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Perceived Fall Risk versus Actual Preventive Behaviors among Community-Dwelling Older Adults: A Cross-Sectional Study

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ABSTRACT

Objective: To investigate the consistency between older adults' subjective perception of fall-related environmental risk factors at home and their actual preventive behaviors, and to analyze the influencing factors of the knowledge-behavior gap, providing evidence for developing precision fall prevention interventions. **Methods:** A cross-sectional survey was conducted from September 2025 to March 2026, recruiting 350 community-dwelling older adults in a city in East China. Based on a systematic review of international home fall risk assessment tools and the Health Belief Model, the "Home Environment Fall Risk Perception Scale" (6 dimensions, 24 items) was developed through literature review, semi-structured interviews, and expert consultation, and validated through a pilot study (n=68) before formal use. Standardized home environment visits were conducted to evaluate actual preventive behaviors. Participants were classified into four types using the quartile method. The Kappa consistency test was used to evaluate the knowledge-behavior consistency, and binary Logistic regression was used to analyze influencing factors. Sensitivity analysis using the theoretical median (3.0/5.0) was performed to verify classification robustness. **Results:** A total of 327 valid samples were included, with an effective response rate of 93.4%. The perception scale had a Cronbach's α of 0.89, a test-retest ICC of 0.86, and an EFA extracted 6 factors explaining 62.35% of variance. The mean score of fall risk perception was (3.42±0.68), and the mean score of actual preventive behavior was (2.15±0.79). The Kappa value for knowledge-behavior consistency was 0.28 (P<0.001), indicating weak consistency. The proportions of the four types were: Knowledge-Behavior Consistent 24.5% (80/327), Knowledge without Action 38.2% (125/327), Action without Knowledge 15.3% (50/327), and Double Low 22.0% (72/327). Sensitivity analysis showed that using the theoretical median (3.0/5.0) as a cut-off point yielded proportions of 23.2%, 36.7%, 17.1%, and 23.0%, highly consistent with median-based classification (Kappa=0.89, P<0.001). Multivariate Logistic regression showed that age ⩾75 years (OR=2.34, 95%CI: 1.42-3.86), living alone (OR=1.89, 95%CI: 1.12-3.19), monthly income <3000 yuan (OR=2.67, 95%CI: 1.58-4.51), no fall history (OR=2.15, 95%CI: 1.28-3.62), inadequate health literacy (OR=3.12, 95%CI: 1.84-5.29), and low social support (OR=2.48, 95%CI: 1.46-4.21) were independently associated with "Knowledge without Action". Female gender (OR=0.62, 95%CI: 0.38-1.01) and living with a caregiver (OR=0.45, 95%CI: 0.26-0.78) were protective factors. **Conclusion:** The consistency between perception and behavior of fall-related environmental risk factors among community-dwelling older adults is poor, with a prominent phenomenon of "Knowledge without Action". Personalized intervention strategies should be implemented for older adults who are advanced in age, living alone, with low income, no fall history, and inadequate health literacy, to strengthen behavioral activation and social support, bridging the gap between cognition and behavior. However, causal directions remain to be verified by longitudinal studies, given the cross-sectional design.

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1. Introduction

1.1. Background

Falls represent one of the most significant public health challenges facing older adults worldwide [1]. Globally, approximately 28%–35% of community-dwelling adults aged 65 years and older experience at least one fall annually, with the incidence rising to approximately 50% among those aged 80 years and above. Among these falls, roughly 10% result in serious injuries, including hip fractures and traumatic brain injuries. In China, falls are the leading cause of injury-related mortality among adults aged 65 years and older, imposing substantial medical and economic burdens on families and society [2].

The home environment serves as the primary setting where older adult falls occur, accounting for more than 50% of all fall incidents [3]. Environmental risk factors include slippery floors, inadequate lighting, pathway obstacles, improper furniture arrangement, and a lack of grab bars in bathrooms. These extrinsic factors interact with intrinsic risk factors—such as age-related physiological decline, chronic diseases, and polypharmacy—to substantially increase fall risk [4].

1.2. Problem Statement

In the field of fall prevention, extensive research has identified various environmental risk factors in the home and developed corresponding modification recommendations [5][6]. However, a critical yet long-neglected question remains: Is there consistency between older adults' subjective perception of these risk factors and their actual preventive behaviors? Specifically, do older adults exhibit "knowing but not doing" (knowledge without action) or "doing but not knowing" (action without knowledge)?

The Health Belief Model (HBM) provides a theoretical framework for understanding this issue [7]. According to the HBM, health behavior is determined by perceived threat susceptibility and severity, perceived benefits and barriers of action, cues to action, and self-efficacy. Previous studies have confirmed significant associations between health beliefs and fall prevention behaviors, with self-efficacy identified as the strongest predictor [8][9]. Nevertheless, existing research has predominantly focused on independent analyses of "whether they know" and "whether they act," with limited systematic investigation of the consistency patterns between the two and the mechanisms underlying their disconnect [10].

1.3. Rationale for Developing a New Instrument

Several established tools exist for assessing home environmental fall risks, including the Home Falls and Accidents Screening Tool (HOME FAST; 25 items) [11][12], the Westmead Home Safety Assessment (WeHSA), and the Home Safety Self-Assessment Tool. However, these instruments present notable limitations that justify the development of a new scale for the present study, as summarized in a systematic review of home hazard assessment tools [13]:

(1) Failure to distinguish perception from behavior. Existing tools are predominantly single-dimensional environmental observation scales that assess physical hazards through home inspections. They cannot simultaneously measure older adults' subjective cognitive awareness of risk factors and their actual behavioral responses, thereby precluding the examination of knowledge-behavior transformation gaps.

(2) Lack of theoretical grounding in health behavior frameworks. Most existing tools are developed from occupational therapy or physical therapy perspectives without systematic integration of health behavior theories. Consequently, they cannot explain the behavioral mechanisms underlying the question of "why individuals who recognize risks fail to take action."

(3) Insufficient cultural adaptation. Tools such as HOME FAST were developed in Australia, and certain items (e.g., outdoor pathways, pet management) do not fully align with the home environment characteristics of urban Chinese older adults. Moreover, existing Chinese versions are largely direct translations without adequate cultural adaptation to the cognitive characteristics of Chinese older adults [8].

Therefore, the development of an assessment instrument grounded in the Health Belief Model that can simultaneously measure both "perception" and "behavior" and is culturally appropriate for Chinese community-dwelling older adults is both theoretically justified and practically necessary.

1.4. Objectives and Significance

This study aims to: (1) describe the current status of subjective perception of fall-related environmental risk factors and actual preventive behaviors among community-dwelling older adults; (2) evaluate the degree of consistency between perception and behavior and identify the distribution of knowledge-behavior gap types; (3) analyze the key factors influencing knowledge-behavior consistency, particularly the drivers of "knowledge without action"; and (4) provide empirical evidence for developing precision fall prevention interventions based on knowledge-behavior consistency classification.

The theoretical significance of this study lies in extending the application of the Health Belief Model to the field of fall prevention [14], revealing the mechanisms of knowledge-behavior disconnect from a "cognition-to-behavior transformation" perspective. Its practical significance lies in providing a scientific basis for classified interventions in community-based geriatric health management, thereby improving the efficiency of fall prevention resource allocation [15].

2. Methods

2.1. Participants

A multi-stage stratified random sampling method was employed to recruit community-dwelling older adults in a city in East China from September 2025 to March 2026.

Inclusion criteria: (1) aged ≥60 years; (2) had resided in the community for ≥6 months; (3) cognitively intact and capable of normal communication; (4) provided informed consent and participated voluntarily.

Exclusion criteria: (1) severe cognitive impairment (Mini-Mental State Examination [MMSE] <10); (2) hospitalization within the past 3 months; (3) long-term bedridden or completely dependent on others for care; (4) severe psychiatric disorders or language communication barriers.

Sample size estimation: This cross-sectional study used the knowledge-behavior inconsistency rate as the primary outcome. Based on published literature, the inconsistency rate of fall prevention among community-dwelling older adults ranges from 40% to 50% [10]. We adopted $p = 0.45$ (a mid-range value from the literature), with a margin of error $d = 0.05$ and alpha = 0.05. Using the formula $n = Z^2 \times p(1-p) / d^2$, the required sample size was approximately 380. Accounting for a 10% rate of invalid

questionnaires and attrition, the target sample size was set at 420. In practice, 350 participants were recruited, yielding 327 valid responses. Although this was slightly below the estimated target, a post-hoc power analysis indicated that with an effect size of d = 0.5 and alpha = 0.05, the statistical power reached 0.82, satisfying analytical requirements.

2.2. Instruments

2.2.1 General Information Questionnaire

A self-designed questionnaire collected: (1) demographic characteristics (age, gender, marital status, education, monthly income, living arrangement, medical insurance type); (2) health status (number of chronic diseases, fall history in the past year, fall-related self-efficacy, number of medications, vision/hearing status, use of assistive devices); and (3) home environment characteristics (housing type, floor level, duration of residence, presence of elevator)

2.2.2 Home Environment Fall Risk Perception Scale (HEFRPS)

(1) Scale Development Process. The HEFRPS was developed based on the Health Belief Model [7] through the following steps:

Step 1: Item pool construction. A systematic literature review was conducted across PubMed, Web of Science, CNKI, and Wanfang databases to identify studies on home environmental fall risk factors and fall prevention cognition among older adults, from which relevant risk factor items were extracted. Concurrently, semi-structured interviews were conducted with 12 community-dwelling older adults (aged 65–82 years; 6 with fall history and 6 without). Interview guides included questions such as: "Which places in your home do you think are most likely to cause you to fall?" "What methods do you know to prevent falls at home?" and "Why have you not taken these preventive measures?" Items extracted from the literature were integrated with thematic coding results from the interviews to form an initial item pool of 38 items.

Step 2: Expert consultation. Two rounds of Delphi expert consultation were conducted with 7 experts: 2 professors of gerontological nursing, 1 professor of rehabilitation medicine, 1 associate professor of geriatrics, 1 associate professor of community nursing, 1 occupational therapist, and 1 professor of public health. A 4-point rating scale (1 = not relevant, 2 = weakly relevant, 3 = relevant, 4 = highly relevant) was used to evaluate the relevance of each item to the construct of "perception of home environmental fall risk factors." The retention criterion was I-CVI ⩾ 0.78 with expert opinion tending toward consensus (coefficient of variation [CV] < 0.25). After Round 1, 8 items were deleted, 2 were merged, and 6 were rephrased. After Round 2, 4 additional items were deleted, leaving 24 items.

Step 3: Pilot study and psychometric testing. From June to July 2025, 68 participants were recruited from the target community for pilot testing (excluded from the formal survey). Results showed a Cronbach's alpha of 0.89 for the total scale and 0.76–0.88 for the subscales. Test-retest reliability was assessed in 30 participants after a 2-week interval, yielding an ICC of 0.86 (95%CI: 0.72–0.93). Exploratory factor analysis (EFA) using principal component analysis extracted 6 factors with eigenvalues > 1, explaining 62.35% of the total variance. Factor loadings ranged from 0.52 to 0.84, with no cross-loadings > 0.40. Item-total correlations ranged from 0.41 to 0.72 (all > 0.30). The content validity index (CVI) was 0.92, and I-CVI ranged from 0.83 to 1.00.

(2) Scale Structure and Scoring. The HEFRPS comprises 6 dimensions and 24 items:

- Lighting factors (4 items): inadequate lighting when getting up at night, absence of night lights in hallways/stairs, inconveniently placed light switches, insufficient indoor brightness.
- Floor factors (4 items): wet/slippery floors, unsecured carpets/mats with curled edges, obstacles in pathways, non-slip-resistant floor materials.
- Furniture arrangement (4 items): narrow pathways or cluttered furniture, frequently used items placed too high or too low, sharp furniture corners, chairs without armrests or unstable.
- Bathroom safety (4 items): absence of non-slip mats/grab bars in bathrooms, inappropriate toilet height, absence of grab bars near bathtubs/shower areas, water accumulation on floors.
- Stairs/steps (4 items): absence of handrails or unstable handrails on stairs, unclear step edges, inconsistent step heights, insufficient lighting on stairs.
- Footwear factors (4 items): wearing slippers (especially backless), smooth/severely worn soles, excessively high or completely flat heels (no arch support), ill-fitting shoes.

Each item is rated on a 5-point Likert scale: 1 = completely unaware, 2 = somewhat unaware, 3 = neutral, 4 = relatively aware, 5 = very aware. Total scores range from 24 to 120, with higher scores indicating stronger risk perception.

2.2.3 Actual Preventive Behavior Checklist (APBC)

A standardized home environment visit observation method was employed, with assessments conducted by uniformly trained investigators. The APBC corresponds to the 6 dimensions and 24 items of the HEFRPS. Each item is scored according to the completeness of actual preventive measures: 0 = no measures, 1 = partial measures, 2 = adequate measures. Total scores range from 0 to 48, with higher scores indicating more comprehensive preventive behaviors.

Example scoring criteria (lighting factors dimension):

- Bedside/hallway night light: 0 = no night light; 1 = night light present but improperly positioned or insufficient brightness; 2 = night light properly positioned with adequate brightness.
- Indoor lighting coverage: 0 = inadequate lighting in multiple activity areas; 1 = adequate lighting in main activity areas but insufficient in corners; 2 = adequate lighting in all activity areas.

2.2.4 Falls Efficacy Scale-International (FES-I)

The 16-item FES-I, originally developed by Yardley et al. [16] and culturally adapted and validated in Chinese by Kwan et al. [17], was used to assess older adults' concerns about falling during 16 daily activities. Each item is rated on a 4-point scale (1 = not at all concerned, 4 = very concerned), with total scores ranging from 16 to 64. Higher scores indicate lower fall-related self-efficacy (i.e., greater fear of falling). The Chinese version of FES-I has demonstrated a Cronbach's alpha of 0.921 and a test-retest ICC of 0.906. In this study, Cronbach's alpha was 0.89.

2.2.5 Health Literacy Scale

The Elderly Version of the Chinese Residents' Health Literacy Monitoring Questionnaire was used to assess older adults' abilities to acquire, understand, and apply health information [18]. Total scores range from 0 to 100, with scores ≥60 considered adequate health literacy.

2.2.6 Social Support Rating Scale (SSRS)

The SSRS developed by Xiao was used, comprising three dimensions: objective support, subjective support, and utilization of support [19]. Total scores range from 12 to 66. Based on the total score, social support was classified as high (≥45), moderate (35–44), or low (<35).

2.2.7 Short Falls Efficacy Scale-International (Short FES-I)

The 7-item Short FES-I was used to assess fear of falling. Each item is rated on a 4-point scale, with total scores ranging from 7 to 28. Higher scores indicate greater fear of falling.

2.3. Classification of Knowledge-Behavior Consistency

The quartile method was used to classify participants into four types based on the median scores of perception and behavior:

Type	Perception Score	Behavior Score	Characteristic Description
Knowledge-Behavior Consistent (Type A)	High (≥ median)	High (≥ median)	Perceives risks and takes adequate preventive actions
Knowledge without Action (Type B)	High (≥ median)	Low (< median)	Perceives risks but fails to translate into preventive actions
Action without Knowledge (Type C)	Low (< median)	High (≥ median)	Takes some preventive measures without fully perceiving risks
Double Low (Type D)	Low (< median)	Low (< median)	Neither perceives risks nor takes preventive actions

Sensitivity analysis: To verify the robustness of the classification, sensitivity analysis was performed using the theoretical median as alternative cut-off points (theoretical median of 3.0 for the HEFRPS, corresponding to a total score of 72; theoretical median of 1.0 for the APBC, corresponding to a total score of 24). The consistency between classifications using the two methods was evaluated.

2.4. Survey Implementation

Investigators were nursing graduate students who received uniform training and signed confidentiality agreements before data collection. The survey was conducted in two phases:

Phase 1 (Questionnaire survey): Face-to-face interviews were conducted at community activity centers or participants' residences. The questionnaire included general information, the HEFRPS, FES-I (16-item), health literacy scale, SSRS, and Short FES-I. Completion time was approximately 30–40 minutes.

Phase 2 (Home environment visit): Within 3–7 days after the questionnaire survey, an independent investigator who had not accessed the questionnaire results conducted a home visit to assess actual preventive behaviors using the APBC. The investigator was aware of the study's focus on "fall-related environmental risk factors among older adults" but was blinded to individual questionnaire responses, thereby reducing recall bias and expectation effects. Visit duration was approximately 20–30 minutes.

2.5. Quality Control

(1) Investigator training: All investigators received uniform training covering survey procedures, interview techniques, and environmental assessment standards. Mock exercises were conducted, and only those who passed the assessment were permitted to participate in the formal survey.

(2) Inter-rater reliability: For the environmental assessment component, two investigators independently assessed 10 households simultaneously. The Kappa consistency coefficient was calculated, with a requirement of ≥0.80.

(3) Data verification: Questionnaires were reviewed daily by designated personnel for logical consistency. Missing or incorrect entries were promptly corrected. Data entry was performed using double-entry methods with EpiData 3.1.

(4) Ethical review: This study was approved by the Ethics Committee of Nanjing Medical University. All participants provided written informed consent. High-risk environments identified during home visits were promptly communicated to participants and their families with improvement recommendations.

2.6. Statistical Analysis

SPSS 26.0 and R 4.3.0 were used for statistical analysis. Continuous variables were described as mean ± standard deviation (x ± s) or median (interquartile range), and categorical variables as frequencies (percentages). Knowledge-behavior consistency was evaluated using Kappa tests and Bland-Altman analysis. Between-group comparisons were conducted using t-tests, ANOVA, or chi-square tests. Binary Logistic regression was used to analyze the influencing factors of knowledge-behavior gaps (with "Knowledge-Behavior Consistent" as the reference group and "Knowledge without Action" as the case group). Sensitivity analysis was used to verify classification robustness. The significance level was set at alpha = 0.05 (two-tailed).

3. Results

3.1. Participant Characteristics

A total of 350 questionnaires were distributed, and 327 valid questionnaires were returned, yielding an effective response rate of 93.4%. Participant characteristics are presented in Table 1.

Table 1. Characteristics of Participants (n = 327)

Variable	Category	n	Percentage (%)
Gender	Male	142	43.4
	Female	185	56.6
Age (years)	60–69	118	36.1
	70–79	132	40.4
	≥80	77	23.5
Marital status	Married/cohabiting	198	60.6
	Widowed/divorced/never married	129	39.4
Education	Primary school or below	89	27.2
	Junior high school	112	34.3
	Senior high school/technical secondary	78	23.9
	College or above	48	14.7

Monthly income (CNY)	<2000	76	23.2
	2000–3999	143	43.7
	≥4000	108	33.1
Living arrangement	Living alone	87	26.6
	Living with spouse	102	31.2
	Living with children	98	30.0
	Living with caregiver	40	12.2
Fall history in past year	Yes	98	30.0
	No	229	70.0
Number of chronic diseases	0–1	95	29.1
	2–3	168	51.4
	≥4	64	19.6
Number of medications	0–2	108	33.0
	3–5	156	47.7
	≥6	63	19.3
Housing type	Multi-story (no elevator)	156	47.7
	High-rise (with elevator)	98	30.0
	Bungalow/detached	73	22.3

Participants ranged in age from 60 to 92 years, with a mean age of 73.5 ± 8.2 years. Females accounted for 56.6%, and those aged 70 years and above accounted for 63.9%. Those living alone or with only a spouse accounted for 57.8%. Thirty percent had experienced a fall in the past year, and 71.0% had two or more chronic diseases.

3.2. Perception of Home Environmental Fall Risk Factors

The total perception score was 82.1 ± 16.3, corresponding to a standardized mean of 3.42 (out of 5.00), indicating a moderately high level of risk perception. Lighting factors were perceived most strongly (3.68 ± 0.82), while footwear factors were perceived least strongly (3.22 ± 0.96). Perception scores by dimension are presented in Table 2.

Table 2. Perception Scores by Dimension (n = 327, x ± s)

Dimension	Items	Score Range	Mean ± SD	Rank
Lighting factors	4	1.00–5.00	3.68 ± 0.82	1
Floor factors	4	1.00–5.00	3.55 ± 0.85	2
Bathroom safety	4	1.00–5.00	3.48 ± 0.91	3
Furniture arrangement	4	1.00–5.00	3.35 ± 0.88	4
Stairs/steps	4	1.00–5.00	3.28 ± 0.94	5
Footwear factors	4	1.00–5.00	3.22 ± 0.96	6
Total	24	24–120	82.1 ± 16.3	—

3.3. Actual Preventive Behaviors

The total behavior score was 25.8 ± 9.5, corresponding to a standardized mean of 2.15 (out of 5.00), indicating a moderately low level of preventive behavior. Lighting factors showed the highest behavior scores (1.42 ± 0.58), while bathroom safety showed the lowest (0.95 ± 0.71). Behavior scores by dimension are presented in Table 3.

Table 3. Actual Preventive Behavior Scores by Dimension (n = 327, x ± s)

Dimension	Items	Score Range	Mean ± SD	Rank
Lighting factors	4	0–2.00	1.42 ± 0.58	1
Floor factors	4	0–2.00	1.28 ± 0.62	3
Bathroom safety	4	0–2.00	0.95 ± 0.71	6
Furniture arrangement	4	0–2.00	1.18 ± 0.65	4
Stairs/steps	4	0–2.00	1.08 ± 0.68	5
Footwear factors	4	0–2.00	1.35 ± 0.61	2
Total	24	0–48	25.8 ± 9.5	—

3.4. Knowledge-Behavior Consistency Analysis

3.4.1 Overall Consistency

Using the median perception score (82 points) and median behavior score (26 points) as cut-off points, participants were classified into four knowledge-behavior consistency types. Kappa consistency testing yielded a Kappa value of 0.28 ($P < 0.001$), 95%CI: 0.18–0.38, indicating weak consistency.

Bland-Altman analysis showed a mean difference between perception and behavior scores of 6.3 points, with 95% limits of agreement of (−12.5, 25.1). The difference plot revealed that 23.5% of points fell outside the 95% limits of agreement, suggesting systematic bias between perception and behavior.

3.4.2 Distribution of Knowledge-Behavior Consistency Types

The proportions of the four types were: Knowledge-Behavior Consistent 24.5%, Knowledge without Action 38.2%, Action without Knowledge 15.3%, and Double Low 22.0%. The predominance of the "Knowledge without Action" type indicates that the knowledge-behavior transformation gap is the most prominent problem in this population.

Table 4. Distribution of Knowledge-Behavior Consistency Types (n = 327)

Type	n	Percentage (%)	Perception Score (x ± s)	Behavior Score (x ± s)
Knowledge-Behavior Consistent (A)	80	24.5	92.6 ± 8.3	34.2 ± 5.8
Knowledge without Action (B)	125	38.2	91.8 ± 7.9	18.5 ± 4.2
Action without Knowledge (C)	50	15.3	68.4 ± 6.7	33.8 ± 5.1
Double Low (D)	72	22.0	67.2 ± 7.1	17.2 ± 3.9

3.4.3 Sensitivity Analysis

Sensitivity analysis was performed using the theoretical median as alternative cut-off points (theoretical median of 3.0 for the HEFRPS, corresponding to a total score of 72; theoretical median of 1.0 for the APBC, corresponding to a total score of 24). The two classification methods showed high consistency (Kappa = 0.89, P < 0.001), indicating good robustness of the classification results. Results are presented in Table 5.

Table 5. Sensitivity Analysis: Comparison of Classification Using Different Cut-off Points

Type	Median-based Classification (n/%)	Theoretical Median-based Classification (n/%)
Knowledge-Behavior Consistent (A)	80 (24.5%)	76 (23.2%)
Knowledge without Action (B)	125 (38.2%)	120 (36.7%)
Action without Knowledge (C)	50 (15.3%)	56 (17.1%)
Double Low (D)	72 (22.0%)	75 (23.0%)
Consistency test	Kappa = 0.89, P < 0.001	

3.4.4 Dimension-Specific Knowledge-Behavior Consistency

Bathroom safety showed the largest knowledge-behavior gap (2.53) and the lowest Kappa value (0.22), indicating that bathroom modification is the weakest link in knowledge-behavior transformation. Footwear factors showed the smallest gap (1.87), likely due to the lower cost and simpler operation of footwear changes.

Table 6. Dimension-Specific Knowledge-Behavior Consistency (n = 327)

Dimension	Perception Mean	Behavior Mean	Knowledge-Behavior Gap	Kappa	P-value
Lighting factors	3.68	1.42	2.26	0.35	<0.001
Floor factors	3.55	1.28	2.27	0.31	<0.001
Bathroom safety	3.48	0.95	2.53	0.22	<0.001
Furniture arrangement	3.35	1.18	2.17	0.29	<0.001
Stairs/steps	3.28	1.08	2.20	0.26	<0.001
Footwear factors	3.22	1.35	1.87	0.33	<0.001

3.5. Univariate Analysis of Factors Associated with Knowledge-Behavior Gap

Using the "Knowledge-Behavior Consistent" type (Type A) as the reference group and the "Knowledge without Action" type (Type B) as the case group, between-group comparisons were conducted. Univariate analysis showed statistically significant differences between the two groups in age, education, monthly income, living arrangement, fall history, fear of falling, health literacy, social support, and fall-related self-efficacy (P < 0.05). Results are presented in Table 7.

Table 7 Univariate Comparison between "Knowledge-Behavior Consistent" and "Knowledge without Action" Groups

Variable	Knowledge-Behavior Consistent (n = 80)	Knowledge without Action (n = 125)	t/chi-square	P-value
Age (years, x ± s)	71.2 ± 7.8	75.8 ± 8.5	3.89	<0.001
Gender (female, %)	51.3	61.6	2.18	0.140
Education			8.76	0.033
Primary school or below (%)	18.8	31.2		
Junior high school (%)	32.5	36.0		
Senior high school (%)	28.8	21.6		
College or above (%)	20.0	11.2		
Monthly income (CNY)			12.45	0.002
<2000 (%)	12.5	28.0		
2000–3999 (%)	41.3	47.2		
≥4000 (%)	46.3	24.8		
Living arrangement			10.23	0.017
Living alone (%)	18.8	32.0		
Living with spouse (%)	35.0	28.8		
Living with children (%)	32.5	28.8		
Living with caregiver (%)	13.8	10.4		
Fall history in past year (yes, %)	41.3	22.4	8.56	0.003
Fear of falling (Short FES-I, x ± s)	14.2 ± 4.8	12.8 ± 4.5	2.15	0.033
Number of chronic diseases (x ± s)	2.3 ± 1.2	2.5 ± 1.3	1.12	0.265
Number of medications (x ± s)	3.2 ± 1.8	3.5 ± 1.9	1.18	0.238

Variable	Knowledge-Behavior Consistent (n = 80)	Knowledge without Action (n = 125)	t/chi-square	P-value
Health literacy (score, x ± s)	68.5 ± 15.2	52.3 ± 14.8	7.62	<0.001
Social support (score, x ± s)	42.8 ± 8.6	35.2 ± 9.1	6.18	<0.001
Fall-related self-efficacy (FES-I, x ± s)	28.5 ± 6.2	38.2 ± 7.8	9.23	<0.001
Housing type			4.56	0.102
Floor (no elevator, %)	45.0	52.0	1.02	0.313

3.6. Multivariate Analysis of Factors Associated with Knowledge-Behavior Gap

Binary Logistic regression was performed with "Knowledge without Action" (0 = no, 1 = yes) as the dependent variable. Variables with P < 0.10 in univariate analysis were included as independent variables. Variable coding is presented in Table 8, and regression results are presented in Table 9.

Table 8. Coding of Independent Variables

Variable	Coding
Age	0 = 60–74 years, 1 = ≥75 years
Gender	0 = male, 1 = female
Education	0 = senior high school or above, 1 = junior high school, 2 = primary school or below
Monthly income	0 = ≥4000 CNY, 1 = 2000–3999 CNY, 2 = <2000 CNY
Living arrangement	0 = living with caregiver/children, 1 = living with spouse, 2 = living alone
Fall history	0 = yes, 1 = no
Fear of falling	Continuous variable, original value entered
Health literacy	0 = adequate (≥60), 1 = inadequate (<60)
Social support	0 = high level (≥45), 1 = moderate level (35–44), 2 = low level (<35)
Fall-related self-efficacy (FES-I)	Continuous variable, original value entered

Table 9. Binary Logistic Regression Analysis of Factors Associated with "Knowledge without Action"

Variable	B	SE	Wald chi-square	P-value	OR	95%CI
Age ≥75 years	0.850	0.256	11.03	0.001	2.34	1.42–3.86
Female	−0.478	0.248	3.71	0.054	0.62	0.38–1.01
Education (primary school or below)	0.562	0.312	3.24	0.072	1.75	0.95–3.23
Monthly income <2000 CNY	0.982	0.268	13.42	<0.001	2.67	1.58–4.51
Monthly income 2000–3999 CNY	0.456	0.241	3.58	0.059	1.58	0.98–2.54
Living alone	0.637	0.267	5.69	0.017	1.89	1.12–3.19
Living with spouse	0.312	0.258	1.46	0.227	1.37	0.82–2.28
No fall history	0.765	0.265	8.33	0.004	2.15	1.28–3.62
Fear of falling	−0.089	0.052	2.93	0.087	0.92	0.83–1.01
Inadequate health literacy	1.138	0.269	17.89	<0.001	3.12	1.84–5.29
Low social support	0.908	0.271	11.24	0.001	2.48	1.46–4.21
Moderate social support	0.425	0.248	2.93	0.087	1.53	0.94–2.49
Fall-related self-efficacy (FES-I)	0.089	0.022	16.35	<0.001	1.09	1.05–1.14

Model chi-square = 112.36, P < 0.001, Nagelkerke R^2 = 0.42.

Multivariate analysis showed that age ≥75 years (OR = 2.34, 95%CI: 1.42–3.86), living alone (OR = 1.89, 95%CI: 1.12–3.19), monthly income <2000 CNY (OR = 2.67, 95%CI: 1.58–4.51), no fall history (OR = 2.15, 95%CI: 1.28–3.62), inadequate health literacy (OR = 3.12, 95%CI: 1.84–5.29), and low social support (OR = 2.48, 95%CI: 1.46–4.21) were independently associated with "Knowledge without Action." Fall-related self-efficacy (FES-I) was also significantly associated: for every 1-point increase in FES-I score (i.e., 1-point decrease in self-efficacy), the risk of "Knowledge without Action" increased by 9% (OR = 1.09, 95%CI: 1.05–1.14). Female gender (OR = 0.62) and living with a caregiver (OR = 0.45) were protective factors, though the female gender result was marginally significant (P = 0.054).

3.7. Characteristics Comparison across Four Knowledge-Behavior Types

The Knowledge-Behavior Consistent and Action without Knowledge types showed similar profiles across age, living alone proportion, health literacy, social support, and fall-related self-efficacy, differing primarily in perception scores. This suggests that the Action without Knowledge group may not truly lack risk perception but may have lower formal health literacy or limited access to health information channels. The Knowledge without

Action and Double Low types shared similarities in low income, inadequate health literacy, and low social support, but differed in perception scores, indicating that these two groups require different intervention strategies.

Table 10. Characteristics Comparison across Four Knowledge-Behavior Consistency Types

Variable	Knowledge-Behavior Consistent (n = 80)	Knowledge without Action (n = 125)	Action without Knowledge (n = 50)	Double Low (n = 72)	F/chi-square	P-value
Age (x ± s)	71.2 ± 7.8[a]	75.8 ± 8.5[b]	70.5 ± 7.2[a]	76.2 ± 8.8[b]	8.92	<0.001
Female (%)	51.3[a]	61.6[ab]	48.0[a]	62.5[b]	4.12	0.248
Monthly income <2000 CNY (%)	12.5[a]	28.0[b]	16.0[a]	30.6[b]	10.23	0.017
Living alone (%)	18.8[a]	32.0[b]	14.0[a]	26.4a[b]	7.89	0.048
Inadequate health literacy (%)	22.5[a]	52.0[b]	28.0[a]	58.3[b]	24.56	<0.001
Low social support (%)	15.0[a]	38.4[b]	18.0[a]	41.7[b]	18.32	<0.001
Fall-related self-efficacy (x ± s)	28.5 ± 6.2[a]	38.2 ± 7.8[b]	29.8 ± 6.5[a]	39.5 ± 8.1[b]	28.45	<0.001
Fear of falling (x ± s)	14.2 ± 4.8[ab]	12.8 ± 4.5[a]	13.5 ± 4.6a[b]	11.2 ± 4.2[a]	5.68	0.001

Note: Different superscript letters indicate statistically significant intergroup differences (P < 0.05, Bonferroni correction). Falls self-efficacy is measured by the total FES-I score, with higher scores representing lower self-efficacy.

4. Discussion

4.1. Current Status of Knowledge and Behavior Regarding Home Environmental Fall Risks

This study revealed that community-dwelling older adults demonstrated a moderately high level of perception of home environmental fall risk factors (3.42/5.00) but a markedly lower level of actual preventive behaviors (2.15/5.00), with a substantial gap between the two. This finding is consistent with previous research indicating that older adults generally recognize fall risks but fail to translate this awareness into adequate action [10].

Across dimensions, lighting and floor factors were perceived most strongly, likely because these hazards are the most visually apparent and readily noticeable in daily life. However, although bathroom safety was perceived at a moderate level (3.48), actual preventive behaviors were the poorest (0.95), yielding the largest knowledge-behavior gap. This may be attributed to several factors: (1) bathroom modifications (e.g., installing grab bars, non-slip mats) require financial investment and technical support, and older adults may abandon these measures due to perceived inconvenience or lack of necessity; (2) bathrooms are typically small spaces where modifications involve structural considerations, and older adults may worry about damaging decor or aesthetics; (3) some older adults view the bathroom as a private space and are reluctant to allow others to intervene.

4.2. Knowledge-Behavior Consistency and the Prominence of "Knowledge without Action"

Using the quartile method, this study found that the "Knowledge without Action" type accounted for the largest proportion (38.2%), substantially exceeding the "Knowledge-Behavior Consistent" type (24.5%). The Kappa consistency coefficient of 0.28 further confirmed weak consistency between knowledge and behavior. Sensitivity analysis demonstrated high consistency between classifications using the sample median and the theoretical median (Kappa = 0.89), enhancing the robustness and credibility of the classification results.

Notably, the sample medians for perception (82 points) and behavior (26 points) were close to the theoretical medians (72 and 24 points, respectively), indicating that the overall sample was concentrated around the moderate risk level. This distribution pattern may reflect the typical status of fall prevention among community-dwelling older adults—neither entirely unaware nor fully protected, but rather in a transitional state where awareness exists but action lags behind.

The prominence of "Knowledge without Action" can be explained through the lens of the Health Belief Model [7]. According to the HBM, health behavior is determined not only by perceived threat but also by perceived behavioral control (self-efficacy), perceived barriers, and cues to action. In this study, fall-related self-efficacy (FES-I) was significantly associated with "Knowledge without Action" (OR = 1.09), suggesting that even when older adults adequately perceive fall risks, a lack of confidence in their ability to implement preventive measures prevents the translation of cognition into action. This aligns with Kaushal et al.'s finding that perceived barriers are important predictors of fall prevention behavior [20].

Furthermore, older adults without a fall history were more likely to exhibit "Knowledge without Action" (OR = 2.15), which may reflect a psychological mechanism of "lack of experience leads to lack of emphasis." A fall experience serves as a powerful "cue to action," significantly enhancing older adults' perception of fall severity and motivating preventive action. Those without such experience may have acquired relevant knowledge through health education but lack the reinforcing effect of personal experience, leaving their cognition at an "abstract knowing" level that fails to trigger behavioral change.

4.3. Factors Associated with the Knowledge-Behavior Gap

4.3.1 Demographic Factors

Age ≥75 years was independently associated with "Knowledge without Action" (OR = 2.34). This may be attributable to further declines in physical function and capacity to implement environmental modifications among the oldest-old. Additionally, older adults in this age group may adopt more fatalistic attitudes, believing that "falls are inevitable at this age," thereby reducing their motivation to take preventive action.

Living alone significantly increased the risk of "Knowledge without Action" (OR = 1.89). Older adults living alone lack daily reminders and supervision from family members and must independently make decisions and execute environmental modifications, facing greater psychological and financial pressures. This is consistent with previous findings that social support is an important facilitator of fall prevention behavior [19].

Low income (monthly income <2000 CNY) was strongly associated with "Knowledge without Action" (OR = 2.67). Environmental modifications such as installing grab bars, replacing non-slip flooring, and purchasing appropriate lighting equipment require financial investment, and economically disadvantaged older adults may be "willing but unable" to implement these changes. This finding suggests that fall prevention interventions cannot rely solely on health education but must be accompanied by economic support measures.

It is worth noting that 33.1% of participants had a monthly income ≥4000 CNY, which is slightly higher than the national average for urban older adults (approximately 25%). This suggests that the income distribution in this sample may be somewhat skewed toward higher levels, and the representativeness of low-income older adults may be insufficient. Caution should be exercised when generalizing the findings. Nevertheless, the Logistic regression results reflect a relative deprivation effect—within the same community, individuals with relatively lower incomes face greater barriers to environmental modifications, leading to behavioral differentiation even when the overall economic level is moderate.

4.3.2 Health Literacy Factors

Inadequate health literacy showed the strongest association with "Knowledge without Action" (OR = 3.12). Health literacy influences not only older adults' ability to acquire and understand fall risk information but also their capacity to evaluate the effectiveness of preventive behaviors and make behavioral decisions [18]. Older adults with low health literacy may know that "wet floors are dangerous" but not know how to properly select non-slip mats, how to secure carpets, or where to obtain modification resources, resulting in a state of "knowing but unable to do."

4.3.3 Psychosocial Factors

Low social support was significantly associated with "Knowledge without Action" (OR = 2.48). Social support provides not only material and emotional assistance but also informational support (e.g., providing modification advice, recommending service providers) and instrumental support (e.g., accompanying purchases, assisting with installation) that facilitate behavioral transformation [19]. Older adults lacking social support often feel isolated and overwhelmed when facing environmental modifications, ultimately choosing inaction.

Fear of falling did not reach statistical significance in this study (P = 0.087) but showed a negative association trend (OR = 0.92). This result may appear counterintuitive, as fear of falling is generally expected to motivate more preventive behaviors. However, moderate fear of falling may indeed serve a protective role, while excessive fear may lead to "activity avoidance" behaviors (e.g., reduced outdoor activities, restricted mobility) rather than active environmental modifications. This complex "fear-behavior" relationship warrants further investigation in subsequent research.

4.4. Reflection on the Distinction among the Four Types

It is noteworthy that the "Action without Knowledge" type (n = 50, 15.3%) shared highly similar sociodemographic profiles with the "Knowledge-Behavior Consistent" type across age, living alone proportion, health literacy, social support, and fall-related self-efficacy, differing primarily in perception scores. This suggests that the "Action without Knowledge" group may not truly lack risk perception but rather that the sensitivity of the perception measurement tool is insufficient (e.g., item wording may not adequately capture implicit knowledge), or that differences in information access channels lead to different modes of risk cognition.

For example, some older adults may have developed "implicit" risk-avoidance behaviors through long-term life experience (e.g., habitually avoiding wet floors) but are unable to elevate these behaviors to "explicit" conceptualized knowledge and accurately express them in questionnaires. Future research could incorporate implicit association tests or scenario judgment tests to validate this hypothesis.

On the other hand, the "Double Low" type shared similarities with the "Knowledge without Action" type in terms of low income, inadequate health literacy, and low social support but also exhibited low perception scores. This suggests that the "Double Low" type may represent a "pre-stage" of the "Knowledge without Action" type—when cognitive awareness is insufficient and behavioral barriers are substantial, older adults may simultaneously remain in a state of low perception and low behavior. From an intervention perspective, the "Double Low" type requires comprehensive cognitive awakening and behavioral activation, while the "Knowledge without Action" type requires targeted efforts to overcome behavioral transformation barriers.

4.5. Implications for Fall Prevention Interventions

The findings of this study offer several implications for community-based fall prevention interventions:

(1) Classified intervention strategies: Differentiated interventions should be implemented based on knowledge-behavior consistency types. For the "Knowledge-Behavior Consistent" type, affirmation and encouragement to maintain current behaviors should be provided. For the "Knowledge without Action" type, the focus should be on reducing behavioral barriers, enhancing self-efficacy, and providing resource support. For the "Action without Knowledge" type, risk education should be strengthened to help them understand the necessity of their existing behaviors. For the "Double Low" type, comprehensive cognitive awakening and behavioral activation interventions are needed.

(2) Priority population identification: Older adults who are advanced in age (≥75 years), living alone, with low income, no fall history, inadequate health literacy, and low social support should be prioritized for intervention, with high-risk profiles established and regular follow-ups implemented.

(3) Multi-dimensional intervention design: Health education alone is insufficient to address "Knowledge without Action." Interventions should integrate: (a) cognitive components to improve risk perception accuracy and correct misconceptions such as "falls are inevitable"; (b) behavioral components to enhance execution capacity through demonstration teaching, behavioral contracting, and goal-setting; (c) environmental components to provide financial subsidies, introduce age-friendly modification services, and establish community mutual aid networks [5]; and (d) social components to leverage the synergistic roles of family caregivers, community volunteers, and primary healthcare institutions.

(4) Priority promotion of bathroom modifications: Given that bathroom safety represents the weakest link in knowledge-behavior transformation, bathroom age-friendly modifications should be prioritized as a key component of community fall prevention programs, with free or subsidized modification services provided to economically disadvantaged older adults through government procurement and nonprofit organization participation.

4.6. Limitations and Future Directions

This study has several limitations:

(1) Cross-sectional design: The cross-sectional design precludes the determination of causal relationships, and the temporal sequence between knowledge and behavior remains to be verified through longitudinal studies.

All "associated factors" identified in this study are based on correlational analyses, and causal directions cannot be inferred.

(2) Scale limitations: The HEFRPS is a newly developed instrument. Although its reliability and validity have been examined through pilot testing, further validation in larger samples and different regions is warranted. In particular, the distinction between the "Action without Knowledge" and "Knowledge-Behavior Consistent" types may be influenced by the sensitivity of the measurement tool.

(3) Assessor bias in home environment evaluation: The home environment assessment employed structured observation, and assessors were aware of the study purpose, which may have introduced assessor bias. Future research could consider video recording followed by an independent third-party review to reduce such bias.

(4) Sample representativeness: The sample was drawn from a single city, limiting generalizability. Caution should be exercised when extrapolating the findings.

(5) Omitted variables: Cultural factors, intergenerational relationships, and community environmental policies that may influence knowledge-behavior transformation were not included.

Future research should: (1) conduct longitudinal tracking studies to reveal the dynamic process of knowledge-behavior transformation; (2) explore the psychological mechanisms underlying "Knowledge without Action," such as procrastination, decision fatigue, and habitual neglect; (3) develop personalized fall prevention interventions based on mobile health technologies; (4) conduct community-level randomized controlled trials to validate the effectiveness of classified intervention strategies [6][15].

5. Conclusion

This study of 327 community-dwelling older adults found that although perception of home environmental fall risk factors was moderately high, actual preventive behaviors were markedly lower, with poor knowledge-behavior consistency (Kappa = 0.28). The "Knowledge without Action" type was the most prevalent (38.2%), representing the most prominent problem in community fall prevention. Age ≥75 years, living alone, low income, no fall history, inadequate health literacy, and low social support were independently associated with "Knowledge without Action," while fall-related self-efficacy was an important protective factor.

These findings suggest that fall prevention interventions must move beyond health education to address the core contradiction of "Knowledge without Action" through multi-dimensional strategies that reduce behavioral barriers, enhance self-efficacy, provide resource support, and build social support networks. However, given the cross-sectional design, the causal directions of these associations remain to be verified by longitudinal studies. Ultimately, the goal is to reduce fall incidence and ensure home safety for older adults.

CRediT authorship contribution statement

Yao Li: Writing – original draft, Methodology, Formal analysis, Conceptualization. **Jing Wang:** Writing – original draft, Methodology. **Hao Zhang:** Writing – review & editing, Methodology. **Min Chen:** Writing – review & editing, Conceptualization. **Wei Zhao:** Writing – review & editing, Methodology. **Liu Fang:** Writing – review & editing, Methodology, Conceptualization.

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The free versions of Grammarly were used for spell-checking and grammar corrections. After using these tools, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the publication.

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REFERENCES

[1] World Health Organization. Step Safely: Strategies for Preventing and Managing Falls across the Life-Course. Geneva: World Health Organization; 2021. ISBN: 978-92-4-002191-4.

[2] National Health Commission of the People's Republic of China. Report on Nutrition and Chronic Disease Status of Chinese Residents (2020). Beijing: People's Medical Publishing House; 2021.

[3] Sun, J., Yang, J., Yang, M., Bai, K., Pan, J., & Huang, W. (2025). Research progress on falls risk assessment and preventive management of older adults in the community. Occupation and Health, 41(20), 2867–2871.

[4] Tinetti ME, Kumar C. The patient who falls: "It's always a trade-off". JAMA. 2010 Jan;303(3):258-266. DOI: 10.1001/jama.2009.2024. PMID: 20085954; PMCID: PMC3740370.

[5] Clemson L, Mackenzie L, Ballinger C, Close JC, Cumming RG. Environmental interventions to prevent falls in community-dwelling older people: a meta-analysis of randomized trials. Journal of Aging and Health. 2008 ;20(8):954-971. DOI: 10.1177/0898264308324672. PMID: 18815408.

[6] Gillespie LD, Robertson MC, Gillespie WJ, et al. Interventions for preventing falls in older people living in the community. The Cochrane Database of Systematic Reviews. 2009 Apr(2): CD007146. DOI: 10.1002/14651858.cd007146.pub2. PMID: 19370674.

[7] Rosenstock, I.M. (1974). The Health Belief Model and Preventive Health Behavior. Health Education & Behavior, 2, 354 - 386.

[8] Li, F., Zhou, D., Chen, Y., Yu, Y., Gao, N., Peng, J., & Wang, S. (2019). The Association between Health Beliefs and Fall-Related Behaviors and Its Implication for Fall Intervention among Chinese Elderly. International Journal of Environmental Research and Public Health, 16(23), 4774. https://doi.org/10.3390/ijerph16234774

[9] Chen, X. F. (2015). Exploring the influence of health beliefs, cues to action, and self-efficacy on fall prevention behaviors from the perspective of community-dwelling older adults [Master's dissertation]. National Taipei University of Nursing and Health Sciences.

[10] Zhang Y, Li H, Wang M. Knowledge, attitude, and practice of fall prevention among older adults in nursing homes and its influencing factors. Nurs Res. 2022;36(15):2745-2750.

[11] Mackenzie L, Byles J, Higginbotham N. Designing the Home Falls and Accidents Screening Tool (HOME FAST): Selecting the Items. British Journal of Occupational Therapy. 2000;63(6):260-269. doi:10.1177/030802260006300604

[12] Mackenzie L, Byles J, Higginbotham N. Reliability of the Home Falls and Accidents Screening Tool (HOME FAST) for identifying older people at increased risk of falls. Disability and Rehabilitation. 2002 Mar;24(5):266-274. DOI: 10.1080/09638280110087089. PMID: 12004972.

[13] Romli, Muhammad & Mackenzie, Lynette & Lovarini, Meryl & Tan, Maw & Clemson, Lindy. (2016). The Clinimetric Properties of Instruments Measuring Home Hazards for Older People at Risk of Falling: A Systematic Review. Evaluation & the Health Professions. 41. 82-128. 10.1177/0163278716684166.

[14] Li, L., & Zheng, S. (2016). Strategies of applying the health belief model to prevent falls among elderly inpatients in internal medicine departments. Journal of Nursing and Rehabilitation, 15(4), 352–355.

[15] Montero-Odasso, M., van der Velde, N., Martin, F. C., et al. (2022). World guidelines for falls prevention and management for older adults: a global initiative. Age and Ageing, 51(9). https://doi.org/10.1093/ageing/afac205

[16] Yardley L, Beyer N, Hauer K, et al. Development and initial validation of the Falls Efficacy Scale-International (FES-I). Age and Ageing. 2005 Nov;34(6):614-619. DOI: 10.1093/ageing/afi196. PMID: 16267188.

[17] Kwan MM, Tsang WW, Close JC, Lord SR. Development and validation of a Chinese version of the Falls Efficacy Scale International. Archives of Gerontology and Geriatrics. 2013 Jan-Feb;56(1):169-174. DOI: 10.1016/j.archger.2012.10.007. PMID: 23116978.

[18] National Health Commission of the People's Republic of China. (2025). 2024 Chinese residents' health literacy monitoring report. Beijing.

[19] Xiao, S. Y. (1994). The Theoretical Basis and Research Application of Social Support Rating Scale. Journal of Clinical Psychiatry, 4, 98-100.

[20] Bea, J. W., Thomson, C. A., Wallace, R. B., et al. (2017). Changes in physical activity, sedentary time, and risk of falling: The Women's Health Initiative Observational Study. Preventive medicine, 95, 103–109. https://doi.org/10.1016/j.ypmed.2016.11.025.