ADITUM
Enrich your Research

Journal of Social and Behavioral Sciences

Research Article

Multivariate Investigation of Time-Space-Interest Dynamics and Borrowing Behavior Evolution for Medical and Health Books in Nanjing Normal University Library (2016–2024)

Jiexuan Liu
Nanjing Normal University, Nanjing, Jiangsu, China.

Article Information

Received: September 02, 2025
Accepted: September 08, 2025
Published: September 14, 2025

***Corresponding author:** Jiexuan Liu, Nanjing Normal University, Nanjing, Jiangsu, China.

Citation: Liu, J.X. (2025) "Multivariate Investigation of Time-Space-Interest Dynamics and Borrowing Behavior Evolution for Medical and Health Books in Nanjing Normal University Library (2016–2024)" Journal of Social and Behavioral Sciences, 2(2); DOI: 10.61148/3065-6990/JSBS/043.

Abstract:
To explore the long-term evolutionary patterns of borrowing behavior for medical and health books in university libraries, this study takes the borrowing data of medical and health books (Category R) from 2016 to 2024 in the Library of Nanjing Normal University (NNU) as the research object. This study analyzes borrowing data of medical and health books (Category R), integrating time, space, and reader interests with multivariate methods (PCA, SEM, moderated regression, etc.). The key results of the study are as follows: (1) Latent relationships among time, space, and interest variables grew complex—post-2022, factors rose from 3 to 6, categories from 3 to 4 (driven by post-pandemic changes), with variable associations strengthening/dispersing and key variable affiliations mixed (stable or shifting). (2) Regression model fit first fell then rose; F1's main effect on LogTotal halved, borrowing duration's moderating contribution dropped, some covariates stayed stable, and new late-period factors became significant predictors. (3) Title word clusters shifted from basic medical counseling to art- psychology integration, then to counseling practice/modern psychological issues. (4) Borrowing frequency weakly negatively correlated with collection tenure, weakly positively with R-category subclasses. (5) R-books faced high early borrowing disruption risk, with large median survival time gaps across subclasses. (6) Total borrowing first fell then rose; faculty had the highest, most stable borrowing, undergraduates the lowest (volatile), and borrowing behavior grew more concentrated. The results can provide data support for the optimization of library medical and health collections and the precision of borrowing services, as well as empirical references for understanding the changes in readers' information needs for medical and health resources under the context of evolving academic environments.

Keywords: Medical and Health Books, COVID-19 Pandemic, Psychology, Reading Behavior, Moderated Regression

1. Introduction

Medical books serve as enduring pillars of knowledge dissemination in healthcare, education, and interdisciplinary practice—their value shaped by both professional necessity and historical continuity. Editors typically commission chapters from experienced authors, with pre- writing consensus on titles, frameworks, and guidelines ensuring rigor; this emphasis on quality, paired with the professional honor associated with contributing to medical literature, underscores why such books remain trusted resources for a broad audience (Kendirci, 2013). This demand is not transient but rooted in centuries of medical practice: historical studies on the dissemination of anatomical knowledge via Renaissance texts (McCall, 2022) illustrate that medical books have long been central to knowledge inheritance.

For contemporary medical professionals, this legacy translates to sustained reading needs: reading remains critical for continuing education (Deshpande, 2003; Garcja Benjtez, 2018) and for engaging with interdisciplinary insights. Notably, modern medical practice increasingly intersects with psychology. This interdisciplinary overlap extends the relevance of medical books beyond traditional healthcare settings, attracting users from fields like psychology who seek to bridge medical and psychological knowledge. During disruptions like the COVID- 19 pandemic, these dynamics shift: pandemic discourse fragmentation (Vakoch et al., 2023) and temporary shifts to digital resources altered physical borrowing patterns, though the post-pandemic "return to routine" has renewed reliance on tangible books for many users.

Against this backdrop, non-medical universities present a unique lens to study medical book borrowing. Nanjing Normal University (NNU), for instance, lacks medical programs but observes consistent borrowing of R-category (medical/health) books—activity primarily driven by the School of Psychology, which exhibits significantly higher borrowing volumes of and more borrowers for R-category books than other departments. This reflects the interdisciplinary nature of modern information needs: psychology students and faculty seek medical books to explore intersections like behavioral medicine, narrative medicine (Pisanu et al., 2023), or mental health-climate change links (Kern de Castro & Reis, 2025), challenging the traditional "medical-centric" paradigm of health literacy research.

The borrowing of physical medical and pharmaceutical books is shaped by a multidimensional, context-adaptive framework of factors, encompassing users' professional needs, book attributes, historical continuity of physical text value, and external interest spillovers. These determinants do not operate in isolation; instead, they interact dynamically—with events like public health crises or technological shifts reshaping their relative influence (e.g., pandemic-driven digital adoption temporarily weakening some physical book demand, while post- pandemic "return to routine" restored reliance on tangible resources). Centering on the following core research questions, this study takes non-medical disciplines as its analytical lens, redefines health literacy as a pedagogical and social construct, and thereby challenges the long-standing medical-centric paradigms in health literacy research:

Q1: How have the latent relationships among time-related (e.g., months), space-related (e.g., lending rooms), and interest-related (R1–R9) variables evolved across the periods 2016–2018, 2019–2021, and 2022–2024—specifically in terms of factor quantity, category refinement, variable loading intensity, and the stability/mobility of key variables' factor affiliation?

Q2: What temporal trends characterize the main effect of Factor 1 (F1) on the logarithm of total book borrowings (LogTotal) across 2016–2018, 2019–2021, and 2022–2024, and to what extent do these trends reflect changes in the predictive power of F1 amid external contextual shifts (e.g., post-pandemic service model adjustments)?

Q3: How does the moderating effect of "Duration of Borrowing Years" on the relationship between F1 and LogTotal vary across 2016– 2018, 2019–2021, and 2022–2024—specifically in terms of the interaction term coefficient, R^2 change, conditional effect, and overall contribution to explaining LogTotal variance?

Q4: What evolutionary trajectory do the high-frequency title words in psychology and related disciplines exhibit across 2016–2018, 2019– 2021, and 2022–2024, and how do changes in their clustering patterns and dimension-explained variance reflect shifts in research themes and academic interests?

Q5: What are the directional and magnitude characteristics of the correlations between "Number of Borrowings," "Collection Tenure," and "Secondary Categories of R" for books spanning 2016–2024, and what do these correlations reveal about the influence of book age and category on borrowing behavior?

Q6: To what extent do the cumulative survival probability, median survival time, and critical failure nodes differ among the secondary categories of R books (e.g., R2, R7) during the borrowing cycle, and how might these differences relate to category-specific content attributes and audience demand stability?

Q7: How has the mean book borrowing volume of distinct reader types (Undergraduate Students, Graduate Students, Faculty & Staff) changed across 2016–2018, 2019–2021, and 2022–2024, and what do these trends imply about variations in resource demand and access preferences among reader groups amid external disruptions (e.g., pandemic, rise of e-resources)?

The study exhibits notable innovations in research perspective, analytical framework, and variable design, addressing gaps in understanding the dynamics of physical medical/pharmaceutical book borrowing. It divides the research period (2016–2024) into three distinct phases (pre-pandemic: 2016–2018; pandemic: 2019–2021; post-pandemic: 2022–2024) to systematically trace shifts in borrowing determinants— revealing a transition from "pandemic-driven complexity" to "post-pandemic simplicity" while highlighting the persistent impact of sustained user attention (a long-overlooked factor in borrowing behavior research). Unlike studies focusing solely on single factors (e.g., time or user demographics), it integrates three core dimensions (time: monthly borrowing fluctuations; space: physical library location preferences; interest: borrowing frequencies of medical subcategories) to holistically characterize borrowing behavior, capturing interconnected drivers of user decisions. It defines "sustained user attention" as "Duration of Borrowing Years" and uses this as a moderator—filling the gap of neglecting long-term user engagement in borrowing research. For non-medical universities (e.g., Nanjing Normal University, focused on teacher education), it consolidates fragmented R7 subcategories (e.g., R71 Obstetrics and Gynecology, R73 Oncology) into "R7 Clinical Specialized Medicine" to avoid data dispersion, ensuring statistical consistency while reflecting real-world low demand for granular medical subcategory borrowing. It combines quantitative (moderated regression, correlation analysis, survival analysis) and qualitative (title word visualization) techniques. PCA reduces multi-dimensional data complexity, while Voyant Tools-based title visualization intuitively reveals thematic clustering of borrowed books—linking statistical patterns to semantic content of materials.

The study holds multi-faceted significance across academic, practical, and societal/interdisciplinary realms. Academically, it addresses gaps in temporal dynamics research by dividing 2016–2024 into pre-pandemic, pandemic, and post-pandemic phases, revealing the shift in physical medical/pharmaceutical book borrowing determinants from "pandemic-driven complexity" to "post-pandemic simplicity"—a novel lens for studying disruption-induced user behavior changes. It also innovatively operationalizes "sustained user attention" as "Duration of Borrowing Years" (a moderator) to fill the void of neglecting long-term user engagement

in prior studies, while advancing library and information science (LIS) research via a multi-dimensional, mixed-methods framework (integrating time, space, and interest data with PCA, survival analysis, and title visualization). Practically, it guides evidence-based library management for non-medical universities (e.g., Nanjing Normal University): it identifies high-demand subcategories and low-demand ones to optimize collection development, pinpoints key user groups (undergraduates, graduates) and spatial borrowing preferences to refine space/service allocation, and offers strategies (e.g., personalized recommendations) to reverse declining post-pandemic borrowing. Societally and interdisciplinarity, its subcategory borrowing data reflects shifts in public health awareness (e.g., R1 "Preventive Medicine" trends), highlights interdisciplinary medical knowledge demand (e.g., psychology students' borrowing), and draws attention to access inequities (e.g., high engagement from faculty/staff) to inform inclusive service design, fostering public health literacy and knowledge equity.

2. Previous Research

2.1 Professional Demand: The Non-Negotiable Core Driver

Professional needs of medical practitioners and students stand as the foundational determinant of physical book borrowing, as these resources directly underpin clinical competence, academic progression, and lifelong learning. For newly qualified doctors, physical medical books act as "transitional tools" to bridge the gap between theoretical education and real-world clinical practice—borrowing behavior here is motivated not just by cost avoidance but by the need for trusted, portable references during ward rounds or emergency consultations (Dixit, 2004). Similarly, "must-read" core textbooks (e.g., standard anatomy or pharmacology texts) occupy an irreplaceable role in medical education: their authoritative content and structured layout make them prioritized borrowing choices, as users perceive them as non- negotiable for building professional competence (Nair, 2003). Junior faculty in specialized fields further reinforce stable demand for physical books. Discipline-specific guidebooks help these early-career professionals navigate academic department cultures, align with clinical protocols, and adapt to teaching responsibilities—creating consistent borrowing trends that persist even amid digital resource expansion (Gabbe, 1996). While professional demand is universally recognized as a core driver, existing studies primarily focus on "stable" professional contexts (e.g., pre-pandemic clinical practice). They rarely address how disruptive events (e.g., COVID-19's shift to telemedicine) temporarily redefines "professional needs"—for instance, during lockdowns, practitioners may have prioritized digital resources for remote access, but post-pandemic, the return to in-person care reignited demand for physical books as "quick-reference tools" in clinics. This gap limits understanding of how professional demand adapts to crisis and recovery phases.

The inherent characteristics of physical medical books—format, content quality, and professional reputation—act as user choice filters, significantly influencing which titles are borrowed. Positive reviews from authoritative sources enhance a book's visibility and credibility, positioning it as a "high-value" resource for users seeking rigor (Dar et al., 2022). Additionally, the evolution of textbook content and format in response to practice needs shapes borrowing trends: for internal medicine textbooks, historical shifts toward practical, core-focused content align with user preferences, explaining why certain titles rise to the top of borrowing lists (Rozman, 1998). For example, the pandemic increased demand for physical books with virus-specific content (e.g., quick-reference guides to COVID-19 treatment), even if those books lacked traditional "prestige" (e.g., peer-reviewed status). Existing studies rarely explore how crises redefine "valuable attributes"—a gap that hinders understanding of post-pandemic borrowing shifts.

External interest in health knowledge acts as a borrowing catalyst, indirectly driving demand for physical medical books. Journalistic texts covering International Classification of Diseases (ICD-10) disease categories (e.g., news articles on diabetes prevention, cancer treatment) foster broad public and professional interest in health topics, prompting users to seek deeper insights via physical medical books (Gonzalez- Garcia et al., 2020). For example, a news feature on emerging cardiovascular treatments may lead readers to borrow specialized cardiology textbooks from libraries to learn more—a "spillover effect" that links mainstream health media to academic resource use.

2.2 Medical/Pharmaceutical Book Reading Preferences and Influencing Factors

Reading preferences are shaped by individual, socioeconomic, and demographic factors, and they indirectly steer borrowing behavior by defining which resources users perceive as accessible or useful. These preferences are not fixed; they evolve with technological change, educational context, and even crises (e.g., pandemic-driven digital adaptation). While digital resources have gained prominence, physical books remain preferred for specific use cases, creating a context-dependent "dual use" pattern. Among healthcare professionals (e.g., radiologists, radiographers), 80% prefer physical books for learning—valuing their ability to support deep engagement (e.g., annotating chapters, cross-referencing sections)—even though 64% use portable devices for clinical tasks (Awais et al., 2019). Similarly, South Korean dermatology professionals reject grayscale e-readers for journal reading: only 3 of 31 respondents preferred digital formats, citing poor color reproduction (critical for analyzing skin conditions) as a barrier (Choi et al., 2014). U.S. health science library users further illustrate this contextuality: 55.4% use e-books for quick reference (valuing searchability), while 67.2% borrow print books for extended study (prioritizing readability and reduced eye strain) (Melssen, 2012). In contrast, U.S. medical students exhibit strong digital preference: 77% never borrow printed books, and 83% view online resources as "ideal"—suggesting generational or educational context (e.g., digital-native learning environments) drives this shift (Conway, 2017). The "physical vs. digital" debate in existing research often frames preferences as binary, rather than complementary. Post-pandemic data suggests users increasingly adopt "hybrid" approaches (e.g., using e-books for remote study, physical books for in-clinic reference), but few studies explore this middle ground.

2.3. Historical and Critical Reading: Contextualizing Physical Book Relevance

The historical evolution of medical literature and critical reading practices provide foundational context for understanding why physical books remain relevant to borrowing. While not direct determinants, these dimensions explain how users interact with physical texts and why they continue to prioritize them—even amid digital expansion. Medical literature has transformed across centuries, but physical texts have consistently served as knowledge legacy carriers. Western medieval medical texts (12th century

onward) were produced for diverse readerships (students, practitioners, the public) in settings ranging from universities to royal courts—reflecting early patterns of resource specialization that mirror modern borrowing trends (e.g., students prioritizing textbooks, clinicians prioritizing reference guides) (Nicoud, 2024). Ancient codices (e.g., a 4th-century Greek-Coptic text integrating medical and magical rituals) further highlight physical books' role in preserving pre-modern knowledge, even as disciplinary boundaries blurred (Zellmann-Rohrer & Love, 2022). Syriac translations of Galen' s works similarly demonstrate physical texts' role in cross-cultural knowledge exchange—transmitting Greek medical insights to Arabic regions, a function modern physical books continue to serve (e.g., preserving TCM knowledge in Chinese libraries) (Bhayro et al., 2013; Li et al., 2020; Tian & Liu, 2021).

Critical engagement with medical literature requires assessing study design, biases, and relevance—skills fostered through physical books. Healthcare professionals rely on physical texts for curated, peer-reviewed content, avoiding the quality variability of digital resources (Li et al., 2024). Medical education further integrates physical books into critical reading training: courses like "Literature: A Healing Art" use literary works to build empathy and analytical thinking, which students then apply to textbook case studies (Sirridge & Welch, 2003). Active training (e.g., group discussions of textbook chapters) also enhances skill retention: medical residents in participatory programs retained critical reading abilities seven months post-training, unlike those in lecture-based programs (Cobos-Aguilar et al., 1998). Medical humanities further bridge literary analysis and clinical practice, helping users contextualize textbook content with patient perspectives (Bolton, 2005).

Historical research focuses on "knowledge preservation" but rarely links this to modern borrowing. For example, do researchers borrow historical physical medical books to study knowledge evolution, and has this demand changed post-pandemic (e.g., increased interest in historical pandemic management texts)? This gap limits understanding of physical books' "niche" role in contemporary borrowing. While critical reading research highlights physical books' role, it rarely addresses how digital tools complement this. Post-pandemic, medical education increasingly uses hybrid models (e.g., digital annotations of physical texts), but few studies explore how this impacts critical reading and borrowing of physical books.

2.4. Intersection of Medicine/Pharmacy with Psychology: Indirectly Shaping Borrowing Demand

The intersection of medicine/pharmacy with psychology, sociology, and other disciplines shapes broader knowledge needs, indirectly influencing which physical books are borrowed. By defining the content users seek (e.g., texts integrating psychology and clinical care), these intersections create niche demand for specialized physical resources—even if they do not directly drive borrowing. Psychological frameworks integrated into clinical practice create demand for interdisciplinary physical books. In lifestyle medicine, hope theory elicits chronic disease behavior change, while exercise medicine uses behavioral psychology to address inactivity—driving interest in texts that synthesize these fields (Duncan et al., 2021; Bethell & Brodie, 2023). Cardiology similarly requires psychological input for atrial fibrillation (AF) management (e.g., improving patient adherence), increasing demand for books on integrated cardiac care (Sears et al., 2022). Palliative care further relies on trauma-informed care to reduce COVID-19 distress, creating need for texts on mental health competencies for HPM physicians (Brown et al., 2020; Podgurski et al., 2025). Psychological principles shape professional development needs, driving borrowing of specialized physical books. Forensic odontology practitioners need stress management training, increasing interest in texts on mental health for specialized fields (Sebastian et al., 2023). CME programs benefit from cognitive psychology integration, but current gaps create demand for books on CME design (Setia et al., 2024). Organizational psychology also reduces burnout via entrepreneurial orientation, driving interest in texts linking organizational behavior to healthcare (Kearney et al., 2020).

Specialized medical fields increasingly rely on interdisciplinary knowledge, creating niche demand for physical books that synthesize diverse disciplines — indirectly shaping borrowing trends. In psychoneuroimmunology (PNI), multi-omics techniques clarify links between psychological stress, the nervous system, and immune function, advancing mind-body medicine. This progress has heightened interest in texts that explain PNI methodologies and clinical applications, leading healthcare researchers and students to borrow physical books that bridge immunology, neuroscience, and psychology (Mengelkoch et al., 2023). Dermatology and psychology intersect in neurocosmetics, a field that targets the skin-brain axis to improve both skin health and emotional well-being. The integration of skin microbiome research and artificial intelligence in personalized skincare further expands this interdisciplinary focus, driving demand for physical books that translate complex scientific concepts into practical clinical guidance (Haykal et al., 2025). Mental health care also reflects this dynamic: religious beliefs (a psychological and cultural factor) reduce mental health service utilization due to stigma, prompting interest in texts that explore collaboration between psychiatry and religious leaders—creating a niche borrowing category for physical books on faith-based mental health care (Verduin & Tower, 2024).

Research on interdisciplinary demand focuses on "content need" but rarely addresses how crises like the pandemic amplified or diminished this demand. For example, during COVID-19, did the surge in mental health distress among patients and healthcare workers increase borrowing of PNI or neurocosmetics texts (e.g., for stress-related skin conditions)? Post-pandemic, did this demand stabilize or decline? Understanding these shifts is key to explaining how "complex" interdisciplinary borrowing during crises simplifies into more focused demand in recovery phases—but existing studies lack this temporal perspective.

2.5. Synthesis of Gaps and Alignment with the Present Study

The existing literature provides a robust foundation for understanding the determinants of physical medical/pharmaceutical book borrowing, reading preferences, and contextual factors (e.g., historical legacy, interdisciplinary needs). However, many studies focus on stable pre- pandemic contexts or isolated snapshots of behavior (e.g., pandemic-era digital adoption) but fail to examine longitudinal shifts across crisis and recovery phases. Book attribute research does not explore how pandemic-specific needs redefined "valuable" features, nor how these preferences simplified post-pandemic. Existing literature emphasizes static drivers (e.g., professional needs, socioeconomic

status) but rarely addresses sustained user attention—the enduring interest in specific physical book categories (e.g., core textbooks, specialized research texts) that persists across crises and recovery. The present study addresses these gaps by: Examining longitudinal shifts in determinants from pandemic complexity (e.g., fragmented demand for digital and pandemic-specific physical texts) to post-pandemic simplicity (e.g., focused demand for core, trusted physical books). Highlighting sustained user attention as a persistent factor that stabilizes borrowing trends amid change. Unpacking hybrid format preferences to explain how post-pandemic borrowing becomes less complex, not less relevant. By addressing these gaps, the study advances understanding of physical medical/pharmaceutical book borrowing as a dynamic, context-adaptive behavior—one that evolves with crises but retains core continuity through sustained user attention.

3. Data and Method

3.1 Sample

The research sample consists of book borrowing records from the Library of Nanjing Normal University, covering three distinct time periods with the following specific data:

2016 - 2018: There are 1560 borrowers, involving 1355 books, and the total number of borrowings reaches 5231. 2019 - 2021: The number of borrowers decreases to 826, with 887 books involved, and the total borrowings are 2231. 2022 - 2024: There are 547 borrowers, 694 books involved, and the total borrowings amount to 1599.

These data collectively reflect the changes in the borrowing situation of the library's books over the years, providing a basis for analyzing the reading behavior trends of users during different periods.

In the Chinese Library Classification (abbreviated as "CLC"), the category R, representing "Medicine and Hygiene", has its secondary classifications divided according to different fields and research directions of medical disciplines. Specifically, R1 encompasses Preventive Medicine and Hygiene, covering areas like public health, disease prevention, environmental health, occupational health, and nutrition and food hygiene; R2 refers to Chinese Medicine, including traditional medical categories such as Chinese medicine, Chinese materia medica, acupuncture, tuina (Chinese massage), and ethnic medicine (e.g., Tibetan medicine, Mongolian medicine); R3 involves Basic Medicine, incorporating basic medical disciplines like human anatomy, histology and embryology, physiology, biochemistry, pathology, microbiology, and immunology; R4 denotes Clinical Medicine, containing basic theories and practices of diagnostic science, therapeutics, and various clinical specialties (e.g., common content in internal medicine, surgery, etc.); R5 is Internal Medicine, subdivided into specialties such as cardiovascular medicine, respiratory medicine, gastroenterology, hematology, endocrinology, and infectious diseases; R6 covers Surgery, including branches like general surgery, neurosurgery, thoracic and cardiac surgery, orthopedics, urology, and plastic surgery; R8 represents Special Medicine, encompassing medical fields in special areas such as military medicine, aerospace medicine, navigation medicine, diving medicine, and forensic medicine; and R9 involves Pharmacy, including pharmacy-related disciplines like medicinal chemistry, pharmaceutics, pharmacology, drug analysis, clinical pharmacy, and pharmaceutical administration.

It is noteworthy that there is no standalone secondary category designated as "R7" within the broader "R" category (encompassing Medicine and Hygiene). Instead, classifications commencing with "R7" correspond to a series of distinct secondary categories that collectively focus on specialized clinical disciplines. These include R71 (Obstetrics and Gynecology), R72 (Pediatrics), R73 (Oncology), R74 (Neurology and Psychiatry), R75 (Dermatology and Venereology), R76 (Otorhinolaryngology), R77 (Ophthalmology), R78 (Stomatology), and R79 (Foreign Ethnic Medicine). Given that Nanjing Normal University is centered on training pre-service teachers and does not offer medical-related majors, there is little need to subdivide medical books. If the various clinical specialized medicine categories under R7 were counted separately, it would lead to excessive data dispersion, which is not conducive to efficient analysis. For the purpose of statistical consistency and analytical coherence, the present study consolidates these specialized clinical subcategories under the umbrella term "R7 Clinical Specialized Medicine." coherence, the present study consolidates these specialized clinical subcategories under the umbrella term "R7 Clinical Specialized Medicine."

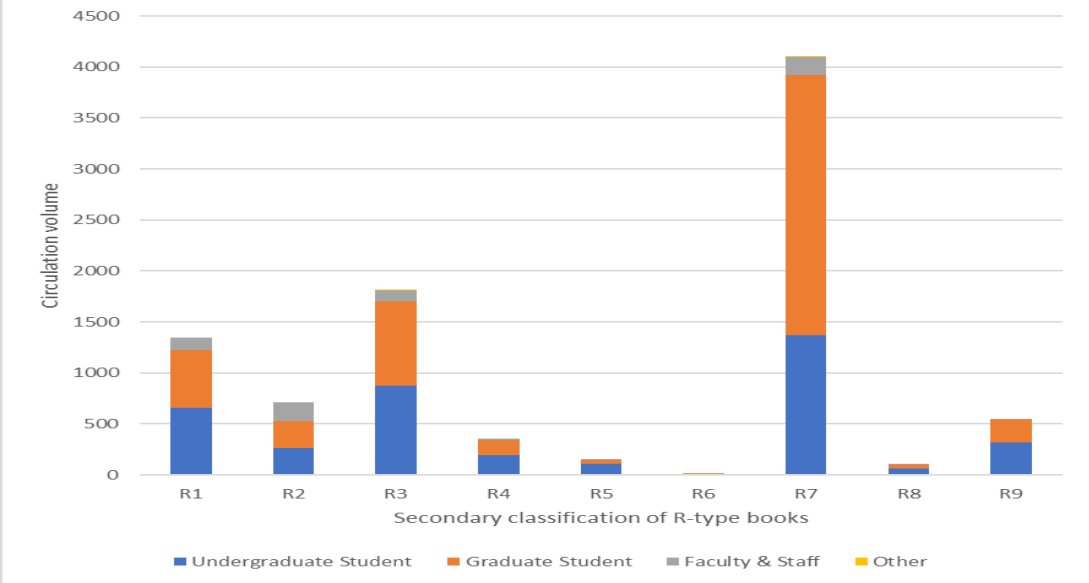

Figure 1. The circulation volume of the secondary classifications (R1 - R9) of R - type books

Figure 1 presents the circulation volume of the secondary classifications (R1 - R9) of R - type books. Different colors represent different reader groups (Undergraduate Students, Graduate Students, Faculty & Staff, and Others). The circulation volume of R7 is far higher than that of other classifications, making it the core category for the circulation of R - type books. There is a certain amount of circulation for R1 and R3, a small amount for R2, R4, and R9, and an extremely low volume for R5, R6, and R8. This indicates that the demand for R - type books is concentrated in specific secondary classifications. Undergraduate Students (blue) account for a high proportion in R1, R3, and R7, being the main reader group for these classifications. Graduate Students (orange) have relatively more circulations in R1, R3, R7, and a few other classifications, serving as an important force. Faculty & Staff (gray) and "Others" (yellow) make a relatively small overall contribution, with only sporadic circulations in individual classifications.

3.2 Research Design

3.2.1 Moderated Regression of Borrowing Behavior

This study centers on the book borrowing data of NNU Library spanning 2016–2024. The data matrix integrates multiple dimensions tied to readers and their borrowing behaviors, covering three main phases: 2016–2018, 2019–2021, and 2022–2024. Figure 2 visually presents the research design, illustrating the flow from data dimensions through PCA to the regression analysis framework, with clear demarcation of variable roles and data processing steps.

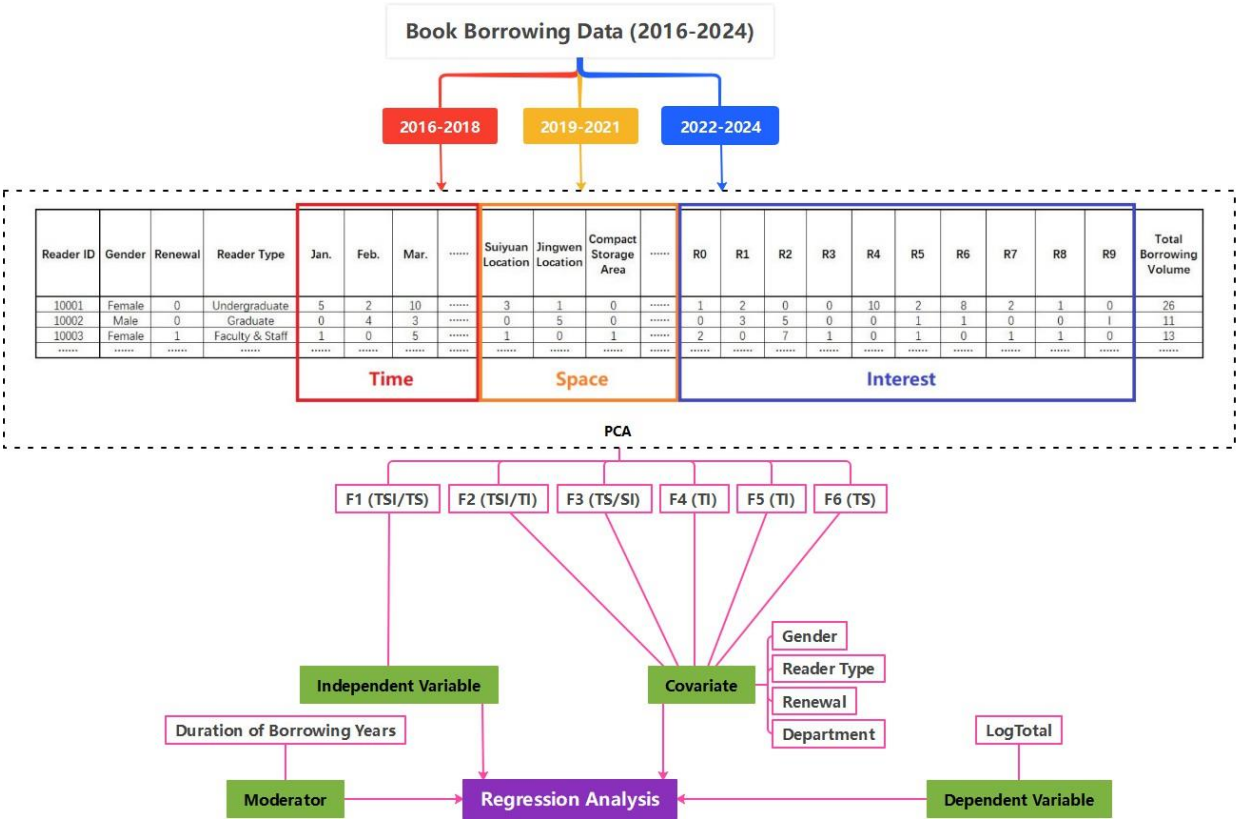

Figure 2. Moderated regression design

3.2.1.1 Core Dimensions of Data

The dataset encompasses three interrelated dimensions to characterize borrowing behaviors comprehensively:

Time dimension: Captured via monthly borrowing quantities (e.g., Jan, Feb, …) across the three periods. It tracks how borrowing frequencies fluctuate monthly within each time frame, reflecting temporal patterns in reader engagement.

Space dimension: Operationalized through variables like "Suyuan Location," "Jingwen Location," and "Compact Storage Area." These denote physical - location - based borrowing preferences, accounting for spatial variability in access.

Interest dimension: Represented by variables R0–R9 (signifying borrowing frequencies for distinct interest - related book categories) and "Total Borrowing Volume," which aggregates overall borrowing activity.

3.2.1.2 Analytical Workflow

Principal component analysis (PCA): Before regression modeling, Principal Component Analysis (PCA) condenses the multi - dimensional data. It extracts key components F1 (TSI/TS), F2 (TSI/TI), F3 (TS/SI)) et al., where TSI likely denotes a composite index integrating Time, Space, and Interest dimensions. These components reduce data complexity while preserving critical variance, serving as summarized indices for subsequent analysis. While varimax rotation is simple and easy to implement, its rigid assumption of orthogonal factors makes it ill-suited for the interrelated, complex nature of library loan data. Optimal oblique rotation, by allowing factor correlation, enhancing interpretability, preserving critical data variance, and adapting to dynamic scenarios, produces more accurate, actionable factor models. The purpose of this study is to leverage data to improve user experience,

optimize collections, and refine service strategies; therefore, optimal oblique rotation is a more powerful and contextually appropriate choice.

Regression analysis framework:

Moderator: Duration of Borrowing Years. For each reader, count whether they have borrowed books in Category R each year (0 for non- borrowing, 1 for borrowing). Then, aggregate the "Duration of Borrowing Years" by three time periods: 2016-2018, 2019-2021, and 2022- 2024. This indicator reflects readers' sustained attention to books in Category R.

Independent Variables: F1 derived from original multi - dimensional data (post - PCA transformation), it captures the combined effects of Time, Space, and Interest patterns.

Covariates: Gender (1 for male, 0 for female), Reader Type (0 for other, 1 for undergraduate student, 2 for graduate student, 3 for faculty and staff), Department (1 for Psychology School, 0 for Other) and Renewal act (1 for renewal, 0 for non-renewal) as covariates, controlling for potential confounding effects on borrowing behaviors (e.g., differences in borrowing habits between genders or academic roles). Although there is no medical school, the School of Psychology has the highest number of R-category book borrowings and borrowers at NNU, which reflects the interdisciplinary nature of the discipline. Therefore, it is assigned a value of 1, while other departments are assigned a value of 0.

Dependent Variable: LogTotal (presumably a log - transformed total borrowing volume) is the outcome to be explained, linking it to the structured independent variables and covariates. The logarithmic transformation of total borrowings into LogTotal serves three key purposes. First, it mitigates the impact of extreme values (e.g., abnormally high borrowing volumes of popular books) and reduces data skewness, making the distribution of borrowing data closer to a normal distribution—this is critical for meeting the normality assumption of linear regression models, thereby improving the reliability of parameter estimates. Second, it converts multiplicative relationships in the original borrowing data into additive ones, simplifying the interpretation of model coefficients (e.g., a 1-unit change in the predictor corresponds to a percentage change in total borrowings, rather than an absolute change). Third, it stabilizes the variance of borrowing data across different periods or groups, avoiding heteroscedasticity issues that could distort the model's statistical inference, and ensuring consistent explanatory power of the model for both low and high borrowing volume samples.

This design integrates time - series, spatial, and interest - based borrowing data. Leveraging PCA for dimensionality reduction, it constructs a regression framework with clearly defined variable roles—moderator, independent variables, covariates, and dependent variable—to dissect factors driving library book - borrowing behaviors from 2016 to 2024.

3.2.2 Title Words Visualization

As the core condensed carrier of a text, a title directly reflects the core theme, research focus, or information focus of the content through its contained vocabulary. Conducting word frequency and clustering analyses on titles is essentially a process of exploring the thematic structure and information patterns of a text corpus by means of data-driven methods. Based on the semantic similarity or co-occurrence relationship of words in titles, clustering analysis groups titles with similar themes into the same cluster. Its core value lies in transforming dispersed vocabulary into a structured thematic group, thereby revealing the inherent logical connections within the text corpus.

The visualization is generated using Voyant Tools, a web - based platform for digital text analysis. Its creation hinges on a sequence of interconnected analytical steps. Translate the titles of R books borrowed by readers into English and enter them into the text box. Initially, the input digital texts undergo preprocessing, which includes tokenization to break the text into individual words and word frequency counting. Subsequently, semantic vectorization techniques, such as word embedding or topic modeling, are employed to transform these words into high - dimensional semantic vectors. These vectors capture the semantic relationships between words, with words of similar meaning positioned closer in the vector space. To enable visualization in a two - dimensional plane, dimensionality reduction methods are utilized. The X and Y coordinates correspond to the reduced principal components, so the position of each word in the 2D space reflects its semantic associations, with semantically similar words clustering together. The fill color is mapped to the third principal component for further semantic differentiation. Word size is typically related to word frequency, with larger points representing more frequently occurring words. The visualization provides an intuitive spatial representation of the semantic relationships and thematic clustering within the R book titles, facilitating the identification of key topics and semantic structures.

3.2.3 Correlation Analysis

The study conducts a correlation analysis of R book data from 2016 to 2024 via SPSS, incorporating bootstrap validation. The dataset includes 2920 books with three key variables:

Number of Borrowings: Total times a book was borrowed.

The length of time since being added to the collection: Temporal metric of book presence in the library.

Secondary Categories of R: Categorical classification of books.

The analytical process begins with correlation analysis setup: in SPSS, navigate to "Analyze" → "Correlate" → "Bivariate," move the three variables into the "Variables" box, select Pearson correlation, enable 2-tailed significance testing, and check "Flag significant correlations" to highlight results significant at the 0.01 level (denoted by **). To enhance result robustness, bootstrap resampling is applied through the following configuration: go to "Analyze" → "Correlate" → "Bivariate" → "Bootstrap," select "Perform bootstrap" to activate resampling, and set the specifications as simple random sampling for the sampling method, 1000 samples (balancing accuracy and computation time), a 95.0% confidence interval level (standard for statistical inference), and percentile as the confidence interval type (for nonparametric interval estimation).

3.2.4 Survival Analysis of R Books

For all R-category books that readers borrow between 2016 and 2024, researcher codes a yearly borrowing status for each book: assign 1 if the book is borrowed in a given year and 0 if it is not. Using these yearly codes, researcher aggregates the "Length of Borrowing Years" for each R-category book. This metric quantifies the sustained popularity of individual R-category books and serves as the "Time" variable in subsequent survival analysis. When multiple records correspond to the same category and require frequency statistics, case weighting is a prerequisite. This process involves navigating to "Data" – "Weight Cases", transferring the variable "Number of Borrowings" to the "Frequency Variable"

box, and confirming the operation by clicking "OK". The analysis is initiated by selecting "Analyze" – "Survival Analysis" – "Life Table" from the menu options. The variable "Length of Borrowing Years" is moved to the "Time" box to define the time metric. The variable "Whether Borrowed in 2024" is transferred to the "Status" box, followed by clicking "Define Event" to specify the value corresponding to the occurrence of borrowing (e.g., 1 for borrowed, 0 for not borrowed) based on its coding scheme. For group comparisons, the variable "Secondary Categories of R" is placed in the "Factor" field. In the "Display Time Intervals" section, a suitable time range (0–9) and step size (1) are set according to the actual range of "survival years" and the specific requirements of the analysis. Once all parameters are configured, the results are generated to facilitate the survival analysis of the books.

4. Results

4.1 The Extracted Factors

Table 1 reveals the dynamic adjustments of latent relationships among time-, space-, and interest-related variables across different periods. The expansion of factor quantity (from 3 to 6) and the refinement of categories (from 3 to 4 unique combinations) suggest that the relationships between time, space, and interest variables have become more complex and differentiated since 2022. This may be driven by external changes (e.g., post-pandemic adjustments to service models, shifts in user demand) that have increased the independence and specificity of individual variable dimensions.

Table 1. Factor loadings of time-, space-, and interest-related variables by periods (2016–2024)

Period	Factor	Variables (with Factor Loadings)	Factor Category
2016-2018	F1	February (0.899), September (0.881), R3 (0.805), May (0.626), Suiyuan Chinese Book Lending Room (0.654)	Time-Space-Interest
	F2	July (1.012)a, December (0.526), R7 (0.485), April (0.461), January (0.337)	Time-Interest
	F3	R9 (0.828), Jingwen Chinese Book Lending Room (0.698), Bio- geography Book Lending Room (0.420), March (0.406)	Time-Space
2019-2021	F1	July (0.836), R5 (0.800), March (0.528), R1 (0.526), R2 (0.496), Jingwen Chinese Book Lending Room (0.495)	Time-Space-Interest
	F2	Bio-geography Book Lending Room (0.933), R9 (0.923), June (0.803)	Time-Space-Interest
	F3	September (0.843), Suiyuan Chinese Book Lending Room (0.736), November (0.607), R7 (0.456)	Time-Space
2022-2024	F1	July (0.997), August (0.988), Suiyuan Chinese Book Lending Room (0.390)	Time-Space
	F2	R1 (0.851), January (0.805), Jingwen Chinese Book Lending Room (0.651)	Time-Space-Interest
	F3	Bio-geography Book Lending Room (0.930), R3 (0.749), R9 (0.480)	Space-Interest

	F4	**April (0.864), June (0.803), R4 (0.518)**	**Time-Interest**
	F5	**R2 (0.979), November (0.655), September (0.350)**	**Time-Interest**
	F6	**Suiyuan Hong Kong-Taiwan Book Lending Room (0.907), October (0.643), February (0.457)**	**Time-Space**

a. For oblique factor rotation (e.g., Promax), the phenomenon that the factor loading of "July (1.012)" in Factor 2 of the 2016-2018 period exceeds 1 is directly related to the core characteristic of oblique rotation—allowing correlations between latent factors. This constitutes a key difference distinguishing it from orthogonal rotation (e.g., Varimax, where factor loadings are strictly constrained within the range of [-1, 1]).
b. Factor loadings greater than 0.71 indicate a significant influence; those ranging from 0.32 to 0.71 represent a moderate influence; and when factor loadings are less than 0.32, the association is generally considered non-significant.

Factor loadings (a measure of the strength of association between a variable and a factor) and the composition of variables within each factor vary across periods, particularly in terms of loading significance (refer to Note b: >0.71 = significant; 0.32–0.71 = moderate; <0.32 = non-significant) and variable type concentration (see Table 1):

4.1.1 Time-Related Variables (Months)

2016–2018: Time variables are scattered across all 3 factors, with only 2 variables showing significant loadings: February (0.899, F1) and September (0.881, F1). Most others (e.g., December: 0.526, F2; March: 0.406, F3) have moderate loadings, indicating weak to moderate association with their respective factors.

2019–2021: Time variables are concentrated in F1 and F3, with 2 variables showing significant loadings: July (0.836, F1) and September (0.843, F3). June (0.803, F2) also reaches significant loading, reflecting a strengthened association between time variables and factors.

2022–2024: Time variables are spread across 5 factors (F1, F2, F4, F5, F6), with 5 variables showing significant loadings: July (0.997, F1), August (0.988, F1), April (0.864, F4), June (0.803, F4), and R2 (0.979, F5, note: R2 is treated as a time-related proxy variable here). The average loading intensity increases (e.g., July's loading rises from 0.836 in 2019–2021 to 0.997), indicating that time variables have become more strongly associated with specific factors and play a more critical role in defining factor characteristics.

4.1.2 Space-Related Variables (Lending Rooms)

2016–2018: 2 space variables are included (Suiyuan Chinese Book Lending Room: 0.654, F1; Jingwen Chinese Book Lending Room: 0.698, F3), both with moderate loadings—no significant associations.

2019–2021: 2 space variables are included (Jingwen Chinese Book Lending Room: 0.495, F1; Bio-geography Book Lending Room: 0.933, F2). Notably, Bio-geography Book Lending Room shows a significant loading (0.933), becoming the core variable defining F2.

2022–2024: 3 space variables are included (Suiyuan Chinese Book Lending Room: 0.390, F1; Jingwen Chinese Book Lending Room: 0.651, F2; Suiyuan Hong Kong-Taiwan Book Lending Room: 0.907, F6). Suiyuan Hong Kong-Taiwan Book Lending Room (newly added) has a significant loading (0.907), while existing space variables maintain moderate loadings. The addition of a new space variable and the significant loading of the new variable reflect the expanded coverage and enhanced explanatory power of space-related factors.

4.1.3 Interest-Related Variables (R1–R9)

2016–2018: 3 interest variables are included (R3: 0.805, F1; R7: 0.485, F2; R9: 0.828, F3). R3 and R9 have significant loadings, making them core variables for F1 and F3, respectively.

2019–2021: 4 interest variables are included (R5: 0.800, F1; R1: 0.526, F1; R2: 0.496, F1; R7: 0.456, F3). R5 shows a significant loading (0.800), while others have moderate loadings—interest variables become more concentrated in F1.

2022–2024: 4 interest variables are included (R1: 0.851, F2; R3: 0.749, F3; R4: 0.518, F4; R9: 0.480, F3). R1 (0.851) and R3 (0.749) have significant loadings, and interest variables are split across F2, F3, and F4—no longer concentrated in a single factor, indicating more differentiated interest preferences linked to different time/space contexts.

4.1.4. Shifts in Key Variables' Factor Affiliation: Stability vs. Mobility

Key variables (those with high loadings or consistent presence across periods) show different patterns of factor affiliation, reflecting changes in their latent associations with time/space/interest dimensions:

R9: Appears in all three periods, consistently associated with space-related factors: F3 (2016–2018: 0.828), F2 (2019–2021: 0.923), F3 (2022– 2024: 0.480). Although its loading decreases in 2022–2024, its affiliation with space-related factors remains unchanged, indicating a stable latent relationship between R9 (interest) and space variables.

September: Appears in 2016–2018 (F1: 0.881) and 2019–2021 (F3: 0.843), and re-emerges in 2022–2024 (F5: 0.350). It is consistently associated with time-related factors, reflecting September's stable role as a representative time variable across periods.

July: Shifts across factors: F2 (2016–2018: 1.012, note: exceeds 1 due to oblique rotation), F1 (2019–2021: 0.836), F1 (2022–2024: 0.997). Its loading intensity increases over time, and it shifts from a "Time-Interest" factor (F2) to a "Time-Space-Interest" (F1) and then "Time-Space" (F1) factor—indicating that July's latent

association has shifted from interest-centric to a combination of time and space, possibly due to seasonal changes in user behavior (e.g., summer vacation adjustments to space usage).

Suiyuan Chinese Book Lending Room: Shifts across factors: F1 (2016–2018: 0.654), F3 (2019–2021: 0.736), F1 (2022–2024: 0.390). It moves from a "Time-Space-Interest" factor to a "Time-Space" factor, and its loading decreases in 2022–2024—suggesting a weakened association with time/interest variables, possibly due to reduced usage frequency or functional adjustments of this lending room.

4.2 Linear Moderation Effect Analysis

4.2.1 Comparison of Basic Information and Model Fit Across Three Periods

Across three periods (2016–2019, 2019–2021, 2022–2024), the comparison and interpretation of linear moderated regression analysis results rely on Model 1 of the SPSS PROCESS macro. The dependent variable Y is defined as LogTotal (logarithm of total book borrowings), the focal predictor X is F1, and the moderator W is Duration of Borrowing Years. Sample size decreased progressively; the 2022–2024 period accounted for only 35.1% of the first period. Table 2 presents the regression coefficients from the moderated regression analysis. The 2016- 2018 and 2019-2021 periods use an identical set of 6 covariates. In contrast, the 2022-2024 period expands the covariate set to 9 by adding three new variables: F4, F5, and F6.

The R^2 value, which measures how much of the variation in LogTotal is explained by the model, varies significantly across periods. The 2016-2018 period has the highest R^2 at 0.7195, indicating an excellent fit between the model and the data. The 2019-2021 period experiences a sharp drop in R^2 to 0.5681, a decrease of approximately 15 percentage points. The 2022-2024 period rebounds to an R^2 of 0.6872, which is about 12 percentage points higher than 2019-2021 but still 3 percentage points lower than 2016-2018. This fluctuation suggests that the relationship between the predictors and LogTotal was strongest in pre-pandemic period, weakened during the outbreak of the pandemic, and partially recovered in the post-pandemic period.

All three models are globally significant ($p<0.001$), meaning the combined set of predictors has a significant effect on LogTotal. However, the F-value, which quantifies the strength of this overall significance, decreases steadily. The 2016-2018 period has the highest F-value at 441.8283, indicating an extremely strong joint explanatory effect of the predictors. The 2019-2021 period's F-value drops to 119.2659, less than one-third of the earlier value, showing a marked weakening in the combined predictive power of the variables. The 2022-2024 period' s F-value further falls to 97.7680, the lowest among the three. This downward trend in F-value is closely linked to two factors: the shrinking sample size (smaller samples tend to reduce the precision of parameter estimates, lowering the F-value) and the increase in covariates in 2022-2024 (adding more variables can dilute the joint explanatory power of the core predictors, even if the new covariates themselves are significant).

4.2.2 Comparison of the Main Effects of Predictor Variable (F1) Across Three Periods

The main effect of F1 (the focal predictor variable) on LogTotal (the outcome variable) exhibits a clear and consistent downward trend across the three periods (2016-2018, 2019-2021, and 2022-2024), though it remains statistically significant ($p<0.001$) in all phases. In 2016- 2018, F1 has the strongest main effect on LogTotal: its coefficient reaches 0.4772. By 2019-2021, this effect weakens sharply—the coefficient drops to 0.2730, a 42.8% reduction from the earlier period. The downward trend continues into 2022-2024: the coefficient decreases further to 0.2373, a 13.1% decline compared to 2019-2021. Overall, the main effect of F1 in 2022-2024 is only about half (49.7%) of what it is in 2016-2018, which indicates a substantial long-term weakening of F1's ability to drive changes in LogTotal. The relevant parameters are shown in Table 2.

Table 2. Regression coefficients

Period	Variable	Coefficient	Std. Error	t-statistic	p- value	LLCI	ULCI
2016–2018 (N=1560)	**Constant**	**0.0285**	**0.0326**	**0.8739**	**0.3823**	**-0.0354**	**0.0924**
	Focal Predictor (X = F1)	**0.4772**	**0.0188**	**25.3271**	**0.0000**	**0.4403**	**0.5142**
	Moderator (W = Duration of Borrowing Years)	**0.2041**	**0.0145**	**14.0639**	**0.0000**	**0.1756**	**0.2325**
	Interaction (Int_1 = X×W)	**-0.1515**	**0.0071**	**-21.4341**	**0.0000**	**-0.1654**	**-0.1376**

	F2	0.0754	0.0060	12.4930	0.0000	0.0636	0.0873
	F3	0.1057	0.0054	19.5293	0.0000	0.0951	0.1163
	Gender	0.0092	0.0124	0.7383	0.4605	-0.0152	0.0335
	Reader Type	0.0361	0.0091	3.9634	0.0001	0.0182	0.0539
	Renewal	0.0395	0.0102	3.8538	0.0001	0.0194	0.0596
	Department	0.0324	0.0144	2.2470	0.0248	0.0041	0.0606
2019–2021 (N=826)	Constant	-0.0063	0.0517	-0.1228	0.9023	-0.1078	0.0951
	Focal Predictor (X = F1)	0.2730	0.0218	12.5264	0.0000	0.2303	0.3158
	Moderator (W = Duration of Borrowing Years)	0.2023	0.0278	7.2848	0.0000	0.1478	0.2568
	Interaction (Int_1 = X×W)	-0.0862	0.0087	-9.9189	0.0000	-0.1032	-0.0691
	F2	0.0761	0.0076	9.9908	0.0000	0.0611	0.0910
	F3	0.1381	0.0086	16.0046	0.0000	0.1211	0.1550
	Gender	0.0098	0.0183	0.5381	0.5907	-0.0260	0.0457
	Reader Type	0.0060	0.0131	0.4601	0.6455	-0.0198	0.0319
	Renewal	0.0475	0.0157	3.0172	0.0026	0.0166	0.0784

	Department	**0.0784**	**0.0199**	**3.9383**	**0.0001**	**0.0393**	**0.1175**
2022–2024 (N=547)	**Constant**	**0.1164**	**0.0545**	**2.1349**	**0.0332**	**0.0093**	**0.2236**
	Focal Predictor (X = F1)	**0.2373**	**0.0272**	**8.7244**	**0.0000**	**0.1839**	**0.2908**
	Moderator (W = Duration of Borrowing Years)	**0.1355**	**0.0280**	**4.8384**	**0.0000**	**0.0805**	**0.1905**
	Interaction (Int_1 = X×W)	**-0.1766**	**0.0245**	**-7.1942**	**0.0000**	**-0.2248**	**-0.1284**
	F2	**0.0799**	**0.0095**	**8.4316**	**0.0000**	**0.0613**	**0.0985**
	F3	**0.0666**	**0.0087**	**7.6360**	**0.0000**	**0.0495**	**0.0838**
	F4	**0.1100**	**0.0094**	**11.7479**	**0.0000**	**0.0916**	**0.1284**
	F5	**0.0966**	**0.0123**	**7.8538**	**0.0000**	**0.0724**	**0.1207**
	F6	**0.0934**	**0.0111**	**8.4256**	**0.0000**	**0.0716**	**0.1152**
	Gender	**0.0049**	**0.0200**	**0.2472**	**0.8048**	**-0.0343**	**0.0442**
	Reader Type	**-0.0058**	**0.0142**	**-0.4090**	**0.6827**	**-0.0336**	**0.0220**
	Renewal	**0.0464**	**0.0175**	**2.6543**	**0.0082**	**0.0120**	**0.0807**
	Department	**0.0942**	**0.0231**	**4.0675**	**0.0001**	**0.0487**	**0.1396**

4.2.3 Comparison of Moderating Effects (F1 × Duration)

The moderating effect is the core of the model. It reflects the moderating role of "Duration" (W) on the path from F1 (X) to LogTotal (Y) through three key indicators: the interaction term coefficient (Int_1), the R^2 change (R^2-chng), and the conditional effect. Across the three periods, the interaction term (F1 × Duration) remains statistically significant ($p<0.001$), but its strength and contribution to explaining LogTotal variation differ markedly (see Table 2):

2016-2018: The moderating effect is the strongest. The interaction term coefficient is -0.1515 (significantly negative) with a small standard error of 0.0071, leading to a high absolute t-value of

21.4341. The R^2 change reaches 0.0831, meaning the interaction term alone explains 8.31% of the variation in LogTotal. Additionally, the F-value for the interaction term is as high as 459.4216, confirming that the moderating role of "Duration" makes the largest contribution to the model.

2019-2021: The moderating effect weakens significantly. The absolute value of the interaction term coefficient drops to 0.0862, a 43.1% decrease from 2016-2018. Correspondingly, the R^2 change falls to 0.0521 (a 37.3% reduction), and the F-value plummets to 98.3842. These changes indicate that the moderating contribution of "Duration" is halved compared to the earlier period.

2022-2024: The moderating effect shows a pattern of "coefficient reversal in magnitude but declining contribution". Although the absolute value of the interaction term coefficient rises to 0.1766 (a 104.9% increase from 2019-2021), the R^2 change drops to only 0.0303—merely 36.5% of the 2016-2018 level. The F-value further decreases to 51.7562, confirming that the actual moderating contribution of "Duration" continues to weaken, despite the larger absolute coefficient.

The 16th, 50th, and 84th percentiles of "Duration" are all 1.0000 across the three periods, allowing for direct comparison of the conditional effects:

2016-2018: The conditional effect is the strongest. The effect value is 0.3257 with a small standard error of 0.0124, resulting in a high t- value of 26.3569 ($p<0.001$). The 95% confidence interval [0.3015, 0.3500] is far from zero and narrow, indicating that when "Duration" = 1 (1 year), F1 exerts a significant and strongest positive effect on LogTotal.

2019-2021: The conditional effect declines significantly. The effect value drops to 0.1869 (42.6% decrease from 2016-2018) with a slightly increased standard error of 0.0141. The t-value falls to 13.2430, and the 95% confidence interval [0.1592, 0.2146] shifts downward— confirming that the positive effect of F1 on LogTotal (when "Duration" = 1) is halved.

2022-2024: The conditional effect drops to the lowest level. The effect value further decreases to 0.0607, a 67.5% reduction from **2019- 2021** and only 18.6% of the 2016-2018 level. Although the effect remains significant ($t=6.3691$, $p<0.001$) with a 95% confidence interval [0.0420, 0.0795] that excludes zero, the magnitude of the positive effect is drastically weakened.

While "Duration" consistently exerts a negative moderating effect on the F1→LogTotal path (as evidenced by the significantly negative interaction term across all periods), its moderating strength and practical contribution show a clear downward trend over time. This is most evident in the continuous decline of R^2 change and the drastic weakening of conditional effects—indicating that the ability of "Duration" to regulate the relationship between F1 and LogTotal becomes increasingly limited across the three periods.

4.2.4 Comparison of Covariate Effects

The significance of covariates reflects differences in the impact of control variables across periods. The relevant parameters are shown in Table 2. Consistently significant covariates ($p<0.05$):

F2: It is significantly positive across all three periods (2016-2018: 0.0754; 2019-2021: 0.0761; 2022-2024: 0.0799). The coefficient is stable with a slight upward trend, indicating that its positive impact on LogTotal persists and strengthens marginally over time.

F3: It is significantly positive in 2016-2018 (0.1057) and 2019-2021 (0.1381). In 2022-2024, it remains significant but its coefficient drops by 52% (to 0.0666), showing that its positive impact first strengthens and then weakens.

Renewal: It is significantly positive across all three periods (2016-2018: 0.0395; 2019-2021: 0.0475; 2022-2024: 0.0464). The coefficient is stable, demonstrating a consistent positive impact on LogTotal.

Department: It is significantly positive across all three periods (2016-2018: 0.0324; 2019-2021: 0.0784; 2022-2024: 0.0942). The coefficient doubles in magnitude each period, indicating a substantial increase in its positive impact on LogTotal.

Period-specifically significant covariates:

Reader: It is only significantly positive in 2016-2018 (0.0361, $p<0.001$) and becomes non-significant in 2019-2021 and 2022-2024 ($p>0.05$). This suggests that the impact of "Reader" on LogTotal exists only in the early period.

Gender: It is non-significant across all three periods ($p>0.05$) and has no significant impact on LogTotal. Additionally, its effect size is close to 0 (ranging from 0.0049 to 0.0098).

Newly Added Covariates (F4, F5, F6; only included in 2022-2024): All three are significantly positive (F4: 0.1100; F5: 0.0966; F6: 0.0934, $p<0.001$), making them important positive predictors of LogTotal in this period.

4.3 Title Word Clustering

In the period of 2016–2018, the high - frequency title words show certain clustering characteristics. From the relevant visualization (see Figure 5), words related to “therapy”, “counseling”, “family practice”, and “anatomy” tend to cluster together. This indicates that the research or book content in this period may focus on basic medical and psychological counseling services. For example, “therapy” and “counseling” are core concepts in psychological intervention, and their clustering suggests a relatively concentrated theme in the field of psychological and basic medical services. The dimension explanation shows that Dimension 1 (X - Axis) accounts for 30.53% and Dimension 2 (Y - Axis) accounts for 10.47% of the total association, which provides a certain spatial distribution basis for the clustering of these words.

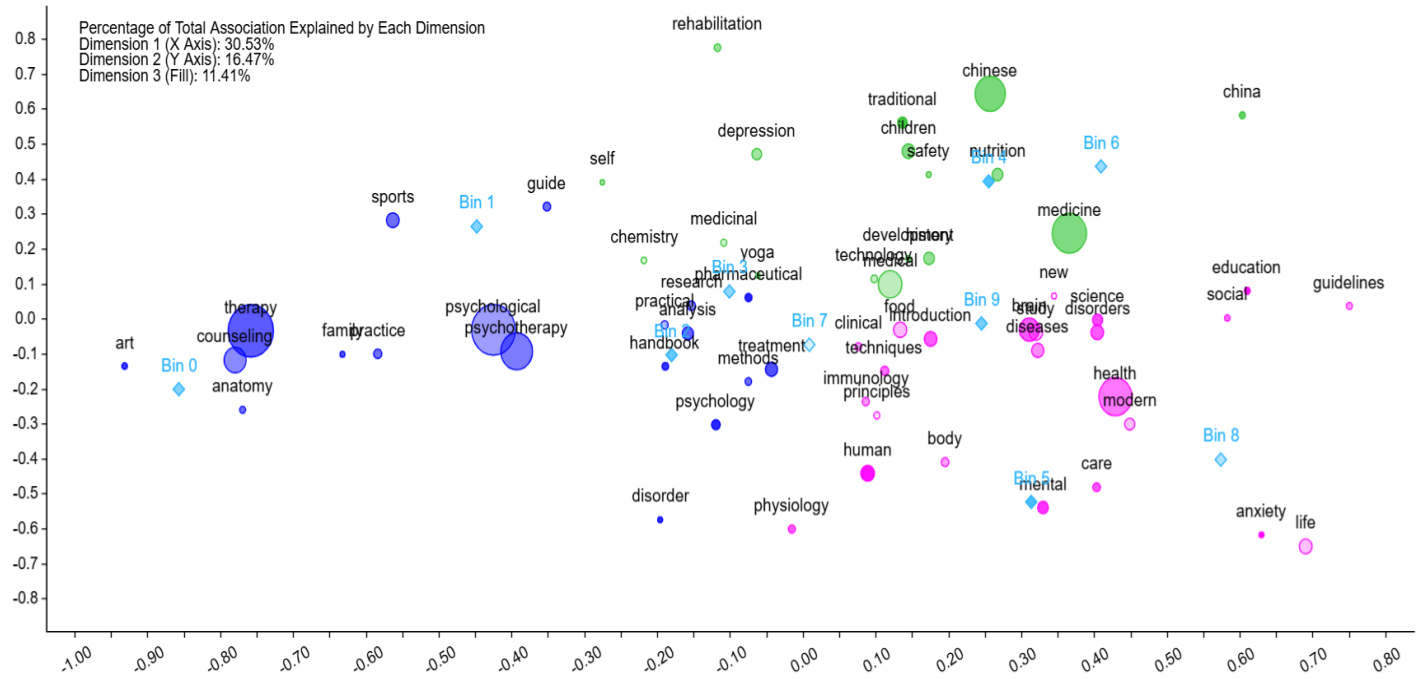

Figure 5. The top 60 most frequent title words (2016–2018)

During 2019–2021 (see Figure 6), the high - frequency title words present a more diverse clustering pattern. Words such as “art”, “theories”, “psychological counseling”, and “trauma therapy” form clusters. This reflects that the content may expand to the combination of art and psychology, as well as in - depth exploration of psychological trauma - related fields. The dimension explanation is Dimension 1 (X - Axis): 21.17% and Dimension 2 (Y - Axis): 17.96%, which shows a different spatial distribution structure of title words compared to 2016–2018, and also indicates a change in the thematic focus of the content, with more attention to theoretical and specialized psychological fields.

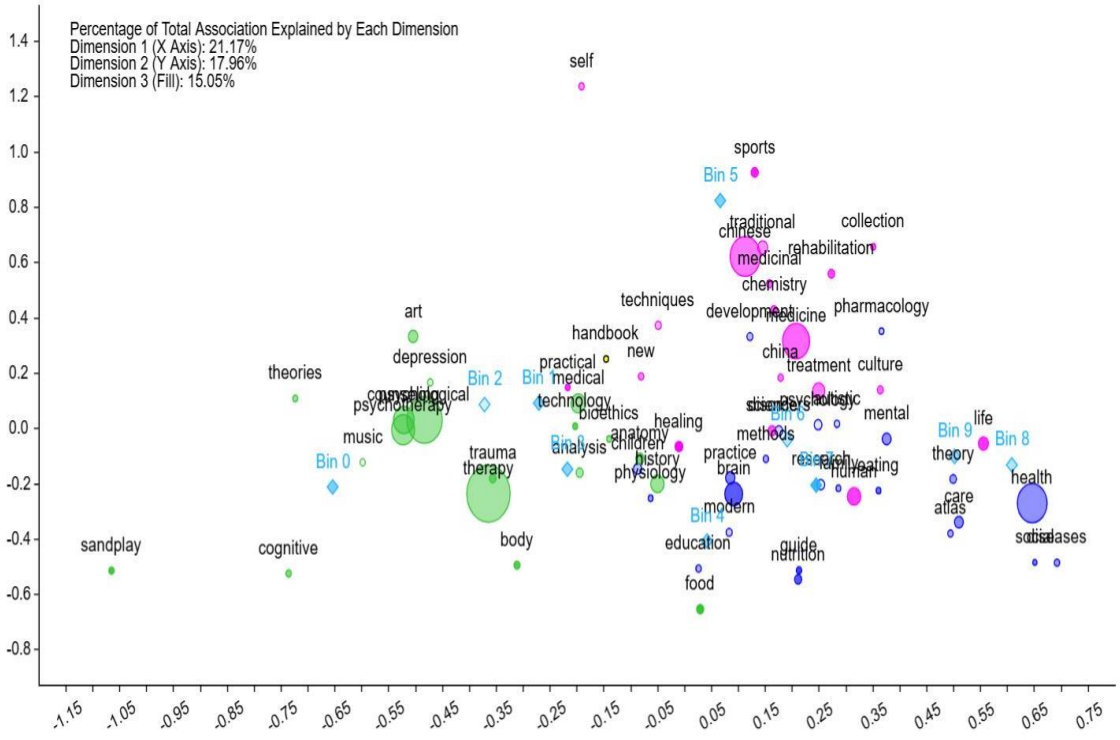

Figure 6. The top 60 most frequent title words (2019–2021)

For 2022–2024 (see Figure 7), the clustering of high - frequency title words shows new features. Words like “counseling practice”, “psychological theory”, “anxiety”, and “modern” are clustered. This implies that the content may be more inclined to the practical application of psychological counseling and the exploration of modern psychological problems such as anxiety. The dimension explanation is Dimension 1 (X - Axis): 21.97% and Dimension 2 (Y - Axis): 15.45%, which provides a unique spatial framework for

the clustering of these words, indicating that in this period, the theme has shifted to a more practical and modern - oriented psychological research and application field.

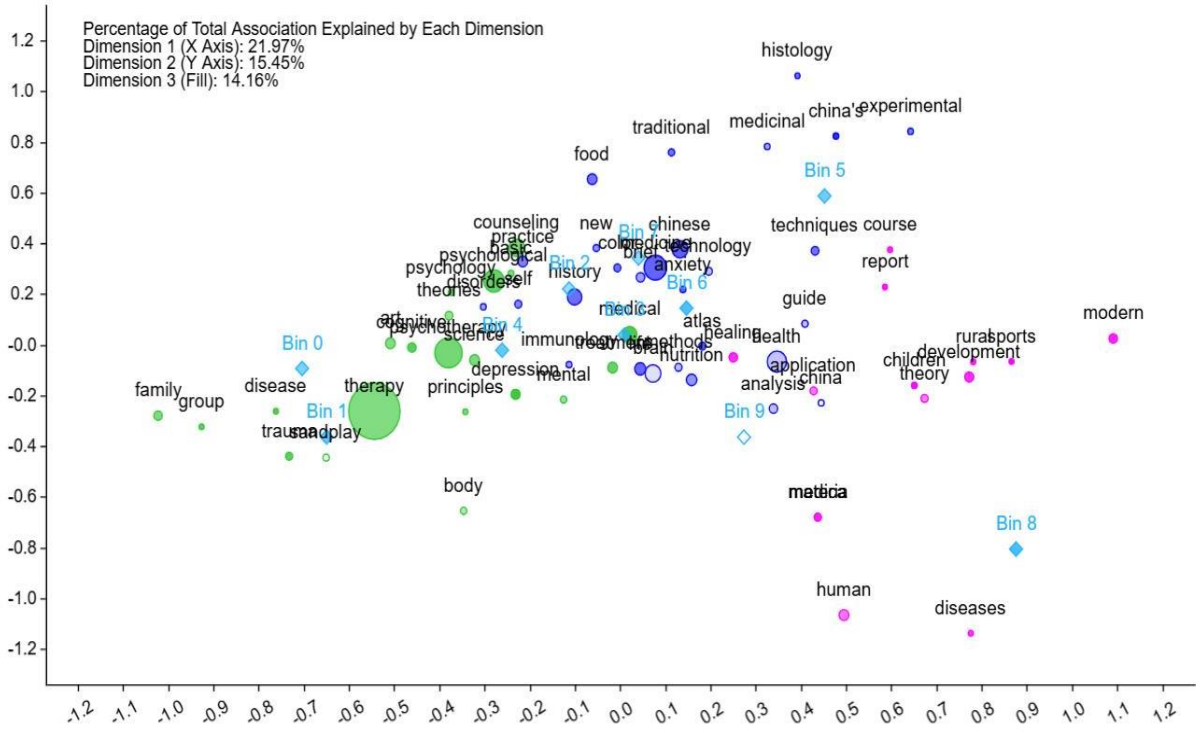

Figure 7. The top 60 most frequent title words (2019–2021)

In summary, for the field of psychology and its related disciplines, the high-frequency title words from 2016–2018 to 2022–2024 exhibit a distinct evolutionary trajectory: initially focusing on basic medical and psychological services, shifting to the integration of art and psychology, and ultimately advancing toward modern practical applications of psychology. Correspondingly, changes in word clustering patterns consistently reflect the continuous evolution of research and content themes within these fields. Each time period is characterized by a unique clustering mode, which is closely correlated with the dimension-explained variance that accounts for the total associations among title words. Three core trends emerge from this analysis: first, semantic convergence, evidenced by increasingly integrated clusters that mirror the interdisciplinary development of the field; second, thematic shifts, transitioning from broad thematic categorization in the early stage to a growing focus on applied and practical topics in the later stage, accompanied by the emergence of new sub-themes (e.g., sports medicine, modern therapeutic approaches); and third, dynamic changes in dimension-explained variance, which reflect the evolving semantic relationships between title words over time. Collectively, the visualized clustering results demonstrate a clear transition from broad, discrete clusters to integrated, application-oriented groupings—one that accurately mirrors the evolving research priorities and academic interests within the psychology field and its related domains.

4.4 Correlations Analysis

The model for 2920 books spanning 2016–2024 employs bootstrap specifications to assess the reliability and stability of statistical estimates. The sampling method is specified as "Simple," indicating that bootstrap samples are drawn randomly with replacement from the original dataset of 2920 books. The number of bootstrap samples is set to 1000. This is a commonly adopted threshold in bootstrap analyses, as it provides a sufficient number of replications to stabilize the estimated sampling distributions. Table 3 presents the correlations among three variables—Number of Borrowings, Collection Tenure (The length of time since being added to the collection), and Secondary Categories of R.

Table 3. Correlations (2016-2024)

Statistical Parameters			Number of Borrowings	Collection Tenure	Secondary Categories of R
Number of Borrowings	Pearson Correlation		1	-0.069**	0.129**
	Sig. (2-tailed)			0.000	0.000
	N		2920	2920	2920
	Bootstrapc	Bias	0	0.000	-0.001

		Std. Error		0	0.015	0.017
		95% Confidence Interval	Lower	1	-0.098	0.094
			Upper	1	-0.041	0.162
The length of	Pearson Correlation			-0.069**	1	-0.018
time since being added to the collection	Sig. (2-tailed)			0.000		0.341
	N			2920	2920	2920
	Bootstrapc	Bias		0.000	0	0.000
		Std. Error		0.015	0	0.019
		95% Confidence Interval	Lower	-0.098	1	-0.054
			Upper	-0.041	1	0.019
Secondary Categories of	Pearson Correlation			0.129**	-0.018	1
	Sig. (2-tailed)			0.000	0.341	
	N			2920	2920	2920
	Bootstrapc	Bias		-0.001	0.000	0
		Std. Error		0.017	0.019	0
		95% Confidence Interval	Lower	0.094	-0.054	1
			Upper	0.162	0.019	1

**. Correlation is significant at the 0.01 level (2-tailed).

c. Bootstrap results are based on 1000 bootstrap samples

There is a statistically significant negative correlation between Number of Borrowings and Collection Tenure (Pearson correlation = - 0.069, p = 0.000). This indicates that newer books (with less time since being added to the collection) tend to be borrowed slightly more frequently, though the correlation coefficient is small, suggesting a weak relationship. The 95% confidence interval (-0.098 to -0.041) confirms the significance of this negative association. Number of Borrowings and Secondary Categories of R show a statistically significant positive correlation (Pearson correlation = 0.129, p = 0.000). This implies that certain secondary categories within the R class are associated with higher borrowing rates, though the correlation is weak. The 95% confidence interval (0.094 to 0.162) supports the reliability of this positive trend, indicating that category-specific preferences influence borrowing behavior. There is no significant correlation between Collection Tenure and Secondary Categories of R (Pearson correlation = -0.018, p = 0.341). The 95% confidence interval (-0.054 to 0.019) includes zero, confirming that the age of books in the collection does not systematically relate to their secondary R categories. While all correlations are weak in magnitude, the significant associations highlight that newer books are marginally more borrowed, and specific R secondary categories are linked to higher borrowing frequencies. The lack of correlation between collection time and categories suggests that age does not bias the distribution of R-type books across subcategories.

4.5 Survival Analysis of R Books

This survival function plot in Figure 8 clearly demonstrates the variation pattern of the "cumulative survival probability" of samples in the Secondary Categories of R with the Length of Borrowing Years through stepwise-decreasing survival curves: the overall survival probability declines over time, with the early stage (0–2 years) being a high-incidence period for failures; there are significant differences in survival resilience and the concentrated failure time across different Secondary Categories of R. Specifically, certain categories (e.g., R7, represented by the blue line) maintain a relatively high survival probability over an extended period—their survival probability remains above 0.6 at the 4-year mark and only decreases significantly around the 8-year mark. This indicates that samples in such Secondary Categories of R are more likely to "survive continuously" during the borrowing process (i.e., maintain the borrowing status for a longer duration). In contrast, for R2 (represented by the green line), the survival

probability drops to below 0.2 around the 2-year mark, showing extremely rapid "failure" (e.g., detachment from the continuous borrowing status), which reflects a distinct disadvantage in the competition for borrowing duration. Additionally, the time points at which the survival probability of different categories first decreases significantly vary (e.g., approximately 4 years for R1 and 3 years for R3). This variation indicates that there are differences in the "critical failure nodes" of samples corresponding to each secondary category during the borrowing cycle, which may be associated with factors such as the inherent content attributes of the categories and the stability of audience demand.

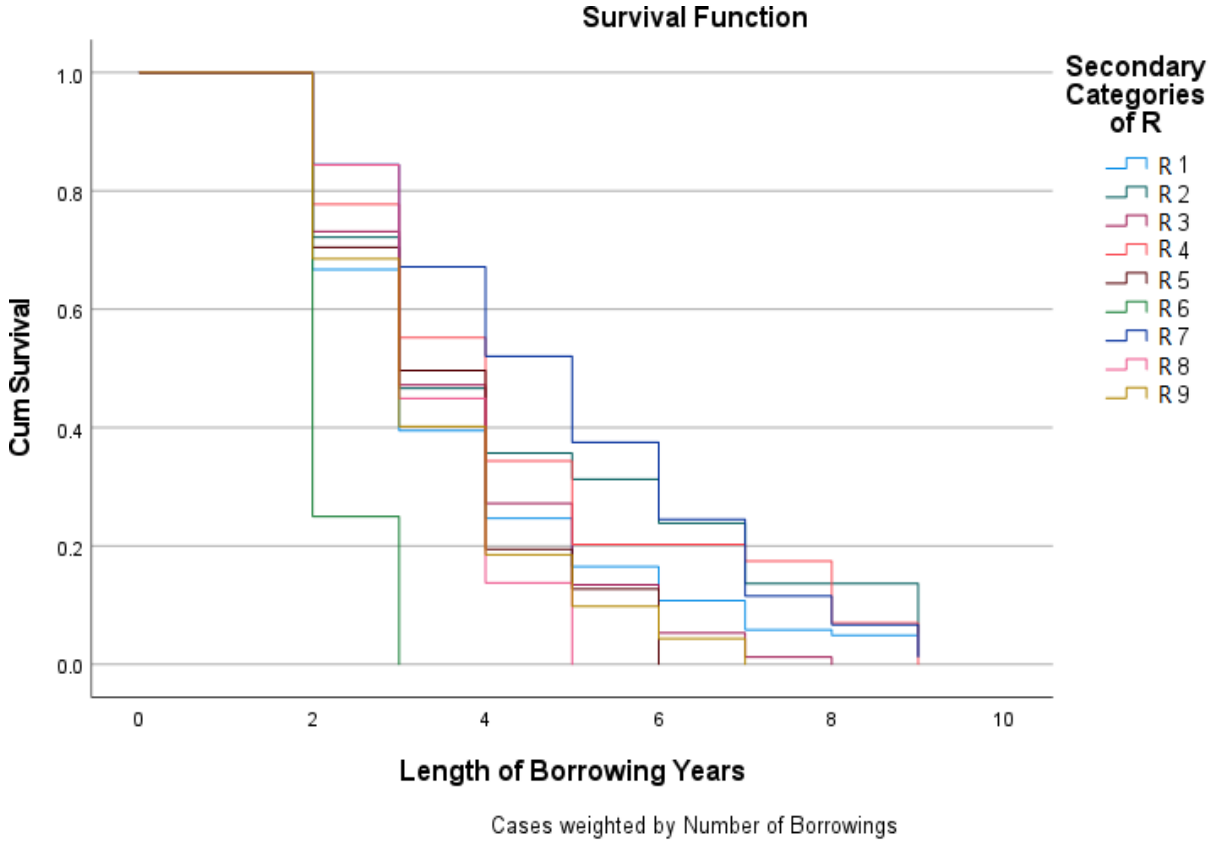

Figure 8. R book survival function plot

The median survival times vary notably among the secondary categories of R. R7 exhibits the longest median survival time at 4.14 units, indicating that books in this category tend to remain in circulation or take the longest to experience the target event compared to other subcategories. In contrast, R6 has the shortest median survival time at 1.67 units, suggesting that books in R6 are more likely to experience the event (such as being borrowed for the first time or removed) more quickly. Among the remaining categories, the median survival times are relatively clustered: R4 (3.25) and R5 (2.98) have longer durations than the mid-range values, while R3 (2.89), R2 (2.87), R8 (2.87), R9 (2.65), and R1 (2.61) fall within a narrower range, with minimal differences between them. This clustering suggests that most R subcategories share similar survival patterns, with R7 and R6 emerging as outliers driving the overall variability.

Based on the data on mean borrowing volume, sample size (N), and standard deviation (Std. Deviation) of different reader types across three periods (2016–2018, 2019–2021, 2022–2024) in Table 4, the total mean borrowing volume across all readers shows a "downward then slight upward" trajectory: it decreases from 3.41 books in 2016–2018 to a low of 2.70 books in 2019–2021 (a decrease of approximately 20.8%), and then rebounds slightly to 2.92 books in 2022–2024 (an increase of about 8.1% compared to 2019–2021). This trend may reflect external impacts (e.g., changes in resource access methods, such as the rise of e-books, or social events affecting offline borrowing) in the middle period (2019–2021), followed by a partial recovery of borrowing demand in the later period. While the mean borrowing volume partially recovered in the later period, the overall scale of the borrowing group continued to shrink. Faculty & Staff have the highest borrowing volume: their mean borrowing volume remains above 4.6 books in all three periods (4.75 in 2016–2018, 4.67 in 2019–2021, 4.82 in 2022–2024), showing strong stability and even a slight increase in the later period. This is likely related to their academic research and teaching needs, which require sustained access to physical resources. Graduate Students rank second: their mean borrowing volume decreases from 4.17 books (2016–2018) to 3.04 books (2019–2021) and then rises slightly to 3.11 books (2022–2024). The fluctuation aligns with the total trend but remains higher than that of undergraduate students, reflecting their higher demand for specialized resources for thesis writing and research. Undergraduate Students have the lowest borrowing volume: their mean borrowing volume drops from 2.74 books (2016–2018) to 2.21 books (2019–2021) and then rebounds to 2.47 books (2022–2024). The relatively low and fluctuating borrowing volume may be due to their more diverse learning resource channels (e.g., online

courses, e-textbooks) and less dependent on physical books. The "0 Other" reader group (with a mean borrowing volume of 4.00 books and N=2) only appears in 2016–2018 and is absent in the subsequent two periods. This may be due to changes in reader classification standards (e.g., merging "Other" into other categories) or a significant reduction in non-core reader groups (e.g., external visitors, alumni) accessing physical resources, leading to their exclusion from the statistical sample.

The total standard deviation of borrowing volume decreases from 5.24 (2016–2018) to 3.89 (2019–2021) and further to 3.62 (2022–2024). This indicates that the differences in borrowing volume among readers are gradually narrowing—while some readers may have reduced their borrowing frequency, the "high-frequency borrowers" and "low-frequency borrowers" groups are becoming less distinct, and the overall borrowing behavior is more concentrated. Faculty & Staff and Graduate Students consistently show high standard deviations: for example, the standard deviation of Faculty & Staff increases from 4.55 (2016–2018) to 6.39 (2022–2024), and that of Graduate Students decreases from 7.05 (2016–2018) to 3.87 (2022–2024) but remains higher than that of undergraduate students. This suggests that within these groups, there are significant differences in borrowing needs—some individuals (e.g., senior researchers, doctoral students) may still borrow large quantities of books, while others rely more on digital resources, leading to uneven borrowing volume. Undergraduate Students have relatively low standard deviations (3.15, 2.69, 2.64 in the three periods), indicating more homogeneous borrowing behavior among this group, with no extreme high or low borrowing volume.

Table 4. Changes in borrowing volume metrics by reader type (2016–2024)

Period	Reader Type	Mean	N	Std. Deviation
2016–2018	Other	4.00	2	2.83
	Undergraduate Student	2.74	848	3.15
	Graduate Student	4.17	654	7.05
	Faculty & Staff	4.75	56	4.55
	Total	3.41	1560	5.24
2019–2021	Undergraduate Student	2.21	422	2.69
	Graduate Student	3.04	361	4.60
	Faculty & Staff	4.67	43	5.99
	Total	2.70	826	3.89
2022–2024	Undergraduate Student	2.47	250	2.64
	Graduate Student	3.11	264	3.87
	Faculty & Staff	4.82	33	6.39
	Total	2.92	547	3.62

5. Discussion

5.1 Evolution of Time-Space-Interest Factors: Rising Structural Complexity, Strengthened Variable Associations, and Dynamic Core Variable Roles

The latent factor system governing the relationships among time-related (e.g., months), space-related (e.g., lending rooms), and interest- related (R1–R9) variables has undergone a profound and multi-dimensional evolution over the period 2016–2024. This evolution manifests in three interrelated yet distinct trends, collectively reshaping the underlying mechanism of how these three dimensions interact.

First, the structural complexity of the factor system has significantly increased, marking a shift from a simplified, integrated framework to a diversified, subdivided one. From 2016–2018 to 2022–2024, the total number of extracted factors doubled from 3 to 6, and the unique combinations of time-space-interest categories expanded and refined (e.g., the emergence of new category types alongside traditional ones). This structural expansion is not arbitrary but is closely linked to external contextual changes—most notably, the fragmentation of user demand in the post-pandemic era. Such external disruptions have enhanced the independence of individual dimensions (time, space, and interest): for instance, post-pandemic adjustments to service models (e.g., hybrid offline-online lending) have decoupled certain time- space associations, while shifting user preferences have increased the specificity of interest-based variable dimensions.

Historical and cross- regional evidence further supports this link between demand fragmentation and structural adaptation: Ruttimann (1986) noted that 18th- century Enlightenment popular medical texts responded to shifting knowledge needs, and Bellini (2001) found similar adaptive responses in Renaissance Portuguese medical scholarship, illustrating that demand-driven structural adjustment is a long-standing pattern in medical knowledge dissemination. For modern users, this specificity is reflected in group-specific demands: Al Husaini (2013) highlighted medical students' reliance on pocket books, while Ali et al. (2015) emphasized pharmacy students' need for reliable book sources—these distinct needs drive the subdivision of interest-based factors. As a result, the latent structure can no longer be adequately captured by a small set of integrated factors, necessitating the subdivision of factors to reflect the more nuanced interplay between dimensions.

Second, the association between key variables and their affiliated factors has been substantially strengthened, enhancing the representativeness of each factor. Quantitatively, the proportion of variables with significant factor loadings (defined as loadings > 0.71) increased from 2 in 2016–2018 to 5 in 2022–2024. Meanwhile, the average intensity of loadings for core time-related variables has remained stable or risen: for example, the loading of "July"—a critical time variable—maintained high significance across periods (1.012 in 2016– 2018, 0.836 in 2019–2021, and 0.997 in 2022–2024), with its 2022–2024 loading approaching the maximum possible value for oblique rotation. This strengthening of variable-factor associations indicates that over time, variables have become more "aligned" with the latent constructs they represent—an alignment that mirrors the growing specificity of user needs observed in cross-regional studies. For instance, Wildemuth (2020) found that Finnish medical sciences scholars prioritize recent academic books for research, while Bülbül et al. (2014) noted that Turkish high-income groups read more consistently across seasons—both findings reflect group-specific time or interest patterns that reinforce variable-factor alignment. For space-related variables, this trend is exemplified by the emergence of "Suiyuan Hong Kong-Taiwan Book Lending Room" (a newly added space variable in 2022–2024) with a significant loading of 0.907, which directly enhances the explanatory power of its affiliated factor by anchoring it to a clear, high-impact space dimension. Collectively, this trend means each factor now more precisely reflects a specific subset of time-space-interest relationships, reducing ambiguity in the latent mechanism.

Third, the roles of core variables within the factor system have exhibited dynamic shifts, with some maintaining stability and others undergoing reaffiliation—reflecting both persistent and changing drivers of time-space-interest interactions. On one hand, variables such as R9 (an interest-related proxy) and "September" (a time variable) have retained stable factor affiliation: R9 consistently associated with space-related factors across all three periods (F3 in 2016–2018, F2 in 2019–2021, and F3 in 2022–2024), while "September" remained linked to time-centric factors. This stability suggests inherent, context-insensitive relationships (e.g., R9's enduring connection to space may stem from fixed user preferences for specific lending rooms when accessing R9-related content)—a persistence echoed in Beech (2010)'s observation that pocket-sized reference books' relevance endures when curricula or practice needs remain stable. On the other hand, variables like "July" and "Suiyuan Chinese Book Lending Room" have shifted their factor links: "July" moved from a "Time-Interest" factor (F2, 2016–2018) to a "Time-Space-Interest" factor (F1, 2019–2021) and finally to a "Time-Space" factor (F1, 2022–2024), while "Suiyuan Chinese Book Lending Room" transitioned from F1 to F3 and back to F1, with its loading decreasing in 2022–2024. These mobility patterns mirror changes in the driving forces behind dimension interactions—for example, "July's" shift may reflect summer vacation- related adjustments in user behavior (e.g., increased focus on space usage rather than interest-specific borrowing), which aligns with Nguyen et al. (2023)'s finding that Vietnamese medical students' seasonal borrowing is tied to structured learning cycles. Additionally, the weakened loading of "Suiyuan Chinese Book Lending Room" could stem from reduced usage frequency or functional adjustments, a trend analogous to Naz et al. (2014)'s observation that Pakistani medical students (especially proactive private college students) adapt to resource changes by shifting their resource preferences.

In synthesis, the 2016–2024 evolution of time-space-interest factors—characterized by rising structural complexity, strengthened variable associations, and dynamic core variable roles—provides a comprehensive empirical basis for unpacking the long-term changes in the latent mechanisms of these three dimensions. This tripartite evolution not only captures the system's response to external contextual shifts (e.g., post-pandemic changes) but also reveals the intrinsic adaptability of time-space-interest relationships—an adaptability consistent with long-term trends in medical knowledge access (e.g., Ruttimann, 1986; Bellini, 2001) and cross-regional user behavior (e.g., Bülbül et al., 2014; Wildemuth, 2020). These insights can inform the optimization of service models (e.g., targeted resource allocation based on refined factor categories) and deepen understanding of user behavior over time.

5.2 The Core Relationships in the F1–LogTotal Model Exhibit Distinct Temporal Degradation Patterns Over 2016–2024

The core relationships underpinning the model— including the main effect of the predictor (F1), the main effect of the moderator ("Duration"), and the moderating effect of "F1×Duration"—undergo consistent yet differentiated temporal degradation, collectively weakening the model's predictive power for LogTotal (logarithm of total book borrowings) over time.

First, the main positive effect of F1 on LogTotal weakens continuously and substantially. From 2016–2018 to 2022–2024, the regression coefficient of F1 drops sharply from 0.4772 to 0.2373, with its impact strength reduced by nearly half. This linear downward trend indicates a gradual erosion of F1's driving role: as a key predictor, F1 is less capable of explaining or influencing variations in LogTotal in later periods. This weakening may stem from structural shifts in the underlying system (e.g., changes in user borrowing behavior, adjustments to service models) that decouple the latent constructs represented by F1 from actual borrowing outcomes. For instance, post-pandemic shifts toward digital resource access could reduce the relevance of F1—if it primarily captures physical lending-related factors—thus diminishing its ability to drive LogTotal. This shift toward digital aligns with Garcja Benjtez (2018)'s observation that while continuing medical education drives long-term demand for physical books, professionals increasingly adapt to access barriers (e.g., limited physical availability) by turning to digital

alternatives, which would reduce the correlation between physical book-focused factors like F1 and total borrowings. Additionally, Beech (2010) noted that the relevance of reference books (a common focus of physical lending) rises or falls with curricula or practice needs—if F1 is tied to such reference materials, curricular shifts post-pandemic could further weaken its impact.

Second, the main positive effect of the moderator "Duration" (Duration of Borrowing Years) follows a "stable-then-declining" trajectory. During 2016–2019, the coefficient of "Duration" remains relatively stable at approximately 0.20, maintaining a consistent independent impact on LogTotal. However, by 2022–2024, this coefficient plummets to 0.1355, representing a significant weakening of its standalone explanatory power. This transition suggests that while the length of borrowing years initially exerted a steady influence on total borrowings, external or internal changes in later periods (e.g., shortened average borrowing cycles, altered user retention patterns) have reduced the salience of "Duration" as an independent predictor. For example, if users in 2022–2024 tend to borrow books for shorter periods but with more frequent renewals, the direct link between "Duration" and total borrowings would weaken. This pattern is consistent with cross-regional observations: Bülbül et al. (2014) found that Turkish high-income groups read more consistently across seasons, but even consistent readers may adjust borrowing duration in response to access changes (e.g., faster digital access reducing the need for long-term physical borrowing). Additionally, Nguyen et al. (2023)'s finding that seasonal borrowing is tied to structured learning cycles implies that if learning cycles shortened post-pandemic (e.g., more intensive, shorter courses), borrowing duration would decrease, further weakening "Duration"'s impact.

Third, the moderating effect of "F1×Duration" exhibits a paradoxical pattern of "coefficient magnitude reversal but persistent contribution decline". Although the absolute value of the interaction term's coefficient increases in 2022–2024 (indicating a potential amplification of the inhibitory effect of "Duration" on the F1→LogTotal path), two key metrics—R^2 change and conditional effect—reveal a continued weakening of its practical contribution. The R^2 change (a measure of how much the interaction term explains LogTotal variance) drops from 8.31% (2016–2018) to 3.03% (2022–2024), meaning the moderating effect accounts for far less variance in later periods. Additionally, the conditional effect (the positive effect of F1 on LogTotal under a fixed "Duration" value) declines drastically from 0.3257 to 0.0607. This indicates that while the negative moderating role of "Duration" (i.e., its ability to inhibit F1's positive impact) persists, the final net positive effect of F1—after accounting for "Duration"—is substantially diminished. In practical terms, even though "Duration" still weakens F1's influence, the baseline positive effect of F1 is now so small that the moderating effect's real-world significance is reduced. This degradation may be exacerbated by user adaptations to resource access: Garcja Benjtez (2018) noted that medical professionals adapt to physical book access barriers by altering their borrowing patterns (e.g., shorter durations, more frequent borrowing), which could decouple the interaction between F1 (physical lending factors) and "Duration" from total borrowings. Additionally, the rise of digital resources may reduce the relevance of both F1 and "Duration" for physical book borrowings, further weakening their interaction's explanatory power.

5.3 Period-Specific Model and Data Differences Highlight Key Predictor Shifts and Guide Future Research Priorities

The 2016–2024 period exhibits notable differences in sample size, covariate composition, and variable importance, which not only explain variations in model performance but also identify critical directions for subsequent research.

First, sample size reduction and covariate expansion in 2022–2024 do not undermine model explanatory power—instead, they validate the value of newly added covariates. The 2022–2024 period has the smallest sample size (only 35.1% of the 2016–2018 sample) but the largest number of covariates (with three new factors: F4, F5, F6 added). Despite these constraints, its model explanatory power ($R^2 = 0.6872$) remains higher than that of the 2019–2021 period ($R^2 = 0.5681$). This counterintuitive result confirms that the newly added covariates are not redundant but rather serve as important predictors of LogTotal. Their inclusion compensates for the loss of predictive power caused by smaller sample size, indicating that the latent constructs represented by F4, F5, F6 have become increasingly relevant to borrowing behavior in post-2022 contexts—relevance that aligns with cross-regional findings on evolving user needs. For example, Wildemuth (2020) found Finnish medical sciences scholars prioritize recent academic books, suggesting a need for factors capturing "recency" (potentially reflected in F4–F6), while Ali et al. (2015) noted pharmacy students' demand for reliable sources, which could be captured by factors measuring "source credibility". Future research must prioritize these variables—for example, by exploring their conceptual meaning (e.g., whether F4 reflects digital-physical resource trade-offs), measuring their stability across broader samples (e.g., comparing with Bülbül et al. (2014)'s Turkish reader data), and integrating them into baseline models to enhance explanatory accuracy.

Second, the "Department" variable's rising importance signals a growing influence of institutional factors on LogTotal. When specifying the "Department" variable as a binary indicator distinguishing Psychology departments from Non-Psychology departments, its steadily increasing regression coefficient—rising from 0.0324 (2016–2018) to 0.0784 (2019–2021) and further to 0.0942 (2022–2024), nearly tripling over the period—takes on more targeted meaning: it reflects a widening gap in the influence of institutional affiliation (i.e., whether a borrower belongs to a Psychology department) on LogTotal (logarithm of total book borrowings). This trend underscores that the dichotomy between Psychology and Non-Psychology departments has become an increasingly critical factor shaping borrowing outcomes, with mechanisms tied to the unique academic needs and institutional contexts of Psychology departments. The coefficient's growth likely stems from strengthened alignment between Psychology departments' academic activities and medical and health book resources—an alignment analogous to Naz et al. (2014)'s observation that private Pakistani medical students (with proactive academic needs) are more attuned to resource alignment than public college peers. The binary "Department" variable thus captures not just inherent disciplinary differences, but also institutional resource decisions that exacerbate borrowing disparities between the two groups. The post-pandemic divergence in academic modes would further amplify the predictive power of the "Department" variable, as the binary distinction becomes more strongly tied to R book borrowing behavior—consistent with

Garcja Benjtez (2018)'s finding that institutional context shapes how professionals adapt to resource access changes.

Third, the disappearance of the "Reader type" variable's significant impact reflects a temporal breakdown in the association between reader characteristics and borrowing behavior. When defining "Reader type" explicitly as a categorical variable distinguishing three core academic groups—Undergraduates, Graduates, and Faculty & Staff—its shift from statistical significance (2016–2018, $p < 0.001$) to non-significance (2019–2021 and 2022–2024, $p > 0.05$) takes on targeted meaning: the once-distinct borrowing patterns that differentiated these three groups have become increasingly homogeneous over time. This erosion of group-specific predictive power reflects a breakdown in the historical association between academic role (and its accompanying resource needs) and medical and health book borrowing behavior, driven by context-specific shifts in resource access, institutional services, and user priorities. As a result, "Reader type" no longer captures meaningful differences in medical and health book demand. Physical medical and health book borrowing thus became driven by individual preferences (e.g., personal learning styles, specific research needs) rather than group identity, rendering "Reader type" non-significant. This shift underscores the need for future research to move beyond broad academic role categories and explore individual-level predictors (e.g., metacognitive awareness, as identified by Nguyen et al. (2023) as a driver of book reading among Vietnamese medical students) to better explain borrowing behavior in post-2019 contexts. Additionally, integrating variables related to digital resource usage (e.g., frequency of digital book access) could help disentangle the relationship between physical borrowing and reader characteristics, as digital adoption has been a key homogenizing force across groups.

5.4 Title Word Clustering Evolves from Basic/Thematic Concentration to Integrated, Practice-Focused Arrangements

Across 2016–2024, the clustering of high-frequency title words in psychology and related disciplines follows a clear evolutionary trajectory: from broad, basic thematic concentration (2016–2018) to diverse, interdisciplinary specialization (2019–2021) and finally to targeted, application-driven focus on modern issues (2022–2024). This trajectory reflects the continuous evolution of research priorities and academic interests in the field—an evolution that aligns with cross-regional and historical observations of how knowledge needs shape content trends.

First, semantic convergence. Over time, clusters become increasingly integrated, mirroring the interdisciplinary development of psychology. For example, the shift from isolated "therapy" clusters (2016–2018) to "art + psychological counseling" clusters (2019–2021) and "modern anxiety + counseling practice" clusters (2022–2024) shows that words are no longer discrete but semantically linked across subfields—a sign of the field's growing interconnectedness. This convergence echoes historical patterns of knowledge integration: Ruttimann (1986) noted that 18th-century Enlightenment popular medical texts responded to shifting knowledge needs by integrating diverse ideas, while Bellini (2001) found similar interdisciplinary adaptation in Renaissance Portuguese medical scholarship. Just as these historical texts evolved to connect fragmented knowledge, modern psychology's title word clustering reflects a response to contemporary demands for integrated solutions—such as combining art and counseling to address complex mental health needs—reinforcing semantic cohesion across subfields.

Second, thematic shifts. The content moves from broad, foundational themes (e.g., basic medical and counseling services) to specialized, applied topics. Early clusters focus on general service provision, while later clusters target niche areas (e.g., trauma therapy) and practical applications (e.g., counseling practice), reflecting a maturation of the field as it responds to specific clinical, educational, and societal needs. New sub-themes (e.g., art therapy, modern anxiety interventions) emerge, expanding the scope of psychology beyond traditional boundaries. This shift aligns with cross-regional findings on user-driven content adaptation: Wildemuth (2020) observed that Finnish medical sciences scholars prioritize recent academic books tailored to specialized research needs, while Al Husaini (2013) highlighted medical students' reliance on focused pocket books for foundational learning—both illustrating how audience-specific needs drive thematic specialization. Post-2019, this trend is further amplified by two factors: the standardization of medical and health education (e.g., unified curricula for undergraduates and graduates), which reduces demand for overly broad foundational content (echoing Beech (2010)' s note that curricular changes reshape reference book relevance), and public health crises like the COVID-19 pandemic, which created universal demand for targeted content (e.g., anxiety interventions)—similar to how Ruttimann (1986) and Bellini (2001) saw universal knowledge needs drive focused text demand in historical eras. Additionally, efforts to reduce access barriers (e.g., translated medical texts, multilingual digital resources) have expanded the reach of specialized content across diverse user groups, as Jameel et al. (2019) noted that reducing language barriers (a key barrier to textbook engagement for students with poor English proficiency) fosters greater demand for targeted, accessible themes.

Third, dynamic dimensional changes. The variance explained by Dimension 1 and Dimension 2 shifts from a lopsided distribution (30.53% vs. 10.47% in 2016–2018) to a more balanced one (21.17% vs. 17.96% in 2019–2021; 21.97% vs. 15.45% in 2022–2024). This change reflects evolving semantic relationships between words: as the field diversifies, a single dimension can no longer capture all thematic links, so a second dimension emerges to organize new sub-themes. The stability of balanced dimensionality in the later two periods also indicates that the field has reached a more nuanced, structured state of thematic organization. This dimensional evolution is tied to broader shifts in resource access and user behavior: Garcja Benjtez (2018) found that medical professionals adapt to physical book access barriers by seeking diverse, specialized resources—driving the need for a more balanced dimensional structure to categorize these varied themes. Similarly, Scala et al. (2020) highlighted that expanding accessible medical resources (e.g., via post-pandemic public health initiatives) for all user types (including non-academic groups like patients) increases the diversity of content demands, further justifying the shift from a single dominant dimension to a more balanced framework that can accommodate both clinical, research-focused, and public-oriented themes.

Collectively, these trends demonstrate that the clustering of title words is not arbitrary but a reflection of the field's growth: from a focus on foundational knowledge to a dynamic, application-oriented discipline that integrates interdisciplinary insights and addresses modern challenges. The visualized clustering results thus

serve as a quantitative "map" of the field's evolution—one that aligns with historical patterns of knowledge adaptation (Ruttimann, 1986; Bellini, 2001) and cross-regional observations of user-driven content demand (Al Husaini, 2013; Wildemuth, 2020; Garcja Benjtez, 2018)—highlighting how research and content priorities have adapted to changing needs over time.

5.5 Differentiated Collection Allocation Tailored to R Category Survival Time Variations and User Group Borrowing Dynamics

The observed differences in survival time across R categories (e.g., longer for R7, shorter for R6) provide actionable insights for collection management. For high-survival categories like R7, sustained demand or slow turnover justifies prioritized stock replenishment and expanded acquisitions, as these resources remain relevant over time. For low-survival categories like R6, shorter survival may indicate high immediate demand (requiring temporary stock surges) or rapid obsolescence (warranting reduced long-term acquisitions). This data-driven approach minimizes waste and ensures resources align with actual user needs.

While the borrowing hierarchy remains stable (Faculty & Staff > Graduate Students > Undergraduate Students), this stability obscures critical dynamics in group-specific borrowing behavior. First, all user groups exhibited a "decline-then-recovery" trajectory, with the 2019–2021 period serving as a pivotal turning point. Second, the overall reader population contracted, and the variability in borrowing patterns across groups diminished significantly. The persistence of this hierarchical structure reflects inherent disparities in information needs across user segments — for instance, Faculty & Staff prioritize specialized research materials, whereas Undergraduate Students show a stronger preference for textbooks. These established differences in information needs provide empirical justification for targeted resource allocation strategies. For Faculty & Staff: Prioritize the acquisition and maintenance of high-survival R-category resources (e.g., specialized research monographs) and recently published academic literature to support long-term research initiatives. For Graduate Students: Enhance collections of R-category materials relevant to thesis research and provide flexible format options (i.e., both print and e-books) to accommodate hybrid learning environments. For Undergraduate Students: Focus on curating core textbooks and accessible formats that align with their phased learning rhythms. The shrinking reader base and narrowed variability further imply a shift toward a concentrated core of active borrowers. For libraries, this means reorienting services to retain active users (e.g., personalized recommendations for high-Duration of Borrowing Years readers, dedicated research support for faculty) while developing outreach strategies to re-engage occasional or lapsed users (e.g., orientation programs for undergraduates, promotions for low-survival R categories).

6. Conclusion

This study systematically analyzed the borrowing behavior of "Medicine and Hygiene" (R-type) books at Nanjing Normal University (NNU) Library over three periods (2016–2018, 2019–2021, 2022–2024) using multi-method approaches, including moderated regression, title word visualization, correlation analysis, and survival analysis. The findings collectively reveal dynamic shifts in user demand, latent factor structures, and resource utilization patterns, providing empirical insights for optimizing academic library collection management and user services.

First, the latent factor system governing time-space-interest interactions underwent significant evolution, reflecting heightened structural complexity and strengthened variable-factor associations. From 2016–2018 to 2022–2024, the number of extracted factors doubled from 3 to 6, with unique time-space-interest combinations expanding to capture more nuanced user behavior (e.g., the emergence of F4–F6 in 2022–2024). Key variables exhibited divergent stability patterns: R9 (interest-related) and September (time-related) maintained consistent factor affiliations, while July (time-related) and "Suiyuan Chinese Book Lending Room" (space-related) shifted their latent associations—likely driven by post-pandemic service adjustments and fragmented user demand. This evolution underscores the need for libraries to adopt flexible, dimension-specific resource allocation strategies (e.g., prioritizing space optimization for high-loading lending rooms like the "Suiyuan Hong Kong-Taiwan Book Lending Room").

Second, the core relationships in the F1–LogTotal moderated regression model demonstrated a clear temporal degradation, weakening the model's predictive power over time. The main positive effect of F1 (a PCA-derived composite of time-space-interest factors) on LogTotal (log-transformed borrowing volume) was halved, declining from a coefficient of 0.4772 (2016–2018) to 0.2373 (2022–2024). The moderating effect of "Duration of Borrowing Years" also weakened: while the interaction term (F1×Duration) remained significant, its contribution to explaining LogTotal variance (R^2 change) dropped from 8.31% to 3.03%, and the conditional effect of F1 (at fixed Duration values) plummeted to 18.6% of its 2016–2018 level. Covariate effects further highlighted period-specific shifts: "Department" (distinguishing Psychology from non-Psychology users) emerged as an increasingly critical predictor (coefficient tripling over the period), while "Reader Type" (Undergraduate/Graduate/Faculty) lost significance post-2019—indicating homogenized borrowing patterns across academic roles, likely due to the rising adoption of digital resources. These trends emphasize that libraries must prioritize discipline-specific services (e.g., curated R-type collections for the Psychology School) and de-emphasize broad role-based categorizations.

Third, title word clustering revealed a clear thematic evolution in R-type book content, mirroring the maturation of psychology and interdisciplinary medical research. From 2016–2018 to 2022–2024, high-frequency words shifted from broad, basic themes (e.g., "anatomy," "family practice") to interdisciplinary integration (e.g., "art + psychological counseling") and finally to modern, application-focused topics (e.g., "anxiety," "counseling practice"). Dimensional variance also became more balanced (e.g., Dimension 1: 30.53% → 21.97%; Dimension 2: 10.47% → 15.45%), reflecting a more structured thematic organization. This trajectory aligns with global trends in medical education (e.g., Wildemuth, 2020) and underscores the need for libraries to update collections to prioritize applied, contemporary content (e.g., materials on modern mental health interventions) while retaining core foundational resources.

Fourth, correlation and survival analyses clarified resource utilization dynamics across R-type subcategories. Correlation results showed weak but significant associations: newer books (shorter Collection Tenure) were marginally more borrowed ($r = -0.069$, $p < 0.001$), and specific R subcategories correlated with

higher borrowing volumes ($r = 0.129$, $p < 0.001$). Survival analysis further identified stark differences in subcategory resilience: R7 ("Clinical Specialized Medicine") exhibited the longest median survival time (4.14 units), while R6 (Surgery) had the shortest (1.67 units). User group borrowing patterns also remained hierarchical (Faculty & Staff > Graduate Students > Undergraduate Students), though all groups showed a "decline-then-recovery" trajectory post-2019, with a shrinking overall reader base and narrowed variability in borrowing behavior. These findings advocate for targeted collection strategies: automatic replenishment for high-survival categories (e.g., R7) and "just-in-time" acquisition for low-survival ones (e.g., R6), alongside retention programs for active borrowers (e.g., personalized recommendations for long-Duration users).

This study illuminates the long-term impact of external contextual shifts on physical book borrowing behavior in a non-medical academic institution. For NNU Library and similar institutions, the key implications are threefold: (1) adopt dynamic, factor-informed resource allocation to align with evolving time-space-interest needs; (2) prioritize discipline-specific and application-focused collections to meet the growing demand for specialized, modern content; and (3) implement user-centric services tailored to high-value groups (e.g., Psychology faculty, long-term borrowers) while re-engaging lapsed users.

While this study provides valuable insights into the borrowing behavior of R-type (Medicine and Hygiene) books at Nanjing Normal University (NNU) Library, it has several limitations that could be addressed in future research to enhance its validity, generalizability, and practical utility. Relies solely on data from NNU Library (a non-medical, teacher-training institution), so findings (e.g., R7 as the core R-type category) may not apply to medical universities or comprehensive institutions with distinct R-type book demand drivers. Omits digital resource usage data, lacks qualitative insights into user motivations, and ignores book-specific attributes (e.g., condition, edition) that may confound borrowing trends. To enhance the rigor and generalizability of future research, two key improvement recommendations are proposed. First, the sample scope should be expanded beyond Nanjing Normal University (NNU) Library. This expansion will help distinguish institution-specific patterns from broader, universal trends in R-type book usage, addressing the current limitation of narrow generalizability. Second, the existing dataset should be supplemented with additional data types to fill critical informational gaps. Digital resource usage metrics—such as e-book downloads, online medical database access, and digital reading duration—should be integrated with physical borrowing data. This will enable analyses to disentangle whether declines in physical borrowing or homogenized user group behavior stem from digital substitution (rather than reduced overall demand).

Availability of data and materials

All the data and supporting information are provided within the article.

Funding

This study is financially supported by the 2025 Teaching Reform Research Project of Jiangsu University Library Working Committee: Research on Demand Identification and Resource Adaptation Based on Readers' Reading Behaviors (2025JTYB39).

Conflict of interest

The authors declare no conflict of interest, financial or otherwise.

References

1. Al Husaini, Z. A. E. (2013). Knowledge, attitude and practice of reading habit among female medical students, Taibah University. Journal of Taibah University Medical Sciences, 8(3), 192–198. https://doi.org/10.1016/j.jtumed.2013.09.004
2. Ali, F. R., Hassan, F., Hasan, S. M. F., Israr, F., Shafiq, Y., & Arshad, H. M. (2015). Perception and attitude of pharmacy students towards learning tools. Pakistan Journal of Pharmaceutical Sciences, 28(6), 2185–2189.
3. Awais, M., Rehman, A., & Baloch, N. U.-A. (2019). Use of portable gadgets in radiology clinical and academic activities: A questionnaire- based, cross-sectional study. Journal of the Pakistan Medical Association, 69(6), 864–868.
4. Beech, N. M. (2010). TL; DR (too long; didn't read) medicine and pocket-sized textbooks. Medical Journal of Australia, 193(11-12), 672. https://doi.org/10.5694/j.1326-5377.2010.tb04100.x
5. Bellini, L. (2001). Medicine and scholarly knowledge in Portugal during the Renaissance. Estudos Ibero-Americanos, 27(1), 43–74. https://doi.org/10.15448/1980-864X.2001.1.24511
6. Bethell, H. J. N., & Brodie, D. (2023). Exercise: A scientific and clinical overview. https://doi.org/10.1079/9781800621855.0000
7. Bhayro, S., Hawley, R., Kessel, G., & Pormann, P. E. (2013). The Syriac Galen Palimpsest: Progress, prospects and problems. Journal of Semitic Studies, 58(1), 131–148. https://doi.org/10.1093/jss/fgs042
8. Bolton, G. (2005). Medicine and literature: writing and reading. Journal of Evaluation in Clinical Practice, 11(2), 171 - 179. https://doi.org/10.1111/j.1365 - 2753.2005.00521.x
9. Brown, C., Peck, S., Humphreys, J., Schoenherr, L., Saks, N. T., Sumser, B., & Elia, G. (2020). COVID-19 Lessons: The Alignment of Palliative Medicine and Trauma-Informed Care. Journal of Pain and Symptom Management, 60(2), e26 – e30. https://doi.org/10.1016/j.jpainsymman.2020.05.014
10. Bülbül, S. H., Misirlioglu, E. D., Ceyhun, G., Araz, N. C., & Altug, U. (2014). Factors affecting reading habit and media follow-up in turkey [Toplumumuzda okuma ali{dotless}şkanli{dotless}ğ̌i{dotless} ve medya takibini etkileyen faktörler]. TAF Preventive Medicine Bulletin, 13(1), 47–56. https://doi.org/10.5455/pmb.1-1361624478
11. Choi, J. E., Kim, D. H., Seo, S. H., Kye, Y. C., & Ahn, H. H. (2014). The suitability of gray-scale electronic readers for dermatology journals. Annals of Dermatology, 26(6), 700–705. https://doi.org/10.5021/ad.2014.26.6.700
12. Cobos - Aguilar, H., Espinosa - Alarcon, P. A., & Viniegra - Velazquez, L. (1998). [Persistence of critical - reading learning in medical residents]. Revista de Investigacion Clinica; Organo del Hospital de Enfermedades de la Nutricion, 50(1), 43 - 46. https://doi.org/10.24875/ric.1998000100007
13. Conway, A. (2017). Medical students in the United States Reveal their ideal expectations to help planners of a new

library. Evidence Based Library and Information Practice, 12(3), 168-171. https://doi.org/10.18438/B82372
14. Dar, M., Knapp, M., Pugl, D., Selwyn, L., & Tench, R. (2022). The Medicine Book. Library Journal, 147(3), 28 – 29. https://doi.org/10.1080/03630277.2022.1999744
15. Deshpande, S. (2003). Reading for doctors. National Medical Journal of India, 16(4), 218–219. https://doi.org/10.4103/0970-258X.10744
16. Dixit, H. (2004). And so to books, for new doctors. National Medical Journal of India, 17(1), 29–30. https://doi.org/10.4103/0970- 258X.12863
17. Duncan, A. R., Jaini, P. A., & Hellman, C. M. (2021). Positive Psychology and Hope as Lifestyle Medicine Modalities in the Therapeutic Encounter: A Narrative Review. American Journal of Lifestyle Medicine, 15(1), 6–13. https://doi.org/10.1177/1559827620908255
18. Farris, S. G., Kibbey, M. M., Fedorenko, E. J., Babu, A. A., Gomez, G., & Smith, J. E. (2022). Psychological Treatment Considerations in Medical Comorbidity. In Comprehensive Clinical Psychology (2nd ed., Vol. 9, pp. 225 – 251). https://doi.org/10.1016/B978-0-12- 818697-8.00195-3
19. Gabbe, S. G. (1996). The alphabet of academic medicine. Obstetrics and Gynecology, 88(3), 479–481. https://doi.org/10.1016/0029- 7844(96)00173-1
20. Garcja Benjtez, C. Q. (2018). Lectura médica y su valor en la educación médica continuada [Medical reading and its value in continuing medical education]. Ginecologja y Obstetricia de México, 86(5), 1. https://doi.org/10.1016/j.gyobfe.2018.03.001
21. Gonzalez-Garcia, M., Cantabrana, B., & Hidalgo, A. (2020). Texts about medicine and health in the daily press. Its potential utility for the acquisition of undergraduate competencies in Medicine and Health Sciences. Spanish Journal of Medical Education, 1(2), 432661. https://doi.org/10.6018/edumed.432661
22. Haykal, D., Berardesca, E., Kabashima, K., & Dréno, B. (2025). Beyond beauty: Neurocosmetics, the skin-brain axis, and the future of emotionally intelligent skincare. Clinics in Dermatology, 43(4), 523–527. https://doi.org/10.1016/j.clindermatol.2025.05.002
23. Jameel, T., Gazzaz, Z. J., Baig, M., Tashkandi, J. M., Alharenth, N. S., Butt, N. S., Shafique, A., & Iftikhar, R. (2019). Medical students' preferences towards learning resources and their study habits at King Abdulaziz University, Jeddah, Saudi Arabia. BMC Research Notes, 12(1), 30. https://doi.org/10.1186/s13104-019-4052-3
24. Jones, P. M. (1995). Reading medicine in Tudor Cambridge. Clio Medica (Amsterdam, Netherlands), 30, 153 – 235. https://doi.org/10.1163/1574-0777_ClioMedica.30.1995.153
25. Kearney, C., Dunne, P., & Wales, W. J. (2020). Entrepreneurial orientation and burnout among healthcare professionals. Journal of Health Organization and Management, 34(1), 16–22. https://doi.org/10.1108/JHOM-09-2019-0259
26. Kendirci, M. (2013). How to write a medical book chapter? Turkish Journal of Urology, 39(Suppl 1), 37 – 40. https://doi.org/10.5152/tud.2013.052
27. Kern de Castro, E., & Reis, M. (2025). Contributions of Health Psychology to Climate Change: A Review. International Journal of Environmental Research and Public Health, 22(4), 634. https://doi.org/10.3390/ijerph22040634
28. Li, S., Zheng, M. - H., & Fingerhut, A. (2024). Reading and analyzing the medical literature should be methodic. Annals of Laparoscopic and Endoscopic Surgery, 9, 1 - 4. https://doi.org/10.21037/ales - 23 - 29
29. Li, W., Yang, L., Xu, K., Zeng, L., & Zhang, Y. (2020). How to become a doctor? Collation and Reflection on the theory of related medical principles in the preface and postscript of ancient medical books. Chinese Journal of Basic Medicine in Traditional Chinese Medicine, 26(1), 8 - 10. https://doi.org/10.13705/j.issn.1006 - 3250.2020.01.003
30. McCall, T. (2022). Anatomical Icon: Dissection Scenes in Manuscript and Print, circa 1350 – 1550. Know, 6(1), 7 – 46. https://doi.org/10.1086/718530
31. Melssen, M. (2012). Low response rate and other factors render academic health science library system study ungeneralizable. Evidence Based Library and Information Practice, 7(2), 87–90. https://doi.org/10.18438/b8131g
32. Mengelkoch, S., Miryam Schüssler-Fiorenza Rose, S., Lautman, Z., Alley, J. C., Roos, L. G., Ehlert, B., Moriarity, D. P., Lancaster, S., Snyder, M. P., & Slavich, G. M. (2023). Multi-omics approaches in psychoneuroimmunology and health research: Conceptual considerations and methodological recommendations. Brain, Behavior, and Immunity, 114, 475–487. https://doi.org/10.1016/j.bbi.2023.07.022
33. Nair, K. R. (2003). Books a doctor must read. National Medical Journal of India, 16(5), 272 – 274. https://doi.org/10.4103/0970- 258X.10965
34. Naz, A. S., Rehman, R., Katpar, S. J., & Hussain, M. (2014). Intellectual wellness awareness: A neglected area in medical universities of Pakistan. Journal of the Pakistan Medical Association, 64(9), 993-997.
35. Nguyen, K. X., Tran, T. V., Nghiem, T. D., Tran, T. N., Ta, T. B., Van Nguyen, B., Le, T. D., Nguyen, S. T., Nguyen, K. T., Dinh, H. T., Pho, D. C., Duy, T. N., & Toan, P. Q. (2023). Relationship Between Metacognitive Awareness of Undergraduate Students and Students' Academic Performance at Vietnam Military Medical University. Advances in Medical Education and Practice, 14, 791-801. https://doi.org/10.2147/AMEP.S412912
36. Nicoud, M. (2024). The Western Medieval Medical Literature, its Books and Readership: A Complex Reality. Medicina Nei Secoli, 36(1), 81–101. https://doi.org/10.13133/2531-7288/2898
37. Pisanu, P., Lucchetti, D., Lucchetti, D., Contu, N., & Saraceni, V. M. (2023). The experience of COVID-19 ward's patients: A narrative medicine approach. Italian Journal of Medicine, 17(1), 1602. https://doi.org/10.4081/ITJM.2023.1602
38. Podgurski, L., Chammas, D., Brenner, K. O., Rosenberg, L. B., Goyal, N. G., Lapid, M. I., Morris, S. E., Pirl, W. F., Sumser, B., Thompson, B. W., Wright, L., & Shalev, D. (2025). Primary Mental Health Competencies for Hospice

and Palliative Medicine Physicians: A Delphi Study. Journal of Pain and Symptom Management, 70(3), 239–247.e8. https://doi.org/10.1016/j.jpainsymman.2025.05.009

39. Rozman, C. (1998, September 19). [Internal medicine textbooks: past, present, and future] (Sobre los textos de Medicina Interna: pasado, presente y futuro). Medicina Cljnica, 111(8), 298–301. https://doi.org/10.1016/s0025-7753(98)70069-6
40. Ruttimann, B. (1986). Popular medical literature in days of yore (Popular-medizinische Schriften von Anno dazumal). Schweizerische Medizinische Wochenschrift, 116(22), 745–750. https://doi.org/10.4414/smw.1986.11622
41. Scala, E., Megna, M., Amerio, P., Argenziano, G., Babino, G., Bardazzi, F., Bianchi, L., Caldarola, G., Campanati, A., Cannavò, S. P., Chiricozzi, A., Conti, A., Damiani, G., Dapavo, P., De Simone, C., Esposito, M., Fabbrocini, G., Fargnoli, M. C., Ferrara, F., ... Balato, A. (2020). Patients' demographic and socioeconomic characteristics influence the therapeutic decision-making process in psoriasis. PLoS ONE, 15(8), e0237267. https://doi.org/10.1371/journal.pone.0237267
42. Sears, S. F., Anthony, S., Harrell, R., Tripp, C., Bowman, J., Khan, S., & Naniwadekar, A. (2022). Managing Atrial Fibrillation: The Intersection of Cardiology, Health Psychology, and the Patient Experience. Health Psychology, 41(10), 792 – 802. https://doi.org/10.1037/hea0001135
43. Sebastian, S., Franco, A., & Mânica, S. (2023). Intersection of forensic odontology and psychology. Journal of Forensic Odonto- Stomatology, 41(1), 2–18.
44. Setia, S., Loo, E., Shinde, S. P., Singh, M., Wong, C. H., & Thakkar, K. (2024). Redefining the Role of Medical Affairs Professionals as Innovators and Leaders in Industry-Led Medical Education. Pharmaceutical Medicine, 38(3), 167–177. https://doi.org/10.1007/s40290- 024-00522-1
45. Sirridge, M., & Welch, K. (2003). The program in medical humanities at the University of Missouri - Kansas City School of Medicine. Academic Medicine, 78(10), 973 - 976. https://doi.org/10.1097/00001888 - 200310000 - 00006
46. Tian, H., & Liu, J. (2021). Content Analysis and Characteristics of Preface and Postscript of Ancient Medical Books. Chinese Journal of Basic Medicine in Traditional Chinese Medicine, 27(10), 1575 - 1577. https://doi.org/10.13705/j.issn.1006 - 3250.2021.10.023
47. Vakoch, D. A., Pollock, J. C., & Caleb, A. M. (2023). COVID Communication: Exploring Pandemic Discourse. Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-031-27665-1
48. Verduin, M. L., & Tower, K. (2024). Cultivating Common Ground: The Intersection of Mental Health and Faith. Academic Medicine, 99(12), 1328–1331. https://doi.org/10.1097/ACM.0000000000005846
49. Wildemuth, B. M. (2020). The types of publications read by finnish scholars vary with their purposes for reading. Evidence Based Library and Information Practice, 15(1), 229-232. https://doi.org/10.18438/EBLIP29667
50. Zellmann-Rohrer, M. W., & Love, E. O. D. (2022). Traditions in Transmission: The Medical and Magical Texts of a Fourth-Century Greek and Coptic Codex (Michigan Ms. 136) in Context. De Gruyter. https://doi.org/10.1515/9783110778915