Research on Evaluation and Optimization of Long-Term Care Insurance Pilot Policies: Based on Multidimensional Quantitative Analysis of Policy Texts and Satisfaction Survey of Disabled Older Adults

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Abstract

Exploring the establishment of a Long-Term Care Insurance (LTCI) system represents a crucial strategy for addressing population aging and enhancing the social security framework. Using Shandong Province as a case study, this paper measures and evaluates its LTCI pilot policies. First, we analyze policy texts issued by all 16 pilot cities in Shandong. Selecting 10 key variables (including coverage scope, benefit range, fund financing, and benefit payment), we construct a policy evaluation index system. Then the AHP-EWM coupling algorithm is employed to calculate hierarchical index weights and derive comprehensive policy effectiveness scores for each city. Results indicate that within the index system, benefit payment levels, claims processing/reimbursement management, and service management exert the most significant influence on policy effectiveness. The average policy effectiveness score across pilot cities is 73.97 (out of 100), revealing substantial inter-city disparities. Subsequently, based on a satisfaction survey of disabled older adults, we found an overall high satisfaction level with LTCI (80.26 out of 100). However, areas identified for improvement include the assessment process, benefit evaluation criteria, and service duration. Empirical analysis using a Multi-Indicator Multi-Cause (MIMIC) structural equation model demonstrates that beneficiaries' overall satisfaction is influenced by individual characteristics, LTCI participation and benefits received, geographic location, and other factors. Specifically, higher satisfaction with the LTCI system is associated with being male, younger age, lower education levels, and

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The authors declare that there is no conflict of interest.

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greater economic independence. These findings provide evidence-based recommendations for improving and optimizing the nationwide implementation of the LTCI system.
Keywords: Ageing, Long Term Care Insurance, Policy Evaluation, Satisfaction

1. Introduction

With persistently declining birth and mortality rates alongside increasing life expectancy, China's population aging has entered an accelerated phase. Relevant data shows that as of November 2020, China's population aged 60 and above reached 264.02 million, accounting for 18.7% of the total population. Within this group, those aged 65 and above numbered 190.64 million, representing 13.5% of the population. Crucially, among China's older adults aged 60 and above, over 42 million are disabled, constituting 16.6% of this demographic. This signifies that at least one in every six older adults faces challenges in performing activities of daily living. These statistics starkly highlight the necessity and urgency for China to implement proactive strategies to address population aging and strengthen its multi-tiered social security system (Du Peng and Li Long, 2021;Peng et al., 2023).

The Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and the Long-Range Objectives Through the Year 2035, released in March 2021, explicitly calls to: "Improve the basic elderly care service system, vigorously develop inclusive elderly care services, and strengthen safety net guarantees for disabled, partially disabled, and impoverished older adults in extreme hardship."A key measure identified is to collaborate with relevant departments to prudently advance pilot programs for the Long-Term Care Insurance (LTCI) system and refine the LTCI framework. This underscores the critical need to summarize the practical experiences of existing LTCI pilots in various cities, evaluate the formulation and operational effectiveness of these policies, and propose improvements and optimization strategies (Yang et al., 2018; Guan Bo and Zhu Xiaoyu, 2019).

LTCI, falling within the domain of social insurance, is a social security mechanism designed to provide services or financial coverage for basic daily living assistance and medically necessary nursing care to insured individuals who have lost the capacity for activities of daily living due to aging or illness. The implementation of the LTCI system helps alleviate the financial burden on families of disabled individuals and reduces pressure on the social security system (Zhang et al., 2020).

In 2012, Qingdao City, Shandong Province, pioneered a nationwide pilot program integrating medical care, elderly support, rehabilitation, and nursing services. This initiative provided valuable practical experience for the subsequent national rollout of the LTCI system.

Marking a formal nationwide commencement, in 2016, the Ministry of Human Resources and Social Security (MoHRSS) issued the Guiding Opinions on Carrying out Pilot Programs for the Long-Term Care Insurance System. This policy designated Jilin and Shandong provinces as key pilot areas and selected 12 cities, to initiate the pilot phase.

Expanding the scope, in September 2020, the National Healthcare Security Administration (NHSA) and the Ministry of Finance jointly released the Guiding Opinions on Expanding the Pilot Program for the Long-Term Care Insurance System. This document added 14 new pilot cities and

provided comprehensive guidance on critical aspects of the pilot stage, including: Target beneficiaries; Scope of coverage; Fund Financing mechanisms; Benefit payments; Fund management; Service provision management; Administrative operations management. The overarching goal outlined in these guidelines is to establish a comprehensive LTCI policy framework during the 14th Five-Year Plan period (2021-2025) and to promote the development of a robust, multi-tiered long-term care security system.

As demonstrated above, Shandong Province has been at the forefront of China's LTCI pilot initiative. By 2024, Shandong Province's Long-Term Care Insurance program covers over 51.73 million participants, continuing to rank first nationally according to official statistics. This systematic implementation has gradually established Shandong as the "Qilu Model" for LTCI operational frameworks. Against the backdrop of the national expansion of LTCI pilots, rigorous evaluation of existing pilot outcomes becomes imperative. This necessitates examining the rationality of institutional frameworks, policy standards, operational mechanisms, and management protocols to inform future refinements. Shandong Province, with its earliest implementation, broadest coverage, and largest participant pool, serves as an ideal representative for studying China's LTCI pilot systems and offers significant research value.

Current research evaluating the effectiveness of LTCI policies in Chinese pilot cities primarily examines institutional design and practical implementation dimensions. LTCI institutional frameworks typically encompass coverage scope, financing mechanisms, benefit payments, disability assessment, service provision, and administrative management. The absence of a unified national structure has resulted in fragmented and heterogeneous designs across localities (Hai et al., 2018; Dai Weidong and Yu Yang, 2021; Kim Hongsoo and Kim Soonman, 2021). Comparative analyses reveal both shared features and variations in LTCI designs across pilot cities. Regarding coverage, while all cities include employees enrolled in basic medical insurance as mandated, certain municipalities have expanded eligibility to varying degrees, creating hierarchical differences in beneficiary inclusion (Li et al., 2024). For financing, pilot cities are establishing tripartite funding models shared by governments, employers, and individuals, though contribution standards remain non-uniform due to local autonomy (Yang Juhua and Du Shenghong, 2018). Li Changyuan and Qian Yanxing (2023) quantitatively demonstrate that contribution levels frequently misalign with economic development and demographic structures, advocating for dynamically adjusted financing mechanisms to optimize fund utilization. Concerning service delivery, scholars such as Wang et al. (2018) propose needs, based stratification of care levels, recognizing services as the operational vehicle for LTCI benefits. Administrative models have evolved toward hybrid public-private partnerships, as suggested by Lu et al. (2020) based on comparative analysis of coverage and care duration under different models. Nevertheless, this approach contends with challenges including inconsistent disability assessment standards, subjective implementation, and inadequate risk mitigation (Fu et al., 2022).

Holistic evaluations further inform this discourse. Yao Hong (2020) reviewing 15 pilot implementations, recommends extending coverage to rural residents and severely cognitively impaired older adults, diversifying financing, and prioritizing daily living support. Similarly, Dai Weidong and Yu Yang (2021) emphasize top-level design integration, standardizing assessments, achieving universal coverage, and establishing multi-channel financing, to overcome systemic fragmentation. Complementing these design-focused studies, empirical micro-level analyses measure policy impacts through objective indicators. In Shanghai, LTCI implementation reduced hospital stays by 41%, hospitalization costs by 17.7%, medical insurance payments by 11.4%, and monthly outpatient visits by 8.1%, with every additional RMB invested in LTCI reducing medical insurance expenditures by RMB 8.6 (Feng et al., 2020). Qingdao witnessed reductions of RMB 210.51 in monthly outpatient costs, RMB 1,901.9 in hospitalization costs, 0.14 monthly outpatient visits, and 0.11 annual hospitalizations per capita among middle-aged and older adults following LTCI implementation, though per capita medical costs exhibited an initial decline followed by sustained increases (Ma et al., 2019; Yu et al., 2019). These findings collectively underscore the operational complexities and contextual variations characterizing China's LTCI pilot development.

Based on a synthesis of existing research, evaluations of the policy effectiveness of the LTCI system at the macro level predominantly consist of descriptive studies, lacking quantitative evaluation models for systematic and holistic comparisons. At the micro level, research has been confined to measuring the impact of long-term care insurance on objective indicators such as service utilization, medical expenses, and hospital stay duration among enrollees, with insufficient attention to subjective indicators from psychological perspectives. Consequently, this study aims to construct a quantitative evaluation model for the long-term care insurance system, using Shandong Province as a case study. Through questionnaire surveys, it further investigates enrollees' satisfaction with various aspects of the system's current operations and analyzes the influencing factors of this satisfaction.

Therefore, the contributions of this study are primarily reflected in three aspects: (1) Unlike previous research, it introduces a quantitative model for evaluating the policy effectiveness of LTCI at the macro level. By establishing a hierarchical indicator system based on policy requirements and pilot implementation realities, the study provides novel approaches and methodologies for assessing the operational effectiveness of LTCI. (2) The study incorporates the subjective variable of "enrollee satisfaction" into the micro-level evaluation indicators of operational effectiveness, addressing a gap in the field. Furthermore, it employs the MIMIC structural equation model, which outperforms traditional multiple regression methods in handling complex conditions, to explore and analyze the factors influencing satisfaction. (3) Shandong Province is selected as the case study due to its pronounced challenges of population aging and disability prevalence, as well as its leading position in China's LTCI pilot initiatives. The province's robust long-term care insurance system avoids potential overestimation of policy effectiveness that might arise from excessively high economic development or healthcare standards.

The subsequent sections of this paper are organized as follows: Section 2 introduces the status of the LTCI system in Shandong Province. Section 3 constructs a quantitative evaluation model for the LTCI system to assess policy implementation across 16 pilot cities in the province. Section 4 reports the satisfaction evaluation results and influencing factors among LTCI enrollees in selected representative cities. Section 5 presents the research findings and proposes policy recommendations.

2. Status of LTCI Pilot in Shandong Province

In July 2012, the General Office of Qingdao Municipal People's Government in Shandong Province issued the Opinions on Establishing a Long-Term Medical Care Insurance System (Trial). This document proposed integrating employee nursing insurance with employee social medical insurance, and resident nursing insurance with resident social medical insurance, thereby establishing a multi-tiered nursing security system anchored by nursing insurance. Consequently, Qingdao emerged as the "pioneer" of the LTCI system.

In 2016, the General Office of the Ministry of Human Resources and Social Security released the Guidance on Launching Pilots for the Long-Term Care Insurance System, designating Shandong as one of two key national pilot provinces. Subsequently, the province began exploring and implementing LTCI for employees. By 2021, all 16 prefecture-level cities in Shandong had established employee LTCI systems, forming a distinctive development pathway. The 14th Five-Year Plan for the Development of Shandong's Healthcare Security Sector (2021) further emphasized the province's commitment to "steadily advancing long-term care insurance pilots and creating a Shandong model (Qilu Model) for long-term care insurance."

By synthesizing implementation rules, notices, and opinions on LTCI published on municipal government websites across Shandong, the status of the province's pilot system can be outlined as follows:

2.1 Target beneficiaries and scope of coverage

At the inception of the LTCI system, its implementation relied on basic medical insurance. Therefore, the Opinions on Piloting the Long-Term Care Insurance System for Employees (2017) issued by the General Office of Shandong Provincial People's Government explicitly stipulated that LTCI should "primarily cover the population enrolled in basic employee medical insurance." Consequently, even today, most pilot cities in Shandong continue to target employee medical insurance enrollees as the primary beneficiaries of LTCI. However, in more economically developed regions, such as Jinan, Qingdao, and selected counties/districts of Dongying, Yantai, Weihai, and Rizhao, resident LTCI has also been established, extending coverage to urban and rural residents.

Across pilot cities in Shandong, the LTCI system predominantly targets severely disabled individuals, with specific eligibility criteria defined, including duration of disability, continuous bedridden period, and consecutive contribution time. Notably, Qingdao pioneered a "special dementia care units" approach in 2017, extending coverage to individuals with severe dementia. The

Implementation Measures for Employee Long-Term Care Insurance in Yantai (Trial) (2018) further allowed insured employees to voluntarily designate long-term care facilities and apply for dementia care benefits. In December 2020, the Binzhou Municipal Medical Insurance Bureau introduced the Pilot Work Plan for Including Severely Demented Individuals in Employee Long-Term Care Insurance, extending coverage to employees aged 60 or older suffering from severe dementia (e.g., due to Alzheimer's disease or vascular dementia) that renders them unable to perform daily living activities.

2.2 Fund financing mechanisms and benefit payments

Regarding financing mechanisms, cities across Shandong Province primarily establish diversified funding channels centered on basic medical insurance pooled funds and individual contributions, supplemented by resources such as supplementary medical insurance funds, fiscal subsidies, welfare lottery funds, and social donations. Two predominant approaches are implemented: proportional financing, where funds are transferred from medical insurance pooled funds and individual accounts at fixed rates, adopted in Qingdao, Weifang, Binzhou, and Zaozhuang, and fixed-amount financing, with an annual standard contribution of approximately 100 yuan, practiced in Jinan, Yantai, Linyi, Liaocheng, Zibo, Heze, Jining, Tai'an, Weihai, Dezhou, and Rizhao. Notably, proportional financing links contributions to income bases, enabling dynamic adjustments based on socioeconomic development, long-term care coverage levels, and fund balances, thereby offering greater flexibility.

In terms of coverage, LTCI in Shandong's pilot cities primarily addresses medical nursing costs, though reimbursement rates vary significantly by region. Weifang provides the highest reimbursement rate at 96% for both home-based and institutional care, while Liaocheng and Zaozhuang reimburse at the lowest rate of 75%, with other cities falling between 80% and 90%. Additionally, beyond medical nursing expenses, six cities (Qingdao, Yantai, Weihai, Liaocheng, Zaozhuang, and Rizhao) have expanded their coverage to include daily living assistance, reflecting a broader approach to long-term care support.

2.3 Fund and service provision management

Regarding fund management regulations, LTCI fundamentally differs from basic medical insurance, requiring its funds to be maintained in separate accounts, independently accounted for, and managed autonomously. All pilot cities in Shandong have implemented measures for independent management of LTCI funds in their administrative frameworks. For instance, Yantai mandates that "LTCI operates under municipal-level coordination, with funds managed through dedicated fiscal accounts. Revenue and expenditure channels are strictly separated, featuring independent accounting, segregated bookkeeping, and earmarked usage. Misappropriation by any entity or individual is prohibited." Additionally, Qingdao has introduced innovative measures in its fund management protocol, such as establishing employee-resident nursing insurance adjustment funds and creating prevention reserves for delaying disability and cognitive decline.

Concerning service management in operational practice, pilot cities are expected to develop unified assessment standards for disability/cognitive impairment and standardized care service frameworks. Currently, Shandong lacks a province-wide standardized assessment system for disability/cognitive impairment levels. Most regions still rely on the Barthel Index, a basic activity of daily living (ADL) scale evaluating 10 indicators like eating, bathing, and dressing, as the primary assessment tool. This approach fails to ensure comprehensive, diverse, or flexible evaluation criteria. To address this, Qingdao issued the Implementation Measures for Assessing Care Needs of Individuals with Disability/Cognitive Impairment (2020) to promote equitable socialized assessment mechanisms. Yantai developed the Rapid Cognitive Screening Scale for grading cognitive impairment, while Dongying adopted the Long-Term Care Insurance Disability Level Assessment Application Form as its evaluation standard. Furthermore, several cities have tailored approaches to local conditions by introducing unique regulatory measures for care service providers, enhancing oversight and auditing of service institutions.

2.4 Operation models and policy coordination

The operational models for LTCI across pilot cities in Shandong Province encompass three primary approaches:

Government-exclusive operation. Primarily managed by human resources and social security departments, with medical insurance agencies administering contractual oversight.

Public-Pr Partnership Exploration. Policy documents explicitly introduce commercial insurers into operation management, as seen in Jinan, Linyi, Binzhou, Jining, Tai’ an, Zaozhuang, and Rizhao.

Commercial Insurance Delegation. Implementation delegated to commercial insurers via public tendering, exemplified by Qingdao and Yantai, where insurers serve as assessors or appoint specialists to review enrollee eligibility.

Across Shandong’ s pilot cities, policy coordination between LTCI, medical insurance, and maternity insurance is well-established: nursing expenses covered by medical, occupational injury, maternity insurance, or legally liable third parties are excluded from long-term care benefit coverage. Core administrative departments include human resources and social security, finance, civil affairs, and health authorities. Several cities further integrate commercial insurers, Disabled Persons’ Federations, aging affairs departments, trade unions, Red Cross societies, and pricing regulators to coordinate cross-departmental responsibilities.

2.5 Care system framework and institutional innovations

Municipalities across the region have responded to national directives by actively promoting broad participation of social organizations and private entities in long-term care service provision through Management of Care Service Institutions or Implementation Measures for Long-Term Care Insurance, aiming to foster industry growth and enhance service capacity. Care modalities under

LTCI typically encompass home-based care, institutional care, specialized care, and roving care. Certain areas impose strict eligibility thresholds for care modalities; for instance, Jinan requires institutional or home care applicants to meet conditions such as "necessity for long-term nasogastric or urinary catheterization" or "non-healing fractures." Conversely, regions like Qingdao empower enrollees to freely choose care modalities based on individualized needs.

The 2020 Guidelines on Expanding Long-Term Care Insurance Pilots jointly issued by the National Healthcare Security Administration and the Ministry of Finance formally established LTCI as an independent insurance category, accelerating the development of a multi-tiered care security framework responsive to diverse public needs. Several regions have translated this mandate into concrete policies:

Qingdao's Long-Term Care Insurance Measures (Article 3) stipulates establishing "a multi-tiered care security system anchored by nursing insurance, supplemented by social assistance, commercial insurance, and charitable initiatives, with coordinated linkages across social security programs."

Jinan's Work Plan for Expanding Long-Term Care Insurance Pilots prioritizes "building an independent insurance category through dedicated design, advancement, and operation to refine the city's institutional framework, policy standards, operational mechanisms, and management protocols."

These innovations demonstrate systematic efforts to integrate institutional design with localized implementation strategies, balancing standardization with flexibility to address regional disparities in care demands.

3. Comprehensive Evaluation of LTCI Pilot Policies

3.1 Construction of the indicator system

Policy analysis reveals that long-term care insurance (LTCI) pilot implementation primarily involves two key dimensions.

The first is institutional design, which establishes specialized management standards for service provision, financing models, and benefit delivery; these are essential prerequisites for overall system functionality.

The second dimension is operational implementation, referring to the practical execution encompassing fund management, service administration, and operational mechanisms, which constitute the foundational elements for sustainable system performance.

Drawing on implementation plans from pilot cities and field research data, this study constructs an evaluation framework anchored in three pillars: core policies, management infrastructure, and supporting coordination. This framework assesses system effectiveness through ten indicators spanning multiple dimensions of LTCI performance.

Specifically, it forms a dual-axis framework for evaluating both institutional design and

operational implementation. The institutional design evaluation framework consists of four primary indicators (and eight secondary indicators): Coverage Scope, Benefit Range, Fund Financing, and Benefit Payment.

The operational evaluation framework consists of six primary indicators (and twelve secondary indicators): Fund Management, Service Administration, Operational Models, Policy Coordination, Care System Framework, and Institutional Innovations. Indicator weights were assigned based on empirical data, with detailed specifications provided in Table 1.

Evaluation framework for LTCI policies

Table 1

Framework	Primary Indicator	Secondary Indicator	Scoring Criteria
Institutional Design	Coverage Scope	Target Population	1. Only urban employees = 25 2. Urban employees + urban residents = 50
		Age Range	1. Only elderly (≥60 years) = 25 2. All age groups = 50
	Benefit Range	Target Groups	1. Only disabled individuals = 25 2. Disabled + cognitively impaired = 50
		Severity Coverage	1. Only severe disability = 25 2. Moderate + severe disability = 50
	Fund Financing	Funding Sources	1. Single source (e.g., medical insurance) = 25 2. Multi-source (incl. fiscal subsidies, donations) = 50
		Financing Approach	1. Fixed-amount financing = 25 2. Proportional financing = 50
	Benefit Payment	Coverage Scope	1. Basic daily care or medical nursing = 25 2. Both daily care + medical nursing = 50
		Payment Level	1. Avg. reimbursement rate <80% = 25 2. Avg. reimbursement rate ≥80% = 50
Operational Implementation	Fund Management	Regulatory Compliance	1. Segregated accounts & independent accounting = 50 2. Other = 25
		Innovation	1. Established innovative funds (e.g.,

	Measures	adjustment/prevention reserves) = 50 2. Other = 25
Service Administration	Disability Assessment	1. Reliance solely on *Barthel Index* = 25 2. Additional assessment tools adopted = 50
	Service Oversight	1. No regulatory measures for care institutions = 25 2. Institutional oversight policies implemented = 50
Operational Models	Policy Incentives	1. Government-exclusive operation = 25 2. Policy mandates commercial insurer involvement = 50
	Delegation Mechanism	1. No delegation to commercial insurers = 25 2. Commercial insurers delegated via public tender = 50
Policy Coordination	Program Coordination	1. Excludes costs covered by medical/ occupational/maternity insurance or liable third parties = 50 2. Other = 25
	Department Coordination	1. Multi-department collaboration (incl. insurers, DPFs, Red Cross) = 50 2. Only core departments[†] = 25
Care System Framework	Care Modalities	1. Encourages free choice (home/ community/institution-based care) = 50 2. Other = 25
	Market Engagement	1. Policies explicitly promote private/ social participation in care services = 50 2. Other = 25
Institutional Innovations	Multi-Tiered System	1. Proposes LTCI-based system supplemented by social assistance/commercial insurance/charity = 50 2. Other = 25
	Independent Insurance Status	1. Formally positions LTCI as "sixth social insurance pillar" = 50 2. Other = 25

3.2 Weight calculation

The AHP-EWM coupling algorithm (Analytic Hierarchy Process-Entropy Weight Method

based on Lagrange Multiplier Method) is adopted to calculate weights for indicators at all hierarchical levels.

3.2.1 Computational procedure of the AHP-EWM coupling algorithm

The Entropy Weight Method (EWM) determines objective weights based on the variability of indicators. A smaller information entropy for an indicator signifies greater variability, richer information contribution, and higher weight in comprehensive evaluation. The computational steps are as follows:

（1）Standardization of Indicator Data:

$$y_{ij} = \frac{x_{ij} - m}{M - m} \qquad (1)$$

Where M denotes the maximum value in x_{ij} and $m$represents the minimum value in x_{ij}.

$$C_{ij} = \frac{y_{ij}}{\sum_{i=1}^{n} y_{ij}} \qquad (2)$$

（2）Calculation of Entropy Values:

$$E_j = -\frac{1}{ln\, n}\sum_{i=1}^{n} C_{ij}\, ln\, C_{ij}, 0 \le E_j \le 1 \qquad (3)$$

（3）Calculation of Variation Coefficients:

$$D_j = 1 - E_j \qquad (4)$$

（4）Calculation of Indicator Weights:

$$\varphi_j = \frac{D_j}{\sum_{j=1}^{k} D_j} (j = 1,2,\cdots,k) \qquad (5)$$

The Analytic Hierarchy Process (AHP) is a decision analysis method wherein decision-makers assign criteria weights across hierarchical levels to determine indicator weights. The subjective weights Φ_{1t} derived from AHP and the objective weights Φ_{2t} obtained via the Entropy Weight Method (EWM) are integrated under the principle of minimum relative entropy. Using the Lagrange multiplier method, the integrated weighting formula is derived as follows:

$$\varphi_t = \frac{\sqrt{\varphi_{1t}\varphi_{2t}}}{\sum_{t=1}^{S}\sqrt{\varphi_{1t}\varphi_{2t}}} (t = 1,2,\cdots,s) \qquad (6)$$

3.2.2 Weight calculation results

By compiling data from all 16 LTCI pilot cities in Shandong Province according to the indicator framework, the adjusted AHP-EWM integrated weights for each evaluation indicator were

calculated, as presented in Table 2. The indicators are ranked in descending order of their influence on policy effectiveness: Benefit Payment (15.85%), Operational Models (15.44%), Service Administration (13.18%), Policy Coordination (10.07%), Benefit Range (9.05%), Fund Financing (8.82%), Care System Framework (8.48%), Coverage Scope (7.93%), Fund Management (6.31%), Institutional Innovations (4.88%).

To validate the scientific rigor of the AHP-EWM integrated weights, key indicators were visualized. The results demonstrate that the integrated weights derived via the Lagrange multiplier algorithm effectively balance subjective biases inherent in the Analytic Hierarchy Process, yielding a more rational and scientifically robust weighting scheme (Figure 1).

Indicator system and weighting for policy assessment

Table 2

Target Level	Criterion Level	Alternative Level	Weight
LTCI Policy Evaluation A	Institutional Design（B1）	Coverage Scope C1	0.0793
		Benefit Range C2	0.0905
		Fund Financing C3	0.0882
		Benefit Payment C4	0.1585
	Operational Implementation（B2）	Fund Management C5	0.0631
		Service Administration C6	0.1318
		Operational Models C7	0.1544
		Policy Coordination C8	0.1007
		Care System Framework C9	0.0848
		Institutional Innovations C10	0.0488

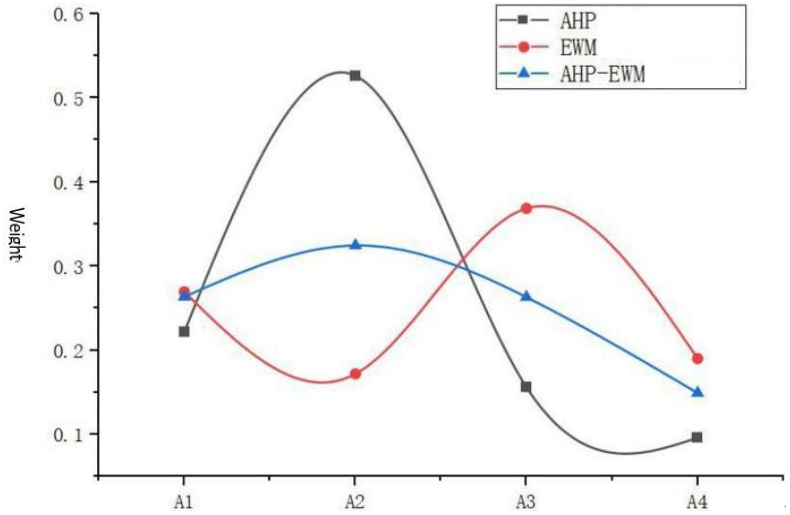

Figure 1. Visualization of the Indicator System

3.3 Comprehensive evaluation of LTCI policies

The comprehensive evaluation of LTCI policies across Shandong’s 16 pilot cities, calculated using indicator weights at the alternative level, reveals significant disparities in effectiveness (Table 3,

ranked by descending score with cities anonymized alphabetically). The provincial average score stands at 73.97, with City A and City B demonstrating exceptional performance.

City A achieves near-perfect results due to its mature institutional design and operational frameworks, despite excluding moderately disabled/cognitively impaired elderly from coverage, positioning it as the provincial benchmark for LTCI development. City B excels in critical high-weight domains: benefit payment (e.g., inclusion of daily living assistance costs), operational models (delegating implementation to insurers via public tender), service administration (customized disability assessment standards), and policy coordination. Notably, City E underperforms relative to City C, despite innovations like commercial insurer partnerships and positioning LTCI as an independent program, primarily because it excludes daily living assistance from reimbursable expenses. This divergence underscores that optimizing core areas—particularly benefit payment structures, operational delegation mechanisms, and multidimensional service management—remains essential for enhancing systemic effectiveness. Pilot cities should prioritize these domains to accelerate policy impact, as they collectively account for over 54% of the evaluation weight.

Pilot cities' associated indicators and comprehensive scores

Table 3

	A	B	C	D	E	F	G	H
Coverage Scope C1	100	100	100	75	100	100	75	75
Benefit Range C2	75	75	50	75	50	50	50	50
Fund Financing C3	100	75	75	100	75	75	75	75
Benefit Payment C4	100	100	100	75	75	100	75	75
Fund Management C5	100	75	75	75	75	75	75	75
Service Administration C6	100	100	75	75	75	50	75	75
Operational Models C7	100	100	50	75	75	75	75	75
Policy Coordination C8	100	100	100	75	75	75	75	75
Care System Framework C9	100	75	100	100	75	75	75	75
Institutional Innovations C10	100	50	50	50	75	50	50	50
Comprehensive Scores	97.74	89.40	78.24	78.10	74.72	74.17	71.52	71.52
	I	J	K	L	M	N	O	P
Coverage Scope C1	100	75	75	75	75	75	75	75
Benefit Range C2	50	50	50	50	50	50	50	50
Fund Financing C3	75	100	75	75	75	75	75	100
Benefit Payment C4	50	75	75	75	75	75	75	75
Fund Management C5	75	75	75	75	75	75	75	75
Service Administration C6	75	75	75	50	50	75	75	50
Operational Models C7	50	50	50	75	50	50	50	50
Policy Coordination C8	100	75	75	75	100	75	75	75

Care System Framework C9	100	75	100	75	75	75	75	75
Institutional Innovations C10	50	50	50	50	75	50	50	50
Comprehensive Scores	70.32	69.86	69.78	68.22	68.10	67.66	67.66	66.57

4. Satisfaction Measurement and Influencing Factors Analysis

Based on the comprehensive policy evaluation of 16 pilot cities in Shandong (Section 3.3), City E-scoring near the provincial average (73.97), was selected as representative of typical pilot cities. A questionnaire survey assessed enrollee satisfaction and its determinants, providing a micro-level evaluation of system effectiveness.

4.1 Data sources

Data were collected via telephone interviews with 110 randomly sampled LTCI enrollees in City E during August 2021. From 117 distributed questionnaires, 110 valid responses were obtained (94.02% validity rate). Respondents spanned diverse socioeconomic strata and geographic areas, adhering to random sampling principles. Demographic characteristics aligned with the city ' s disabled elderly population, ensuring representativeness.

4.2 Satisfaction measurement

4.2.1 Statistical analysis

The questionnaire assessed participant satisfaction from eight distinct perspectives: the insurance system's assessment process, benefit determination, service duration, service fees, reimbursement rate, settlement cycle, follow-up frequency, and service quality. Figure 2 presents the statistical results of all respondents' answers. Among these, respondents expressed relatively high satisfaction with the settlement cycle and service quality. For both indicators, over 80% of respondents selected the "reasonable" option, with a particularly high 96.23% expressing satisfaction with service quality. However, 17.27% still indicated the settlement cycle was too long and should be shortened appropriately. Conversely, satisfaction was lower regarding the assessment process, benefit determination, and service duration. For these three indicators, less than 70% of respondents selected "reasonable." Specifically, 27% of respondents felt the assessment process was overly cumbersome and needed simplification, over 26% indicated the benefit determination criteria were either too strict or too lenient and required improvement, and 43.04% stated the service duration was insufficient and should be increased appropriately.

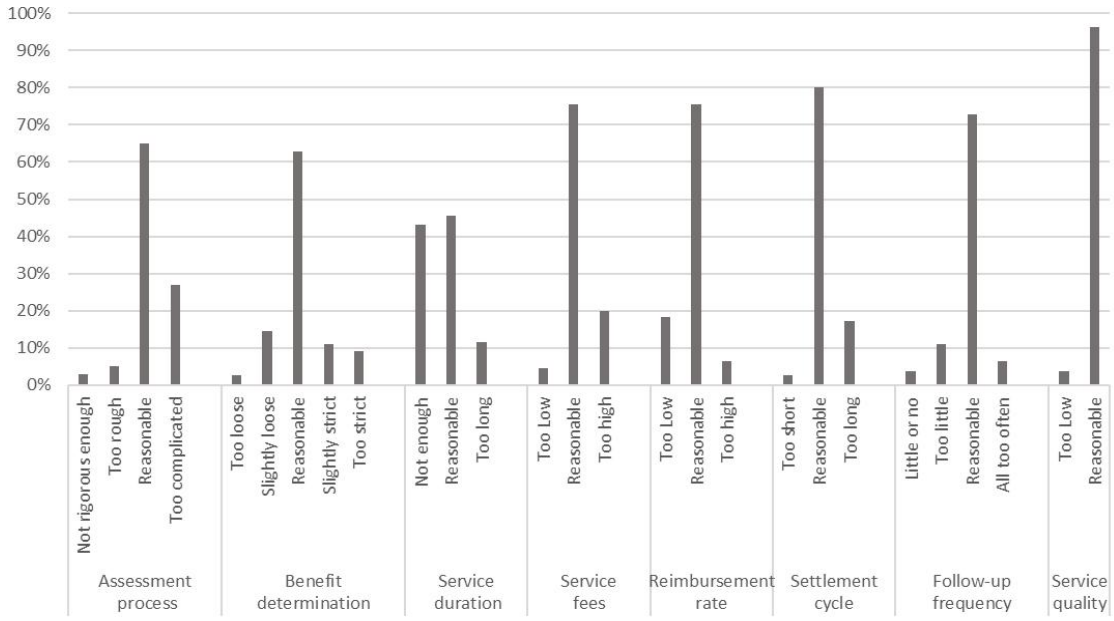

Figure 2 Survey on satisfaction with the LTCI system

4.2.2 Comprehensive satisfaction index

First, each of the eight satisfaction indicators (assessment process, benefit determination, service duration, service fees, reimbursement rate, settlement cycle, follow-up frequency, and service quality) was assigned a percentage-based score (0 – 100) according to respondents' selected answers, as detailed in Table 4:

Value assignment for satisfaction indicator variables

Table 4

Indicator Variable	Response Option	Assigned Value
Assessment Process	Assessment process is excessively cumbersome and requires streamlining	25
	Assessment process is overly simplistic and requires refinement	
	Assessment process lacks rigor and standardized procedures	50
	Unaware of specific procedures; reserve judgment	75
	Other suggestions	
	Assessment process is efficient and well-established; no changes needed	100
Benefit Determination	Standards are excessively stringent; significant relaxation needed	33.3

	Standards are excessively lenient; significant tightening needed	
	Generally reasonable; minor tightening recommended	66.6
	Generally reasonable; minor relaxation recommended	
	Other suggestions	
	Standards are reasonable and acceptable	100
Service Duration	Service duration is insufficient; moderate extension needed	50
	Service duration requirement is excessive; moderate reduction recommended	
	Service duration is appropriately set; no adjustment needed	100
Service Fees	Fees are too high; moderate reduction recommended	50
	Fees are too low; moderate increase recommended	
	Fees are reasonable and satisfactory	100
Reimbursement Rate	Reimbursement rate is too high; moderate reduction recommended	50
	Reimbursement rate is too low; moderate increase recommended	
	Reimbursement rate is appropriately set; no adjustment needed	100
Settlement Cycle	Settlement cycle is too long; moderate shortening recommended	50
	Settlement cycle is too short; moderate extension recommended	
	Other suggestions	
	Satisfied; maintain current practice	100
Follow-up Frequency	Follow-ups are nearly absent; urgent need to establish regular system	25

	Follow-ups are too frequent; reduce frequency	50
	Follow-ups are too infrequent; increase frequency	
	Follow-ups are overly formalized without substantive value	75
	Other suggestions	
	Follow-up frequency is appropriate and regular; no improvement needed	100
Service Quality	Current service quality is low; requires immediate improvement	33.3
	Current service quality is adequate but could be enhanced	66.6
	Current service quality is excellent; no enhancement needed	100

Then, the entropy weight method was used to calculate the weights of the eight indicator variables, with the results shown in Table 5. The weights in descending order are as follows: assessment process (29.03%), service duration (15.28%), benefit determination (11.67%), reimbursement rate (9.7%), service fees (9.7%), settlement cycle (8.44%), service quality (8.32%), and follow-up frequency (7.85%).

Weight distribution of total satisfaction indicator variables

Table 5

Indicator Variables	Assessment Process	Benefit Determination	Service Duration	Reimbursement Rate	Service Fees	Settlement Cycle	Follow-Up Frequency	Service Quality
Weight	0.2903	0.1167	0.1528	0.0970	0.0970	0.0844	0.0785	0.0832

Finally, the comprehensive satisfaction scores of respondents were calculated by combining the weights with the assigned values of survey options. The mean score for the total sample was 80.26 (on a scale of 0 to 100), indicating that insured individuals in City E generally express an above-average satisfaction level with the LTCI system.

4.3 Analysis of satisfaction influencing factors

4.3.1 Model specification

To further explore the factors influencing satisfaction with the LTCI system, a Multiple Indicators Multiple Causes (MIMIC) model within the Structural Equation Modeling framework was employed. As illustrated in Figure 3, the model posits that:

Explanatory variables, including individual characteristics (gender, age, education level, marital status, income source), insurance details (coverage category, payment duration vs. actual service

duration, number of service items, supervision status, caregiving approach), and regional factors, collectively influence insured individuals' satisfaction with the LTCI system.

Total satisfaction serves as a reflective latent variable, measured by eight observed indicators: satisfaction with the assessment process, benefit determination, service duration, reimbursement rate, service fees, settlement cycle, follow-up frequency, and service quality.

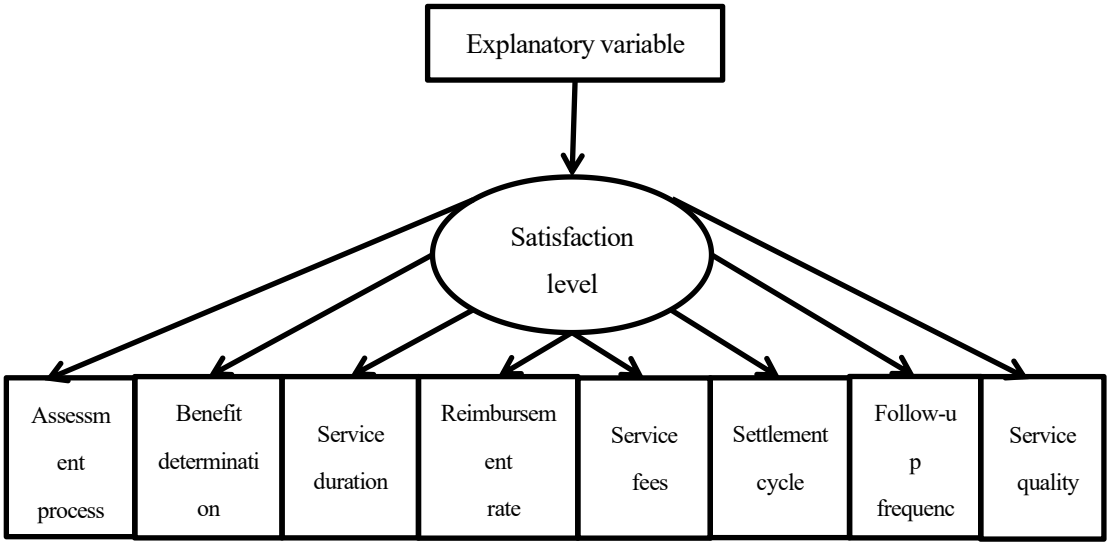

Figure 3 MIMIC Model of Factors Influencing Satisfaction with the LTCI System

4.3.2 Variable specification

As described above, the explanatory variables for analyzing influencing factors of the LTCI system are categorized into three groups:

The first category encompassed respondents' individual characteristics: gender (coded as male=1, female=0), age (continuous variable), education level (primary school or below=0, junior high school=1, high school=2, college/bachelor's=3, graduate degree or above=4), marital status (married=1, other=0), and primary income source modeled as a dummy variable set comprising financial support from children, pension benefits, and wage income.

The second category covered details of the LTCI: insurance type (resident insurance=1, employee insurance=0), paid service duration (log-transformed), actual service duration (log-transformed), number of services utilized (e.g., feeding assistance, bed-making, toenail care, dressing assistance), service supervision status (yes=1, no=0), and caregiving approach represented as a dummy variable set for home care, institutional care, and specialized care.

The third category addressed regional distribution through a dummy variable set for districts a through e, with District a serving as the reference category. All eight indicator variables reflecting total satisfaction were operationalized using the coding methodology consistent with Table 3.

4.3.3 Variable statistics

Based on the computational results from the preceding section, the composite satisfaction score with the LTCI system among respondents was 80.26. The sample was divided into two groups

according to this threshold: 47 cases demonstrated lower satisfaction (⩽80.26), while 63 cases exhibited higher satisfaction (>80.26). Descriptive statistics for explanatory and indicator variables across these groups are presented in Table 6.

Notably, the higher-satisfaction cohort predominantly comprised males, older individuals, those with lower education levels, married respondents, and financially independent participants. This group also experienced longer service durations, utilized fewer service items, and predominantly received institutional or specialized care.

Across the total sample, all satisfaction indicator scores exceeded 80 except for assessment process and service duration. The service duration metric marginally exceeded the passing threshold (>60) yet remained substantially lower than other indicators. Between-group comparisons revealed the most pronounced divergence in assessment process satisfaction, while service duration showed minimal differentiation.

Descriptive statistics of explanatory variables and indicator variables (N=110)

Table 6

Variable		Total Sample（N=110）		Satisfaction≤80.26（N=47）		Satisfaction>80.26（N=63）	
		Mean	Std.	Mean	Std.	Mean	Std.
Explanatory Variables	Gender	0.5301	0.5000	0.4500	0.5000	0.5900	0.5000
	Age	75.7600	11.3800	74.6400	11.7400	76.6000	11.1300
	Education Level	1.1900	1.0900	1.3800	1.0900	1.0500	1.0700
	Marital Status	0.7400	0.4400	0.6400	0.4900	0.8100	0.4000
	Income Source: Children's Support	0.1900	0.3900	0.2600	0.4400	0.1400	0.3500
	Income Source: Pension Funds	0.6400	0.4800	0.6400	0.4900	0.6500	0.4800
	Income Source: Wages	0.1600	0.3700	0.1100	0.3100	0.2100	0.4100
	LTCI Type	0.3100	0.4600	0.3000	0.4600	0.3200	0.4700
	Paid Service Hours	171.35	58.8000	170.53	59.4500	171.95	58.7800
	Paid Service Hours (Ln)	5.0500	0.5400	5.0200	0.6700	5.0700	0.4200
	Actual Service Hours	172.87	59.3700	170.96	59.7500	174.30	59.5300
	Actual Service Hours (Ln)	5.0600	0.5400	5.0200	0.6700	5.0900	0.4200
	Number of Service Items	10.5300	10.1600	11.4700	9.8600	9.8300	10.4000

	Supervision (Yes/No)	0.1500	0.3500	0.1500	0.3600	0.1400	0.3500
	Care Mode: Home Care	0.7200	0.4500	0.7900	0.4100	0.6700	0.4800
	Care Mode: Institutional Care	0.1900	0.3900	0.1700	0.3800	0.2100	0.4100
	Care Mode: Specialized Care	0.0900	0.2900	0.0400	0.2000	0.1300	0.3400
	Region: Area a	0.1200	0.3200	0.0900	0.2800	0.1400	0.3500
	Region: Area b	0.0800	0.2800	0.0900	0.2800	0.0800	0.2700
	Region: Area c	0.3700	0.4900	0.4500	0.5000	0.3200	0.4700
	Region: Area d	0.1700	0.3800	0.1500	0.3600	0.1900	0.4000
	Region: Area e	0.2500	0.4400	0.2300	0.4300	0.2700	0.4500
Indicator Variables	Assessment process	74.1000	34.2000	42.5500	28.0300	98.8100	5.3700
	Benefit determination	83.1600	24.1700	67.3300	23.5700	96.2900	12.1500
	Service duration	65.7700	24.2900	64.8900	23.1100	67.4600	24.0300
	Reimbursement rate	86.9400	23.0700	76.6000	25.2200	96.0300	13.6200
	Service fees	86.9400	23.0700	74.4700	25.2600	97.6200	10.7300
	Settlement cycle	89.1900	21.7500	78.7200	24.9900	98.4100	8.8400
	Follow-up frequency	89.4100	20.3800	85.6300	20.0200	93.6500	16.7800
	Service quality	82.5500	20.5500	73.0000	19.2300	90.9900	14.9400

4.3.4 Regression results and analysis

An exploratory factor analysis (EFA) was first conducted to examine whether the eight indicators measured a single common factor. This step aimed to ensure that these indicators comprehensively captured the overall satisfaction of insured individuals from multiple dimensions without generating extraneous factors. Principal component factor analysis (PCFA) was employed, revealing that among the eight extracted factors, only Factor 1 exhibited strong explanatory power, with a significant eigenvalue of 3.39. This factor accounted for 42.33% of the total variance in the indicators, which was sufficient to justify the construction of a single factor.

Subsequently, confirmatory factor analysis (CFA) was performed to test the significance of the factor loadings of the remaining seven indicators on the latent variable of overall satisfaction with the LTCI system. The model fit indices were as follows: RMSEA = 0.113, SRMR = 0.061, suggesting no significant discrepancy between the constructed factor model and the actual data. Additionally,

CFI = 0.909 and R^2 = 0.828 indicated a high overall model fit

The standardized coefficients of all seven measurement indicators exceeded 0.3 and were statistically significant at the 0.1% level ($p < 0.001$). This confirms that satisfaction with the LTCI system exerted a significantly positive influence on each indicator. Among these, service fees exhibited the highest factor loading, followed by reimbursement rate, service quality, benefit determination, assessment process, settlement cycle, and follow-up frequency.

Results of PCFA and CFA

Table 7

Principal Component Factor Analysis (PCFA)			Confirmatory Factor Analysis (CFA)	
Factor	Eigenvalue	Factor 1 Loading	Indicator Variable	Standardized Coefficient
factor1	3.3900	0.6600	Assessment process	0.5781****
factor2	1.1000	0.7000	Benefit determination	0.6272****
factor3	0.9100	0.2200	Service duration	—
factor4	0.7300	0.7200	Reimbursement rate	0.6797****
factor5	0.6200	0.7700	Service fees	0.7340****
factor6	0.4900	0.6700	Settlement cycle	0.5774****
factor7	0.4500	0.5700	Follow-up frequency	0.4974****
factor8	0.3200	0.7300	Service quality	0.6715****

As shown in Table 8, the model fit indices include R2=1, CFI=1, SRMR=0.155. These results indicate that the proposed model aligns closely with the true variable relationship model, demonstrating high overall fit and acceptable estimation outcomes.

For the measurement model, all seven indicators (assessment process, benefit determination, reimbursement rate, service fees, settlement cycle, follow-up frequency, and service quality) showed statistically significant positive effects ($p < 0.001$) on the latent variable satisfaction with the LTCI system, confirming the validity of these indicators in measuring the construct.

Regarding structural relationships, individual characteristics of disabled elderly revealed several insights.

Gender: The regression coefficient was significantly positive at the 1% level ($p < 0.01$), indicating that males reported higher satisfaction than females. This may stem from physiological differences, as females often require more meticulous care.

Age: The coefficient was significantly negative at the 0.1% level ($p < 0.001$), suggesting that satisfaction decreases with age. Older individuals typically require more intensive care and have higher expectations.

Education Level: The coefficient was significantly negative at the 0.1% level ($p < 0.001$). Higher-educated individuals reported lower satisfaction, potentially due to unmet psychological needs, as the current system inadequately addresses mental well-being.

Marital Status: The coefficient was negative but statistically insignificant.

Primary Income Source (reference: wage earners):

Financial support from children and pension showed significantly negative coefficients at the 0.1% ($p < 0.001$) and 5% ($p < 0.05$) levels, respectively. This implies that those relying on these sources reported lower satisfaction than wage earners, indicating that greater financial independence correlates with higher satisfaction.

Insurance Participation Status also revealed several insights.

Type of Insurance: The coefficient was significantly negative at the 0.1% level ($p < 0.001$). Participants in employee-based insurance reported higher satisfaction than those in resident-based insurance, likely because the latter is in its pilot phase with underdeveloped systems and facilities.

Paid Service Hours and Actual Service Hours: Coefficients were significantly positive at the 10% ($p < 0.10$) and 0.1% ($p < 0.001$) levels, respectively. Longer service hours increased satisfaction, with actual hours having a stronger effect than paid hours. This suggests that disabled elderly prioritize care quality over financial coverage.

Number of Service Items: The coefficient was significantly positive at the 1% level ($p < 0.01$). Participants accessing more services reported higher satisfaction.

Supervision Status: The coefficient was significantly negative at the 1% level ($p < 0.01$), indicating lower satisfaction among supervised individuals, potentially due to cumbersome procedures.

Care Type (reference: home-based care):

Institution-based care and specialized care had significantly positive coefficients at the 0.1% level ($p < 0.001$). Both modes enhanced satisfaction compared to home-based care, likely due to their professional and comprehensive nature.

Regional fixed effects, using District D (central urban) as reference, revealed that District A had a significantly positive coefficient at the 1% level ($p < 0.01$), while Districts B and C showed significantly negative coefficients at the 0.1% ($p < 0.001$) and 1% ($p < 0.01$) levels, respectively. District E was insignificant. These results suggest higher satisfaction in economically developed regions.

Estimation results of MIMIC structural equation model

Table 8

Model	Variable relationship	Regression coefficient
Structural model	Satisfaction:	
	Gender	0.2760***
	Age	-0.0506****
	Education Level	-0.1204****
	Marital Status	-0.0064

	Income Source: Children's Support	-1.7495****
	Income Source: Pension Funds	-0.4424**
	LTCI Type	-0.6691****
	Paid Service Hours (Ln)	0.1396*
	Actual Service Hours (Ln)	0.7672****
	Number of Service Items	0.0092***
	Supervision (Yes/No)	-0.4227***
	Care Mode: Institutional Care	0.2345****
	Care Mode: Specialized Care	0.5716****
	Region: Area a	0.9547****
	Region: Area b	-1.1782****
	Region: Area c	-0.5088***
	Region: Area e	0.0101
Measurement model	Satisfaction:	
	Assessment process	0.9009****
	Benefit determination	0.9193****
	Reimbursement rate	0.8597****
	Service fees	0.7388****
	Settlement cycle	0.7971****
	Follow-up frequency	0.5699****
	Service quality	0.4135****
Fit indices	*N*	110
	R2	1
	CFI	1
	RMSEA	—
	SRMR	0.1140

Note: Standard coefficients, ****, ***, **, * indicate significance at the 0.1%, 1%, 5%, and 10% levels, respectively.

5. Conclusions and Policy Recommendations

Establishing a LTCI system represents a crucial strategy for addressing social challenges arising from population aging. It provides medical care services or financial support for disabled elderly individuals, thereby alleviating the burden on social security systems. Evaluating policy implementation and operational outcomes in existing pilot cities offers valuable insights for refining the system nationwide. This study assesses the pilot program in Shandong Province (a nationally representative case) through the following approach:

First, policies across Shandong’s pilot cities were systematically reviewed and compared. Ten indicators were selected to construct an evaluation framework for institutional design and operational

performance. Using an AHP-EWM coupled weighting method, indicator weights were calculated in descending order: benefit payments, administration, service management, policy coordination, coverage scope, funding sources, care delivery system, insured population, fund management, and multi-tier safeguards. The comprehensive operational scores for 16 pilot cities averaged 73.97, with significant regional disparities. Based on survey responses, overall satisfaction with the system averaged 80.26 out of 100. However, categorical analysis revealed persistent issues: overly complex assessment procedures, unreasonable benefit criteria, insufficient service hours, and excessive service fees.

Further analysis of satisfaction determinants demonstrated higher satisfaction among: males, younger individuals, those with lower education levels, financially independent participants, enrollees in employee-based insurance, recipients of longer/more diverse services, and those receiving institution-based or specialized care.

Based on these findings, the following recommendations are proposed for nationwide pilot programs:

First, expand coverage. Broaden the pilot from developed regions to nationwide implementation, tailoring benefits and services to local economic conditions. Extend eligibility from urban employees to all urban/rural residents, and from the disabled to those with cognitive impairments (e.g., Jinan, Qingdao, Yantai, and Dongyang already cover rural/urban residents; Qingdao and Binzhou include severe dementia patients). Additionally, increase elderly care facilities in rural areas, provide subsidies to low-income residents, and replicate Qingdao's dementia coverage model.

Second, reform financing. While Shandong's pilots primarily draw funds from medical insurance pools and individual accounts, sustainable long-term financing requires multi-channel solutions. Integrate diversified funding, such as individual premiums and tax reforms, into the system's design. Establish a tripartite contribution mechanism (society, employers, individuals) with exemptions for vulnerable groups to ensure equity.

Third, promote social participation. Professionalize, centralize, and digitize insurance administration through third-party collaboration. Following Qingdao and Yantai's model of outsourcing operations to commercial insurers via competitive bidding, governments should incentivize private-sector partnerships to leverage their expertise in service delivery and management.

Fourth, cultivate the care market. Address diverse elderly needs by developing tailored services for physical/cognitive impairments. Optimize implementation through: differentiated benefits, flexible care modalities, and customized service packages—enhancing participant satisfaction and perceived value.

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