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ARTICLE

Exploring Recovery through Life Narratives in Psychiatric Home-Visit Nursing: A Natural Language Processing Approach Using BERTopic

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ABSTRACT: Background: In mental health, recovery is emphasized, and qualitative analyses of service users' narratives have accumulated; however, while qualitative approaches excel at capturing rich context and generating new concepts, they are limited in generalizability and feasible data volume. This study aimed to quantify the subjective life history narratives of users of psychiatric home-visit nursing using natural language processing (NLP) and to clarify the relationships between linguistic features and recovery-related indicators. **Methods:** We conducted audio-recorded and transcribed semi-structured interviews on daily life verbatim and collected self-report questionnaires (Recovery Assessment Scale [RAS]) and clinician ratings (Global Assessment of Functioning [GAF]) from Japanese users of psychiatric home-visit nursing. Using the artificial intelligence-based topic-modeling method BERTopic, we extracted topics from the interview texts and calculated each participant's topic proportions, and then examined associations between topic proportions and recovery-related indicators using Pearson correlation analyses. **Results:** "School" showed a significant positive correlation with RAS (r = 0.39, $p = 0.05$), whereas "Family" showed a significant negative correlation (r = −0.46, $p = 0.02$). GAF was positively correlated with word count (r = 0.44, $p = 0.02$) and "Hospital" (r = 0.42, $p = 0.03$), and negatively correlated with "Backchannels" (aizuchi) (r = −0.41, $p = 0.03$). **Conclusion:** The present results suggest that the quantity, quality, and content of narratives can serve as useful indicators of mental health and recovery, and that objective NLP-based analysis of service users' narratives can complement traditional self-report scales and clinician ratings to inform the design of recovery-oriented care in psychiatric home-visit nursing.

KEYWORDS: Personal recovery; life history narratives; natural language processing; psychiatric home-visit nursing; artificial intelligence

1 Introduction

In the field of mental health, the concept of recovery has received increasing emphasis. Recovery consists of two dimensions: clinical recovery and personal recovery [1]. The former refers to improvement based on clinical, objective indicators such as diagnosis, symptom remission, and rehospitalization, whereas personal recovery, proposed by Anthony [2], refers to a subjective process of reclaiming hope and one's sense of self and reconstructing a meaningful life beyond the mere presence or absence of symptoms. A systematic review identified five key components—Connectedness, Hope, Identity, Meaning, and Empowerment—which are widely cited as the CHIME framework [3].

1.1 Mental Health Support in Japan: Psychiatric Home-Visit Nursing

As health systems have moved away from institutional care, community mental health services have developed internationally, and outreach in people's living environments has become more prevalent [4]. In Japan, psychiatric home-visit nursing is a representative outreach service within community mental health. Provided under the national health insurance scheme, nurses, occupational therapists, and psychiatric social workers deliver support in service users' homes. The scope of care is broad, ranging from psychological support to assistance with activities of daily living, support for employment and social participation, daytime leisure activities, and family support. Qualitative evidence from staff and users indicates that psychiatric home-visit nursing, marked by acceptance, equal partnership, expansion of clients' worlds, future-oriented care, and support for hobbies and empowerment, aligns with personal recovery [5,6].

1.2 Measuring Recovery and Leveraging Narratives

To enhance the quality of recovery-oriented support in mental health, international research has sought to clarify the concept of recovery and develop its assessment. Service users' narratives have played a central role, with knowledge accumulating through qualitative analyses by experts. Indeed, the very definition of recovery has emerged from narrative research that synthesizes the lived experiences of people with mental disorders, positioning narrative as indispensable for understanding and practicing recovery [2,7]. The CHIME framework arises from an integration of qualitative studies grounded in the accounts of service users [3]. These frameworks rest on a substantial body of interview-based and first-person research. For example, Davidson and colleagues, drawing on in-depth interviews and qualitative analyses with people living with schizophrenia and other serious mental illnesses, have shown that recovery in-volves reconstructing a valued sense of self, renegotiating relationships with mental health services, and reclaiming everyday roles and citizenship in the community [8,9]. Similarly, classic first-person and narrative accounts of recovery, such as those by Anthony and Deegan, highlight themes of hope, meaning, and active self-determination in building a life beyond illness [2,10]. In this sense, qualitative research has provided a foundational empirical and conceptual basis for existing recovery frameworks. At the same time, qualitative analysis has limitations. While it excels at grasping rich context and generating new concepts, generalization is difficult and the volume of analyzable data is constrained [11]. As a complementary quantitative approach, Recovery Assessment Scale (RAS) [12] has been widely used. However, the RAS depends on self-evaluation at a single point in time and may insufficiently reflect aspects of social participation and narrative [13].

1.3 Quantifying Mental Disorders Using Natural Language Processing (NLP)

A key challenge in mental health, including recovery research, is the difficulty of quantitatively analyzing subjective narratives. In response to this challenge, NLP has attracted attention. NLP refers to computational methods that enable machines to understand and analyze natural languages. Across studies of schizophrenia and mood disorders, reduced speech output, impoverished vocabulary, and semantic fragmentation are associated with poorer social functioning and outcomes, and measures such as discourse coherence and the frequency of emotion words correlate significantly with clinician-rated symptom scales [14–16]. Although diagnosis and assessment have traditionally relied on questionnaires and clinician observation, growing evidence that patients' speech and conversations can yield clinical insights suggests that NLP can provide new objective indicators that complement these subjective approaches.

1.4 Artificial Intelligence (AI)-Based Text Analysis: BERTopic

This study focuses on BERTopic [17], an AI-based method built upon Bidirectional Encoder Representations from Transformers (BERT) [18]. Unlike simple word counts, BERT captures context-dependent meaning.

Applying BERT to topic extraction yields BERTopic, which can infer the themes of texts while taking context into account. Using BERTopic, a study analyzing mental-health helpline conversations reported more interpretable topic structures and superior performance compared with non-contextual baselines [19]. Another study found that narratives by individuals with severe mental illness included more food-related topics with positive sentiment than those of healthy controls [20]. Together, these findings suggest that BERTopic is a promising approach in the mental health domain.

1.5 Potential of BERTopic for Recovery Analysis

With respect to quantifying recovery, studies have analyzed social media posts using topic modeling. Sik et al. [21] identified intimacy, social criticism, and despair as novel recovery-related topics. However, social media posts are fragmentary and insufficient for capturing the recovery process as a whole. Applying NLP to life history narratives told by service users may objectively quantify subjective experiences and reveal aspects of recovery not fully captured by existing scales or qualitative frameworks. In particular, analyzing the structure of narratives spanning past to future is expected to offer a new perspective that complements prior research.

1.6 Objectives

The objectives of this exploratory study were to quantify the subjective life history narratives of psychiatric home-visit nursing users using NLP and to clarify how linguistic features relate to recovery-related indicators.

This study is significant in that it treats service users' life history narratives themselves as quantitative data. This approach goes beyond methods that rely only on questionnaires or conventional qualitative analysis and makes it possible to view recovery from several complementary perspectives. By examining how linguistic features are related to measures of outcome domains relevant to recovery, including mental health status, global functioning, social functioning, and subjective recovery, we can explore how different aspects of recovery are reflected in the ways people talk about their lives. Furthermore, because life history narratives naturally include memories of the past, awareness of the present, and expectations for the future, they can provide, even in a cross-sectional study, an overall picture of the recovery process. By using NLP, this study seeks to capture service users' experiences in a way that does not depend on clinicians' subjective judgment, and aims to contribute to new developments in recovery research and in recovery-oriented clinical practice and evaluation, particularly in community-based services such as psychiatric home-visit nursing.

2 Methods

This cross-sectional study examined the relationship between life history interviews and recovery-related questionnaires among users of psychiatric home-visit nursing services.

2.1 Participants

Data were obtained from Kusunoki Mental Hospital, Specific Medical Corporation Kusunokikai, a psychiatric hospital in Japan. This hospital is a psychiatric specialty institution that provides inpatient and outpatient services, including outpatient consultation, psychiatric home-visit nursing, ambulatory psychotherapy, and psychiatric rehabilitation. Users of the hospital's psychiatric home-visit nursing service, which offers care comparable to typical services in Japan and is delivered at home by nurses and occupational therapist, were targeted in this study. All users had a psychiatric diagnosis and were outpatients of the hospital. The inclusion criteria were: age $\geq$ 18 years; a diagnosis classified under Mental, Behavioural or

Neurodevelopmental disorders in the International Classification of Diseases 11th Revision (ICD-11) [22]; current use of psychiatric home-visit nursing services; and informed consent provided by the participant and their primary physician. The exclusion criteria were: difficulty understanding an interview conducted in Japanese; and prominent symptoms such as delusions that would preclude appropriate understanding of the study and provision of consent. Recruitment took place from August 2024 to March 2025. This study was approved in 2024 by the Research Ethics Committee of the Kusunoki Mental Hospital, Specific Medical Corporation Kusunokikai, Japan (approval No. 2024-0001). All participants received oral and written explanations regarding the study purpose and methods and provided informed consent.

2.2 Data Collection

2.2.1 Demographic and Medical Data

From medical records, we obtained the participants' age, sex, diagnosis, duration of psychiatric service use, education level, marital status, cohabiting family, employment status, and Global Assessment of Functioning (GAF) scores [23].

2.2.2 Questionnaire Data

Three self-administered questionnaires were completed. After the interview, participants were given the questionnaires in paper-and-pencil format and asked to complete them at home before the next psychiatric home-visit nursing session, which was usually scheduled one week later. The completed questionnaires were collected by the home-visit staff at the subsequent visit, and any questions that participants had about completing the forms were addressed at that time. The first was the RAS [12], a 24-item, five-point scale on which higher total scores indicate more advanced recovery. The reliability and validity of the Japanese version of the RAS have been confirmed [24]. The second was the Social Functioning Scale (SFS) [25], a 78-item self-report instrument assessing a broad range of social functioning variables. Items are rated, for example, on four-point scales for frequency and adequacy, with higher total scores indicating better social functioning. The reliability and validity of the Japanese version of the SFS have been confirmed [26]. The third was the General Health Questionnaire-30 (GHQ-30) [27], a 30-item, four-point scale on which higher scores indicate poorer mental health. The reliability and validity of the Japanese version of the GHQ-30 have been confirmed [28].

2.2.3 Interview Data

We conducted semi-structured interviews using the Occupational Performance History Interview-II (OPHI-II) [29], a 45–60-min life history interview comprising about 50 recommended questions on roles, routines, environments (home/workplace), activity choices, significant life events, and future expectations; selected examples appear in Table 1. Interviews were conducted after the home-visit session by two occupational therapists from the home-visit department, each of whom had ≥5 years of psychiatric clinical experience, a master's degree or higher, and prior OPHI-II use. As routine psychiatric home-visit providers, they maintained therapeutic relationships with the participants and regularly provided conversation and day-to-day support, which facilitated detailed life history narratives. To enhance the comfort and recall of daily contexts, all interviews were conducted in the participants' homes and were audio-recorded after obtaining consent.

Table 1: Example questions for the semi-structured interviews (OPHI-II: Occupational Performance History Interview-II).

Roles
Do you currently occupy the role of a worker (student/caregiver)? What kind of worker (student/caregiver) do you think you are? Outside of work or study, do you belong to or participate in any groups?
Daily routine
Please describe a typical day in your life. What is the most important part of your daily routine? Which parts of your routine would you like to change?
Environment
What is "home" like for you? How are things with the people you live with? What is your place of work (day program/school) like?
Activity choices
Why did you choose this place of work (day program/school)? Has anything repeatedly gotten in the way of the things you want to do? Have you ever set goals or made plans for the future?
Major life events and changes, successes and failures, experiences, and future expectations
When did your life undergo a major change? What has been the greatest success (or failure) in your life? If you could change the future in the way you hope, what would you like to be doing?

2.3 Data Analysis

Data analysis comprised text preprocessing, use of a sentiment dictionary, topic modeling, and statistical analyses examining relationships between recovery-related measures and interview data.

2.3.1 Text Preprocessing

The audio recordings were transcribed using AutoMemo (Sourcenext Corporation, Tokyo, Japan), which incorporates Whisper [30]. The interviewers reviewed and corrected the transcripts, with AutoMemo serving as an assistive tool. Only the utterances of the participants were analyzed. Then, personal names and other identifiers were anonymized. In addition, because Japanese does not use whitespace to separate words, morphological analysis is essential. Therefore, we used MeCab [31] for tokenization.

2.3.2 Sentiment Dictionary: Linguistic Inquiry and Word Count (LIWC)

As one means of quantifying text, we used LIWC [32]. The Japanese version, J-LIWC [33], contains 11,600 words annotated with membership in 69 categories. We adopted four categories: Positive Emotion and Negative Emotion (to capture valence), Biological Processes (potentially related to symptoms), and Social (potentially related to recovery). For each category, we computed the proportion of words belonging to that category within each participant's utterances.

2.3.3 Topic Modeling: BERTopic

Topic modeling was performed using BERTopic, which is well-suited for data with an unknown cluster structure because it does not require prespecifying the number of clusters. Unlike traditional topic models such as Latent Dirichlet Allocation (LDA), which treat documents as unordered bags of words and identify

topics based on patterns of word co-occurrence, BERTopic represents each sentence as a high-dimensional vector that captures its meaning in context. In this vector space, sentences that are semantically similar are located close to each other even if they do not share many surface words, and clusters of these sentence embeddings are then interpreted as topics. This context-sensitive representation is particularly suitable for conversational clinical narratives, where subtle differences in phrasing and word choice can be important for interpreting meaning.

We implemented BERTopic as follows. First, sentences from the interviews were embedded into 768-dimensional vectors using Sentence-BERT (sonoisa/sentence-bert-base-ja-mean-tokens-v2) [34]. Next, to improve clustering performance, we reduced dimensionality to five using uniform manifold approximation and projection (UMAP) [35], and then applied hierarchical density-based spatial clustering of applications with noise (HDBSCAN) [36]. We set the minimum number of sentences per cluster to 100, allowing semantically similar content within narratives to be grouped automatically.

After clustering, we inferred each cluster's topic based on representative words and sentences. Representative words (nouns, adjectives, verbs) characteristic of each cluster were extracted using class-based term frequency–inverse document frequency, which identifies words specific to a given cluster relative to others. Representative sentences were selected by cosine similarity to the cluster centroid. Researchers—including the interviewers, who are also clinicians—reviewed the representative words and sentences, discussed the meaning of each cluster, and assigned topic labels by consensus. The proportion of the narrative assigned to each topic was then calculated for each participant. Finally, to complement the results of BERTopic, we assessed the sentiment tendencies of words within each topic using J-LIWC. Adding sentiment to BERTopic outputs has been shown to improve interpretability [20]. For Positive Emotion and Negative Emotion, we computed topic-wise occurrence rates and calculated the positive/negative (P/N) ratio by dividing the positive rate by the negative rate. Values > 1 indicate predominantly positive content, whereas values < 1 indicate predominantly negative content.

2.3.4 Statistical Analysis

We examined associations between J-LIWC category proportions and BERTopic topic proportions and scores on recovery-related measures (RAS, SFS, GHQ-30, GAF) using Pearson correlation tests. First, we tested correlations between the proportions of Positive Emotion, Negative Emotion, Biological Processes, and Social categories and RAS, SFS, GHQ-30, and GAF. This assessed how emotional valence (P/N) and psychosocial lexical tendencies (biological/social) in life history narratives relate to recovery measures. Next, we tested correlations between the proportions of BERTopic-derived topics and the same outcome measures, thereby examining how latent topics in life history narratives relate to recovery. All NLP and statistical analyses were conducted in Python 3.10 (Python Software Foundation) [37], with the significance level set at 0.05.

3 Results

We analyzed data from 27 participants. Details regarding demographics/medical data, questionnaire data, interview data, and statistical results are summarized below.

3.1 Demographic, Medical, and Questionnaire Data

The mean age of the participants was 58.6 years (standard deviation [SD] = 14.5); 10 (37.0%) were men and 17 (63.0%) were women. Diagnoses were schizophrenia (6A2) in 10 (37.0%), bipolar disorder (6A6) in 6 (22.2%), depression (6A7) in 6 (22.2%), and other (e.g., neurodevelopmental or substance use disorders) in 5

(18.5%). Mean questionnaire scores were 79.1 for RAS (SD = 18.0), 31.1 for GHQ-30 (SD = 16.7), and 110.4 for SFS (SD = 23.5). More details can be seen in Table 2.

Table 2: Participant demographic and clinical characteristics and questionnaire/interview data (n = 27).

Characteristic	n (%)/mean (SD)
Age (years), mean (SD)	58.6 (14.5)
Sex, n (%)	
Male	10 (37.0%)
Female	17 (63.0%)
Diagnosis, n (%)	
Schizophrenia	10 (37.0%)
Bipolar disorder	6 (22.2%)
Depression	6 (22.2%)
Other (e.g., neurodevelopmental disorder, substance use disorder)	5 (18.5%)
Duration of psychiatric service use (years), mean (SD)	22.4 (13.2)
Education level (years), mean (SD)	12.6 (2.5)
Marital status, n (%)	
Never married	12 (44.4%)
Married	3 (11.1%)
Divorced/widowed	12 (44.4%)
Living with family, n (%)	
No	18 (66.7%)
Yes	9 (33.3%)
Employment status, n (%)	
Unemployed	19 (70.4%)
Employed	8 (29.6%)
GAF (points), mean (SD)	64.8 (7.4)
RAS (points), mean (SD)	79.1 (18.0)
SFS (points), mean (SD)	110.4 (23.5)
GHQ-30 (points), mean (SD)	31.1 (16.7)
Interview duration (minutes), mean (SD)	58.0 (12.6)
Number of utterances, mean (SD)	228.6 (61.4)
Number of words, mean (SD)	5353.0 (2254.7)

Abbreviations: SD, standard deviation; Employed, includes non-regular employment and supported employment programs; GAF, Global Assessment of Functioning; RAS, Recovery Assessment Scale; SFS, Social Functioning Scale; GHQ-30, General Health Questionnaire-30.

3.2 Interview Data

The mean interview duration was 58.0 min (SD = 12.6). Participants produced an average of 228.6 utterances (SD = 61.4) and 5353.0 words (SD = 2254.7). BERTopic identified 12 topics. The total number of utterances assigned to topics was 3824, accounting for 62.0% of all utterances; hence, 38% were unassigned. Although the proportion of unassigned items depends on parameter settings, prior research reports approximately 20%–50% or higher [19,38–40]. For conversations or short texts, 10–20 topics are commonly used to ensure interpretability [19,41,42]. The indices in the present study fall within these ranges.

The 12 topics were: Backchannels (aizuchi) (non–self-initiated responses to the interviewer; P/N ratio = 0.05), Thinking (utterances with unclear purpose; 9.87), Physical condition (primarily health complaints; 0.24), Eating (interest in food and routines; 5.13), School (recollections of learning and experiences; 9.34), Sleep (routines and bodily sensations; 0.81), Family (family history and parent–child conflict; 0.99), Conversation (awareness of speaking and relations with others; 2.44), Work (experiences of employment; 3.07), Hobbies (leisure including creative activity and learning; 4.11), Housework (routines to maintain daily life and perceived burden; 2.21), and Hospital (engagement with healthcare and its impact; 0.21). Further details can be seen in Supplementary Materials S1, characteristic words and exemplar sentences in Table 3, and word counts and sentiment tendencies in Table 4.

Table 3: Characteristic words and exemplar utterances for each topic based on BERTopic.

Topic 1. Backchannels: minimal, noninitiated responses to the interviewer	
Top terms: edge, circle, patrol, Bible, cold, winter, point, above	
Exemplar utterances:	Yeah, none.
	Not at all.
	Of course.
Topic 2. Thinking: statements with unclear aims or purposes	
Top terms: good, think, thought, oneself, now, idea, feel, feelings, experience	
Exemplar utterances:	I'd like to keep going like that if I can.
	I know I should get myself together, but I just can't get motivated.
	I'm still not quite feeling up to it yet.
Topic 3. Physical condition: mainly feeling unwell	
Top terms: impossible, think, person, thought, bad, no good, mood, self, worse, say	
Exemplar utterances:	My body feels worn out, so I'm not sure I can do it.
	How should I put it? If I'm feeling down, I don't know how it'll go.
	I still get tired sometimes, but I think I've become more able to do things.
Topic 4. Eating: interest in food and daily routines	
Top terms: eat, rice/meal, time, eating, make, cooking, meal, drink, go, day	
Exemplar utterances:	I don't eat a lot, so I try to eat properly here.
	At lunch, instead of serving myself, they weigh it out in grams for me.
	I like not being tied to set times.
Topic 5. School: recollections of learning and experiences	
Top terms: study, high school, school, university, graduation, go, employment, fun, junior high, student	
Exemplar utterances:	High school was fun.
	When I went to high school, I discovered how interesting school could be.
	Junior high was good for me.
Topic 6. Sleep: narratives about routine and bodily sensations	
Top terms: sleep, go to bed, morning, time, get up, can't sleep, night, nap, daytime, day	
Exemplar utterances:	I usually get up around six in the morning and go to bed around ten at night.
	As for naps—these days, not so much.
	When I'm really tired, I go to bed around nine; if I'm not sleepy, around two.
Topic 7. Family: parent–child conflict and family history	
Top terms: mother, father, child, daughter, son, aunt, kids, home, for me, parent	
Exemplar utterances:	My mother probably had a lot going on because of my father.
	The Child Guidance Center still hasn't said, "You can have (the child) back."
	My grandpa was quiet, but my dad was overinvolved.
Topic 8. Conversation: awareness of talking and relations with others	
Top terms: listen, talk, people, chat, consult, conversation, say, speak, tell, talking	
Exemplar utterances:	What I gained is…I realized people actually approach me more than I thought.
	Once I start talking I can't stop, so I usually keep quiet.
	I chat about all sorts of things.
Topic 9. Work: narratives about employment	
Top terms: work, tasks, office work, worked, part-time job, do, people, working, company, factory	
Exemplar utterances:	I'd like to work a bit more.
	I used to have a job.
	As for work—yes, I do have one.
Topic 10. Hobbies: leisure activities including creative work and learning	
Top terms: music, book, drawing, song, guitar, read, watch, paint/draw, newspaper, radio	
Exemplar utterances:	I'm self-taught—I've never studied music with a proper teacher.
	I listen to music, do coloring, and lately I spend time folding origami.
	While reading, I sometimes realize, "Oh, so that's how to play it."
Topic 11. Housework: daily maintenance and sense of burden	
Top terms: cleaning, laundry, vacuum, bath, day, toilet, do, wash, take, time	
Exemplar utterances:	I don't really like it, but I vacuum and clean the toilet once a day.
	I do the laundry, but I hardly manage to clean.
	Cleaning the shower room and the dryer in the washer was pretty tough.

Table 3: *Cont.*

Topic 12. Hospital: engagement with health care and its impact	
Top terms: hospital, admission, discharge, go, illness, visit, tooth, nursing, for me, doctor	
Exemplar utterances:	That led me to go to a psychiatric hospital.
	I ended up being hospitalized—it had an impact.
	If anything counts as a success, it's that I was able to start working after leaving the psychiatric hospital.

Note: Top terms are English translations of the original Japanese tokens identified by BERTopic.

Table 4: Word counts and sentiment tendencies by topic based on BERTopic.

Topic	Utterances (count)	Word Count	Positive (%)	Negative (%)	P/N Ratio
Backchannels	1087	3930	0.06	1.19	0.05
Thinking	569	10,823	7.91	0.80	9.87
Physical condition	355	8842	1.70	7.19	0.24
Eating	406	17,464	2.83	0.55	5.13
School	204	4844	2.68	0.29	9.34
Sleep	202	4422	0.97	1.20	0.81
Family	165	6745	1.81	1.83	0.99
Conversation	163	3768	2.48	1.01	2.44
Work	208	6079	3.31	1.08	3.07
Hobbies	192	6727	3.04	0.74	4.11
Housework	169	5829	2.07	0.94	2.21
Hospital	104	3155	0.34	1.67	0.21

Note: Positive = occurrence rate of words in the J-LIWC "Positive Emotion" category, Negative = occurrence rate of words in the J-LIWC "Negative Emotion" category, P/N ratio = Positive/Negative (values > 1 indicate positive-dominant; <1 negative-dominant).

3.3 Statistical Analysis

Topic 5 (School) showed significant positive correlations with RAS (r = 0.39, $p = 0.05$) and SFS (r = 0.57, $p < 0.01$). Topic 7 (Family) was negatively correlated with RAS (r = −0.46, $p = 0.02$). Regarding GAF, total word count (r = 0.44, $p = 0.02$) and topic 12 (Hospital) (r = 0.42, $p = 0.03$) were positively correlated, whereas Negative Emotion in J-LIWC (r = −0.49, $p = 0.01$) and topic 1 (Backchannels) (r = −0.41, $p = 0.03$) were negatively correlated. In addition, Positive Emotion in J-LIWC showed a significant negative correlation with GHQ-30 (r = −0.44, $p = 0.02$). The results of the correlation analyses among demographics, J-LIWC category proportions, BERTopic topic proportions, and recovery-related measures are summarized in Table 5.

Table 5: Results of statistical analyses using Pearson's correlation coefficients.

Variables	RAS		SFS		GHQ-30		GAF	
	r	*p*	r	*p*	r	*p*	r	*p*
Basic characteristics								
Age	−0.17	0.39	−0.24	0.23	−0.12	0.56	0.28	0.16
Duration of psychiatric service use	0.01	0.21	−0.21	0.36	0.16	0.44	−0.16	0.42
Number of utterances	−0.22	0.26	−0.20	0.31	−0.19	0.34	−0.19	0.35
Number of words	−0.02	0.92	0.23	0.25	0.17	0.41	0.44	0.02*
J-LIWC								
Positive	0.14	0.49	−0.03	0.88	−0.44	0.02*	0.05	0.81
Negative	−0.15	0.44	−0.27	0.18	−0.09	0.67	−0.49	0.01*
Biological processes	0.01	0.96	−0.35	0.07	−0.20	0.32	−0.05	0.80
Social processes	−0.18	0.38	−0.15	0.45	0.17	0.39	−0.07	0.73

Table 5: *Cont.*

Variables	RAS		SFS		GHQ-30		GAF	
	r	*p*	r	*p*	r	*p*	r	*p*
BERTopic								
Backchannels	−0.19	0.35	−0.05	0.81	−0.02	0.91	−0.41	0.03*
Thinking	0.02	0.92	−0.09	0.65	0.05	0.79	−0.02	0.93
Physical condition	0.01	0.96	−0.09	0.66	−0.04	0.85	0.00	0.99
Eating	0.07	0.73	0.08	0.69	−0.07	0.75	0.34	0.08
School	0.39	0.05*	0.57	<0.001***	−0.07	0.71	0.07	0.73
Sleep	0.02	0.94	−0.06	0.76	0.06	0.76	−0.15	0.45
Family	−0.46	0.02*	−0.27	0.17	0.16	0.44	−0.22	0.08
Conversation	−0.13	0.53	−0.08	0.71	0.19	0.34	0.02	0.90
Work	0.30	0.13	0.32	0.11	−0.22	0.27	0.11	0.58
Hobbies	−0.04	0.84	−0.06	0.78	0.12	0.56	0.12	0.55
Housework	0.18	0.36	0.13	0.53	0.17	0.41	0.35	0.08
Hospital	−0.01	0.94	0.17	0.39	−0.04	0.85	0.42	0.03*

Note: r = Pearson's correlation coefficients, p = p-value, $^{*}p < 0.05$, $^{***}p < 0.001$. Abbreviations: RAS, Recovery Assessment Scale; SFS, Social Functioning Scale; GHQ-30, General Health Questionnaire-30; GAF, Global Assessment of Functioning.

4 Discussion

This exploratory study quantified life history interview narratives of users of psychiatric home-visit nursing using NLP and examined how linguistic features relate to recovery-related indicators. We found that a higher proportion of the School topic was associated with higher subjective recovery and social functioning, whereas a higher proportion of the Family topic was associated with lower subjective recovery. In addition, linguistic features reflecting emotional tone and the quantity and spontaneity of speech were related to mental health status and global functioning: greater use of positive emotion words was associated with better mental health, whereas greater use of negative emotion words, more backchannels, and shorter narratives were associated with lower clinician-rated functioning, while a higher proportion of the Hospital topic was associated with higher functioning.

4.1 Linguistic Features and Personal Recovery

4.1.1 Narratives of School Experiences and Recovery

A proportion of the School topic was positively associated with RAS, implying that more talk about school experiences may reflect higher subjective recovery. Content within the School topic also tended to show a positive sentiment. Positive meaning-making school experiences may reflect important psychosocial processes in recovery. Positive recollections of interpersonal relations and achievement in school have been linked to identity development and self-efficacy in adulthood [43], corresponding to the Identity and Empowerment elements of CHIME. Reinterpreting past experiences affirmatively and integrating them into one's life story strengthens Meaning and Hope and may promote recovery [44]. Thus, positive recollections within the School topic can be seen as not only reminiscence, but also resources that support recovery through self-understanding and active meaning-making. Moreover, supportive relationships and a sense of belonging at school are re-ported to act as protective factors for long-term mental health, even among those with adverse experiences [45]. The positive discourse observed in the School topic aligns with these findings and suggests that positive experiences through schooling may contribute to recovery.

4.1.2 Narratives of Family Relationships and Recovery

The Family topic was associated with lower RAS scores, suggesting that more talk about the family may reflect lower subjective recovery. This topic showed a slight tendency toward negative sentiment. Family

involvement strongly influences recovery in mental disorders. High expressed emotion (EE)—characterized by criticism and hostility—and family conflict or lack of support can diminish hope and self-efficacy and hinder recovery [46]. Thus, while the family can be a source of support, it may also become a significant barrier, depending on its quality. In Japan's sociocultural context, co-residence with parents into adulthood is not uncommon [47], and compared with peers living apart from their parents, psychological preparedness for adult role transitions may be relatively low [48]. Where family is the only or primary resource and connections beyond family are limited, a higher proportion of family-related narratives may track with lower recovery. Social isolation has been reported to be associated with the onset of mental disorders in Japan [49], consistent with Connectedness in the CHIME framework. The relative abundance of family-related talk in our data may therefore reflect narrower psychological and social networks.

4.2 Linguistic Features and Mental Health, Global Functioning, and Social Functioning

In interpreting these findings, it is important to note that personal recovery, mental health status, global functioning, and social functioning were treated as related but distinct constructs in this study. Mental health status was assessed by the GHQ-30, global functioning by the GAF, social functioning by the SFS, and personal recovery by the RAS. Accordingly, the associations involving emotion words, backchannels, and narrative length primarily reflect current mental health status and overall functioning, whereas the topic-level findings regarding School and Family are more directly related to subjective recovery and social functioning.

4.2.1 Emotional Words, Mental Health, and Global Functioning

Participants who used more positive emotion words had lower GHQ-30 scores (better mental health), and those who used more negative emotion words had lower GAF scores. Prior research has reported that frequent use of positive emotion words is associated with diagnosis, better mental health, and a lower incidence of depression [50,51], while frequent use of negative emotion words is associated with diagnosis and lower clinician-rated functioning [14]. The present results are consistent with these previous findings and support the reliability of our interview data. By contrast, the frequency of use of emotion words was not correlated with the RAS. Recovery extends beyond simple positive–negative affect to encompass multidimensional psychosocial processes such as hope, reconstruction of roles, and relationships [12]. While the emotional tone of narratives may reflect the foundations of mental health and functioning, it might be insufficient to explain the more comprehensive and agentic process of recovery.

4.2.2 Narrative Quantity/Spontaneity and Global Functioning

Lower word counts and higher proportions of the Backchannels topic were associated with lower GAF scores, suggesting that narrative quantity and spontaneity may reflect overall functioning. In everyday Japanese conversation, listeners typically produce frequent backchannels (aizuchi)—short responses such as "un" ("yeah") or "hai" ("yes")—to signal attention and engagement with the speaker. In interviews, however, these backchannels are usually interspersed with the interviewee's own self-initiated statements. In our topic model, the Backchannels topic mainly comprised such brief acknowledgments (e.g., "yes", "not really", "of course"; Table 3). Thus, a higher proportion of this topic in a participant's speech indicates that, relative to the length of the interview, a larger share of their utterances consisted of backchannels rather than elaborated, self-generated narrative, which may reflect a paucity of longer, spontaneous speech. Prior research has linked impoverished vocabulary and reduced speech output with poorer interpersonal and occupational functioning, and non-spontaneous features such as fragmented speech and short replies to lower overall functioning [52–54]. Our results accord with these findings and support the reliability

of our data: even in a cultural context where frequent backchannels are normative, interviews in which participants' utterances are dominated by brief acknowledgments rather than extended narratives appear to reflect lower levels of global functioning.

4.2.3 Narratives of Medical Experiences and Global Functioning

A higher proportion of the Hospital topic was correlated with higher GAF scores. Although a discussion of hospitals or hospitalization might at first seem indicative of impairment, our data suggest the opposite. Health care-related talk was associated with better global functioning. This pattern aligns with prior work showing that explicit references to treatment and support in the narratives of people with severe mental illness are linked to higher clinician-rated functioning [14]. Among people with schizophrenia, insight and metacognition correlate with interpersonal functioning and GAF scores, and the capacity to reflect on and make meaning of symptoms and treatment experiences relates to better social functioning [55–57]. Accordingly, the Hospital topic may capture reflective engagement with care rather than dependence, a quality tied to insight and metacognition that may contribute to higher global functioning.

4.3 NLP Applications in Personal Recovery

These findings indicate that the narratives of users of psychiatric home-visit nursing contain signals related to mental health status and functioning, consistent with previous NLP research showing that linguistic features of patients' speech and text are associated with psychopathology and functional outcomes [14–16,20]. In this study, the use of emotion words, the amount of speech, and talk about medical care were systematically linked to psychological distress and global functioning, suggesting that similar linguistic indicators can provide clinically meaningful information even when applied to life history interviews conducted in everyday settings.

At the same time, the focus of this study was not symptom or risk detection per se, but the understanding of personal recovery [1–3]. The associations between topics such as School and Family and subjective recovery suggest that how individuals narrate their life histories—what experiences they view as resources and which relationships they experience as difficult—is closely related to their sense of recovery, in line with narrative accounts of recovery as an ongoing process of meaning-making and identity reconstruction [2,3,44]. This implies that NLP can be positioned not only as a tool for early problem detection, but also as a means of visualizing recovery processes and supporting recovery-oriented practice in community-based mental health care. Future work applying similar approaches to more diverse service contexts and longitudinal data may further clarify the role of language in personal recovery.

4.4 Limitations

This study has several limitations.

First, the sample size was small (n = 27) and restricted to users of psychiatric home-visit nursing from a single hospital in Japan, which constrains the generalizability of the findings. Participants were mainly middle-aged and older long-term service users with severe mental illness, so the results may not directly extend to younger people, those with different diagnostic profiles, or users of other services and inpatient care. Even so, the study demonstrates the feasibility of applying NLP to life history narratives of core community mental health service users and examining their associations with recovery-related indicators. The present findings should therefore be interpreted as exploratory and context-specific, and larger multi-site studies with more diverse cohorts are needed to test reproducibility.

Second, the cross-sectional design precludes causal conclusions about whether narrative features predict changes in recovery and functioning or merely reflect current status. Although life history narratives

naturally contained past, present, and future-oriented content and thus allowed us to capture part of the broader recovery process, narratives were obtained at only one time point. Longitudinal studies that track changes in both narratives and recovery-related indicators over time are needed to examine how narrative features and recovery trajectories co-vary, and which kinds of linguistic change precede or accompany advances in recovery.

Third, the NLP approach itself has limitations. While BERTopic and J-LIWC yielded interpretable topic structures and sentiment categories, 38% of utterances remained unassigned. These segments may contain low-frequency, highly individualized, context-bound narratives in which personal aspects of recovery are embedded, and excluding them may have attenuated or obscured some associations. Future work should qualitatively inspect unassigned utterances and consider modeling their recovery-related meanings using alternative topic models, adjusted parameters, or hybrid qualitative–quantitative frameworks.

Fourth, topic labels and their interpretation were based on the clinical judgments of the research team. Although this approach is more objective and reproducible than traditional qualitative analyses, some subjectivity remains, and no independent validation by external experts or service users was conducted. Nonetheless, the extracted topics corresponded well to clinically familiar themes (e.g., school, family, work, hospital). Future studies should enhance objectivity and transparency by involving multiple independent raters, including people with lived experience.

Fifth, data collection procedures may have influenced both narratives and questionnaire responses. Interviews were conducted immediately after routine home-visit nursing sessions, so day-to-day condition, preceding interaction, and the home recording environment may have affected speech quantity and content, although established therapeutic relationships likely facilitated detailed and personal narratives. In addition, participants completed three relatively lengthy self-administered questionnaires (RAS, SFS, GHQ-30) in addition to the 45–60-min interview, which may have caused respondent burden and fatigue, potentially reducing concentration and increasing "good-enough" responding. Questionnaires were distributed after the interview, so the reflective process during the interview may also have influenced responses, for example by temporarily heightening subjective distress or, conversely, strengthening perceived recovery. Future research should reduce assessment burden (e.g., through shorter scales or distribution across visits) and systematically examine the impact of the order and timing of interviews and questionnaires.

Sixth, the corpus consisted of Japanese life history interviews, and caution is needed when generalizing to other languages and cultures. Frequent subject omission in Japanese complicates comparison with English-language indicators such as first-person singular pronoun frequency, and differences in J-LIWC coverage and conversational practices (e.g., frequent backchannels) may affect how narrative quantity and responsiveness appear.

Even so, this study represents an early attempt to apply BERTopic to life history narratives in psychiatric home-visit nursing and to examine their associations with recovery-related indicators, providing a basis for applications in other languages and cultures and for comparisons with other NLP methods. Future work should apply similar approaches in different linguistic and cultural settings and formally evaluate cross-linguistic and cross-cultural validity to strengthen the generalizability and clinical utility of this approach.

5 Conclusions

In this exploratory study, we quantified life history interview narratives of psychiatric home-visit nursing users using NLP (LIWC and BERTopic) and examined associations with various recovery-related measures. We found that the use of emotion words was associated with mental health and global functioning. Narrative quantity and spontaneity reflected functional status, with frequent backchannels indicating poorer

functioning. Furthermore, positive talk about school life was related to enhanced recovery, whereas talk about family relationships was related to hindered recovery. These findings suggest that the quantity, quality, and content of narratives can all serve as important indicators of mental health and recovery. As a complement to questionnaires and clinician ratings, objective NLP-based analysis of service users' narratives may support the development of recovery-oriented mental health promotion programs.

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Availability of Data and Materials: Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data is not available.

Ethics Approval: This study involved human participants. All procedures were conducted in accordance with the Declaration of Helsinki and relevant institutional and national research ethics guidelines. The protocol was reviewed and approved in 2024 by the Research Ethics Committee of the Kusunoki Mental Hospital, Specific Medical Corporation Kusunokikai, Japan (approval No. 2024-0001). Written informed consent was obtained from all participants and their primary physicians prior to data collection.

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