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# Editorial

## Advancing Family Medicine through Innovation, Evidence, and Patient-Centered Care

Family medicine is undergoing a profound transformation. Rapid advances in clinical science, digital technology, medical education, and chronic disease management are reshaping how primary care is delivered worldwide. At the same time, aging populations, the growing burden of obesity and multimorbidity, and increasing expectations for evidence-based, person-centered care demand that family physicians continually expand both their clinical expertise and educational approaches. The five papers featured in this issue of the Middle East Journal of Family Medicine collectively illustrate this evolution. Although they address diverse topics—from dementia assessment and obesity pharmacotherapy to residency education and mentorship—they converge around a common message: excellence in family medicine depends on integrating scientific evidence with lifelong learning, innovation, and holistic patient care.

One of the defining challenges facing primary care is the growing prevalence of dementia. As populations age across the Middle East and globally, family physicians increasingly serve as the first point of contact for patients and families concerned about cognitive decline. The comprehensive review on **Clinical Assessment of Dementia** reinforces an important principle that remains highly relevant despite remarkable advances in biomarkers and artificial intelligence: dementia remains fundamentally a clinical diagnosis. The review reminds clinicians that careful history taking, collateral information, functional assessment, behavioral evaluation, neurological examination, and thoughtful interpretation of investigations remain the cornerstones of diagnosis. While emerging blood biomarkers, advanced neuroimaging, and AI-assisted diagnostics promise earlier and more precise disease classification, they should complement, not replace, sound clinical reasoning. This balanced perspective is especially important in primary care, where physicians must distinguish dementia from depression, delirium, medication effects, and other reversible conditions before initiating long-term management.

Another major public health challenge addressed in this issue is obesity, now recognized as one of the most important chronic diseases confronting modern healthcare systems. The review of **incretin-based obesity pharmacotherapy** highlights how treatment has evolved beyond achieving weight loss toward long-term management of cardiometabolic risk and overall health. Landmark trials involving semaglutide and tirzepatide have transformed expectations regarding pharmacologic therapy, while evidence regarding maintenance treatment emphasizes that obesity requires sustained management rather than short-term intervention. Particularly noteworthy is the emphasis on the central role of family physicians, who are uniquely positioned to coordinate individualized treatment plans, monitor long-term adherence, manage comorbidities, and integrate pharmacotherapy with lifestyle interventions. As obesity increasingly affects every aspect of primary care, this review provides timely guidance for translating rapidly evolving evidence into everyday practice.

While advances in clinical science are essential, improving patient care also requires excellence in physician education. Three educational studies from Qatar provide complementary perspectives on how residency training can evolve to meet future healthcare needs.

The proof-of-concept study evaluating an **asynchronous problem-based learning (PBL) curriculum** demonstrates the potential of flexible, technology-enabled educational models to strengthen clinical reasoning while accommodating the realities of modern residency training. The findings suggest that carefully designed asynchronous learning environments encourage deeper reflection, evidence-based discussion, and meaningful engagement with complex clinical problems. Rather than replacing traditional bedside teaching, asynchronous PBL appears to enrich it by promoting self-directed learning, collaborative knowledge construction, and higher-order clinical reasoning—competencies that are increasingly essential in contemporary family medicine.
Educational success, however, depends not only on curriculum design but also on understanding how residents learn.

The study examining **factors influencing ABFM In-Training Examination performance** explores the relationships among learning styles, academic stress, prior academic achievement, and examination outcomes. Its findings reinforce the multifactorial nature of educational performance. While kinesthetic learning preferences were associated with improved examination performance, academic stress emerged as an important negative predictor, whereas undergraduate GPA remained a strong positive predictor. Perhaps the most important message is that residency programs should move beyond one-size-fits-all educational approaches. Supporting learners requires attention not only to instructional methods but also to learner well-being, stress reduction, and individualized academic support.

Equally important is the recognition that successful residency education depends upon effective mentorship. The mixed-methods study examining participation in formal mentoring programs highlights that although residents highly value mentorship, its perceived effectiveness declines during the later years of training. Time constraints, competing clinical responsibilities, and evolving career priorities appear to diminish engagement, suggesting that mentorship programs must remain dynamic rather than static. Protected meeting times, structured mentoring relationships, and career-focused discussions tailored to different stages of residency may help sustain meaningful faculty–resident interactions throughout training. In an era where physician burnout and workforce retention have become global concerns, strengthening mentorship may be as important as strengthening curricula.

Taken together, these five contributions illustrate an increasingly integrated vision of family medicine. They remind us that clinical excellence cannot be separated from educational excellence. Better-trained physicians provide better patient care, while advances in clinical science require educational systems capable of rapidly translating evidence into practice. Likewise, innovations in education ultimately serve patients by producing clinicians who think critically, adapt continuously, and embrace lifelong learning.

Several themes emerge across the issue. First, **patient-centered care** remains the guiding principle whether evaluating cognitive impairment, managing obesity, or teaching clinical reasoning. Second, **evidence-based practice** requires not only access to new knowledge but also the ability to critically interpret and apply that knowledge within individual clinical contexts. Third, **innovation** should enhance rather than replace the human dimensions of medicine. Artificial intelligence, digital learning platforms, biomarkers, and novel therapeutics all represent powerful tools, but their value ultimately depends on thoughtful integration into compassionate, individualized patient care.

These themes also reflect broader changes occurring throughout healthcare systems in the Middle East. Countries across the region are investing heavily in primary healthcare reform, postgraduate medical education, digital health, and chronic disease management. Family physicians are increasingly expected to lead multidisciplinary teams, coordinate complex care, manage aging populations, and incorporate rapidly evolving technologies into routine practice. The studies presented in this issue demonstrate that regional investigators are not merely adopting international developments but actively contributing meaningful evidence that addresses local educational and clinical priorities while maintaining international relevance.

While effective pharmacological treatment represents a major advance in obesity management, prevention remains the cornerstone of long-term population health. The paper Obesity and Sedentary Lifestyle – A Practical National Initiative Using Existing Digital Technologies expands the discussion beyond individual patient management by examining how existing digital technologies can be leveraged to promote physical activity at a national level. Building upon the World Health Organization's recognition that physical inactivity affects nearly one-third of adults worldwide and substantially increases the risk of cardiovascular disease, type 2 diabetes, and several cancers, the author describes an innovative public health strategy that combines wearable technology, smartphone applications, behavioural incentives, and measurable activity targets to encourage sustained lifestyle modification.

The proposed model is particularly relevant to family medicine because it illustrates how primary care can move beyond treating established disease toward facilitating prevention through digital engagement. Family physicians increasingly operate within healthcare systems that incorporate remote monitoring, patient-generated health data, and technology-assisted behavioural interventions. Such approaches complement rather than replace traditional counselling by providing continuous feedback, enhancing patient motivation, and promoting long-term adherence to healthy lifestyles. As healthcare systems increasingly embrace digital transformation, initiatives of this nature demonstrate how readily available technologies can be integrated into national prevention strategies without requiring complex new infrastructure.

The Middle East Journal of Family Medicine remains committed to publishing work that bridges clinical medicine, education, health systems, and research. By bringing together investigations spanning dementia, obesity, educational innovation, examination performance, and mentorship, this issue highlights the breadth of modern family medicine while reinforcing its unifying mission: improving the health of individuals, families, and communities through comprehensive, evidence-informed primary care.

As healthcare continues to evolve, so too must family medicine. The future belongs to clinicians who combine scientific rigor with clinical judgment, embrace innovation without abandoning fundamental principles, and recognize that excellence in patient care begins with excellence in education. The contributions in this issue provide valuable guidance toward achieving that future and underscore the continuing importance of primary care as the foundation of resilient, equitable, and high-quality healthcare systems.

Warm regards,
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# Factors Influencing Participation in the Formal Mentoring Program among Family Medicine Residents in Qatar: A Mixed-Methods Study

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## Abstract

Background: The transition into residency is a demanding period. While mentorship programs aim to improve well-being, confidence, and career guidance, active engagement among family medicine residents often varies. This study aimed to systematically identify barriers and facilitators affecting participation in a formal mentoring program among family medicine residents in Qatar.

Methods: A descriptive cross-sectional mixed-methods survey was conducted among 48 Family Medicine residents (PGY1-PGY4) at the West Bay Training Facility in Qatar. The survey captured quantitative data on mentoring frequency, satisfaction, engagement, and perceived effectiveness, alongside qualitative open-ended responses regarding barriers and facilitators. Quantitative data were analyzed using Kruskal-Wallis and Chi-square tests, while qualitative data underwent thematic analysis.

Results: The study included 48 residents (12 per PGY level), of whom 77.1% were female and 70.8% were non-Qatari nationals. The response rate was 92.3%. Perceived mentorship effectiveness significantly declined as residents advanced in their training ($H = 20.96$, $p < 0.001$), with PGY1 residents reporting the highest effectiveness (median = 10.0) and PGY4 residents the lowest (median = 5.0). Despite this decline, overall mentorship satisfaction ($p = 0.149$) and self-reported engagement ($p = 0.881$) remained consistently high across all cohorts. Thematic analysis identified "Time Constraints" as the primary barrier (28 mentions), whereas "Emotional/ Interpersonal Support" (17 mentions) and "Structured Scheduling" (12 mentions) were the main facilitators of engagement.

Conclusion: Formal mentorship is highly valued, but its perceived effectiveness diminishes in senior residency years. Addressing severe time constraints through protected meeting times and tailoring mentorship focus to align with the evolving career planning needs of senior residents are critical steps to optimizing mentorship engagement.

Key words: participation. mentoring, family medicine residets, Qatar

## Introduction

The transition from undergraduate medical education to postgraduate residency training is a demanding period characterized by increased clinical responsibilities, high stress, and significant professional identity formation [1]. To mitigate burnout and support residents through this transition, many medical training institutions have implemented formal mentorship programs. Effective mentorship has been consistently linked to improved resident well-being, enhanced clinical confidence, accelerated professional development, and better career guidance [3] [4].

Mentorship in medical education generally falls into two categories: informal mentorship, which develops organically through shared interests, and formal mentorship, which involves institutionally assigned relationships with structured goals [10]. The Family Medicine Residency Training Program in Qatar, which comprises 52 residents who are predominantly female and represent diverse nationalities, has established a formal mentoring program consisting of monthly one-hour meetings to ensure all residents have access to faculty guidance. However, program leadership has observed that despite the availability of assigned mentors and positive publicity, active participation and engagement among residents remain inconsistent.

Understanding the factors that drive or hinder engagement is critical for program optimization. Previous literature highlights that time constraints, mismatched mentor-mentee expectations, and lack of structured meeting times often impede formal mentorship success [9]. Furthermore, previous research in Qatar has indicated confusion among residents regarding the distinction between supervisory and mentorship roles. Yet, specific barriers to participation for family medicine residents in Qatar have not been systematically explored.

Therefore, this study aimed to systematically identify the barriers to engagement and highlight the factors that promote effective participation in the formal mentorship program among family medicine residents (PGY1-PGY4) in Qatar. The findings are intended to provide data-driven recommendations to enhance the mentorship experience and improve the overall educational environment.

## Methods

### 1 Study Design and Setting

A descriptive, cross-sectional, mixed-methods study was conducted at the Family Medicine Residency Training Program, West Bay Training Facility, Qatar. The study utilized a self-administered, face-to-face survey comprising both quantitative rating scales and qualitative open-ended questions to capture a comprehensive view of the mentorship experience.

### 2 Participants and Recruitment

The target population consisted of all Family Medicine residents from Postgraduate Year 1 (PGY1) through Postgraduate Year 4 (PGY4) enrolled during the academic year. Census sampling was employed, inviting all eligible residents to participate. To eliminate the risk of coercion, recruitment and consenting were conducted exclusively by independent co-investigators who held no supervisory or evaluative roles over the residents. The Principal Investigator (PI) was not present during data collection. Five residents who participated in the pilot testing of the instrument were excluded from the final analysis. A total of 48 residents (12 from each PGY level) provided written informed consent and completed the survey.

### 3 Data Collection Instrument

The survey instrument was developed by the research team based on established mentorship evaluation frameworks [7]. It demonstrated face, content, and construct validity, and was pilot-tested prior to full deployment. The survey included:

***1. Demographics:*** Gender, nationality, and residency year.
***2. Quantitative Metrics:*** Frequency of formal and informal mentoring, mentorship satisfaction, self-reported engagement, perceived mentorship effectiveness (rated on a 1-10 scale), and perceived impact on clinical decision-making, leadership, and career planning (measured on Likert scales).
***3. Qualitative Prompts:*** Open-ended questions exploring barriers to participation, facilitators of engagement, most beneficial aspects of mentorship, and recommendations for program improvement.

### 4 Ethical Considerations

The study protocol was approved by the Primary Health Care Corporation (PHCC) Institutional Review Board (IRB Reference No: BUHOOTH-D-25-00110). Participation was strictly voluntary, and all collected data were anonymized and stored securely on password-protected, encrypted systems.

**5 Data Analysis**

Quantitative data were analyzed using SPSS. Descriptive statistics (means, medians, standard deviations, and frequencies) were calculated for all variables. Given the ordinal nature of the Likert scales and the non-normal distribution of the effectiveness scores, non-parametric Kruskal-Wallis H tests were utilized to compare continuous and ordinal variables across the four PGY levels. For statistically significant findings, Bonferroni-corrected Mann-Whitney U tests (alpha = 0.05/6 = 0.0083) were performed for post-hoc pairwise comparisons. Categorical variables were analyzed using Chi-square tests of independence.

Qualitative data from open-ended responses were analyzed using thematic analysis following the framework described by Braun and Clarke [21]. Responses were reviewed, coded, and categorized into recurring themes, with frequencies calculated to determine the most prevalent barriers and facilitators [20] [22].

## Results

**1 Participant Demographics**

A total of 48 family medicine residents participated in the study, equally distributed across the four postgraduate training years with 12 residents in each cohort. The majority of participants were female (n = 37, 77.1%), while male residents constituted 22.9% (n = 11) of the sample. Regarding nationality, non-Qatari residents represented the majority of the cohort (n = 34, 70.8%), whereas Qatari nationals comprised 29.2% (n = 14). Chi-square analysis demonstrated no statistically significant differences in gender distribution (Chi-square = 0.354, df = 3, p = 0.950) or nationality composition (Chi-square = 0.403, df = 3, p = 0.940) across the four PGY levels, confirming demographic homogeneity among the groups. The mean duration in the mentorship program increased progressively from 9.1 months in PGY1 to 45.4 months in PGY4. The complete demographic profile is presented in Table 1 and visually summarized in Figure 1.

**Table 1. Demographic Characteristics of Participants by Postgraduate Year**

| Characteristic | PGY1 (n = 12) | PGY2 (n = 12) | PGY3 (n = 12) | PGY4 (n = 12) | Total (N = 48) | p-value |
|---|---|---|---|---|---|---|
| Gender | | | | | | 0.950 |
| Female | 10 (83.3%) | 9 (75.0%) | 9 (75.0%) | 9 (75.0%) | 37 (77.1%) | |
| Male | 2 (16.7%) | 3 (25.0%) | 3 (25.0%) | 3 (25.0%) | 11 (22.9%) | |
| Nationality | | | | | | 0.940 |
| Non-Qatari | 8 (66.7%) | 9 (75.0%) | 8 (66.7%) | 9 (75.0%) | 34 (70.8%) | |
| Qatari | 4 (33.3%) | 3 (25.0%) | 4 (33.3%) | 3 (25.0%) | 14 (29.2%) | |

**Figure 1. Demographic Characteristics of Study Participants (N = 48)**

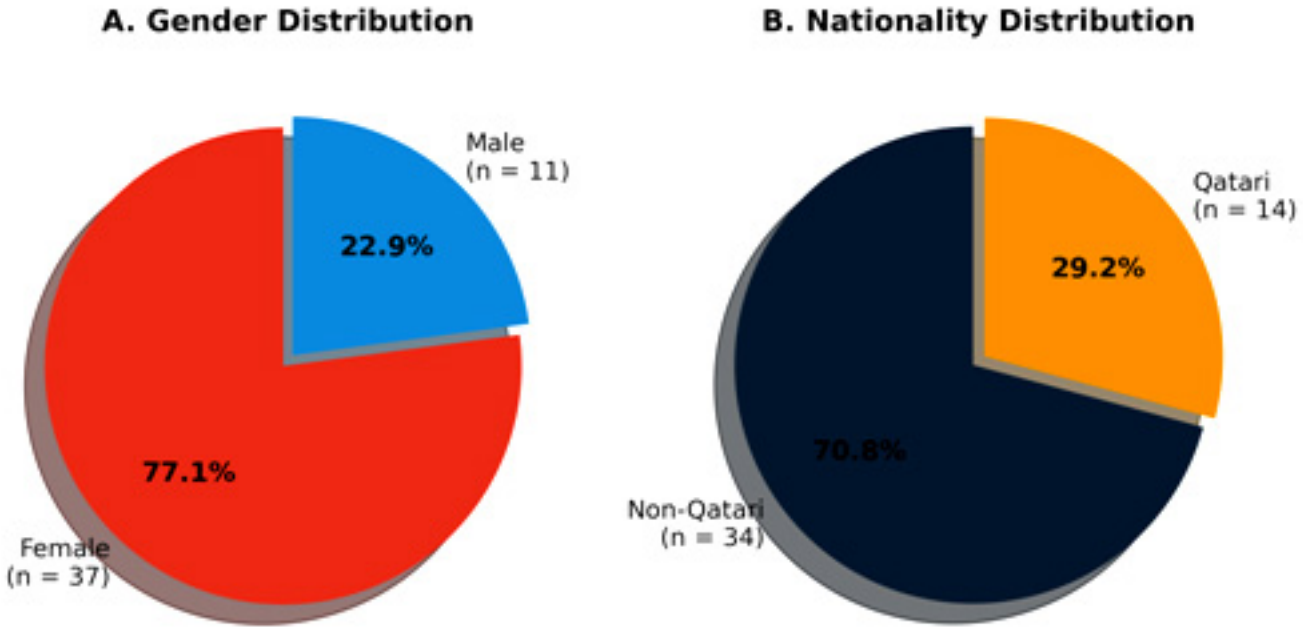
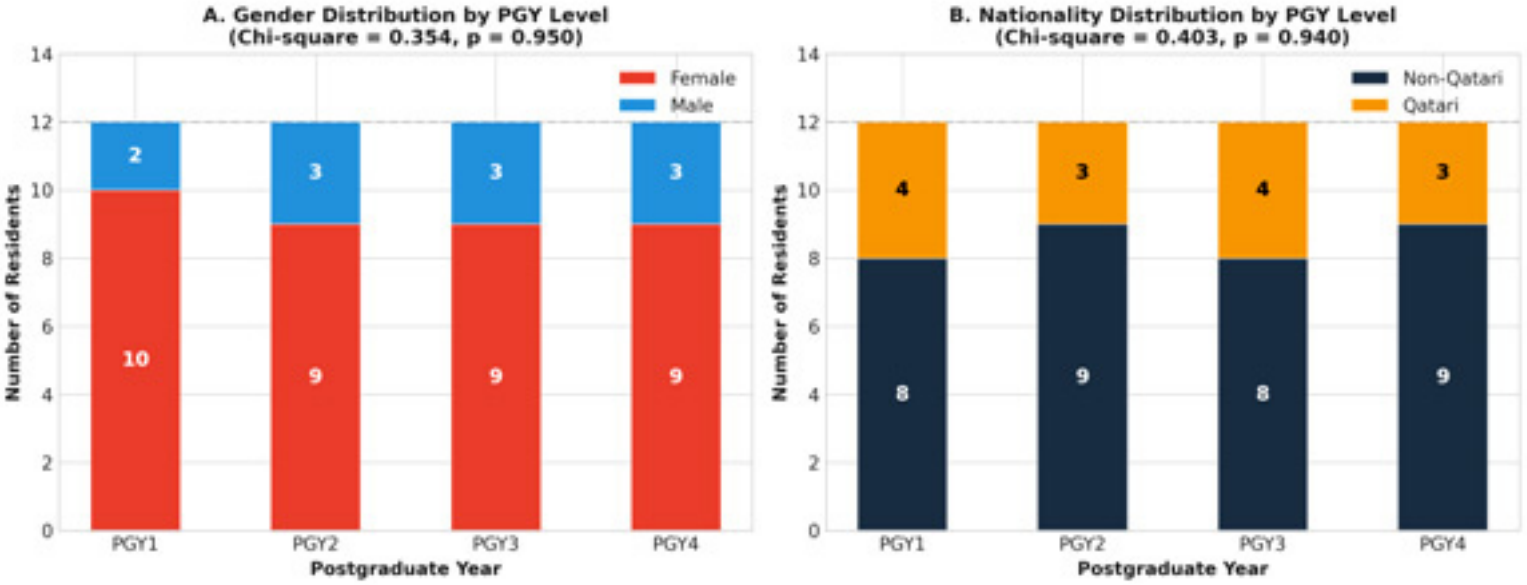



**Figure 2. Distribution of Gender and Nationality Across PGY Levels**



**2 Mentorship Engagement and Satisfaction**

The frequency of formal mentoring interactions did not differ significantly across the four PGY levels (Kruskal-Wallis H = 3.72, df = 3, p = 0.293). Similarly, informal mentoring frequency remained comparable among all training cohorts (Kruskal-Wallis H = 3.09, df = 3, p = 0.377). These findings indicate that residents at all stages of training had equitable access to both formal and informal mentoring opportunities.

Overall mentorship satisfaction was consistently high across the entire cohort. No statistically significant decline in satisfaction was observed as residents progressed through training (Kruskal-Wallis H = 5.34, df = 3, p = 0.149). First-year residents reported a median satisfaction score of 5.0, while residents in PGY2 through PGY4 reported medians ranging from 4.0 to 4.5. Self-reported engagement levels were similarly stable, with no significant variation across training years (Kruskal-Wallis H = 0.67, df = 3, p = 0.881). All four cohorts reported a median engagement score of 4.0 out of 5.0. These comparative dimensions are illustrated in Figure 4.

**3 Perceived Mentorship Effectiveness**

In marked contrast to the stable satisfaction and engagement scores, the perceived overall effectiveness of the mentorship program demonstrated a highly significant decline across training levels (Kruskal-Wallis H = 20.96, df = 3, p < 0.001). As presented in Table 2 and Figure 3, PGY1 residents reported the highest perceived effectiveness with a mean score of 9.08 (SD = 1.11) and a median of 10.0 on the 10-point scale. This score progressively declined through PGY2 (mean = 7.42, SD = 1.32, median = 7.5) and PGY3 (mean = 7.92, SD = 1.32, median = 8.5), reaching its lowest point among PGY4 residents (mean = 5.67, SD = 1.49, median = 5.0).

**Table 2. Perceived Mentorship Effectiveness Scores by Postgraduate Year**

| Residency Level | n | Mean (SD) | Median | IQR |
|---|---|---|---|---|
| PGY1 | 12 | 9.08 (1.11) | 10.0 | 8.0 to 10.0 |
| PGY2 | 12 | 7.42 (1.32) | 7.5 | 6.0 to 9.0 |
| PGY3 | 12 | 7.92 (1.32) | 8.5 | 7.0 to 9.0 |
| PGY4 | 12 | 5.67 (1.49) | 5.0 | 4.8 to 6.5 |

Post-hoc pairwise comparisons using Bonferroni-corrected Mann-Whitney U tests (adjusted significance threshold: p < 0.0083) identified the following statistically significant differences: PGY1 versus PGY4 (U = 135.0, adjusted p = 0.001).
Additional comparisons approaching significance included PGY1 versus PGY2 (U = 117.5, adjusted p = 0.045), PGY2 versus PGY4 (U = 118.0, adjusted p = 0.043), and PGY3 versus PGY4 (U = 124.0, adjusted p = 0.015).

**Figure 3. Perceived Mentorship Effectiveness by Postgraduate Year (Kruskal-Wallis H = 20.96, df = 3, p < 0.001)**

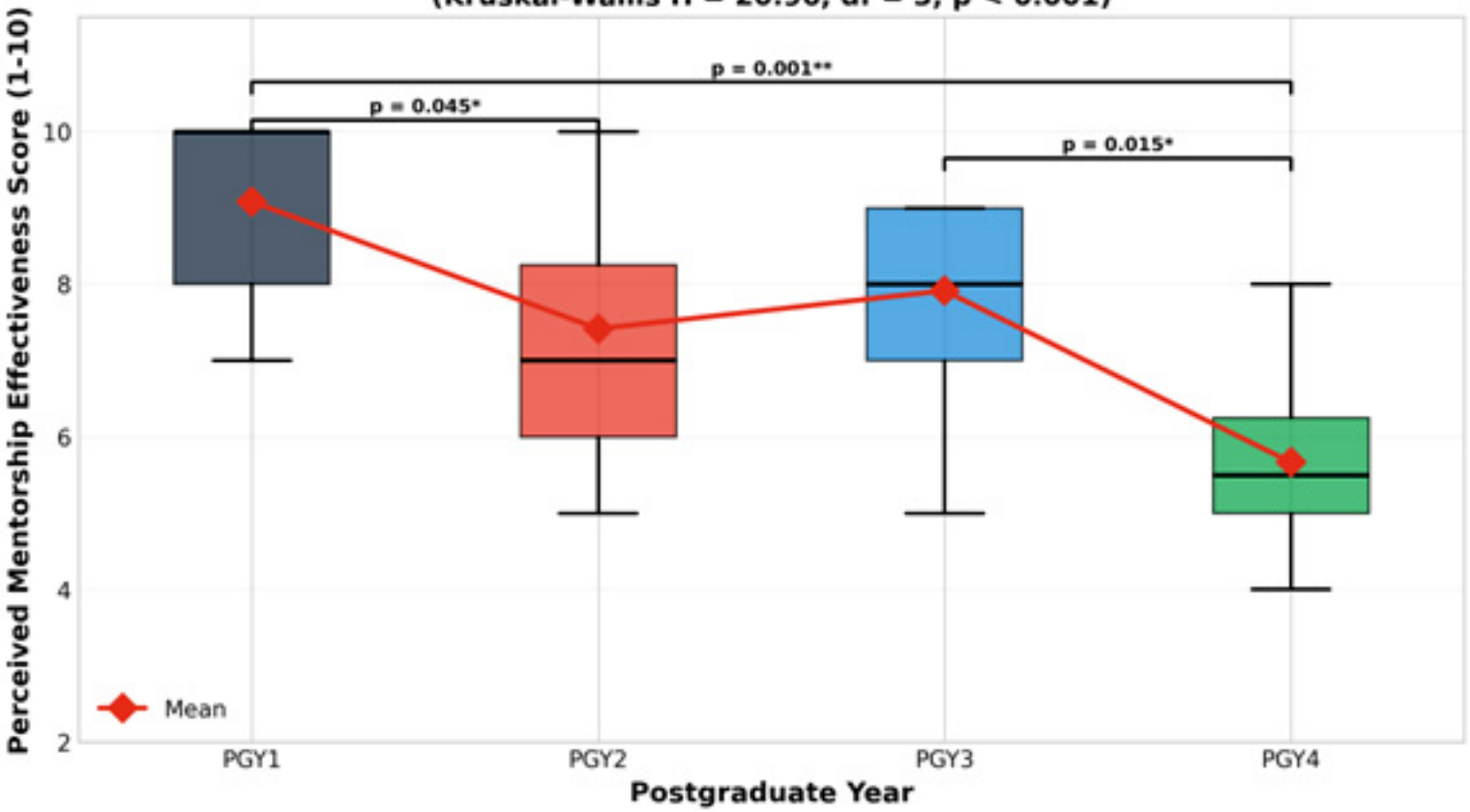
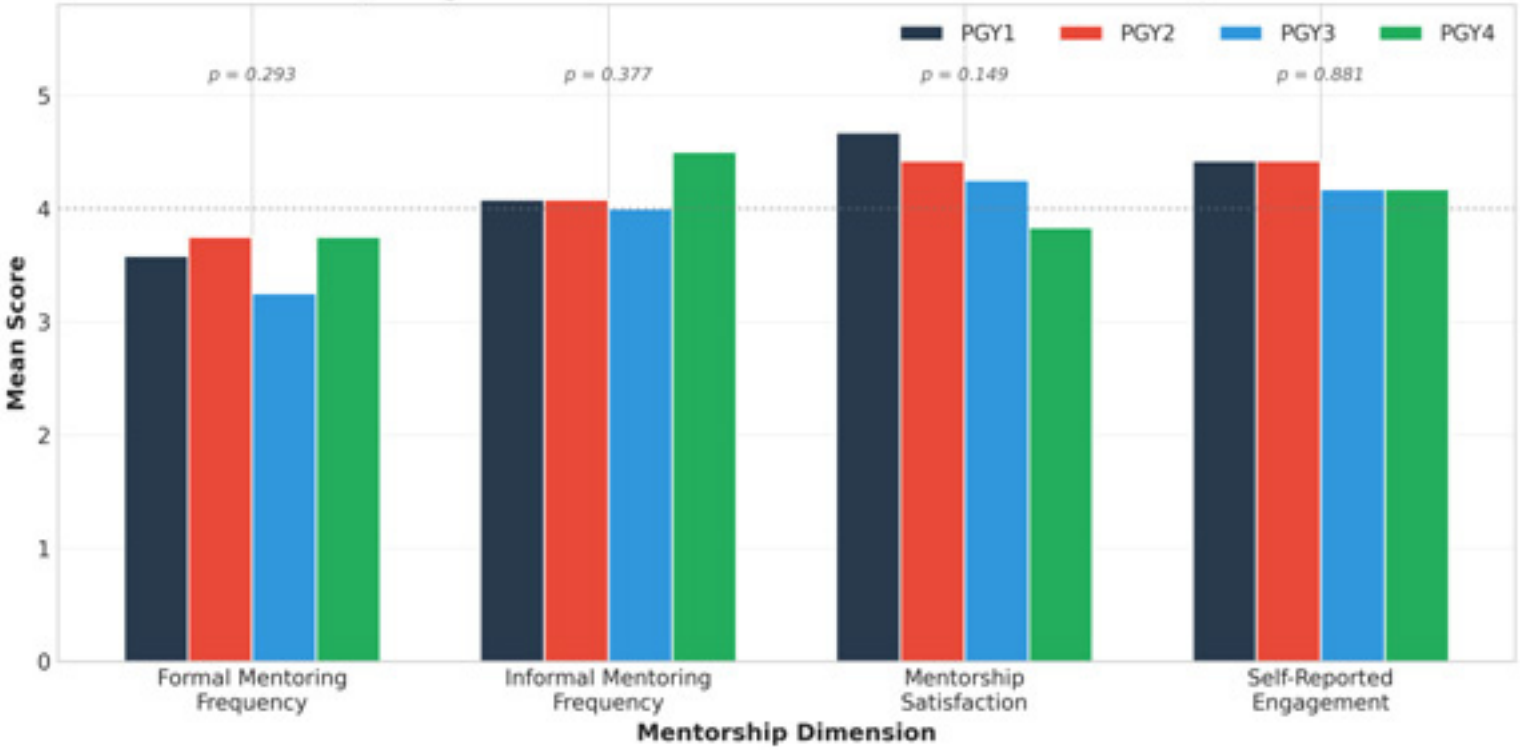



**Figure 4. Mentorship Engagement and Satisfaction Scores by Postgraduate Year (No significant differences observed across all dimensions)**



Notwithstanding the decline in overall effectiveness ratings, residents across all training years consistently endorsed the positive impact of mentorship on their clinical decision-making, leadership skill development, and career planning. The majority of participants agreed or strongly agreed that mentorship contributed meaningfully to these professional competencies, with no significant differences observed across PGY levels for clinical decision-making (Kruskal-Wallis $H = 7.14$, $df = 3$, $p = 0.068$), leadership development (Kruskal-Wallis $H = 0.94$, $df = 3$, $p = 0.817$), or career planning (Kruskal-Wallis $H = 1.07$, $df = 3$, $p = 0.784$). The distribution of these perceived impacts is detailed in Figure 6.

**4 Qualitative Findings: Barriers and Facilitators**

Thematic analysis of the open-ended survey responses yielded rich contextual data that complemented and explained the quantitative findings.

Regarding barriers to active participation, “Time Constraints” emerged as the most frequently cited obstacle, mentioned by the overwhelming majority of respondents (28 mentions). Residents described competing clinical responsibilities, on-call schedules, and heavy patient loads as primary impediments to consistent mentorship engagement. “Workload” was additionally cited as a distinct but related barrier (8 mentions), reflecting the cumulative burden of clinical and academic demands.

With respect to facilitators of engagement, “Emotional and Interpersonal Support” was identified as the most influential factor promoting active participation (17 mentions). Residents emphasized that feeling genuinely supported and understood by their mentors motivated continued engagement. “Structured Scheduling” (12 mentions) and “Mentor Approachability” (10 mentions) were also identified as critical enablers, suggesting that both systemic and relational factors contribute to sustained participation.

When asked to provide recommendations for program improvement, the most frequently endorsed suggestion was the implementation of “Regular and Protected Meeting Times” (17 mentions), directly mirroring the primary barrier of time constraints. Participants also placed high value on receiving “Feedback and Review” during mentorship sessions (15 mentions), indicating that structured, goal-oriented interactions are perceived as more valuable than informal check-ins alone. A complete summary of these qualitative themes is presented in Figure 5.

**Figure 5. Thematic Analysis: Barriers and Facilitators of Mentorship Engagement**

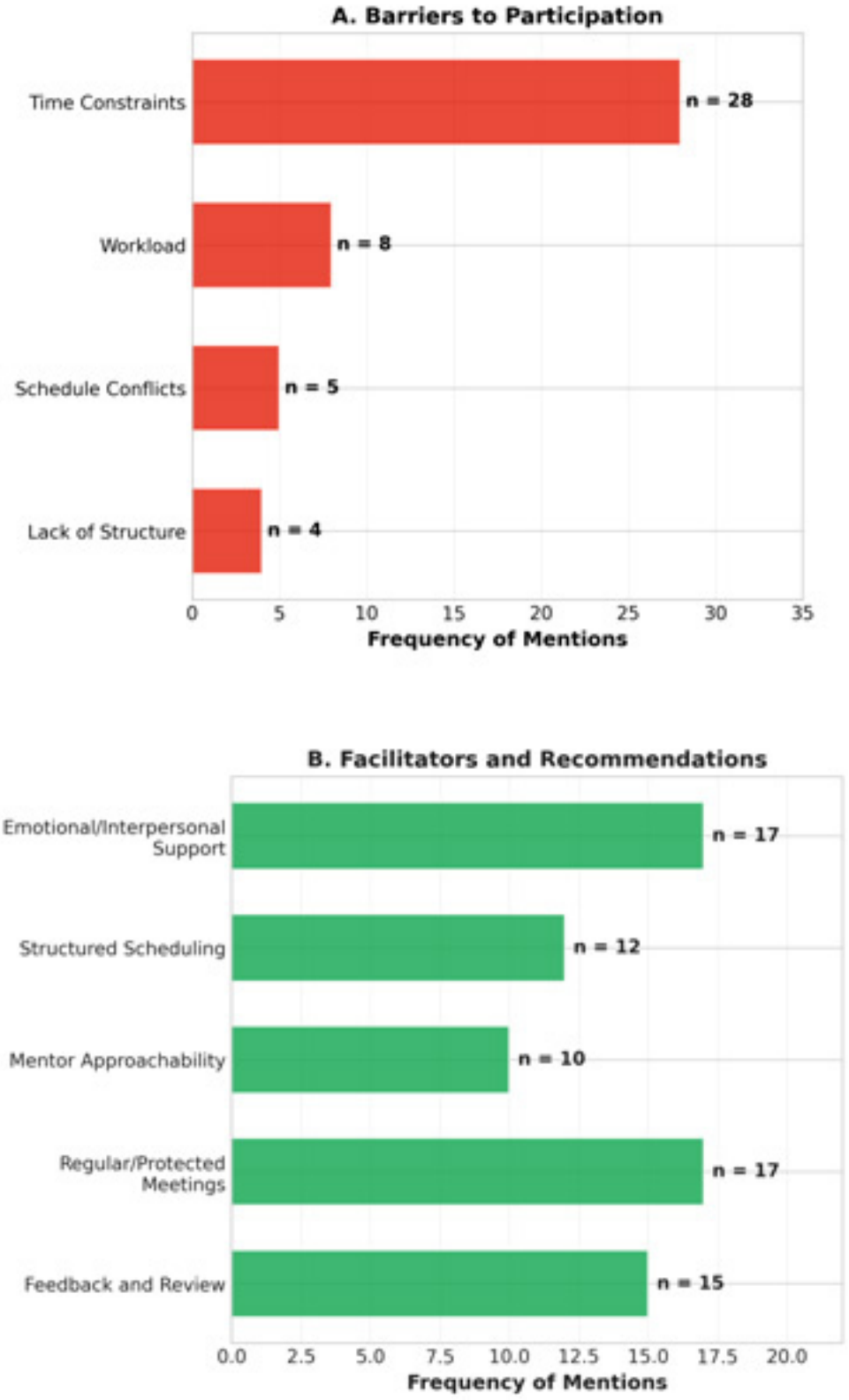
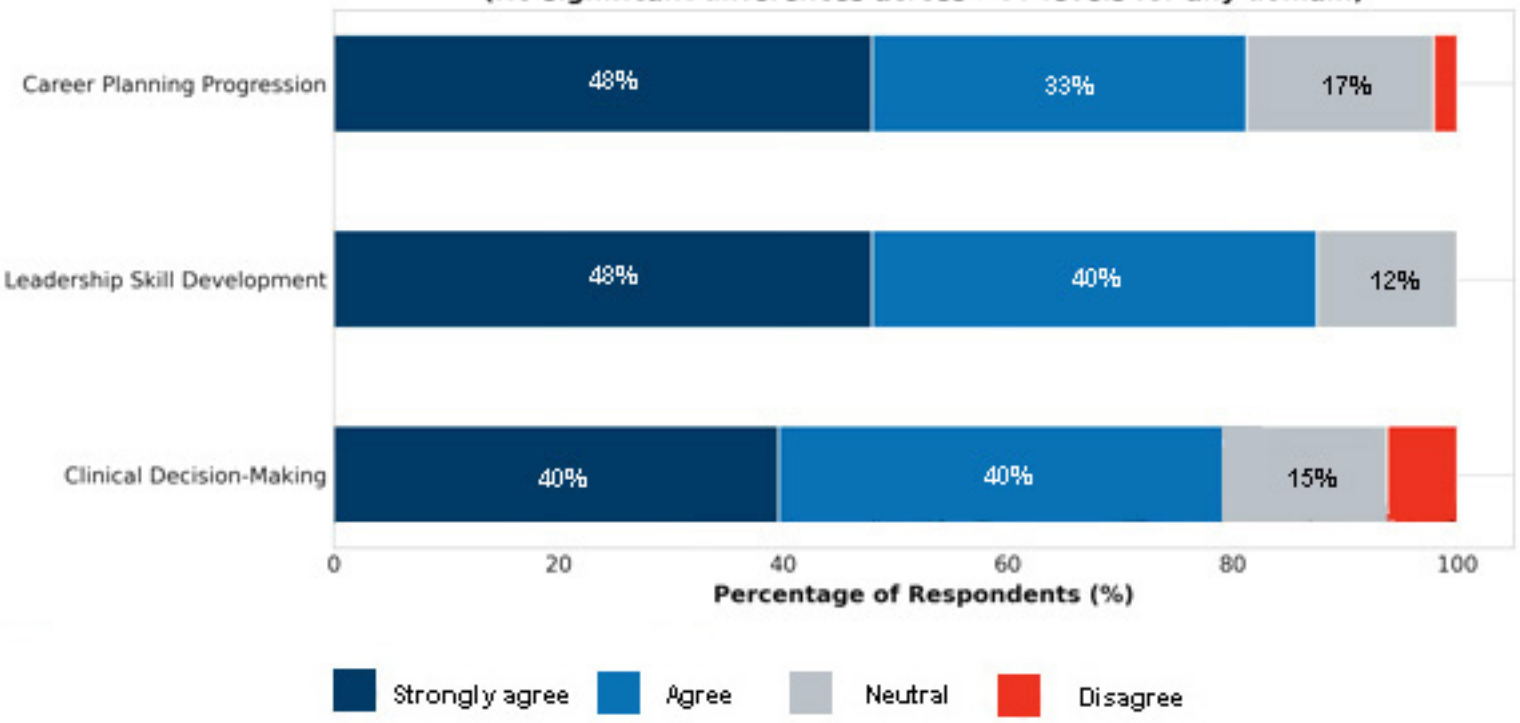


**Figure 6. Perceived Impact of Mentorship on Professional Competencies (N = 48)**
**(No significant differences across PGY levels for any domain)**



## Discussion

This mixed-methods study highlights a critical paradox in formal residency mentorship: while satisfaction, meeting frequency, and self-reported engagement remain high throughout the four years of family medicine training, the perceived effectiveness of the mentorship program declines significantly as residents progress to their senior years.

The high effectiveness scores in PGY1 (Median = 10.0) align with existing literature suggesting that junior residents rely heavily on mentors for emotional support and basic professional orientation during the stressful transition into residency [6]. However, the significant drop in effectiveness by PGY4 (Median = 5.0) suggests that the current formal mentoring structure may not be adapting to the evolving needs of senior residents. As residents gain clinical autonomy, their needs likely shift from basic emotional support to highly specific career sponsorship, advanced fellowship planning, and transition-to-practice guidance [5]. If formal mentors are not equipped or trained to provide this advanced sponsorship, senior mentees may perceive the relationship as less effective, even if they remain satisfied with the mentor personally.

Qualitatively, the study overwhelmingly identified "Time Constraints" as the primary barrier to engagement. The demanding clinical workload of family medicine residency often leaves little room for extracurricular meetings. This is directly supported by the residents' primary recommendations: implementing structured scheduling and protected time for mentorship meetings. Relying on residents and mentors to find time organically within a packed clinical schedule is a systemic vulnerability that limits the depth of the mentoring relationship.

Furthermore, the emphasis on "Emotional/Interpersonal Support" as a key facilitator underscores the psychological value of mentorship. Given the diverse nature of the residency cohort - with 70.8% being non-Qatari nationals adapting to both a demanding training program and a new cultural context - this emotional support is particularly vital. The fact that residents highly value mentor approachability suggests that successful formal programs must carefully consider cultural competency, personality fit, and interpersonal dynamics during the mentor-mentee matching process, rather than relying solely on random assignment [17] [19]. Power dynamics inherent in mentor-mentee relationships must also be acknowledged and managed to foster open.

**Strengths and Limitations**

A major strength of this study is its mixed-methods design, which allowed the qualitative themes to contextualize the quantitative findings. The census sampling of the eligible cohort (12 residents per PGY level) minimizes non-response bias and allows for robust comparisons across training years. Furthermore, the strict separation of the Principal Investigator from the recruitment and data collection processes successfully mitigated the risk of coercion in this vulnerable educational population.

However, the study has limitations. It was conducted at a single training facility in Qatar, which may limit the generalizability of the findings to programs with different structures or cultural contexts. The predominantly non-Qatari composition of the cohort (70.8%) reflects the international nature of medical training in the Gulf region and may influence the generalizability of findings to more homogeneous training settings. Additionally, the sample size of 48, while representing the complete eligible cohort for this specific program, is relatively small, which may limit the statistical power to detect smaller effect sizes. The cross-sectional design precludes causal inferences regarding the observed decline in perceived effectiveness across training years.

## Conclusion and Recommendations

Formal mentorship in family medicine residency is highly valued and successful in providing emotional support and early professional guidance. However, to maintain its effectiveness throughout the entirety of the training program, mentorship models must evolve alongside the resident.

Based on these findings, we recommend the following institutional interventions:

1. **Implement Protected Time:** Programs must provide formally scheduled, protected time for mentor-mentee meetings to overcome the primary barrier of time constraints and clinical workload.
2. **Phase-Specific Mentor Training:** Faculty development should include training on how to transition from providing emotional support to junior residents to offering targeted career sponsorship and transition-to-practice guidance for senior residents.
3. **Re-evaluate Senior Mentorship:** Programs should consider allowing senior residents (PGY3/PGY4) to select mentors based on specific career interests rather than maintaining a single assigned mentor for all four years.
4. **Culturally Sensitive Mentorship:** Given the predominantly international composition of the residency cohort, mentorship programs should incorporate cultural competency training for mentors and consider the unique adjustment challenges faced by non-Qatari residents navigating both professional development and cross-cultural adaptation.

**Acknowledgement**

Mr. Ady Candra, Program Analyst, Family Medicine

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# Enhancing Clinical Reasoning in Family Medicine Residents through a Comprehensive Asynchronous Problem-Based Learning Curriculum: A Proof-of-Concept Study

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## Abstract

Introduction: Postgraduate medical education (PGME) faces the challenge of providing comprehensive clinical training that fosters deep learning and clinical reasoning skills. Traditional didactic methods often fail to promote active learning and knowledge application, especially given the time constraints of busy residency programs. Asynchronous Problem-Based Learning (PBL) offers a flexible, learner-led alternative that encourages self-directed learning and peer collaboration. Grounded in Constructivism and Self-Directed Learning Theory, this study presents a secondary data analysis of an existing asynchronous PBL curriculum implemented for second-year (PGY2) family medicine residents.

Hypothesis & Objectives: We hypothesized that a structured, asynchronous PBL curriculum would maintain high resident engagement and significantly improve clinical reasoning through collaborative case analysis. The primary objective was to evaluate a 35-week online PBL framework for PGY2 family medicine residents using retrospectively collected educational data, specifically targeting core competencies in basic knowledge (10%), clinical skills (60%), and data interpretation/synthesis (30%).

Methods: A secondary data analysis of a mixed-methods educational innovation was conducted using de-identified records from the 2021/2022 academic year (35 weeks). The curriculum encompassed 12 detailed modules, including Endocrinology, Cardiology, Respiratory Disease, and Psychiatry. Data were retrospectively extracted from the existing online learning platform, including engagement metrics and standardized In-Training Examination (ITE) scores for 12 PGY2 residents. Qualitative content analysis was performed on archived resident discussion posts to assess clinical reasoning and management strategy synthesis. A descriptive correlation analysis was performed between the depth of PBL participation and ITE performance outcomes.

Results: The PBL curriculum demonstrated robust learner engagement across 35 weeks. Residents consistently applied sophisticated clinical reasoning, such as identifying Major Depressive Disorder (MDD) while managing comorbidities. Qualitative analysis revealed that residents with the most sophisticated evidence-based contributions also demonstrated strong quantitative performance on the ITE, with scores ranging from 320 to 670 (Mean = 456.3). High-engaging residents who consistently cited current literature and challenged peer assumptions achieved higher ITE scores (e.g., 610, 670), supporting a dose-response relationship between asynchronous PBL participation and standardized knowledge acquisition.

Discussion & Conclusions: This proof-of-concept study demonstrates that a comprehensive, asynchronous PBL curriculum is an effective method for enhancing clinical reasoning in family medicine residents. The format facilitated asynchronous “thinking time,” allowing residents to synthesize complex data and formulate management plans that address multimorbidity. The observed correlation between high-quality PBL engagement and superior ITE performance confirms that asynchronous collaborative learning effectively supports both clinical reasoning development and standardized knowledge retention. This model provides a replicable and scalable framework for residency programs seeking to modernize their curricula.

Keywords: asynchronous learning; problem-based learning; clinical reasoning; postgraduate medical education; In-Training Examination; family medicine; self-directed learning; competency-based medical education

## Introduction

The development of robust clinical reasoning skills is a cornerstone of postgraduate medical education (PGME). However, residency programs often face challenges in providing educational experiences that effectively bridge the gap between theoretical knowledge and its practical application in complex clinical scenarios [1, 2]. Traditional didactic lectures, while efficient for information dissemination, frequently fail to foster the active, self-directed learning required for deep conceptual understanding and long-term knowledge retention [3]. In response to these challenges, innovative pedagogical approaches are needed to create more engaging and effective learning environments for residents facing significant clinical service demands [4].

Problem-based learning (PBL) has been widely recognized as a powerful student-centered pedagogy that promotes active learning, critical thinking, and collaborative problem-solving [5, 6]. Meta-analytic evidence has consistently demonstrated that PBL enhances knowledge application and higher-order thinking skills compared to conventional teaching methods [7, 8]. By grounding learning in authentic clinical cases, PBL encourages learners to integrate basic and clinical sciences, develop self-directed learning skills, and construct a more robust and applicable knowledge base [9]. While PBL has been successfully implemented in undergraduate medical education, its application in the postgraduate setting, particularly in a comprehensive, longitudinal asynchronous format, remains understudied [10, 11].

This study is theoretically grounded in Constructivism, Self-Directed Learning Theory, and Cognitive Load Theory [12, 13, 14]. Constructivism posits that learners build knowledge through active engagement and social interaction [15], while Self-Directed Learning Theory emphasizes the adult learner's autonomy in identifying learning gaps and seeking evidence-based solutions [16, 17]. Asynchronous online environments uniquely support these theories by providing extended "thinking time" that reduces cognitive load and allows for deeper reflection before contributing to peer discussions [14]. Collaborative learning in health professions further enhances these processes through peer interaction and shared knowledge construction [18].

We address the current gap in the literature through a proof-of-concept secondary data analysis of a comprehensive, asynchronous problem-based learning curriculum implemented for second-year (PGY2) family medicine residents. Our central research question was: How does a comprehensive, asynchronous problem-based learning curriculum impact clinical reasoning skills, knowledge application, and learner engagement among PGY2 family medicine residents? We hypothesized that this structured, asynchronous PBL curriculum would maintain high resident engagement and significantly improve clinical reasoning through collaborative case analysis, ultimately translating to improved standardized test performance.

## Methods

### Study Design

This proof-of-concept study employed a secondary data analysis of a mixed-methods educational innovation that was implemented for PGY2 family medicine residents during the 2021-2022 academic year. All data were retrospectively extracted from existing educational records, including the online learning platform and institutional examination databases. The study was designed to evaluate learner engagement, the quality of clinical reasoning, and the correlation with standardized In-Training Examination (ITE) performance using pre-existing, de-identified educational data.

### Ethical Considerations

This study constituted a secondary analysis of de-identified, routinely collected educational data. All data were originally gathered as part of standard educational program evaluation and quality improvement activities. No direct interaction with participants occurred for the purposes of this research. All identifying information was removed prior to analysis, and data are presented exclusively at the group or category level to prevent identification of individual residents within the small cohort.

### Theoretical Framework

The curriculum design and evaluation are grounded in three complementary educational theories:

- **Constructivism:** Learners actively construct knowledge through engagement with authentic problems and social interaction with peers, rather than passively receiving information [13, 15]. The PBL cases provided the authentic clinical problems, while the asynchronous discussion threads provided the social interaction context.
- **Self-Directed Learning Theory:** Adult learners are motivated to identify their own learning gaps and seek solutions autonomously [16]. The asynchronous format empowered residents to independently research clinical questions before contributing to discussions, fostering professional self-regulation [17].
- **Cognitive Load Theory:** By removing the time pressure of synchronous sessions, the asynchronous format reduced extraneous cognitive load, allowing residents to allocate more cognitive resources to germane processing, the deep integration of new knowledge with existing clinical schemas [14].

### Curriculum Description

The curriculum under evaluation was structured as a 35-week longitudinal program that encompassed 12 detailed specialty modules (see Supplementary Table 1 for the fully de-identified curriculum guide). Modules included Psychiatry, Sleep Disorders, Endocrinology, Pediatrics, Environmental Health, ENT, Preventive Health, Musculoskeletal Problems, Geriatric/Aged Care, Gastroenterology & Liver Disease, Hematology, and Cardiology. Each module was designed around a series of problem-based learning cases (43 cases total), which were delivered to 12 PGY2 residents through a dedicated

asynchronous online learning platform. The curriculum specifically targeted core competencies distributed as follows: basic knowledge (10%), clinical skills (60%), and data interpretation/synthesis (30%).

The PBL cases were designed to be authentic and representative of the clinical challenges faced by family medicine residents. Each case included a patient presentation, relevant clinical data, and a series of questions designed to guide the residents through the process of clinical reasoning, from differential diagnosis to management planning. Residents were required to participate in structured discussions, providing initial assessments and responding to peer contributions using evidence-based frameworks. The asynchronous format provided extended "thinking time," a critical component for deep learning in clinical reasoning.

**Data Sources**

Data for this secondary analysis were retrospectively extracted from two pre-existing sources:

**Online Learning Platform Records:** De-identified engagement metrics, including the number of views per case, the number of resident responses, and archived discussion thread content, were extracted from the educational platform database.

**Institutional Examination Database:** Standardized In-Training Examination (ITE) scores for the participating cohort were obtained from existing institutional records.

**Data Analysis**

Quantitative Analysis: Engagement metrics and ITE scores were analyzed using descriptive statistics. A descriptive correlation analysis was performed between the depth of PBL participation (engagement level) and ITE performance outcomes.

**Qualitative Analysis:** A qualitative content analysis was performed on the archived resident discussion threads [25]. To ensure reliability, two investigators independently reviewed a random subset of discussion posts (approximately 20% of total posts) to identify themes related to clinical reasoning, risk management, and management strategy synthesis (e.g., DSM-5 criteria application, pharmacotherapy justification). Inter-rater agreement was assessed using percentage agreement, achieving 87% concordance prior to consensus discussion. Following calibration, the remaining posts were coded by the primary investigator. This qualitative reasoning depth was then cross-checked with standardized ITE outcomes for validation.

## Results

The secondary analysis of the asynchronous PBL curriculum data revealed robust learner engagement across the 35 weeks and demonstrated a clear correlation between engagement and standardized knowledge acquisition. The conceptual model illustrating the relationship between the theoretical foundations, curriculum design, engagement, and outcomes is presented in Figure 1.

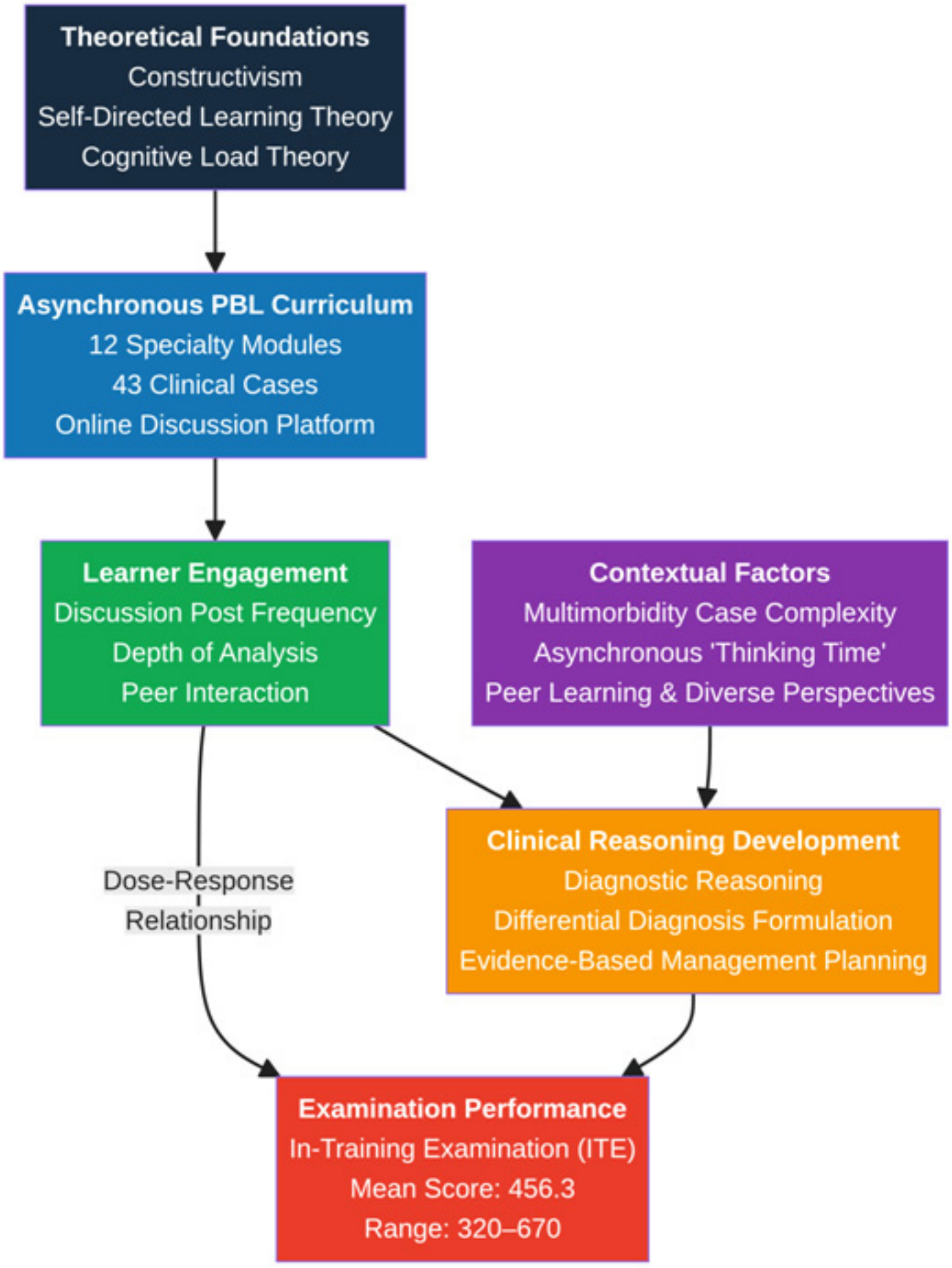


**Figure 1: Conceptual Model linking Theoretical Foundations, Asynchronous PBL Curriculum, Learner Engagement, Clinical Reasoning Development, and Examination Performance.**

**Learner Engagement and Quantitative Outcomes**

Quantitative analysis revealed a strong association between engagement level and ITE performance. The overall mean ITE score for the cohort was 456.3, with scores ranging from 320 to 670. When residents were categorized by engagement level, a clear dose-response relationship emerged: low-engagement residents achieved a mean ITE score of approximately 350, moderate-engagement residents achieved approximately 440, and high-engagement residents achieved approximately 580. This demonstrates that higher engagement predicted superior standardized exam performance, confirming the correlation between qualitative reasoning depth and quantitative metrics. Figure 2 illustrates this relationship.

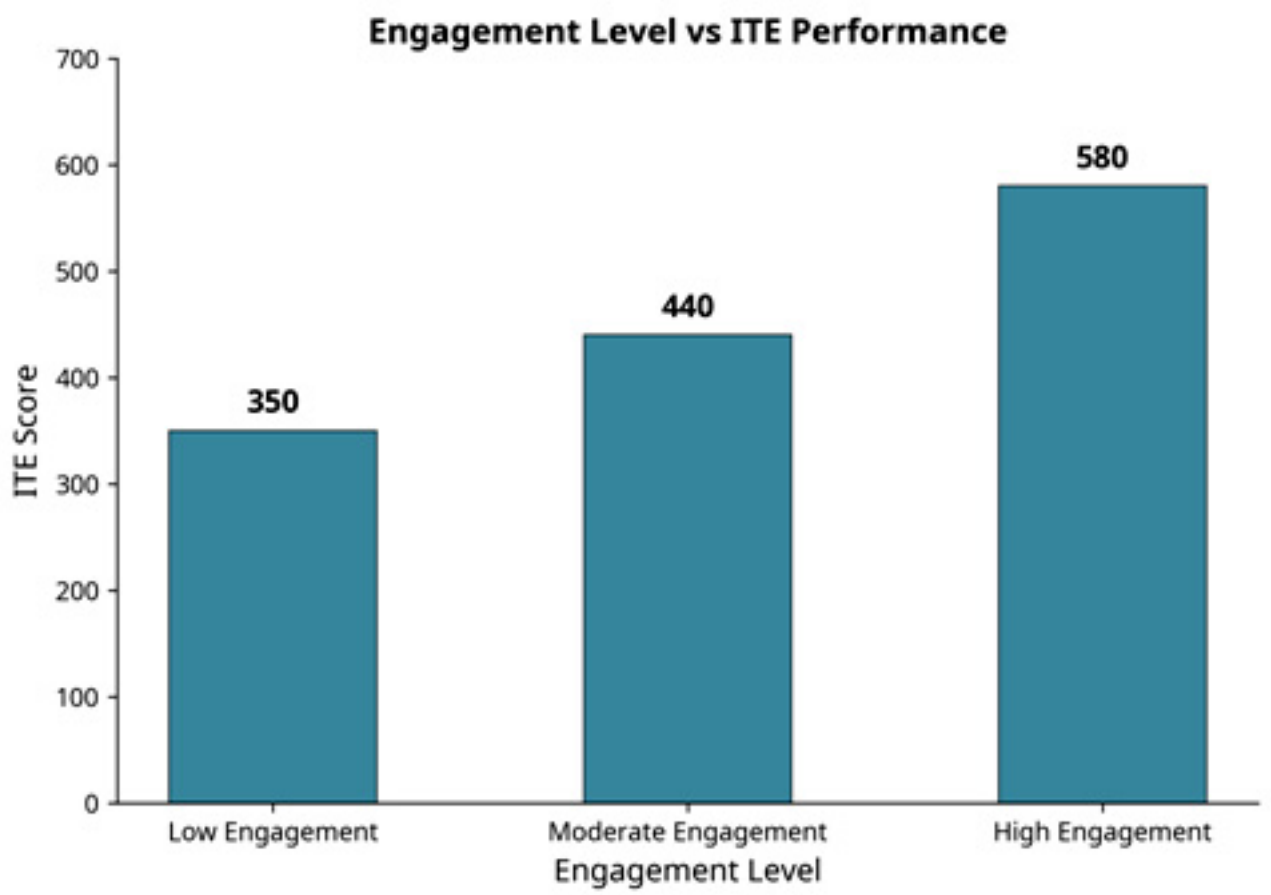


Figure 2. Engagement Level vs ITE Performance. Mean ITE Score = 456.3 (Range: 320–670).

**Quality of Clinical Reasoning**

The qualitative content analysis of the archived resident discussion threads provided strong evidence of the curriculum's effectiveness in fostering advanced clinical reasoning skills, especially in multimorbidity contexts. Table 1 summarizes the key qualitative findings and their quantitative correlations.

| Analysis Domain | Case-specific Findings | Quantitative Correlation |
|---|---|---|
| **Clinical frameworks** | DSM-5 application for Major Depressive Disorder (MDD) | Corresponds with Mean ITE = 456.3 |
| **Pharmacotherapy** | Justification of Duloxetine for MDD with peripheral neuropathy | Supports ITE score > 600 |
| **Risk Management** | Identification of contraindications (e.g., Bupropion in epilepsy) | Correlates with correct identification |
| **Engagement** | High engagement in peer discussions | Management competencies correlated with ITE |

**Table 1. Qualitative Clinical Reasoning Findings and Quantitative Correlations**

The discussions were characterized by a strong emphasis on evidence-based practice. Residents consistently applied sophisticated clinical reasoning, such as identifying MDD while managing comorbidities. Notably, high-engaging residents who consistently cited current literature and challenged peer assumptions (e.g., managing SSRI-induced sexual dysfunction in patients with epilepsy) achieved the highest ITE scores (e.g., 610, 670).

The asynchronous format fostered a rich, collaborative learning environment. Residents built upon each other's contributions, challenged assumptions, and engaged in meaningful peer-to-peer teaching [18]. This collaborative process allowed for a deeper exploration of the clinical problems and a more comprehensive understanding of the material.

## Discussion & Conclusions

This proof-of-concept secondary data analysis demonstrates that a comprehensive, asynchronous problem-based learning curriculum is a highly effective and engaging educational strategy for postgraduate medical education. Our findings indicate that this innovative approach not only fosters the development of clinical reasoning skills but also promotes a collaborative and self-directed learning environment, bridging the gap between theoretical knowledge and clinical practice.

Grounded in Constructivism and Self-Directed Learning Theory, the format facilitated essential "thinking time," allowing residents to synthesize complex data and formulate advanced management plans that address multimorbidity without the immediate cognitive load of synchronous settings [14]. The observed correlation between high-quality PBL engagement and superior ITE performance confirms that asynchronous collaborative learning effectively supports both clinical reasoning development and standardized knowledge retention. The high-engaging residents who actively utilized current literature and evidence-based frameworks demonstrated the highest level of standardized exam success, directly supporting our initial hypothesis.

This unique approach in an understudied area of asynchronous medical education offers a sustainable solution to the logistical and educational challenges of modern medical training [10, 11]. By emphasizing data interpretation and management strategies over rote memorization, programs can better support the development of self-directed, evidence-based practitioners [8, 17]. The effectiveness of PBL in enhancing critical thinking skills has been well-established in the literature [5, 7], and our findings extend this evidence to the asynchronous postgraduate context [19]. Furthermore, providing a clear, replicable 12-module curriculum guide (Supplementary Table 1) allows other institutions to adopt and test this framework, contributing to the broader movement toward competency-based medical education (CBME) in family medicine [20, 21]. The ITE, which has demonstrated predictive validity for board certification success [22, 23], serves as a meaningful outcome measure linking engagement to knowledge acquisition.

### Implications for Practice

The findings of this study have several practical implications for residency program directors and medical educators:

- Asynchronous PBL can be implemented as a longitudinal curriculum spanning multiple specialty areas without requiring dedicated synchronous teaching time, making it particularly suitable for programs with heavy clinical service demands.
- The dose-response relationship between engagement and performance suggests that programs should implement strategies to promote active participation, such as structured peer response requirements and faculty facilitation.
- The 12-module framework provided in Supplementary Table 1 offers a directly replicable model that can be adapted to local contexts and specialty requirements.

### Limitations

The small sample size (N=12) and single-institution design limit external validity and generalizability. Additionally, the retrospective, descriptive nature of the analysis precludes definitive causal inferences. The inter-rater reliability, while demonstrating high agreement, was assessed on a subset of posts rather than the complete dataset. However, as a proof-of-concept study, these findings lay the groundwork for future research, which should include larger, prospective cohorts and multi-institutional studies to further validate this pedagogical model [24,25].

### Conclusion

In conclusion, this secondary data analysis provides strong preliminary evidence that a comprehensive, asynchronous problem-based learning curriculum is a valuable and effective educational tool for family medicine residency programs. This scalable and sustainable model effectively enhances clinical reasoning, improves standardized knowledge acquisition, and provides a replicable framework for residency programs seeking to modernize their curricula to meet the demands of competency-based medical education [20, 21].

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**Supplementary Table 1: De-Identified PBL Curriculum Module Overview**
Asynchronous Problem-Based Learning Curriculum for PGY-2 Family Medicine Residents
Academic Year: 2021–2022 | Total Duration: 35 weeks | Number of Modules: 12 | Total Cases: 43

**Delivery Format:** Asynchronous online case-based discussions via institutional learning management system

| No. | Specialty Area | Weeks | Cases | Representative Case Themes (De-Identified) |
|---|---|---|---|---|
| 1 | Psychiatry | 4 | 5 | MDD in elderly with multimorbidity; recurrent depression; persistent depressive disorder; medication-induced sexual dysfunction; GAD; panic disorder |
| 2 | Sleep Disorders | 3 | 3 | Insomnia with depressive features; obstructive sleep apnea; restless legs syndrome |
| 3 | Endocrinology | 5 | 2 | Recurrent hypoglycemia in diabetes post-MI; hypothyroidism management |
| 4 | Pediatrics | 4 | 3 | Red eye in a child; underweight child with suspected eating disorder; pediatric vulvovaginitis |
| 5 | Environmental Health | 1 | 1 | Asthma exacerbation triggered by environmental factors |
| 6 | ENT | 2 | 4 | Vertigo and Meniere's disease; allergic rhinitis; recurrent dizziness; nasal obstruction |
| 7 | Preventive Health | 2 | 4 | Colorectal cancer risk; hereditary breast cancer risk; cervical cancer prevention; influenza vaccination |
| 8 | Musculoskeletal | 2 | 5 | Rotator cuff tendinopathy; carpal tunnel syndrome; lateral elbow pain; trochanteric pain; low back pain |
| 9 | Geriatric/Aged Care | 2 | 5 | Falls risk; dyspnea in elderly; hypertension review; behavioral symptoms of dementia; geriatric assessment |
| 10 | Gastroenterology | 2 | 4 | Hepatitis C risk; cirrhosis diagnosis; liver fibrosis; hepatitis B assessment |
| 11 | Hematology | 2 | 3 | Easy bruising/von Willebrand disease; immune thrombocytopenia; thalassemia in pregnancy |
| 12 | Cardiology | 4 | 4 | Hypertension management; dyslipidemia; CAD with ECG interpretation; heart failure |

**Competency Weighting:**

| Competency Domain | Weight |
|---|---|
| Basic Knowledge | 10% |
| Clinical Skills | 60% |
| Data Interpretation and Synthesis | 30% |

**Note:** All case titles have been de-identified. Original cases used fictional patient names for pedagogical engagement; these have been replaced with generic clinical descriptors. No resident or faculty identifiers are included. Data presented are at the module/group level only.

# Factors Influencing ABFM-ITE Performance among Family Medicine Residents in Qatar: The Role of Learning Styles, Academic Stress, and Undergraduate GPA

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## Abstract

Background: The association between learning styles and examination performance has been explored in various medical education settings. However, research focusing on Family Medicine residents, particularly in Qatar and the broader Arabian Gulf region, remains limited. Additionally, few studies have accounted for confounding factors when assessing this relationship. This study aims to determine the effect of learning styles on the American Board of Family Medicine In-Training Examination (ABFM-ITE) scores among Family Medicine residents in Qatar while exploring other influential factors that may confound the effect.

Methods :A cross-sectional study was conducted among Family Medicine residents in Qatar across postgraduate years 1 to 4. A self-administered online questionnaire was distributed to all 52 residents, with 21 responding. The questionnaire included the VARK learning styles assessment, motivation factors, stress levels, mentorship, and other relevant variables. Learning styles were analyzed as individual scores for visual, auditory, read/write, and kinesthetic preferences. Linear regression analysis was performed to examine associations with ABFM-ITE performance, with stepwise removal of non-significant variables. A p-value of <0.05 was considered statistically significant.

Results: Among the 21 participants, 9 (42.9%) were categorized as bimodal, 7 (33.3%) as multimodal, and 5 (23.8%) as unimodal. The kinesthetic (K) style was the most prevalent, appearing in nearly all dominant style combinations. The most common dominant learning styles were (A, K) in 5 participants, (K, V) and (A, K, R) in 4 participants each, and (K) alone in 3 participants. Regression analysis identified academic stress as a significant negative predictor of ABFM-ITE performance ($\beta$ = -0.513 to -0.664, $p < 0.05$). Undergraduate GPA emerged as a strong positive predictor ($\beta$ = 0.492 to 0.496, $p < 0.05$), while kinesthetic scores had a moderate positive effect ($\beta$ = 0.354, $p = 0.032$).

Conclusions: Findings emphasize the importance of addressing academic stress and providing targeted academic support for lower-GPA residents. Implementing active learning strategies, including case-based discussions, simulations, and problem-based learning, may enhance performance for kinesthetic learners and improve engagement across all learning styles.

Trial registration
Not applicable.

Keywords:
Learning styles, VARK, Family Medicine, In-Training Exam, medical education, academic stress, performance predictors

## Background

The Accreditation Council for Graduate Medical Education International (ACGME-I) accredited Family Medicine residency program in Qatar recruits 13 residents annually. Over four years of training, residents undergo rigorous academic and clinical preparation, culminating in the Qatar Board Medical Specialization Exam and the Arab Board Medical Specialization Exam. Upon successful completion, they become Family Medicine specialists, contributing to primary health care services across the Primary Health Care Corporation (PHCC) health centers in Qatar. Given their role in shaping the future of primary care, optimizing their academic success is essential to ensuring high-quality patient care delivery.

Understanding the factors influencing examination performance is crucial for enhancing the residency training process. Academic success in residency is shaped by multiple elements, including individual learning styles, academic stress, and prior academic performance, such as Grade Point Average (GPA). The American Board of Family Medicine In-Training Examination (ABFM-ITE) is a key assessment tool used to evaluate residents' medical knowledge through multiple-choice questions (MCQs). Its results inform remediation plans and guide academic improvement efforts.

One key factor influencing academic performance is learning style, which refers to an individual's preferred approach to acquiring, processing, and retaining information. The VARK (Visual, Aural, Read/Write, and Kinesthetic) learning model categorizes learners based on their dominant or multimodal learning preferences (1). Visual learners benefit from diagrams and charts, aural learners from discussions and lectures, read/write learners from textual materials, and kinesthetic learners from hands-on experiences and practical applications. Understanding residents' learning styles can help educators tailor instructional methods to optimize comprehension and retention, potentially improving examination performance.

This study investigates the impact of learning styles on ABFM-ITE scores among Family Medicine residents. By identifying key predictors of examination performance, the findings can support the development of tailored educational strategies to enhance learning outcomes. A deeper understanding of these factors will enable residency programs to optimize training methodologies, ultimately strengthening the competence and preparedness of future Family Medicine specialists.

The relationship between learning styles and academic performance has been explored in various medical education settings. Several studies have examined learning styles among residents across different medical specialties. Hassanzadeh et al. (2019) descriptively mapped the preferred learning styles among ophthalmology residents in Iran and found insignificant correlations between gender, residency levels, and learning styles (2). Similarly, Modi et al. (2015) studied the correlation between learning style and surgical performance using a simulator and found no significant relationship between them (3).

Conversely, some studies have reported a positive correlation between learning styles and examination performance. Muganlinskaya et al. (2021) examined the preferred learning styles of Internal Medicine residents in years 1 and 2 and found significant improvement in their In-Training Exam (ITE) scores (4). Olanipekun et al. (2019) investigated the association between Internal Medicine residents' learning styles and their ITE performance, concluding that residents with a diverging learning style performed better and had the highest mean score; however, the reported p-value of 0.14 was considered statistically insignificant (5). Amal et al. (2021) conducted a cross-sectional descriptive study on Family Medicine residents' learning styles and found that the majority identified as activists (60.5%), reflectors (44.7%), pragmatists (34.2%), and theorists (36.8%) (6). These studies primarily used the Kolb Learning Style Inventory as a data collection tool.

More recent research has employed Fleming's VARK learning style inventory. Kim et al. (2015) studied the association between learning style preferences and American Board of Surgery In-Training Examination (ABSITE) performance, finding that residents who preferred the read/write style performed better, while those with an aural preference scored the lowest ($p = 0.03$) (7). Kim and Gilbert (2015) further examined learning style preferences among general surgery residency applicants, reporting significant differences in USMLE Step 1 and 2 scores based on learning styles (both p-values $< 0.05$), although no significant differences were found for class ranks, interview scores, or final rankings (all p-values $> 0.05$)(8). Despite these contributions, prior studies have not accounted for various covariates that may influence the observed associations. Factors such as prior academic performance (GPA) (9), study habits and time spent studying (10), motivation (11), and stress levels (12) all play significant roles in academic performance. This gap in the literature is particularly evident in studies focusing on residents and medical students in the Arabian Gulf peninsula. One of the most relevant recent studies, conducted by Al Ali et al. (2021), examined Family Medicine residents' learning styles through a cross-sectional descriptive study but did not investigate their predictive value in relation to resident performance (6).

Given this gap, our study aims to explore the relationship between learning styles and American In-Training Exam (AITE) scores among Family Medicine residents. This research is particularly significant as it not only investigates the direct association between learning styles and exam performance but also considers other potential influencing factors. By addressing these gaps, this study seeks to contribute meaningful insights to medical education and residency training, particularly in the context of Family Medicine within the Arabian Gulf region.

## Methods

### Study Design and Setting

This study was a cross-sectional analytical study conducted to examine the relationship between learning styles and exam performance among Family Medicine residents in Qatar. The study was carried out at the Family Medicine Department in West Bay Training Center, a primary healthcare training facility affiliated with the Family Medicine residency program. The study targeted all Family Medicine residents enrolled in the residency program during the 2024 academic year. Using Cochran's formula, the estimated sample size required to achieve a 95% confidence level with a 5% margin of error was 46 residents. However, 21 residents ultimately participated in the study.

Participants were recruited via email invitations, and participation was voluntary. Only those who provided consent proceeded to complete the questionnaire. Residents were eligible to participate if they were actively enrolled in the Family Medicine residency program (PGY 1–4) and provided consent to complete the questionnaire, including self-reporting their American Board of Family Medicine In-Training Examination (ABFM-ITE) scores. Residents were excluded if they were on leave, did not take the ABFM-ITE, or did not complete the questionnaire. Additionally, those who withdrew from or were dismissed from the residency program during the study period were excluded from the analysis.

### Data Collection and Measures

Data were collected through an online questionnaire developed using Microsoft Forms. Participants received an email with a link to the questionnaire and were asked to complete it at their convenience. The questionnaire consisted of multiple sections covering various research variables. Demographic information such as age, gender, and academic background was collected. Learning styles were assessed using the VARK Learning Styles Inventory, which provides individual scores for Visual (V), Auditory (A), Read/Write (R), and Kinesthetic (K) learning preferences. Based on the resulting scores, individuals with the highest dominant style were grouped into either Unimodal, Bimodal, Trimodal, or Multimodal. The latter three categories were concluded if the second, third, or fourth highest scores were within 3 cutoff points from the style with the highest score.

Motivation levels were evaluated using the strength motivation general practitioner (STRONG) questionnaire (13), and additional factors influencing exam performance were measured, including prior academic performance (undergraduate GPA), study habits, stress levels (academic stress), clinical experience, workload, access to learning resources, feedback, mentorship, and personal attributes. The ABFM-ITE scores were self-reported by participants as part of the questionnaire.

### Data Analysis

All statistical analyses were conducted using IBM SPSS Statistics version 26. Descriptive statistics were used to summarize the respondents' demographic characteristics. The primary independent variables were the VARK learning style scores, which were treated as continuous variables in the analysis. To examine the relationship between learning styles and ABFM-ITE scores, a multiple linear regression model was employed. The model included other additional covariates to control for potential confounding factors. Statistical significance was set at $p<0.05$ for all analyses.

## Results

The demographic characteristics of the study participants indicate a diverse group of Family Medicine residents, with notable variability in the disclosure of personal information. Among the 21 respondents, males and females were equally represented (28.6% each), while 42.9% preferred not to disclose their sex. Similarly, 42.9% of participants reported being between the ages of 26-30, whereas 14.3% were older than 30, and a substantial proportion (42.9%) opted not to reveal their age. This pattern extended to postgraduate year (PGY) levels and marital status, where nearly half of the respondents chose not to disclose their information (Table 1).

### Fisher's Exact Test

A Fisher's Exact Test was performed due to the violation of chi-square assumptions, as 100% of cells had expected counts below 5 (minimum expected count = 0.95). The test did not reveal a statistically significant association between learning modality (Unimodal, Bimodal, Multimodal) and ABFM performance categories (Below Passing, Minimum Passing, Meets Expectation, Above Average)(14), $p = .394$ (two-sided). These findings suggest that preferred learning modality was not associated with the performance on the ABFM-ITE exam in this sample. Thus, $H_1$ is rejected and $H_0$ (Null Hypothesis) is accepted. There is no association between learning modality (unimodal, bimodal, etc.) and ABFM performance categories.

The bar chart (Figure 1) illustrates the distribution of learning modalities across ABFM performance categories. Bimodal learners were most frequent in the "Meets Expectation" category, while Multimodal learners were more evenly spread across categories. Unimodal learners had a lower presence overall. Notably, the "Above Average" category included only Unimodal and Multimodal learners. This visual trend aligns with the statistical results, confirming no significant association between learning modality and ABFM performance.

**Table 1. Demographic Characteristics of Study Objects (n=21)**

| Characteristics | | Frequency (%) |
|---|---|---|
| Sex | Female | 6 (28.6%) |
| | Male | 6 (28.6%) |
| | Prefer not to say | 9 (42.9%) |
| Age group | 26-30 | 9 (42.9%) |
| | > 30 | 3 (14.3%) |
| | Prefer not to say | 9 (42.9%) |
| PGY Level | PGY2 | 3 (14.3%) |
| | PGY3 | 6 (28.6%) |
| | PGY4 | 3 (14.3%) |
| | Prefer not to say | 9 (42.9%) |
| Marital Status | Single | 6 (28.6%) |
| | Married | 3 (14.3%) |
| | Married with children | 3 (14.3%) |
| | Prefer not to say | 9 (42.9%) |

**Table 2. Fisher's exact test of learning modality and ABFM-ITE performance categories**

| | Learn Modality | | | | Test Result |
|---|---|---|---|---|---|
| ABFM score category | Unimodal | Bimodal | Multimodal | Total | |
| 1 Below Passing Standard | 1 | 2 | 2 | 5(23.8%) | p = .394 |
| 2 Minimum Passing Standard | 2 | 3 | 1 | 6(28.6%) | (two-sided) |
| 3 Meets Expectation | 0 | 4 | 2 | 6(28.6%) | |
| 4 Above Average | 2 | 0 | 2 | 4(19.0%) | |
| **Total** | 5(23.8%) | 9(42.9%) | 7(33.3%) | 21(100%) | |

**Figure 1. Distribution of Learning Modalities Across ABFM-ITE scores categories**

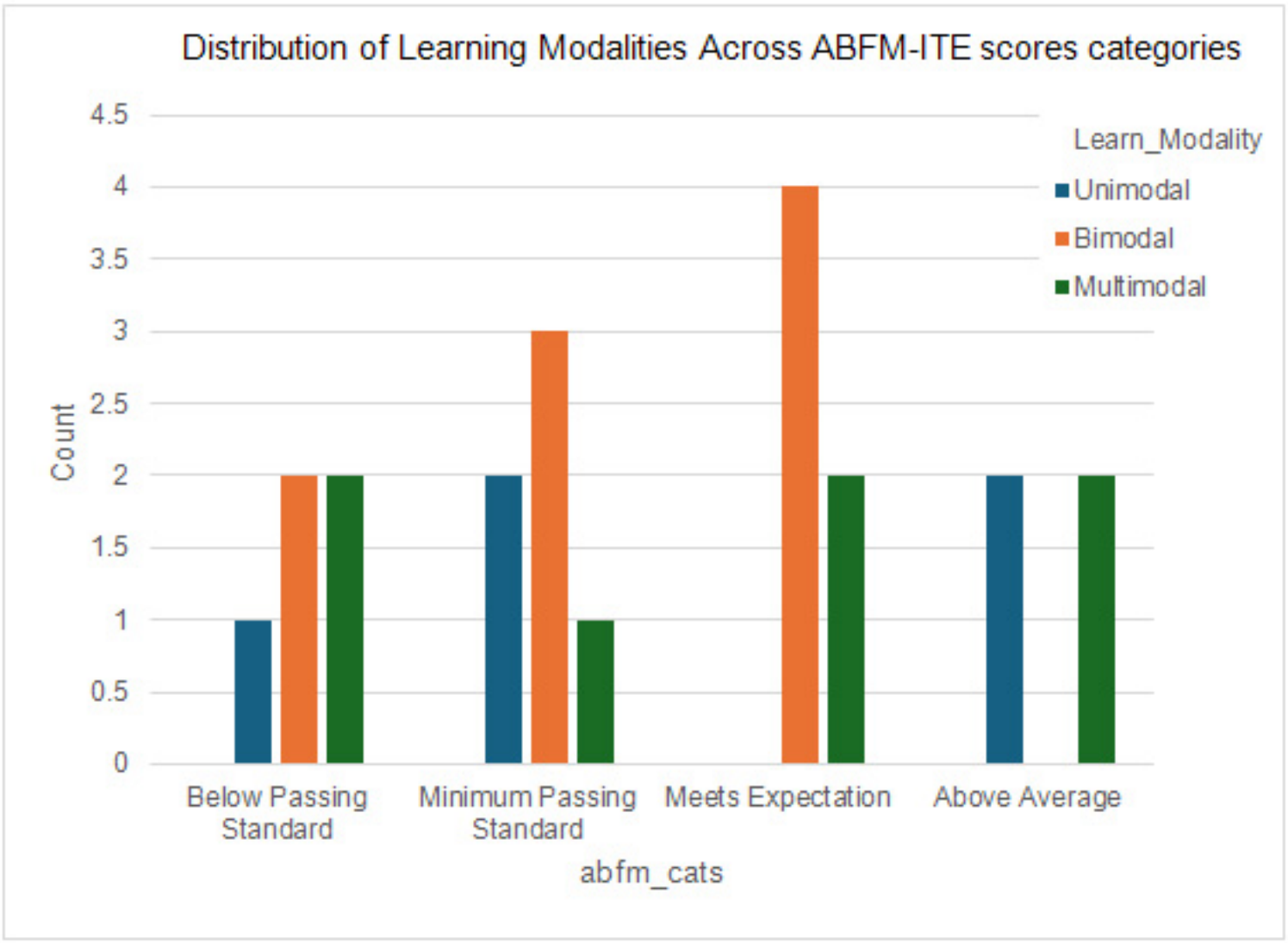
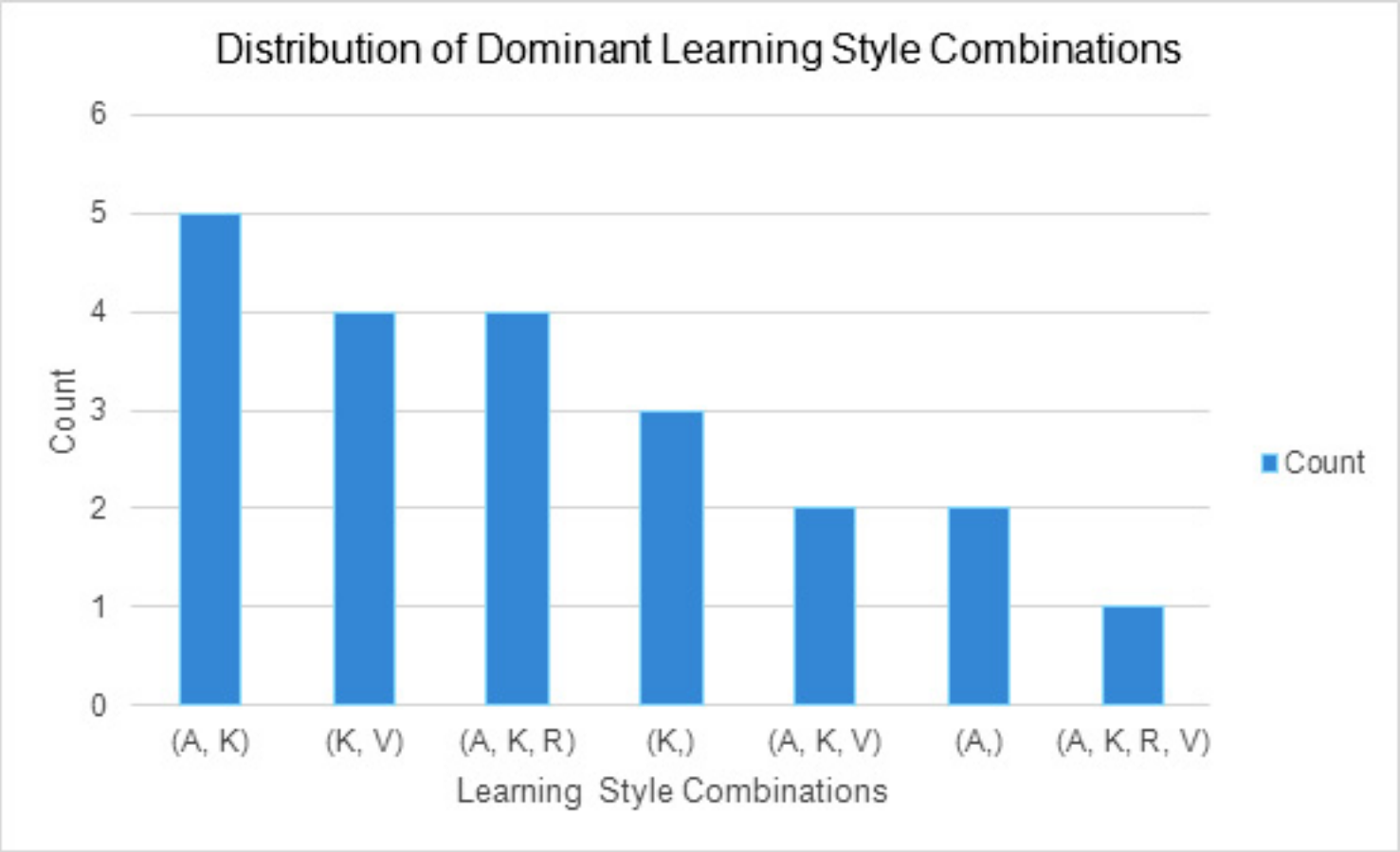


**Figure 2. Distribution of Dominant Learning Style Combinations**




**General Linear Regression**

To further investigate the relationship between learning preferences and ABFM performance, a stepwise general linear regression model was performed using individual VARK scores (Visual, Auditory, Read/Write, Kinesthetic) as continuous independent variables and ABFM raw scores as the dependent variable. In addition, academic stress, undergraduate GPA, motivation, and other variables were included as covariates.

The regression analysis identified Kinesthetic learning preference (K-score) ($p < 0.05$), academic stress ($p < 0.05$), and undergraduate GPA ($p < 0.05$) as significant predictors of ABFM score. However, Visual, Auditory, and Read/Write learning preferences did not exhibit significant associations with ABFM performance.

General linear regression models showed that academic stress was a significant negative predictor in all models, while undergraduate GPA and kinesthetic scores were positive predictors in Models 2 and 3. The final model (Model 3) explained 61.2% of the variance in ABFM-ITE scores ($R^2 = .612$, $p = .001$) (Table 3). Thus, we reject the null hypothesis (H0) that VARK scores (V, A, R, K) and other variables (e.g. academic stress, and undergraduate GPA) do not significantly predict ABFM in-training exam scores while accepting the alternative hypothesis (H1) that at least one of the VARK scores, academic stress, and undergraduate GPA significantly predicts ABFM in-training exam scores. Figure 3 illustrates the linear regression model predicting ABFM-ITE scores.

| | β Coefficients, (95% CI), Effect Size | | |
|---|---|---|---|
| **Regression Variables** | **Model 1** | **Model 2** | **Model 3** |
| Constant (without 95% CI) | 649.181 (501.949 to 796.413)*** | 468.487 (282.675 to 654.299)*** | 358.155 (163.759 to 552.550)*** |
| acad_stress | -57.343 (-103.358 to -11.329), -0.513* | -74.208 (-115.814 to -32.602), -0.664* | -71.949 (-109.398 to -34.500), -0.664*** |
| ug_gpa | --- | 69.868 (17.349 to 122.388), 0.496** | 69.385 (22.181 to 116.589), 0.492** |
| K_score | --- | --- | 10.018 (0.983 to 19.053), 0.354* |
| **Model Significance** | .017 | .002 | .001 |
| **Durbin Watson** | --- | -- | 1.340 |
| **R Square** | .264 | .487 | .612 |
| **Cook's distance** | --- | --- | .057 (.000 to .494) |
| **Variance Inflation Factors (VIF)** | 1.000 | 1.102 | 1.070 |

Dependent Variable is American Board of Family Medicine In-training Exam (ABFM-ITE) scores

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

**Table 3: General linear regression models**

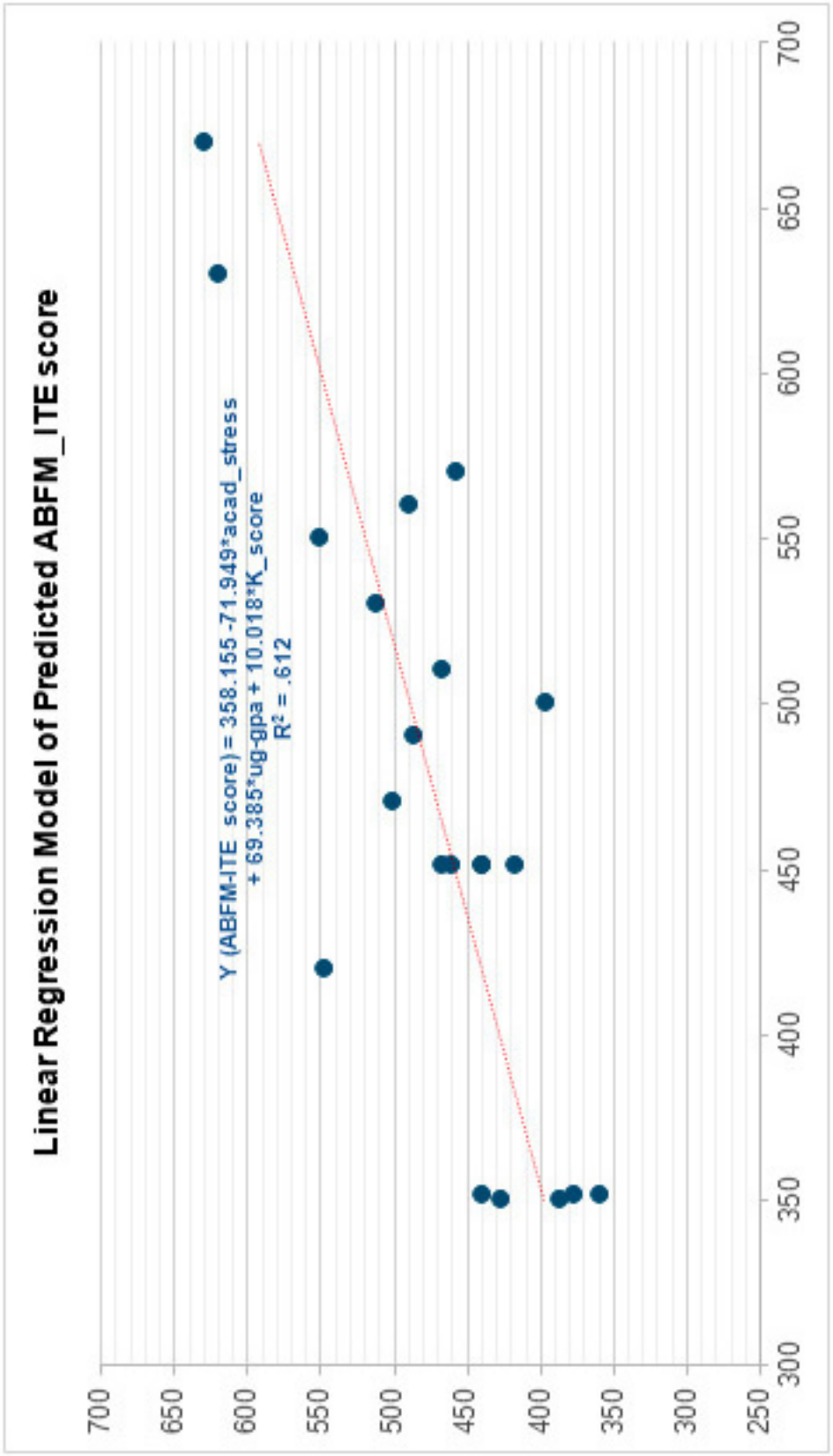



**Figure 3.**
**Linear Regression Model of Predicted ABFM_ITE score**

## Discussion

The findings from Fisher's Exact test align with previous studies that reported no significant association between learning styles and performance on the EyeSi cataract surgery simulator (3) and between learning styles and previous GPA (15). However, our results contradict the findings of El-Saftawy et al. (16), who identified a significant association between two learning modes (trimodal and multimodal) and post-test results.

To further investigate potential associations beyond Fisher's test, we conducted a general linear regression analysis. In this model, we treated VARK scores as continuous variables and regressed them against ABFM-ITE scores while controlling for other covariates. As described in the Results section, kinesthetic learning style emerged as a significant predictor of performance ($\beta = 0.354$, $p = 0.032$), corresponding to an increase of 10.018 points in the ABFM-ITE score. However, this effect was relatively modest compared to academic stress ($\beta = -0.664$, $p = 0.001$), which had a strong negative impact, reducing scores by up to 71.949 points. Additionally, undergraduate GPA ($\beta = 0.492$, $p = 0.006$) showed a moderate positive association with ABFM-ITE performance, leading to an increase of up to 69.384 points. The final regression model obtained is as follows:

**Y (ABFM-ITE score) = 358.155 (-71.949 * academic stress) + (69.384 * undergraduate GPA) + (10.018 * kinesthetic score)**

Our linear regression analysis highlights the widespread dominance of kinesthetic learning style among participants, a finding consistent with Tonkaboni et al. (17), who reported increased utilization of kinesthetic learning with higher education levels. In contrast, Kim et al. (7) found that residents with a read/write learning style performed better on surgical in-training exams.

Adding to this complexity, Muganlinskaya et al. (4) observed significant improvement in in-training exam scores from PGY1 to PGY2 across all learning styles, while Olanipekun et al. (5) identified the diverging learning style as yielding the highest scores in Internal Medicine In-Training Exams, followed by assimilating and converging styles, which are based on Kolb's learning style model.

The discrepancies between Fisher's Exact test and the general linear regression analysis suggest that broad classifications of learning styles (e.g., unimodal, bimodal, and multimodal) may obscure subtle effects, such as the kinesthetic learning style's influence on ABFM-ITE performance. This may be due to the oversimplification inherent in categorizing individuals based on their dominant learning styles. By treating VARK scores as continuous variables, our regression model provided a more nuanced assessment, revealing that kinesthetic learning was significantly associated with higher scores, albeit with a smaller effect compared to other predictors.

These findings emphasize the need for a more refined approach in evaluating the impact of learning styles on medical education outcomes.

The unexpected emergence of academic stress and undergraduate GPA as significant predictors of ABFM performance nuanced the focus of our study. We initially believed that learning styles would have a greater impact than other variables; however, our findings suggest that academic stress and undergraduate GPA play a more substantial role. Our results align with West et al. (2011), who reported that lower quality of life (QOL) and burnout symptoms were associated with lower scores on Internal Medicine in-training exams (18). Similarly, other studies suggest that chronic academic stress can impair cognitive functioning and hinder medical students' learning (19).

However, our findings contradict those of LeBlanc and Bandiera (2007), who found that junior residents performed better under high-stress conditions during in-training examinations, while intermediate and senior residents showed no significant changes in performance (20). This discrepancy may be explained by differences in stress type, namely, acute stress versus chronic stress. Acute stress, which is short-term, may enhance exam performance by increasing alertness and focus (21,22). In contrast, chronic stress, which persists over time, can lead to fatigue, anxiety, and impaired learning ability (23). Furthermore, Bogdanov et al. (2021) found that while acute stress did not directly impair cognitive function, it made individuals more likely to avoid effortful or demanding tasks (24).

**Sources of Academic Stress**

Among the 21 participants surveyed, multiple sources of academic stress were identified, as participants could select more than one stressor. The most frequently reported stressor was exams, cited 19 times (31.15%), indicating that most participants found exams to be a major source of stress. This aligns with existing research identifying exams as a key stressor for medical trainees (25,26).

Assignments were the second most common stressor (16 times, 26.23%), followed by time management challenges (13 times, 21.31%). Additionally, personal life difficulties (7 times, 11.48%) and clinical rotations (5 times, 8.20%) were reported as stressors. Multiple evaluations were mentioned once (1.64%), highlighting concerns about frequent assessments. These findings suggest that while exams remain the primary academic stressor, the combined burden of assignments, time constraints, and personal responsibilities significantly contributes to residents' overall stress levels.

Consistent with our study's findings, a systematic review demonstrated that previous academic records, such as GPA scores, are significant predictors of academic success, supporting the use of GPA-based selection criteria in medical education (27). Similarly, a study conducted in the UAE found that undergraduate

GPA, along with medical residency entry examination scores and multiple mini-interview results, could predict end-of-year-one performance among residents (28). However, conflicting evidence exists. A study examining anesthesiology residents found no significant correlation between undergraduate GPA and in-training exam (ITE) scores, suggesting that other factors may play a more influential role in certain specialties (29). These discrepancies highlight the complexity of academic performance predictors and the need for further research across different medical fields.

## Conclusions

This study explored the relationship between VARK learning styles and American Board of Family Medicine In-Training Exam (ABFM-ITE) performance, revealing that kinesthetic learning style had a modest yet significant positive association with exam scores. However, academic stress and undergraduate GPA emerged as stronger predictors, underscoring the complexity of factors influencing resident performance. These findings suggest that broad categorizations of learning styles may overlook nuanced effects, highlighting the need for a more tailored approach to medical education, moving beyond broad learning style categorizations to consider individual learning preferences, particularly kinesthetic tendencies, alongside academic stress levels and prior academic performance. Incorporating hands-on techniques such as clinical simulations, 3D models or augmented reality (AR), and procedural task training can better engage kinesthetic learners.

Medical educators should design tailored interventions that accommodate these factors to optimize learning outcomes and exam performance. Additionally, the significant role of academic stress in resident performance underscores the importance of integrating stress management programs into medical training. Mindfulness training, resilience workshops, and structured mentorship programs can equip residents with effective coping strategies.

Furthermore, revisiting assessment methods and exam preparation approaches is crucial. Streamlining exams, optimizing study plans, and incorporating active learning techniques, such as simulation-based training for kinesthetic learners, can enhance knowledge retention while reducing stress. Strengthening mentorship and peer support systems can further provide residents with guidance on effective study techniques and coping mechanisms. Aligning with recommendations from Mian et al.(30), medical schools and residency programs should also implement systematic burnout monitoring and prevention initiatives, ensuring that residents have access to mental health resources, flexible scheduling, and institutional support for work-life balance.

### Limitations

This study has several limitations that should be considered when interpreting the results. The small sample size (21 out of 52 residents) may have introduced participation bias, thereby limiting the generalizability of the findings. Additionally, a potential overrepresentation of kinesthetic learners could have introduced selection bias, influencing the overall results. The statistical power of the study may also have been insufficient to detect significant associations between VARK learning styles and American In-Training Exam (ITE) scores. Moreover, the reliance on self-reported VARK assessments without pre- and post-testing introduces the possibility of recall bias, potentially affecting the accuracy of reported learning preferences.

Given the exploratory nature of this study, its findings should be interpreted with caution, and future research involving larger samples and more rigorous study designs is warranted. Although demographic data were collected from more than half of the participants, they were excluded from the final analysis due to a substantial number of participants declining to share their demographic information. However, this omission does not undermine the study's primary objective of examining the relationship between learning styles and exam performance. Rather, the findings remain relevant for optimizing residency training strategies based on cognitive preferences rather than demographic factors.

### List of abbreviations

ABFM-ITE: the American Board of Family Medicine In-Training Examination.
ABFM: the American Board of Family Medicine.
STRONG questionnaire: the strength motivation general practitioner questionnaire
VARK: Visual, Aural, Read/Write, Kinesthetic
GPA: grade point average
MCQ: multiple-choice questions
PHCC: Primary Health Care Corporation
ACGME-I: The Accreditation Council for Graduate Medical Education International
IBM© SPSS: International Business Machines Corporation Statistical Package for the Social Sciences

### Declarations

Ethics approval and consent to participate
The study was conducted in compliance with the Declaration of Helsinki, Belmont Report, and Good Clinical Practice frameworks. It is approved by the Institutional Review Board (or Ethics Committee) of Primary Health Care Corporation, Qatar. IRB Reference No. BUHOOTH-D-24-00071. Informed consent obtained from all the participants.

### Consent for publication

Not applicable.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.

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**Authors' contributions**

MTA is responsible for planning and writing, AC collected data, analyzed and interpreted the data set on the impact of learning style on the ABFM-ITE scores. ZA, MHM and AB are responsible for revising the final manuscript, and MS is responsible for conducting the literature review. All authors read and approved the final manuscript.

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# Obesity and sedentary lifestyle - a practical national initiative using existing digital technologies

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## Abstract

A WHO report in June 2024 highlighted that 1.8 billion adults, nearly one third (31%) of adults worldwide, did not meet recommended physical activity levels in 2022. It further reported failing to achieve these goals drastically increases the risk of cardiovascular disease, type 2 diabetes, and certain cancers.

The World Health Organization (WHO) outlined that adults require at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic physical activity per week to maintain optimal health.

The study showed that almost half of the world's countries have made some improvements over the past decade, and 22 countries were identified as likely to reach the global target of reducing inactivity by 15% by 2030, if their trend continues at the same pace.

The National Health Services (NHS) of the UK has, in response, initiated a national program using digital technology which is due to commence in January 2027. The scheme, called Movement 26.2 tracks individual efforts via a 'smartwatch' or 'smartphone' and incentives are provided to individuals who are rewarded shopping vouchers or discounts if they meet their monthly targets of 26 miles.

Key words: physical inactivity, digital technology, cardiovascular disease, type 2 diabetes, national fitness programs

## Background

A WHO report in June 2024 highlighted that 1.8 billion adults, nearly one third (31%) of adults worldwide, did not meet recommended physical activity levels in 2022.

It further reported failing to achieve these goals drastically increases the risk of cardiovascular disease, type 2 diabetes, and certain cancers.

The World Health Organization (WHO) outlined that adults require at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic physical activity per week to maintain optimal health.

If the trend continues, levels of inactivity are projected to further rise to 35% by 2030, and the world is currently off track from meeting the global target to reduce physical inactivity by 2030. The WHO recommends that adults undertake 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity physical activity, or equivalent, per week. Physical inactivity puts adults at greater risk of cardiovascular diseases such as heart attacks and strokes, type 2 diabetes, dementia and cancers such as breast and colon.

“These findings highlight a lost opportunity to reduce cancer and heart disease, and improve mental health and well-being through increased physical activity,” said Dr Tedros Adhanom Ghebreyesus, WHO Director-General. “We must renew our commitment to increasing levels of physical activity and prioritizing bold action, including strengthened policies and increased funding, to reverse this worrying trend.”

The highest rates of physical inactivity were observed in the high-income Asia Pacific region (48%) and South Asia (45%), with levels of inactivity in other regions ranging from 28% in high-income Western countries to 14% in Oceania.

Physical inactivity is still more common among women globally compared with men, with inactivity rates of 34% compared to 29%. In some countries, this difference is as much as 20 percentage points. Additionally, people over 60 are less active than other adults, underscoring the importance of promoting physical activity for older adults. “Physical inactivity is a silent threat to global health, contributing significantly to the burden of chronic diseases,” said Dr Rüdiger Krech, Director of Health Promotion at WHO. “We need to find innovative ways to motivate people to be more active, considering factors like age, environment, and cultural background. By making physical activity accessible, affordable, and enjoyable for all, we can significantly reduce the risk of non-communicable diseases and create a population that is healthier and more productive.”

“Promoting physical activity requires a whole-of-society approach and creating environments that make it easier and safer for everyone to be more active in ways they enjoy to reap the many health benefits of regular physical activity,” said Dr Fiona Bull, Head of the WHO Unit for Physical Activity.

The societal and economic cost of inaction will lead to millions of new preventable, non-communicable diseases.

Despite the worrying results, there are some signs of improvement in some countries. The study showed that almost half of the world’s countries have made some improvements over the past decade, and 22 countries were identified as likely to reach the global target of reducing inactivity by 15% by 2030, if their trend continues at the same pace.

In light of these findings, WHO is calling on countries to strengthen their policy implementation to promote and enable physical activity through grassroots and community sport and active recreation and transport (walking, cycling and use of public transport), among other measures.

“These new findings highlight a lost opportunity to reduce cancer and heart disease, and improve mental health and well-being through increased physical activity,” said Dr Tedros Adhanom Ghebreyesus, WHO Director-General. “We must renew our commitment to increasing levels of physical activity and prioritizing bold action, including strengthened policies and increased funding, to reverse this worrying trend.”

Collective efforts based on partnerships between government and non-governmental stakeholders and increased investments in innovative approaches will be needed to reach the least active people and to reduce inequalities in access to measures promoting and improving physical activity.

## Movement 26.2 – an NHS Initiative in the UK

The NHS is set to launch a new scheme in January 2027, called Movement 26.2, which will incentivise Britons to walk for at least 20 minutes a day.

Participants will earn shopping vouchers and discounts from high street and online retailers by logging their daily walks online, via phone, or smartwatch, with the aim of completing the equivalent of a marathon (26 miles) each month.

The initiative was developed by NHS England alongside Olympic medallist Sir Brendan Foster (founder of the Great North Run) and Sir Keith Mills (creator of the Air Miles scheme). NHS chief executive Sir Jim Mackey said the scheme aims to make physical activity a daily choice, improving both physical and mental health.

**Movement 26.2** encourages participants to walk about 20-30 minutes daily to hit a 26.2-mile monthly target, which can be tracked using a smartwatch, phone, or other online platform. Successfully completing the challenge earns the participant digital badges, shopping vouchers, and retail discounts.

It is free to join, and the rewards are funded via corporate partnerships rather than NHS budgets. The programme is designed to tackle physical inactivity, which costs the NHS billions annually, by 'gamifying' exercise and building sustainable daily habits.

## Conclusion

A program that uses current, almost universal, digital technologies usually carried 'on person' each day has both the means and the availability to counteract both physical inactivity and obesity. It will also have benefits on mental health and personal empowerment.

A program that involves no personal cost (such as gym membership) and which provides financial incentives to participants is an excellent way to reach all members of society and provides a good model for many countries to adapt to their own situations and needs.

Further, being in partnership with commercial and philanthropic interest groups it lessens the financial burden on National Health Services.

"Promoting physical activity goes beyond promoting individual lifestyle choice - it will require a whole-of-society approach and creating environments that make it easier and safer for everyone to be more active in ways they enjoy, to reap the many health benefits of regular physical activity," said Dr Fiona Bull, Head of the WHO Unit for Physical Activity.

Physical inactivity is associated with one in six deaths, according to NHS England. A person is classified as physically inactive if they do less than 30 minutes of moderate-intensity equivalent physical activity per week. A survey by Sport England showed that in the year to November 2025 nearly a quarter of adults, or around 12 million people, were in that category.

The NHS is covering the initial set up, but the wider plan is to draw in philanthropic backing from major corporates as the scheme rolls out.

"If someone walks 30 minutes five times a week, they could gain up to four extra years of healthy life," he says. Health officials say the NHS will not be paying for the rewards. They say the NHS in England will be in partnership with other organisations from the public and private sectors who will run the scheme.

GPs and other health staff will be encouraged to promote the initiative among their patients.

The initiative is to encourage citizens to increase their fitness levels through walking 30 minutes a day / 26 miles a month and it does not relate to just walking. If a smart phone or other appropriate device is worn or carried each day, normal activity of work/leisure will also be logged.

Citizens are encouraged to meet the monthly requirements through earning vouchers and discounts from 'local' or national businesses.

Movement 26.2 commences January 2027 and the scheme has generated interest among various sectors of the population. If found to be successful in increasing fitness and activity among the population it can both advantage the individual participant and the National health services through decreased health spending related to diseases of obesity and sedentary lifestyles as well as improving population mental health.

Hopefully other countries will keep a watch on this and similar systems, as national models for their own populations. Most people worldwide will have a smart phone or similar device. Using it for such a purpose counteracts the sedentary influences of the same technologies.

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# Clinical Assessment of Dementia: A Practical Evidence-Based Approach to Diagnosis

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## Abstract

Background: Dementia is a heterogeneous clinical syndrome characterized by progressive cognitive decline that interferes with independent functioning. Although advances in neuroimaging, fluid biomarkers, molecular diagnostics, and genetic testing have improved etiological classification, dementia remains fundamentally a clinical diagnosis. Biomarker findings must therefore be interpreted within the context of the patient's cognitive, functional, behavioural, neurological, medical, and psychosocial presentation.

Objective: This narrative review provides a practical, evidence-based framework for the comprehensive clinical assessment of adults presenting with suspected dementia, with emphasis on translating contemporary diagnostic principles into routine clinical practice across primary care, geriatrics, neurology, psychiatry, and memory-clinic settings.

Methods: Current clinical guidelines, consensus criteria, validated assessment instruments, and contemporary evidence concerning dementia diagnosis were narratively synthesized. The review examines history taking and collateral information, characterization of cognitive symptom profiles, functional assessment, neurological examination, early warning signs, longitudinal progression, behavioural and psychological symptoms, differential diagnosis, cognitive screening, laboratory and neuroimaging evaluation, biomarkers, and emerging digital and artificial-intelligence technologies.

Results: Accurate assessment requires integration of multiple complementary sources of information rather than reliance on any single test. A detailed history from both the patient and a knowledgeable informant establishes symptom onset, tempo, affected cognitive domains, and change from premorbid functioning. Functional assessment is essential for distinguishing dementia from mild cognitive impairment, while neurological and behavioural findings assist with syndrome differentiation, severity determination, safety evaluation, and identification of reversible or contributing conditions. Serial assessment is particularly valuable because longitudinal changes in cognition, function, and behaviour may be more diagnostically informative than a single evaluation. Biomarkers and artificial intelligence can improve diagnostic confidence, subtype classification, and monitoring but should complement rather than replace clinical reasoning and patient-centered judgment.

Conclusion: Comprehensive clinical assessment remains the cornerstone of timely and accurate dementia diagnosis. A systematic, multidisciplinary, and patient-centered approach integrating history, cognition, function, behaviour, neurological examination, and appropriately selected investigations provides the strongest basis for etiological diagnosis, individualized management, caregiver support, safety planning, and longitudinal care.

Keywords: dementia; cognitive impairment; clinical assessment; diagnosis; functional assessment; neurological examination; neuropsychiatric symptoms; biomarkers; artificial intelligence; patient-centered care.

## Introduction

Dementia is a clinical syndrome characterized by acquired, progressive impairment in one or more cognitive domains that interferes with independence in activities of daily living. Rather than representing a single disease, it comprises a heterogeneous group of neurodegenerative, vascular, inflammatory, infectious, metabolic, and other neurological disorders that differ in their pathophysiology, clinical manifestations, prognosis, and therapeutic approach (World Health Organization [WHO], 2023; Livingston et al., 2024). Alzheimer's disease (AD) remains the most common cause of dementia, accounting for approximately 60–70% of cases worldwide, followed by vascular dementia, dementia with Lewy bodies (DLB), frontotemporal dementia (FTD), Parkinson's disease dementia (PDD), and several less common disorders (WHO, 2023; Knopman et al., 2021).

The importance of accurate and timely diagnosis has increased substantially with the emergence of disease-modifying therapies and advances in biomarker technology. Early recognition enables optimization of reversible risk factors and comorbidities, initiation of appropriate pharmacological and non-pharmacological interventions, advance care planning, caregiver education, and timely access to health and community support services. Moreover, distinguishing among dementia subtypes has important prognostic and therapeutic implications because disease progression, treatment response, and management strategies differ according to the underlying etiology (Livingston et al., 2024; Galvin & Atri, 2022).

Over the past decade, the diagnostic paradigm has evolved considerably with the introduction of structural magnetic resonance imaging (MRI), molecular positron emission tomography (PET), cerebrospinal fluid (CSF) biomarkers, plasma biomarkers, and genetic testing. The 2024 Alzheimer's Association diagnostic criteria represent an important advance by incorporating validated biomarkers into the diagnostic framework and recognizing AD as a biological continuum that begins years before overt clinical symptoms develop (Jack et al., 2024). Nevertheless, these developments reinforce rather than diminish the central role of clinical assessment. Biomarker results should always be interpreted within the context of the patient's clinical presentation and should complement, not replace, clinical judgment (Jack et al., 2024; Hansson, 2023).

Despite rapid technological advances, dementia remains fundamentally a clinical diagnosis. Biomarkers identify underlying pathological processes but cannot independently determine whether these changes explain an individual's symptoms, functional impairment, behavioural manifestations, or overall clinical syndrome. Consequently, accurate diagnosis requires integration of a detailed clinical history, collateral information from a knowledgeable informant, cognitive and functional assessment, physical and neurological examination, laboratory investigations, and appropriate neuroimaging (Galvin & Atri, 2022; Jack et al., 2024).

This review provides a practical, evidence-based approach to the clinical assessment of adults presenting with suspected dementia. The emphasis is on comprehensive history taking, cognitive and functional assessment, neurological examination, behavioural and psychological symptoms of dementia (BPSD), differential diagnosis, cognitive screening instruments, and the appropriate integration of biomarkers into routine clinical practice. The overall objective is to translate current evidence into practical recommendations that support accurate diagnosis and patient-centred care across primary care, geriatric medicine, neurology, psychiatry, and specialised memory clinic settings.

**Table 1. Major Components of Comprehensive Clinical Assessment in Patients with Suspected Dementia**

| Component | Primary objective |
|---|---|
| Clinical history | Characterize symptom onset, progression, and the pattern of cognitive decline |
| Collateral history | Confirm cognitive and functional decline through a reliable informant |
| Physical and neurological examination | Identify neurological signs and alternative or coexisting disorders |
| Cognitive assessment | Evaluate affected cognitive domains and estimate severity |
| Functional assessment | Determine the impact of cognitive impairment on independence |
| Behavioural assessment | Identify neuropsychiatric symptoms and assess caregiver burden |
| Laboratory investigations | Exclude reversible or contributing medical conditions |
| Neuroimaging and biomarkers | Support etiological diagnosis and improve diagnostic confidence |

**Clinical Practice Points**

• Dementia remains a clinical syndrome, even in the era of biomarker-based diagnosis.
• Comprehensive clinical assessment provides the framework for interpreting laboratory, imaging, and biomarker findings.
• Accurate diagnosis requires integration of cognitive, functional, behavioural, neurological, and investigative findings rather than reliance on a single diagnostic modality.
• Early assessment facilitates timely intervention, individualized management, and improved outcomes for patients and caregivers.

## Clinical Assessment

Clinical assessment remains the cornerstone of dementia diagnosis despite major advances in neuroimaging, fluid biomarkers, molecular genetics, and artificial intelligence. Although these technologies have substantially improved diagnostic precision, they cannot replace comprehensive bedside evaluation in determining whether cognitive impairment is clinically significant, identifying its impact on daily functioning, establishing the most likely dementia syndrome, and excluding potentially reversible causes (Jack et al., 2024; Galvin & Atri, 2022; Knopman et al., 2021).

The principal objective of clinical assessment is to develop an integrated diagnostic formulation rather than simply confirm cognitive impairment. This requires combining information from the clinical history, collateral interview, cognitive and functional assessment, physical and neurological examination, laboratory investigations, and neuroimaging. Such an approach distinguishes normal ageing, subjective cognitive decline, mild cognitive impairment (MCI), delirium, depression, and dementia while identifying the most likely underlying etiology and disease severity (Livingston et al., 2024; Gauthier et al., 2022).

A fundamental principle is to distinguish **syndromic diagnosis** from **etiological diagnosis**. Syndromic diagnosis establishes that the patient meets criteria for dementia based on objective cognitive impairment associated with functional decline, whereas etiological diagnosis identifies the underlying disease, such as Alzheimer's disease, vascular dementia, dementia with Lewy bodies, frontotemporal dementia, or another neurological disorder. Maintaining this distinction promotes systematic clinical reasoning and reduces premature diagnostic labelling, particularly during the early stages when clinical features may overlap (Jack et al., 2024; McKhann et al., 2011; Knopman et al., 2021).

Clinical assessment should begin with an unbiased evaluation of the presenting problem rather than a presumed diagnosis. The clinician must determine whether reported cognitive symptoms represent pathological decline or are attributable to normal ageing, psychiatric illness, systemic disease, medication effects, or other neurological disorders. Throughout the assessment, emphasis should be placed on the chronology of symptom onset, pattern of progression, associated neurological and behavioural features, functional consequences, and the presence of reversible or treatable conditions (Hort et al., 2024; Livingston et al., 2024).

Because dementia affects multiple aspects of health, assessment should extend beyond cognition to include functional status, BPSD, frailty, nutritional status, mobility, fall risk, caregiver burden, and environmental safety. These domains contribute not only to diagnosis but also to treatment planning, prognosis, monitoring of disease progression, and individualized care (Gauthier et al., 2022; Livingston et al., 2024).

Collateral information from a knowledgeable informant is an essential component of dementia assessment. Many patients have impaired insight or limited recall of symptom progression, whereas caregivers often provide a more accurate description of cognitive decline, behavioural changes, and loss of functional independence. Combining patient and caregiver interviews substantially improves diagnostic accuracy (Galvin & Atri, 2022; Ismail et al., 2020).

The temporal profile of cognitive decline provides important diagnostic clues. Alzheimer's disease typically progresses gradually over several years, vascular cognitive impairment may follow a stepwise course, delirium develops acutely with fluctuating cognition, and rapidly progressive dementias evolving over weeks to months should prompt urgent evaluation for autoimmune, infectious, inflammatory, toxic-metabolic, or prion disorders (Geschwind, 2016; Jack et al., 2024).
Although biomarkers have become increasingly important in clinical practice, they should be interpreted as complementary rather than definitive diagnostic tools. Plasma biomarkers, CSF analysis, amyloid PET, tau PET, and structural MRI enhance diagnostic confidence but cannot substitute for careful clinical assessment. The most accurate diagnosis is achieved by integrating biological findings with the patient's clinical phenotype, functional status, comorbidities, and individual circumstances (Jack et al., 2024; Hansson, 2023; Livingston et al., 2024).

**Table 2. Fundamental Principles of Clinical Assessment in Patients with Suspected Dementia**

| Principle | Clinical significance |
|---|---|
| Establish that cognitive decline represents a change from baseline | Differentiates pathological decline from normal ageing and lifelong low cognitive performance. |
| Distinguish syndromic from etiological diagnosis | Confirms dementia before identifying the underlying disease. |
| Integrate cognition, function, behaviour, and neurological findings | Improves diagnostic accuracy and disease characterization. |
| Obtain collateral history from a reliable informant | Enhances recognition of symptom progression and functional decline. |
| Consider reversible and treatable causes throughout the evaluation | Prevents premature diagnosis of irreversible neurodegenerative disease. |
| Interpret biomarkers within the clinical context | Prevents overreliance on biological findings in isolation. |
| Reassess patients longitudinally when uncertainty exists | Disease evolution often clarifies the diagnosis. |

Source: Adapted from Jack et al. (2024); Galvin & Atri (2022); Livingston et al. (2024); Knopman et al. (2021).

**Clinical Practice Points**

- Comprehensive clinical assessment remains the foundation of dementia diagnosis.
- Differentiate syndromic diagnosis from etiological diagnosis before assigning a specific dementia subtype.
- Functional decline distinguishes dementia from MCI and subjective cognitive decline.
- Obtain collateral history whenever possible to improve diagnostic accuracy.
- Biomarkers complement, but never replace, a thorough clinical evaluation.
- Assessment should include cognition, function, BPSD, neurological findings, caregiver burden, and reversible causes of cognitive impairment.

## History Taking

History taking is the cornerstone of dementia assessment and remains the single most informative component of the diagnostic evaluation. Although neuroimaging, biomarkers, and neuropsychological testing have improved diagnostic accuracy, none can replace a structured clinical interview with both the patient and a knowledgeable informant. In many cases, the chronology of symptoms, pattern of cognitive decline, associated behavioural changes, and functional consequences allow experienced clinicians to formulate the most likely diagnosis before formal cognitive testing is undertaken (Galvin & Atri, 2022; Hort et al., 2024; NICE, 2022).

The objectives of history taking are to determine whether cognitive decline has truly occurred, establish the pattern and rate of progression, identify the cognitive domains involved, assess the impact on daily functioning, recognize behavioural and psychological symptoms, and identify medical, psychiatric, or medication-related conditions that may contribute to cognitive impairment. History taking also provides the foundation for selecting appropriate investigations, determining prognosis, and planning individualized management (Livingston et al., 2024; Gauthier et al., 2022; Galvin & Atri, 2022).

A fundamental principle is to establish change from the patient's previous level of functioning rather than relying solely on current performance. Educational attainment, occupation, premorbid intellectual ability, and social functioning should be considered because cognitive reserve may mask early disease, whereas lifelong low educational achievement may mimic impairment. The history should therefore focus on decline over time rather than isolated deficits identified during the consultation (Stern et al., 2020; Jack et al., 2024).

The clinical interview should begin with open-ended questions that encourage the patient to describe symptoms in their own words. This approach not only clarifies the presenting complaint but also provides an opportunity to observe spontaneous speech, language, attention, executive function, insight, affect, and interpersonal behaviour before formal cognitive testing. Equally important is identifying who initiated the consultation. Patients seeking assessment independently often retain insight and may have subjective cognitive decline or MCI, whereas those brought by family members despite denying symptoms frequently demonstrate impaired awareness (anosognosia), a common feature of Alzheimer's disease and frontotemporal dementia (Galvin & Atri, 2022; Goldman et al., 2020; Starkstein, 2014).

Establishing the chronology of symptom onset and progression is one of the most valuable aspects of dementia assessment. Alzheimer's disease usually progresses gradually over several years, vascular cognitive impairment may follow a stepwise course, delirium develops acutely with fluctuating cognition, and rapidly progressive cognitive decline over weeks or months should prompt urgent investigation for autoimmune, infectious, inflammatory, toxic-metabolic, or prion disorders (Geschwind, 2016; Jack et al., 2024; Livingston et al., 2024). Anchoring symptom onset to major life events, such as retirement, hospitalization, bereavement, or stroke, often improves the accuracy of historical recall.

The sequence in which symptoms develop frequently suggests the underlying dementia syndrome. Early episodic memory impairment is typical of Alzheimer's disease; executive dysfunction suggests vascular cognitive impairment, behavioural or personality change raises suspicion for behavioural-variant frontotemporal dementia, visual hallucinations with cognitive fluctuations favour dementia with Lewy bodies, progressive language impairment indicates primary progressive aphasia, and isolated visuospatial dysfunction may indicate posterior cortical atrophy or atypical Alzheimer's disease (McKeith et al., 2020; Rascovsky et al., 2011; Gorno-Tempini et al., 2011; Skrobot et al., 2020). Specific examples of cognitive failure, such as repeatedly asking the same questions, becoming lost in familiar surroundings, difficulty managing finances or medications, or declining work performance—are substantially more informative than nonspecific complaints of "poor memory".

The history should also explore associated neurological, psychiatric, and systemic symptoms. Hallucinations, REM sleep behaviour disorder, tremor, gait disturbance, seizures, autonomic dysfunction, mood disorders, sleep disorders, alcohol misuse, sensory impairment, and adverse medication effects may provide important diagnostic clues or identify potentially reversible contributors to cognitive impairment. A comprehensive medication review is essential, particularly in older adults with polypharmacy (Livingston et al., 2024; Galvin & Atri, 2022).

Collateral history is an indispensable component of dementia assessment. Because impaired memory and reduced insight frequently limit the reliability of the patient's account, information from a knowledgeable caregiver often provides the most accurate description of symptom onset, progression, behavioural changes, and loss of functional independence. Discrepancies between the patient's and caregiver's accounts should be regarded as diagnostically valuable rather than contradictory. Combining information from both sources consistently improves diagnostic accuracy and should be considered standard clinical practice (Galvin & Atri, 2022; NICE, 2022; Hort et al., 2024).

**Table 3. Objectives of History Taking in Patients with Suspected Dementia**

| Objective | Clinical importance |
|---|---|
| Confirm cognitive decline | Differentiate pathological decline from normal ageing or subjective cognitive complaints. |
| Establish symptom chronology | Distinguish progressive neurodegeneration from acute or fluctuating disorders such as delirium. |
| Identify affected cognitive domains | Assist syndromic diagnosis and guide subsequent assessment. |
| Assess functional consequences | Differentiate mild cognitive impairment from dementia and determine disease severity. |
| Detect behavioural and psychological symptoms | Improve diagnostic accuracy and management planning. |
| Identify reversible causes | Recognize treatable medical, psychiatric, or medication-related conditions. |
| Guide investigations | Determine appropriate laboratory tests, neuroimaging, and biomarker evaluation. |
| Facilitate individualized care planning | Support treatment decisions, caregiver education, and future planning. |

Source: Galvin and Atri (2022), Jack et al. (2024), Livingston et al. (2024), Hort et al. (2024), NICE (2022), and Gauthier et al. (2022).

**Clinical Practice Points**

• History taking remains the single most informative component of dementia assessment.
• Establish decline from the patient's baseline cognitive and functional status rather than relying on current performance.
• Characterize symptom chronology, rate of progression, and the first affected cognitive domain, as these often indicate the underlying dementia syndrome.
• Obtain specific examples of cognitive and functional impairment instead of relying on general complaints.
• Screen systematically for reversible medical, psychiatric, sleep-related, and medication-induced causes of cognitive impairment.
• Always obtain collateral history from a knowledgeable informant whenever possible.

**1 Presenting Complaint**

The assessment of a patient with suspected dementia begins by clearly defining the presenting complaint. Rather than accepting a general statement such as "memory loss," the clinician should determine the specific cognitive, behavioural, or functional changes that prompted medical attention. The interview should initially allow the patient to describe symptoms in their own words before moving to focused questioning. This approach provides valuable information regarding language, attention, executive function, insight, mood, and communication while avoiding interviewer bias (Galvin & Atri, 2022; NICE, 2022).

Equally important is identifying who recognized the problem first. Patients who seek medical attention independently often retain insight and may have subjective cognitive decline or mild cognitive impairment. Conversely, patients brought by family members despite denying difficulties frequently exhibit anosognosia, a feature commonly observed in Alzheimer's disease and frontotemporal dementia. Understanding the reason for consultation and the source of concern frequently provides important diagnostic clues (Starkstein, 2014; Livingston et al., 2024).

The presenting complaint should be explored using concrete examples rather than vague descriptions. Questions should determine the nature of the cognitive difficulty, circumstances in which it occurs, progression over time, and its impact on occupational, social, and daily functioning. Examples such as repeated questioning, getting lost in familiar places, medication errors, financial mismanagement, or declining work performance are considerably more informative than nonspecific complaints of poor memory (Galvin & Atri, 2022).

**Table 4. Key Elements of the Presenting Complaint**

| Component | Clinical relevance |
|---|---|
| Reason for consultation | Establishes the primary concern and diagnostic focus |
| Who first noticed symptoms | Provides information regarding insight and anosognosia |
| First symptom | Helps identify the likely dementia subtype |
| Time of onset | Differentiates acute, subacute, and chronic disorders |
| Pattern of progression | Distinguishes gradual, stepwise, fluctuating, or rapidly progressive disease |
| Examples of cognitive failures | Improves diagnostic accuracy compared with general complaints |
| Functional consequences | Determines clinical significance and disease stage |

**Clinical Pearl**
The first five minutes of the consultation frequently provide valuable diagnostic information. Spontaneous speech, word-finding ability, attention, affect, social interaction, insight, and behaviour should be observed before formal cognitive testing begins.

**2 Chronology and Evolution of Symptoms**
Determining when symptoms began and how they have evolved is one of the most informative aspects of dementia assessment. Accurate chronology frequently distinguishes neurodegenerative disease from delirium, depression, medication effects, or other reversible causes of cognitive impairment. Whenever possible, symptom onset should be linked to significant life events such as retirement, hospitalization, stroke, surgery, bereavement, or relocation to improve recall accuracy (Jack et al., 2024; Livingston et al., 2024).

The rate of progression provides important diagnostic clues. Alzheimer's disease usually progresses insidiously over years, whereas vascular cognitive impairment often demonstrates a stepwise decline associated with cerebrovascular events. Dementia with Lewy bodies is characterized by fluctuating cognition, while frontotemporal dementia commonly begins with progressive behavioural or language disturbance. In contrast, cognitive decline developing over weeks to months should prompt urgent investigation for autoimmune encephalitis, prion disease, inflammatory disorders, infections, toxic-metabolic abnormalities, or neoplastic disease (Geschwind, 2016; McKeith et al., 2020).

The sequence in which cognitive domains become impaired may further assist differential diagnosis. Early episodic memory impairment strongly suggests Alzheimer's disease, executive dysfunction is typical of vascular cognitive impairment, behavioural change suggests behavioural-variant frontotemporal dementia, visual hallucinations and cognitive fluctuations favour dementia with Lewy bodies, and isolated language impairment indicates primary progressive aphasia (McKeith et al., 2020; Rascovsky et al., 2011; Gorno-Tempini et al., 2011).

**Table 5. Diagnostic Value of the Presenting Complaint and History of Present Illness in Common Dementia Syndromes**

| Clinical feature | Diagnostic implication |
|---|---|
| Progressive episodic memory impairment | Typical Alzheimer's disease |
| Early executive dysfunction with vascular risk factors | Vascular cognitive impairment |
| Early behavioural or personality change | Behavioural variant frontotemporal dementia |
| Progressive language impairment | Primary progressive aphasia |
| Visual hallucinations, REM sleep behaviour disorder, cognitive fluctuations | Dementia with Lewy bodies |
| Predominant visuospatial impairment | Posterior cortical atrophy or atypical Alzheimer's disease |
| Rapid progression (weeks to months) | Autoimmune encephalitis, prion disease, infection, malignancy, toxic-metabolic disorders |
| Acute onset with fluctuating attention | Delirium rather than dementia |

Source: Jack et al. (2024), McKeith et al. (2020), Rascovsky et al. (2011), Gorno-Tempini et al. (2011), Skrobot et al. (2020), Livingston et al. (2024), Galvin and Atri (2022), NICE (2022), and Geschwind (2016).

**Clinical Practice Points**

- Establish the first symptom, not simply the current complaint.
- Determine the tempo of progression, as it often provides the strongest clue to etiology.
- Link symptom onset to major life events whenever possible.
- Rapidly progressive dementia is a neurological emergency requiring urgent investigation.

**3 Collateral History and the Informant Interview**

The evaluation of a patient with suspected dementia should never rely exclusively on the patient's account. Cognitive impairment, reduced insight (anosognosia), impaired recall, executive dysfunction, and language disturbances frequently limit the patient's ability to provide an accurate history. Consequently, obtaining collateral information from a knowledgeable informant is regarded as an essential component of dementia assessment by major international guidelines and is considered standard practice in memory clinics worldwide (NICE, 2022; Galvin & Atri, 2022; Hort et al., 2024).

An ideal informant is an individual who has regular contact with the patient, has observed changes over an extended period, and is familiar with the patient's previous level of functioning. In most cases, this is a spouse or partner, followed by an adult child, sibling, or another close relative. Professional caregivers may also provide valuable information, particularly for patients living in residential care facilities, although they may be less able to describe the earliest stages of cognitive decline. The reliability of the informant should always be documented because discrepancies in knowledge, emotional involvement, or frequency of contact may influence the accuracy of the information provided (Jorm, 2004; Galvin & Sadowsky, 2012).

Collateral history serves several complementary purposes. First, it confirms whether cognitive decline represents a genuine departure from the patient's previous level of functioning. Second, it establishes the chronology and rate of symptom progression. Third, it evaluates functional decline that may not be recognized by the patient. Finally, it identifies behavioural and psychological symptoms, safety concerns, caregiver burden, and social circumstances that directly influence management planning. Numerous studies have demonstrated that diagnostic accuracy improves significantly when information from both the patient and an informant is integrated rather than relying on either source alone (Jorm, 2004; Ismail et al., 2020).

One of the most valuable aspects of the informant interview is the assessment of **change over time**. Rather than asking whether the patient has a poor memory, clinicians should explore whether memory has deteriorated relative to previous abilities. Questions such as "*What activities could your relative perform independently five years ago that are now difficult?*" or "*Can you describe the first changes you noticed?*" are generally more informative than asking whether memory problems are present. Establishing this longitudinal perspective helps distinguish pathological cognitive decline from lifelong personality traits, limited educational attainment, or normal ageing (Galvin & Atri, 2022).

Collateral history is particularly important because many patients underestimate or deny their cognitive deficits. Impaired awareness of illness, commonly referred to as anosognosia, occurs frequently in Alzheimer's disease and is even more pronounced in behavioural variant frontotemporal dementia. Patients may confidently report that they continue to manage finances, medications, or driving safely despite objective evidence to the contrary. Conversely, some individuals with depression or anxiety markedly overestimate their cognitive difficulties, producing a discrepancy in the opposite direction. Comparing patient and caregiver accounts therefore provides important diagnostic information beyond the factual content of either interview alone (Starkstein, 2014; Livingston et al., 2024).

The interview should systematically explore each cognitive domain while emphasizing real-life examples rather than abstract descriptions. Informants should be asked about repetitive questioning, forgotten conversations, missed appointments, difficulty following television programs or newspaper articles, problems operating household appliances, errors in financial management, changes in cooking ability, reduced occupational performance, navigational difficulties, impaired judgment, and increasing dependence on reminders. Whenever possible, clinicians should request specific incidents illustrating these changes, as concrete examples are less susceptible to recall bias and provide stronger evidence of clinically significant impairment (Galvin & Sadowsky, 2012).

Behavioural and psychological symptoms of dementia (BPSD) are often more apparent to caregivers than to patients and should be explored during every collateral interview. Changes in personality, emotional responsiveness, irritability, apathy, anxiety, depression, hallucinations, delusions, compulsive behaviours, altered eating habits, sleep disturbances, wandering, aggression, and socially inappropriate behaviour frequently precede or accompany cognitive decline and may provide valuable clues regarding the underlying diagnosis. Early apathy and disinhibition, for example, strongly suggest frontotemporal dementia, whereas recurrent well-formed visual hallucinations and cognitive fluctuations are highly characteristic of dementia with Lewy bodies (McKeith et al., 2020; Rascovsky et al., 2011).

Functional decline represents another major focus of collateral assessment. Family members often recognize subtle losses of independence before these become evident during formal examination. Difficulties managing finances, paying bills, organizing medications, shopping independently, preparing meals, using transportation, handling electronic devices, or maintaining household responsibilities frequently mark the transition from mild cognitive impairment to dementia. Caregivers should also be asked whether increased supervision has become necessary, even if the patient continues to perform certain tasks independently. Such compensatory support may mask the true degree of functional impairment unless specifically explored (Marshall et al., 2015; Gauthier et al., 2022).

Safety issues require particular attention during the informant interview. Questions should address medication adherence, driving ability, falls, wandering, vulnerability to financial exploitation, firearm access where applicable, kitchen safety, use of electrical appliances, and the patient's ability to respond appropriately during emergencies. These issues are central to risk assessment and often determine the urgency of interventions irrespective of formal cognitive test scores (NICE, 2022; Galvin & Atri, 2022).

The caregiver interview should also evaluate caregiver wellbeing. Family members frequently experience considerable psychological distress, physical exhaustion, social isolation, financial burden, and depressive symptoms while caring for a person with dementia. Recognition of caregiver strain is important because caregiver health directly influences the patient's ability to remain safely in the community. Routine assessment of caregiver burden facilitates timely referral to community resources, respite services, psychological support, and educational programs, all of which have been shown to improve outcomes for both patients and caregivers (Brodaty & Donkin, 2009; Livingston et al., 2024).

Whenever feasible, clinicians should interview the caregiver separately from the patient for at least part of the consultation. Separate interviews encourage open discussion of sensitive issues such as personality change, aggression, hallucinations, financial difficulties, driving concerns, urinary incontinence, alcohol misuse, or caregiver stress that family members may hesitate to discuss in front of the patient.

Several standardized informant-based instruments can complement the clinical interview. Among the most widely validated is the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE), which assesses changes in cognitive function over the preceding decade and is relatively independent of educational attainment and premorbid intelligence. Other useful instruments include the AD8 Dementia Screening Interview, the Functional Activities Questionnaire (FAQ), and disease-specific caregiver questionnaires. Although these tools should never replace clinical judgment, they improve diagnostic consistency, facilitate longitudinal monitoring, and provide objective documentation of cognitive and functional decline (Jorm, 2004; Galvin et al., 2005; Pfeffer et al., 1982).

Ultimately, the collateral history transforms isolated cognitive symptoms into a coherent longitudinal narrative that integrates cognition, function, behaviour, and daily life. For many patients, particularly those with limited insight or moderate dementia, it represents the single most informative component of the clinical assessment and frequently determines both diagnosis and management.

**Table 6. Essential Components of the Informant Interview**

| Domain | Key questions | Clinical relevance |
|---|---|---|
| Symptom onset | When were the first changes noticed? | Establishes disease chronology. |
| Disease progression | Has decline been gradual, stepwise, or fluctuating? | Suggests underlying etiology. |
| Memory | Repetition, forgetting conversations, appointments, misplaced items | Typical of Alzheimer's disease. |
| Executive function | Managing finances, planning, organization, multitasking | Sensitive for vascular and frontal disorders. |
| Language | Word-finding difficulty, comprehension, naming problems | Supports diagnosis of aphasic syndromes or Alzheimer's disease. |
| Visuospatial ability | Getting lost, driving problems, recognizing faces or objects | Suggests DLB, posterior cortical atrophy, or Alzheimer's disease. |
| Behavioural changes | Apathy, disinhibition, hallucinations, delusions, sleep disturbance | Helps differentiate dementia syndromes. |
| Functional status | Medication management, cooking, shopping, finances, household tasks | Determines severity and distinguishes MCI from dementia. |
| Safety | Driving, falls, wandering, financial vulnerability, medication adherence | Guides immediate management. |
| Caregiver wellbeing | Emotional stress, physical exhaustion, support systems | Essential for long-term care planning. |

Source: Jorm (2004), Galvin et al. (2005), Galvin and Atri (2022), NICE (2022), Livingston et al. (2024), Hort et al. (2024), Marshall et al. (2015), and Brodaty and Donkin (2009).

**Table 7. Common Informant-Based Assessment Instruments**

| Instrument | Primary purpose | Advantages | Limitations |
|---|---|---|---|
| IQCODE | Assessment of longitudinal cognitive decline | Less influenced by education or baseline intelligence; extensively validated | Requires a reliable long-term informant |
| AD8 Dementia Screening Interview | Rapid dementia screening | Brief, sensitive for early cognitive change | Less useful without an informed caregiver |
| Functional Activities Questionnaire (FAQ) | Assessment of instrumental activities of daily living | Quantifies functional impairment and disease progression | Focuses primarily on IADLs |
| Blessed Dementia Scale | Functional and behavioural assessment | Historical importance; useful in longitudinal follow-up | Less commonly used in contemporary practice |
| Neuropsychiatric Inventory (NPI) | Assessment of behavioural and psychological symptoms | Comprehensive evaluation of BPSD and caregiver distress | More time-consuming than brief screening tools |

Source: Adapted from Jorm (2004), Galvin et al. (2005), Pfeffer et al. (1982), Cummings et al. (1994), and current international dementia guidelines (NICE, 2022; Hort et al., 2024).

**Clinical Practice Points**

• A collateral history is essential, not optional, in the assessment of suspected dementia.
• Compare the patient's account with the caregiver's narrative; discrepancies often reveal impaired insight or alternative diagnoses.
• Focus on change from baseline, using concrete examples of declining cognition and function.
• Assess behavioural symptoms, safety risks, and caregiver burden systematically during every evaluation.
• Incorporate validated informant-based instruments, such as the IQCODE, AD8, and FAQ, to complement, but never replace, a comprehensive clinical interview.

**4 Cognitive Symptom Profiles**

Characterizing cognitive symptoms is the principal objective of the clinical interview and forms the basis of syndromic diagnosis. Rather than relying on screening test scores, clinicians should determine which cognitive domain was affected first, how symptoms have evolved, and their impact on everyday functioning. Different dementia syndromes exhibit distinct cognitive profiles that frequently allow an experienced clinician to formulate a provisional diagnosis before confirmatory investigations are performed.

**4.1 Episodic Memory**

Progressive episodic memory impairment is the hallmark of typical Alzheimer's disease and the most common presenting cognitive symptom. Patients usually report forgetting recent conversations, appointments, or the location of personal belongings, whereas caregivers often describe repetitive questioning and increasing reliance on reminders.

History taking should emphasize specific examples of recent memory failure rather than general questions regarding memory. Clinicians should determine whether forgetting interferes with daily activities, whether cues improve recall, and whether remote memory remains relatively preserved. Although strongly suggestive of Alzheimer's disease, episodic memory impairment is not disease-specific and should always be interpreted within the overall clinical context.

**4.2 Executive Dysfunction**

Executive function includes planning, organization, judgement, reasoning, cognitive flexibility, problem-solving, and multitasking. Patients seldom complain of executive dysfunction directly; instead, they describe increasing difficulty organizing daily activities, managing finances, following complex instructions, or making decisions.

Targeted questions should explore changes in organization, medication management, financial responsibilities, occupational performance, and the ability to complete previously familiar tasks. Early executive dysfunction is particularly characteristic of vascular cognitive impairment, frontal-subcortical disorders, and some frontotemporal dementias, although it also develops during Alzheimer's disease progression.

**4.3 Attention and Processing Speed**

Attention and processing speed influence nearly every aspect of cognitive function. Patients may complain of distractibility, inability to follow conversations, reduced concentration while reading, mental fatigue, or slowing of thought.

Marked fluctuations in attention suggest delirium or dementia with Lewy bodies, whereas slowed processing speed is particularly characteristic of vascular cognitive impairment and Parkinsonian disorders. The temporal pattern of attentional impairment therefore provides important diagnostic information.

**4.4 Language Dysfunction**

Language impairment varies according to the underlying dementia syndrome. Early Alzheimer's disease commonly presents with word-finding difficulty (anomia), whereas progressive deterioration in speech production or comprehension suggests primary progressive aphasia or frontotemporal lobar degeneration.

History taking should evaluate naming difficulty, comprehension, fluency, repetition, reading, writing, and the ability to participate in everyday conversation. Caregiver observations often identify progressive communication difficulties before patients recognize them.

**4.5 Visuospatial Dysfunction**

Visuospatial impairment may present as getting lost in familiar places, difficulty judging distances, problems recognizing faces or objects, impaired navigation, or increasing difficulty driving. These symptoms are particularly suggestive of posterior cortical atrophy, dementia with Lewy bodies, or atypical Alzheimer's disease and should always be explored during the clinical interview.

**4.6 Praxis**

Apraxia is the inability to perform learned purposeful motor activities despite preserved strength and comprehension. Caregivers may report difficulty using household appliances, dressing, preparing meals, or operating familiar devices despite otherwise adequate motor function. Recognition of progressive praxis impairment contributes to syndromic diagnosis and assessment of disease severity.

**4.7 Social Cognition**

Changes in personality, empathy, social judgement, emotional regulation, and interpersonal behaviour frequently precede significant memory impairment in behavioural-variant frontotemporal dementia. Family members may describe inappropriate social behaviour, loss of empathy, impulsivity, compulsive behaviours, or poor judgement. Because patients often lack insight, collateral history is particularly important when assessing social cognition.

**Table 8. Characteristic Cognitive Symptom Profiles in Common Dementia Syndromes**

| Predominant symptom | Most likely syndrome |
|---|---|
| Progressive episodic memory impairment | Typical Alzheimer's disease |
| Early executive dysfunction | Vascular cognitive impairment, frontal-subcortical disorders |
| Fluctuating attention | Dementia with Lewy bodies or delirium |
| Progressive language impairment | Primary progressive aphasia |
| Early visuospatial dysfunction | Posterior cortical atrophy, DLB, atypical Alzheimer's disease |
| Progressive apraxia | Alzheimer's disease, corticobasal syndrome |
| Early personality and social behavioural change | Behavioural-variant frontotemporal dementia |

**Clinical Practice Points**

- History taking should identify the first affected cognitive domain, as this often predicts the underlying pathology.
- Obtain specific real-life examples rather than general descriptions of memory loss.
- Different cognitive symptom profiles support syndromic diagnosis before formal investigations.
- Cognitive symptoms should always be interpreted together with functional decline, behavioural changes, and neurological findings.

**5 Relevant Background Information**

A comprehensive medical history provides essential diagnostic context and helps distinguish neurodegenerative dementia from potentially reversible causes of cognitive impairment. Particular attention should be directed toward previous neurological disease, cardiovascular risk factors, psychiatric disorders, systemic illnesses, medication exposure, substance use, and family history. Together, these factors influence both the likelihood of specific dementia syndromes and subsequent management (Livingston et al., 2024; Galvin & Atri, 2022).

**Past Medical History**

The medical history should identify disorders associated with cognitive decline or cerebrovascular injury, including hypertension, diabetes mellitus, dyslipidaemia, atrial fibrillation, heart failure, chronic kidney disease, obstructive sleep apnoea, thyroid disease, vitamin deficiencies, chronic liver disease, autoimmune disorders, malignancy, and previous neurological illnesses such as stroke, traumatic brain injury, epilepsy, Parkinson's disease, or multiple sclerosis. Previous episodes of delirium, especially following surgery or hospitalization, should also be documented because they increase the risk of subsequent cognitive decline (Livingston et al., 2024; WHO, 2023).

**Medication History**

Medication review is an integral component of dementia assessment because drug-induced cognitive impairment is common in older adults and is frequently reversible. Clinicians should review all prescribed medications, over-the-counter products, herbal preparations, and recent medication changes. Particular attention should be paid to drugs with anticholinergic properties, benzodiazepines, sedative-hypnotics, opioids, corticosteroids, antipsychotics, anticonvulsants, centrally acting antihypertensive agents, and polypharmacy. Medication adherence and administration errors should also be assessed, as they may reflect declining executive function rather than treatment failure (American Geriatrics Society Beers Criteria®, 2023; Galvin & Atri, 2022).

**Table 9. Medications Commonly Associated with Cognitive Impairment**

| Drug class | Potential cognitive effects |
|---|---|
| Anticholinergic medications | Memory impairment, confusion, delirium |
| Benzodiazepines | Sedation, impaired attention, falls, amnesia |
| Opioids | Reduced alertness, confusion, delirium |
| Sedative-hypnotics | Excessive daytime somnolence, impaired cognition |
| Corticosteroids | Mood disturbance, psychosis, memory impairment |
| Anticonvulsants | Cognitive slowing, impaired concentration |
| Polypharmacy | Increased risk of adverse cognitive effects and delirium |

**Family History**

A detailed family history should explore dementia, Parkinson's disease, motor neuron disease, Huntington's disease, psychiatric illness, cerebrovascular disease, and other inherited neurological disorders. Particular attention should be given to age at onset, affected relatives across successive generations, and patterns suggestive of autosomal dominant inheritance. Although most dementias are sporadic, a strong family history may indicate a monogenic disorder or increased genetic susceptibility and may warrant referral for genetic counselling (Goldman et al., 2020; Jack et al., 2024).

**Social and Lifestyle History**

Social history provides important information regarding cognitive reserve, functional expectations, and modifiable risk factors. Assessment should include educational attainment, previous occupation, language, living arrangements, social support, driving status, alcohol and substance use, smoking history, physical activity, nutrition, hearing and vision impairment, and participation in cognitively stimulating activities. Exposure to occupational toxins, repeated head trauma, or environmental hazards should also be documented when relevant (Livingston et al., 2024; Stern et al., 2020).

Patients should also be asked about recent changes in financial management, employment, medication administration, cooking, shopping, technology use, and community engagement, as these activities often reveal subtle functional decline before dependence in basic activities of daily living becomes apparent.

**Table 10. Background Information Required During History Taking**

| Domain | Key information |
|---|---|
| Medical history | Neurological disease, vascular risk factors, endocrine and metabolic disorders, sleep disorders |
| Medication history | Prescription drugs, OTC medications, herbal products, anticholinergic burden, recent medication changes |
| Psychiatric history | Depression, anxiety, psychosis, substance misuse |
| Family history | Dementia, Parkinson's disease, Huntington's disease, early-onset neurological disorders |
| Social history | Education, occupation, living arrangements, social support |
| Lifestyle | Alcohol, smoking, exercise, diet, cognitive and social activities |
| Environmental exposure | Toxins, occupational hazards, repeated head injury |

Clinical Practice Points
• Review medications systematically at every assessment; medication-related cognitive impairment is common and often reversible.
• Identify vascular and metabolic risk factors because aggressive management may slow cognitive decline.
• A three-generation family history is particularly valuable in patients with early-onset dementia.
• Social history provides insight into cognitive reserve, functional expectations, and available caregiver support.
• Background information should be interpreted alongside cognitive and functional assessment rather than in isolation.

**6 Behavioural and Psychological Symptoms During History Taking**
Behavioural and psychological symptoms of dementia (BPSD), also known as neuropsychiatric symptoms (NPS), are among the most common and clinically significant manifestations of dementia. They include apathy, depression, anxiety, agitation, irritability, aggression, hallucinations, delusions, sleep disturbance, wandering, compulsive behaviours, disinhibition, appetite changes, and emotional lability. More than 90% of patients with dementia develop one or more neuropsychiatric symptoms during the course of illness, making their systematic assessment an essential component of the clinical interview.

Importantly, behavioural symptoms may precede measurable cognitive impairment and provide valuable diagnostic clues. Early apathy, loss of empathy, compulsive behaviours, altered eating habits, and social disinhibition strongly suggest behavioural-variant frontotemporal dementia, whereas recurrent visual hallucinations, REM sleep behaviour disorder, anxiety, and cognitive fluctuations are characteristic of dementia with Lewy bodies. Recognition of these symptom clusters improves early syndromic diagnosis and guides further evaluation.

Because many patients lack insight into behavioural changes, caregivers usually provide the most reliable information. Assessment should therefore include interviews with both the patient and an informant, recognizing that discrepancies between their accounts may themselves indicate impaired awareness of illness. Open-ended questions regarding changes in personality, mood, interests, motivation, or social behaviour should precede focused questioning about individual symptoms. Once identified, each symptom should be characterized according to its onset, frequency, severity, precipitating factors, duration, and effect on the patient and caregiver.

**Apathy**
Apathy is one of the earliest and most prevalent neuropsychiatric symptoms. It is characterized by reduced motivation, diminished initiative, emotional indifference, and loss of interest despite preserved physical ability. Family members often report that patients require prompting to initiate activities, conversations, or self-care and gradually abandon previously enjoyable hobbies.

Apathy should be distinguished from depression. While depression is associated with sadness, hopelessness, guilt, and emotional distress, apathetic patients usually appear emotionally neutral and deny feeling depressed despite marked inactivity. This distinction has important therapeutic implications.

**Depression and Anxiety**

Depression and anxiety frequently coexist with dementia and may both worsen cognitive performance and reduce quality of life. Depression commonly presents with impaired concentration, psychomotor slowing, sleep disturbance, appetite change, and subjective memory complaints that may mimic dementia. Anxiety often manifests as excessive reassurance seeking, repetitive questioning, irritability, fearfulness, or resistance to unfamiliar situations. Identifying these symptoms is important because they are potentially treatable and substantially influence patient function and caregiver burden.

**Psychotic Symptoms**

Hallucinations and delusions should be assessed routinely because they often assist differential diagnosis. Recurrent, well-formed visual hallucinations are a core clinical feature of dementia with Lewy bodies, whereas persecutory delusions, misidentification syndromes, or paranoid beliefs commonly occur in later Alzheimer's disease. Clinicians should determine the nature, frequency, associated distress, and potential safety implications of psychotic symptoms, while excluding delirium, medication effects, or primary psychiatric illness as alternative causes.

**Table 11. Behavioural Symptoms Suggestive of Specific Dementia Syndromes**

| Behavioural manifestation | Diagnostic implication |
|---|---|
| Early apathy, loss of empathy, disinhibition | Behavioural variant frontotemporal dementia |
| Well-formed recurrent visual hallucinations | Dementia with Lewy bodies |
| REM sleep behaviour disorder | Lewy body disease/Parkinsonian disorders |
| Depression with prominent subjective cognitive complaints | Consider depression (with or without dementia) |
| Agitation triggered by medical illness | Exclude delirium, pain, infection, medication effects |
| Progressive compulsive or ritualistic behaviours | Frontotemporal dementia |
| Delusions of theft or misidentification | Common in Alzheimer's disease and Lewy body dementia |
| Marked personality change | Frontotemporal dementia or advanced neurodegenerative disease |

Source: McKeith et al. (2020), Rascovsky et al. (2011), Cummings et al. (1994), Kales et al. (2015), Robert et al. (2018), Livingston et al. (2024), and Galvin and Atri (2022).

**Clinical Practice Points**

- Behavioural symptoms should be assessed routinely in every patient with suspected dementia.
- Obtain behavioural history from both the patient and a knowledgeable caregiver whenever possible.
- Apathy should be distinguished from depression because management differs.
- Early neuropsychiatric symptoms often provide important clues to the underlying dementia syndrome.
- Evaluate the severity, frequency, precipitating factors, and impact of each symptom on both the patient and caregiver.

**7 Medical, Psychiatric, and Medication History**

A comprehensive medical, psychiatric, and medication history is essential in the evaluation of suspected dementia because many systemic disorders and medications contribute to cognitive impairment, influence disease expression, or mimic neurodegenerative disease. The primary objective is to identify potentially reversible causes of cognitive decline, recognize comorbid conditions affecting prognosis, and define factors that influence subsequent investigations and management.

**Medical History**

Clinicians should systematically review vascular, neurological, endocrine, metabolic, infectious, autoimmune, and systemic disorders known to affect cognition. Particular attention should be paid to hypertension, diabetes mellitus, dyslipidaemia, atrial fibrillation, cerebrovascular disease, chronic kidney disease, thyroid disorders, vitamin B12 deficiency, liver disease, malignancy, sleep disorders, and previous episodes of delirium. Because many of these conditions are potentially modifiable, their identification has important therapeutic and prognostic implications.

Previous neurological disorders, including stroke, traumatic brain injury, epilepsy, Parkinson's disease, multiple sclerosis, central nervous system infections, brain tumours, and neurosurgical procedures, should be documented carefully, with emphasis on their temporal relationship to cognitive decline.

**Psychiatric History**

Psychiatric disorders commonly coexist with dementia and may either mimic or exacerbate cognitive impairment. A history of depression, anxiety disorders, bipolar disorder, psychosis, substance misuse, or previous psychiatric hospitalization should be obtained. Depression deserves particular attention because it may present with impaired concentration, psychomotor slowing, and prominent subjective memory complaints ("pseudodementia"), whereas longstanding psychiatric illness may coexist with an underlying neurodegenerative disorder.

Changes in personality, mood, emotional regulation, or behaviour preceding cognitive symptoms should also be explored, as these may suggest frontotemporal dementia or dementia with Lewy bodies rather than primary psychiatric disease.

**Medication History**

Medication review is a mandatory component of dementia assessment. All prescribed medications, over-the-counter preparations, herbal products, and nutritional supplements should be reviewed, with particular attention to recently initiated or dose-adjusted therapies and their temporal relationship to symptom onset.

Drugs with anticholinergic or sedative properties are especially important because they commonly impair memory, attention, and executive function and increase the risks of delirium, falls, and functional decline. Polypharmacy itself is associated with adverse cognitive outcomes and should prompt regular medication reconciliation and deprescribing when appropriate.

Assessment should also evaluate medication adherence, as difficulty managing complex medication regimens may represent early executive dysfunction rather than simple non-compliance.

**Table 12. Medical and Medication Factors Contributing to Cognitive Impairment**

| Factor | Clinical significance |
|---|---|
| Hypertension, diabetes, dyslipidaemia | Major vascular risk factors for dementia |
| Stroke or transient ischemic attack | Suggests vascular cognitive impairment |
| Parkinson's disease | Raises suspicion for Parkinson's disease dementia or DLB |
| Traumatic brain injury | Increases long-term dementia risk |
| Thyroid disease | Potentially reversible cause of cognitive dysfunction |
| Vitamin B12 deficiency | Reversible metabolic cause of cognitive impairment |
| Chronic kidney or liver disease | May contribute to metabolic encephalopathy |
| Depression and anxiety | May mimic or worsen dementia symptoms |
| Anticholinergic medications | Memory impairment, confusion, delirium |
| Benzodiazepines, opioids, sedative-hypnotics | Cognitive slowing, sedation, falls |
| Polypharmacy | Increased risk of adverse cognitive effects and medication errors |

**Clinical Practice Points**

• Review medical illnesses, psychiatric disorders, and medications systematically in every patient with suspected dementia.
• Identify potentially reversible contributors before diagnosing irreversible neurodegenerative disease.
• Minimize medications with significant anticholinergic or sedative effects whenever clinically appropriate.
• Evaluate medication adherence as part of the assessment of executive function.
• Management of vascular and metabolic risk factors remains an important component of dementia care.

## Functional assessment

Functional assessment is a fundamental component of dementia evaluation because the diagnosis requires not only objective cognitive impairment but also evidence that cognitive decline interferes with independence in everyday activities. Functional impairment distinguishes dementia from subjective cognitive decline and mild cognitive impairment (MCI), in which daily functioning is largely preserved despite measurable cognitive deficits (DSM-5-TR, 2022; Jack et al., 2024).

The primary objectives of functional assessment are to determine the degree of independence, establish disease severity, identify safety concerns, monitor progression, and guide individualized care planning. Functional evaluation should be based on information obtained from both the patient and a knowledgeable informant, as impaired insight frequently leads patients to underestimate their limitations (Galvin & Atri, 2022; Livingston et al., 2024).

Functional decline usually follows a predictable sequence. Instrumental activities of daily living (IADLs), which require higher-order executive and cognitive abilities, are affected early in most neurodegenerative disorders. Basic activities of daily living (ADLs) generally remain intact during the early stages and decline later as the disease progresses. Recognition of this pattern assists both diagnosis and clinical staging (Lawton & Brody, 1969; Katz et al., 1963).

Assessment should include practical examples rather than simple yes-or-no questions. Difficulties with financial management, medication administration, shopping, meal preparation, driving, use of household appliances, technology, or keeping appointments often represent the earliest manifestations of functional decline. Later stages are characterized by dependence in dressing, bathing, toileting, feeding, transferring, and continence (Livingston et al., 2024).

Because functional impairment has important medico-legal implications, clinicians should also evaluate driving safety, medication self-management, financial capacity, vulnerability to exploitation, home safety, fall risk, nutritional status, and the need for caregiver supervision. These domains directly influence treatment planning, community support, and long-term care decisions (NICE, 2022; Galvin & Atri, 2022).

**Table 13. Functional Domains in Dementia Assessment**

| Functional domain | Examples | Typical stage affected |
|---|---|---|
| Instrumental ADLs (IADLs) | Managing finances, medications, shopping, cooking, transportation, telephone/computer use | Early |
| Basic ADLs (ADLs) | Bathing, dressing, toileting, grooming, feeding, transferring | Moderate to advanced |
| Occupational function | Reduced work performance, inability to manage responsibilities | Early |
| Social function | Withdrawal from social activities, impaired communication, reduced participation | Early–moderate |
| Safety | Driving, medication errors, falls, wandering, financial vulnerability | Any stage |
| Caregiver dependence | Need for supervision or assistance | Progressive |

**Functional Assessment Instruments**
Several standardized instruments improve the objectivity and reproducibility of functional assessment. Selection should depend on the clinical setting, disease stage, and purpose of evaluation.

**Table 14. Common Functional Assessment Scales**

| Instrument | Primary purpose | Advantages | Limitations |
|---|---|---|---|
| Lawton Instrumental Activities of Daily Living Scale | Assessment of IADLs | Sensitive to early functional decline | Less useful in advanced dementia |
| Katz Index of Activities of Daily Living | Assessment of basic ADLs | Simple and widely validated | Limited sensitivity in early disease |
| Functional Activities Questionnaire (FAQ) | Informant-based assessment of complex daily activities | Excellent for MCI and early dementia | Requires reliable caregiver |
| Disability Assessment for Dementia (DAD) | Comprehensive functional assessment | Useful for monitoring progression | Longer administration time |
| Clinical Dementia Rating (CDR) | Global staging incorporating cognition and function | Widely used in research and clinical practice | Requires structured interview |

**Caregiver Assessment**
Caregiver observations frequently provide the most reliable measure of functional decline because they reflect the patient's actual performance in everyday life rather than perceived ability. Particular attention should be directed toward:
• Medication administration
• Financial management
• Driving behaviour
• Cooking and household tasks
• Personal hygiene
• Wandering or getting lost
• Falls and mobility
• Behavioural changes affecting daily function
• Requirement for supervision

Disagreement between patient and caregiver reports should prompt further evaluation, as poor insight (anosognosia) is common in Alzheimer's disease and frontotemporal dementia (Galvin & Atri, 2022; Starkstein, 2014).

**Functional Red Flags**
The following findings strongly suggest progression from MCI to dementia:
• Progressive loss of independence in IADLs
• Recurrent medication errors
• Inability to manage finances
• Unsafe driving or getting lost
• Frequent missed appointments
• Household neglect
• Dependence in basic ADLs
• Increasing caregiver supervision

**Clinical Practice Points**
• Functional impairment is required for the diagnosis of dementia.
• IADLs are affected earlier than basic ADLs in most neurodegenerative dementias.
• Functional assessment should combine patient interview, caregiver history, and standardized assessment tools.
• Declining functional ability predicts caregiver burden, institutionalization, and mortality.
• Evaluation of driving, financial capacity, medication management, and home safety should form part of every comprehensive dementia assessment.

## Neurological Examination

The neurological examination is an integral component of the clinical assessment of patients with suspected dementia. Although the examination may be normal in early Alzheimer's disease, abnormal neurological findings frequently provide important diagnostic clues, help distinguish among dementia subtypes, identify potentially reversible causes of cognitive impairment, and guide further investigations. The neurological examination should therefore be performed systematically in every patient undergoing dementia evaluation (Jack et al., 2024; McKeith et al., 2020; Gauthier et al., 2022).

The examination should evaluate mental status, cranial nerves, motor function, sensory function, coordination, gait and balance, primitive reflexes, extrapyramidal signs, cerebellar function, and focal neurological deficits. Findings should always be interpreted within the context of the patient's clinical history, cognitive profile, functional status, laboratory investigations, and neuroimaging results (Livingston et al., 2024; NICE, 2022).

**1 General Observation**
Observation begins when the patient enters the consultation room. Clinicians should assess spontaneous movement, posture, facial expression, eye contact, grooming, hygiene, affect, psychomotor activity, and interaction with accompanying family members. Difficulty following conversation, reduced spontaneous speech, apathy, inappropriate social behaviour, or impaired awareness of deficits may provide valuable clues before formal examination begins (Jack et al., 2024; Livingston et al., 2024).

**2 Cranial Nerve Examination**
A focused cranial nerve examination helps identify neurological disorders that may contribute to cognitive impairment. Visual field defects may suggest cerebrovascular disease or structural brain lesions, impaired eye movements may indicate progressive supranuclear palsy, anosmia is frequently associated with Parkinsonian disorders, and dysarthria or dysphagia may suggest motor neuron disease or advanced neurodegenerative conditions. Although cranial nerve abnormalities are uncommon in uncomplicated Alzheimer's disease, their presence should prompt consideration of alternative diagnoses (Höglinger et al., 2017; McKeith et al., 2020).

**3 Motor Examination**
Motor assessment should include muscle bulk, tone, strength, involuntary movements, and the presence of pyramidal or extrapyramidal signs. Parkinsonism, including bradykinesia, rigidity, resting tremor, and postural instability, is characteristic of dementia with Lewy bodies and Parkinson's disease dementia, whereas upper motor neuron signs may suggest vascular dementia, corticobasal syndrome, amyotrophic lateral sclerosis, or other neurodegenerative disorders. Myoclonus, particularly when rapidly progressive, should raise suspicion for Creutzfeldt–Jakob disease (McKeith et al., 2020; Armstrong et al., 2013).

**4 Coordination and Cerebellar Function**
Assessment of finger-to-nose testing, heel-to-shin movements, rapid alternating movements, and tandem gait assists in identifying cerebellar dysfunction. Cerebellar signs are uncommon in Alzheimer's disease and should prompt evaluation for alternative neurodegenerative, vascular, toxic, infectious, or structural disorders (Höglinger et al., 2017; Armstrong et al., 2013).

**5 Gait and Balance**
Evaluation of gait is among the highest-yield components of the neurological examination. Clinicians should assess gait initiation, stride length, arm swing, turning, postural stability, and balance. A shuffling gait with reduced arm swing suggests Parkinsonian syndromes, whereas a broad-based ataxic gait indicates cerebellar disease. A magnetic gait with difficulty initiating walking is characteristic of normal-pressure hydrocephalus. Early gait impairment also increases fall risk and has important implications for functional independence and caregiver planning (McKeith et al., 2020; Jack et al., 2024; Livingston et al., 2024).

**6 Primitive Reflexes**
Primitive or frontal release reflexes, including the grasp, snout, palmomental, and glabellar reflexes, may re-emerge with frontal lobe dysfunction. Although these findings support frontal cortical involvement, they are neither sensitive nor specific for dementia and should always be interpreted alongside the overall neurological examination (Jack et al., 2024; Gauthier et al., 2022).

**Table 15. Neurological Findings and Their Diagnostic Implications**

| Neurological finding | Diagnostic implication |
|---|---|
| Normal neurological examination | Common in early Alzheimer's disease |
| Bradykinesia, rigidity, resting tremor | Dementia with Lewy bodies or Parkinson's disease dementia |
| Vertical gaze palsy | Progressive supranuclear palsy |
| Limb apraxia with asymmetric rigidity | Corticobasal syndrome |
| Myoclonus | Creutzfeldt–Jakob disease |
| Magnetic gait | Normal-pressure hydrocephalus |
| Cerebellar ataxia | Cerebellar degeneration, toxic or structural disease |
| Focal neurological deficits | Vascular dementia or structural brain lesion |
| Primitive reflexes | Frontal lobe dysfunction |

Source: Adapted from Jack et al. (2024), McKeith et al. (2020), Armstrong et al. (2013), Höglinger et al. (2017), Livingston et al. (2024), and Gauthier et al. (2022).

**Clinical Practice Points**

• A normal neurological examination does not exclude early Alzheimer's disease.
• Focal neurological deficits, early Parkinsonism, cerebellar signs, or upper motor neuron findings should prompt investigation for alternative diagnoses.
• Careful assessment of gait is one of the highest-yield components of the neurological examination in older adults with cognitive impairment.
• Primitive reflexes support, but are not diagnostic of, frontal lobe dysfunction.
• The neurological examination should always be interpreted alongside the history, functional assessment, cognitive evaluation, laboratory investigations, and neuroimaging.

## Early Warning Signs of Dementia

Early recognition of dementia is increasingly important because disease-modifying therapies, comprehensive risk factor management, advance care planning, and non-pharmacological interventions are most effective during the earliest stages of disease. Unfortunately, the initial manifestations of dementia are frequently subtle, develop gradually, and may be misattributed to normal aging, stress, depression, or other medical conditions. Careful clinical assessment remains the cornerstone of early diagnosis (Jack et al., 2024; Livingston et al., 2024; NICE, 2022).

The earliest clinical manifestations vary according to the underlying neurodegenerative disorder. While episodic memory impairment is the hallmark of typical Alzheimer's disease, early executive dysfunction, language impairment, visuospatial deficits, behavioural changes, or Parkinsonian features may predominate in non-Alzheimer dementias. Consequently, clinicians should evaluate cognitive, functional, behavioural, and neurological changes collectively rather than relying solely on memory complaints (McKhann et al., 2024; McKeith et al., 2020; Livingston et al., 2024).

Importantly, family members often recognize subtle changes before patients themselves because impaired insight (anosognosia) commonly accompanies early dementia. A structured collateral history is therefore indispensable when evaluating suspected early cognitive decline (Jack et al., 2024; Gauthier et al., 2022).

**1 Cognitive Warning Signs**

Persistent impairment in recent memory remains the most common presenting feature of Alzheimer's disease. Patients frequently repeat questions, misplace personal belongings, forget recent conversations or appointments, and become increasingly dependent on calendars or reminder systems. Unlike age-associated memory changes, these deficits progressively interfere with daily functioning (McKhann et al., 2024; Jack et al., 2024).

Early executive dysfunction may manifest as difficulty organizing activities, managing finances, solving problems, multitasking, or making decisions. Patients may require increasing assistance with complex instrumental activities of daily living before significant memory impairment becomes apparent (Livingston et al., 2024; Gauthier et al., 2022).

Language impairment may initially present with word-finding difficulty, reduced verbal fluency, or impaired naming, whereas visuospatial dysfunction may manifest as getting lost in familiar environments, impaired navigation, difficulty judging distances, or problems recognizing familiar faces or objects (McKhann et al., 2024; Jack et al., 2024).

## Progressive Clinical Features of Dementia

Dementia is a progressive neurodegenerative syndrome characterized by gradual deterioration in cognition, functional independence, behaviour, and neurological function. Although the rate of progression varies among individuals and according to the underlying pathology, most patients experience an evolving pattern of deficits that ultimately results in complete dependency. Recognition of disease progression is essential for prognosis, treatment planning, caregiver education, advanced care planning, and timely implementation of supportive services (Jack et al., 2024; Livingston et al., 2024; NICE, 2022).

Progression should be evaluated longitudinally rather than during a single clinical encounter. Serial assessment of cognitive performance, functional status, behavioural symptoms, neurological findings, nutritional status, mobility, and caregiver burden provides a more accurate measure of disease evolution than isolated cognitive scores alone (Gauthier et al., 2022; Jack et al., 2024).

**1 Cognitive Progression**
In Alzheimer's disease, episodic memory impairment usually dominates the earliest stage, followed by progressive deterioration in executive function, language, visuospatial abilities, and attention. As the disease advances, patients become increasingly unable to learn new information, recognize familiar individuals, communicate effectively, or perform complex cognitive tasks. In advanced disease, orientation, comprehension, and even basic communication may be profoundly impaired (McKhann et al., 2024; Jack et al., 2024).

Other dementia syndromes follow different trajectories. Frontotemporal dementia often begins with prominent behavioural or language disturbances before memory impairment becomes evident, whereas dementia with Lewy bodies is characterized by fluctuating cognition, visual hallucinations, REM sleep behaviour disorder, and progressive Parkinsonism. Vascular dementia may demonstrate a stepwise decline associated with recurrent cerebrovascular events (McKeith et al., 2020; Armstrong et al., 2013; Livingston et al., 2024).

**2 Functional Progression**
Functional impairment progresses from subtle difficulties with instrumental activities of daily living to complete dependence for basic self-care. Initially, patients require assistance with complex tasks such as medication management, financial affairs, transportation, and meal preparation. As dementia advances, patients progressively lose independence in dressing, bathing, toileting, feeding, and mobility, eventually requiring continuous supervision and comprehensive personal care (Lawton & Brody, 1969; Katz et al., 1963; Gauthier et al., 2022).

Increasing dependence is accompanied by escalating caregiver burden, greater healthcare utilization, and higher rates of hospitalization and institutionalization, underscoring the importance of regular reassessment and anticipatory care planning (Livingston et al., 2024; NICE, 2022).

**3 Behavioural and Psychological Progression**
Behavioural and psychological symptoms frequently increase as dementia progresses. Agitation, aggression, apathy, depression, anxiety, wandering, sleep disturbances, psychosis, and resistance to care become more prevalent and often represent the principal source of caregiver distress. Symptom severity may fluctuate, particularly in dementia with Lewy bodies, but persistent or worsening neuropsychiatric symptoms usually indicate advancing disease and necessitate reassessment for potential medical, environmental, or medication-related precipitants (Livingston et al., 2024; Ismail et al., 2020; McKeith et al., 2020).

**4 Neurological Progression**
Neurological impairment generally becomes more apparent during the later stages of dementia. Gait instability, recurrent falls, dysphagia, urinary and fecal incontinence, rigidity, Parkinsonism, contractures, and impaired mobility contribute substantially to disability, aspiration risk, malnutrition, and mortality. Advanced neurological impairment often signals the need for palliative approaches and comprehensive multidisciplinary care (Jack et al., 2024; Livingston et al., 2024; NICE, 2022).

**Table 18. Progressive Clinical Features across the Course of Dementia**

| Clinical domain | Early stage | Moderate stage | Advanced stage |
|---|---|---|---|
| Cognition | Mild episodic memory loss, executive dysfunction | Language, visuospatial, and attention deficits | Severe global cognitive impairment |
| Function | Declining IADLs | Assistance with ADLs | Complete dependence |
| Behaviour | Apathy, depression, anxiety | Agitation, wandering, psychosis | Severe behavioural disturbance or reduced responsiveness |
| Neurological | Usually normal examination | Gait impairment, Parkinsonism in selected dementias | Dysphagia, immobility, incontinence, contractures |
| Care needs | Minimal supervision | Daily caregiver assistance | Twenty-four-hour care |

Source: Adapted from Jack et al. (2024), Livingston et al. (2024), McKhann et al. (2024), McKeith et al. (2020), Gauthier et al. (2022), Katz et al. (1963), Lawton and Brody (1969), and NICE (2022).

**Clinical Practice Points**

• Dementia usually progresses gradually, with increasing cognitive, functional, and behavioural impairment.
• Instrumental activities of daily living are affected before basic activities of daily living.
• The pace of progression varies considerably among dementia subtypes and individual patients.
• Rapid or abrupt deterioration is atypical for Alzheimer's disease and should prompt evaluation for reversible or alternative causes.
• Serial clinical assessment remains the most reliable method for monitoring disease progression and guiding management.

## Behavioural and Psychological Symptoms of Dementia (BPSD)

Behavioural and Psychological Symptoms of Dementia (BPSD), also referred to as neuropsychiatric symptoms (NPS), comprise a heterogeneous group of non-cognitive disturbances affecting mood, perception, thought content, personality, sleep, and behaviour. More than 90% of individuals with dementia develop one or more neuropsychiatric symptom during the course of illness, making BPSD one of the principal causes of caregiver burden, institutionalization, reduced quality of life, increased healthcare utilization, and accelerated disease progression (Livingston et al., 2024; Ismail et al., 2020; Gauthier et al., 2022).

Although behavioural manifestations often become more prominent as dementia progresses, they may also represent the earliest manifestation of certain neurodegenerative disorders, particularly behavioural-variant frontotemporal dementia and dementia with Lewy bodies. Consequently, systematic assessment of behavioural symptoms should form part of every comprehensive dementia evaluation (McKeith et al., 2020; Rascovsky et al., 2011; Livingston et al., 2024).

BPSD should never be interpreted in isolation. Their occurrence frequently reflects an interaction between neurodegeneration, environmental stressors, unmet physical needs, caregiver communication, medical illness, medication effects, pain, delirium, sensory impairment, and psychosocial factors. Identifying potentially reversible contributors is therefore a fundamental component of assessment before considering pharmacological intervention (NICE, 2022; Livingston et al., 2024).

**1 Common Behavioural and Psychological Symptoms**

The most frequently encountered manifestations include:

- Apathy
- Depression
- Anxiety
- Agitation
- Aggression
- Irritability
- Psychosis (hallucinations and delusions)
- Sleep disturbances
- Wandering
- Disinhibition
- Repetitive or compulsive behaviours
- Appetite and eating disturbances
- Emotional lability

Symptom frequency and severity vary according to dementia subtype and disease stage. Alzheimer's disease commonly presents with apathy, depression, and agitation, whereas recurrent visual hallucinations and cognitive fluctuations strongly suggest dementia with Lewy bodies. Early personality change, loss of empathy, compulsive behaviours, and disinhibition are characteristic of behavioural-variant frontotemporal dementia (McKeith et al., 2020; Rascovsky et al., 2011; Livingston et al., 2024).

**2 Clinical Assessment**

Assessment should include interviews with both the patient and a reliable caregiver because impaired insight frequently limits patient reporting. Each behavioural symptom should be characterized according to:

- Onset and progression
- Frequency and severity
- Duration
- Triggering or precipitating factors
- Associated risks to the patient or others
- Impact on caregiver burden
- Previous interventions and treatment response

Validated instruments such as the Neuropsychiatric Inventory (NPI), Cornell Scale for Depression in Dementia, and Cohen-Mansfield Agitation Inventory improve objectivity and facilitate longitudinal monitoring (Cummings et al., 1994; Ismail et al., 2020; Livingston et al., 2024).

**3 Differential Diagnosis**

Before attributing behavioural changes to dementia, clinicians should exclude reversible causes including:

- Delirium
- Infection
- Pain
- Medication adverse effects
- Constipation or urinary retention
- Sleep disorders
- Sensory impairment
- Depression
- Metabolic abnormalities
- Environmental stressors

Failure to recognize these conditions may lead to inappropriate psychotropic prescribing and unnecessary morbidity (NICE, 2022; Livingston et al., 2024).

**4 Management Principles**

Management should prioritize non-pharmacological interventions, which remain the first-line approach for most behavioural symptoms. Effective strategies include caregiver education, environmental modification, structured daily routines, meaningful activities, sensory optimization, pain management, sleep hygiene, and treatment of precipitating medical conditions (Livingston et al., 2024; NICE, 2022).

Psychotropic medications should be reserved for severe symptoms causing substantial distress or immediate risk to the patient or others after reversible causes have been addressed. Treatment should employ the lowest effective dose, be reviewed regularly, and discontinued whenever clinically feasible because antipsychotics and sedative medications increase the risks of stroke, falls, cognitive decline, and mortality in older adults with dementia (American Geriatrics Society Beers Criteria® Update Expert Panel, 2023; NICE, 2022; Livingston et al., 2024).

**Table 18. Common Behavioural and Psychological Symptoms of Dementia**

| Symptom | Clinical significance | Dementia subtype commonly associated |
|---|---|---|
| Apathy | Most common neuropsychiatric symptom | Alzheimer's disease, FTD |
| Depression | Reduced quality of life, functional decline | Alzheimer's disease |
| Anxiety | Increased dependence and caregiver burden | Early Alzheimer's disease |
| Agitation/Aggression | Common cause of hospitalization | Moderate-to-severe dementia |
| Visual hallucinations | Core diagnostic feature | Dementia with Lewy bodies |
| Delusions | Often occur in moderate disease | Alzheimer's disease, DLB |
| Disinhibition | Suggests frontal lobe involvement | Behavioural-variant FTD |
| Compulsive behaviours | Diagnostic clue | Behavioural-variant FTD |
| Wandering | Important safety concern | Moderate-to-advanced dementia |
| Sleep disturbance | Increases caregiver burden | All dementia syndromes |

Source: Adapted from Livingston et al. (2024), McKeith et al. (2020), Rascovsky et al. (2011), Ismail et al. (2020), NICE (2022), and Cummings et al. (1994).

**Clinical Practice Points**

• BPSD affects most patients with dementia during the course of illness and is a major determinant of caregiver burden and institutionalization.
• Behavioural symptoms should be considered clinical syndromes with potentially reversible contributors, not simply inevitable consequences of dementia.
• A systematic assessment should always exclude delirium, pain, infection, medication adverse effects, and other medical illnesses.
• Non-pharmacological interventions are the cornerstone of management and should be implemented before considering psychotropic medications.
• Antipsychotic medications should be reserved for severe psychosis or dangerous agitation after careful assessment of risks and benefits.
• Regular reassessment is essential, as behavioural symptoms fluctuate and treatment requirements change over time.

## Future Directions: The Emerging Role of Artificial Intelligence in the Clinical Assessment of Dementia

Artificial intelligence (AI) is rapidly transforming the clinical assessment of dementia by enhancing diagnostic accuracy, facilitating earlier disease detection, improving risk stratification, and supporting individualized clinical decision-making. Rather than replacing clinical judgment, AI serves as a decision-support tool that integrates complex multidimensional data, including clinical history, cognitive testing, neuroimaging, digital biomarkers, genetics, laboratory findings, and electronic health records, to assist clinicians throughout the diagnostic process (Jack et al., 2024; Livingston et al., 2024; WHO, 2023).

Machine learning and deep learning algorithms have demonstrated increasing accuracy in distinguishing normal aging from mild cognitive impairment and Alzheimer's disease, predicting disease progression, identifying individuals at high risk of cognitive decline, and classifying dementia subtypes using multimodal datasets. AI-assisted interpretation of structural MRI, PET imaging, retinal imaging, speech analysis, gait assessment, and digital cognitive assessments offers opportunities for earlier diagnosis, particularly during the preclinical and prodromal stages of disease (Topol, 2019; Jack et al., 2024; Frisoni et al., 2024).

Digital health technologies further extend dementia assessment beyond the traditional clinic. Wearable sensors, smartphones, home-based monitoring systems, and passive digital biomarkers permit continuous evaluation of mobility, sleep, speech, daily functioning, and behavioural changes in real-world settings. These technologies may detect subtle decline before it becomes clinically apparent while providing objective longitudinal data for monitoring disease progression and treatment response (WHO, 2023; Livingston et al., 2024).

Despite these advances, important challenges remain. AI systems require rigorous external validation across diverse populations and healthcare settings to minimize bias and ensure generalizability. Ethical considerations, including patient privacy, transparency, algorithmic fairness, data governance, cyber-security, and clinician accountability, must be addressed before widespread implementation. Importantly, AI should complement rather than replace comprehensive clinical assessment, multidisciplinary evaluation, and individualized patient-centered care (WHO, 2023; NICE, 2022; Topol, 2019).

**Table 19. Potential Applications of Artificial Intelligence in Dementia Assessment**

| Clinical application | Potential benefit |
|---|---|
| Automated neuroimaging analysis | Earlier and more accurate detection of neurodegeneration |
| Digital cognitive assessment | Remote, standardized cognitive evaluation |
| Speech and language analysis | Identification of early language impairment |
| Gait and movement analysis | Detection of subtle motor abnormalities |
| Wearable technologies | Continuous monitoring of mobility, sleep, and activity |
| Electronic health record analytics | Risk prediction and clinical decision support |
| Multimodal machine learning | Improved diagnostic classification and prognostic prediction |

Source: Adapted from Jack et al. (2024), Livingston et al. (2024), Frisoni et al. (2024), Topol (2019), WHO (2023), and NICE (2022).

**Clinical Practice Points**

- Artificial intelligence has the potential to facilitate earlier recognition of cognitive decline through analysis of multimodal clinical and digital data.
- AI should be regarded as a clinical decision-support tool, not a substitute for comprehensive clinical assessment.
- Validation across diverse populations and healthcare settings remains essential before widespread implementation.
- Ethical issues, including transparency, fairness, privacy, and data governance, must accompany technological advances.
- Integration of AI into dementia care should strengthen, not replace, the clinician-patient relationship.

## Conclusion

Clinical assessment remains the cornerstone of dementia diagnosis despite major advances in biomarkers, neuroimaging, molecular diagnostics, and artificial intelligence. An accurate diagnosis depends on a comprehensive, patient-centered evaluation that integrates detailed history taking, collateral information, functional assessment, neurological examination, recognition of early warning signs, longitudinal evaluation of disease progression, and systematic assessment of behavioural and psychological symptoms. No single investigation can substitute for a careful clinical assessment performed within the context of the patient's medical, psychological, functional, and social circumstances (Jack et al., 2024; Livingston et al., 2024; NICE, 2022).

The clinical manifestations of dementia are heterogeneous, reflecting the diversity of underlying neurodegenerative disorders. Recognition of syndrome-specific cognitive, behavioural, functional, and neurological patterns facilitates earlier diagnosis, improves differential diagnosis, and enables timely implementation of evidence-based pharmacological and non-pharmacological interventions. Equally important is the identification of reversible contributors to cognitive impairment and modifiable risk factors that may influence disease progression and patient outcomes (Gauthier et al., 2022; McKhann et al., 2024).

As disease-modifying therapies and precision medicine continue to evolve, the importance of early and accurate clinical diagnosis will become even greater. Emerging development ,including artificial intelligence, digital biomarkers, wearable devices, and multimodal predictive models, will increasingly complement traditional clinical practice by supporting earlier detection and individualized management. However, these innovations should enhance rather than replace comprehensive clinical evaluation, multidisciplinary collaboration, and compassionate patient-centered care.
Ultimately, high-quality dementia assessment requires the integration of scientific evidence, clinical expertise, standardized assessment tools, caregiver perspectives, and individualized decision-making. This comprehensive approach provides the strongest foundation for accurate diagnosis, effective management, improved quality of life for patients and caregivers, and optimal long-term outcomes (Livingston et al., 2024; WHO, 2023; Jack et al., 2024).

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# Obesity Pharmacotherapy Beyond Weight Loss: Incretin-Based Therapies, Maintenance, and the Role of Family Physicians

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## Abstract

According to the American Association of Clinical Endocrinology, obesity is a chronic disease driven by complex genetic, environmental, metabolic, and neuroregulatory factors that disrupt energy homeostasis and promote excess adiposity (1). This framing has shifted obesity treatment from short-term weight reduction toward long-term chronic disease management. Incretin-based therapies, including glucagon-like peptide-1 receptor agonists and dual glucose-dependent insulinotropic polypeptide/glucagon-like peptide-1 receptor agonists, have transformed medical obesity treatment, with trials such as STEP 1 and SURMOUNT-1 demonstrating clinically meaningful weight reduction (2,3). However, the clinical value of these therapies increasingly depends on long-term continuation of therapy, cardiometabolic outcomes, and real-world implementation. Maintenance studies show that discontinuation is associated with weight regain and worsening of metabolic and functional measures, while continued therapy helps sustain improvements linked to reduced obesity-related complications (6-8) . Real-world evidence highlights discontinuation, lower-than-trial dosing, access barriers, and follow-up challenges that may limit translation of trial efficacy into routine care (9,10). This narrative review examines landmark efficacy trials, maintenance and withdrawal data, real-world evidence, and selected future therapies, including retatrutide, orforglipron, and CagriSema. For family physicians, the key implication is that obesity pharmacotherapy should be approached as individualized, long-term chronic disease care aimed not only at weight reduction, but also at sustaining cardiometabolic health, function, and quality of life.

Keywords: Obesity; pharmacotherapy; GLP-1 receptor agonists; tirzepatide; semaglutide; primary care; family medicine; weight maintenance

## Introduction

Obesity pharmacotherapy has changed rapidly with the emergence of incretin-based therapies capable of producing clinically meaningful weight loss. In particular, GLP-1 receptor agonists and dual GIP/GLP-1 receptor agonists have produced mean weight reductions of approximately 15% with semaglutide and more than 20% with tirzepatide, approaching the 25%–35% total body weight loss often reported after metabolic and bariatric surgery (2,3,14). As these agents have moved treatment into a new phase, attention has shifted from achieving clinically meaningful weight loss to maintaining it and defining its longer-term clinical value (2,3,6-8).

The central question is no longer whether substantial pharmacologic weight loss can be achieved, but how it can be sustained, what follows treatment withdrawal, and whether newer therapies can improve long-term outcomes. Against this background, this narrative review examines evidence from landmark semaglutide and tirzepatide trials, the challenge of weight regain after discontinuation, and developing therapies that may shape the future of obesity management.

## Landmark Trials That Changed Obesity Treatment

The STEP 1 trial was a pivotal moment in modern obesity medicine. In adults with overweight or obesity without diabetes, once-weekly semaglutide 2.4 mg combined with lifestyle intervention produced mean weight loss of approximately 14.9% at 68 weeks (2). This degree of weight reduction was substantially greater than that achieved with older anti-obesity medications and helped establish GLP-1 receptor agonist therapy as an effective central component of medical obesity treatment rather than a limited adjunct. Weight loss in STEP 1 was also associated with greater improvement in cardiometabolic risk factors, including blood pressure, glycated hemoglobin levels, lipid levels, and markers of inflammation (2).

Tirzepatide further advanced this field. SURMOUNT-1 showed weight reductions exceeding 20% with higher-dose tirzepatide in adults with obesity or overweight without diabetes, supporting the hypothesis that dual GIP and GLP-1 receptor agonism may enhance weight loss beyond GLP-1 receptor agonism alone (3). This was later confirmed in SURMOUNT-5, where tirzepatide produced greater reductions in body weight and waist circumference than semaglutide at 72 weeks in adults with obesity but without diabetes (4).

The SELECT cardiovascular outcomes trial is particularly relevant to family medicine because it showed benefits beyond weight loss. SELECT demonstrated that semaglutide reduced the composite risk of cardiovascular death, nonfatal myocardial infarction, or nonfatal stroke over a mean follow-up of 39.8 months in patients with overweight or obesity and pre-existing cardiovascular disease, even in the absence of diabetes (5). For family physicians, this supports viewing incretin-based therapy not only as weight-loss treatment, but also as part of cardiometabolic risk reduction in appropriately selected patients.

**Figure 1. Evolution of obesity pharmacotherapy toward long-term, personalized chronic disease management**

| Earlier pharmacotherapy | GLP-1 receptor agonists | Dual incretin agonists | Emerging therapies |
|---|---|---|---|
| Modest mean weight loss; short-term weight-loss focus | Semaglutide 2.4 mg; approximately 15% mean weight loss | Tirzepatide; more than 20% mean weight loss | Retatrutide, orforglipron, and CagriSema; greater efficacy, oral options, and combination approaches |
| *Weight-centric treatment* | *Substantial pharmacologic weight loss* | *Weight-loss magnitudes approaching those previously associated mainly with bariatric surgery* | *Personalized long-term chronic disease management* |

Together, these trials redefined obesity pharmacotherapy by establishing substantial weight loss as achievable, broadening treatment goals beyond body weight alone, and shifting attention toward the challenge of long-term maintenance.

The major trials informing current practice are summarized in Table 1.

**Table 1. Key trials informing the clinical use of incretin-based obesity pharmacotherapy, including efficacy, maintenance, cardiovascular outcomes, and implications for family medicine practice.**

| Trial | Agent / design | Duration | Key finding | Clinical message |
|---|---|---|---|---|
| **STEP 1**[2] | Semaglutide 2.4 mg vs placebo in adults with overweight or obesity without diabetes | 68 weeks | Mean weight change −14.9% vs −2.4% with placebo | Established high-efficacy GLP-1 receptor agonist therapy for obesity |
| **SURMOUNT-1**[3] | Tirzepatide 5, 10, or 15 mg vs placebo in adults without diabetes | 72 weeks | Mean weight loss up to −20.9%; ≥20% loss in up to 56.7% | Approached weight-loss magnitudes previously associated mainly with bariatric surgery |
| **SELECT**[5] | Semaglutide 2.4 mg vs placebo in adults with overweight/obesity and cardiovascular disease, without diabetes | Mean 39.8 months | Major cardiovascular events 6.5% vs 8.0%; hazard ratio 0.80 | Supports cardiometabolic benefit beyond weight reduction |
| **STEP 4**[6] | Continued semaglutide vs placebo after semaglutide run-in | 68 weeks total | Continued semaglutide: additional −7.9%; placebo switch: +6.9% regain | Shows importance of continued therapy for maintenance |
| **SURMOUNT-4**[7] | Continued tirzepatide vs placebo after open-label lead-in | 88 weeks total | Overall weight change −25.3% with continued tirzepatide vs −9.9% after placebo switch | Reinforces long-term treatment rather than short-term use |
| **SURMOUNT-MAINTAIN**[8] | Continued or reduced-dose tirzepatide vs placebo after weight-loss phase | 112 weeks total | Week 112 weight change: −21.9% maximum tolerated dose, −16.6% 5 mg, −9.9% placebo | Supports individualized maintenance strategies |

## Long term maintenance and treatment discontinuation

The success of incretin-based therapy has exposed a major unresolved issue in obesity care: long-term maintenance. Withdrawal and maintenance studies increasingly show that weight loss achieved with pharmacotherapy is difficult to sustain after treatment discontinuation.

The STEP 4 randomized clinical trial demonstrated the effect of continued once-weekly subcutaneous semaglutide 2.4 mg on maintenance of body weight loss in adults with overweight or obesity without diabetes. After an initial 20-week run-in, participants who continued semaglutide lost an additional 7.9% of body weight from weeks 20 to 68, whereas those switched to placebo regained 6.9% (6). Continued treatment also helped preserve improvements in waist circumference, blood pressure, lipid levels, glucose metabolism, and physical functioning, while discontinuation and switch to placebo were associated with worsening of these measurements (6). This is clinically important because these markers are closely linked to obesity-related complications. For patients, the benefit of treatment may therefore extend beyond the number on the scale; for family physicians, the trial reinforces the need to discuss obesity pharmacotherapy as long-term chronic disease management rather than a short-term course of treatment.

SURMOUNT-4 further demonstrated that continued tirzepatide therapy is important for maintaining weight reduction and associated health benefits. At week 88, participants who remained on tirzepatide were more likely than those switched to placebo to maintain at least 80% of the weight loss achieved during the initial treatment period, with sustained improvements in BMI, waist circumference, cardiometabolic measures, and patient-reported outcomes (7). These findings reinforce that discontinuation of anti-obesity pharmacotherapy can lead to weight regain and attenuation of broader clinical benefits.

SURMOUNT-MAINTAIN addressed a practical maintenance question: whether patients who achieved weight loss on maximum tolerated tirzepatide need to remain at that dose or may maintain benefit with dose reduction. Continuing the maximum tolerated dose maintained body-weight reduction and health-related benefits, while reduction to tirzepatide 5 mg offered a potential alternative to discontinuation, although individual responses varied (8). These findings support ongoing pharmacotherapy while allowing for individualized, patient-centered decisions.

Real-practice data suggest that GLP-1 receptor agonist–based obesity therapies may perform differently outside trials, with reported first-year discontinuation rates of approximately 20%–50% and frequent use of doses below those tested in pivotal studies (9). Key evidence gaps include optimal dosing, discontinuation rates, comparative effectiveness, withdrawal effects, long-term outcomes, safety, and cost-effectiveness (9). These gaps matter in primary care, where sustained benefit depends on access, adherence, individualized dosing, and longitudinal monitoring (9, 10).

For family physicians, the benefits of GLP-1 receptor agonists and dual incretin agonists are increasingly clear, but maintenance in routine practice is rarely a simple choice between continuing maximum-dose therapy and stopping treatment. Access, cost, tolerability, dose escalation, persistence, comorbidities, and patient preference all shape what is feasible. Many patients have experienced repeated weight-loss attempts followed by regain, and acknowledging this history can help position family physicians as allies in long-term obesity care(10). The practical task is to individualize therapy so that weight loss, cardiometabolic gains, and functional improvements can be preserved (9,10).

These maintenance and implementation challenges have shaped interest in newer agents that may improve efficacy, delivery, tolerability, or individualized long-term treatment options.

## Future therapies

The future obesity-treatment landscape is likely to become more complex as newer agents aim not only to increase weight-loss efficacy, but also to broaden therapeutic options and address practical barriers to long-term treatment.

Retatrutide is a subcutaneous injection with triple action at the GIP, GLP-1, and glucagon receptors. In a phase 2 trial of adults with obesity without diabetes, the 12-mg dose produced a mean weight reduction of 24.2% at 48 weeks, with weight loss still ongoing at the end of treatment (11). Its adverse-effect profile was broadly similar to other incretin-based therapies, but longer-term data are needed to define sustained effectiveness, safety, maintenance needs, and its place in routine obesity care.

Orforglipron is a nonpeptide oral GLP-1 receptor agonist that activates the GLP-1 receptor and is designed for once-daily administration. In phase 2 testing, it produced clinically meaningful weight loss over 36 weeks and improved prespecified weight-related and cardiometabolic measures (12). Further studies are needed to determine whether orforglipron provides the broader health benefits demonstrated with injectable GLP-1 receptor agonists.

CagriSema combines once-weekly semaglutide with cagrilintide, a long-acting amylin analogue, targeting complementary appetite-regulating pathways. In adults with overweight or obesity and type 2 diabetes, it produced greater weight loss than placebo over 68 weeks and improved glycemic outcomes, including achievement of HbA1c targets (13). Further data are needed to clarify its comparative effectiveness, tolerability, and place in routine primary care.

For family physicians, future obesity pharmacotherapy will likely involve choosing among agents that act on overlapping appetite and incretin pathways but differ in how they are delivered, combined, and tolerated. Retatrutide may test whether triple agonism can produce greater weight reduction; orforglipron may make oral GLP-1 receptor agonism a practical option; and CagriSema may combine appetite and glycemic benefits, particularly for patients with type 2 diabetes. In routine practice, the key question will be how to match these therapies to the right patient while considering comorbidities, tolerability, adherence, cost, access, and long-term maintenance.

## Conclusion

For family physicians, the central message is that obesity pharmacotherapy is evolving from short-term weight-loss treatment toward individualized long-term chronic disease management. Semaglutide and tirzepatide have shown that substantial weight reduction and cardiometabolic benefits are achievable, but maintenance studies and real-world evidence show that long-term benefit depends on continued therapy, access, tolerability, dosing, adherence, and follow-up. Current guidance supports a person-centered, complication-centric approach, including personalized lifestyle and behavioural interventions, in which treatment goals extend beyond weight to metabolic health, comorbidity burden, function, and quality of life (1,10). As newer agents become available, family physicians will be central to matching therapy to the right patient and sustaining meaningful benefit over time.

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