of neighborhood were identified: public-housing neighborhood, high-end neighborhood, midrange neighborhood, rural neighborhood, local urban aging neighborhood, migrant neighborhood and affordable-housing neighborhood (Figure 2). To sum up, based on the factor analysis and clustering of multiple dimensional indicators, the neighborhoods in the central urban area in Guangzhou were classified into seven types of social area. However, the naming of each type of neighborhood was relatively difficult, and only the most typical features were selected for naming.

For the selection of sample neighborhoods, a scientific random stratified sampling method was adopted. First, based on the census data, the sample size was determined according to the proportion of the total population of each type of neighborhood. Next, the "aging" indicator was used as the standard. If the proportion of the population over 60 years old in the neighborhood reaches 10% of the total population, it is regarded as an aging neighborhood [49]. Each of the nine types of neighborhood was divided into two sub-categories, "aging" and "non-aging", and the final number of sample neighborhoods was determined according to the relative proportions of the two sub-categories. At the same time, the distribution of sample neighborhoods must be relatively balanced in space. After integrated consideration of the accessibility, population scale, spatial location of neighborhood as well as the project budget, 45 typical neighborhoods were selected for the questionnaire survey (Figure 2a).

3.2. Data Source

The data used in this study include the sixth census data, points of interest (POI), road networks, and questionnaires conducted in Guangzhou. Between October 2016 and December 2016, the survey was conducted randomly with people older than 60 on the street in 45 typical neighborhoods. To ensure the scientificity of the data, a strict random stratified sampling method was adopted (see Section 3.1 for details). In addition to determining the number of respondents based on the proportion of the total population of

each sample neighborhood, the survey team also comprehensively considered the gender ratio (male: female) of the neighborhoods. With an average of 20 to 30 samples assigned to a neighborhood, a total of 1050 questionnaires were collected from 45 neighborhoods, of which 1012 were valid, with an effective rate of 96.38%. The distribution of the samples is listed in Table 1.
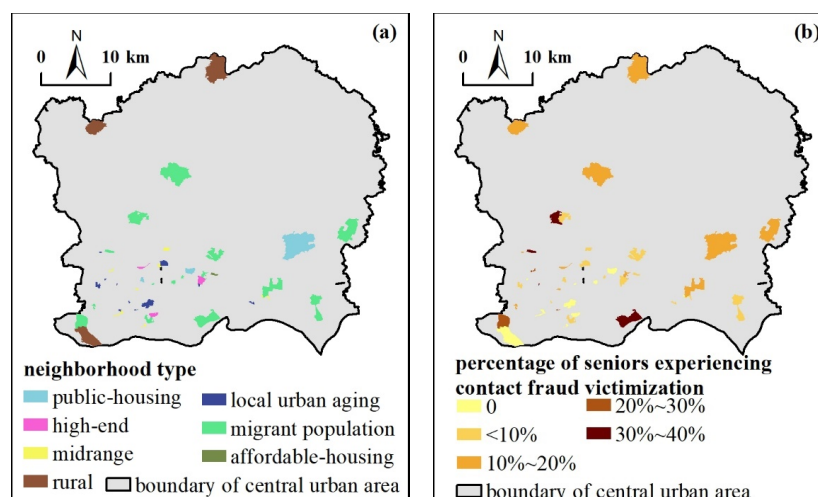

Figure 2. Typical neighborhoods surveyed by questionnaire. (**a**) shows the distribution of sample neighborhoods featured with different neighborhood types. (**b**) shows the distribution of sample neighborhoods featured with the percentage of seniors experiencing contact fraud victimization.

Table 1. Distribution of the samples.

Social Area Type	Aging Type	Population Proportion	Actual Sample Allocation		Number of Neighborhoods Selected
			Male	Female	
Public-housing	Non-aging	6.98%	36	37	3
	Aging	0.19%	0	0	0
High-end	Non-aging	3.73%	28	22	2
	Aging	3.62%	13	12	1
Midrange	Non-aging	6.47%	36	31	3
	Aging	10.88%	57	50	5
Rural	Non-aging	3.62%	15	16	1
	Aging	3.40%	19	21	2
Local urban Aging	Aging	23.04%	121	112	11
Migrant population	Non-aging	35.11%	171	175	15
	Aging	1.16%	10	10	1
Affordable-housing	Non-aging	0.91%	10	10	1
	Aging	0.88%	0	0	0
Total		100%	516	496	45

The contents of the questionnaire mainly included basic personal information, residence, daily activities and sense of security, experience of economic fraud, social integration, travel logs, pension methods, and physical and mental health. The interviewees were randomly intercepted on the street and were asked to fill in the survey consent form. At the beginning of the questionnaire, two filter questions were used: "Do you live in this neighborhood?" "How old are you at this time?" to ensure the accuracy of the respondents' sample. Each interview lasted approximately 60 min.

The survey obtained the socioeconomic status, daily activities, and contact-fraud victimization experiences of the seniors. Among 1012 valid questionnaires, 516 partic-

ipants were male, and 496 participants were female. The number of people reporting the experience of fraud victimization was 275 (27.17%), of which 110 people (10.87%) reported contact-fraud victimization, more than in the West and Hong Kong [50]. Fraud victimization among seniors occurs more frequently in China, and thus related research is urgently needed. In addition, this study further mapped the spatial distribution of the percentage seniors who reported the experience of contact-fraud victimization among all the survey participants in the neighborhood (Figure 2b). It was shown that the likelihood of experiencing contact fraud among senior people was spatially uneven and spatial variation was obvious between neighborhoods.

In terms of the descriptive statistics of the type of contact-fraud victimization among the senior, deception by strangers took up the largest part (96.36%). Among these, deception through medical purchases was the most serious (46.23%), followed by tourism activities (15.09%), and product promotion activities (12.26%). Instances of fraud victimization among acquaintances were mainly related to mortgages for relatives and friends (45%), followed by transfers of private property between acquaintances (25%) and emotional fraud (20%). Compared to other studies, it was found that the type of fraud crime aligns with prior results [50] and that the seniors presented vulnerability to fraud victimization due to the decrease in their body functions [3].

3.3. Research Methods

This paper explores whether contact-fraud victimization among seniors is not only affected by individual socioeconomic attributes, but also restricted by the built environment and social environment of the neighborhoods where seniors live. The dependent variable was defined as 1 if the senior experienced contact fraud, and as 0 if not. The seniors were asked "As a senior, have you ever experienced contact-fraud crime?" (Yes = 1, no = 0). During the interview, the interviewee first needed to confirm that the fraud they suffered happened in his/her old age (at least 60 years). Next, the interviewee was told that, if they had suffered from fraud, regardless of the number times, their answer for that question should be Yes.

Given the data were multilevel nested and the dependent variable was binary, a multilevel logit regression model was applied in this paper [13,35,37]. The model excels at avoiding the estimation bias of traditional regression methods, and is good at explaining the effect of factors from different levels on contact-fraud victimization among seniors. A hierarchical generalized linear model (HGLM) was implemented by HLM 6.08 software, and the specific model formula used in this paper was:

The first level (individual level):

$$\text{Prob}(Y_{ij} = 1/\beta_j) = \Phi_{ij}$$
$$\log\left[\Phi_{ij}/(1 - \Phi_{ij})\right] = \eta_{ij}$$
$$\eta_{ij} = \beta_{0j} + \beta_{ij}X_{ij} + r_{ij}$$

The complete model at the first level:

$$\eta_{ij} = \log\left[\Phi_{ij}/(1 - \Phi_{ij})\right] = \beta_{0j} + \beta_{ij}X_{ij} + r_{ij} \tag{1}$$

The second level (neighborhood level):

$$\beta_{0j} = \gamma_{01}W_{ij} + \mu_{0j}$$
$$\beta_{ij} = \gamma_{i0} + \mu_{ij}$$

The full model with two levels combined:

$$\log\left[\Phi_{ij}/(1 - \Phi_{ij})\right] = (\gamma_{00} + \gamma_{01}W_{ij} + \gamma_{i0}X_{ij}) + (\mu_{0j} + \mu_{ij}X_{ij} + r_{ij}) \tag{2}$$

where $\log\left[\Phi_{ij}/(1 - \Phi_{ij})\right]$ is the natural logarithm of the ratio of the occurrence of contact-fraud victimization to the occurrence of non-contact-fraud victimization (including non-

contact-fraud victimization and non-victimization). Subscript i represents the unit at the individual level, and subscript j represents the unit at the neighborhood level. η_{ij} denotes the type of fraud victimization for the individual i in the j neighborhood (contact-fraud victimization = 1, no contact-fraud victimization = 0). X_{ij} is the influencing factor that affects the probability of the occurrence of contact-fraud victimization in comparison to no contact-fraud victimization at the individual level, and W_{ij} is the influencing factor that affects the probability of the occurrence of contact-fraud victimization in comparison to no contact-fraud victimization at the neighborhood level. At the first level (individual level), β_{0j} is the random intercept, represented by the occurrence probability of contact-fraud victimization in the jth neighborhood at the second level (neighborhood level). β_{0j} is processed as linear function of independent variables at the neighborhood level. r_{ij} is the residual or random term. At the second level, γ_{00} is the random intercept of this layer and μ_{0j} is the residual or random term. After combining the second-level model with the first-level model, an equation for the full model with two levels combined is obtained, where $(\gamma_{00} + \gamma_{01}W_{ij} + \gamma_{i0}X_{ij})$ and $(\mu_{0j} + \mu_{ij}X_{ij} + r_{ij})$ are the fixed and random components of the model, respectively.

The analysis steps presented in this paper were as follows. First, a null model was constructed with no explanatory variables to judge whether there was significant between-level variation in the dependent variable. Furthermore, it was used to determine whether it was necessary to construct a multilevel model. Secondly, a random effect model was constructed to judge the significance of the influence of individual-level variables on the dependent variable, and whether there were between-level differences in this influence. Thirdly, a complete model with neighborhood level variables was constructed to examine the effect of independent variables at the individual and neighborhood levels on the dependent variable under the control conditions, as well as the extent to which the neighborhood level (second level) accounted for the background effects reflected by the individual-level (first-level) variation.

3.4. Variable Selection and Processing

Based on the conceptual framework of the research on contact-fraud victimization among seniors in Guangzhou (Figure 1), this paper constructs variables from the following four dimensions: built environment and social environment at the neighborhood level, as well as socioeconomic attribute and lifestyle attribute at the individual level.

In terms of built environment at the neighborhood level, living environment (the number of real-estate units in the neighborhood), leisure environment (the number of urban parks and leisure squares), and traffic environment (the lengths of roads) were used [41]. In China, most real-estate units are gated or semi-gated, with property management, access control, or the implementation of a reservation registration system. The effective management of the real-estate units increases the risk of fraudsters entering these units to commit crimes, thus weakening the motivation of criminals to exploit these areas [35,51]. In addition, familiarity within real-estate units increase the sense of civic duty and territoriality, which play the role of guardianship to some extent [52–54].Furthermore, parks and squares are two of the biggest leisure activity locations for seniors. Seniors exercise and socialize in parks or squares, forming activity circles [55]. Fraudsters can better find suitable targets and commit crimes in these places by gaining the trust of seniors through in-depth communication. With reference to the study by Song et.al. (2021) and Stucky and Ottensmann (2009), road length was applied to represent the accessibility of a place, which is related to the travel cost and awareness space of offenders. The longer the road in a neighborhood is, the greater the accessibility the neighborhood will have, which also means it costs the offender less to travel, strengthening the offender's awareness of the location, thereby creating more crimes [56,57].

In terms of social environment at the neighborhood level, the variables were chosen based on social disorganization theory, including neighborhood structure variables and neighborhood process variables [37]. Neighborhood structure variables aim to describe

concentrated poverty and residential instability. By referring to [58], the percentage of the senior and the percentage of the migrant population were used to represent these two dimensions. Neighborhood process variables center around formal control (how often residents see the police in their neighborhood), informal control (collective efficacy), and semi-formal control (the degree of satisfaction with the neighborhood committee) [59]. Collective efficacy, as a measure of informal control, is based on three questions in the questionnaire about residents in the neighborhood: "Whether they participate in activities organized by neighborhood committees", "Whether they often make suggestions to neighborhood committees", and "Whether they unite to deal with common problems in the neighborhood". The indicators were measured and divided into five grades, from "absolutely not" (one point) to "absolutely yes" (five points) according to the degree of the residents' participation. Three indicators were analyzed (*p* value is 0.000, KMO value is 0.654), and one main factor was extracted (62.86% explanation rate). The collective efficacy of a neighborhood was calculated as the average value of the main factor from all the samples in the same neighborhood.

In terms of socioeconomic variables at the individual level, seven variables were selected: age, sex, household registration, education, household income, physical health (compared to peers' health status), and mental health (whether work or daily activities were affected by emotions in the past month). Studies have shown that the physical and mental health of seniors have an important impact on their fraud victimization experiences [24].

In terms of lifestyle at the individual level, two indicators were selected to reflect whether the seniors had self-exposure and low self-control behaviors in the daily lives: (1) whether the respondents actively watched the promotion of health care products on the street, and (2) whether they tried high-risk and high-yield investment and wealth management. It is generally believed that self-exposure and low self-control behaviors of seniors have a significant impact on their fraud victimization experiences [39].

It should be noted that the data included both subjective and objective variables, which originated from the questionnaire, census data, and points of interest, respectively. Multidimensional indicators (both subjective and objective) can help us better understand the mechanisms of the contact fraud against the elderly. The descriptions and statistics of the variables are listed in Table 2.

Table 2. Descriptions and statistics of variables.

Level	Variables	Variable Names	Descriptions	Mean	Std	Min	Max
	Dependent variables	Contact fraud	Contact fraud = 1, no contact fraud = 0	0.11	0.31	0	1
Individual level	Socioeconomic characteristics	Age	Natural number	67.61	4.69	60	82
		Sex	Female = 1, Male = 0	0.49	0.50	0	1
		Household registration	Local = 1, Others = 0	0.64	0.48	0	1
		Education level	Illiterate = 1, Primary school = 2, Junior school = 3, High school = 4, College = 5, Bachelor = 6, Graduate = 7	3.29	0.95	2	7
		Household income	Less than 10,000 RMB = 1, 10,001~20,000 RMB = 2, 20,001~30,000 RMB = 3, 30,001~50,000 RMB = 4, 50,001~80,000 RMB = 5, more than 80,000 = 6	2.05	0.91	1	6
		Physical health	Very poor = 1, poor = 2, general = 3, good = 4, very good = 5	3.48	0.8	1	5
		Mental health	No = 1, seldom = 2, sometimes = 3, often = 4, always = 5	1.81	0.79	1	4
	Lifestyle	Low self-control	Actively watching the promotion of health care products	2.76	0.94	1	5
		High-risk investment	Preference for high-risk high-yield tinvestment	2.22	1	1	5

Table 2. *Cont.*

Level	Variables	Variable Names	Descriptions	Mean	Std	Min	Max
Neighborhood level	Social disorganization	Collective efficacy	Evaluation of neighborhood social cohesion	0.00	0.65	−1.37	1.38
		Satisfaction with neighborhood committee	Very unsatisfied = 1, unsatisfied = 2, general = 3, satisfied = 4, very satisfied = 5	3.71	0.58	1	5
		Frequency of police presence	Almost no = 1, seldom = 2, sometimes = 3, often = 4, always = 5	3.35	0.39	2.62	4.24
		Migrant population	The percentage of the migrant population in the neighborhood	0.1	0.09	0.01	0.54
		Aging population	The percentage of the population over 60 years old in the neighborhood	0.10	0.07	0.01	0.27
	Built environment	Living environment	The number of real estates	22.31	38.47	0	207
		Leisure environment	Number of city squares and parks	6.80	5.97	0	25
		Traffic environment	Length of road (meter)	12.70	16.40	0.01	76.77

4. Results

To systematically study the multilevel influencing factors of contact-fraud victimization among seniors in Guangzhou, and to test whether the statistical results were biased due to the nesting of individual- and neighborhood-level data, it was necessary to build a two-level model consisting of individual and neighborhood levels for in-depth analysis.

The analysis steps were as follows. First, a null model was constructed with no explanatory variables to judge whether there was significant between-level variation in the dependent variables. Furthermore, it was used to determine whether it was necessary to construct a multilevel model. Secondly, a random-effect model was constructed to judge the significance of the influence of individual-level variables on the dependent variable, and whether there were between-level differences in this influence. Thirdly, a complete model with neighborhood level variables was constructed to examine the effect of independent variables at the individual and neighborhood levels on the dependent variable under the control conditions, as well as the extent to which the neighborhood level (second level) accounted for the background effects reflected by the individual-level (first-level) variation.

4.1. Null Model of Contact-Fraud Victimization among Seniors

Before constructing a complete model, the variance components were first analyzed. A null model with no explanatory variables was constructed [26] (see Tables 3 and 4, Model 1), to determine the extent to which the overall variance of experiencing contact-fraud victimization among seniors was due to the differences in the attributes of the second level (neighborhood level). The judgment standard used the rule of thumb recognized by most scholars, which is the intra-class correlation coefficient—ICC. An ICC larger than 0.059 indicates correlation [13]. As Table 3 indicates, the ICC index at the neighborhood level reached 21.96%. According to the judgment standard, an ICC index greater than 0.138 indicates high correlation. The results of the variance estimation show that 21.96% of the differences in contact-fraud victimization among seniors in different neighborhoods were caused by neighborhood differences, and the remaining 78.04% of the differences came from the individual socioeconomic characteristics and daily activities of the seniors. Therefore, the analysis of the influencing factors of contact-fraud victimization among seniors is suitable for a multilevel model.

Table 3. Results of variance estimation in the null model.

Level	Variance	ICC Index	Chi-Square Test
Individual level	3.30	0.7804	-
Neighborhood level	0.926	0.2196	31.07 ***

Note: *** $p < 0.01$. ICC is within group correlation coefficient. '-' is blank item.

Table 4. Multilevel logistic regression model results of contact-fraud victimization among the senior.

Levels	Variables	Variable Names	Collinearity Test (VIF)	Model 1 β (OR)	Model 2 β (OR)	Model 3 β (OR)
		Intercept	-	−2.40 *** (0.09)	2.14 (8.48)	−2.71 (0.07)
Individual level	Socioeconomic characteristics	Age	1.34	-	−0.05 * (0.95)	−0.07 ** (0.93)
		Sex	1.04	-	−0.27 (0.76)	−0.23 (0.79)
		Household registration	1.37	-	−0.33 (0.72)	−0.32 (0.72)
		Education level	1.40	-	0.29 ** (1.34)	0.19 (1.20)
		Household income	1.19	-	−0.38 ** (0.69)	−0.25 * (0.78)
		Physical health	1.09	-	−0.25 * (0.78)	−0.26 * (0.77)
		Mental health	1.71	-	−0.33 (0.72)	0.08 (1.08)
	Lifestyle	Low self-control	1.18	-	0.23 * (1.26)	0.42 *** (1.52)
		High-risk investment	1.56	-	−0.33 (1.02)	0.22 (1.24)
Neighborhood level	Social disorganization	Collective efficacy	2.84	-	-	−1.62 *** (0.20)
		Satisfaction with neighborhood committee	1.09	-	-	0.30 (1.35)
		Frequency of police presence	1.89	-	-	0.35 (1.42)
		Migrant population	1.53	-	-	2.02 ** (7.55)
		Aging population	2.79	-	-	11.62 *** (111,129.20)
	Built environment	Living environment	1.56	-	-	−0.01 * (0.99)
		Leisure environment	1.52	-	-	−0.01 (0.99)
		Traffic environment	2.36	-	-	0.03 *** (1.03)
Total variance			-	4.27	3.20	0.45
Variance at the neighborhood level				0.93	0.70	0.10
Chi-square test			-	-	21.44 **	56.67 ***
Likelihood ratio				−332.37	−321.23	−302.65

Notes: * *p* < 0.1; ** *p* < 0.05; *** *p* < 0.01. '-' is blank item. β denotes coefficient. OR stands for odds ratio. OR > 1 indicates that the factor is a risk factor for being deceived; OR < 1 indicates the factor is a protective factor against being deceived.

4.2. Analysis of Influencing Factors at the Individual Level

According to the characteristics of the nested data, the influence of explanatory variables at the individual level was first examined. The most basic model (Table 4, Model 2) was constructed for the contact-fraud victimization among the seniors, in which the socioeconomic characteristics and lifestyle behaviors of the seniors at the individual level served as explanatory variables, and the experience of contact-fraud victimization was used as the dependent variable. The regression model identified the influencing factors of the senior's experience of contact-fraud victimization and showed statistical significance.

In terms of individual socioeconomic attributes, the results show that education level, age, household income, and physical health had significant impacts on contact-fraud victimization among the seniors, which is in accordance with the conclusions of Western research [30]. Specifically, a one-unit increase in education level made the probability of the senior encountering contact fraud 1.34 times greater. One possible reason for this is that the higher the education level of the senior, the more likely the senior may be to think, subconsciously, that they are less likely to be cheated and, therefore, to reduce their daily precautions and become a target for offenders. For every one-year increase in age, the probability of experiencing contact-fraud victimization among the seniors decreased by 5%. This is because as age increases, social activities reduce greatly, and the probability of meeting offenders outdoors decreases accordingly [36]. For each one-unit increase in household income, the probability of experiencing contact-fraud victimization among the seniors reduced by 0.69. This might have been due to the fact that seniors with higher household income have better living conditions, so they are less likely to be attracted by low prices of products and services and to be affected by fraud crimes amid

product promotions. As the physical health status of the seniors increased by one level, the probability of experiencing contact-fraud crime dropped to 0.78. Seniors with better physical health conditions tend to take part more actively in social activities and have a stronger ability to receive information. A healthy physical condition can also reduce the susceptibility to deception resulting from a significant decline in physical function, a fear associated with aging [3], making subjects more resistant to contact-fraud crime. This is consistent with Western research, which has shown that seniors have an increased risk of being cheated due to the threat of illness and death [60].

In terms of lifestyle, the preference for watching promotion activities of healthcare products on the street had a significant positive effect on the probability of experiencing contact-fraud crime. This indicates that the low self-control behaviors of seniors increase their risk of exposure to offenders, thus increasing the likelihood of their being cheated. This is in accordance with the conclusions of existing research on fraud crimes [39], indicating that the research on contact-fraud victimization among seniors is also in line with the theoretical assumptions of routine activity theory and low self-control theory. It is worth mentioning that, unlike existing research, which suggests that a preference for risky investment has a significant positive effect on fraud victimization [2], risk-based investment and financial management behaviors had no significant effect on the probability of experiencing contact-fraud victimization among the seniors in this paper.

4.3. Analysis of Influencing Factors with Individual Level and Neighborhood Level Combined

To further explore the differences in the effects of influencing factors at the individual and neighborhood levels, the neighborhood variables were added to the basic model to improve its interpretation (Table 4, Model 3). Specifically, neighborhood-level variables were added to the intercept part. Meanwhile, the variables with insignificant variance results and low estimated slope values in Model 2 were set as fixed parameters without random components to test how well the social control factors, built environment, and social environment in different neighborhoods could explain contextual effects and explain differences between neighborhoods in terms of contact-fraud victimization among seniors.

In terms of the social process variables, collective efficacy is a kind of crime control—when public order is threatened, neighbors have greater cohesion and intervene in common issues [2]. The type of collective efficacy emphasized in the West refers to the consciousness and autonomy of neighborhood residents, which is more democratic and spontaneous [61], while the specific form of collective efficacy in China blurs the boundary between public control and semi-public control to a greater extent [36]. The results show that, similar to theft crime [37], collective efficacy has a significant negative effect on the probability of contact-fraud victimization among seniors in Guangzhou. Enhancing the collective efficacy of neighborhoods can significantly reduce the occurrence of contact-fraud crime, which is consistent with previous results [62].

Regarding neighborhood structure variables, the percentage of the migrant population and aging population in a neighborhood had a significant positive effect on contact-fraud victimization among the seniors. These results are consistent with the theoretical assumption of social disorganization theory. The percentage of the migrant population can be used to represent the poverty level of a neighborhood. The concentration of rural migrants is often considered to be an indicator of poverty and disorder and to be related to criminal activities [63]. Neighborhoods with large numbers of migrants have a lower level of socioeconomic status and a higher level of population heterogeneity. They have a lower level of management and crime control efforts to prevent seniors from experiencing contact-fraud crime. On the other hand, neighborhoods with large aging populations are often located in central urban areas [49], where buildings are old, and management levels are low. The probability of the elderly going out is relatively high in these areas, providing opportunities for potential criminals. In real life, the way to defraud seniors is often through "health education classes" or "financial management classes", etc., in order to bring seniors together and provide them small favors regularly until they gradually give up their vigilance and

open themselves up to deception. The greater the level of aging in a neighborhood, the more likely it is to provide a better condition for contact-fraud crime.

With respect to built environments, the influence of living environment, leisure environment, and traffic environment were further explored. The amount of real estate in a neighborhood significantly reduces the possibility of seniors experiencing contact-fraud victimization, but better traffic environments increase the probability of contact-fraud victimization among seniors. The real estate neighborhoods where Chinese urban residents live are mostly gated, which helps reduce the occurrence of crimes [63]. The "wall effect" of these neighborhoods blocks the contact opportunities between offenders and seniors to a certain extent, thus reducing the possibility of contact fraud. This agrees with prior research results and routine activity theory [35]. Similar to other types of crimes, road accessibility in neighborhoods increases population mobility, thereby increasing the opportunities for seniors to come into contact with offenders, which further increases the probability of seniors being deceived.

5. Discussion and Conclusions

Fraud crimes against seniors have become a serious social problem in both China and the West. Most previous research results attend to non-contact fraud victimization among seniors. There few results on contact-fraud victimization among seniors from the perspective of crime geography. Taking Guangzhou, an aging megacity in China, as an example, this paper constructed a conceptual framework of "environment–activity–fraud victimization" based on the integration of multiple theories. It was found that:

(1) The probability of experiencing contact-fraud victimization among senior was affected by both individual-level factors and neighborhood-level factors. Among them, individual-level factors played a more important role, accounting for 78.04%.

(2) The influencing factors at the individual level mainly included socioeconomic characteristics and daily lifestyle. Specifically, seniors with higher education levels were more likely to encounter contact fraud, while the older and healthier the senior was, and the higher their higher household income was, the more significantly higher their probability of experiencing contact fraud was. Older adults with low self-control behaviors in their lives were at greater risk of contact fraud. The results show that it is feasible to study contact-fraud victimization among Chinese urban seniors based on lifestyle theory.

(3) The neighborhood-level influencing factors mainly included social control efforts, built environments, and social environments. Specifically, collective efficacy within a neighborhood can significantly reduce the probability of contact-fraud victimization among seniors. The percentage of the migrant population and the percentage of the aging population in a neighborhood significantly increased the probability of seniors experiencing contact-fraud victimization. The better the living environment, the lower the probability of seniors being exposed to contact fraud; however, the more developed the traffic, the higher the probability of seniors being exposed to contact fraud. These results show that social disorganization theory and routine activity theory are applicable to the explanation of contact-fraud victimization among seniors.

This study enriches and deepens the research on contact-fraud victimization among seniors in the field of crime geography and provides scientific guidance for the prevention of contact-fraud crime targeted at seniors. The model results of contact-fraud victimization among seniors are near-ideal (Table 4). From the calculation results of the variance components in the three models, it can be seen that the variance components in the three models gradually decrease, indicating that the selection of social disorder variables at the neighborhood level is more scientific. It can be seen that the variance components in the three models gradually decrease, indicating that the selection of social disorganization variables at the neighbor level is more scientific. Additionally, the aging index is the most important explanatory variable in the model (11.62), indicating that the more significant the level of aging, the greater the probability of a senior encountering contact fraud. At

the same time, the coefficient of the senior's age is negative (−0.07), indicating that as the senior grows older, they are less likely to encounter contact fraud. This is due to the fact that the percentage of seniors of younger ages was the highest in the sample (standard mean = 67.61, standard deviation = 4.689).

This research has the following limitations. First, the research did not clearly define the time when the seniors experienced contact-fraud crime, nor did it systematically analyze the temporal distribution and temporal influencing factors of the crimes. Second, there was no clear division between defrauding amount and frequency among the elderly group, and there was no further discussion of whether the elderly were repeatedly deceived. Third, the survey only collected cross-sectional data, making it impossible to conduct a longitudinal comparison. For example, the relationship between perceived collective efficacy and victimization among seniors may also be reciprocal, with those fraud victimization experiences more likely to have negative impressions of the neighborhood. In this case, victimization experience is a contributing factor, not an outcome. Fourth, different types of road can have varied effects on crimes. For example, studies have shown that highways without access can act as physical barriers to offenders' travel, and unlike highways or motorways, the traffic-free streets attract more pedestrian flow [64]. Such variance leads to different effects on crimes and needs further refinement in the future. All these contents can be further deepened as future research directions.

In sum, the results show that, similar to other forms of criminal victimization, it is feasible to study the factors influencing contact-fraud victimization among Chinese urban seniors based on the integration of multiple theories developed in Western countries [37]. As predicted by routine activity theory/lifestyle theory, the reduction in target attractiveness and guardianship leads to a significantly increased risk of contact-fraud victimization among seniors. As predicted by social disorganization theory, neighborhood process variables, represented by collective efficacy, significantly reduce the risk of contact-fraud victimization among seniors. This study successfully constructs a theoretical framework to explain contact-fraud victimization among the Chinese urban elderly. The results provide a theoretical reference for the study of the complex mechanisms through which particular groups are deceived, and also provide a direction for research on the different types of fraud crime encountered by different social groups.

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